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# U.S. Army Corps of Engineers
# New England District

**FINAL**
**REMEDIAL INVESTIGATION REPORT**
**AREA OF CONTAMINATION (AOC) 57**

**VOLUME III OF III**
**APPENDICES E**
**THROUGH Q**

**CONTRACT DACA-31-94-D-0061**
**DELIVERY ORDER NUMBER 0001**

**U.S. ARMY CORPS OF ENGINEERS**
**NEW ENGLAND DISTRICT**
**CONCORD, MASSACHUSETTS**

**JUNE 2000**

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Harding
Lawson
Associates

FINAL
REMEDIAL INVESTIGATION REPORT
AREA OF CONTAMINATION (AOC) 57

**VOLUME III OF III**
APPENDICES E THROUGH Q

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*Prepared for:*

U.S. Army Corps of Engineers
New England District
Concord, Massachusetts

*Prepared by:*

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Task No. 0914403

June 2000

# AOC 57 AND LOWER COLD SPRING BROOK HISTORICAL SURFACE WATER AND SEDIMENT ANALYTICAL DATA

## STORM DRAIN SYSTEMS NO. 1/2 AND ASSOCIATED LOWER COLD SPRING BROOK
## ANALYTICAL SEDIMENT SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA.

| | DITCH SAMPLE LOCATIONS | | | COLD SPRING BROOK SAMPLE LOCATIONS | | | |
|---|---|---|---|---|---|---|---|
| | | | | UPSTREAM | DOWNSTREAM | | |
| | SSD-93-01B 08/17/93 0 FT | CSD-94-29X 09/21/94 0 FT | CSD-94-30X 09/21/94 0 FT | CSD-94-31X 09/21/94 0 FT | CSD-94-32X 09/21/94 0 FT | CSD-94-33X 09/21/94 0 FT | CSD-94-34X 09/21/94 0 FT |
| **PAL METALS (µg/g)** | | | | | | | |
| Aluminum | 9620 | 9430 | 7700 | 16700 | 5010 | 9320 | 5790 |
| Arsenic | 15.5 | 16 | 23.3 | 14.6 | 11.4 | 5.87 | 25 |
| Barium | 27.1 | 32.4 | 33.2 | 91.2 | 39.8 | 60.4 | 42.7 |
| Beryllium | ND | ND | ND | < 0.5 | < 0.5 | < 0.5 | < 0.5 |
| Cadmium | < 1.2 | 1.63 | < 0.7 | ND | ND | ND | ND |
| Calcium | 819 | 820 | 2470 | 3260 | 2410 | 1600 | 2340 |
| Chromium | 24.5 | 32.2 | 15.9 | 34.9 | 11.7 | 20.7 | < 4.05 |
| Cobalt | 4.7 | 5.99 | 6.54 | 8.04 | 5.66 | 4.87 | 9.94 |
| Copper | 44.5 | 46.7 | 15.9 | 6.39 | 6.86 | 3.17 | 13.9 |
| Iron | 16700 | 13000 | 10400 | 12300 | 6770 | 7300 | 9740 |
| Lead | 44 | 78.7 | 43 | 15.5 | 23.5 | 6.92 | 52 |
| Magnesium | 4470 | 4590 | 2220 | 3500 | 1430 | 2410 | 1710 |
| Manganese | 203 | 259 | 277 | 759 | 891 | 597 | 358 |
| Mercury | 0.192 | < 0.05 | < 0.05 | ND | ND | ND | ND |
| Nickel | 18 | 24.5 | 15.6 | 25 | 10.4 | 14.3 | 15.7 |
| Potassium | 1700 | 1400 | 641 | 577 | < 100 | 355 | < 100 |
| Selenium | ND | ND | ND | 1.27 | 0.9 | 0.993 | 1.44 |
| Sodium | 76.6 | 519 | 1000 | 1330 | 891 | 796 | 1300 |
| Vanadium | 18.4 | 21.7 | 18.5 | 15.2 | < 3.39 | 8.74 | 14.5 |
| Zinc | 62.9 | 53.9 | 83.5 | 33.2 | 39.7 | 20.3 | 83.6 |
| **PAL SEMIVOLATILE ORGANICS (µg/g)** | | | | | | | |
| 2-methylnaphthalene | 0.21 | < 22 | < 1 | ND | ND | ND | ND |
| 9h-carbazole | ND | ND | ND | .1ND R | 1ND R | .1ND R | 1ND R |
| Acenaphthylene | 5.8 | < 2 | < 0.7 | < 0.033 | < 0.3 | < 0.033 | < 0.3 |
| Anthracene | 7.1 | < 2 | < 0.7 | 0.33 | < 0.3 | < 0.033 | < 0.3 |
| Benzo [a] Anthracene | 16 | < 8 | < 3 | < 0.17 | < 2 | < 0.17 | < 2 |
| Benzo [a] Pyrene | 8.4 | < 10 | < 5 | < 0.25 | < 2 | < 0.25 | < 2 |
| Benzo [b] Fluoranthene | 11 | < 10 | < 4 | < 0.21 | < 2 | < 0.21 | < 2 |
| Benzo [g,h,i] Perylene | 11 | < 10 | < 5 | < 0.25 | < 2 | < 0.25 | < 2 |
| Benzo [k] Fluoranthene | 6.3 | < 30 | < 1 | < 0.066 | < 0.7 | < 0.066 | < 0.7 |
| Bis(2-ethylhexyl) Phthalate | ND | ND | ND | < 0.62 | < 6 | < 0.62 | < 6 |
| Chrysene | 14 | 10 | < 2 | < 0.12 | < 1 | < 0.12 | < 1 |
| Fluoranthene | 30 | 10 | 6 | 0.62 | 2 | < 0.068 | 3 |
| Fluorene | 2.3 | < 2 | < 0.7 | < 0.033 | < 0.3 | < 0.033 | < 0.3 |
| Indeno [1,2,3-c,d] Pyrene | 8.9 | < 10 | < 6 | < 0.29 | < 3 | < 0.29 | < 3 |
| Phenanthrene | 30 | 4 | 3 | 0.25 | < 0.3 | < 0.033 | < 0.3 |
| Pyrene | 30 | 10 | 7 | 0.47 | 2 | < 0.033 | 2 |

## STORM DRAIN SYSTEMS NO. 1/2 AND ASSOCIATED LOWER COLD SPRING BROOK
## ANALYTICAL SEDIMENT SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA.

| | DITCH SAMPLE LOCATIONS | | | COLD SPRING BROOK SAMPLE LOCATIONS | | | |
|---|---|---|---|---|---|---|---|
| | | | | UPSTREAM | DOWNSTREAM | | |
| | SSD-93-01B 08/17/93 0 FT | CSD-94-29X 09/21/94 0 FT | CSD-94-30X 09/21/94 0 FT | CSD-94-31X 09/21/94 0 FT | CSD-94-32X 09/21/94 0 FT | CSD-94-33X 09/21/94 0 FT | CSD-94-34X 09/21/94 0 FT |
| **PAL PESTICIDES/PCBS (µg/g)** | | | | | | | |
| DDT | NA | NA | NA | NA | < 0.00707 M | NA | < 0.00707 M |
| DDD | NA | NA | NA | NA | 0.024 C | NA | 0.0537 C |
| DDE | NA | NA | NA | NA | < 0.00765 | NA | < 0.00765 |
| Dieldrin | NA | NA | NA | NA | < 0.00629 M | NA | < 0.00629 M |
| Endosulfan Sulfate | NA | NA | NA | NA | < 0.00763 | NA | < 0.00763 |
| gamma-chlordane | NA | NA | NA | .33ND R | 3ND R | .33ND R | 3ND R |
| **OTHER (µg/g)** | | | | | | | |
| Total Organic Carbon | 30000 | 32500 | 58400 | 67400 | 42400 | 24600 | 64700 |
| Total Petroleum Hydrocarbons | 240 | 281 | 239 | < 28.2 | 71.9 | 55.1 | 110 |

NOTES:
R = Non-target compound analyzed for but not detected.
M = Duplicate high spike analysis, not within control limits.
C = Analysis was confirmed.
NA = Not analyzed
ND = Not detectable
µg/g = micrograms/gram

# STORM DRAIN SYSTEMS NO. 2/3/4 AND ASSOCIATED LOWER COLD SPRING BROOK
# ANALYTICAL SEDIMENT SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA.

| ANALYTE | DITCH SAMPLE LOCATIONS | | | | | |
|---|---|---|---|---|---|---|
| | SSD-93-03B 08/17/93 0 FT | CSD-94-22X 09/20/94 0 FT | CSD-94-21X 09/20/94 0 FT | CSD-94-24X 09/20/94 0 FT | CSD-94-23X 09/20/94 0 FT | CSD-94-25X 09/20/94 0 FT |
| **PAL METALS (µg/g)** | | | | | | |
| Aluminum | 9380 | 6000 | 7840 | 29500 | 5000 | 14000 |
| Antimony | < 19.6 | < 1.09 | 10.6 | 18.8 | < 1.09 | 3.48 |
| Arsenic | 19.2 | 8.4 | 18 | 60 | 8.55 | 19 |
| Barium | 46.2 | 12.7 | 30.9 | 155 | 15.9 | 63.9 |
| Beryllium | ND | ND | ND | ND | ND | ND |
| Cadmium | 3.74 | 0.947 | 2.18 | 27.7 | < 0.7 | 6.35 |
| Calcium | 2240 | 3850 | 1140 | 3440 | 686 | 2040 |
| Chromium | 38.4 | 23.5 | 39.5 | 142 | 19.7 | 57.2 |
| Cobalt | 8 | 3.86 | 5.83 | 15.7 | 3.91 | 10.6 |
| Copper | 43.9 | 13.4 | 36.1 | 145 | 12.2 | 49 |
| Iron | 21900 | 12100 | 14300 | 42400 | 11100 | 20900 |
| Lead | 230 | 18 | 137 | 410 | 34.8 | 166 |
| Magnesium | 4200 | 5020 | 3910 | 14900 | 2430 | 6360 |
| Manganese | 572 | 231 | 174 | 551 | 172 | 423 |
| Mercury | 0.0751 | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Nickel | 22.3 | 18.3 | 22.7 | 82.1 | 15 | 38.3 |
| Potassium | 1140 | 552 | 1040 | 4610 | 583 | 1860 |
| Selenium | ND | ND | ND | ND | ND | ND |
| Sodium | 108 | 327 | 564 | 1650 | 412 | 840 |
| Vanadium | 28.2 | 19.6 | 24 | 91.4 | 14.2 | 39.5 |
| Zinc | 171 | 46.9 | 115 | 573 | 41 | 184 |
| **PAL SEMIVOLATILE ORGANICS (µg/g)** | | | | | | |
| 2-methylnaphthalene | 2.1 | < 1 | < 1 | < 5 | < 0.5 | < 2 |
| 2-methylphenol / 2-cresol | 0.35 | < 0.6 | < 0.6 | < 3 | 0.3 | < 1 |
| 4-methylphenol / 4-cresol | 2.2 | < 5 | < 5 | < 20 | 2 | < 10 |
| 9h-carbazole | ND | ND | ND | ND | ND | ND |
| Acenaphthene | 3.6 | 1 | < 0.7 | < 4 | 0.4 | < 2 |
| Acenaphthylene | 30 | < 0.7 | < 0.7 | < 3 | 0.3 | < 2 |
| Anthracene | 30 | 2 | 1 | < 3 | 0.6 | < 2 |
| Benzo [a] Anthracene | 60 | 6 | 9 | < 20 | 2 | < 8 |
| Benzo [a] Pyrene | 60 | < 5 | 10 | < 20 | < 2 | < 10 |
| Benzo [b] Fluoranthene | 60 | 10 | 20 | < 20 | 6 | < 10 |
| Benzo [g,h,i] Perylene | 30 | < 5 | < 5 | < 20 | < 2 | < 10 |
| Benzo [k] Fluoranthene | 70 | 2 | 6 | < 7 | 1 | < 3 |
| Bis(2-ethylhexyl) Phthalate | ND | ND | ND | ND | ND | ND |
| Chrysene | 90 | 10 | 10 | < 10 | 6 | < 6 |
| Dibenz [a,h] Anthracene | 1.7 | < 4 | < 4 | < 20 | < 2 | < 10 |

## STORM DRAIN SYSTEMS NO. 2/3/4 AND ASSOCIATED LOWER COLD SPRING BROOK
## ANALYTICAL SEDIMENT SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA.

| ANALYTE | DITCH SAMPLE LOCATIONS | | | | | |
|---|---|---|---|---|---|---|
| | SSD-93-03B 08/17/93 0 FT | CSD-94-22X 09/20/94 0 FT | CSD-94-21X 09/20/94 0 FT | CSD-94-24X 09/20/94 0 FT | CSD-94-23X 09/20/94 0 FT | CSD-94-25X 09/20/94 0 FT |
| Dibenzofuran | 2.6 | 1 | < 0.7 | < 4 | < 0.4 | < 2 |
| Fluoranthene | 100 | 20 | 20 | 50 | 8 | 20 |
| Fluorene | 8.1 | 2 | < 0.7 | < 3 | < 0.3 | < 2 |
| Indeno [1,2,3-c,d] Pyrene | ND | ND | ND | ND | ND | ND |
| Naphthalene | 3.6 | < 0.7 | < 0.7 | < 4 | < 0.4 | < 2 |
| Phenanthrene | 100 | 20 | 10 | 20 | 5 | 7 |
| Pyrene | 200 | 20 | 20 | 40 | 7 | 20 |
| **PAL VOLATILE ORGANICS (µg/g)** | | | | | | |
| 1,1,1-trichloroethane | ND | NA | NA | NA | NA | NA |
| Acetone | ND | NA | NA | NA | NA | NA |
| Toluene | ND | NA | NA | NA | NA | NA |
| Tetrachloroethylene / Tetrachloroethene | 0.24 | NA | NA | NA | NA | NA |
| Trichlorofluoromethane | ND | NA | NA | NA | NA | NA |
| **OTHER (µg/g)** | | | | | | |
| Total Organic Carbon | 66000 | 5320 | 14700 | 154000 | 4490 | 54600 |
| Total Petroleum Hydrocarbons | 1200 | 625 | 2500 | 5490 | 625 | 1220 |

## STORM DRAIN SYSTEMS NO. 2/3/4 AND ASSOCIATED LOWER COLD SPRING BROOK
## ANALYTICAL SEDIMENT SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA.

| ANALYTE | COLD SPRING BROOK SAMPLE LOCATIONS | | | |
|---|---|---|---|---|
| | UPSTREAM | | DOWNSTREAM | |
| | G3D-92-03X 06/23/92 0 FT | CSD-94-27X 09/20/94 0 FT | 57D-92-02X 08/19/92 0 FT | CSD-94-28X 09/22/94 0 FT |
| **PAL METALS (µg/g)** | | | | |
| Aluminum | 12500 | 6190 | NA | 3410 |
| Antimony | ND | ND | NA | ND |
| Arsenic | 95.2 | 9.37 | NA | 7.65 |
| Barium | 127 | 35.3 | NA | 23.3 |
| Beryllium | < 0.5 | < 0.5 | NA | < 0.5 |
| Cadmium | ND | ND | NA | ND |
| Calcium | 5810 | 1810 | NA | 898 |
| Chromium | < 4.05 | 14.9 | NA | 8.5 |
| Cobalt | < 1.42 | 7.86 | NA | 6.52 |
| Copper | 60.4 | 7.83 | NA | 4.14 |
| Iron | 15900 | 6590 | NA | 4800 |
| Lead | 350 | 8.17 | NA | 10.2 |
| Magnesium | 4610 | 2050 | NA | 1340 |
| Manganese | 339 | 524 | NA | 242 |
| Mercury | ND | ND | NA | ND |
| Nickel | 41 | 13.2 | NA | 8.67 |
| Potassium | 1520 | 308 | NA | 173 |
| Selenium | < 0.25 | < 0.25 | NA | < 0.25 |
| Sodium | 2120 | 707 | NA | 516 |
| Vanadium | 72.5 | 8.45 | NA | < 3.39 |
| Zinc | 372 | 31.4 | NA | 32.1 |
| **PAL SEMIVOLATILE ORGANICS (µg/g)** | | | | |
| 2-methylnaphthalene | ND | ND | ND | ND |
| 2-methylphenol / 2-cresol | ND | ND | ND | ND |
| 4-methylphenol / 4-cresol | ND | ND | ND | ND |
| 9h-carbazole | 4.68 S | .1ND R | .033ND R | .1ND |
| Acenaphthene | ND | ND | ND | ND |
| Acenaphthylene | 4.37 | < 0.033 | 0.075 | < 0.033 |
| Anthracene | 4.42 | < 0.033 | 0.1 | < 0.033 |
| Benzo [a] Anthracene | 18.1 | < 0.17 | 0.35 | 0.27 |
| Benzo [a] Pyrene | 22.9 | < 0.25 | 0.51 | < 0.25 |
| Benzo [b] Fluoranthene | 32.7 | < 0.21 | 0.67 | < 0.21 |
| Benzo [g,h,i] Perylene | 18.9 | < 0.25 | 0.34 | < 0.25 |
| Benzo [k] Fluoranthene | 33.2 | < 0.066 | 0.47 | < 0.066 |
| Bis(2-ethylhexyl) Phthalate | < 3.1 | 1.5 | < 0.62 | < 0.62 |
| Chrysene | 47.1 | < 0.12 | 0.8 | 0.67 |
| Dibenz [a,h] Anthracene | ND | ND | ND | ND |

## STORM DRAIN SYSTEMS NO. 2/3/4 AND ASSOCIATED LOWER COLD SPRING BROOK
## ANALYTICAL SEDIMENT SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA.

| ANALYTE | COLD SPRING BROOK SAMPLE LOCATIONS | | | |
|---|---|---|---|---|
| | UPSTREAM | | DOWNSTREAM | |
| | G3D-92-03X 06/23/92 0 FT | CSD-94-27X 09/20/94 0 FT | 57D-92-02X 08/19/92 0 FT | CSD-94-28X 09/22/94 0 FT |
| Dibenzofuran | ND | ND | ND | ND |
| Fluoranthene | 59.4 | < 0.068 | 1.4 | 1.1 |
| Fluorene | < 0.165 | < 0.033 | 0.086 | < 0.033 |
| Indeno [1,2,3-c,d] Pyrene | 20.3 | < 0.29 | 0.33 | < 0.29 |
| Naphthalene | ND | ND | ND | ND |
| Phenanthrene | 19.8 | < 0.033 | 0.78 | 0.39 |
| Pyrene | 53.1 | < 0.033 | 1.3 | 1.1 |
| **PAL VOLATILE ORGANICS (µg/g)** | | | | |
| 1,1,1-trichloroethane | < 0.0044 | NA | NA | NA |
| Acetone | < 0.017 | NA | NA | NA |
| Toluene | < 0.00078 | NA | NA | NA |
| Tetrachloroethylene / Tetrachloroethene | ND | NA | NA | NA |
| Trichlorofluoromethane | < 0.0059 | NA | NA | NA |
| **PAL PESTICIDES/PCBS (µg/l)** | | | | |
| DDT | NA | < 0.00707 M | NA | NA |
| DDD | NA | < 0.00826 | NA | NA |
| DDE | NA | < 0.00765 | NA | NA |
| Dieldrin | NA | < 0.00629 M | NA | NA |
| Endosulfan Sulfate | NA | < 0.00763 | NA | NA |
| gamma-chlordane | 2ND R | 33ND R | 33ND R | 33ND R |
| **OTHER (µg/g)** | | | | |
| Total Organic Carbon | 219000 | 32500 | 24400 | 19700 |
| Total Petroleum Hydrocarbons | 827 | < 28 | 92.6 | 47.3 |

NOTES:
M = Duplicate high spike analysis, not within control limits.
R = Non-target compound analyzed for but not detected.
S = Non-target compound analyzed for and detected.
NA = Not analyzed
ND = Not detectable
µg/g = micrograms per gram

# BOWERS BROOK AND ASSOCIATED LOWER COLD SPRING BROOK
# ANALYTICAL SEDIMENT SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA.

| ANALYTE | BOWERS BROOK SAMPLE LOCATION | COLD SPRING BROOK SAMPLE LOCATIONS | | |
|---|---|---|---|---|
| | | UPSTREAM | DOWNSTREAM | |
| | CSD-94-16X 09/22/94 0 FT | G3D-92-02X 06/24/92 0 FT | CSD-94-18X 09/22/94 0 FT | CSD-94-26X 09/20/94 0 FT |
| **PAL INORGANICS (µg/g)** | | | | |
| Aluminum | 7550 | 12800 | 8910 | 7860 |
| Arsenic | 57.9 | 96 | 63 | 7.79 |
| Barium | 65.4 | 188 | 97.3 | 39.1 |
| Beryllium | < 0.5 | < 0.5 | < 0.5 | < 0.5 |
| Calcium | 3060 | 17000 | 3150 | 1400 |
| Chromium | < 4.05 | < 4.05 | < 4.05 | 19.8 |
| Cobalt | 23.4 | 19 | 36 | 6 |
| Copper | 20.8 | 54.9 | 21.8 | 2.34 |
| Iron | 11800 | 23200 | 24400 | 6820 |
| Lead | 89 | 220 | 67 | 6.9 |
| Magnesium | 2070 | 3210 | 2360 | 2140 |
| Manganese | 1140 | 3150 | 1360 | 275 |
| Nickel | 22.6 | 41.5 | 26.4 | 12.9 |
| Potassium | < 100 | 1130 | 555 | 294 |
| Selenium | < 0.25 | 2.89 | < 0.25 | < 0.25 |
| Sodium | 2570 | 1620 | 1730 | 692 |
| Vanadium | < 3.39 | 41.4 | 23.9 | 10.9 |
| Zinc | 147 | 398 | 193 | 19.9 |
| **PAL SEMIVOLATILE ORGANICS** | | | | |
| 9h-carbazole | .1ND R | .165ND R | .5ND R | .1ND R |
| Acenaphthylene | < 0.033 | < 0.165 | < 0.2 | < 0.033 |
| Anthracene | < 0.033 | < 0.165 | < 0.2 | < 0.033 |
| Benzo [a] Anthracene | < 0.17 | < 0.8 | < 0.8 | < 0.17 |
| Benzo [a] Pyrene | < 0.25 | < 1.25 | < 1 | < 0.25 |
| Benzo [b] Fluoranthene | < 0.21 | < 1.05 | < 1 | < 0.21 |
| Benzo [g,h,i] Perylene | < 0.25 | < 1.25 | < 1 | < 0.25 |
| Benzo [k] Fluoranthene | 1.1 | < 0.33 | < 0.3 | < 0.066 |
| Bis (2-ethylhexyl) Phthalate | < 0.62 | < 3.1 | < 3 | < 0.62 |
| Chrysene | 1.3 | < 0.6 | < 0.6 | < 0.12 |
| Fluoranthene | 1.6 | 4.5 | < 0.3 | < 0.068 |
| Fluorene | < 0.033 | < 0.165 | < 0.2 | < 0.033 |
| Indeno [1,2,3-c,d] Pyrene | < 0.29 | < 1.45 | < 1 | < 0.29 |
| Phenanthrene | 1.1 | 2.22 | < 0.2 | < 0.033 |
| Pyrene | 2.6 | 4.59 | 1 | < 0.033 |
| **PAL VOLATILE ORGANICS (µg/g)** | | | | |
| 1,1,1-trichloroethane | NA | < 0.0044 | NA | NA |
| Acetone | NA | 0.49 | NA | NA |
| Toluene | NA | < 0.00078 | NA | NA |
| Trichlorofluoromethane | NA | < 0.0059 | NA | NA |
| **PAL PESTICIDES/PCBS (µg/g)** | | | | |
| DDT | NA | NA | < 0.00707 M | NA |
| DDD | NA | NA | 0.0498 C | NA |
| DDE | NA | NA | < 0.00765 | NA |
| Dieldrin | NA | NA | < 0.00629 M | NA |
| Endosulfan Sulfate | NA | NA | < 0.00763 | NA |
| gamma-chlordane | .33ND R | 2ND R | 2ND R | .33ND R |
| **OTHER** | | | | |
| Total Organic Carbon | 104000 | 166000 | 113000 | 18500 |
| Total Petroleum Hydrocarbons | 192 | 312 | 203 | < 28.2 |

NOTES:
M = Duplicate high spike analysis, not within control limits.
C = Analysis was confirmed.
R = Non-target compound analyzed for but not detected.
NA = Not analyzed
ND = Not Detected
µg/g = micrograms per gram

## STUDY AREA 57 MARSH AND ASSOCIATED LOWER COLD SPRING BROOK
## ANALYTICAL SEDIMENT SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA.

| ANALYTE | MARSH SAMPLE LOCATIONS | | | | |
|---|---|---|---|---|---|
| | CSD-94-20X 09/22/94 0 FT | CSD-94-20X 09/22/94 0 FT (dup) | CSD-94-14X 09/22/94 0 FT | CSD-94-35X 09/22/94 0 FT | CSD-94-17X 09/22/94 0 FT |
| **PAL METALS (µg/g)** | | | | | |
| Aluminum | 20200 | 21600 D | 8820 | 8540 | 5160 |
| Arsenic | 21 | 22.3 D | 11.5 | 26.7 | 26 |
| Barium | 78.8 | 84.2 D | < 5.18 | 74.3 | 37.1 |
| Beryllium | ND | ND | ND | ND | ND |
| Cadmium | 2.96 | 3 D | < 0.7 | < 0.7 | < 0.7 |
| Calcium | 2840 | 4890 D | 10800 | 13000 | 4140 |
| Chromium | 53.2 | 56.7 D | < 4.05 | 31.6 | 14.6 |
| Cobalt | 9.12 | 10.4 D | < 1.42 | 8.41 | 5.15 |
| Copper | 39.2 | 44.2 D | 93 | 44.6 | 16.2 |
| Iron | 21600 | 22800 D | 5790 | 12100 | 7560 |
| Lead | 222 | 248 D | 240 | 120 | 95 |
| Magnesium | 5340 | 5690 D | 1610 | 2470 | 1590 |
| Manganese | 161 | 174 D | 41.7 | 265 | 473 |
| Nickel | 33.8 | 37.2 D | < 1.71 | 22 | 15.3 |
| Potassium | 1620 | 1600 D | < 100 | 563 | 427 |
| Selenium | 0.925 | 0.924 D | 9.46 | 2.61 | 1.17 |
| Sodium | 819 | 984 D | 5930 | 2210 | 1020 |
| Vanadium | 38.4 | 41.2 D | < 3.39 | 23.1 | 16.9 |
| Zinc | 160 | 176 D | 176 | 209 | 124 |
| **PAL SEMIVOLATILE ORGANICS (µg/g)** | | | | | |
| 9h-carbazole | ND | ND | ND | ND | ND |
| Acenaphthylene | ND | ND | ND | ND | ND |
| Anthracene | ND | ND | ND | ND | ND |
| Benzo [a] Anthracene | ND | ND | ND | ND | ND |
| Benzo [a] Pyrene | ND | ND | ND | ND | ND |
| Benzo [b] Fluoranthene | ND | ND | ND | ND | ND |
| Benzo [g,h,i] Perylene | ND | ND | ND | ND | ND |
| Benzo [k] Fluoranthene | < 3 | < 3 D | < 0.7 | < 0.7 | 1 |
| Bis (2-ethylhexyl) Phthalate | ND | ND | ND | ND | ND |
| Chrysene | < 6 | < 6 D | < 1 | < 1 | 1 |
| Fluoranthene | 1 | < 3 D | < 0.7 | < 0.7 | 3 |

## STUDY AREA 57 MARSH AND ASSOCIATED LOWER COLD SPRING BROOK
## ANALYTICAL SEDIMENT SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA.

| ANALYTE | MARSH SAMPLE LOCATIONS | | | | |
|---|---|---|---|---|---|
| | CSD-94-20X 09/22/94 0 FT | CSD-94-20X 09/22/94 0 FT (dup) | CSD-94-14X 09/22/94 0 FT | CSD-94-35X 09/22/94 0 FT | CSD-94-17X 09/22/94 0 FT |
| Fluorene | ND | ND | ND | ND | ND |
| Indeno [1,2,3-c,d] Pyrene | ND | ND | ND | ND | ND |
| Phenanthrene | 0.8 | < 2 D | < 0.3 | < 0.3 | 1 |
| Pyrene | 2 | < 2 D | < 0.3 | < 0.3 | 3 |
| **PAL VOLATILE ORGANICS (µg/g)** | | | | | |
| 1,1,1,-trichloroethane | ND | ND | ND | ND | ND |
| Acetone | 0.035 | 0.052 D | < 0.017 | 0.11 | < 0.017 |
| Toluene | 0.0016 | < 0.00078 D | < 0.00078 | 0.0047 | < 0.00078 |
| Trichlorofluoromethane | 0.031 | 0.041 D | 0.35 | 0.099 | 0.033 |
| **PAL PESTICIDES/PCBS (µg/g)** | | | | | |
| DDT | 0.083 CM | 0.09 CDM | NA | NA | NA |
| DDD | 0.04 C | 0.041 CD | NA | NA | NA |
| DDE | 0.0338 C | 0.035 CD | NA | NA | NA |
| alpha chlordane | 0.013 CS | 0.0123 CSD | 3ND R | 3ND R | 2ND R |
| Dieldrin | 0.0298 CM | 0.0311 CDM | NA | NA | NA |
| Endosulfan Sulfate | ND | ND | NA | NA | NA |
| gamma-chlordane | 0.0276 CS | 0.0298 CSD | 3ND R | 3ND R | 2ND R |
| Aroclor 1260 | 0.243 C | 0.309 C | 30ND R | 30ND R | 20ND R |
| **OTHER (µg/g)** | | | | | |
| Total Organic Carbon | 63600 | 56700 D | 266000 | 148000 | 58400 |
| Total Petroleum Hydrocarbons | 2700 | 1760 D | 1380 | 251 | 375 |

## STUDY AREA 57 MARSH AND ASSOCIATED LOWER COLD SPRING BROOK
## ANALYTICAL SEDIMENT SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA.

| ANALYTE | COLD SPRING BROOK SAMPLE LOCATIONS | | | | | |
|---|---|---|---|---|---|---|
| | UPSTREAM | | DOWNSTREAM | | | |
| | CSD-94-13X 09/22/94 0 FT | | SSD-93-92G 09/16/93 0 FT | | CSD-94-19X 09/22/94 0 FT | |
| **PAL METALS (µg/g)** | | | | | | |
| Aluminum | | 10000 | | 20100 | | 6130 |
| Arsenic | | 65 | | 51.1 | | 53 |
| Barium | | 90.1 | | 118 | | 63.5 |
| Beryllium | < | 0.5 | < | 0.427 | < | 0.5 |
| Cadmium | | ND | | ND | | ND |
| Calcium | | 8380 | | 5440 | | 6980 |
| Chromium | | 30.9 | | 39.8 | < | 4.05 |
| Cobalt | | 19 | < | 2.5 | | 9.31 |
| Copper | | 28.5 | | 63.7 | | 21.1 |
| Iron | | 22300 | | 30700 | | 12700 |
| Lead | | 240 | | 340 | | 79 |
| Magnesium | | 3220 | | 4340 | | 1740 |
| Manganese | | 1580 | | 317 | | 1490 |
| Nickel | | 35.9 | | 31.1 | | 20.1 |
| Potassium | | 608 | | 1540 | < | 100 |
| Selenium | | 3.01 | < | 0.449 | | 2.34 |
| Sodium | < | 100 | | 38.7 | | 1820 |
| Vanadium | | 31.8 | | 45.6 | | 15.8 |
| Zinc | | 305 | | 290 JR | | 147 |
| **PAL SEMIVOLATILE ORGANICS (µg/g)** | | | | | | |
| 9h-carbazole | | .5ND R | | ND | | .5ND R |
| Acenaphthylene | < | 0.2 | < | 0.033 | < | 0.2 |
| Anthracene | < | 0.2 | < | 0.71 | < | 0.2 |
| Benzo [a] Anthracene | < | 0.8 | | 1.2 | < | 0.8 |
| Benzo [a] Pyrene | < | 1 | < | 1.2 | < | 1 |
| Benzo [b] Fluoranthene | < | 1 | < | 0.31 | < | 1 |
| Benzo [g,h,i] Perylene | < | 1 | < | 0.18 | < | 1 |
| Benzo [k] Fluoranthene | | 2 | < | 0.13 | < | 0.3 |
| Bis (2-ethylhexyl) Phthalate | < | 3 | < | 0.48 | < | 3 |
| Chrysene | < | 0.6 | < | 0.032 | < | 0.6 |
| Fluoranthene | | 6 | | 1 | | 2 |

## STUDY AREA 57 MARSH AND ASSOCIATED LOWER COLD SPRING BROOK
## ANALYTICAL SEDIMENT SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA.

| ANALYTE | COLD SPRING BROOK SAMPLE LOCATIONS | | |
|---|---|---|---|
| | UPSTREAM | DOWNSTREAM | |
| | CSD-94-13X 09/22/94 0 FT | SSD-93-92G 09/16/93 0 FT | CSD-94-19X 09/22/94 0 FT |
| Fluorene | < 0.2 | < 0.065 | < 0.2 |
| Indeno [1,2,3-c,d] Pyrene | < 1 | < 2.4 | < 1 |
| Phenanthrene | 2 | 1.1 | 1 |
| Pyrene | 6 | 2.1 | 2 |
| **PAL VOLATILE ORGANICS (µg/g)** | | | |
| 1,1,1,-trichloroethane | < 0.0044 | < 0.2 | < 0.0044 |
| Acetone | 0.22 | < 3.3 | 0.66 |
| Toluene | 0.0043 | < 0.1 | 0.0033 |
| Trichlorofluoromethane | 0.096 | < 0.23 | 0.1 |
| **PAL PESTICIDES/PCBS (µg/g)** | | | |
| DDT | 0.0553 C M | < 0.1 | NA |
| DDD | 0.49 C | < 0.064 | NA |
| DDE | 0.14 C | 0.0206 | NA |
| alpha chlordane | ND | ND | NA |
| Dieldrin | < 0.00629 M | 0.0192 | NA |
| Endosulfan Sulfate | < 0.00763 | < 1.2 | NA |
| gamma-chlordane | ND | ND | NA |
| Aroclor 1260 | 0.0392 C S | ND | 2ND R |
| **OTHER (µg/g)** | | | |
| Total Organic Carbon | 124000 | 170000 | 161000 |
| Total Petroleum Hydrocarbons | 460 | 1800 | 242 |

NOTES:
D = duplicate
R = Non-target compound analyzed for but not detected.
S = Non-target compound analyzed for and detected.
C = Analysis was confirmed
M = Duplicate high spike analysis, not within control limits.
NA = Not analyzed
ND = Not detectable
µg/g = micrograms per gram

# STORM DRAIN SYSTEM NO. 6 AND ASSOCIATED LOWER COLD SPRING BROOK
# ANALYTICAL SEDIMENT SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA.

| ANALYTE | DITCH SAMPLE LOCATIONS | | | | |
|---|---|---|---|---|---|
| | SSD-93-06B 08/18/93 0 FT | SSD-93-06B 08/18/93 0 FT (dup) | 57S-92-01X 08/19/92 0 FT | 57S-92-02X 08/19/92 0 FT | 57S-92-03X 08/19/92 0 FT |
| **PAL METALS (µg/g)** | | | | | |
| Aluminum | 5750 | 9680 D | NA | NA | NA |
| Arsenic | 10.3 | 20.9 D | NA | NA | NA |
| Barium | 24 | 69 D | NA | NA | NA |
| Beryllium | ND | ND | NA | NA | NA |
| Cadmium | < 1.2 | 3.82 D | NA | NA | NA |
| Calcium | 1190 | 1760 D | NA | NA | NA |
| Chromium | 27.1 | 64.6 D | NA | NA | NA |
| Cobalt | 4.23 | 7.39 D | NA | NA | NA |
| Copper | 40.7 | 105 D | NA | NA | NA |
| Iron | 14900 | 21800 D | NA | NA | NA |
| Lead | 140 | 420 D | NA | NA | NA |
| Magnesium | 2500 | 3770 D | NA | NA | NA |
| Manganese | 184 | 320 D | NA | NA | NA |
| Mercury | < 0.05 | 0.115 D | NA | NA | NA |
| Nickel | 14.1 | 22.8 D | NA | NA | NA |
| Potassium | 885 | 1670 D | NA | NA | NA |
| Selenium | ND | ND | NA | NA | NA |
| Sodium | 76.2 | 138 D | NA | NA | NA |
| Tin | < 7.43 | 13.5 D | NA | NA | NA |
| Vanadium | 16.8 | 36.8 D | NA | NA | NA |
| Zinc | 83.1 | 189 D | NA | NA | NA |
| **PAL SEMIVOLATILE ORGANICS (µg/g)** | | | | | |
| 9-h carbazole | ND | ND | ND | ND | ND |
| 2-methylnaphthalene | 0.19 | 0.15 D | < 1 | < 2 | < 2 |
| Acenaphthene | 0.22 | 0.18 D | < 0.7 | < 1 | < 1 |
| Acenaphthylene | 3.2 | 2.7 D | < 0.7 | < 1 | < 1 |
| Anthracene | 3 | 2.5 D | < 0.7 | < 1 | < 1 |
| Benzo [a] Anthracene | 3.5 | 2.7 D | < 3 | < 7 | < 7 |
| Benzo [a] Pyrene | 4.1 | 3.1 D | < 5 | < 10 | < 10 |
| Benzo [b] Fluoranthene | 4.9 | 3.5 D | < 4 | < 8 | < 8 |
| Benzo [g,h,i] Perylene | 4.9 | 3.1 D | < 5 | < 10 | < 10 |
| Benzo [k] Fluoranthene | 3.6 | 3 D | < 1 | 4 | 4 |
| Bis (2-ethylhexyl) Phthalate | 1.4 | < 0.48 D | < 10 | < 20 | < 20 |
| Chrysene | 4.3 | 3.3 D | < 2 | 5 | 5 |
| Di-n-butyl Phthalate | 9.3 | 6.2GT D | < 1 | < 2 | < 2 |

## STORM DRAIN SYSTEM NO. 6 AND ASSOCIATED LOWER COLD SPRING BROOK
## ANALYTICAL SEDIMENT SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA.

| ANALYTE | DITCH SAMPLE LOCATIONS | | | | |
|---|---|---|---|---|---|
| | SSD-93-06B 08/18/93 0 FT | SSD-93-06B 08/18/93 0 FT (dup) | 57S-92-01X 08/19/92 0 FT | 57S-92-02X 08/19/92 0 FT | 57S-92-03X 08/19/92 0 FT |
| Dibenz [a,h] Anthracene | 0.83 | < 0.31 D | < 4 | < 8 | < 8 |
| Fluoranthene | 5.2 | 4 D | < 1 | 9 | 10 |
| Fluorene | 0.61 | < 0.065 D | < 0.7 | < 1 | < 1 |
| Indeno [1,2,3-c,d] Pyrene | ND | ND | ND | ND | ND |
| Phenanthrene | 4.6 | 3.2 D | < 0.7 | 4 | 4 |
| Pyrene | 5.9 | 4.6 D | < 0.7 | 10 | 10 |
| **PAL VOLATILE ORGANICS (µg/g)** | | | | | |
| 1,1,1-trichloroethane | ND | ND | NA | NA | NA |
| Acetone | ND | ND | NA | NA | NA |
| Toluene | ND | ND | NA | NA | NA |
| Trichlorofluoromethane | ND | ND | NA | NA | NA |
| **OTHER (µg/g)** | | | | | |
| Total Organic Carbon | 75000 | NA | 24500 | 24700 | 18400 |
| Total Petroleum Hydrocarbons | 3500 | 2600 D | 1860 | 1410 | 2210 |

# STORM DRAIN SYSTEM NO. 6 AND ASSOCIATED LOWER COLD SPRING BROOK
# ANALYTICAL SEDIMENT SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA.

| ANALYTE | COLD SPRING BROOK SAMPLE LOCATIONS | | | |
|---|---|---|---|---|
| | UPSTREAM | DOWNSTREAM | | |
| | CSD-94-10X 09/20/94 0 FT | CSD-94-11X 09/21/94 0 FT | CSD-94-12X 09/21/94 0 FT | G3D-92-01X 06/23/92 0 FT |
| **PAL METALS (µg/g)** | | | | |
| Aluminum | 5030 | 12300 | 11800 | 17400 |
| Arsenic | 26.8 | 47.4 | 67 | 120 |
| Barium | 41.9 | 83.7 | 103 | 121 |
| Beryllium | < 0.5 | < 0.5 | < 0.5 | 4.37 |
| Cadmium | ND | ND | ND | ND |
| Calcium | 4500 | 8540 | 9740 | 13500 |
| Chromium | 16.7 | 44.5 | 39.7 | 50.7 |
| Cobalt | 5.78 | 16 | 17.2 | 29.8 |
| Copper | 10 | 35.7 | 37.9 | 42.2 |
| Iron | 8150 | 19200 | 23200 | 33100 |
| Lead | 55.5 | 273 | 258 | 340 |
| Magnesium | 1460 | 3650 | 3250 | 4960 |
| Manganese | 1340 | 934 | 1840 | 1020 |
| Mercury | ND | ND | ND | ND |
| Nickel | 11.6 | 35.2 | 33.6 | 55.1 |
| Potassium | < 100 | 840 | 666 | 1580 |
| Selenium | 1.09 | 2.98 | 2.57 | < 0.25 |
| Sodium | 909 | 1830 | 2000 | 727 |
| Tin | ND | ND | ND | ND |
| Vanadium | 11 | 38.4 | 34.3 | 50.2 |
| Zinc | 63.2 | 336 | 341 | 479 |
| **PAL SEMIVOLATILE ORGANICS (µg/g)** | | | | |
| 9-h carbazole | ND | ND | ND | ND |
| 2-methylnaphthalene | .1ND R | .5ND R | .5ND R | .165ND R |
| Acenaphthene | ND | ND | ND | ND |
| Acenaphthylene | < 0.033 | < 0.2 | < 0.2 | < 0.165 |
| Anthracene | < 0.033 | < 0.2 | < 0.2 | < 0.165 |
| Benzo [a] Anthracene | 0.42 | < 0.8 | < 0.8 | < 0.8 |
| Benzo [a] Pyrene | < 0.25 | < 1 | < 1 | < 1.25 |
| Benzo [b] Fluoranthene | < 0.21 | < 1 | < 1 | < 1.05 |
| Benzo [g,h,i] Perylene | < 0.25 | < 1 | < 1 | < 1.25 |
| Benzo [k] Fluoranthene | 0.47 | 5 | 2 | < 0.33 |
| Bis (2-ethylhexyl) Phthalate | < 0.62 | < 3 | < 3 | < 3.1 |
| Chrysene | 0.84 | 6 | < 0.6 | < 0.6 |
| Di-n-butyl Phthalate | ND | ND | ND | ND |

# STORM DRAIN SYSTEM NO. 6 AND ASSOCIATED LOWER COLD SPRING BROOK
## ANALYTICAL SEDIMENT SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA.

| ANALYTE | COLD SPRING BROOK SAMPLE LOCATIONS | | | |
|---|---|---|---|---|
| | UPSTREAM | DOWNSTREAM | | |
| | CSD-94-10X 09/20/94 0 FT | CSD-94-11X 09/21/94 0 FT | CSD-94-12X 09/21/94 0 FT | G3D-92-01X 06/23/92 0 FT |
| Dibenz [a,h] Anthracene | ND | ND | ND | ND |
| Fluoranthene | 0.89 | 9 | 3 | 3.69 |
| Fluorene | < 0.033 | < 0.2 | < 0.2 | < 0.165 |
| Indeno [1,2,3-c,d] Pyrene | < 0.29 | < 1 | < 1 | < 1.45 |
| Phenanthrene | 0.55 | 5 | 2 | 2.63 |
| Pyrene | 1.6 | 9 | 6 | 7.54 |
| **PAL VOLATILE ORGANICS (µg/g)** | | | | |
| 1,1,1-trichloroethane | NA | NA | NA | < 0.0044 |
| Acetone | NA | NA | NA | 0.657 |
| Toluene | NA | NA | NA | < 0.00078 |
| Trichlorofluoromethane | NA | NA | NA | < 0.0059 |
| **PAL PESTICIDES/PCBS (µg/g)** | | | | |
| DDT | NA | 0.0923 CM | NA | NA |
| DDD | NA | 0.41 C | NA | NA |
| DDE | NA | 0.2 C | NA | NA |
| Dieldrin | NA | < 0.00629 CM | NA | NA |
| Endosulfan Sulfate | NA | < 0.00763 | NA | NA |
| gamma-chlordane | .33ND R | 0.0663 CS | 2ND R | 2ND R |
| **OTHER (µg/g)** | | | | |
| Total Organic Carbon | 85700 | 149000 | 223000 | 4250 |
| Total Petroleum Hydrocarbons | 272 | 534 | 574 | 472 |

NOTES:
D = duplicate
M = Duplicate high spike analysis, not within control limits.
C = Analysis was confirmed.
R = Non-target compound analyzed for but not detected.
S = Non-target compound analyzed for and detected.
NA = Not analyzed
ND = Not detectable
µg/g = micrograms per gram

# STORM DRAIN SYSTEM NO. 7 AND ASSOCIATED LOWER COLD SPRING BROOK
# ANALYTICAL SEDIMENT SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA.

| ANALYTE | DITCH SAMPLE LOCATIONS | | | | | | |
|---|---|---|---|---|---|---|---|
| | CSD-94-04X 09/19/94 0 FT | SSD-93-07A 08/18/93 0 FT | CSD-94-05 09/19/94 0 FT | CSD-94-05 09/19/94 0 FT (dup) | SSD-93-07B 08/18/93 0 FT | CSD-94-06 09/19/94 0 FT | CSD-94-07 09/19/94 0 FT |
| **PAL METALS (µg/g)** | | | | | | | |
| Aluminum | 4280 | 6760 | 13900 | 2670 D | 20900 | 6210 | 9760 |
| Arsenic | 12.8 | 9.91 | 37.9 | 38.4 D | 41.6 | 9.75 | 16.2 |
| Barium | 36.2 | 9.65 | 207 | < 5.18 D | 545 | 28.5 | 82.8 |
| Beryllium | < 0.5 | < 0.427 | 3.37 | < 0.5 D | 8.35 | < 0.5 | < 0.5 |
| Cadmium | < 0.7 | < 1.2 | 6.43 | < 0.7 D | 10.6 | < 0.7 | < 0.7 |
| Calcium | 1040 | 6450 | 6470 | 1020 D | 6910 | 1430 | 2430 |
| Chromium | < 4.05 | 18.6 | < 4.05 | < 4.05 D | 9.64 | 30.2 | 40.5 |
| Cobalt | 21.7 | 4.39 | 116 | 20.6 D | 298 | 4.32 | 15 |
| Copper | 7.31 | 20.6 | 28 | < 0.965 D | 36.2 | 13.5 | 22 |
| Iron | 9230 | 15900 | 28300 | 4790 D | 67800 | 10300 | 19600 |
| Lead | 17 | 26 | 136 | 83 D | 91 | 109 | 212 |
| Magnesium | 817 | 2960 | 1390 | < 100 D | 923 | 3280 | 4600 |
| Manganese | 1610 | 189 | 5560 | 843 D | 25000 | 264 | 1340 |
| Nickel | 19.4 | 13.7 | 145 | 23.2 D | 140 | 16.5 | 34.4 |
| Potassium | < 100 | 544 | < 100 | < 100 D | < 131 | 916 | 1290 |
| Selenium | < 0.25 | < 0.449 | 2.18 | < 0.25 D | < 0.449 | < 0.25 | < 0.25 |
| Sodium | 775 | 67.2 | 1980 | < 100 D | 455 | 642 | 932 |
| Vanadium | < 3.39 | 10.8 | 25.7 | < 3.39 D | 24.6 | 16.1 | 27.4 |
| Zinc | 69 | 46.9 | 604 | 105 D | 415 | 69.9 | 158 |
| **PAL SEMIVOLATILE ORGANICS (µg/g)** | | | | | | | |
| 9-h carbazole | ND | ND | ND | ND | ND | ND | ND |
| Acenaphthylene | < 0.033 | 0.36 | < 0.033 | < 0.033 D | < 0.033 | < 0.3 | < 0.2 |
| Anthracene | ND | ND | ND | ND | ND | ND | ND |
| Benzo [a] Anthracene | < 0.17 | 0.64 | < 0.17 | < 0.17 D | < 0.041 | < 2 | < 0.8 |
| Benzo [a] Pyrene | ND | ND | ND | ND | ND | ND | ND |
| Benzo [k] Fluoranthene | < 0.066 | 0.76 | < 0.066 | 0.48 D | < 0.13 | < 0.7 | 3 |
| Benzo [g,h,i] Perylene | ND | ND | ND | ND | ND | ND | ND |
| Benzo [k] Fluoranthene | ND | ND | ND | ND | ND | ND | ND |
| Bis(2-ethylhexyl) Phthalate | ND | ND | ND | ND | ND | ND | ND |
| Chrysene | < 0.12 | 0.84 | < 0.12 | 0.94 D | < 0.032 | < 1 | 3 |
| Di-n-butyl Phthalate | < 0.061 | 5.5 | < 0.061 | < 0.061 D | 22 | < 0.6 | < 0.3 |
| Fluoranthene | 0.27 | 1 | 1.3 | 1.7 D | 1 | 2 | 6 |
| Fluorene | ND | ND | ND | ND | ND | ND | ND |
| Indeno [1,2,3-c,d] Pyrene | ND | ND | ND | ND | ND | ND | ND |
| Phenanthrene | 0.16 | 1 | 0.74 | 0.92 D | < 0.032 | 2 | 3 |
| Pyrene | 0.28 | 1.5 | 1.4 | 1.4 D | < 0.083 | 2 | 5 |

## STORM DRAIN SYSTEM NO. 7 AND ASSOCIATED LOWER COLD SPRING BROOK
## ANALYTICAL SEDIMENT SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA.

| ANALYTE | DITCH SAMPLE LOCATIONS | | | | | | |
|---|---|---|---|---|---|---|---|
| | CSD-94-04X 09/19/94 0 FT | SSD-93-07A 08/18/93 0 FT | CSD-94-05 09/19/94 0 FT | CSD-94-05 09/19/94 0 FT (dup) | SSD-93-07B 08/18/93 0 FT | CSD-94-06 09/19/94 0 FT | CSD-94-07 09/19/94 0 FT |
| **PAL VOLATILE ORGANICS (µg/g)** | | | | | | | |
| 1,1,1-trichloroethane | NA | ND | NA | NA | NA | NA | NA |
| Acetone | NA | ND | NA | NA | NA | NA | NA |
| Toluene | NA | ND | NA | NA | NA | NA | NA |
| Trichlorofluoromethane | NA | ND | NA | NA | NA | NA | NA |
| **OTHER** | | | | | | | |
| Total Organic Carbon | 41700 | 9600 | 85600 | 199000 D | 1500000 | 27800 | 63200 |
| Total Petroleum Hydrocarbons | 219 | 250 | 470 | 481 D | 300 | 2320 | 1590 |

# STORM DRAIN SYSTEM NO. 7 AND ASSOCIATED LOWER COLD SPRING BROOK
# ANALYTICAL SEDIMENT SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA.

| | COLD SPRING BROOK SAMPLE LOCATIONS | | | | |
|---|---|---|---|---|---|
| | UPSTREAM | | DOWNSTREAM | | |
| ANALYTE | 57D-92-01X 01/11/93 0 FT | 57D-92-01X 08/19/92 0 FT | CSD-94-08X 09/19/94 0 FT | CSD-94-09X 09/20/94 0 FT | SSD-93-92E 09/08/93 0 FT |
| **PAL METALS (µg/g)** | | | | | |
| Aluminum | 11700 | NA | 6770 | 9330 | 18000 |
| Arsenic | 55.3 J | NA | 20.7 | 39 | 54.7 |
| Barium | 93.9 | NA | 61.2 | 92.3 | 125 |
| Beryllium | < 0.5 | NA | < 0.5 | < 0.5 | < 0.427 |
| Cadmium | ND | NA | ND | ND | ND |
| Calcium | 9100 | NA | 2410 | 5760 | 12500 |
| Chromium | 33.3 | NA | 26.1 | 31 | 44.3 |
| Cobalt | 21.3 | NA | 10.7 | 16.2 | 22.4 |
| Copper | 27.8 | NA | 16.4 | 28.1 | 30.1 |
| Iron | 25600 | NA | 14600 | 20400 | 35000 |
| Lead | 99 | NA | 141 | 180 | 190 |
| Magnesium | 3160 | NA | 2990 | 2790 | 4520 |
| Manganese | 1400 | NA | 1030 | 2040 | 2440 |
| Nickel | 32.2 | NA | 24.6 | 30.4 | 31.3 |
| Potassium | 799 | NA | 816 | 727 | 1160 |
| Selenium | < 0.25 | NA | < 0.25 | 1.78 | < 0.449 |
| Sodium | 1110 | NA | 945 | 1230 | 349 |
| Vanadium | 32.4 | NA | 17.8 | 26.9 | 37 |
| Zinc | 239 | NA | 143 | 234 | 359 |
| **PAL SEMIVOLATILE ORGANICS (µg/g)** | | | | | |
| 9-h carbazole | .5ND R | 2ND R | .5ND R | .5ND | |
| Acenaphthylene | < 0.2 | < 0.2 | < 0.2 | < 0.2 | < 0.033 |
| Anthracene | < 0.2 | < 0.2 | < 0.2 | < 0.2 | < 0.71 |
| Benzo [a] Anthracene | < 0.8 | < 0.8 | < 0.8 | < 0.8 | 1.6 |
| Benzo [a] Pyrene | < 1 | < 1 | < 1 | < 1 | < 1.2 |
| Benzo [k] Fluoranthene | < 1 | < 1 | < 1 | < 1 | < 0.31 |
| Benzo [g,h,i] Perylene | < 1 | < 1 | < 1 | < 1 | < 0.18 |
| Benzo [k] Fluoranthene | < 0.3 | < 0.3 | 1 | < 0.3 | < 0.13 |
| Bis(2-ethylhexyl) Phthalate | < 3 | < 3 | < 3 | < 3 | < 0.48 |
| Chrysene | < 0.6 | < 0.6 | 2 | 4 | < 0.032 |
| Di-n-butyl Phthalate | ND | ND | ND | ND | ND |
| Fluoranthene | < 0.3 | 2 | 4 | 4 | 1.8 |
| Fluorene | < 0.2 | < 0.2 | < 0.2 | < 0.2 | < 0.065 |
| Indeno [1,2,3-c,d] Pyrene | < 1 | < 1 | < 1 | < 1 | < 2.4 |
| Phenanthrene | < 0.2 | 1 | 3 | 2 | 1.8 |
| Pyrene | < 0.2 | 2 | 3 | 6 | 2.7 |

# STORM DRAIN SYSTEM NO. 7 AND ASSOCIATED LOWER COLD SPRING BROOK
# ANALYTICAL SEDIMENT SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA.

| | COLD SPRING BROOK SAMPLE LOCATIONS | | | | |
|---|---|---|---|---|---|
| | UPSTREAM | | DOWNSTREAM | | |
| ANALYTE | 57D-92-01X 01/11/93 0 FT | 57D-92-01X 08/19/92 0 FT | CSD-94-08X 09/19/94 0 FT | CSD-94-09X 09/20/94 0 FT | SSD-93-92E 09/08/93 0 FT |
| **PAL VOLATILE ORGANICS (μg/g)** | | | | | |
| 1,1,1-trichloroethane | < 0.0044 | NA | NA | NA | < 0.2 |
| Acetone | 0.44 | NA | NA | NA | < 3.3 |
| Toluene | < 0.00078 | NA | NA | NA | < 0.1 |
| Trichlorofluoromethane | < 0.0059 | NA | NA | NA | < 0.23 |
| **PAL PESTICIDES/PCBS (μg/g)** | | | | | |
| DDT | NA | NA | 0.0202 C | NA | < 0.1 |
| DDD | NA | NA | 0.0518 C | NA | 0.062 |
| DDE | NA | NA | < 0.00765 | NA | < 0.068 |
| Dieldrin | NA | NA | < 0.00629 | NA | < 0.079 |
| Endosulfan Sulfate | NA | NA | < 0.00763 | NA | 0.0112 |
| gamma-chlordane | 2ND R | 2ND R | 2ND R | 2ND | |
| **OTHER** | | | | | |
| Total Organic Carbon | NA | 34800 | 75700 | 132000 | 170000 |
| Total Petroleum Hydrocarbons | 466 | 497 | 734 | 635 | 160 |

NOTES:
D = duplicate
C = Analysis was confirmed
R = Non-target compound analyzed for but not detected
NA = Not analyzed
ND = Not detectable
μg/g = micrograms per gram

# STORM DRAIN SYSTEM NO. 8 AND ASSOCIATED LOWER COLD SPRING BROOK
# ANALYTICAL SEDIMENT SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA.

| ANALYTE | DITCH SAMPLE LOCATION SSD-93-08A 08/18/93 0 FT | COLD SPRING BROOK SAMPLE LOCATIONS UPSTREAM CSD-94-03X 09/20/94 0 FT | DOWNSTREAM SSD-93-92D 09/07/93 0 FT |
|---|---|---|---|
| **PAL METALS (µg/g)** | | | |
| Aluminum | 14300 | 3590 | 15400 |
| Arsenic | 13.2 | 14 | 25.8 |
| Barium | 49.2 | 15.7 | 72.8 |
| Beryllium | 0.945 | ND | < 0.427 |
| Calcium | 1510 | 1010 | 3140 |
| Chromium | 38 | 8.53 | 39.4 |
| Cobalt | 13.8 | 2.98 | 11.7 |
| Copper | 26 | 6.39 | 4.76 |
| Iron | 19200 | 7020 | 37200 |
| Lead | 110 | 30.8 | 34 |
| Magnesium | 3040 | 1330 | 11000 |
| Manganese | 595 | 516 | 1500 |
| Mercury | ND | < 0.05 J | ND |
| Nickel | 17.9 | 8.98 | 37.4 |
| Potassium | 1430 | 194 | 3830 |
| Selenium | ND | < 0.25 | < 0.449 |
| Sodium | 121 | 502 | 91 |
| Vanadium | 26.4 | 6.45 | 26.9 |
| Zinc | 190 | 48.7 | 85.2 |
| **PAL SEMIVOLATILE ORGANICS (µg/g)** | | | |
| 9h-carbazole | ND | 1ND R | ND |
| Acenaphthylene | ND | < 0.033 | < 0.033 |
| Anthracene | ND | < 0.033 | < 0.71 |
| Benzo [a] Anthracene | ND | < 0.17 | < 0.041 |
| Benzo [a] Pyrene | ND | < 0.25 | < 1.2 |
| Benzo [b] Fluoranthene | ND | < 0.21 | < 0.31 |
| Benzo [g,h,i] Perylene | ND | < 0.25 | < 0.18 |
| Benzo [k] Fluoranthene | ND | 0.15 | < 0.13 |
| Bis (2-ethylhexyl) Phthalate | ND | ND | < 0.48 |
| Chrysene | 0.4 | 0.25 | < 0.032 |
| Di-n-butyl Phthalate | 2.1 | ND | ND |
| Fluoranthene | 0.53 | 0.29 | < 0.032 |
| Fluorene | ND | < 0.033 | < 0.065 |
| Indeno [1,2,3-c,d] Pyrene | ND | < 0.29 | < 2.4 |
| Naphthalene | ND | < 0.037 | ND |
| Phenanthrene | 0.48 | 0.15 | < 0.032 |
| Pyrene | 0.45 | 0.4 | < 0.083 |
| **PAL VOLATILE ORGANICS (µg/g)** | | | |
| 1,1,1 - trichloroethane | ND | NA | 0.28 |
| Acetone | ND | NA | < 3.3 |
| Toluene | ND | NA | < 0.1 |
| Trichlorofluoromethane | ND | NA | < 0.23 |
| **PAL PESTICIDES/PCBS (µg/g)** | | | |
| DDT | NA | 0.012 CM | < 0.1 |
| DDD | NA | 0.0324 C | < 0.064 |
| DDE | NA | 0.0234 C | < 0.068 |
| Dieldrin | NA | ND | < 0.079 |
| Endosulfan Sulfate | NA | ND | < 1.2 |
| gamma-chlordane | NA | .33ND R | |
| **OTHER (µg/g)** | | | |
| Total Organic Carbon | 66000 | 22000 | 50000 |
| Total Petroleum Hydrocarbons | 780 | 103 | 23 |

NOTES:
C = Analysis was confirmed
M = Duplicate high spike analysis, not within control limits.
Non-target compound analyzed for but not detected.
NA = Not analyzed
ND = Not detectable
µg/g = micrograms per gram

# STORM DRAIN SYSTEM NO. 9 AND ASSOCIATED LOWER COLD SPRING BROOK
# ANALYTICAL SEDIMENT SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA.

| ANALYTE | DITCH SAMPLE LOCATIONS | | | COLD SPRING BROOK SAMPLE LOCATIONS | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | UPSTREAM | | DOWNSTREAM | | | |
| | SSD-95-09L | SSD-95-09K | SSD-93-09A 8/19/93 0 FT | SSD-93-92C | SSD-95-09J | SSD-95-09I | CSD-94-01X 09/20/94 0 FT | CSD-94-02X 09/21/94 0 FT | SSD-95-09H |
| **PAL METALS (µg/g)** | | | | | | | | | |
| Aluminum | 11600 B | 3320 B | 5850 | 3080 | 4780 B | 4400 B | 1720 | 13100 | 2440 B |
| Arsenic | 24.8 | 4.25 | 17.5 | 13.1 | 13.3 | 12.1 | 11.9 | 62 | 9.4 |
| Barium | 64.4 B | 16.3 B | 19.5 | 7.85 | 18.9 B | 10.8 B | < 5.18 | 117 | 16.8 B |
| Calcium | 4750 B | 779 B | 1080 | 482 | 1870 B | 661 B | 408 | 6780 | 788 B |
| Chromium | 46.6 | 9.38 | 17.4 | 6.24 | 10.8 | 14.8 | < 4.05 | 48 | 5.51 |
| Cobalt | 12.7 | < 2.5 | 3.14 | ND | < 2.5 | < 2.5 | < 1.42 | 9.6 | 23.2 |
| Copper | 62.9 | 6.24 | 11.1 | ND | 8.38 | 8.8 | 3.04 | 48.8 | 2.84 |
| Iron | 26300 B | 6900 B | 14200 | 6440 | 8030 B | 9840 B | 3450 | 28700 | < 5080 B |
| Lead | 82 B | 13.2 B | 52 | 6.31 | 32.6 B | 54 B | 5.48 | 241 | 10.6 B |
| Magnesium | 4730 B | 1410 B | 3030 | 1370 | 1470 B | 2730 B | 637 | 4130 | 932 B |
| Manganese | 864 B | 62.6 B | 108 | 214 | 195 B | 64.1 B | 61.5 | 861 | 517 B |
| Mercury | .163 | < .05 | ND | ND | < .05 | < .05 | < 0.05 J | 0.247 J | .05 |
| Nickel | 29.3 | 5.02 | 13.6 | 3.94 | 7.09 | 9.52 | 4.12 | 33.5 | < 26.3 |
| Potassium | 2560 B | 849 B | 672 | ND | 480 B | 527 B | 195 | 1380 | < 197 B |
| Selenium | NA | NA | ND | ND | NA | NA | < 0.25 | 1.78 | NA |
| Sodium | 241 | 61.6 | 98 | ND | 112 | < 38.7 | 409 | 1900 | 38.7 |
| Vanadium | 49.3 B | 7.85 B | 12.6 | 4.09 | 7.75 B | 9.76 B | < 3.39 | 34.3 | 3.31 B |
| Zinc | 272 BI | 25.9 BI | 43.6 | 18.1 | 40.8 BI | 57.6 BI | 15.2 | 332 | 16.5 BI |
| **PAL SEMIVOLATILE ORGANICS (µg/g)** | | | | | | | | | |
| 2-methylnaphthalene | < .06 | .3 | NA | NA | .3 | .2 | NA | NA | .032 |
| Acenaphthene | < .08 | 1 | NA | NA | < .08 | < .08 | NA | NA | < .041 |
| 9h-carbazole | NA | NA | ND | ND | NA | NA | 0.28 S | IND R | NA |
| Acenaphthylene | < .07 | .7 | ND | 0.15 | < .07 | .9 | 0.12 | < 0.3 | < .033 |
| Anthracene | < 1 | 5 | ND | ND | < 1 | < 1 | 0.19 | < 0.3 | < .71 |
| Bis(2-ethylhexyl) Phthalate | 20 | < 1 | NA | NA | < 1 | < 1 | NA | NA | < .48 |
| Benzo [a] Anthracene | .7 | 7 | 2 | 0.64 | .7 | 7 | 0.7 | < 2 | < .041 |
| Benzo [a] Pyrene | < 2 | 5 | ND | ND | < 2 | < 2 | 0.74 | < 2 | < 1.2 |
| Benzo [b] Fluoranthene | < .6 | 9 | ND | ND | < .6 | 10 | 0.68 | < 2 | < .31 |
| Benzo [g,h,i] Perylene | < .4 | 2 | ND | ND | < .4 | < .4 | 0.38 | < 2 | < .18 |
| Benzo [k] Fluoranthene | < .3 | 3 | ND | 0.51 | < .3 | 4 | 0.61 | < 0.7 | < .13 |
| Chrysene | 1 | 6 | 3 | 0.68 | .9 | 8 | 1.3 | < 1 | .032 |
| Dibenzofuran | < .8 | 1 | NA | NA | < .8 | < .8 | NA | NA | < .38 |
| Di-n-butyl Phthalate | < 3 | < 3 | NA | NA | < 3 | < 3 | NA | NA | < 1.3 |
| Fluoranthene | .9 | 10 | ND | 0.95 | .8 | 9 | 2.1 | 5 | < .032 |
| Fluorene | < .1 | 4 | ND | 0.17 | < .1 | 2 | 0.16 | < 0.3 | < .065 |

# STORM DRAIN SYSTEM NO. 9 AND ASSOCIATED LOWER COLD SPRING BROOK
# ANALYTICAL SEDIMENT SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA.

| ANALYTE | DITCH SAMPLE LOCATIONS | | | | | | COLD SPRING BROOK SAMPLE LOCATIONS | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | UPSTREAM | | | | DOWNSTREAM | | | | | | | |
| | SSD-95-09L | | SSD-95-09K | | SSD-93-09A 8/19/93 0 FT | | SSD-93-92C | | SSD-95-09J | | SSD-95-09I | | CSD-94-01X 09/20/94 0 FT | | CSD-94-02X 09/21/94 0 FT | | SSD-95-09H | |
| Hexadecanoic Acid / Palmitic Acid | 9 | NB | 2 | NB | NA | | NA | | 3 | NB | 2 | NB | NA | | NA | | < 4 | NB |
| Indeno [1,2,3-c,d] Pyrene | NA | | NA | | ND | | ND | | NA | | NA | | 0.4 | | < 3 | | NA | |
| Naphthalene | NA | | NA | | ND | | ND | | NA | | NA | | 0.073 | | < 0.4 | | NA | |
| Octadecanoic Acid | 2 | NB | | | NA | | NA | | | | | | NA | | NA | | < .81 | NB |
| Phenanthrene | 1 | | 20 | | ND | | 1.7 | | 1 | | 10 | | 1.6 | | 3 | | < .032 | |
| Pyrene | 1 | | 10 | | ND | | 1.4 | | 1 | | 10 | | 2.4 | | 6 | | < .083 | |
| **PAL PESTICIDES/PCBS (µg/g)** | | | | | | | | | | | | | | | | | | |
| Endosulfan Ii | .00296 | C | < .0007 | | NA | | NA | | .00294 | C2 | .00305 | C2 | NA | | NA | | .0007 | |
| Dieldrin | .00504 | C | .00235 | C | NA | | NA | | .0118 | C | .0135 | C | NA | | NA | | < .0016 | |
| DDT | .0113 | U2 | .0056 | U2 | NA | | NA | | .0319 | U2 | .0216 | U2 | NA | | 0.15 | CM | < .0035 | |
| DDD | .00541 | C | .0121 | C | NA | | NA | | .0927 | C | .106GT | 2X | NA | | 0.56 | C | < .00505 | C |
| DDE | .0113 | U | .00428 | C | NA | | NA | | .0774 | U | .0203 | C | NA | | 0.16 | C | < .0027 | |
| gamma-chlordane | NA | | NA | | NA | | NA | | NA | | NA | | .33ND | R | 0.0716 | CS | NA | |
| **OTHER (µg/g)** | | | | | | | | | | | | | | | | | | |
| Total Organic Carbon | 125000 | | 1490 | | 51000 | | 9600 | | 36600 | | 24200 | | 2080 | | 120000 | | 7400 | |
| Total Petroleum Hydrocarbons | 965 | | 537 | | 270 | | NA | | 77.8 | | 315 | | 61 | | 2120 | | 534 | |

NOTES:
µg/g = micrograms per gram
s.u. = standard units
< = less than
2 = ending calibration not within acceptable limits
B = analyte found in method blank or QC blank as well as the sample
I = low spike recovery is high
J = Value is estimated
M = Duplicate high spike analysis, not within control limits.
N = tentatively identified compound
R = Non-target compound analyzed for but not detected
S = Non-target compound analyzed for and detected
C = Analysis was confirmed
NA = Not analyzed
ND = Not detectable
X = analyte concentration is above the upper reporting level

# STORM DRAIN SYSTEM NO. 5
# ANALYTICAL SEDIMENT SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA.

| ANALYTE | DITCH SAMPLE LOCATIONS | | |
|---|---|---|---|
| | SSD-93-05A 08/17/93 0 FT | GRD-94-06X 09/19/94 0 FT | GRD-94-07X 09/19/94 0 FT |
| **PAL METALS (µg/g)** | | | |
| Aluminum | 30400 | 10700 | 42200 |
| Arsenic | 43 | 20 | 5.35 |
| Barium | 99 | 57 | < 5.18 |
| Beryllium | 1.62 | < 0.5 | < 0.5 |
| Cadmium | 4.59 | 0.931 | < 0.7 |
| Calcium | 6960 | 591 | 1830 |
| Chromium | 163 | 36.9 | < 4.05 |
| Cobalt | 28.8 | 13.1 | < 1.42 |
| Copper | 65.6 | 47.3 | 63 |
| Iron | 48700 | 16300 | 2200 |
| Lead | 160 | 356 | 160 |
| Magnesium | 17500 | 4080 | < 100 |
| Manganese | 1300 | 2410 | 43.2 |
| Mercury | < 0.05 | 0.0961 | < 0.05 |
| Nickel | 82 | 25.3 | < 1.71 |
| Potassium | 5950 | 755 | < 100 |
| Selenium | < 0.449 | 0.67 | 8.64 |
| Sodium | 270 | 448 | 5310 |
| Vanadium | 88.6 | 48.8 | < 3.39 |
| Zinc | 301 | 63.7 | < 8.03 |
| **PAL SEMIVOLATILE ORGANICS (µg/g)** | | | |
| Acenaphthene | 0.21 | < 2 | < 0.036 |
| Acenaphthylene | 3.8 | 3 | < 0.033 |
| Anthracene | 4.5 | < 2 | < 0.033 |
| Benzo [a] Anthracene | 5.9 | < 8 | < 0.17 |
| Benzo [a] Pyrene | 5.8 | < 10 | < 0.25 |
| Benzo [b] Fluoranthene | 6.9 | 20 | < 0.21 |
| Benzo [g,h,i] Perylene | 5 | < 10 | < 0.25 |
| Benzo [k] Fluoranthene | 6.2 | 10 | < 0.066 |
| Chrysene | 7.4 | 20 | < 0.12 |
| Fluoranthene | 7.3 | 30 | < 0.068 |
| Fluorene | 0.91 | < 2 | < 0.033 |
| Phenanthrene | 8.4 | 10 | < 0.033 |
| Pyrene | 12 | 30 | 0.66 |
| **OTHER (µg/g)** | | | |
| Total Organic Carbon | 55000 | 92600 | 428000 |
| Total Petroleum Hydrocarbons | 3200 | 1570 | 3200 |

NOTES:
µg/g = micrograms per gram

# LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA

| ANALYTE | CSW-94-01X 09/20/94 | CSW-94-01X 09/20/94 (filtered) | CSW-94-02X 09/21/94 | CSW-94-02X 09/21/94 (filtered) | CSW-94-03X 09/20/94 | CSW-94-03X 09/20/94 (filtered) | CSW-94-08X 09/19/94 | CSW-94-08X 09/19/94 (filtered) |
|---|---|---|---|---|---|---|---|---|
| **PAL METALS (µg/L)** | | | | | | | | |
| Aluminum | < 141 | < 141 F | 297 | < 141 F | < 141 | < 141 F | < 141 | < 141 F |
| Antimony | < 3.03 | < 3.03 F | < 3.03 | < 3.03 F | < 3.03 | < 3.03 F | < 3.03 | 3.48 F |
| Arsenic | 3.52 | 3.09 F | 5.22 | 3.73 F | 4.9 | 3.41 F | 5.44 | 3.94 F |
| Barium | 8.06 | 8.24 F | 12.8 | 7.38 F | 5.37 | < 5 F | 7.86 | 6.9 F |
| Beryllium | < 5 | < 5 F | < 5 | < 5 F | < 5 | < 5 F | < 5 | < 5 F |
| Cadmium | < 4.01 | < 4.01 F | < 4.01 | < 4.01 F | < 4.01 | < 4.01 F | < 4.01 | < 4.01 F |
| Calcium | 23800 | 23900 F | 24200 | 24300 F | 23200 | 23100 F | 22800 | 22200 F |
| Chromium | < 6.02 | < 6.02 F | < 6.02 | < 6.02 F | < 6.02 | < 6.02 F | < 6.02 | < 6.02 F |
| Cobalt | < 25 | < 25 F | < 25 | < 25 F | < 25 | < 25 F | < 25 | < 25 F |
| Copper | < 8.09 | < 8.09 F | < 8.09 | < 8.09 F | < 8.09 | < 8.09 F | < 8.09 | < 8.09 F |
| Iron | 205 | 85.4 F | 691 | 144 F | 474 | 82.8 F | 454 | 207 F |
| Lead | < 1.26 | < 1.26 F | 2.39 | < 1.26 F | < 1.26 | < 1.26 F | 1.41 | < 1.26 F |
| Magnesium | 3380 | 3430 F | 3410 | 3400 F | 3270 | 3280 F | 3260 | 3190 F |
| Manganese | 49.5 | 48.1 F | 59.2 | 44.7 F | 45.1 | 10.1 F | 64.4 | 56.4 F |
| Mercury | < .243 | < .243 F | < .243 | < .243 F | < .243 | < .243 F | < .243 | < .243 F |
| Nickel | < 34.3 | < 34.3 F | < 34.3 | < 34.3 F | < 34.3 | < 34.3 F | < 34.3 | < 34.3 F |
| Potassium | 2160 | 1690 F | 1350 | 1520 F | 1080 | 1490 F | 1830 | 1490 F |
| Selenium | < 3.02 | < 3.02 F | < 3.02 | < 3.02 F | < 3.02 | < 3.02 F | < 3.02 | < 3.02 F |
| Sodium | 21500 | 21800 F | 21100 | 21400 F | 20900 | 20800 F | 20900 | 20400 F |
| Vanadium | < 11 | < 11 F | < 11 | < 11 F | < 11 | < 11 F | < 11 | < 11 F |
| Zinc | < 21.1 | < 21.1 F | < 21.1 | < 21.1 F | < 21.1 | < 21.1 F | < 21.1 | < 21.1 F |
| **PAL PESTICIDES/PCBS (µg/L)** | | | | | | | | |
| 4,4'-ddd | | | < .0233 | | < .0233 | | < .0233 | |
| 4,4'-ddt | | | < .034 | | < .034 | | < .034 | |
| Bhc - Alpha | | | < .0385 | | < .0385 | | < .0385 | |
| Bhc - Beta | | | < .024 | | < .024 | | < .024 | |
| Bhc - Delta | | | < .0293 | | < .0293 | | < .0293 | |
| Bhc - Gamma (lindane) | | | < .0507 | | < .0507 | | < .0507 | |
| Endosulfan I | | | < .023 | | < .023 | | < .023 | |
| Endrin Aldehyde | | | < .0285 | | < .0285 | | < .0285 | |
| Heptachlor | | | < .0423 | | < .0423 | | < .0423 | |
| Isodrin | | | < .0562 | | < .0562 | | < .0562 | |
| **PAL SEMIVOLATILE ORGANICS (µg/L)** | | | | | | | | |
| Bis(2-ethylhexyl) Phthalate | < 4.8 | | < 4.8 | | < 4.8 | | 4.5 | |

# LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA

| ANALYTE | CSW-94-01X 09/20/94 | CSW-94-01X 09/20/94 (filtered) | CSW-94-02X 09/21/94 | CSW-94-02X 09/21/94 (filtered) | CSW-94-03X 09/20/94 | CSW-94-03X 09/20/94 (filtered) | CSW-94-08X 09/19/94 | CSW-94-08X 09/19/94 (filtered) |
|---|---|---|---|---|---|---|---|---|
| **PAL WET CHEMISTRY** | | | | | | | | |
| Alkalinity | 47000 | | 49000 | | 48000 | | 46000 | |
| Chloride | 66000 | | 33000 | | 33000 | | 33000 | |
| Sulfate | | | | | | | | |
| Total Hardness | 70400 | | 71600 | | 69600 | | 67600 | |
| Total Suspended Solids | < 4000 | | 4000 | | < 4000 | | < 4000 | |
| **OTHER** | | | | | | | | |
| Total Organic Carbon (µg/L) | | | | | | | | |

NOTES:
µg/L = micrograms per liter
< = less than
B = analyte found in method blank or QC blank as well as the sample.
C = analysis was confirmed
D = duplicate
F = filtered
I = low spike recovery is high
M = high spike recovery is high
N = high spike recovery is low
U = analysis is unconfirmed
V = sample was subjected to unusual storage/preservation conditions

# LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA

| ANALYTE | CSW-94-09X 09/20/94 | CSW-94-09X 09/20/94 (filtered) | CSW-94-10X 09/20/94 | CSW-94-10X 09/20/94 (filtered) | CSW-94-11X 09/21/94 | CSW-94-11X 09/21/94 (filtered) | CSW-94-12X 09/21/94 | CSW-94-12X 09/21/94 (filtered) |
|---|---|---|---|---|---|---|---|---|
| **PAL METALS (µg/L)** | | | | | | | | |
| Aluminum | < 141 | < 141 F | < 141 | < 141 F | < 141 | < 141 F | 402 | < 141 F |
| Antimony | < 3.03 | 3.3 F | < 3.03 | 4.11 F | < 3.03 | < 3.03 F | < 3.03 | 4.02 F |
| Arsenic | 5.97 | 4.05 F | 4.69 | < 2.54 F | 4.58 | 3.3 F | 8.74 | 3.52 F |
| Barium | 8.06 | 7.09 F | 7.86 | 6.9 F | 7.77 | 6.81 F | 10.4 | 8.53 F |
| Beryllium | < 5 | < 5 F | < 5 | < 5 F | < 5 | < 5 F | < 5 | < 5 F |
| Cadmium | < 4.01 | < 4.01 F | < 4.01 | < 4.01 F | < 4.01 | < 4.01 F | < 4.01 | < 4.01 F |
| Calcium | 22700 | 22200 F | 23300 | 22000 F | 22800 | 21300 F | 22800 | 21900 F |
| Chromium | < 6.02 | < 6.02 F | < 6.02 | < 6.02 F | < 6.02 | < 6.02 F | < 6.02 | < 6.02 F |
| Cobalt | < 25 | < 25 F | < 25 | < 25 F | < 25 | < 25 F | < 25 | < 25 F |
| Copper | < 8.09 | < 8.09 F | < 8.09 | < 8.09 F | < 8.09 | < 8.09 F | < 8.09 | < 8.09 F |
| Iron | 439 | 139 F | 405 | 119 F | 421 | 105 F | 1200 | 112 F |
| Lead | < 1.26 | < 1.26 F | < 1.26 | < 1.26 F | < 1.26 | < 1.26 F | 5.1 | < 1.26 F |
| Magnesium | 3250 | 3170 F | 3340 | 3160 F | 3250 | 3080 F | 3280 | 3140 F |
| Manganese | 84.3 | 72.2 F | 81.2 | 69.8 F | 94.5 | 93.7 F | 272 | 355 F |
| Mercury | < .243 | < .243 F | < .243 | < .243 F | < .243 | < .243 F | < .243 | < .243 F |
| Nickel | < 34.3 | < 34.3 F | < 34.3 | < 34.3 F | < 34.3 | < 34.3 F | < 34.3 | < 34.3 F |
| Potassium | 1370 | 1590 F | 1770 | 1820 F | 1260 | 1460 F | 1700 | 1410 F |
| Selenium | < 3.02 | < 3.02 F | < 3.02 | < 3.02 F | < 3.02 | < 3.02 F | < 3.02 | < 3.02 F |
| Sodium | 20500 | 20000 F | 20600 | 19600 F | 20000 | 19000 F | 19800 | 19800 F |
| Vanadium | < 11 | < 11 F | < 11 | < 11 F | < 11 | < 11 F | < 11 | < 11 F |
| Zinc | < 21.1 | < 21.1 F | < 21.1 | < 21.1 F | < 21.1 | < 21.1 F | < 21.1 | < 21.1 F |
| **PAL PESTICIDES/PCBS (µg/L)** | | | | | | | | |
| 4,4'-ddd | | | | | < .0233 | | | |
| 4,4'-ddt | | | | | < .034 | | | |
| Bhc - Alpha | | | | | < .0385 | | | |
| Bhc - Beta | | | | | < .024 | | | |
| Bhc - Delta | | | | | < .0293 | | | |
| Bhc - Gamma (lindane) | | | | | < .0507 | | | |
| Endosulfan I | | | | | < .023 | | | |
| Endrin Aldehyde | | | | | < .0285 | | | |
| Heptachlor | | | | | < .0423 | | | |
| Isodrin | | | | | < .0562 | | | |
| **PAL SEMIVOLATILE ORGANICS (µg/L)** | | | | | | | | |
| Bis(2-ethylhexyl) Phthalate | < 4.8 | | < 4.8 | | < 4.8 | | < 4.8 | |

# LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA

| ANALYTE | CSW-94-09X 09/20/94 | CSW-94-09X 09/20/94 (filtered) | CSW-94-10X 09/20/94 | CSW-94-10X 09/20/94 (filtered) | CSW-94-11X 09/21/94 | CSW-94-11X 09/21/94 (filtered) | CSW-94-12X 09/21/94 | CSW-94-12X 09/21/94 (filtered) |
|---|---|---|---|---|---|---|---|---|
| **PAL WET CHEMISTRY** | | | | | | | | |
| Alkalinity | 45000 | | 46000 | | 41000 | | 49000 | |
| Chloride | 33000 | | 33000 | | 33000 | | 33000 | |
| Sulfate | | | | | | | | |
| Total Hardness | 67600 | | 67600 | | 67600 | | 68400 | |
| Total Suspended Solids | < 4000 | | < 4000 | | 6000 | | 37000 | |
| **OTHER** | | | | | | | | |
| Total Organic Carbon (µg/L) | | | | | | | | |

NOTES:
µg/L = micrograms per liter
< = less than
B = analyte found in method blank or QC blank as well as the sample.
C = analysis was confirmed
D = duplicate
F = filtered
I = low spike recovery is high
M = high spike recovery is high
N = high spike recovery is low
U = analysis is unconfirmed
V = sample was subjected to unusual storage/preservation conditions

# LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA

| ANALYTE | CSW-94-13X 09/22/94 | CSW-94-13X 09/22/94 (filtered) | CSW-94-14X 09/22/94 | CSW-94-14X 09/22/94 (filtered) | CSW-94-16X 09/22/94 | CSW-94-16X 09/22/94 (filtered) | CSW-94-17X 09/22/94 | CSW-94-17X 09/22/94 (filtered) |
|---|---|---|---|---|---|---|---|---|
| **PAL METALS (µg/L)** | | | | | | | | |
| Aluminum | < 141 | < 141 F | 7740 | < 141 F | 501 | < 141 F | < 141 | < 141 F |
| Antimony | < 3.03 | 2.95 F | < 3.03 | < 3.03 F | < 3.03 | < 3.03 F | < 3.03 | 2.95 F |
| Arsenic | 3.84 | 3.3 F | 8.42 | < 2.54 F | 15.8 | < 2.54 F | 3.52 | < 2.54 F |
| Barium | 8.63 | 8.15 F | 107 | 11.6 F | 46.9 | 12.5 F | 8.95 | 8.28 F |
| Beryllium | < 5 | < 5 F | < 5 | < 5 F | < 5 | < 5 F | < 5 | < 5 F |
| Cadmium | < 4.01 | < 4.01 F | 9.74 | < 4.01 F | < 4.01 | < 4.01 F | < 4.01 | < 4.01 F |
| Calcium | 24000 | 24000 F | 22300 | 7300 F | 18000 | 17200 F | 22900 | 22800 F |
| Chromium | < 6.02 | < 6.02 F | 14 | < 6.02 F | < 6.02 | < 6.02 F | < 6.02 | < 6.02 F |
| Cobalt | < 25 | < 25 F | < 25 | < 25 F | < 25 | < 25 F | < 25 | < 25 F |
| Copper | < 8.09 | < 8.09 F | 60.5 | < 8.09 F | < 8.09 | < 8.09 F | < 8.09 | < 8.09 F |
| Iron | 423 | 115 F | 7800 | < 38.8 F | 6080 | 438 F | 474 | 249 F |
| Lead | < 1.26 | < 1.26 F | 140 | 1.41 F | 3.36 | < 1.26 F | < 1.26 | < 1.26 F |
| Magnesium | 3450 | 3460 F | 2020 | 611 F | 3420 | 3300 F | 3270 | 3270 F |
| Manganese | 101 | 96.5 F | 60 | 7.88 F | 4480 | 217 F | 102 | 90 F |
| Mercury | < .243 | < .243 F | < .243 | < .243 F | < .243 | < .243 F | < .243 | < .243 F |
| Nickel | < 34.3 | < 34.3 F | < 34.3 | < 34.3 F | < 34.3 | < 34.3 F | < 34.3 | < 34.3 F |
| Potassium | 2110 | 2010 F | 2860 | 1540 F | 2500 | 2540 F | 1500 | 1460 F |
| Selenium | < 3.02 | < 3.02 F | < 3.02 | < 3.02 F | < 3.02 | < 3.02 F | < 3.02 | < 3.02 F |
| Sodium | 19600 | 19700 F | 44700 | 46200 F | 32800 | 32800 F | 20500 | 20600 F |
| Vanadium | < 11 | < 11 F | 16.4 | < 11 F | < 11 | < 11 F | < 11 | < 11 F |
| Zinc | < 21.1 | < 21.1 F | 240 | < 21.1 F | < 21.1 | < 21.1 F | < 21.1 | < 21.1 F |
| **PAL PESTICIDES/PCBS (µg/L)** | | | | | | | | |
| 4,4'-ddd | < .0233 | | | | | | | |
| 4,4'-ddt | < .034 | | | | | | | |
| Bhc - Alpha | < .0385 | | | | | | | |
| Bhc - Beta | < .024 | | | | | | | |
| Bhc - Delta | < .0293 | | | | | | | |
| Bhc - Gamma (lindane) | < .0507 | | | | | | | |
| Endosulfan I | < .023 | | | | | | | |
| Endrin Aldehyde | < .0285 | | | | | | | |
| Heptachlor | < .0423 | | | | | | | |
| Isodrin | < .0562 | | | | | | | |
| **PAL SEMIVOLATILE ORGANICS (µg/L)** | | | | | | | | |
| Bis(2-ethylhexyl) Phthalate | < 4.8 | | < 4.8 | | < 4.8 | | < 4.8 | |

# LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA

| ANALYTE | CSW-94-13X 09/22/94 | CSW-94-13X 09/22/94 (filtered) | CSW-94-14X 09/22/94 | CSW-94-14X 09/22/94 (filtered) | CSW-94-16X 09/22/94 | CSW-94-16X 09/22/94 (filtered) | CSW-94-17X 09/22/94 | CSW-94-17X 09/22/94 (filtered) |
|---|---|---|---|---|---|---|---|---|
| **PAL WET CHEMISTRY** | | | | | | | | |
| Alkalinity | 51000 | | 13000 | | 33000 | | 47000 | |
| Chloride | 33000 | | 55000 | | 55000 | | 33000 | |
| Sulfate | | | | | | | | |
| Total Hardness | 71600 | | 57200 | | 62400 | | 67200 | |
| Total Suspended Solids | < 4000 | | 212000 | | 146000 | | 9000 | |
| **OTHER** | | | | | | | | |
| Total Organic Carbon (µg/L) | | | | | | | | |

NOTES:
µg/L = micrograms per liter
< = less than
B = analyte found in method blank or QC blank as well as the sample.
C = analysis was confirmed
D = duplicate
F = filtered
I = low spike recovery is high
M = high spike recovery is high
N = high spike recovery is low
U = analysis is unconfirmed
V = sample was subjected to unusual storage/preservation conditions

# LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA

| ANALYTE | CSW-94-18X 09/22/94 | CSW-94-18X 09/22/94 (filtered) | CSW-94-19X 09/22/94 | CSW-94-19X 09/22/94 (filtered) | CSW-94-20X 09/22/94 | CSW-94-20X 09/22/94 (filtered) | CSW-94-26X 09/20/94 | CSW-94-26X 09/20/94 (filtered) |
|---|---|---|---|---|---|---|---|---|
| **PAL METALS (µg/L)** | | | | | | | | |
| Aluminum | < 141 | < 141 F | < 141 | < 141 F | 167 | < 141 F | < 141 | < 141 F |
| Antimony | < 3.03 | 3.04 F | < 3.03 | < 3.03 F | < 3.03 | < 3.03 F | < 3.03 | < 3.03 F |
| Arsenic | 2.98 | < 2.54 F | 3.73 | < 2.54 F | < 2.54 | < 2.54 F | < 2.54 | < 2.54 F |
| Barium | 11.5 | 12.5 F | 8.95 | 8.18 F | 16.8 | 16.5 F | 12.8 | 9.44 F |
| Beryllium | < 5 | < 5 F | < 5 | < 5 F | < 5 | < 5 F | < 5 | < 5 F |
| Cadmium | < 4.01 | < 4.01 F | < 4.01 | < 4.01 F | < 4.01 | < 4.01 F | < 4.01 | < 4.01 F |
| Calcium | 18400 | 17500 F | 22300 | 22500 F | 21300 | 21100 F | 17300 | 16900 F |
| Chromium | < 6.02 | < 6.02 F | < 6.02 | < 6.02 F | < 6.02 | < 6.02 F | < 6.02 | < 6.02 F |
| Cobalt | < 25 | < 25 F | < 25 | < 25 F | < 25 | < 25 F | < 25 | < 25 F |
| Copper | < 8.09 | < 8.09 F | < 8.09 | < 8.09 F | < 8.09 | < 8.09 F | < 8.09 | < 8.09 F |
| Iron | 305 | 873 F | 562 | 105 F | 1090 | 172 F | 804 | 150 F |
| Lead | < 1.26 | < 1.26 F | < 1.26 | < 1.26 F | 1.41 | < 1.26 F | < 1.26 | < 1.26 F |
| Magnesium | 3200 | 3300 F | 3200 | 3230 F | 2820 | 2810 F | 2900 | 2870 F |
| Manganese | 278 | 442 F | 128 | 86.8 F | 119 | 108 F | 613 | 222 F |
| Mercury | < .243 | < .243 F | < .243 | < .243 F | < .243 | < .243 F | < .243 | < .243 F |
| Nickel | < 34.3 | < 34.3 F | < 34.3 | < 34.3 F | < 34.3 | < 34.3 F | < 34.3 | < 34.3 F |
| Potassium | 2040 | 2200 F | 1580 | 1830 F | 2620 | 2160 F | 1730 | 1850 F |
| Selenium | < 3.02 | < 3.02 F | < 3.02 | < 3.02 F | < 3.02 | < 3.02 F | < 3.02 | < 3.02 F |
| Sodium | 29100 | 32100 F | 19900 | 20200 F | 21200 | 20900 F | 22900 | 22600 F |
| Vanadium | < 11 | < 11 F | < 11 | < 11 F | < 11 | < 11 F | < 11 | < 11 F |
| Zinc | < 21.1 | < 21.1 F | < 21.1 | < 21.1 F | < 21.1 | < 21.1 F | < 21.1 | < 21.1 F |
| **PAL PESTICIDES/PCBS (µg/L)** | | | | | | | | |
| 4,4'-ddd | < .0233 | | | | < .0233 | | | |
| 4,4'-ddt | < .034 | | | | < .034 | | | |
| Bhc - Alpha | < .0385 | | | | < .0385 | | | |
| Bhc - Beta | < .024 | | | | < .024 | | | |
| Bhc - Delta | < .0293 | | | | < .0293 | | | |
| Bhc - Gamma (lindane) | < .0507 | | | | < .0507 | | | |
| Endosulfan I | < .023 | | | | < .023 | | | |
| Endrin Aldehyde | < .0285 | | | | < .0285 | | | |
| Heptachlor | < .0423 | | | | < .0423 | | | |
| Isodrin | < .0562 | | | | < .0562 | | | |
| **PAL SEMIVOLATILE ORGANICS (µg/L)** | | | | | | | | |
| Bis(2-ethylhexyl) Phthalate | 11 | | < 4.8 | | < 4.8 | | < 4.8 | |

# LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA

| ANALYTE | CSW-94-18X 09/22/94 | CSW-94-18X 09/22/94 (filtered) | CSW-94-19X 09/22/94 | CSW-94-19X 09/22/94 (filtered) | CSW-94-20X 09/22/94 | CSW-94-20X 09/22/94 (filtered) | CSW-94-26X 09/20/94 | CSW-94-26X 09/20/94 (filtered) |
|---|---|---|---|---|---|---|---|---|
| **PAL WET CHEMISTRY** | | | | | | | | |
| Alkalinity | 34000 | | 47000 | | 22000 | | 36000 | |
| Chloride | 66000 | | 33000 | | 66000 | | 66000 | |
| Sulfate | | | | | | | | |
| Total Hardness | 56400 | | 68000 | | 61600 | | 54400 | |
| Total Suspended Solids | < 4000 | | < 4000 | | 131000 | | < 4000 | |
| **OTHER** | | | | | | | | |
| Total Organic Carbon (µg/L) | | | | | | | | |

NOTES:
µg/L = micrograms per liter
< = less than
B = analyte found in method blank or QC blank as well as the sample.
C = analysis was confirmed
D = duplicate
F = filtered
I = low spike recovery is high
M = high spike recovery is high
N = high spike recovery is low
U = analysis is unconfirmed
V = sample was subjected to unusual storage/preservation conditions

# LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA

| ANALYTE | CSW-94-27X 09/20/94 | CSW-94-27X 09/20/94 (filtered) | CSW-94-28X 09/22/94 | CSW-94-28X 09/22/94 (filtered) | CSW-94-31X 09/21/94 | CSW-94-31X 09/21/94 (filtered) | CSW-94-32X 09/21/94 | CSW-94-32X 09/21/94 (filtered) |
|---|---|---|---|---|---|---|---|---|
| **PAL METALS (µg/L)** | | | | | | | | |
| Aluminum | < 141 | < 141 F | < 141 | < 141 F | 3150 | < 141 F | < 141 | < 141 F |
| Antimony | < 3.03 | < 3.03 F | < 3.03 | 3.12 F | < 3.03 | < 3.03 F | < 3.03 | 2.95 F |
| Arsenic | < 2.54 | < 2.54 F | < 2.54 | < 2.54 F | 79.3 | < 2.54 F | < 2.54 | < 2.54 F |
| Barium | 9.54 | 8.18 F | 8.18 | 8.56 F | 179 | 7.01 F | 7.4 | 8.18 F |
| Beryllium | < 5 | < 5 F | < 5 | < 5 F | < 5 | < 5 F | < 5 | < 5 F |
| Cadmium | < 4.01 | < 4.01 F | < 4.01 | < 4.01 F | < 4.01 | < 4.01 F | < 4.01 | < 4.01 F |
| Calcium | 16700 | 16400 F | 17800 | 17500 F | 19700 | 16400 F | 16400 | 16400 F |
| Chromium | < 6.02 | < 6.02 F | < 6.02 | < 6.02 F | 6.33 | < 6.02 F | < 6.02 | < 6.02 F |
| Cobalt | < 25 | < 25 F | < 25 | < 25 F | < 25 | < 25 F | < 25 | < 25 F |
| Copper | < 8.09 | < 8.09 F | < 8.09 | < 8.09 F | < 8.09 | < 8.09 F | < 8.09 | < 8.09 F |
| Iron | 381 | 109 F | 323 | 151 F | 40300 | 200 F | 490 | 247 F |
| Lead | < 1.26 | < 1.26 F | 3.15 | < 1.26 F | 32.8 | 10.6 F | 5.97 | < 1.26 F |
| Magnesium | 2800 | 2790 F | 3050 | 3020 F | 3640 | 2810 F | 2790 | 2820 F |
| Manganese | 209 | 179 F | 181 | 132 F | 6320 | 151 F | 177 | 171 F |
| Mercury | < .243 | < .243 F | < .243 | < .243 F | < .243 | < .243 F | < .243 | < .243 F |
| Nickel | < 34.3 | < 34.3 F | < 34.3 | < 34.3 F | < 34.3 | < 34.3 F | < 34.3 | < 34.3 F |
| Potassium | 2080 | 1910 F | 1650 | 1750 F | 2720 | 1530 F | 1760 | 1800 F |
| Selenium | < 3.02 | < 3.02 F | < 3.02 | < 3.02 F | < 3.02 | < 3.02 F | < 3.02 | < 3.02 F |
| Sodium | 22300 | 22200 F | 26100 | 25900 F | 23000 | 23000 F | 22500 | 22600 F |
| Vanadium | < 11 | < 11 F | < 11 | < 11 F | < 11 | < 11 F | < 11 | < 11 F |
| Zinc | < 21.1 | < 21.1 F | < 21.1 | < 21.1 F | 83 | < 21.1 F | < 21.1 | < 21.1 F |
| **PAL PESTICIDES/PCBS (µg/L)** | | | | | | | | |
| 4,4'-ddd | < .0233 | | | | | | < .0233 | |
| 4,4'-ddt | < .034 | | | | | | < .034 | |
| Bhc - Alpha | < .0385 | | | | | | < .0385 | |
| Bhc - Beta | < .024 | | | | | | < .024 | |
| Bhc - Delta | < .0293 | | | | | | < .0293 | |
| Bhc - Gamma (lindane) | < .0507 | | | | | | < .0507 | |
| Endosulfan I | < .023 | | | | | | < .023 | |
| Endrin Aldehyde | < .0285 | | | | | | < .0285 | |
| Heptachlor | < .0423 | | | | | | < .0423 | |
| Isodrin | < .0562 | | | | | | < .0562 | |
| **PAL SEMIVOLATILE ORGANICS (µg/L)** | | | | | | | | |
| Bis(2-ethylhexyl) Phthalate | < 4.8 | | < 4.8 | | < 4.8 | | < 4.8 | |

# LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA

| ANALYTE | CSW-94-27X 09/20/94 | CSW-94-27X 09/20/94 (filtered) | CSW-94-28X 09/22/94 | CSW-94-28X 09/22/94 (filtered) | CSW-94-31X 09/21/94 | CSW-94-31X 09/21/94 (filtered) | CSW-94-32X 09/21/94 | CSW-94-32X 09/21/94 (filtered) |
|---|---|---|---|---|---|---|---|---|
| **PAL WET CHEMISTRY** | | | | | | | | |
| Alkalinity | 35000 | | 35000 | | 32000 | | 35000 | |
| Chloride | 33000 | | 66000 | | 66000 | | 66000 | |
| Sulfate | | | | | | | | |
| Total Hardness | 51600 | | 56000 | | 63200 | | 51200 | |
| Total Suspended Solids | < 4000 | | < 4000 | | 380000 | | 4000 | |
| **OTHER** | | | | | | | | |
| Total Organic Carbon (µg/L) | | | | | | | | |

NOTES:
µg/L = micrograms per liter
< = less than
B = analyte found in method blank or QC blank as well as the sample.
C = analysis was confirmed
D = duplicate
F = filtered
I = low spike recovery is high
M = high spike recovery is high
N = high spike recovery is low
U = analysis is unconfirmed
V = sample was subjected to unusual *storage/preservation conditions*

# LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA

| ANALYTE | CSW-94-33X 09/21/94 | CSW-94-33X 09/21/94 (filtered) | CSW-94-34X 09/21/94 | CSW-94-34X 09/21/94 (filtered) | CSW-94-35X 09/22/94 | CSW-94-35X 09/22/94 (filtered) | BSW-95-09H 07/10/95 | |
|---|---|---|---|---|---|---|---|---|
| **PAL METALS (µg/L)** | | | | | | | | |
| Aluminum | 1370 | < 141 F | 374 | < 141 F | < 141 | < 141 F | < 112 | |
| Antimony | < 3.03 | 2.77 F | < 3.03 | < 3.03 F | < 3.03 | 4.11 F | < 60 | |
| Arsenic | 40 | < 2.54 F | 5.22 | < 2.54 F | < 2.54 | < 2.54 F | 8.94 | M |
| Barium | 89.9 | 7.59 F | 13.3 | 7.98 F | 9.35 | 8.37 F | 18.1 | |
| Beryllium | < 5 | < 5 F | < 5 | < 5 F | < 5 | < 5 F | 1.21 | |
| Cadmium | < 4.01 | < 4.01 F | < 4.01 | < 4.01 F | < 4.01 | < 4.01 F | < 6.78 | |
| Calcium | 17800 | 16300 F | 16400 | 15500 F | 11200 | 11200 F | 24200 | |
| Chromium | 19.7 | < 6.02 F | 6.26 | < 6.02 F | < 6.02 | < 6.02 F | < 16.8 | |
| Cobalt | < 25 | < 25 F | < 25 | < 25 F | < 25 | < 25 F | < 25 | |
| Copper | < 8.09 | < 8.09 F | < 8.09 | < 8.09 F | < 8.09 | < 8.09 F | < 18.8 | |
| Iron | 19200 | 247 F | 2120 | 429 F | 389 | 195 F | 1700 | |
| Lead | 12.9 | 2.06 F | 4.56 | < 1.26 F | 2.71 | < 1.26 F | < 4.47 | MP |
| Magnesium | 3210 | 2790 F | 2830 | 2660 F | 1300 | 1310 F | 3620 | |
| Manganese | 1870 | 148 F | 211 | 157 F | 46.2 | 39.1 F | 196 | |
| Mercury | < .243 | < .243 F | < .243 | < .243 F | < .243 | < .243 F | < .1 | |
| Nickel | < 34.3 | < 34.3 F | < 34.3 | < 34.3 F | < 34.3 | < 34.3 F | < 32.1 | |
| Potassium | 2150 | 1860 F | 2020 | 1960 F | 1340 | 801 F | < 1240 | |
| Selenium | < 3.02 | < 3.02 F | < 3.02 | < 3.02 F | < 3.02 | < 3.02 F | < 2.53 | |
| Sodium | 23000 | 22500 F | 22600 | 22000 F | 24700 | 24900 F | 20300 | |
| Vanadium | < 11 | < 11 F | < 11 | < 11 F | < 11 | < 11 F | < 27.6 | |
| Zinc | 29.6 | < 21.1 F | < 21.1 | < 21.1 F | < 21.1 | < 21.1 F | < 18 | MI |
| **PAL PESTICIDES/PCBS (µg/L)** | | | | | | | | |
| 4,4'-ddd | | | < .0233 | | | | < .0081 | |
| 4,4'-ddt | | | < .034 | | | | < .0025 | |
| Bhc - Alpha | | | < .0385 | | | | .0182 | C |
| Bhc - Beta | | | < .024 | | | | < .0099 | |
| Bhc - Delta | | | < .0293 | | | | < .0034 | |
| Bhc - Gamma (lindane) | | | < .0507 | | | | < .0025 | N |
| Endosulfan I | | | < .023 | | | | < .0025 | N |
| Endrin Aldehyde | | | < .0285 | | | | < .0504 | |
| Heptachlor | | | < .0423 | | | | .0034 | U |
| Isodrin | | | < .0562 | | | | < .0025 | |
| **PAL SEMIVOLATILE ORGANICS (µg/L)** | | | | | | | | |
| Bis(2-ethylhexyl) Phthalate | < 4.8 | | < 4.8 | | < 4.8 | | < 7.7 | V |

# LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA

| ANALYTE | CSW-94-33X 09/21/94 | CSW-94-33X 09/21/94 (filtered) | CSW-94-34X 09/21/94 | CSW-94-34X 09/21/94 (filtered) | CSW-94-35X 09/22/94 | CSW-94-35X 09/22/94 (filtered) | SSW-95-09H 07/18/95 |
|---|---|---|---|---|---|---|---|
| **PAL WET CHEMISTRY** | | | | | | | |
| Alkalinity | 33000 | | 27000 | | 19000 | | 46600 F |
| Chloride | 33000 | | 33000 | | 33000 | | 42000 |
| Sulfate | | | | | | | 13000 |
| Total Hardness | 52000 | | 50400 | | 31600 | | 73900 |
| Total Suspended Solids | 192000 | | 352000 | | < 4000 | | < 4000 |
| **OTHER** | | | | | | | |
| Total Organic Carbon (µg/L) | | | | | | | 3430 |

NOTES:
µg/L = micrograms per liter
< = less than
B = analyte found in method blank or QC blank as well as the sample.
C = analysis was confirmed
D = duplicate
F = filtered
I = low spike recovery is high
M = high spike recovery is high
N = high spike recovery is low
U = analysis is unconfirmed
V = sample was subjected to unusual storage/preservation conditions

# LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA

| ANALYTE | SSW-95-09H 07/10/95 | | | SSW-95-09I 07/10/95 | | | SSW-95-09I 07/10/95 (filtered) | | | SSW-95-09J 07/10/95 | | | SSW-95-09J 07/10/95 (filtered) | | | SSW-95-09J 07/10/95 (duplicate) | | | SSW-95-09J 07/10/95 (duplicate/filtered) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PAL METALS (µg/L)** | | | | | | | | | | | | | | | | | | | | | |
| Aluminum | < | 112 | F | < | 112 | | < | 112 | F | < | 112 | | < | 112 | F | < | 112 | D | < | 112 | DF |
| Antimony | < | 60 | F | < | 60 | | < | 60 | F | < | 60 | | < | 60 | F | < | 60 | D | < | 60 | DF |
| Arsenic | | 4.98 | FM | | 19.9 | M | < | 2.35 | FM | | 11.6 | M | | 3.89 | FM | | 4.38 | DM | | 2.54 | DFM |
| Barium | | 16 | F | | 21.6 | | | 18.3 | F | | 7.05 | | | 7.75 | F | | 8.22 | D | | 7.05 | DF |
| Beryllium | < | 1.12 | F | | 1.47 | | | 1.39 | F | | 1.19 | | | 1.27 | F | | 1.31 | D | | 1.21 | DF |
| Cadmium | < | 6.78 | F | < | 6.78 | | < | 6.78 | F | < | 6.78 | | < | 6.78 | F | < | 6.78 | D | < | 6.78 | DF |
| Calcium | | 24100 | F | | 30800 | | | 29000 | F | | 23800 | | | 25900 | F | | 26900 | D | | 24300 | DF |
| Chromium | < | 16.8 | F | < | 16.8 | | < | 16.8 | F | < | 16.8 | | < | 16.8 | F | < | 16.8 | D | < | 16.8 | DF |
| Cobalt | < | 25 | F | < | 25 | | < | 25 | F | < | 25 | | < | 25 | F | < | 25 | D | < | 25 | DF |
| Copper | < | 18.8 | F | < | 18.8 | | < | 18.8 | F | < | 18.8 | | < | 18.8 | F | < | 18.8 | D | < | 18.8 | DF |
| Iron | | 437 | F | | 3470 | | | 1830 | F | < | 77.5 | | | 167 | F | | 178 | D | < | 77.5 | DF |
| Lead | < | 4.47 | FMP | < | 4.47 | MP | < | 4.47 | FMP | < | 4.47 | MP | < | 4.47 | FMP | < | 4.47 | DMP | < | 4.47 | DFMP |
| Magnesium | | 3610 | F | | 3400 | | | 3240 | F | | 3580 | | | 3850 | F | | 4010 | D | | 3630 | DF |
| Manganese | | 99.9 | F | | 704 | | | 489 | F | | 45.4 | | | 146 | F | | 56 | D | | 43.9 | DF |
| Mercury | < | .1 | F | < | .1 | | < | .1 | F | < | .1 | | < | .1 | F | < | .1 | D | < | .1 | DF |
| Nickel | < | 32.1 | F | < | 32.1 | | < | 32.1 | F | < | 32.1 | | < | 32.1 | F | < | 32.1 | D | < | 32.1 | DF |
| Potassium | < | 1240 | F | | 1380 | | < | 1240 | F | < | 1240 | | < | 1240 | F | < | 1240 | D | | 1340 | DF |
| Selenium | < | 2.53 | F | < | 2.53 | | < | 2.53 | F | < | 2.53 | | < | 2.53 | F | < | 2.53 | D | < | 2.53 | DF |
| Sodium | | 20500 | F | | 33300 | | | 31800 | F | | 20300 | | | 21900 | F | | 22600 | D | | 20700 | DF |
| Vanadium | < | 27.6 | F | < | 27.6 | | < | 27.6 | F | < | 27.6 | | < | 27.6 | F | < | 27.6 | D | < | 27.6 | DF |
| Zinc | < | 18 | FMI | | 23.8 | MI | | 18.7 | FMI | < | 18 | MI | < | 18 | FMI | < | 18 | DMI | < | 18 | DFMI |
| **PAL PESTICIDES/PCBS (µg/L)** | | | | | | | | | | | | | | | | | | | | | |
| 4,4'-ddd | | | | | .00833 | C | | | | < | .0081 | | | | | | | | | | |
| 4,4'-ddt | | | | < | .0025 | | | | | < | .0025 | | | | | | | | | | |
| Bhc - Alpha | | | | | .021 | C | | | | < | .0025 | | | | | | | | | | |
| Bhc - Beta | | | | < | .0099 | | | | | < | .0099 | | | | | | | | | | |
| Bhc - Delta | | | | < | .0034 | | | | | | .00862 | U | | | | | | | | | |
| Bhc - Gamma (lindane) | | | | | .00318 | UN | | | | < | .0025 | N | | | | | | | | | |
| Endosulfan I | | | | < | .0025 | N | | | | < | .0025 | N | | | | | | | | | |
| Endrin Aldehyde | | | | < | .0504 | | | | | | .0921 | U | | | | | | | | | |
| Heptachlor | | | | | .00358 | U | | | | | .0032 | U | | | | | | | | | |
| Isodrin | | | | < | .0025 | | | | | | .00848 | BU | | | | | | | | | |
| **PAL SEMIVOLATILE ORGANICS (µg/L)** | | | | | | | | | | | | | | | | | | | | | |
| Bis(2-ethylhexyl) Phthalate | | | | < | 7.7 | V | | | | < | 7.7 | V | | | | < | 7.7 | VD | | | |

# LOWER COLD SPRING BROOK ANALYTICAL SURFACE WATER SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA

| ANALYTE | SSW-95-09H 07/10/95 | SSW-95-09I 07/10/95 | SSW-95-09I 07/10/95 (filtered) | SSW-95-09J 07/10/95 | SSW-95-09J 07/10/95 (filtered) | SSW-95-09J 07/10/95 (duplicate) | SSW-95-09J 07/10/95 (duplicate/filtered) |
|---|---|---|---|---|---|---|---|
| **PAL WET CHEMISTRY** | | | | | | | |
| Alkalinity | | 70800 FV | | 44200 FV | | | |
| Chloride | | 57000 V | | 42000 V | | | |
| Sulfate | | 10100 V | | 14000 V | | | |
| Total Hardness | | 89500 | | | | 82000 D | |
| Total Suspended Solids | | < 4000 | | < 4000 | | | |
| **OTHER** | | | | | | | |
| Total Organic Carbon (µg/L) | | 3650 | | 1340 | | 1150 D | |

NOTES:
µg/L = micrograms per liter
< = less than
B = analyte found in method blank or QC blank as well as the sample.
C = analysis was confirmed
D = duplicate
F = filtered
I = low spike recovery is high
M = high spike recovery is high
N = high spike recovery is low
U = analysis is unconfirmed
V = sample was subjected to unusual storage/preservation conditions

# STORM DRAIN SYSTEM ANALYTICAL SURFACE WATER SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA

| ANALYTE | CSW-94-04X 09/19/94 | CSW-94-04X 09/19/94 (filtered) | CSW-94-05X 09/19/94 | CSW-94-05X 09/19/94 (duplicate) | CSW-94-05X 09/19/94 (filtered) | CSW-94-05X 09/19/94 (duplicate/filtered) | CSW-94-06X 09/19/94 | CSW-94-06X 09/19/94 (filtered) |
|---|---|---|---|---|---|---|---|---|
| **PAL METALS (µg/L)** | | | | | | | | |
| Aluminum | 1070 | < 141 F | 1970 | 4740 D | < 141 F | < 141 DF | 208 | < 141 F |
| Antimony | < 3.03 | < 3.03 F | < 3.03 | < 3.03 D | < 3.03 F | < 3.03 DF | < 3.03 | < 3.03 F |
| Arsenic | < 2.54 | < 2.54 F | 5.54 | 14.1 D | < 2.54 F | < 2.54 DF | < 2.54 | < 2.54 F |
| Barium | 42.7 | 27.8 F | 65 | 136 D | 35.4 F | 33.8 DF | 29 | 26.7 F |
| Beryllium | < 5 | < 5 F | < 5 | < 5 D | < 5 F | < 5 DF | < 5 | < 5 F |
| Cadmium | < 4.01 | < 4.01 F | < 4.01 | < 4.01 D | < 4.01 F | < 4.01 DF | < 4.01 | < 4.01 F |
| Calcium | 11000 | 10600 F | 12400 | 14500 D | 11700 F | 11400 DF | 11600 | 11800 F |
| Chromium | < 6.02 | < 6.02 F | < 6.02 | < 6.02 D | < 6.02 F | < 6.02 DF | < 6.02 | < 6.02 F |
| Cobalt | < 25 | < 25 F | < 25 | 44.3 D | < 25 F | < 25 DF | < 25 | < 25 F |
| Copper | < 8.09 | < 8.09 F | < 8.09 | 8.94 D | < 8.09 F | < 8.09 DF | < 8.09 | < 8.09 F |
| Iron | 6680 | < 38.8 F | 5770 | 14000 D | 124 F | 107 DF | 679 | 124 F |
| Lead | < 1.26 | < 1.26 F | 10.1 | 27.3 D | < 1.26 F | < 1.26 DF | 3.58 | < 1.26 F |
| Magnesium | 1290 | 1260 F | 1470 | 1770 D | 1400 F | 1370 DF | 1460 | 1440 F |
| Manganese | 1450 | 195 F | 1940 | 6050 D | 385 F | 336 DF | 323 | 224 F |
| Mercury | < .243 | < .243 F | < .243 | < .243 D | < .243 F | < .243 DF | < .243 | < .243 F |
| Nickel | < 34.3 | < 34.3 F | < 34.3 | 42.1 D | < 34.3 F | < 34.3 DF | < 34.3 | < 34.3 F |
| Potassium | 1360 | 1560 F | 1820 | 2500 D | 1710 F | 1800 DF | 1830 | 1630 F |
| Selenium | < 3.02 | < 3.02 F | < 3.02 | 3.3 D | < 3.02 F | < 3.02 DF | < 3.02 | < 3.02 F |
| Sodium | 15000 | 15000 F | 15900 | 15800 D | 16500 F | 15800 DF | 19400 | 19800 F |
| Vanadium | < 11 | < 11 F | < 11 | < 11 D | < 11 F | < 11 DF | < 11 | < 11 F |
| Zinc | 33.9 | < 21.1 F | 112 | 187 D | < 21.1 F | < 21.1 DF | < 21.1 | < 21.1 F |
| **PAL PESTICIDES/PCBS (µg/L)** | | | | | | | | |
| DDD | | | | | | | | |
| DDT | | | | | | | | |
| Bhc - Alpha | | | | | | | | |
| Bhc - Beta | | | | | | | | |
| Bhc - Delta | | | | | | | | |
| Bhc - Gamma (lindane) | | | | | | | | |
| Endosulfan I | | | | | | | | |
| Endrin Aldehyde | | | | | | | | |
| Heptachlor | | | | | | | | |
| Isodrin | | | | | | | | |
| **PAL SEMIVOLATILE ORGANICS (µg/L)** | | | | | | | | |
| Bis(2-ethylhexyl) Phthalate | 10 | | < 4.8 | 6.1 D | | | 4.5 | |

# STORM DRAIN SYSTEM ANALYTICAL SURFACE WATER SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA

| ANALYTE | CSW-94-04X 09/19/94 | CSW-94-04X 09/19/94 (filtered) | CSW-94-05X 09/19/94 | CSW-94-05X 09/19/94 (duplicate) | CSW-94-05X 09/19/94 (filtered) | CSW-94-05X 09/19/94 (duplicate/filtered) | CSW-94-06X 09/19/94 | CSW-94-06X 09/19/94 (filtered) |
|---|---|---|---|---|---|---|---|---|
| **PAL WET CHEMISTRY** | | | | | | | | |
| Alkalinity | 15000 | | 13000 | 13000 D | | | 18000 | |
| Chloride | 27400 | | 31800 | 31800 D | | | 33000 | |
| Sulfate | | | | | | | | |
| Total Hardness | 32400 | | 37600 | 48000 D | | | 34800 | |
| Total Suspended Solids | 9000 | | 9000 | 21000 D | | | 10000 | |
| **OTHER** | | | | | | | | |
| Total Organic Carbon (µg/L) | | | | | | | | |

NOTES:
µg/L = micrograms per liter
< = less than
B = analyte found in method blank or QC blank as well as the sample.
C = analysis was confirmed
D = duplicate
F = filtered
I = low spike recovery is high
M = high spike recovery is high
N = high spike recovery is low
U = analysis is unconfirmed
V = sample was subjected to unusual storage/preservation conditions

# STORM DRAIN SYSTEM ANALYTICAL SURFACE WATER SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA

| ANALYTE | CSW-94-07X 09/19/94 | CSW-94-07X 09/19/94 (filtered) | SW-94-21X 09/20/94 | CSW-94-21X 09/20/94 (filtered) | SW-94-24X 09/20/94 | CSW-94-24X 09/20/94 (filtered) | SW-94-30X 09/21/94 | CSW-94-30X 09/21/94 (filtered) |
|---|---|---|---|---|---|---|---|---|
| **PAL METALS (µg/L)** | | | | | | | | |
| Aluminum | < 141 | < 141 F | 930 | < 141 F | 710 | < 141 F | 74600 | < 141 F |
| Antimony | < 3.03 | < 3.03 F | < 3.03 | < 3.03 F | < 3.03 | 3.66 F | 7.68 | < 3.03 F |
| Arsenic | < 2.54 | < 2.54 F | 14 | 11.4 F | 19.3 | 7.78 F | 93.2 | 3.09 F |
| Barium | 25.9 | 24.9 F | 18 | 12 F | 52.5 | 47.1 F | 387 | 14.5 F |
| Beryllium | < 5 | < 5 F | < 5 | < 5 F | < 5 | < 5 F | < 5 | < 5 F |
| Cadmium | < 4.01 | < 4.01 F | < 4.01 | < 4.01 F | < 4.01 | < 4.01 F | 27 | < 4.01 F |
| Calcium | 11600 | 11500 F | 7650 | 7290 F | 8310 | 8490 F | 38800 | 14400 F |
| Chromium | < 6.02 | < 6.02 F | < 6.02 | < 6.02 F | < 6.02 | < 6.02 F | 187 | < 6.02 F |
| Cobalt | < 25 | < 25 F | < 25 | < 25 F | < 25 | < 25 F | 75 | < 25 F |
| Copper | < 8.09 | < 8.09 F | < 8.09 | < 8.09 F | 8.97 | < 8.09 F | 194 | < 8.09 F |
| Iron | 332 | 115 F | 3710 | 1680 F | 6320 | 158 F | 126000 | 3060 F |
| Lead | 1.52 | < 1.26 F | 20.6 | 1.52 F | 18.2 | 2.93 F | 370 | 1.41 F |
| Magnesium | 1430 | 1410 F | 798 | 517 F | 1450 | 1300 F | 29600 | 2570 F |
| Manganese | 226 | 204 F | 350 | 324 F | 1190 | 973 F | 4250 | 920 F |
| Mercury | < .243 | < .243 F | < .243 | < .243 F | < .243 | < .243 F | .426 | < .243 F |
| Nickel | < 34.3 | < 34.3 F | < 34.3 | < 34.3 F | < 34.3 | < 34.3 F | 185 | < 34.3 F |
| Potassium | 1780 | 1730 F | 1570 | 1250 F | 2080 | 1710 F | 14000 | 2250 F |
| Selenium | < 3.02 | < 3.02 F | < 3.02 | < 3.02 F | < 3.02 | < 3.02 F | < 3.02 | < 3.02 F |
| Sodium | 19000 | 19000 F | 22500 | 22000 F | 18000 | 18600 F | 24000 | 22300 F |
| Vanadium | < 11 | < 11 F | < 11 | < 11 F | < 11 | < 11 F | 162 | < 11 F |
| Zinc | < 21.1 | < 21.1 F | 61.2 | 42.9 F | 280 | 277 F | 935 | < 21.1 F |
| **PAL PESTICIDES/PCBS (µg/L)** | | | | | | | | |
| DDD | | | | | | | | |
| DDT | | | | | | | | |
| Bhc - Alpha | | | | | | | | |
| Bhc - Beta | | | | | | | | |
| Bhc - Delta | | | | | | | | |
| Bhc - Gamma (lindane) | | | | | | | | |
| Endosulfan I | | | | | | | | |
| Endrin Aldehyde | | | | | | | | |
| Heptachlor | | | | | | | | |
| Isodrin | | | | | | | | |
| **PAL SEMIVOLATILE ORGANICS (µg/L)** | | | | | | | | |
| Bis(2-ethylhexyl) Phthalate | < 4.8 | | < 4.8 | | < 4.8 | | < 4.8 | |

# STORM DRAIN SYSTEM ANALYTICAL SURFACE WATER SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA

| ANALYTE | CSW-94-07X 09/19/94 | CSW-94-07X 09/19/94 (filtered) | SW-94-21X 09/20/94 | CSW-94-21X 09/20/94 (filtered) | SW-94-24X 09/20/94 | CSW-94-24X 09/20/94 (filtered) | SW-94-30X 09/21/94 | CSW-94-30X 09/21/94 (filtered) |
|---|---|---|---|---|---|---|---|---|
| **PAL WET CHEMISTRY** | | | | | | | | |
| Alkalinity | 17000 | | 24000 | | 16000 | | 30000 | |
| Chloride | 33000 | | 28500 | | 18700 | | 33000 | |
| Sulfate | | | | | | | | |
| Total Hardness | 34000 | | 20000 | | 27200 | | 92400 | |
| Total Suspended Solids | < 4000 | | 31000 | | 36000 | | 3950000 | |
| **OTHER** | | | | | | | | |
| Total Organic Carbon (µg/L) | | | | | | | | |

NOTES:
µg/L = micrograms per liter
< = less than
B = analyte found in method blank or QC blank as well as the sample.
C = analysis was confirmed
D = duplicate
F = filtered
I = low spike recovery is high
M = high spike recovery is high
N = high spike recovery is low
U = analysis is unconfirmed
V = sample was subjected to unusual storage/preservation conditions

# STORM DRAIN SYSTEM ANALYTICAL SURFACE WATER SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA

| ANALYTE | SSW-95-09K 07/10/95 | | SSW-95-09K 07/10/95 (duplicate) | | SSW-95-09K 07/10/95 (filtered) | |
|---|---|---|---|---|---|---|
| **PAL METALS (µg/L)** | | | | | | |
| Aluminum | 223 | | | | < 112 | F |
| Antimony | < 60 | | | | < 60 | F |
| Arsenic | 63.4 | M | | | 26.7 | FM |
| Barium | 30.5 | | | | 25.1 | F |
| Beryllium | 1.15 | | | | 1.15 | F |
| Cadmium | < 6.78 | | | | < 6.78 | F |
| Calcium | 22500 | | | | 22500 | F |
| Chromium | < 16.8 | | | | < 16.8 | F |
| Cobalt | < 25 | | | | < 25 | F |
| Copper | < 18.8 | | | | < 18.8 | F |
| Iron | 23500 | | | | 9250 | F |
| Lead | < 4.47 | MP | | | < 4.47 | FMP |
| Magnesium | 2300 | | | | 2290 | F |
| Manganese | 845 | | | | 835 | F |
| Mercury | < .1 | | | | < .1 | F |
| Nickel | < 32.1 | | | | < 32.1 | F |
| Potassium | 1610 | | | | 1420 | F |
| Selenium | < 2.53 | | | | < 2.53 | F |
| Sodium | 27900 | | | | 28000 | F |
| Vanadium | < 27.6 | | | | < 27.6 | F |
| Zinc | < 18 | MI | | | < 18 | FMI |
| **PAL PESTICIDES/PCBS (µg/L)** | | | | | | |
| DDD | < .0081 | | .0178 | DC | | |
| DDT | < .0025 | | .00314 | DU | | |
| Bhc - Alpha | .00444 | C | .00479 | DU | | |
| Bhc - Beta | < .0099 | | .0119 | DU | | |
| Bhc - Delta | .0037 | U | < .0034 | D | | |
| Bhc - Gamma (lindane) | .00423 | UN | .00553 | DUN | | |
| Endosulfan I | < .0025 | N | .00436 | DUN | | |
| Endrin Aldehyde | .0639 | U | < .0504 | D | | |
| Heptachlor | < .0025 | | .0034 | DU | | |
| Isodrin | < .0025 | | < .0025 | D | | |
| **PAL SEMIVOLATILE ORGANICS (µg/L)** | | | | | | |
| Bis(2-ethylhexyl) Phthalate | < 7.7 | V | | | | |

# STORM DRAIN SYSTEM ANALYTICAL SURFACE WATER SAMPLE RESULTS

## LOWER COLD SPRING BROOK SITE INVESTIGATION
## FORT DEVENS, MA

| ANALYTE | SSW-95-09K 07/10/95 | | SSW-95-09K 07/10/95 (duplicate) | SSW-95-09K 07/10/95 (filtered) |
|---|---|---|---|---|
| **PAL WET CHEMISTRY** | | | | |
| Alkalinity | 53100 | FV | | |
| Chloride | 39000 | V | | |
| Sulfate | 5640 | V | | |
| Total Hardness | 64500 | | | |
| Total Suspended Solids | < 59000 | | | |
| **OTHER** | | | | |
| Total Organic Carbon (µg/L) | 13300 | | | |

NOTES:
µg/L = micrograms per liter
< = less than
B = analyte found in method blank or QC blank as well as the sample.
C = analysis was confirmed
D = duplicate
F = filtered
I = low spike recovery is high
M = high spike recovery is high
N = high spike recovery is low
U = analysis is unconfirmed
V = sample was subjected to unusual storage/preservation conditions

# HYDROGEOLOGIC DATA

F-1 IN-SITU HYDRAULIC CONDUCTIVITY TESTING

F-2 HYDRAULIC GRADIENT AND GROUNDWATER FLOW VELOCITY CALCULATIONS

# IN-SITU HYDRAULIC CONDUCTIVITY TESTING

## APPENDIX F-1 HYDRAULIC CONDUCTIVITY TEST RESULTS

ABB-ES performed rising head slug tests on monitoring wells installed during the AOC 57 RI in November 1995 and January 1997. This appendix discusses the analytical procedure and presents estimated values of hydraulic conductivity. The test methodology is presented in Subsections 4.8.2 of Volume I of the Fort Devens POP (ABB-ES, 1995a). Field data from all tests were analyzed to estimate hydraulic conductivity using a derivation of the method of Hvorslev (1951)[1] and the method of Bouwer and Rice (1976)[2].

The form of the Hvorslev equation that was used relates the hydraulic conductivity, K, of an unconfined aquifer to the well geometry and the rate of head recovery by:

$$-K = \left[\frac{\mathrm{Log}(H_1)-\mathrm{Log}(H_2)}{t_1 - t_2}\right] \frac{r^2 \ \mathrm{Log}(L / R)}{2L}$$

Parameters in this equation included: r (radius of the well casing), R (radius of the borehole), L (length of the aquifer tested), as well as time (t) and water level (H) data expressed as drawdown. Log values are log base ten. Test data were also analyzed using AQTESOLV™[3], an aquifer test analysis program by Geraghty Miller, Inc. AQTESOLV™ utilizes the Bouwer and Rice method for estimating hydraulic conductivities in unconfined aquifers.

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[1]Hvorslev, M.J., 1951. "Time Lag and Soil Permeability in Groundwater Observations;" U.S. Army Corps of Engineers, Waterways Experiment Station, Bulletin 36; Vicksburg, Mississippi.

[2]Bouwer, H. and R.C. Rice, 1976. A Slug Test Method for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells, Water Resources Research, Vol. 12, No. 3, pp 423-428.

[3]AQTESOLV, 1991 "ATESOLV, Aquifer Test Solver Version 1.00;" Geraghty and Miller Modeling Group; Reston, VA.

Estimates of hydraulic conductivity for the 15 wells/piezometers tested at AOC 57 range between $1.22 \times 10^{-1}$ cm/sec and $4.22 \times 10^{-4}$ cm/sec for the Bouwer and Rice method while the Hvorslev method yields values of $1.26 \times 10^{-2}$ cm/sec to $4.28 \times 10^{-5}$ cm/sec. Typically the Bouwer and Rice method provided hydraulic conductivity values which were greater than the values obtained with the Hvorslev equation.

The results of hydraulic conductivity testing are summarized in Table F-1. The data for each test are also provided. The information contained in this Appendix is organized as follows:

1) Table F-1, Summary of In-Situ Hydraulic Conductivity Test Results; input parameters used for AQTESOLV™ analyses;

2) AQTESOLV™ plots with computed hydraulic conductivity values;

3) A table of calculation of hydraulic conductivities using the Hvorslev Equation; and

4) Raw data and plots of data for Hvorslev analyses;

Static water levels in each well were generally referenced to zero with head stress being expressed as a positive change.

# AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. _____

| SETUP | DATE | BY WHOM D. McCabe / R. Lago |
|---|---|---|
| MONITORING WELL ID | 57M-95-01X | |
| DATE OF TEST | 11/16/95 | |
| TYPE OF TEST | Falling Head | Rising Head |
| HERMIT TYPE/SERIAL# | 1000C 1KB 480 | |
| TEST # | 1 | 2 |
| DATA COLLECTION RATE | Log | |
| **TRANSDUCER** | | |
| SERIAL # | 272872 | |
| PSIG | 10 | |
| SCALE FACTOR | 10.023 | |
| OFFSET | -0.01 | |
| INPUT CHANNEL | 1 | |
| **TEST DATA** | | |
| INPUT MODE (TOC/SUR) | Level | |
| STATIC WATER LEVEL (FT./TOC) | 23.91 | |
| WELL DEPTH (FT./TOC) | 31.0 | |
| XD DEPTH (FT.TOC) | 29.8 | |
| INITIAL XD REFERENCE | 0.00 | 0.00 |
| SLUG DEPTH (FT./TOC) | | |
| TIME OF SLUG PLACEMENT | 11:23 | 11:30 |
| TIME OF WL EQUILIBRATION | | |
| NEW XD REFERENCE | 0.00 | 0.00 |
| START TIME OF TEST | | |
| END TIME OF TEST | | |
| NOTES: | 3"Ø by 3" long bar stock PVC slug | |

# AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. _____

| SETUP | DATE | BY WHOM |
|---|---|---|
| MONITORING WELL ID | 57M-95-03X | D.McCabe / R. Lango |
| DATE OF TEST | 11/17/95 | |
| TYPE OF TEST | Falling Head | Rising Head |
| HERMIT TYPE/SERIAL# | 1000C KB 480 | 1000C KB 480 |
| TEST # | 19 | 0 |
| DATA COLLECTION RATE | Log | |
| TRANSDUCER | | |
| SERIAL # | 272872 | |
| PSIG | 10 | |
| SCALE FACTOR | 10.023 | |
| OFFSET | -0.01 | |
| INPUT CHANNEL | 1 | |
| TEST DATA | | |
| INPUT MODE (TOC/SUR) | Level | |
| STATIC WATER LEVEL (FT./TOC) | 17.99 (PVC) | |
| WELL DEPTH (FT./TOC) | 26.80 (PVC) | |
| XD DEPTH (FT.TOC) | 25.0 | |
| INITIAL XD REFERENCE | 0.00 | 0.00 |
| SLUG DEPTH (FT./TOC) | | |
| TIME OF SLUG PLACEMENT | | |
| TIME OF WL EQUILIBRATION | | |
| NEW XD REFERENCE | 0.00 | 0.00 |
| START TIME OF TEST | | |
| END TIME OF TEST | | |
| NOTES: | | |

Slug 3" Ø by 3' barstock PVC

# AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. _____

| SETUP | DATE | BY WHOM<br>D McCabe / R. Lago |
|---|---|---|
| MONITORING WELL ID | 57M-95-03X | 57M-95-03X |
| DATE OF TEST | 11/16/95 | |
| TYPE OF TEST | Falling Head | Rising Head |
| HERMIT TYPE/SERIAL# | 1000C KB 480 | |
| TEST # | 3 | 4 |
| DATA COLLECTION RATE | Log | |
| **TRANSDUCER** | | |
| SERIAL # | 272872 | |
| PSIG | 10 | |
| SCALE FACTOR | 10.023 | |
| OFFSET | -0.01 | |
| INPUT CHANNEL | 1 | |
| **TEST DATA** | | |
| INPUT MODE (TOC/SUR) | Level | |
| STATIC WATER LEVEL (FT./TOC) | 10.09 | |
| WELL DEPTH (FT./TOC) | 19.60 | |
| XD DEPTH (FT.TOC) | 19.0 | |
| INITIAL XD REFERENCE | 8.71 | |
| SLUG DEPTH (FT./TOC) | | |
| TIME OF SLUG PLACEMENT | 13:27 | 13:57 |
| TIME OF WL EQUILIBRATION | 13:48 | 14:10 |
| NEW XD REFERENCE | | |
| START TIME OF TEST | | |
| END TIME OF TEST | | |
| NOTES: | 3'Ø by 3' bar stock | PVC slug |

# AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. _____

| SETUP | DATE | BY WHOM D. McCab / R. Lago |
|---|---|---|
| MONITORING WELL ID | 57M-95-04A | |
| DATE OF TEST | 11/17/95 | |
| TYPE OF TEST | Falling Head | Rising Head |
| HERMIT TYPE/SERIAL# | 1000C KB 480 | |
| TEST # | 17 | 18 |
| DATA COLLECTION RATE | Log | |
| TRANSDUCER | | |
| SERIAL # | 2.728 72 | |
| PSIG | 10 | |
| SCALE FACTOR | 10.023 | |
| OFFSET | -0.01 | |
| INPUT CHANNEL | 1 | |
| TEST DATA | | |
| INPUT MODE (TOC/SUR) | Level | |
| STATIC WATER LEVEL (FT./TOC) | 2.85 | |
| WELL DEPTH (FT./TOC) | 13.0 | |
| XD DEPTH (FT.TOC) | 12 | |
| INITIAL XD REFERENCE | 8.63 | |
| SLUG DEPTH (FT./TOC) | | |
| TIME OF SLUG PLACEMENT | | |
| TIME OF WL EQUILIBRATION | | |
| NEW XD REFERENCE | 0.00 | |
| START TIME OF TEST | | |
| END TIME OF TEST | | |
| NOTES: | 3" Ø by 3' long | bar stock PVC slug |



92021580 (g)

# AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. _____

| SETUP | DATE | BY WHOM D. McCabe / R. Lapp |
|---|---|---|
| MONITORING WELL ID | 57M-95-04B | |
| DATE OF TEST | 11/17/95 | |
| TYPE OF TEST | Falling Head | Rising Head |
| HERMIT TYPE/SERIAL# | 1000 C KB 480 | |
| TEST # | 15 | 16 |
| DATA COLLECTION RATE | Log | |
| **TRANSDUCER** | | |
| SERIAL # | 272872 | |
| PSIG | 10 | |
| SCALE FACTOR | 10.023 | |
| OFFSET | -0.01 | |
| INPUT CHANNEL | 1 | |
| **TEST DATA** | | |
| INPUT MODE (TOC/SUR) | Level | |
| STATIC WATER LEVEL (FT./TOC) | 3.69 | |
| WELL DEPTH (FT./TOC) | 31.0 | |
| XD DEPTH (FT.TOC) | ±20.0 | |
| INITIAL XD REFERENCE | 16.0 | |
| SLUG DEPTH (FT./TOC) | | |
| TIME OF SLUG PLACEMENT | | |
| TIME OF WL EQUILIBRATION | | |
| NEW XD REFERENCE | | |
| START TIME OF TEST | | |
| END TIME OF TEST | | |
| NOTES: | 3"Ø by 3' long bar | stock PVC slug |

# AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. _____

| SETUP | DATE | BY WHOM<br>D McCabe / R. Lago |
|---|---|---|
| MONITORING WELL ID | 57M-95-05X | |
| DATE OF TEST | 11/16/95 | |
| TYPE OF TEST | Falling Head | Rising Head |
| HERMIT TYPE/SERIAL# | 1000 C KB 480 | |
| TEST # | 9 | 10 |
| DATA COLLECTION RATE | Log | |
| **TRANSDUCER** | | |
| SERIAL # | 272872 | |
| PSIG | 10 | |
| SCALE FACTOR | 10.023 | |
| OFFSET | -0.01 | |
| INPUT CHANNEL | 1 | |
| **TEST DATA** | | |
| INPUT MODE (TOC/SUR) | Level | |
| STATIC WATER LEVEL (FT./TOC) | 15.11 | |
| WELL DEPTH (FT./TOC) | 22.2 | |
| XD DEPTH (FT.TOC) | 20 | |
| INITIAL XD REFERENCE | 4.93 | |
| SLUG DEPTH (FT./TOC) | | |
| TIME OF SLUG PLACEMENT | | |
| TIME OF WL EQUILIBRATION | | |
| NEW XD REFERENCE | | |
| START TIME OF TEST | | |
| END TIME OF TEST | | |
| NOTES: | 3"Ø by 3' long bar | stock PVC slug |

# AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. _____

| SETUP | DATE | BY WHOM D. McCabe / R. Lago |
|---|---|---|
| MONITORING WELL ID | 57M-95-06X | |
| DATE OF TEST | 11/16/95 | |
| TYPE OF TEST | Falling Head | Rising Head |
| HERMIT TYPE/SERIAL# | 1000C KB 480 | |
| TEST # | 5 | 6 |
| DATA COLLECTION RATE | Log | |
| **TRANSDUCER** | | |
| SERIAL # | 272872 | |
| PSIG | 10 | |
| SCALE FACTOR | 10.023 | |
| OFFSET | -0.01 | |
| INPUT CHANNEL | 1 | |
| **TEST DATA** | | |
| INPUT MODE (TOC/SUR) | Level | |
| STATIC WATER LEVEL (FT./TOC) | 13.28 | |
| WELL DEPTH (FT./TOC) | 24.50 | |
| XD DEPTH (FT.TOC) | 20 | |
| INITIAL XD REFERENCE | 6.86 | |
| SLUG DEPTH (FT./TOC) | | |
| TIME OF SLUG PLACEMENT | 14.35 | |
| TIME OF WL EQUILIBRATION | 14.38 | |
| NEW XD REFERENCE | | |
| START TIME OF TEST | | |
| END TIME OF TEST | | |
| NOTES: | Slug 3"Ø by 3' long | bar stock PVC |

# AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. _____

| SETUP | DATE | BY WHOM D. McCabe / R. Lago |
|---|---|---|
| MONITORING WELL ID | 57M-95-07X | |
| DATE OF TEST | 11/16/95 | |
| TYPE OF TEST | Falling Head | Rising Head |
| HERMIT TYPE/SERIAL# | 1000 C KB 480 | |
| TEST # | 7 | 8 |
| DATA COLLECTION RATE | Log | |
| **TRANSDUCER** | | |
| SERIAL # | 272872 | |
| PSIG | 10 | |
| SCALE FACTOR | 10.023 | |
| OFFSET | -0.01 | |
| INPUT CHANNEL | 1 | |
| **TEST DATA** | | |
| INPUT MODE (TOC/SUR) | Level | |
| STATIC WATER LEVEL (FT./TOC) | 3.13 (PVC) | |
| WELL DEPTH (FT./TOC) | 14.50 | |
| XD DEPTH (FT.TOC) | 12 | |
| INITIAL XD REFERENCE | 8.81 | |
| SLUG DEPTH (FT./TOC) | | |
| TIME OF SLUG PLACEMENT | | |
| TIME OF WL EQUILIBRATION | | |
| NEW XD REFERENCE | | |
| START TIME OF TEST | | |
| END TIME OF TEST | | |
| NOTES: | 3 in Ø by 3' long | bar-stock PVC slug |

# AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. _____

| SETUP | DATE | BY WHOM D. McCabe / R. Lago |
|---|---|---|
| MONITORING WELL ID | 57M-95-08A | |
| DATE OF TEST | 11/17/95 | |
| TYPE OF TEST | Falling Head | Rising Head |
| HERMIT TYPE/SERIAL# | 1000 C KB 480 | |
| TEST # | 12 | 13 |
| DATA COLLECTION RATE | Log | |
| **TRANSDUCER** | | |
| SERIAL # | 272872 | |
| PSIG | 10 | |
| SCALE FACTOR | 10.023 | |
| OFFSET | -0.01 | |
| INPUT CHANNEL | 1 | |
| **TEST DATA** | | |
| INPUT MODE (TOC/SUR) | Level | |
| STATIC WATER LEVEL (FT./TOC) | 2.78 | |
| WELL DEPTH (FT./TOC) | 14.1 | |
| XD DEPTH (FT.TOC) | 12 | |
| INITIAL XD REFERENCE | 9.65 | |
| SLUG DEPTH (FT./TOC) | | |
| TIME OF SLUG PLACEMENT | | |
| TIME OF WL EQUILIBRATION | | |
| NEW XD REFERENCE | 0.0 | |
| START TIME OF TEST | | |
| END TIME OF TEST | | |
| NOTES: | 3"φ by 3' long bar | stock PVC slug |

# AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. _____

| SETUP | DATE | BY WHOM D. McCabe / R. Lapp |
|---|---|---|
| MONITORING WELL ID | 57M-95-08B | |
| DATE OF TEST | 11/17/95 | |
| TYPE OF TEST | Falling Head | Rising Head |
| HERMIT TYPE/SERIAL# | 1000 C KB 480 | |
| TEST # | 11 | 12 |
| DATA COLLECTION RATE | Log | |
| **TRANSDUCER** | | |
| SERIAL # | 2728.72 | |
| PSIG | 10 | |
| SCALE FACTOR | 10.023 | |
| OFFSET | -0.01 | |
| INPUT CHANNEL | 1 | |
| **TEST DATA** | | |
| INPUT MODE (TOC/SUR) | Level | |
| STATIC WATER LEVEL (FT./TOC) | 3.56 (PVC) | |
| WELL DEPTH (FT./TOC) | 30.2 | |
| XD DEPTH (FT.TOC) | ± 20 | |
| INITIAL XD REFERENCE | 16.28 | |
| SLUG DEPTH (FT./TOC) | | |
| TIME OF SLUG PLACEMENT | | |
| TIME OF WL EQUILIBRATION | | |
| NEW XD REFERENCE | 0.0 | |
| START TIME OF TEST | | |
| END TIME OF TEST | | |
| NOTES: | 3"Ø by 3' long brass | stock PVC slug |

# AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. 00 - 01

| SETUP | DATE | BY WHOM R. ROSTAD |
|---|---|---|
| MONITORING WELL ID | 57M.96-09X | 57M.96.09X |
| DATE OF TEST | 1.16.~~96~~ 97 | 1.16.97 |
| TYPE OF TEST | RISING HEAD | RISING HEAD |
| HERMIT TYPE/SERIAL# | 10000C / 1KB-480 | |
| TEST # | 00 - 01 | |
| DATA COLLECTION RATE | LOG 01 | |
| **TRANSDUCER** | | |
| SERIAL # | 6638 | |
| PSIG | 30 PSI | |
| SCALE FACTOR | 29.6952 | |
| OFFSET | -0.0162 | |
| INPUT CHANNEL | #1 | |
| **TEST DATA** | | |
| INPUT MODE (TOC/SUR) | TOC | |
| STATIC WATER LEVEL (FT./TOC) | 16.61 | |
| WELL DEPTH (FT./TOC) | 25.69 | |
| XD DEPTH (FT.TOC) | ~~TOC~~ 25.1' | |
| INITIAL XD REFERENCE | 0.0 (8.55) | |
| SLUG DEPTH (FT./TOC) | 23.0 | |
| TIME OF SLUG PLACEMENT | 0930 | |
| TIME OF WL EQUILIBRATION | 0931 | |
| NEW XD REFERENCE | RE-REF TO 0.0 (8.57) | |
| START TIME OF TEST | 0933 / 0950 | |
| END TIME OF TEST | 0940 / 0954 | |
| NOTES: TWO RISING HEAD TESTS PERFORMED | | |

# AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. 02-03

| SETUP | DATE | BY WHOM |
|---|---|---|
| MONITORING WELL ID | 57M.96.10X | R. RUSTAD |
| DATE OF TEST | 1.16.97 | |
| TYPE OF TEST | RISING HEAD (2) | |
| HERMIT TYPE/SERIAL# | 1000 C / 1KB-480 | |
| TEST # | 02-03 | |
| DATA COLLECTION RATE | LOG 01 | |
| **TRANSDUCER** | | |
| SERIAL # | 6638 | |
| PSIG | 30 PSI | |
| SCALE FACTOR | 29.6952 | |
| OFFSET | -0.0162 | |
| INPUT CHANNEL | # 1 | |
| **TEST DATA** | | |
| INPUT MODE (TOC/SUR) | TOC | |
| STATIC WATER LEVEL (FT./TOC) | 6.45' | |
| WELL DEPTH (FT./TOC) | 15.56 | |
| XD DEPTH (FT.TOC) | 14' | |
| INITIAL XD REFERENCE | 0.0 | |
| SLUG DEPTH (FT./TOC) | 11' | |
| TIME OF SLUG PLACEMENT | 1010 | |
| TIME OF WL EQUILIBRATION | 1030 | |
| NEW XD REFERENCE | 0.0 (REREFERENCE) | |
| START TIME OF TEST | 1033 (T1) / 1100 (T2) | |
| END TIME OF TEST | 1045 (T1) / 1110 (T2) | |
| NOTES: 2 RISING HEAD TESTS PERFORMED | | |

# AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. ~~03-04~~ 04-05 (AN)

| SETUP | DATE | BY WHOM |
|---|---|---|
| MONITORING WELL ID | 57M·96·11X | R. Rustad |
| DATE OF TEST | 1·16·97 | |
| TYPE OF TEST | Rising Head | |
| HERMIT TYPE/SERIAL# | 1000C / 1KB-480 | |
| TEST # | (AN) ~~03-04~~ 04-05 | |
| DATA COLLECTION RATE | Log 01 | |
| **TRANSDUCER** | | |
| SERIAL # | 6638 | |
| PSIG | 30 PSI | |
| SCALE FACTOR | 29.6952 | |
| OFFSET | -0.0162 | |
| INPUT CHANNEL | #1 | |
| **TEST DATA** | | |
| INPUT MODE (TOC/SUR) | TOC | |
| STATIC WATER LEVEL (FT./TOC) | 3.30' | |
| WELL DEPTH (FT./TOC) | 14.59 | |
| XD DEPTH (FT.TOC) | 13.00 | |
| INITIAL XD REFERENCE | 0.0 | |
| SLUG DEPTH (FT./TOC) | 8.0' | |
| TIME OF SLUG PLACEMENT | 1115 | |
| TIME OF WL EQUILIBRATION | 1130 | |
| NEW XD REFERENCE | 0.0 | |
| START TIME OF TEST | 1133 / 1200 | |
| END TIME OF TEST | 1147 / 1212 | |
| NOTES: 2 Rising Head Tests Performed | | |

ABB Environmental Services, Inc.

# AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. 05-07

| SETUP | DATE | BY WHOM |
|---|---|---|
| MONITORING WELL ID | 57m.96.12x | R. Rustad |
| DATE OF TEST | 1.16.97 | |
| TYPE OF TEST | Rising Head | |
| HERMIT TYPE/SERIAL# | 1000C / IKB-480 | |
| TEST # | 06-07 | |
| DATA COLLECTION RATE | Loc 01 | |
| **TRANSDUCER** | | |
| SERIAL # | 6638 | |
| PSIG | 30 PSI | |
| SCALE FACTOR | 29.6952 | |
| OFFSET | -0.0162 | |
| INPUT CHANNEL | | |
| **TEST DATA** | | |
| INPUT MODE (TOC/SUR) | TOC | |
| STATIC WATER LEVEL (FT./TOC) | 4.39' | |
| WELL DEPTH (FT./TOC) | 15.13' | |
| XD DEPTH (FT.TOC) | 13' | |
| INITIAL XD REFERENCE | 0.0 | |
| SLUG DEPTH (FT./TOC) | 10' | |
| TIME OF SLUG PLACEMENT | 1220 | |
| TIME OF WL EQUILIBRATION | 1230 | |
| NEW XD REFERENCE | 0.0 | |
| START TIME OF TEST | 1231 / 1249 | |
| END TIME OF TEST | 1240 / 1257 | |
| NOTES: 2 Rising Head | TESTS PERFORMED | |

# AQUIFER TESTING COMPLETION CHECKLIST

AQUIFER TEST NO. 08-09

| SETUP | DATE | BY WHOM |
|---|---|---|
| MONITORING WELL ID | 57M.96.13X | R. Rustad |
| DATE OF TEST | 1.16.97 | |
| TYPE OF TEST | Rising Head | |
| HERMIT TYPE/SERIAL# | 1000C / KB-480 | |
| TEST # | 08-09 | |
| DATA COLLECTION RATE | Log 01 | |
| **TRANSDUCER** | | |
| SERIAL # | 6638 | |
| PSIG | 30 PSI | |
| SCALE FACTOR | 29.6952 | |
| OFFSET | -0.0162 | |
| INPUT CHANNEL | # 1 | |
| **TEST DATA** | | |
| INPUT MODE (TOC/SUR) | TOC | |
| STATIC WATER LEVEL (FT./TOC) | 4.28' | |
| WELL DEPTH (FT./TOC) | 14.89 | |
| XD DEPTH (FT.TOC) | 13' | |
| INITIAL XD REFERENCE | 0.0 | |
| SLUG DEPTH (FT./TOC) | 9' | |
| TIME OF SLUG PLACEMENT | 1310 | |
| TIME OF WL EQUILIBRATION | 1316 | |
| NEW XD REFERENCE | 0.0 | |
| START TIME OF TEST | 1320 / 1330 | |
| END TIME OF TEST | 1325 / 1335 | |
| NOTES: 2 Rising Head Tests Performed | | |

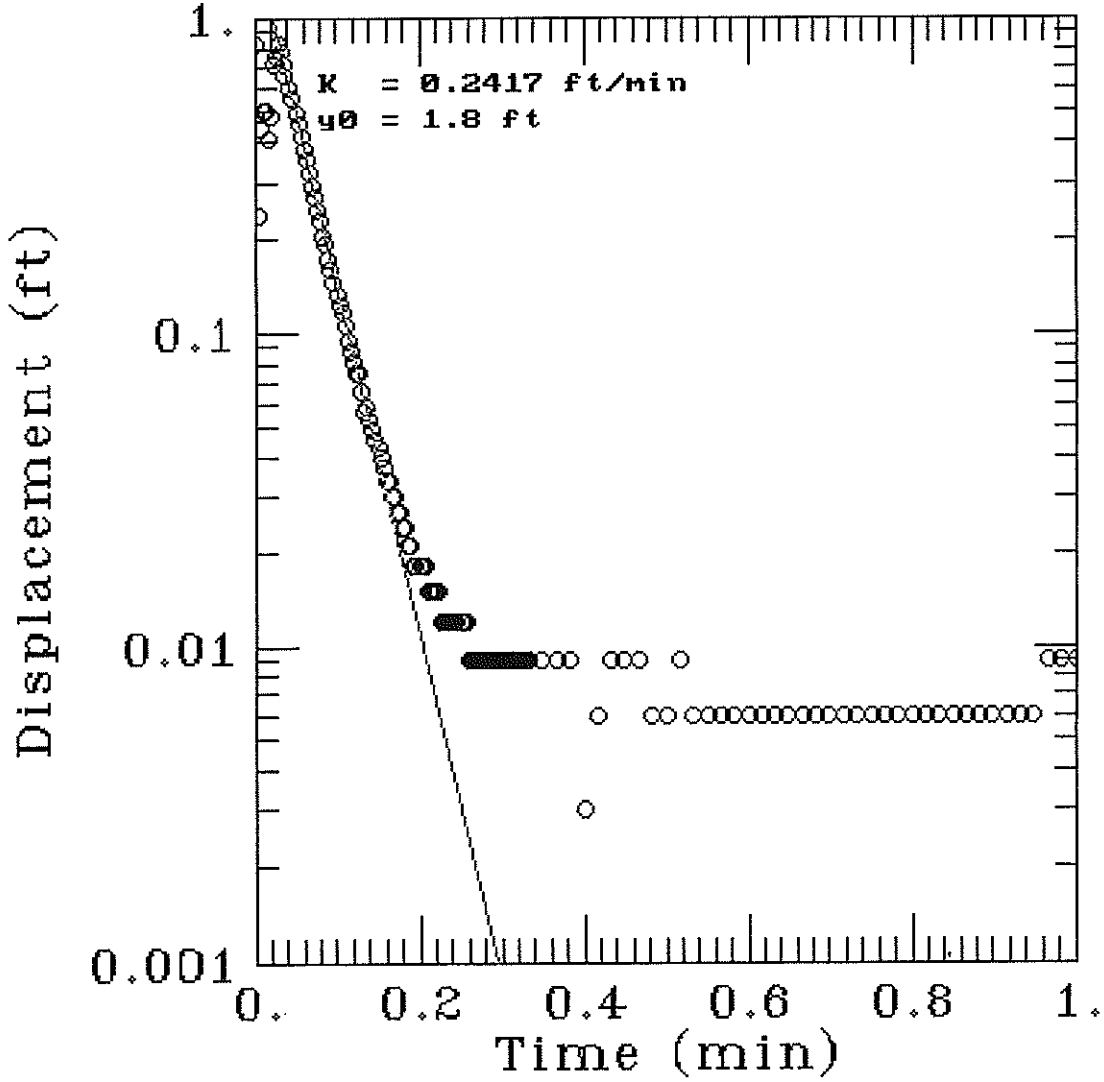
TABLE F-1
SUMMARY OF HYDRAULIC CONDUCTIVITY TEST RESULTS
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

| Well ID | Well Diam. (in) | Screen Int. (feet, bgs) | Filter Pack Int. (feet, bgs) | Saturated Height (feet) | Rc (feet) | Rw (feet) | Le (feet) | Hw (feet) | Bouwer and Rice Hydraulic Cond. (ft/min) | Bouwer and Rice Hydraulic Cond. (cm/s) | Hvorslev Hydraulic Cond. (ft/min) | Hvorslev Hydraulic Cond. (cm/s) | Screened Geology (USCS) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 57M-95-01X | 4 | 19 to 29 | 13 to 29 | 7.09 | 0.29 | 0.46 | 7.09 | 7.09 | 2.40E-01 | 1.22E-01 | 2.49E-02 | 1.26E-02 | SP |
| 57M-95-02X | 4 | 14 to 24 | 9 to 25 | 8.81 | 0.29 | 0.46 | 9.81 | 9.81 | 1.80E-01 | 9.14E-02 | 1.61E-02 | 8.17E-03 | SW-SM |
| 57M-95-03X | 4 | 7 to 17 | 5 to 18 | 9.51 | 0.29 | 0.46 | 10.51 | 10.51 | 1.10E-02 | 5.59E-03 | 1.04E-03 | 5.27E-04 | SW-SM |
| 57M-95-04A | 4 | 2.4 to 12.4 | 1.9 to 13 | 10.15 | 0.29 | 0.46 | 10.75 | 10.75 | 5.70E-02 | 2.90E-02 | 5.70E-03 | 2.90E-03 | SP |
| 57M-95-04B | 4 | 18.5 to 28.5 | 13 to 30 | 27.31 | 0.17 | 0.46 | 17 | 28.81 | 2.30E-02 | 1.17E-02 | 5.77E-03 | 2.93E-03 | SP |
| 57M-95-05X | 4 | 10 to 20 | 6 to 20 | 7.09 | 0.29 | 0.46 | 7.09 | 7.09 | 1.00E-01 | 5.08E-02 | 1.01E-02 | 5.14E-03 | SW-SM |
| 57M-95-06X | 4 | 11.9 to 21.9 | 8 to 23 | 11.22 | 0.29 | 0.46 | 12.32 | 12.32 | 1.70E-02 | 8.64E-03 | 1.66E-03 | 8.42E-04 | SP |
| 57M-95-07X | 4 | 3 to 13 | 2 to 14 | 11.37 | 0.29 | 0.46 | 12.37 | 12.37 | 6.70E-02 | 3.40E-02 | 7.00E-03 | 3.56E-03 | SW-SM |
| 57M-95-08A | 4 | 3 to 13 | 2 to 15 | 11.32 | 0.29 | 0.46 | 13 | 13.32 | 8.30E-04 | 4.22E-04 | 8.42E-05 | 4.28E-05 | SW-SM |
| 57M-95-08B | 4 | 18 to 28 | 13 to 30 | 26.64 | 0.17 | 0.46 | 17 | 28.64 | 7.40E-03 | 3.76E-03 | 2.02E-03 | 1.03E-03 | SM |
| 57M-96-09X | 2 | 12.8 to 22.8 | 8 to 23 | 8.53 | 0.2 | 0.33 | 8.73 | 8.73 | 8.15E-03 | 4.14E-03 | 4.18E-04 | 2.13E-04 | SP |
| 57M-96-10X | 2 | 3 to 13 | 2 to 13 | 9.03 | 0.2 | 0.33 | 9.03 | 9.03 | 1.36E-03 | 6.89E-04 | 4.39E-05 | 2.23E-05 | SM |
| 57M-96-11X | 2 | 2 to 12 | 1.5 to 12 | 10.91 | 0.2 | 0.33 | 10.91 | 10.91 | 2.11E-03 | 1.07E-03 | 1.28E-04 | 6.53E-05 | SM |
| 57M-96-12X | 2 | 2 to 12 | 1.5 to 12 | 10.66 | 0.2 | 0.33 | 10.66 | 10.66 | 2.60E-03 | 1.32E-03 | 1.20E-04 | 6.10E-05 | SM |
| 57M-96-13X | 2 | 2 to 12 | 1.5 to 12 | 10.39 | 0.2 | 0.33 | 10.39 | 10.39 | 2.96E-03 | 1.50E-03 | 1.62E-04 | 8.24E-05 | SM |
| | | | | | | | | **Geom. Mean** | **1.34E-02** | **6.79E-03** | **1.18E-03** | **6.01E-04** | |
| | | | | | | | | **Average** | 4.80E-02 | 2.44E-02 | 5.02E-03 | 2.55E-03 | |

Notes:
Hydraulic conductivities for 1996-series wells are the average of results of two rising head tests.
Data analyzed using AQTESOLV (Bouwer & Rice Solution).
Rc = Well casing radius for fully saturated filterpacks and equivalent casing radius which accounts for filterpack resaturation at n=30% for partially saturated filterpacks.
Rw = Radius of borehole.
Le = Saturated length of filterpack.
Hw = Height of Water Column above filterpack bottom.
Saturated Height is height of water column measured in well.
All measurements in feet unless otherwise noted.

# 57M-95-01X Rising Head

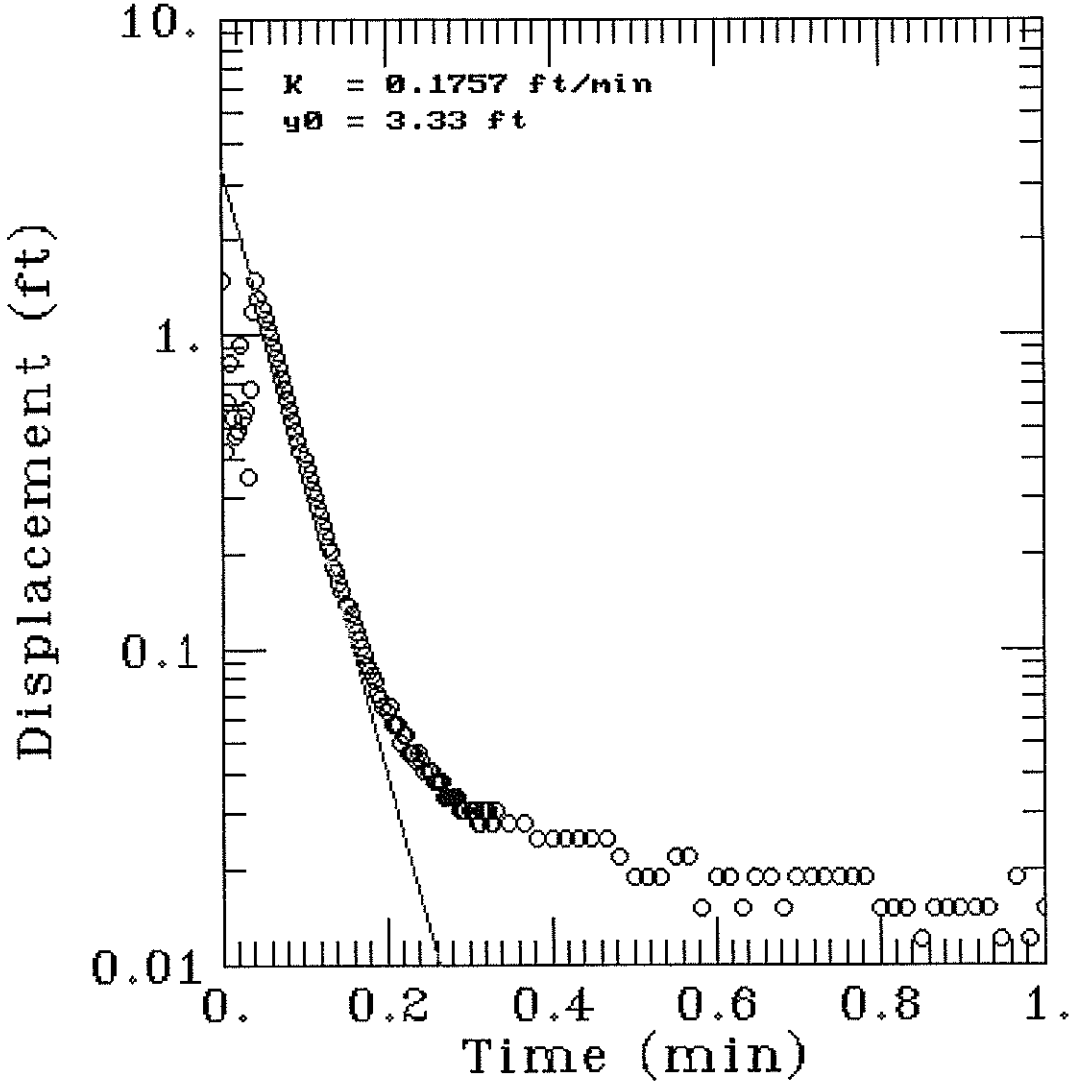



AQTESOLV

GERAGHTY & MILLER, INC.

Modeling Group

# 57M-95-02X Rising Head

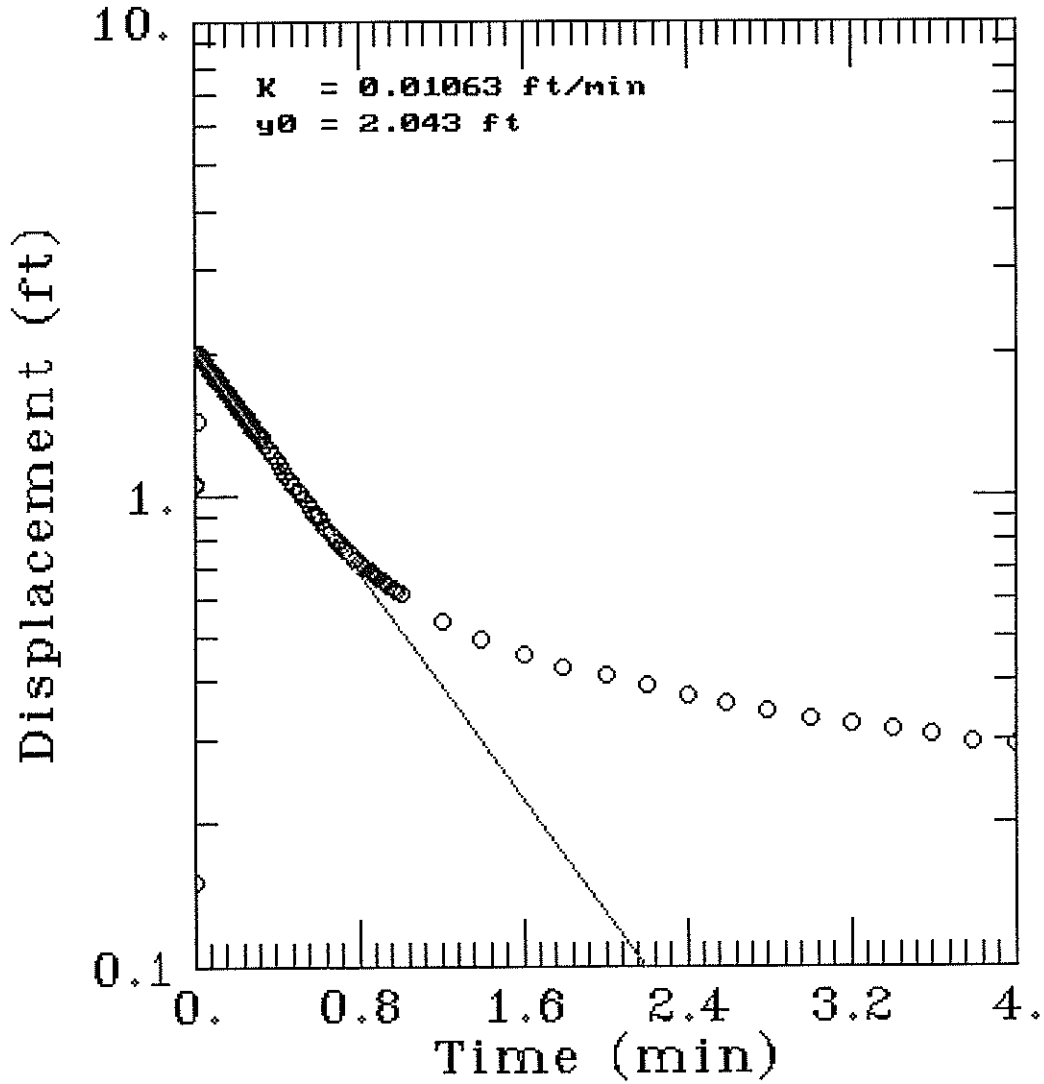



AQTESOLV

GERAGHTY & MILLER, INC.

Modeling Group

# 57M-95-03X Rising Head

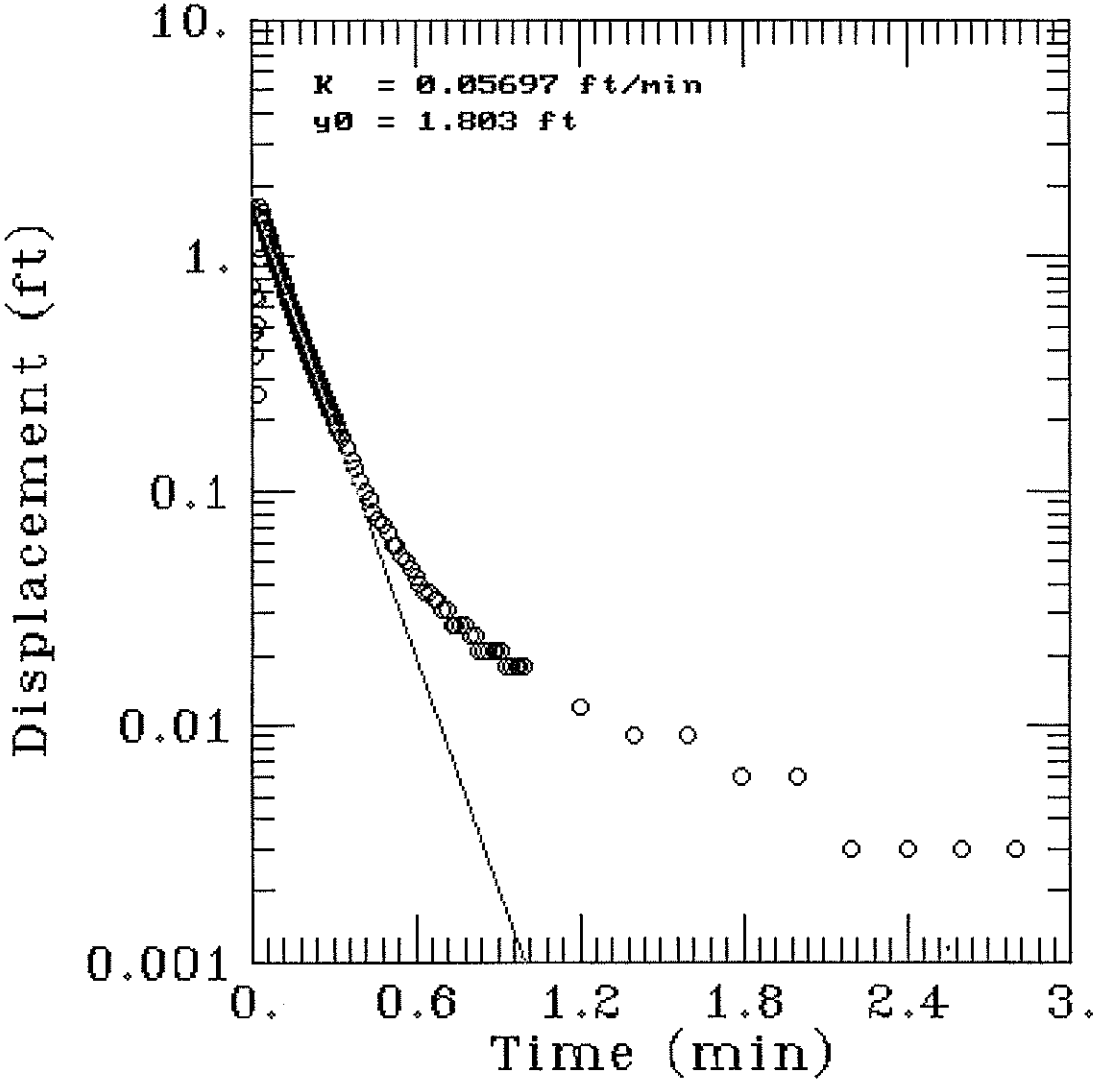



AQTESOLV

GERAGHTY & MILLER, INC.

Modeling Group

# 57M-95-04A Rising Head

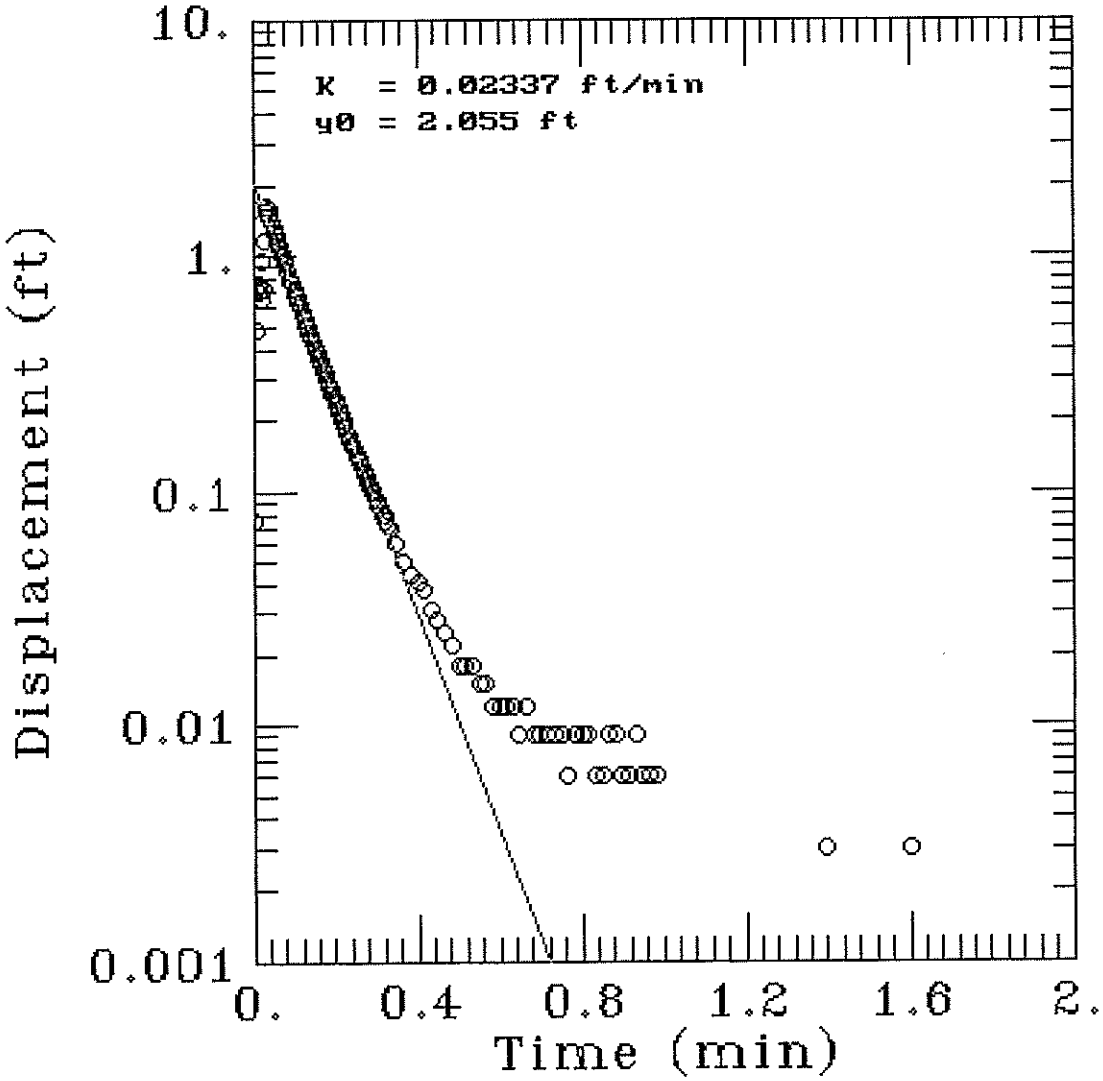



AQTESOLV

GERAGHTY & MILLER, INC.

Modeling Group

# 57M-95-04B Rising Head

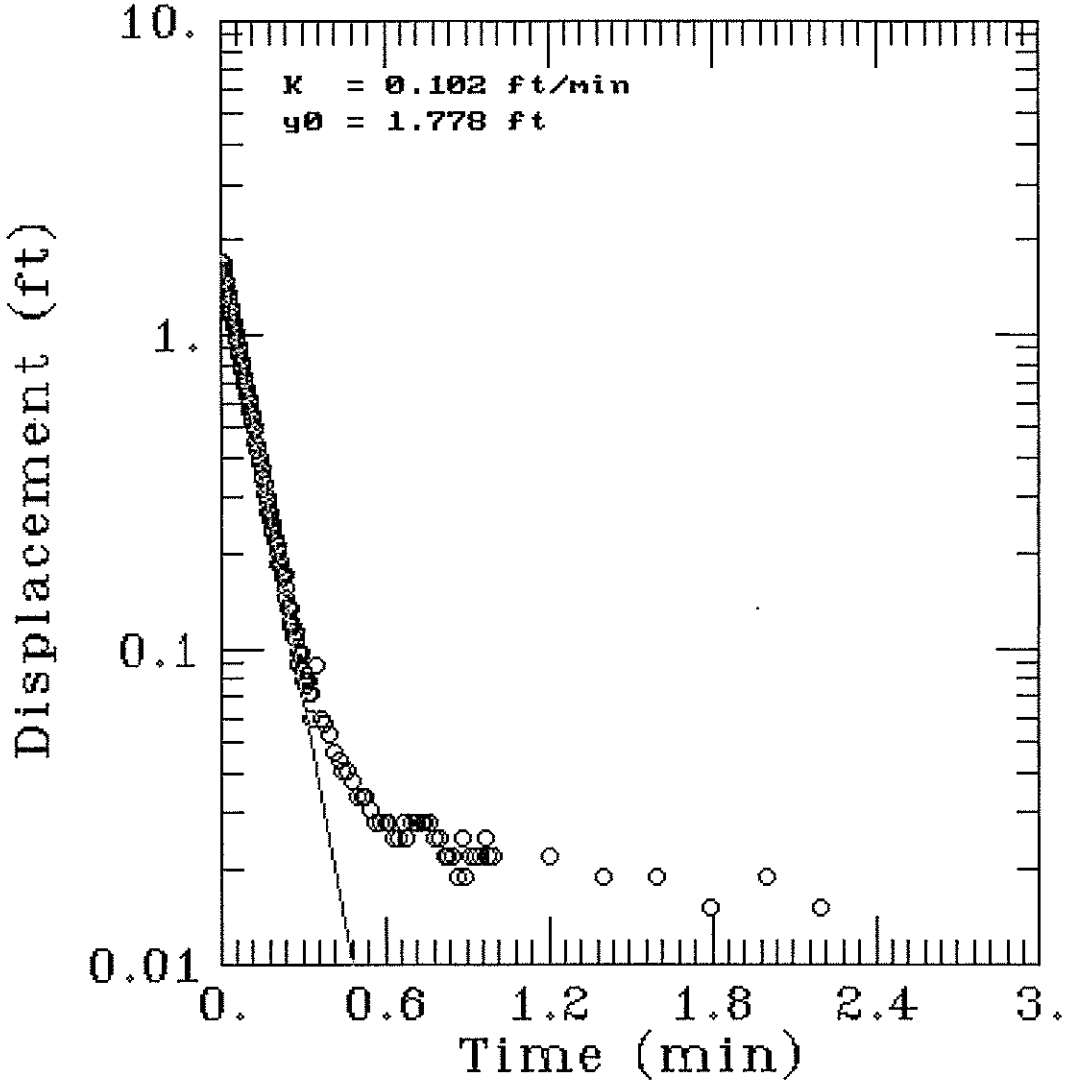



AQTESOLV

GERAGHTY & MILLER, INC.

Modeling Group

# 57M-95-05X Rising Head

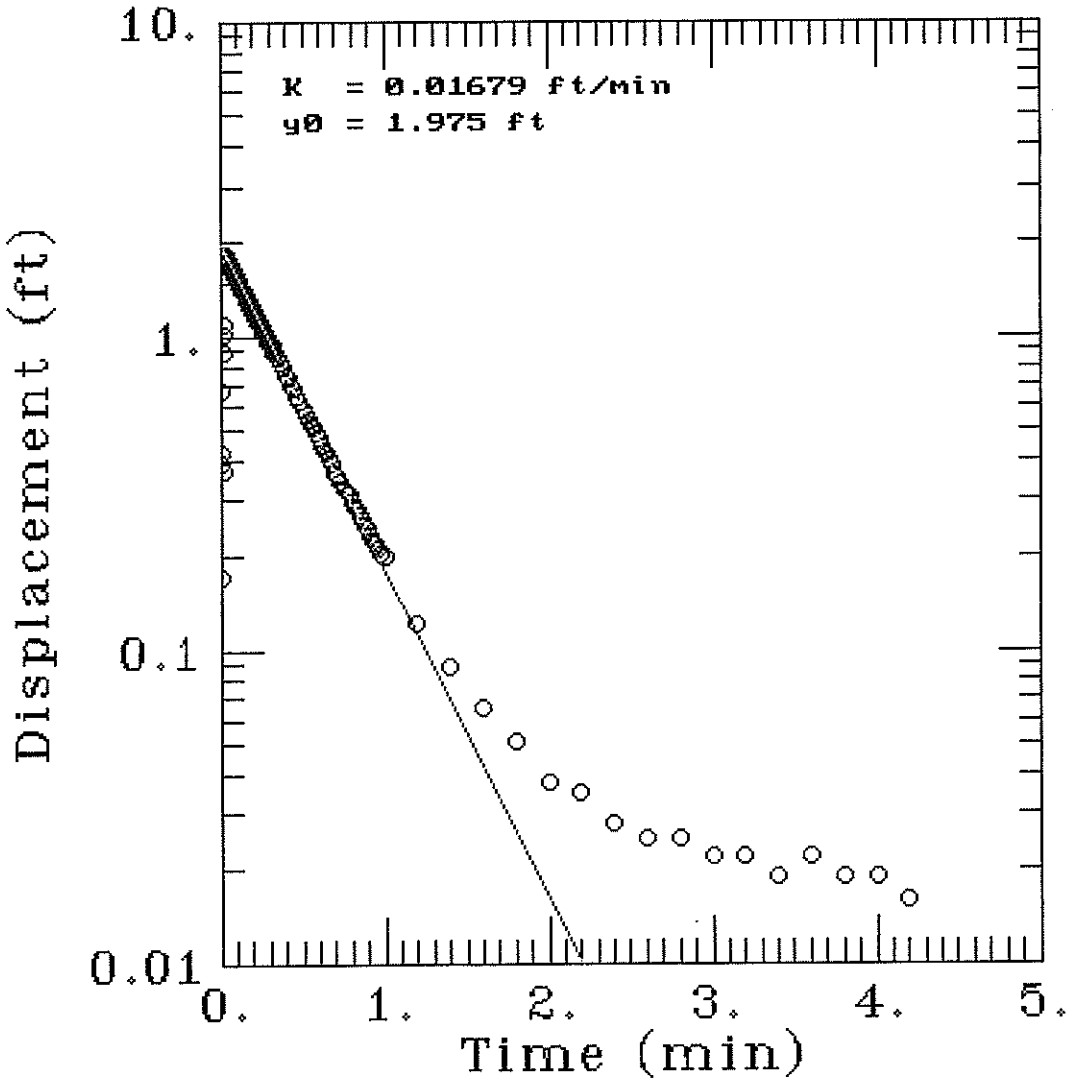



AQTESOLV

GERAGHTY & MILLER, INC.

Modeling Group

# 57M-95-06X Rising Head

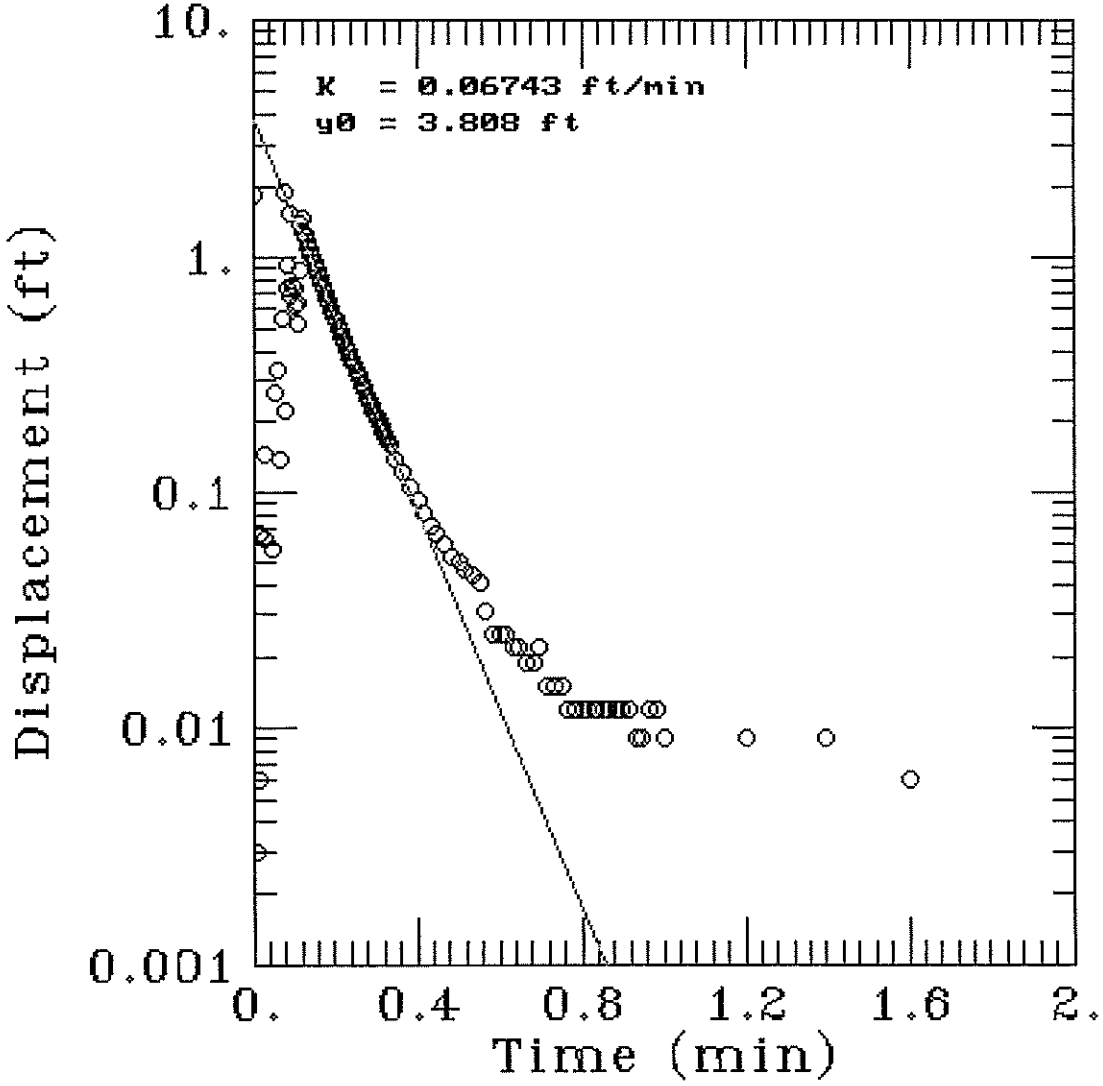



AQTESOLV

GERAGHTY & MILLER, INC.

Modeling Group

# 57M-95-07X Rising Head

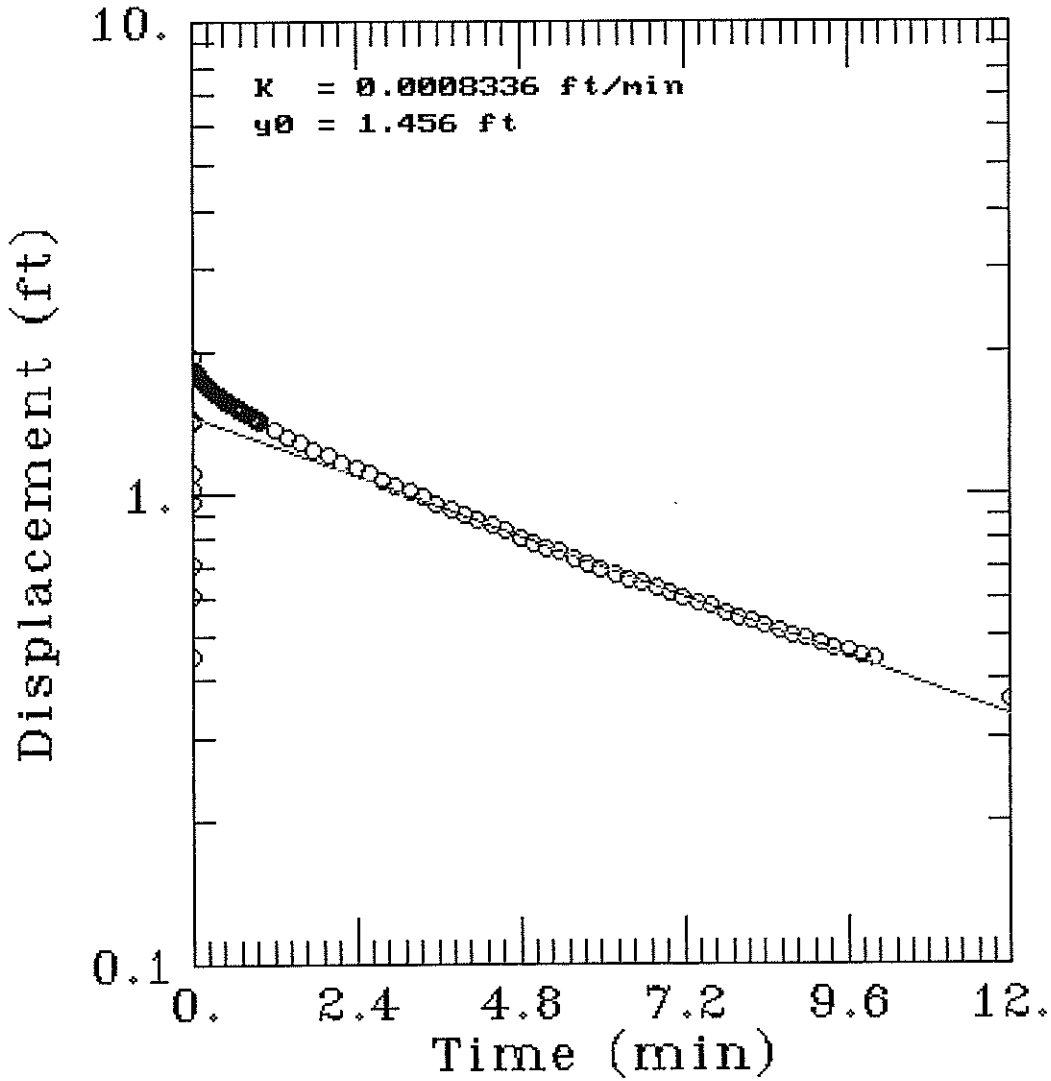



AQTESOLV

GERAGHTY & MILLER, INC.

Modeling Group

# 57M-95-08A Rising Head

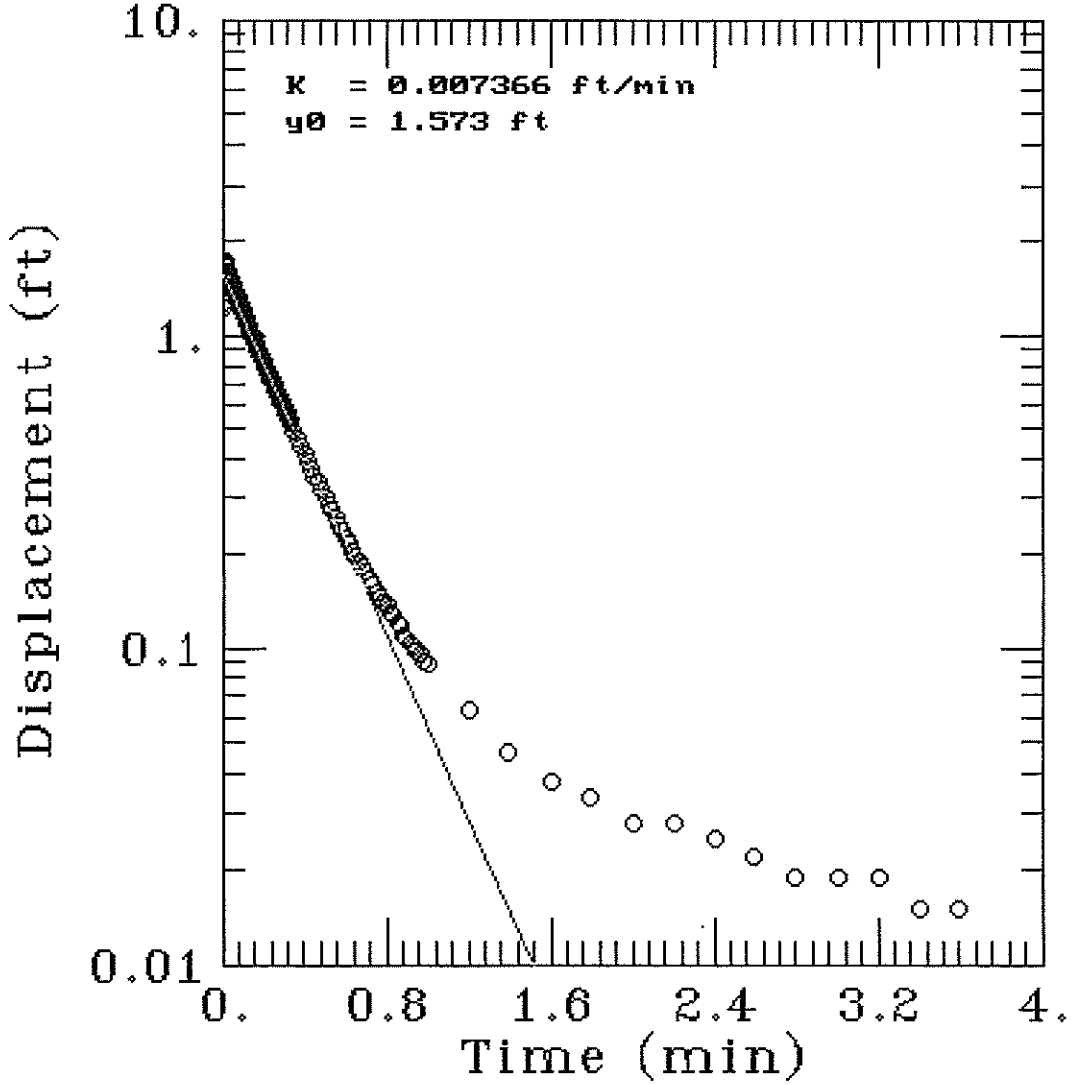



AQTESOLV

GERAGHTY & MILLER, INC.

Modeling Group

# 57M-95-08B Rising Head

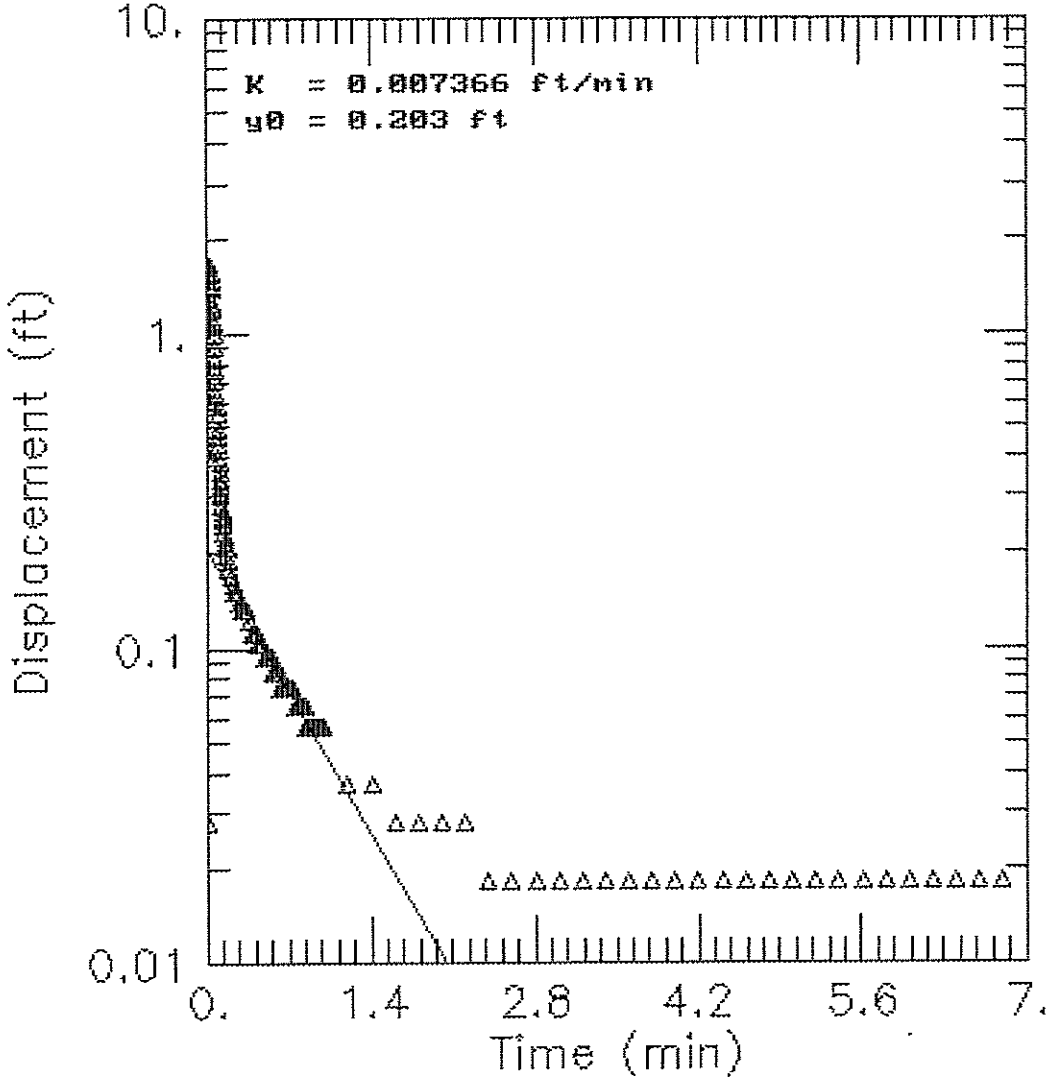



AQTESOLV

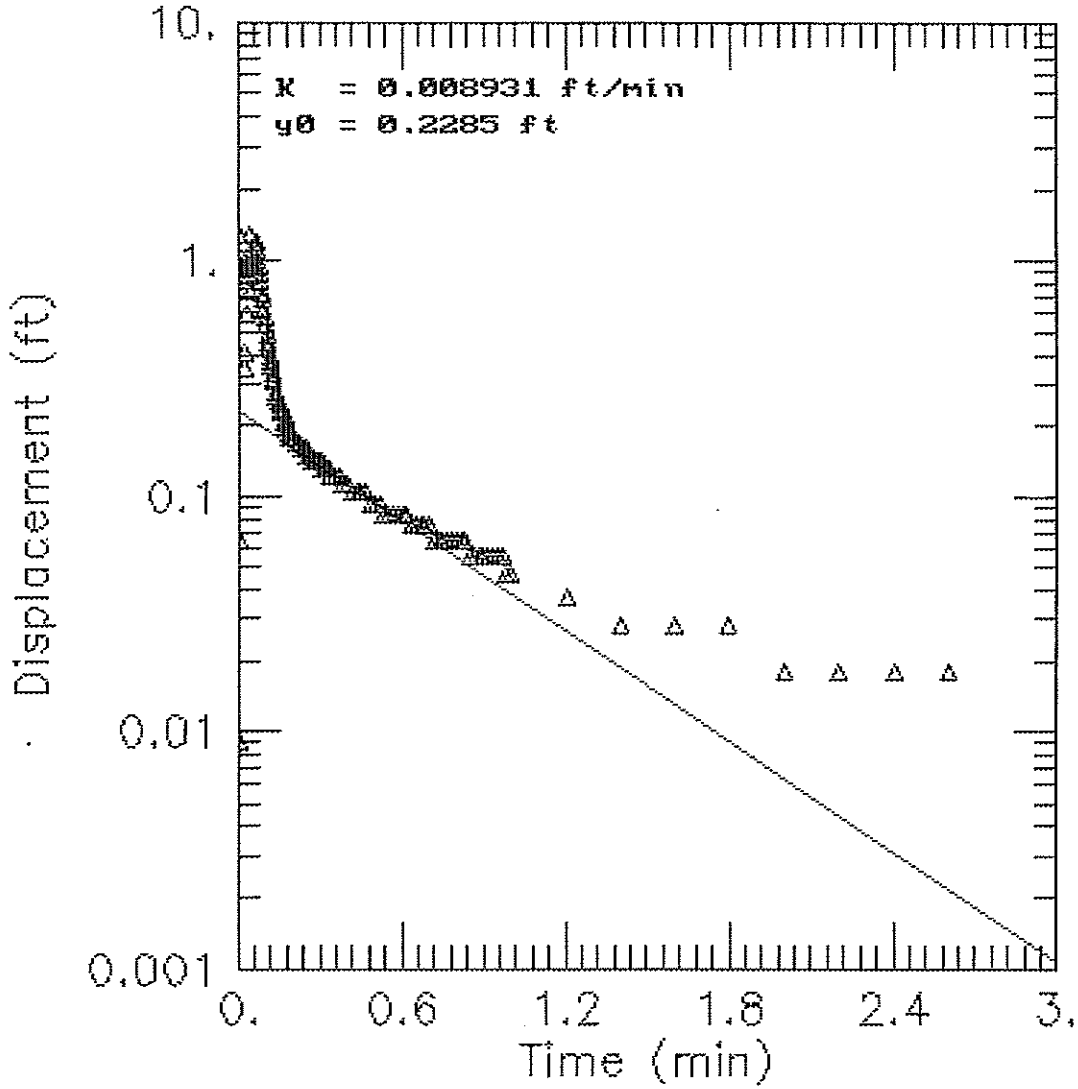
GERAGHTY & MILLER, INC.

Modeling Group

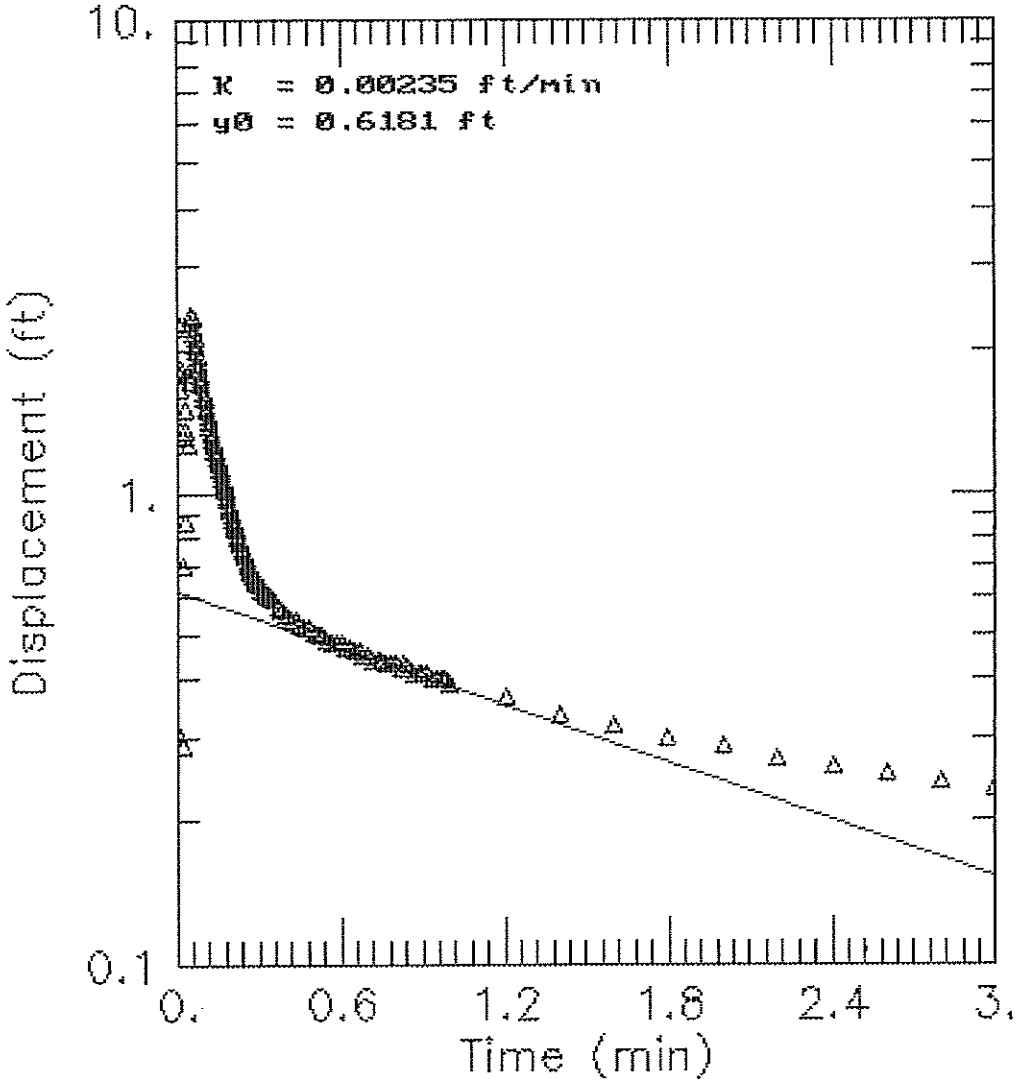
# 57M-96-09X RISING HEAD TEST #1



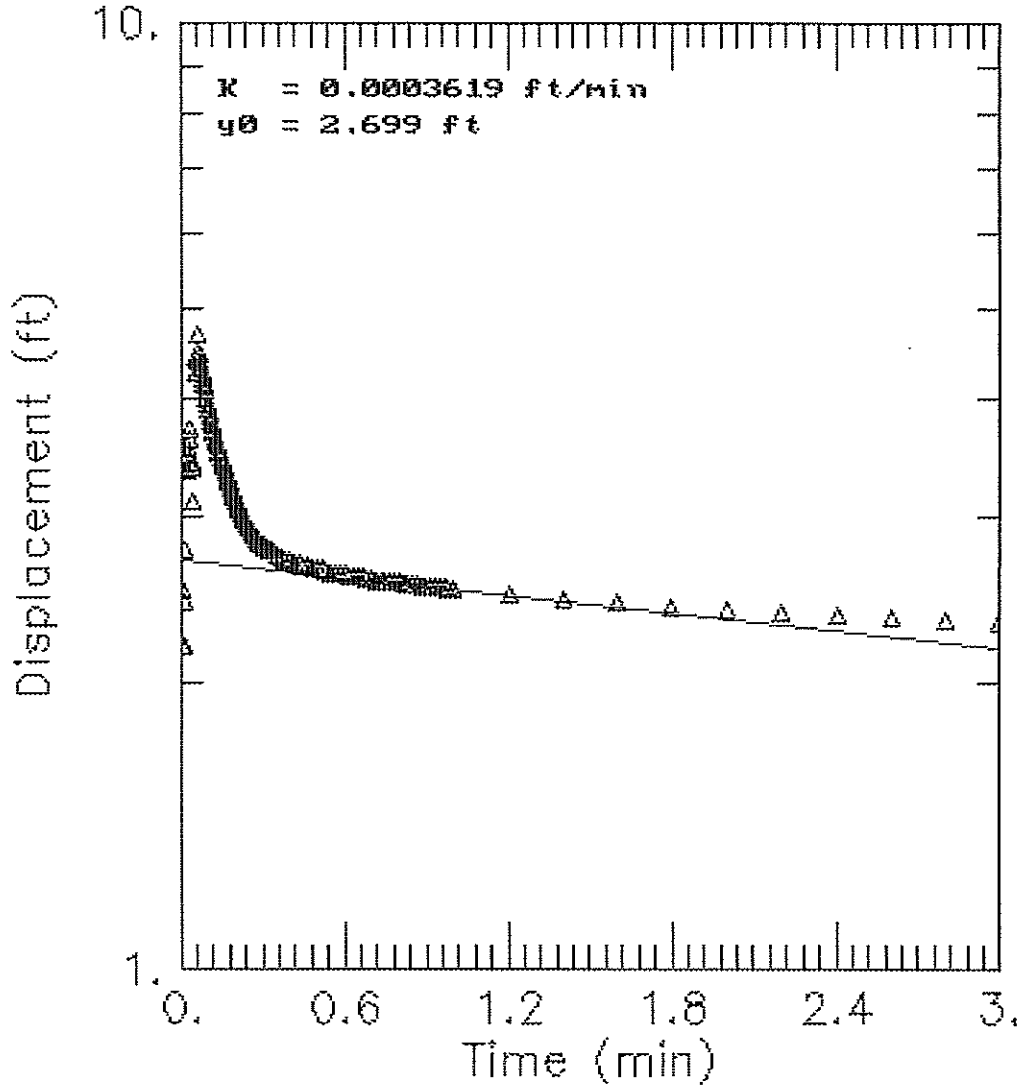
# 57M-96-09X RISING HEAD TEST #2



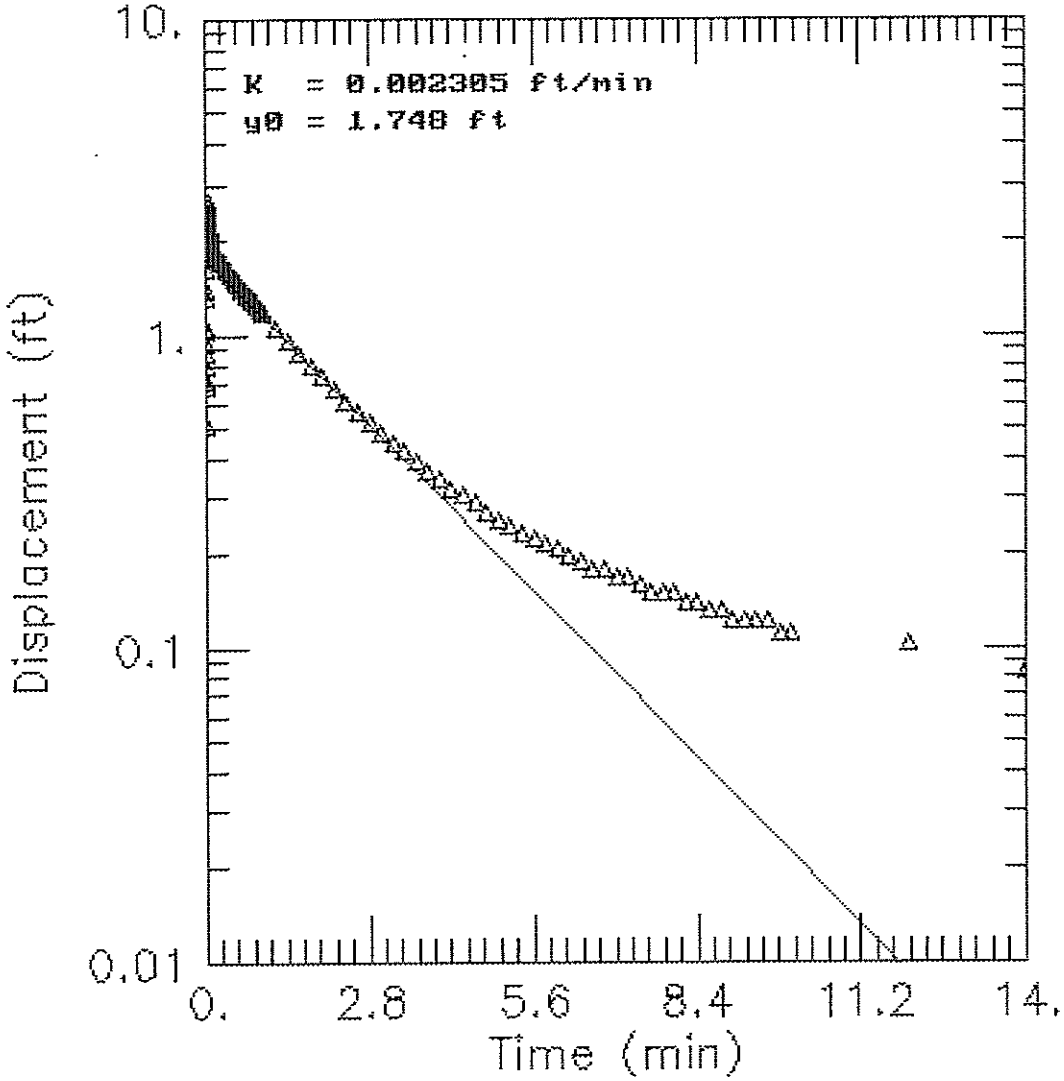
# 57M-96-10X RISING HEAD TEST #1



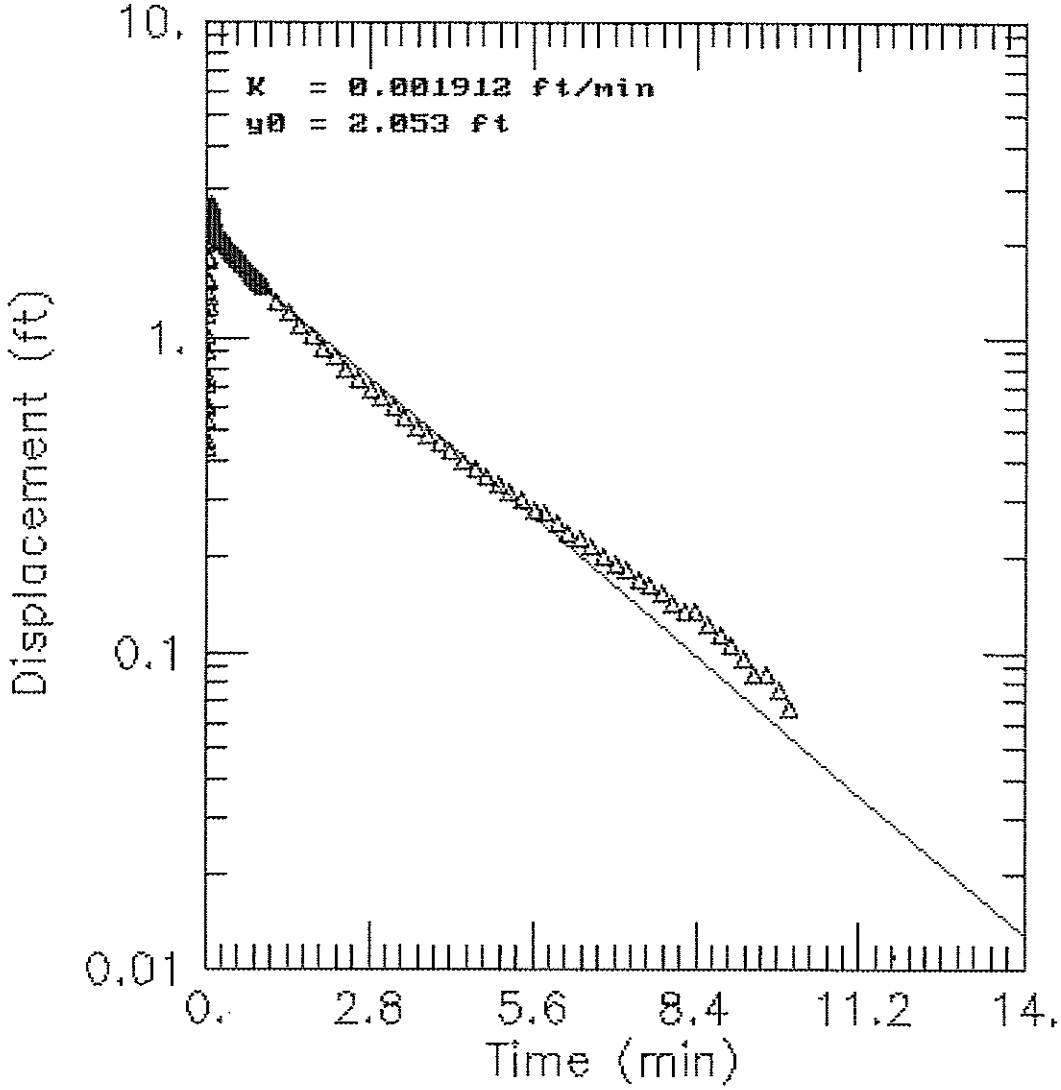
# 57M-96-10X RISNG HEAD TEST #2



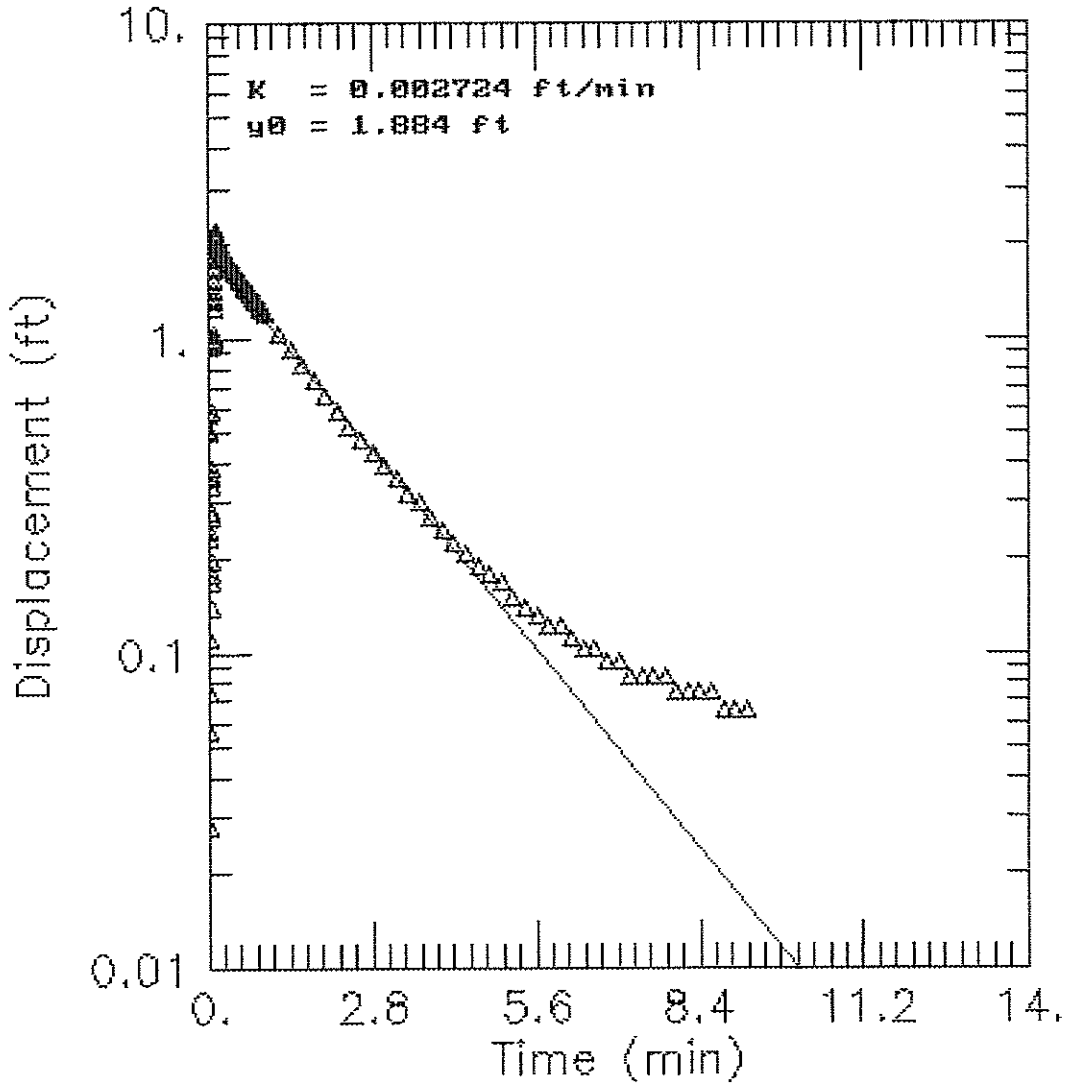
# 57M-96-11X RISING HEAD TEST #1



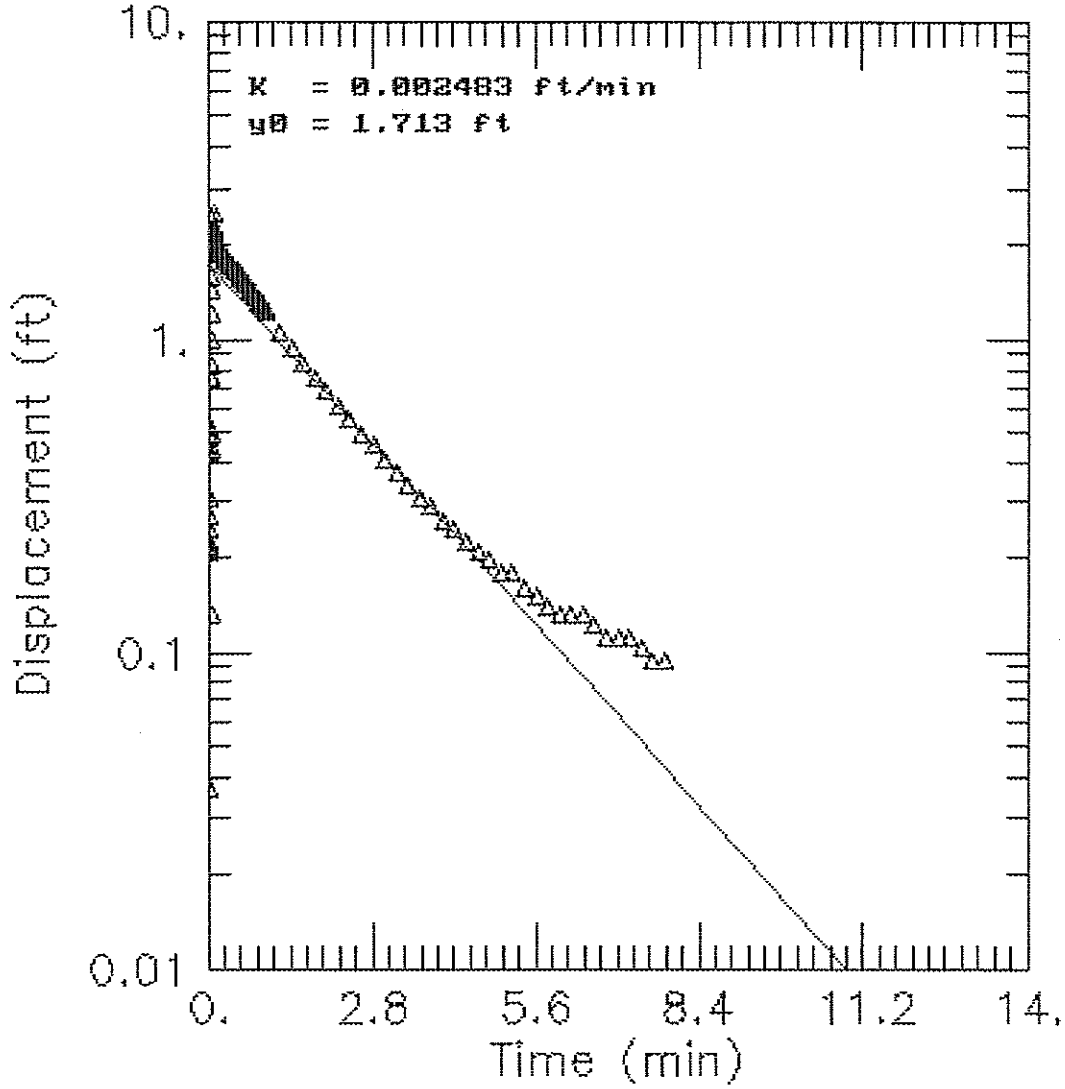
# 57M-96-11X RISING HEAD TEST #2



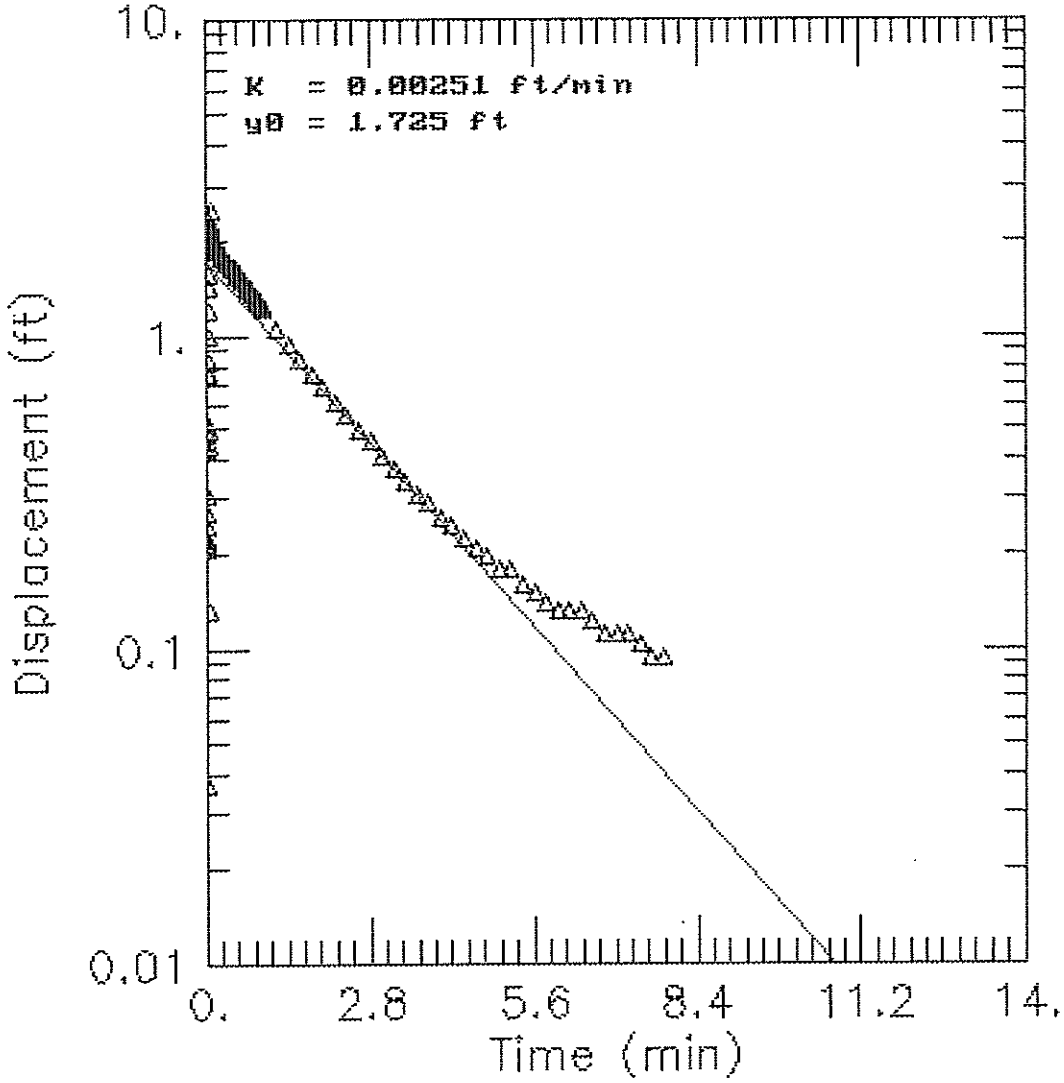
# 57M-96-12X RISING HEAD TEST #1



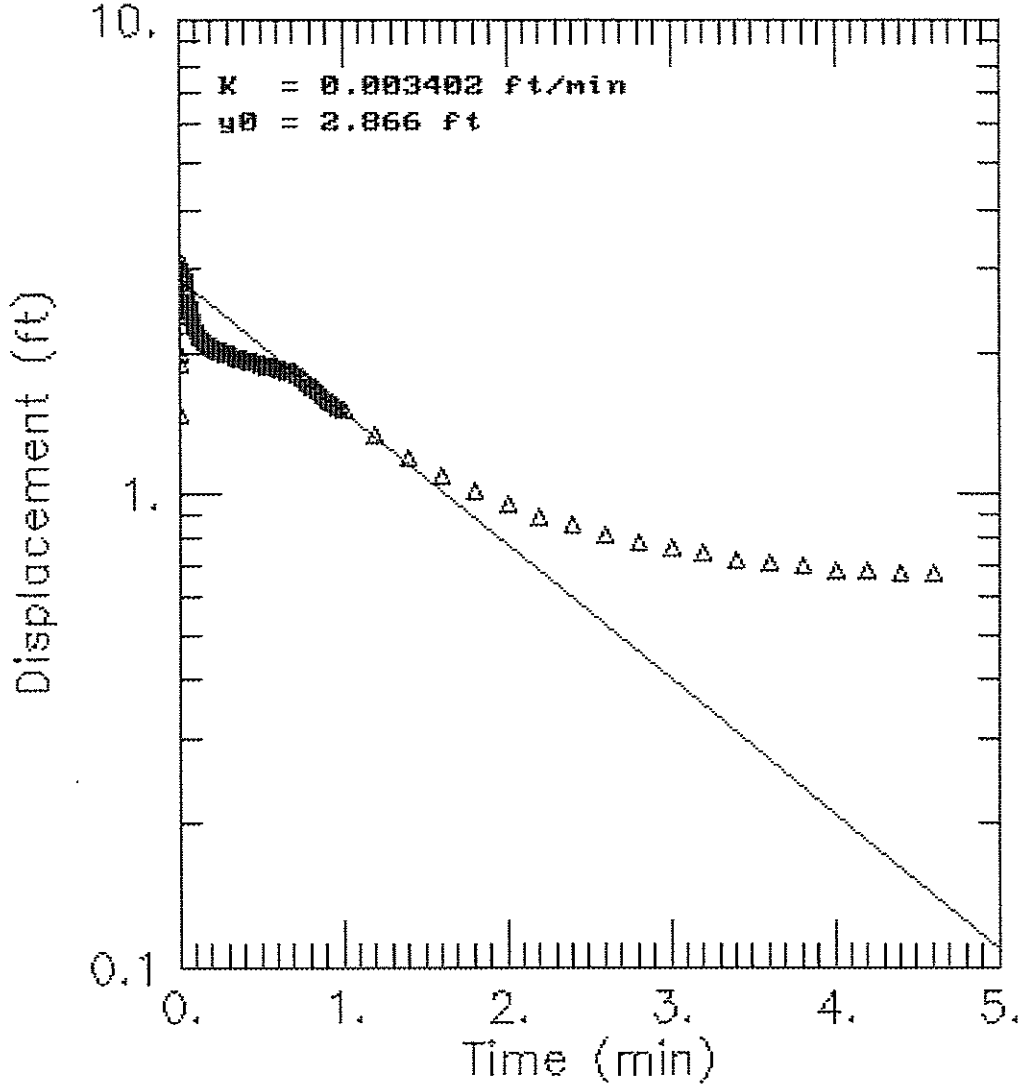
# 57M-96-12X RISING HEAD TEST #2



# 57M-96-13X RISING HEAD TEST #1



# 57M-96-13X RISING HEAD TEST #2



## CALCULATION OF HYDRAULIC CONDUCTIVITIES USING THE HVORSLEV EQUATION
## AOC 57

K = -[(LOG Ht1 - LOG Ht2)/(t1 - t2)]{[(r)^2 LOG (L/R)]/2L}

WHERE:

t1 = TIME 1 (MINUTES)
t2 = TIME 2 (MINUTES)
Ht1 = HEAD STRESS AT TIME 1 (FEET)
Ht2 = HEAD STRESS AT TIME 2 (FEET)
r = RADIUS OF WELL CASING (FEET)
R = RADUS OF BOREHOLE (FEET)
L = EFFECTIVE SATURATED LENGTH OF SCREEN (FEET)

| | | | | | | | | | | | AVERAGE OF MULTIPLE TESTS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WELL | t1 | t2 | Ht1 | Ht2 | r | R | L | TYPE | K (FT/MIN) | K (CM/SEC) | K (FT/MIN) | K (CM/SEC) |
| 57M-95-01X | 0.035 | 0.1 | 0.654 | 0.132 | 0.17 | 0.46 | 7.09 | RISING | 2.5E-02 | 1.3E-02 | | |
| 57M-95-02X | 0.05 | 0.2 | 1.207 | 0.063 | 0.17 | 0.46 | 9.81 | RISING | 1.6E-02 | 8.2E-03 | | |
| 57M-95-03X | 0.1 | 0.3 | 1.788 | 1.37 | 0.17 | 0.46 | 10.51 | RISING | 1.0E-03 | 5.3E-04 | | |
| 57M-95-04A | 0.08 | 0.3 | 1.05 | 0.205 | 0.17 | 0.46 | 10.75 | RISING | 5.7E-03 | 2.9E-03 | | |
| 57M-95-04B | 0.1 | 0.3 | 0.725 | 0.091 | 0.17 | 0.46 | 17 | RISING | 5.8E-03 | 2.9E-03 | | |
| 57M-95-05X | 0.1 | 0.3 | 0.63 | 0.085 | 0.17 | 0.46 | 7.09 | RISING | 1.0E-02 | 5.1E-03 | | |
| 57M-95-06X | 0.1 | 0.6 | 1.544 | 0.472 | 0.17 | 0.46 | 12.32 | RISING | 1.7E-03 | 8.4E-04 | | |
| 57M-95-07X | 0.15 | 0.3 | 0.956 | 0.212 | 0.17 | 0.46 | 12.37 | RISING | 7.0E-03 | 3.6E-03 | | |
| 57M-95-08A | 4.6 | 7.2 | 0.832 | 0.601 | 0.17 | 0.46 | 13 | RISING | 8.4E-05 | 4.3E-05 | | |
| 57M-95-08B | 0.1 | 0.4 | 1.193 | 0.418 | 0.17 | 0.46 | 17 | RISING | 2.0E-03 | 1.0E-03 | | |
| 57M-96-09X[1] | 0.4 | 0.8 | 0.112 | 0.065 | 0.08 | 0.33 | 8.7 | RISING | 3.3E-04 | 1.7E-04 | | |
| 57M-96-09X[2] | 0.3 | 0.5 | 0.14 | 0.093 | 0.08 | 0.33 | 8.7 | RISING | 5.0E-04 | 2.6E-04 | 4.2E-04 | 2.1E-04 |
| 57M-96-10X[1] | 1.2 | 2 | 0.366 | 0.29 | 0.08 | 0.33 | 9.0 | RISING | 7.0E-05 | 3.5E-05 | | |
| 57M-96-10X[2] | 0.8 | 1.4 | 2.562 | 2.449 | 0.08 | 0.33 | 9.0 | RISING | 1.8E-05 | 9.2E-06 | 4.4E-05 | 2.2E-05 |
| 57M-96-11X[1] | 1.6 | 2.8 | 0.872 | 0.525 | 0.08 | 0.33 | 10.9 | RISING | 8.9E-05 | 4.5E-05 | | |
| 57M-96-11X[2] | 2.8 | 4 | 0.366 | 0.14 | 0.08 | 0.33 | 10.9 | RISING | 1.7E-04 | 8.5E-05 | 1.3E-04 | 6.5E-05 |
| 57M-96-12X[1] | 1 | 3 | 1.192 | 0.394 | 0.08 | 0.33 | 10.7 | RISING | 1.2E-04 | 6.0E-05 | | |
| 57M-96-12X[2] | 0.8 | 2.4 | 1.379 | 0.553 | 0.08 | 0.33 | 10.7 | RISING | 1.2E-04 | 6.2E-05 | 1.2E-04 | 6.1E-05 |
| 57M-96-13X[1] | 0.6 | 1 | 1.248 | 0.863 | 0.08 | 0.33 | 10.4 | RISING | 2.0E-04 | 1.0E-04 | | |
| 57M-96-13X[2] | 0.8 | 1.6 | 1.717 | 1.088 | 0.08 | 0.33 | 10.4 | RISING | 1.2E-04 | 6.3E-05 | 1.6E-04 | 8.2E-05 |

NOTES:
1) Rising Head Test #1
2) Rising Head Test #2

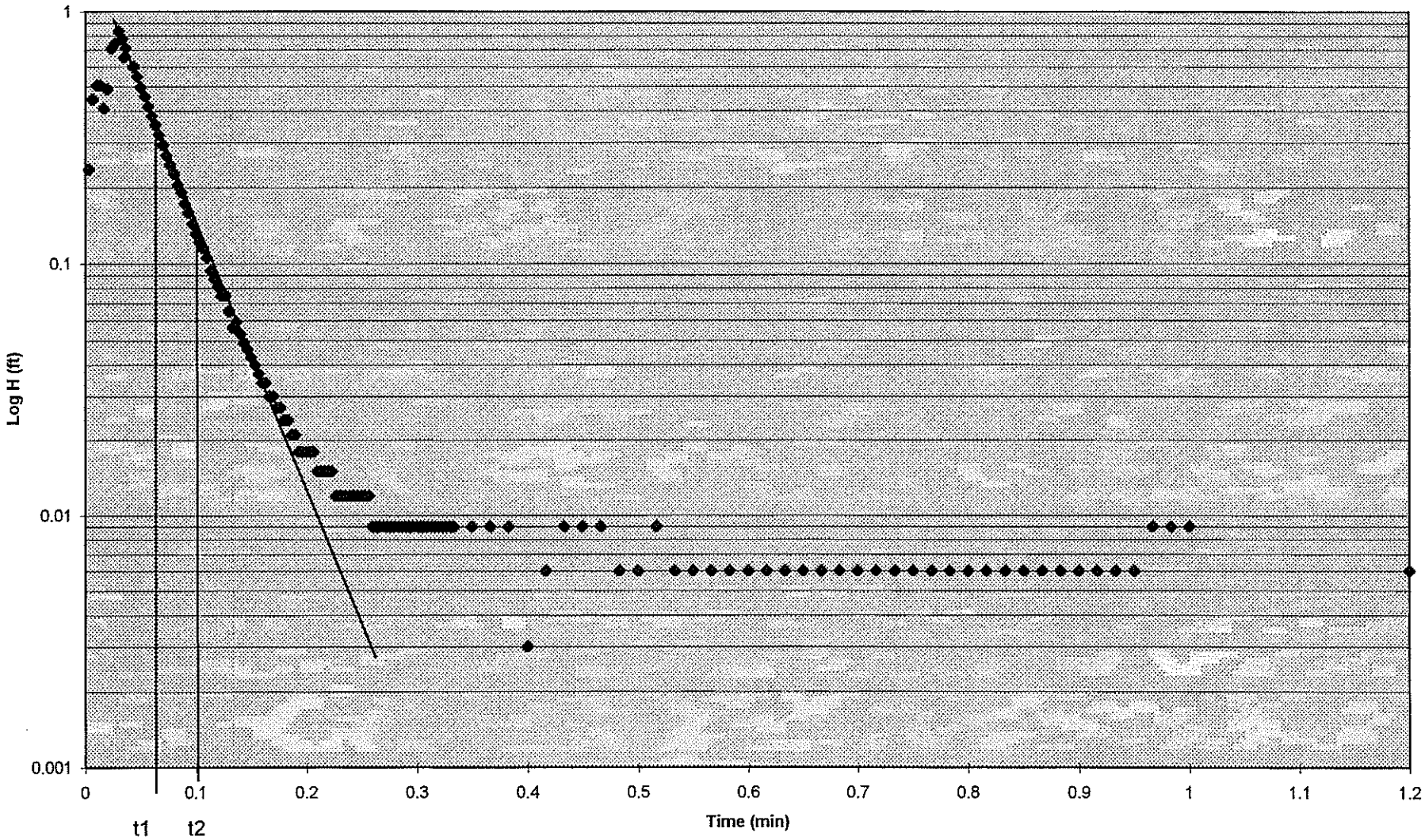
| Time (min) | delta H (ft.) |
|---|---|
| 0 | 0.515 |
| 0.0033 | 0.236 |
| 0.0066 | 0.445 |
| 0.01 | 0.505 |
| 0.0133 | 0.505 |
| 0.0166 | 0.41 |
| 0.02 | 0.489 |
| 0.0233 | 0.711 |
| 0.0266 | 0.746 |
| 0.03 | 0.832 |
| 0.0333 | 0.778 |
| 0.0366 | 0.714 |
| 0.035 | 0.654 |
| 0.0433 | 0.6 |
| 0.0466 | 0.55 |
| 0.05 | 0.499 |
| 0.0533 | 0.458 |
| 0.0566 | 0.417 |
| 0.06 | 0.382 |
| 0.0633 | 0.353 |
| 0.0666 | 0.322 |
| 0.07 | 0.293 |
| 0.0733 | 0.268 |
| 0.0766 | 0.246 |
| 0.08 | 0.227 |
| 0.0833 | 0.205 |
| 0.0866 | 0.192 |
| 0.09 | 0.173 |
| 0.0933 | 0.16 |
| 0.0966 | 0.144 |
| 0.1 | 0.132 |
| 0.1033 | 0.122 |
| 0.1066 | 0.116 |
| 0.11 | 0.106 |
| 0.1133 | 0.094 |
| 0.1166 | 0.087 |
| 0.12 | 0.081 |
| 0.1233 | 0.075 |
| 0.1266 | 0.075 |
| 0.13 | 0.065 |
| 0.1333 | 0.056 |
| 0.1366 | 0.059 |
| 0.14 | 0.053 |
| 0.1433 | 0.049 |
| 0.1466 | 0.046 |
| 0.15 | 0.043 |
| 0.1533 | 0.04 |
| 0.1566 | 0.037 |
| 0.16 | 0.034 |
| 0.1633 | 0.034 |

Well ID: 57M-95-01X
Test Date: 11/16/95
Test Type: Rising Head
Well Diameter: 0.333 ft.
Boring Diameter: 0.833 ft.
Screened Interval (bgs): 19-29 ft.
Water Column Height: 7.09 ft.

| Time (min) | delta H (ft.) | | | | | |
|---|---|---|---|---|---|---|
| 0.1666 | 0.03 | | | | | |
| 0.17 | 0.03 | | | | | |
| 0.1733 | 0.027 | | | | | |
| 0.1766 | 0.027 | | | | | |
| 0.18 | 0.024 | | | | | |
| 0.1833 | 0.024 | | | | | |
| 0.1866 | 0.021 | | | | | |
| 0.19 | 0.021 | | | | | |
| 0.1933 | 0.018 | | | | | |
| 0.1966 | 0.018 | | | | | |
| 0.2 | 0.018 | | | | | |
| 0.2033 | 0.018 | | | | | |
| 0.2066 | 0.018 | | | | | |
| 0.21 | 0.015 | | | | | |
| 0.2133 | 0.015 | | | | | |
| 0.2166 | 0.015 | | | | | |
| 0.22 | 0.015 | | | | | |
| 0.2233 | 0.015 | | | | | |
| 0.2266 | 0.012 | | | | | |
| 0.23 | 0.012 | | | | | |
| 0.2333 | 0.012 | | | | | |
| 0.2366 | 0.012 | | | | | |
| 0.24 | 0.012 | | | | | |
| 0.2433 | 0.012 | | | | | |
| 0.2466 | 0.012 | | | | | |
| 0.25 | 0.012 | | | | | |
| 0.2533 | 0.012 | | | | | |
| 0.2566 | 0.012 | | | | | |
| 0.26 | 0.009 | | | | | |
| 0.2633 | 0.009 | | | | | |
| 0.2666 | 0.009 | | | | | |
| 0.27 | 0.009 | | | | | |
| 0.2733 | 0.009 | | | | | |
| 0.2766 | 0.009 | | | | | |
| 0.28 | 0.009 | | | | | |
| 0.2833 | 0.009 | | | | | |
| 0.2866 | 0.009 | | | | | |
| 0.29 | 0.009 | | | | | |
| 0.2933 | 0.009 | | | | | |
| 0.2966 | 0.009 | | | | | |
| 0.3 | 0.009 | | | | | |
| 0.3033 | 0.009 | | | | | |
| 0.3066 | 0.009 | | | | | |
| 0.31 | 0.009 | | | | | |
| 0.3133 | 0.009 | | | | | |
| 0.3166 | 0.009 | | | | | |
| 0.32 | 0.009 | | | | | |
| 0.3233 | 0.009 | | | | | |
| 0.3266 | 0.009 | | | | | |
| 0.33 | 0.009 | | | | | |

| Time (min) | delta H (ft.) | | | | | |
|---|---|---|---|---|---|---|
| 0.3333 | 0.009 | | | | | |
| 0.35 | 0.009 | | | | | |
| 0.3666 | 0.009 | | | | | |
| 0.3833 | 0.009 | | | | | |
| 0.4 | 0.003 | | | | | |
| 0.4166 | 0.006 | | | | | |
| 0.4333 | 0.009 | | | | | |
| 0.45 | 0.009 | | | | | |
| 0.4666 | 0.009 | | | | | |
| 0.4833 | 0.006 | | | | | |
| 0.5 | 0.006 | | | | | |
| 0.5166 | 0.009 | | | | | |
| 0.5333 | 0.006 | | | | | |
| 0.55 | 0.006 | | | | | |
| 0.5666 | 0.006 | | | | | |
| 0.5833 | 0.006 | | | | | |
| 0.6 | 0.006 | | | | | |
| 0.6166 | 0.006 | | | | | |
| 0.6333 | 0.006 | | | | | |
| 0.65 | 0.006 | | | | | |
| 0.6666 | 0.006 | | | | | |
| 0.6833 | 0.006 | | | | | |
| 0.7 | 0.006 | | | | | |
| 0.7166 | 0.006 | | | | | |
| 0.7333 | 0.006 | | | | | |
| 0.75 | 0.006 | | | | | |
| 0.7666 | 0.006 | | | | | |
| 0.7833 | 0.006 | | | | | |
| 0.8 | 0.006 | | | | | |
| 0.8166 | 0.006 | | | | | |
| 0.8333 | 0.006 | | | | | |
| 0.85 | 0.006 | | | | | |
| 0.8666 | 0.006 | | | | | |
| 0.8833 | 0.006 | | | | | |
| 0.9 | 0.006 | | | | | |
| 0.9166 | 0.006 | | | | | |
| 0.9333 | 0.006 | | | | | |
| 0.95 | 0.006 | | | | | |
| 0.9666 | 0.009 | | | | | |
| 0.9833 | 0.009 | | | | | |
| 1 | 0.009 | | | | | |
| 1.2 | 0.006 | | | | | |

## 57M-95-01X RISING HEAD



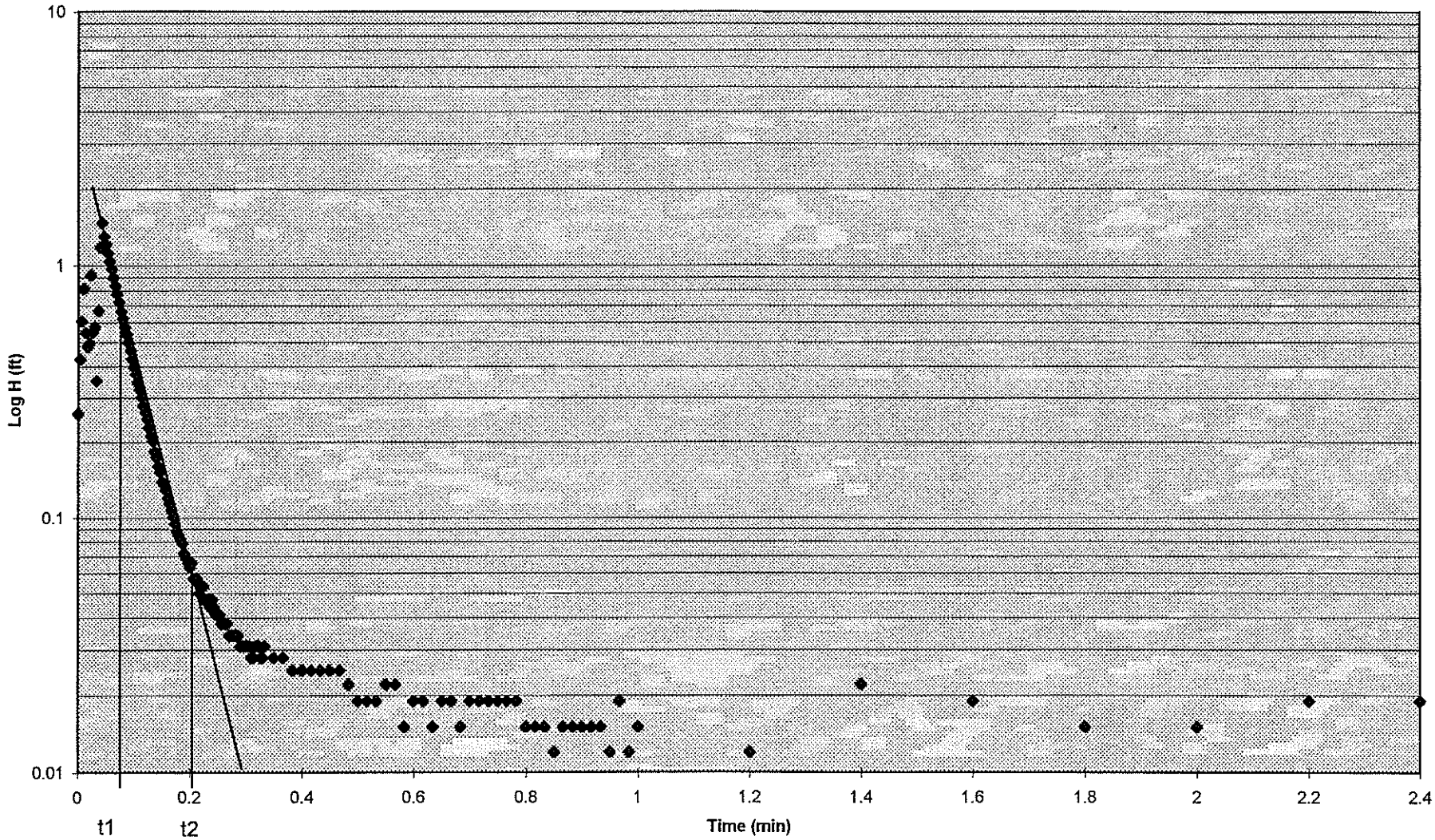
| Time (min) | delta H (ft.) |
|---|---|
| 0 | 0.259 |
| 0.0033 | 0.427 |
| 0.0066 | 0.608 |
| 0.01 | 0.814 |
| 0.0133 | 0.545 |
| 0.0166 | 0.478 |
| 0.02 | 0.494 |
| 0.0233 | 0.922 |
| 0.0266 | 0.548 |
| 0.03 | 0.573 |
| 0.0333 | 0.351 |
| 0.0366 | 0.668 |
| 0.04 | 1.182 |
| 0.0433 | 1.473 |
| 0.0466 | 1.302 |
| 0.05 | 1.207 |
| 0.0533 | 1.118 |
| 0.0566 | 1.039 |
| 0.06 | 0.969 |
| 0.0633 | 0.9 |
| 0.0666 | 0.833 |
| 0.07 | 0.779 |
| 0.0733 | 0.722 |
| 0.0766 | 0.665 |
| 0.08 | 0.621 |
| 0.0833 | 0.576 |
| 0.0866 | 0.535 |
| 0.09 | 0.497 |
| 0.0933 | 0.462 |
| 0.0966 | 0.427 |
| 0.1 | 0.399 |
| 0.1033 | 0.373 |
| 0.1066 | 0.345 |
| 0.11 | 0.323 |
| 0.1133 | 0.301 |
| 0.1166 | 0.278 |
| 0.12 | 0.263 |
| 0.1233 | 0.247 |
| 0.1266 | 0.228 |
| 0.13 | 0.212 |
| 0.1333 | 0.202 |
| 0.1366 | 0.183 |
| 0.14 | 0.174 |
| 0.1433 | 0.161 |
| 0.1466 | 0.152 |
| 0.15 | 0.139 |
| 0.1533 | 0.136 |
| 0.1566 | 0.129 |
| 0.16 | 0.12 |
| 0.1633 | 0.114 |

Well ID: 57M-95-02X
Test Date: 11/17/95
Test Type: Rising Head
Well Diameter: 0.333 ft.
Boring Diameter: 0.833 ft.
Screened Interval (bgs): 14-24 ft.
Water Column Height: 8.81 ft.

| Time (min) | delta H (ft.) | | | | | |
|---|---|---|---|---|---|---|
| 0.1666 | 0.107 | | | | | |
| 0.17 | 0.101 | | | | | |
| 0.1733 | 0.095 | | | | | |
| 0.1766 | 0.088 | | | | | |
| 0.18 | 0.085 | | | | | |
| 0.1833 | 0.082 | | | | | |
| 0.1866 | 0.079 | | | | | |
| 0.19 | 0.072 | | | | | |
| 0.1933 | 0.069 | | | | | |
| 0.1966 | 0.066 | | | | | |
| 0.2 | 0.063 | | | | | |
| 0.2033 | 0.066 | | | | | |
| 0.2066 | 0.057 | | | | | |
| 0.21 | 0.057 | | | | | |
| 0.2133 | 0.057 | | | | | |
| 0.2166 | 0.05 | | | | | |
| 0.22 | 0.053 | | | | | |
| 0.2233 | 0.053 | | | | | |
| 0.2266 | 0.047 | | | | | |
| 0.23 | 0.047 | | | | | |
| 0.2333 | 0.047 | | | | | |
| 0.2366 | 0.044 | | | | | |
| 0.24 | 0.047 | | | | | |
| 0.2433 | 0.044 | | | | | |
| 0.2466 | 0.041 | | | | | |
| 0.25 | 0.041 | | | | | |
| 0.2533 | 0.041 | | | | | |
| 0.2566 | 0.038 | | | | | |
| 0.26 | 0.038 | | | | | |
| 0.2633 | 0.038 | | | | | |
| 0.2666 | 0.038 | | | | | |
| 0.27 | 0.034 | | | | | |
| 0.2733 | 0.034 | | | | | |
| 0.2766 | 0.034 | | | | | |
| 0.28 | 0.034 | | | | | |
| 0.2833 | 0.034 | | | | | |
| 0.2866 | 0.034 | | | | | |
| 0.29 | 0.031 | | | | | |
| 0.2933 | 0.031 | | | | | |
| 0.2966 | 0.031 | | | | | |
| 0.3 | 0.031 | | | | | |
| 0.3033 | 0.031 | | | | | |
| 0.3066 | 0.031 | | | | | |
| 0.31 | 0.028 | | | | | |
| 0.3133 | 0.028 | | | | | |
| 0.3166 | 0.031 | | | | | |
| 0.32 | 0.031 | | | | | |
| 0.3233 | 0.031 | | | | | |
| 0.3266 | 0.028 | | | | | |
| 0.33 | 0.028 | | | | | |

| Time (min) | delta H (ft.) | | | | | |
|---|---|---|---|---|---|---|
| 0.3333 | 0.031 | | | | | |
| 0.35 | 0.028 | | | | | |
| 0.3666 | 0.028 | | | | | |
| 0.3833 | 0.025 | | | | | |
| 0.4 | 0.025 | | | | | |
| 0.4166 | 0.025 | | | | | |
| 0.4333 | 0.025 | | | | | |
| 0.45 | 0.025 | | | | | |
| 0.4666 | 0.025 | | | | | |
| 0.4833 | 0.022 | | | | | |
| 0.5 | 0.019 | | | | | |
| 0.5166 | 0.019 | | | | | |
| 0.5333 | 0.019 | | | | | |
| 0.55 | 0.022 | | | | | |
| 0.5666 | 0.022 | | | | | |
| 0.5833 | 0.015 | | | | | |
| 0.6 | 0.019 | | | | | |
| 0.6166 | 0.019 | | | | | |
| 0.6333 | 0.015 | | | | | |
| 0.65 | 0.019 | | | | | |
| 0.6666 | 0.019 | | | | | |
| 0.6833 | 0.015 | | | | | |
| 0.7 | 0.019 | | | | | |
| 0.7166 | 0.019 | | | | | |
| 0.7333 | 0.019 | | | | | |
| 0.75 | 0.019 | | | | | |
| 0.7666 | 0.019 | | | | | |
| 0.7833 | 0.019 | | | | | |
| 0.8 | 0.015 | | | | | |
| 0.8166 | 0.015 | | | | | |
| 0.8333 | 0.015 | | | | | |
| 0.85 | 0.012 | | | | | |
| 0.8666 | 0.015 | | | | | |
| 0.8833 | 0.015 | | | | | |
| 0.9 | 0.015 | | | | | |
| 0.9166 | 0.015 | | | | | |
| 0.9333 | 0.015 | | | | | |
| 0.95 | 0.012 | | | | | |
| 0.9666 | 0.019 | | | | | |
| 0.9833 | 0.012 | | | | | |
| 1 | 0.015 | | | | | |
| 1.2 | 0.012 | | | | | |
| 1.4 | 0.022 | | | | | |
| 1.6 | 0.019 | | | | | |
| 1.8 | 0.015 | | | | | |
| 2 | 0.015 | | | | | |
| 2.2 | 0.019 | | | | | |
| 2.4 | 0.019 | | | | | |

## 57M-95-02X RISING HEAD



| Time (min) | delta H (ft.) |
|---|---|
| 0 | 0.809 |
| 0.0033 | 1.05 |
| 0.0066 | 0.151 |
| 0.01 | 1.066 |
| 0.0133 | 1.443 |
| 0.0166 | 1.959 |
| 0.0233 | 1.99 |
| 0.0266 | 1.987 |
| 0.03 | 1.971 |
| 0.0333 | 1.959 |
| 0.0366 | 1.949 |
| 0.04 | 1.94 |
| 0.0433 | 1.937 |
| 0.0466 | 1.921 |
| 0.05 | 1.924 |
| 0.0533 | 1.902 |
| 0.0566 | 1.892 |
| 0.06 | 1.899 |
| 0.0633 | 1.876 |
| 0.0666 | 1.87 |
| 0.07 | 1.864 |
| 0.0733 | 1.857 |
| 0.0766 | 1.848 |
| 0.08 | 1.838 |
| 0.0833 | 1.829 |
| 0.0866 | 1.823 |
| 0.09 | 1.813 |
| 0.0933 | 1.807 |
| 0.0966 | 1.797 |
| 0.1 | 1.788 |
| 0.1033 | 1.769 |
| 0.1066 | 1.778 |
| 0.11 | 1.762 |
| 0.1133 | 1.762 |
| 0.1166 | 1.75 |
| 0.12 | 1.743 |
| 0.1233 | 1.734 |
| 0.1266 | 1.728 |
| 0.13 | 1.721 |
| 0.1333 | 1.705 |
| 0.1366 | 1.709 |
| 0.14 | 1.686 |
| 0.1433 | 1.693 |
| 0.1466 | 1.693 |
| 0.15 | 1.677 |
| 0.1533 | 1.674 |
| 0.1566 | 1.661 |
| 0.16 | 1.652 |
| 0.1633 | 1.645 |
| 0.1666 | 1.636 |

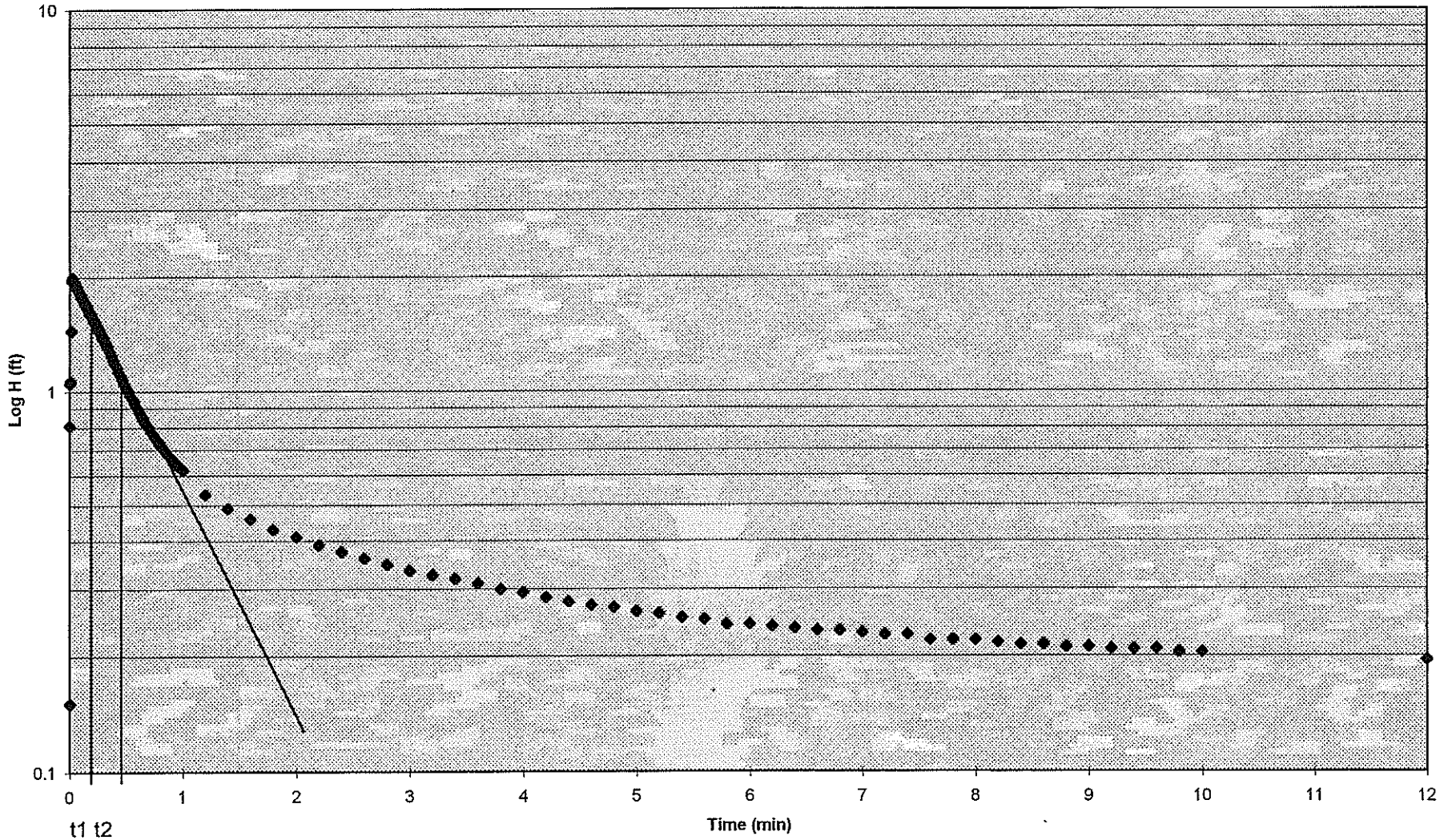
Well ID: 57M-95-03X
Test Date: 11/16/95
Test Type: Rising Head
Well Diameter: 0.333 ft.
Boring Diameter: 0.833 ft.
Screened Interval (bgs): 7-17 ft.
Water Column Height: 9.51 ft.

| Time (min) | delta H (ft.) | | | | | |
|---|---|---|---|---|---|---|
| 0.17 | 1.629 | | | | | |
| 0.1733 | 1.62 | | | | | |
| 0.1766 | 1.598 | | | | | |
| 0.18 | 1.607 | | | | | |
| 0.1833 | 1.604 | | | | | |
| 0.1866 | 1.601 | | | | | |
| 0.19 | 1.588 | | | | | |
| 0.1933 | 1.582 | | | | | |
| 0.1966 | 1.576 | | | | | |
| 0.2 | 1.566 | | | | | |
| 0.2033 | 1.553 | | | | | |
| 0.2066 | 1.553 | | | | | |
| 0.21 | 1.55 | | | | | |
| 0.2133 | 1.528 | | | | | |
| 0.2166 | 1.534 | | | | | |
| 0.22 | 1.525 | | | | | |
| 0.2233 | 1.506 | | | | | |
| 0.2266 | 1.515 | | | | | |
| 0.23 | 1.506 | | | | | |
| 0.2333 | 1.503 | | | | | |
| 0.2366 | 1.493 | | | | | |
| 0.24 | 1.481 | | | | | |
| 0.2433 | 1.49 | | | | | |
| 0.2466 | 1.471 | | | | | |
| 0.25 | 1.465 | | | | | |
| 0.2533 | 1.471 | | | | | |
| 0.2566 | 1.449 | | | | | |
| 0.26 | 1.443 | | | | | |
| 0.2633 | 1.439 | | | | | |
| 0.2666 | 1.433 | | | | | |
| 0.27 | 1.427 | | | | | |
| 0.2733 | 1.424 | | | | | |
| 0.2766 | 1.417 | | | | | |
| 0.28 | 1.408 | | | | | |
| 0.2833 | 1.401 | | | | | |
| 0.2866 | 1.389 | | | | | |
| 0.29 | 1.389 | | | | | |
| 0.2933 | 1.382 | | | | | |
| 0.2966 | 1.373 | | | | | |
| 0.3 | 1.37 | | | | | |
| 0.3033 | 1.36 | | | | | |
| 0.3066 | 1.357 | | | | | |
| 0.31 | 1.354 | | | | | |
| 0.3133 | 1.344 | | | | | |
| 0.3166 | 1.341 | | | | | |
| 0.32 | 1.335 | | | | | |
| 0.3233 | 1.325 | | | | | |
| 0.3266 | 1.322 | | | | | |
| 0.33 | 1.316 | | | | | |
| 0.3333 | 1.31 | | | | | |

| Time (min) | delta H (ft.) | | | | | |
|---|---|---|---|---|---|---|
| 0.35 | 1.278 | | | | | |
| 0.3666 | 1.246 | | | | | |
| 0.3833 | 1.211 | | | | | |
| 0.4 | 1.183 | | | | | |
| 0.4166 | 1.161 | | | | | |
| 0.4333 | 1.129 | | | | | |
| 0.45 | 1.104 | | | | | |
| 0.4666 | 1.075 | | | | | |
| 0.4833 | 1.047 | | | | | |
| 0.5 | 1.025 | | | | | |
| 0.5166 | 1.002 | | | | | |
| 0.5333 | 0.977 | | | | | |
| 0.55 | 0.958 | | | | | |
| 0.5666 | 0.939 | | | | | |
| 0.5833 | 0.914 | | | | | |
| 0.6 | 0.898 | | | | | |
| 0.6166 | 0.879 | | | | | |
| 0.6333 | 0.86 | | | | | |
| 0.65 | 0.841 | | | | | |
| 0.6666 | 0.822 | | | | | |
| 0.6833 | 0.809 | | | | | |
| 0.7 | 0.797 | | | | | |
| 0.7166 | 0.781 | | | | | |
| 0.7333 | 0.768 | | | | | |
| 0.75 | 0.755 | | | | | |
| 0.7666 | 0.743 | | | | | |
| 0.7833 | 0.73 | | | | | |
| 0.8 | 0.717 | | | | | |
| 0.8166 | 0.711 | | | | | |
| 0.8333 | 0.698 | | | | | |
| 0.85 | 0.689 | | | | | |
| 0.8666 | 0.679 | | | | | |
| 0.8833 | 0.67 | | | | | |
| 0.9 | 0.664 | | | | | |
| 0.9166 | 0.654 | | | | | |
| 0.9333 | 0.648 | | | | | |
| 0.95 | 0.638 | | | | | |
| 0.9666 | 0.632 | | | | | |
| 0.9833 | 0.626 | | | | | |
| 1 | 0.619 | | | | | |
| 1.2 | 0.534 | | | | | |
| 1.4 | 0.489 | | | | | |
| 1.6 | 0.458 | | | | | |
| 1.8 | 0.429 | | | | | |
| 2 | 0.41 | | | | | |
| 2.2 | 0.391 | | | | | |
| 2.4 | 0.375 | | | | | |
| 2.6 | 0.36 | | | | | |
| 2.8 | 0.347 | | | | | |
| 3 | 0.334 | | | | | |

| Time (min) | delta H (ft.) | | | | | |
|---|---|---|---|---|---|---|
| 3.2 | 0.325 | | | | | |
| 3.4 | 0.318 | | | | | |
| 3.6 | 0.309 | | | | | |
| 3.8 | 0.299 | | | | | |
| 4 | 0.293 | | | | | |
| 4.2 | 0.284 | | | | | |
| 4.4 | 0.277 | | | | | |
| 4.6 | 0.271 | | | | | |
| 4.8 | 0.268 | | | | | |
| 5 | 0.261 | | | | | |
| 5.2 | 0.258 | | | | | |
| 5.4 | 0.252 | | | | | |
| 5.6 | 0.249 | | | | | |
| 5.8 | 0.242 | | | | | |
| 6 | 0.242 | | | | | |
| 6.2 | 0.239 | | | | | |
| 6.4 | 0.236 | | | | | |
| 6.6 | 0.233 | | | | | |
| 6.8 | 0.233 | | | | | |
| 7 | 0.23 | | | | | |
| 7.2 | 0.227 | | | | | |
| 7.4 | 0.227 | | | | | |
| 7.6 | 0.22 | | | | | |
| 7.8 | 0.22 | | | | | |
| 8 | 0.22 | | | | | |
| 8.2 | 0.217 | | | | | |
| 8.4 | 0.214 | | | | | |
| 8.6 | 0.214 | | | | | |
| 8.8 | 0.211 | | | | | |
| 9 | 0.211 | | | | | |
| 9.2 | 0.208 | | | | | |
| 9.4 | 0.208 | | | | | |
| 9.6 | 0.208 | | | | | |
| 9.8 | 0.204 | | | | | |
| 10 | 0.204 | | | | | |
| 12 | 0.195 | | | | | |

## 57M-95-03X RISING HEAD



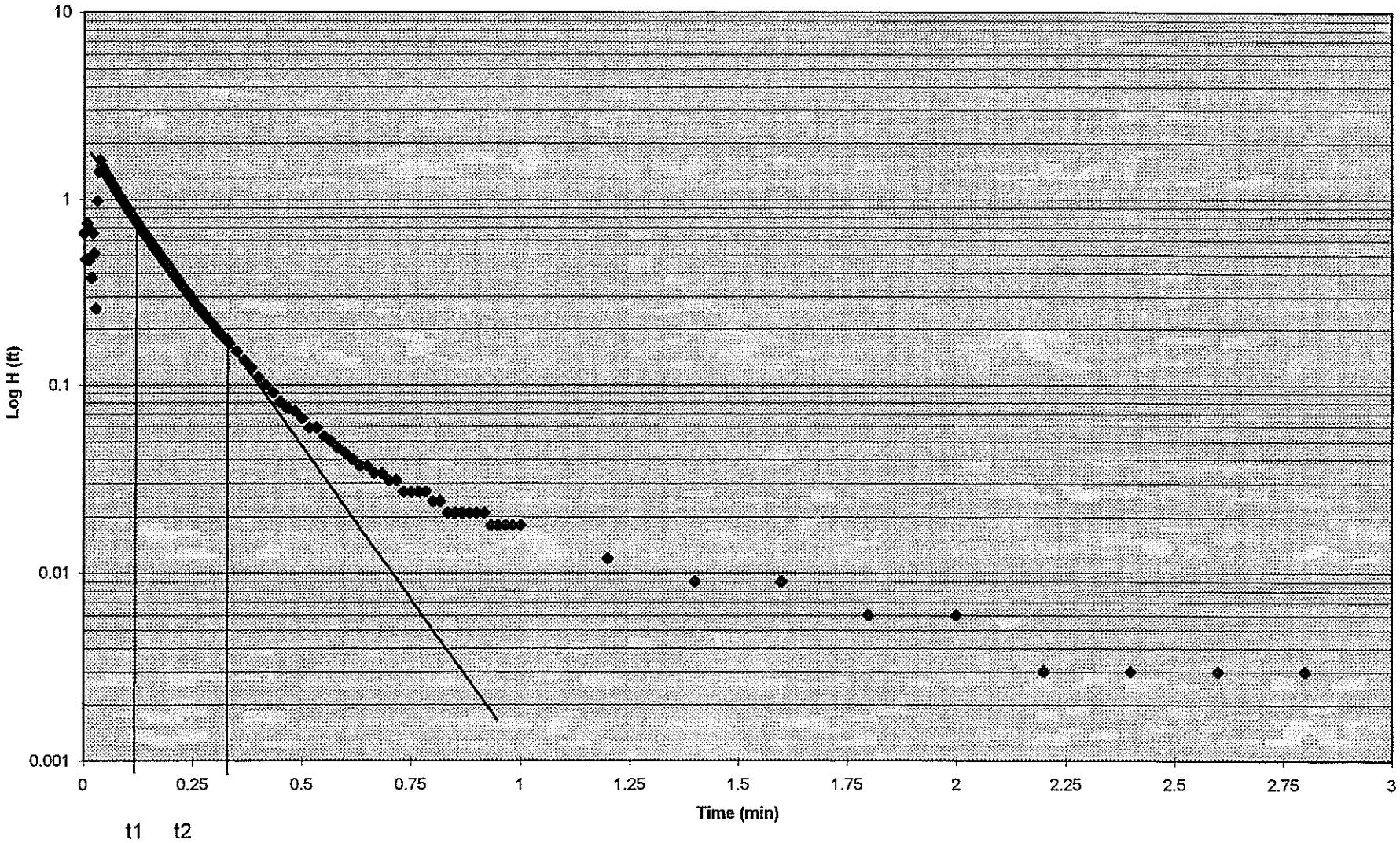
| Time (min) | delta H (ft.) |
|---|---|
| 0 | 0.654 |
| 0.0033 | 0.474 |
| 0.0066 | 0.743 |
| 0.01 | 0.471 |
| 0.0133 | 0.677 |
| 0.0166 | 0.379 |
| 0.02 | 0.654 |
| 0.0233 | 0.512 |
| 0.0266 | 0.259 |
| 0.03 | 0.984 |
| 0.0333 | 1.414 |
| 0.0366 | 1.633 |
| 0.04 | 1.525 |
| 0.0433 | 1.471 |
| 0.0466 | 1.424 |
| 0.05 | 1.38 |
| 0.0533 | 1.338 |
| 0.0566 | 1.294 |
| 0.06 | 1.256 |
| 0.0633 | 1.212 |
| 0.0666 | 1.186 |
| 0.07 | 1.148 |
| 0.0733 | 1.114 |
| 0.0766 | 1.082 |
| 0.08 | 1.05 |
| 0.0833 | 1.022 |
| 0.0866 | 0.993 |
| 0.09 | 0.965 |
| 0.0933 | 0.939 |
| 0.0966 | 0.914 |
| 0.1 | 0.889 |
| 0.1033 | 0.867 |
| 0.1066 | 0.841 |
| 0.11 | 0.819 |
| 0.1133 | 0.794 |
| 0.1166 | 0.775 |
| 0.12 | 0.756 |
| 0.1233 | 0.734 |
| 0.1266 | 0.715 |
| 0.13 | 0.696 |
| 0.1333 | 0.677 |
| 0.1366 | 0.661 |
| 0.14 | 0.642 |
| 0.1433 | 0.629 |
| 0.1466 | 0.61 |
| 0.15 | 0.597 |
| 0.1533 | 0.582 |
| 0.1566 | 0.566 |
| 0.16 | 0.55 |
| 0.1633 | 0.537 |

Well ID: 57M-95-04A
Test Date: 11/17/95
Test Type: Rising Head
Well Diameter: 0.333 ft.
Boring Diameter: 0.833 ft.
Screened Interval (bgs): 2.4-12.4 ft.
Water Column Height: 10.15 ft.

| Time (min) | delta H (ft.) | | | | | |
|---|---|---|---|---|---|---|
| 0.1666 | 0.525 | | | | | |
| 0.17 | 0.509 | | | | | |
| 0.1733 | 0.496 | | | | | |
| 0.1766 | 0.483 | | | | | |
| 0.18 | 0.474 | | | | | |
| 0.1833 | 0.461 | | | | | |
| 0.1866 | 0.449 | | | | | |
| 0.19 | 0.439 | | | | | |
| 0.1933 | 0.426 | | | | | |
| 0.1966 | 0.417 | | | | | |
| 0.2 | 0.407 | | | | | |
| 0.2033 | 0.395 | | | | | |
| 0.2066 | 0.389 | | | | | |
| 0.21 | 0.379 | | | | | |
| 0.2133 | 0.369 | | | | | |
| 0.2166 | 0.36 | | | | | |
| 0.22 | 0.35 | | | | | |
| 0.2233 | 0.344 | | | | | |
| 0.2266 | 0.335 | | | | | |
| 0.23 | 0.328 | | | | | |
| 0.2333 | 0.322 | | | | | |
| 0.2366 | 0.313 | | | | | |
| 0.24 | 0.306 | | | | | |
| 0.2433 | 0.3 | | | | | |
| 0.2466 | 0.293 | | | | | |
| 0.25 | 0.287 | | | | | |
| 0.2533 | 0.278 | | | | | |
| 0.2566 | 0.271 | | | | | |
| 0.26 | 0.265 | | | | | |
| 0.2633 | 0.259 | | | | | |
| 0.2666 | 0.255 | | | | | |
| 0.27 | 0.249 | | | | | |
| 0.2733 | 0.243 | | | | | |
| 0.2766 | 0.24 | | | | | |
| 0.28 | 0.233 | | | | | |
| 0.2833 | 0.227 | | | | | |
| 0.2866 | 0.224 | | | | | |
| 0.29 | 0.217 | | | | | |
| 0.2933 | 0.214 | | | | | |
| 0.2966 | 0.211 | | | | | |
| 0.3 | 0.205 | | | | | |
| 0.3033 | 0.198 | | | | | |
| 0.3066 | 0.195 | | | | | |
| 0.31 | 0.192 | | | | | |
| 0.3133 | 0.186 | | | | | |
| 0.3166 | 0.183 | | | | | |
| 0.32 | 0.179 | | | | | |
| 0.3233 | 0.176 | | | | | |
| 0.3266 | 0.176 | | | | | |
| 0.33 | 0.17 | | | | | |

| Time (min) | delta H (ft.) | | | | | |
|---|---|---|---|---|---|---|
| 0.3333 | 0.167 | | | | | |
| 0.35 | 0.151 | | | | | |
| 0.3666 | 0.135 | | | | | |
| 0.3833 | 0.123 | | | | | |
| 0.4 | 0.11 | | | | | |
| 0.4166 | 0.1 | | | | | |
| 0.4333 | 0.091 | | | | | |
| 0.45 | 0.081 | | | | | |
| 0.4666 | 0.075 | | | | | |
| 0.4833 | 0.072 | | | | | |
| 0.5 | 0.066 | | | | | |
| 0.5166 | 0.059 | | | | | |
| 0.5333 | 0.059 | | | | | |
| 0.55 | 0.053 | | | | | |
| 0.5666 | 0.05 | | | | | |
| 0.5833 | 0.046 | | | | | |
| 0.6 | 0.043 | | | | | |
| 0.6166 | 0.04 | | | | | |
| 0.6333 | 0.037 | | | | | |
| 0.65 | 0.037 | | | | | |
| 0.6666 | 0.034 | | | | | |
| 0.6833 | 0.034 | | | | | |
| 0.7 | 0.031 | | | | | |
| 0.7166 | 0.031 | | | | | |
| 0.7333 | 0.027 | | | | | |
| 0.75 | 0.027 | | | | | |
| 0.7666 | 0.027 | | | | | |
| 0.7833 | 0.027 | | | | | |
| 0.8 | 0.024 | | | | | |
| 0.8166 | 0.024 | | | | | |
| 0.8333 | 0.021 | | | | | |
| 0.85 | 0.021 | | | | | |
| 0.8666 | 0.021 | | | | | |
| 0.8833 | 0.021 | | | | | |
| 0.9 | 0.021 | | | | | |
| 0.9166 | 0.021 | | | | | |
| 0.9333 | 0.018 | | | | | |
| 0.95 | 0.018 | | | | | |
| 0.9666 | 0.018 | | | | | |
| 0.9833 | 0.018 | | | | | |
| 1 | 0.018 | | | | | |
| 1.2 | 0.012 | | | | | |
| 1.4 | 0.009 | | | | | |
| 1.6 | 0.009 | | | | | |
| 1.8 | 0.006 | | | | | |
| 2 | 0.006 | | | | | |
| 2.2 | 0.003 | | | | | |
| 2.4 | 0.003 | | | | | |
| 2.6 | 0.003 | | | | | |
| 2.8 | 0.003 | | | | | |

## 57M-95-04A RISING HEAD



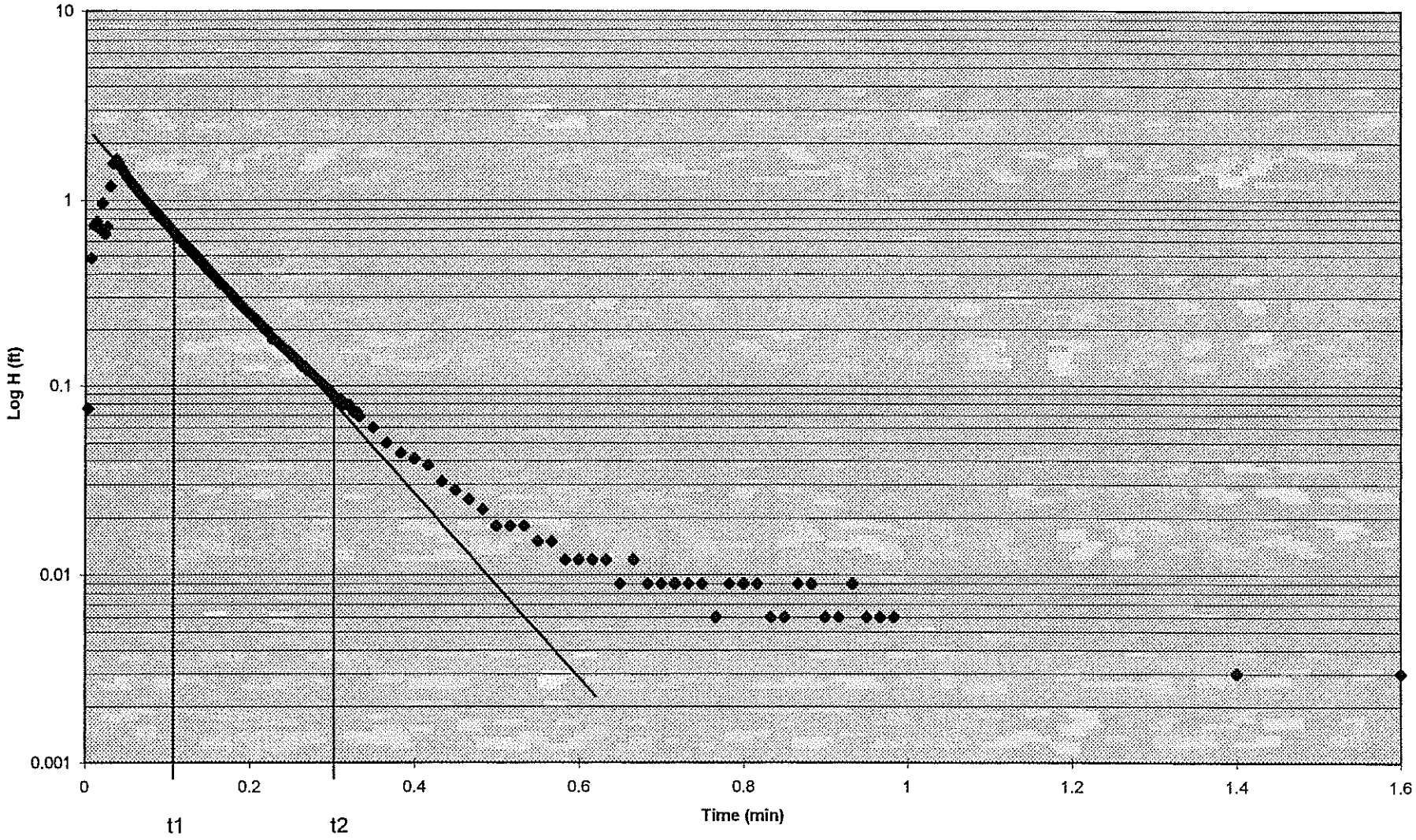
| Time (min) | delta H (ft.) |
|---|---|
| 0.0033 | 0.076 |
| 0.0066 | 0.487 |
| 0.01 | 0.731 |
| 0.0133 | 0.766 |
| 0.0166 | 0.706 |
| 0.02 | 0.962 |
| 0.0233 | 0.661 |
| 0.0266 | 0.725 |
| 0.03 | 1.184 |
| 0.0333 | 1.545 |
| 0.0366 | 1.633 |
| 0.04 | 1.573 |
| 0.0433 | 1.475 |
| 0.0466 | 1.396 |
| 0.05 | 1.326 |
| 0.0533 | 1.269 |
| 0.0566 | 1.216 |
| 0.06 | 1.168 |
| 0.0633 | 1.121 |
| 0.0666 | 1.076 |
| 0.07 | 1.035 |
| 0.0733 | 0.997 |
| 0.0766 | 0.956 |
| 0.08 | 0.924 |
| 0.0833 | 0.874 |
| 0.0866 | 0.861 |
| 0.09 | 0.81 |
| 0.0933 | 0.785 |
| 0.0966 | 0.753 |
| 0.1 | 0.725 |
| 0.1033 | 0.696 |
| 0.1066 | 0.671 |
| 0.11 | 0.639 |
| 0.1133 | 0.62 |
| 0.1166 | 0.601 |
| 0.12 | 0.573 |
| 0.1233 | 0.557 |
| 0.1266 | 0.535 |
| 0.13 | 0.513 |
| 0.1333 | 0.497 |
| 0.1366 | 0.478 |
| 0.14 | 0.465 |
| 0.1433 | 0.446 |
| 0.1466 | 0.427 |
| 0.15 | 0.411 |
| 0.1533 | 0.399 |
| 0.1566 | 0.383 |
| 0.16 | 0.37 |
| 0.1633 | 0.354 |
| 0.1666 | 0.348 |

Well ID: 57M-95-04B
Test Date: 11/17/95
Test Type: Rising Head
Well Diameter: 0.333 ft.
Boring Diameter: 0.833 ft.
Screened Interval (bgs): 18.5-28.5 ft.
Water Column Height: 27.31 ft.

| Time (min) | delta H (ft.) | | | | | |
|---|---|---|---|---|---|---|
| 0.17 | 0.335 | | | | | |
| 0.1733 | 0.323 | | | | | |
| 0.1766 | 0.313 | | | | | |
| 0.18 | 0.297 | | | | | |
| 0.1833 | 0.288 | | | | | |
| 0.1866 | 0.275 | | | | | |
| 0.19 | 0.269 | | | | | |
| 0.1933 | 0.259 | | | | | |
| 0.1966 | 0.25 | | | | | |
| 0.2 | 0.243 | | | | | |
| 0.2033 | 0.234 | | | | | |
| 0.2066 | 0.228 | | | | | |
| 0.21 | 0.218 | | | | | |
| 0.2133 | 0.212 | | | | | |
| 0.2166 | 0.202 | | | | | |
| 0.22 | 0.199 | | | | | |
| 0.2233 | 0.19 | | | | | |
| 0.2266 | 0.177 | | | | | |
| 0.23 | 0.177 | | | | | |
| 0.2333 | 0.171 | | | | | |
| 0.2366 | 0.164 | | | | | |
| 0.24 | 0.161 | | | | | |
| 0.2433 | 0.155 | | | | | |
| 0.2466 | 0.152 | | | | | |
| 0.25 | 0.145 | | | | | |
| 0.2533 | 0.142 | | | | | |
| 0.2566 | 0.139 | | | | | |
| 0.26 | 0.133 | | | | | |
| 0.2633 | 0.126 | | | | | |
| 0.2666 | 0.126 | | | | | |
| 0.27 | 0.12 | | | | | |
| 0.2733 | 0.117 | | | | | |
| 0.2766 | 0.114 | | | | | |
| 0.28 | 0.11 | | | | | |
| 0.2833 | 0.107 | | | | | |
| 0.2866 | 0.104 | | | | | |
| 0.29 | 0.101 | | | | | |
| 0.2933 | 0.098 | | | | | |
| 0.2966 | 0.095 | | | | | |
| 0.3 | 0.091 | | | | | |
| 0.3033 | 0.088 | | | | | |
| 0.3066 | 0.085 | | | | | |
| 0.31 | 0.085 | | | | | |
| 0.3133 | 0.079 | | | | | |
| 0.3166 | 0.079 | | | | | |
| 0.32 | 0.079 | | | | | |
| 0.3233 | 0.076 | | | | | |
| 0.3266 | 0.072 | | | | | |
| 0.33 | 0.072 | | | | | |
| 0.3333 | 0.069 | | | | | |

| Time (min) | delta H (ft.) | | | | | |
|---|---|---|---|---|---|---|
| 0.35 | 0.06 | | | | | |
| 0.3666 | 0.05 | | | | | |
| 0.3833 | 0.044 | | | | | |
| 0.4 | 0.041 | | | | | |
| 0.4166 | 0.038 | | | | | |
| 0.4333 | 0.031 | | | | | |
| 0.45 | 0.028 | | | | | |
| 0.4666 | 0.025 | | | | | |
| 0.4833 | 0.022 | | | | | |
| 0.5 | 0.018 | | | | | |
| 0.5166 | 0.018 | | | | | |
| 0.5333 | 0.018 | | | | | |
| 0.55 | 0.015 | | | | | |
| 0.5666 | 0.015 | | | | | |
| 0.5833 | 0.012 | | | | | |
| 0.6 | 0.012 | | | | | |
| 0.6166 | 0.012 | | | | | |
| 0.6333 | 0.012 | | | | | |
| 0.65 | 0.009 | | | | | |
| 0.6666 | 0.012 | | | | | |
| 0.6833 | 0.009 | | | | | |
| 0.7 | 0.009 | | | | | |
| 0.7166 | 0.009 | | | | | |
| 0.7333 | 0.009 | | | | | |
| 0.75 | 0.009 | | | | | |
| 0.7666 | 0.006 | | | | | |
| 0.7833 | 0.009 | | | | | |
| 0.8 | 0.009 | | | | | |
| 0.8166 | 0.009 | | | | | |
| 0.8333 | 0.006 | | | | | |
| 0.85 | 0.006 | | | | | |
| 0.8666 | 0.009 | | | | | |
| 0.8833 | 0.009 | | | | | |
| 0.9 | 0.006 | | | | | |
| 0.9166 | 0.006 | | | | | |
| 0.9333 | 0.009 | | | | | |
| 0.95 | 0.006 | | | | | |
| 0.9666 | 0.006 | | | | | |
| 0.9833 | 0.006 | | | | | |
| 1.4 | 0.003 | | | | | |
| 1.6 | 0.003 | | | | | |

## 57M-95-04B RISING HEAD



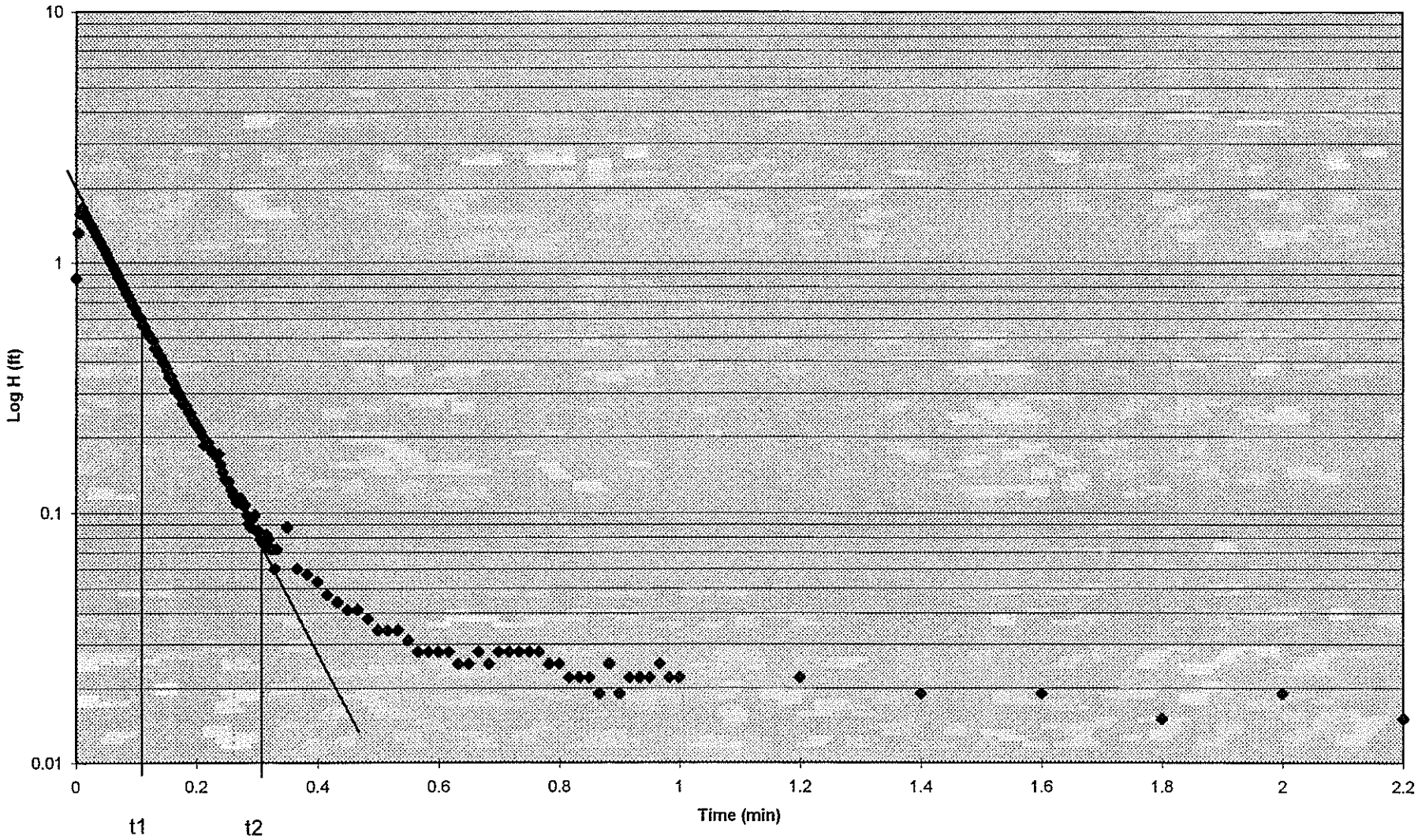
| Time (min) | delta H (ft.) |
|---|---|
| 0 | 0.867 |
| 0.0033 | 1.323 |
| 0.0066 | 1.583 |
| 0.01 | 1.675 |
| 0.0133 | 1.583 |
| 0.0166 | 1.535 |
| 0.02 | 1.485 |
| 0.0233 | 1.437 |
| 0.0266 | 1.393 |
| 0.03 | 1.348 |
| 0.0333 | 1.295 |
| 0.0366 | 1.253 |
| 0.04 | 1.215 |
| 0.0433 | 1.168 |
| 0.0466 | 1.139 |
| 0.05 | 1.089 |
| 0.0533 | 1.048 |
| 0.0566 | 1.013 |
| 0.06 | 0.981 |
| 0.0633 | 0.949 |
| 0.0666 | 0.915 |
| 0.07 | 0.88 |
| 0.0733 | 0.851 |
| 0.0766 | 0.823 |
| 0.08 | 0.791 |
| 0.0833 | 0.76 |
| 0.0866 | 0.741 |
| 0.09 | 0.712 |
| 0.0933 | 0.68 |
| 0.0966 | 0.664 |
| 0.1 | 0.63 |
| 0.1033 | 0.617 |
| 0.1066 | 0.601 |
| 0.11 | 0.563 |
| 0.1133 | 0.554 |
| 0.1166 | 0.531 |
| 0.12 | 0.516 |
| 0.1233 | 0.5 |
| 0.1266 | 0.49 |
| 0.13 | 0.452 |
| 0.1333 | 0.443 |
| 0.1366 | 0.427 |
| 0.14 | 0.421 |
| 0.1433 | 0.399 |
| 0.1466 | 0.389 |
| 0.15 | 0.373 |
| 0.1533 | 0.348 |
| 0.1566 | 0.351 |
| 0.16 | 0.332 |
| 0.1633 | 0.31 |

Well ID: 57M-95-05X
Test Date: 11/16/95
Test Type: Rising Head
Well Diameter: 0.333 ft.
Boring Diameter: 0.833 ft.
Screened Interval (bgs): 10-20 ft.
Water Column Height: 7.09 ft.

| Time (min) | delta H (ft.) | | | | | |
|---|---|---|---|---|---|---|
| 0.1666 | 0.31 | | | | | |
| 0.17 | 0.3 | | | | | |
| 0.1733 | 0.291 | | | | | |
| 0.1766 | 0.272 | | | | | |
| 0.18 | 0.272 | | | | | |
| 0.1833 | 0.266 | | | | | |
| 0.1866 | 0.253 | | | | | |
| 0.19 | 0.25 | | | | | |
| 0.1933 | 0.237 | | | | | |
| 0.1966 | 0.231 | | | | | |
| 0.2 | 0.224 | | | | | |
| 0.2033 | 0.218 | | | | | |
| 0.2066 | 0.212 | | | | | |
| 0.21 | 0.202 | | | | | |
| 0.2133 | 0.186 | | | | | |
| 0.2166 | 0.19 | | | | | |
| 0.22 | 0.19 | | | | | |
| 0.2233 | 0.18 | | | | | |
| 0.2266 | 0.174 | | | | | |
| 0.23 | 0.171 | | | | | |
| 0.2333 | 0.167 | | | | | |
| 0.2366 | 0.171 | | | | | |
| 0.24 | 0.155 | | | | | |
| 0.2433 | 0.145 | | | | | |
| 0.2466 | 0.136 | | | | | |
| 0.25 | 0.133 | | | | | |
| 0.2533 | 0.133 | | | | | |
| 0.2566 | 0.123 | | | | | |
| 0.26 | 0.117 | | | | | |
| 0.2633 | 0.117 | | | | | |
| 0.2666 | 0.11 | | | | | |
| 0.27 | 0.11 | | | | | |
| 0.2733 | 0.114 | | | | | |
| 0.2766 | 0.107 | | | | | |
| 0.28 | 0.107 | | | | | |
| 0.2833 | 0.098 | | | | | |
| 0.2866 | 0.091 | | | | | |
| 0.29 | 0.088 | | | | | |
| 0.2933 | 0.095 | | | | | |
| 0.2966 | 0.098 | | | | | |
| 0.3 | 0.085 | | | | | |
| 0.3033 | 0.085 | | | | | |
| 0.3066 | 0.079 | | | | | |
| 0.31 | 0.076 | | | | | |
| 0.3133 | 0.079 | | | | | |
| 0.3166 | 0.082 | | | | | |
| 0.32 | 0.079 | | | | | |
| 0.3233 | 0.072 | | | | | |
| 0.3266 | 0.072 | | | | | |
| 0.33 | 0.06 | | | | | |

| Time (min) | delta H (ft.) | | | | | |
|---|---|---|---|---|---|---|
| 0.3333 | 0.072 | | | | | |
| 0.35 | 0.088 | | | | | |
| 0.3666 | 0.06 | | | | | |
| 0.3833 | 0.057 | | | | | |
| 0.4 | 0.053 | | | | | |
| 0.4166 | 0.047 | | | | | |
| 0.4333 | 0.044 | | | | | |
| 0.45 | 0.041 | | | | | |
| 0.4666 | 0.041 | | | | | |
| 0.4833 | 0.038 | | | | | |
| 0.5 | 0.034 | | | | | |
| 0.5166 | 0.034 | | | | | |
| 0.5333 | 0.034 | | | | | |
| 0.55 | 0.031 | | | | | |
| 0.5666 | 0.028 | | | | | |
| 0.5833 | 0.028 | | | | | |
| 0.6 | 0.028 | | | | | |
| 0.6166 | 0.028 | | | | | |
| 0.6333 | 0.025 | | | | | |
| 0.65 | 0.025 | | | | | |
| 0.6666 | 0.028 | | | | | |
| 0.6833 | 0.025 | | | | | |
| 0.7 | 0.028 | | | | | |
| 0.7166 | 0.028 | | | | | |
| 0.7333 | 0.028 | | | | | |
| 0.75 | 0.028 | | | | | |
| 0.7666 | 0.028 | | | | | |
| 0.7833 | 0.025 | | | | | |
| 0.8 | 0.025 | | | | | |
| 0.8166 | 0.022 | | | | | |
| 0.8333 | 0.022 | | | | | |
| 0.85 | 0.022 | | | | | |
| 0.8666 | 0.019 | | | | | |
| 0.8833 | 0.025 | | | | | |
| 0.9 | 0.019 | | | | | |
| 0.9166 | 0.022 | | | | | |
| 0.9333 | 0.022 | | | | | |
| 0.95 | 0.022 | | | | | |
| 0.9666 | 0.025 | | | | | |
| 0.9833 | 0.022 | | | | | |
| 1 | 0.022 | | | | | |
| 1.2 | 0.022 | | | | | |
| 1.4 | 0.019 | | | | | |
| 1.6 | 0.019 | | | | | |
| 1.8 | 0.015 | | | | | |
| 2 | 0.019 | | | | | |
| 2.2 | 0.015 | | | | | |

## 57M-95-05X RISING HEAD



| Time (min) | delta H (ft.) |
|---|---|
| 0 | 0.13 |
| 0.0033 | 0.424 |
| 0.0066 | 0.674 |
| 0.01 | 0.171 |
| 0.0133 | 0.393 |
| 0.0166 | 0.374 |
| 0.02 | 1.091 |
| 0.0233 | 1.009 |
| 0.0266 | 0.886 |
| 0.03 | 1.566 |
| 0.0333 | 1.817 |
| 0.0366 | 1.722 |
| 0.04 | 1.817 |
| 0.0433 | 1.788 |
| 0.0466 | 1.769 |
| 0.05 | 1.759 |
| 0.0533 | 1.744 |
| 0.0566 | 1.725 |
| 0.06 | 1.725 |
| 0.0633 | 1.699 |
| 0.0666 | 1.68 |
| 0.07 | 1.671 |
| 0.0733 | 1.652 |
| 0.0766 | 1.636 |
| 0.08 | 1.627 |
| 0.0833 | 1.614 |
| 0.0866 | 1.598 |
| 0.09 | 1.582 |
| 0.0933 | 1.57 |
| 0.0966 | 1.557 |
| 0.1 | 1.544 |
| 0.1033 | 1.525 |
| 0.1066 | 1.516 |
| 0.11 | 1.503 |
| 0.1133 | 1.497 |
| 0.1166 | 1.484 |
| 0.12 | 1.471 |
| 0.1233 | 1.462 |
| 0.1266 | 1.433 |
| 0.13 | 1.433 |
| 0.1333 | 1.424 |
| 0.1366 | 1.411 |
| 0.14 | 1.399 |
| 0.1433 | 1.386 |
| 0.1466 | 1.373 |
| 0.15 | 1.364 |
| 0.1533 | 1.364 |
| 0.1566 | 1.351 |
| 0.16 | 1.326 |
| 0.1633 | 1.322 |

Well ID: 57M-95-06X
Test Date: 11/16/95
Test Type: Rising Head
Well Diameter: 0.333 ft.
Boring Diameter: 0.833 ft.
Screened Interval (bgs): 11.9-21.9 ft.
Water Column Height: 11.22 ft.

| Time (min) | delta H (ft.) | | | | | |
|---|---|---|---|---|---|---|
| 0.1666 | 1.313 | | | | | |
| 0.17 | 1.304 | | | | | |
| 0.1733 | 1.291 | | | | | |
| 0.1766 | 1.278 | | | | | |
| 0.18 | 1.266 | | | | | |
| 0.1833 | 1.256 | | | | | |
| 0.1866 | 1.253 | | | | | |
| 0.19 | 1.243 | | | | | |
| 0.1933 | 1.227 | | | | | |
| 0.1966 | 1.218 | | | | | |
| 0.2 | 1.209 | | | | | |
| 0.2033 | 1.205 | | | | | |
| 0.2066 | 1.19 | | | | | |
| 0.21 | 1.183 | | | | | |
| 0.2133 | 1.17 | | | | | |
| 0.2166 | 1.164 | | | | | |
| 0.22 | 1.155 | | | | | |
| 0.2233 | 1.145 | | | | | |
| 0.2266 | 1.139 | | | | | |
| 0.23 | 1.114 | | | | | |
| 0.2333 | 1.123 | | | | | |
| 0.2366 | 1.107 | | | | | |
| 0.24 | 1.107 | | | | | |
| 0.2433 | 1.091 | | | | | |
| 0.2466 | 1.088 | | | | | |
| 0.25 | 1.076 | | | | | |
| 0.2533 | 1.069 | | | | | |
| 0.2566 | 1.06 | | | | | |
| 0.26 | 1.053 | | | | | |
| 0.2633 | 1.041 | | | | | |
| 0.2666 | 1.041 | | | | | |
| 0.27 | 1.025 | | | | | |
| 0.2733 | 1.019 | | | | | |
| 0.2766 | 1.012 | | | | | |
| 0.28 | 1.006 | | | | | |
| 0.2833 | 0.994 | | | | | |
| 0.2866 | 0.991 | | | | | |
| 0.29 | 0.988 | | | | | |
| 0.2933 | 0.978 | | | | | |
| 0.2966 | 0.966 | | | | | |
| 0.3 | 0.956 | | | | | |
| 0.3033 | 0.95 | | | | | |
| 0.3066 | 0.947 | | | | | |
| 0.31 | 0.94 | | | | | |
| 0.3133 | 0.943 | | | | | |
| 0.3166 | 0.921 | | | | | |
| 0.32 | 0.915 | | | | | |
| 0.3233 | 0.909 | | | | | |
| 0.3266 | 0.896 | | | | | |
| 0.33 | 0.893 | | | | | |

| Time (min) | delta H (ft.) | | | | | |
|---|---|---|---|---|---|---|
| 0.3333 | 0.89 | | | | | |
| 0.35 | 0.852 | | | | | |
| 0.3666 | 0.823 | | | | | |
| 0.3833 | 0.788 | | | | | |
| 0.4 | 0.754 | | | | | |
| 0.4166 | 0.731 | | | | | |
| 0.4333 | 0.697 | | | | | |
| 0.45 | 0.678 | | | | | |
| 0.4666 | 0.646 | | | | | |
| 0.4833 | 0.624 | | | | | |
| 0.5 | 0.589 | | | | | |
| 0.5166 | 0.564 | | | | | |
| 0.5333 | 0.548 | | | | | |
| 0.55 | 0.526 | | | | | |
| 0.5666 | 0.51 | | | | | |
| 0.5833 | 0.494 | | | | | |
| 0.6 | 0.472 | | | | | |
| 0.6166 | 0.453 | | | | | |
| 0.6333 | 0.434 | | | | | |
| 0.65 | 0.424 | | | | | |
| 0.6666 | 0.408 | | | | | |
| 0.6833 | 0.393 | | | | | |
| 0.7 | 0.367 | | | | | |
| 0.7166 | 0.358 | | | | | |
| 0.7333 | 0.348 | | | | | |
| 0.75 | 0.326 | | | | | |
| 0.7666 | 0.323 | | | | | |
| 0.7833 | 0.313 | | | | | |
| 0.8 | 0.298 | | | | | |
| 0.8166 | 0.288 | | | | | |
| 0.8333 | 0.279 | | | | | |
| 0.85 | 0.272 | | | | | |
| 0.8666 | 0.26 | | | | | |
| 0.8833 | 0.25 | | | | | |
| 0.9 | 0.247 | | | | | |
| 0.9166 | 0.234 | | | | | |
| 0.9333 | 0.225 | | | | | |
| 0.95 | 0.218 | | | | | |
| 0.9666 | 0.212 | | | | | |
| 0.9833 | 0.203 | | | | | |
| 1 | 0.199 | | | | | |
| 1.2 | 0.123 | | | | | |
| 1.4 | 0.089 | | | | | |
| 1.6 | 0.066 | | | | | |
| 1.8 | 0.051 | | | | | |
| 2 | 0.038 | | | | | |
| 2.2 | 0.035 | | | | | |
| 2.4 | 0.028 | | | | | |
| 2.6 | 0.025 | | | | | |
| 2.8 | 0.025 | | | | | |

57M-95-06X RH

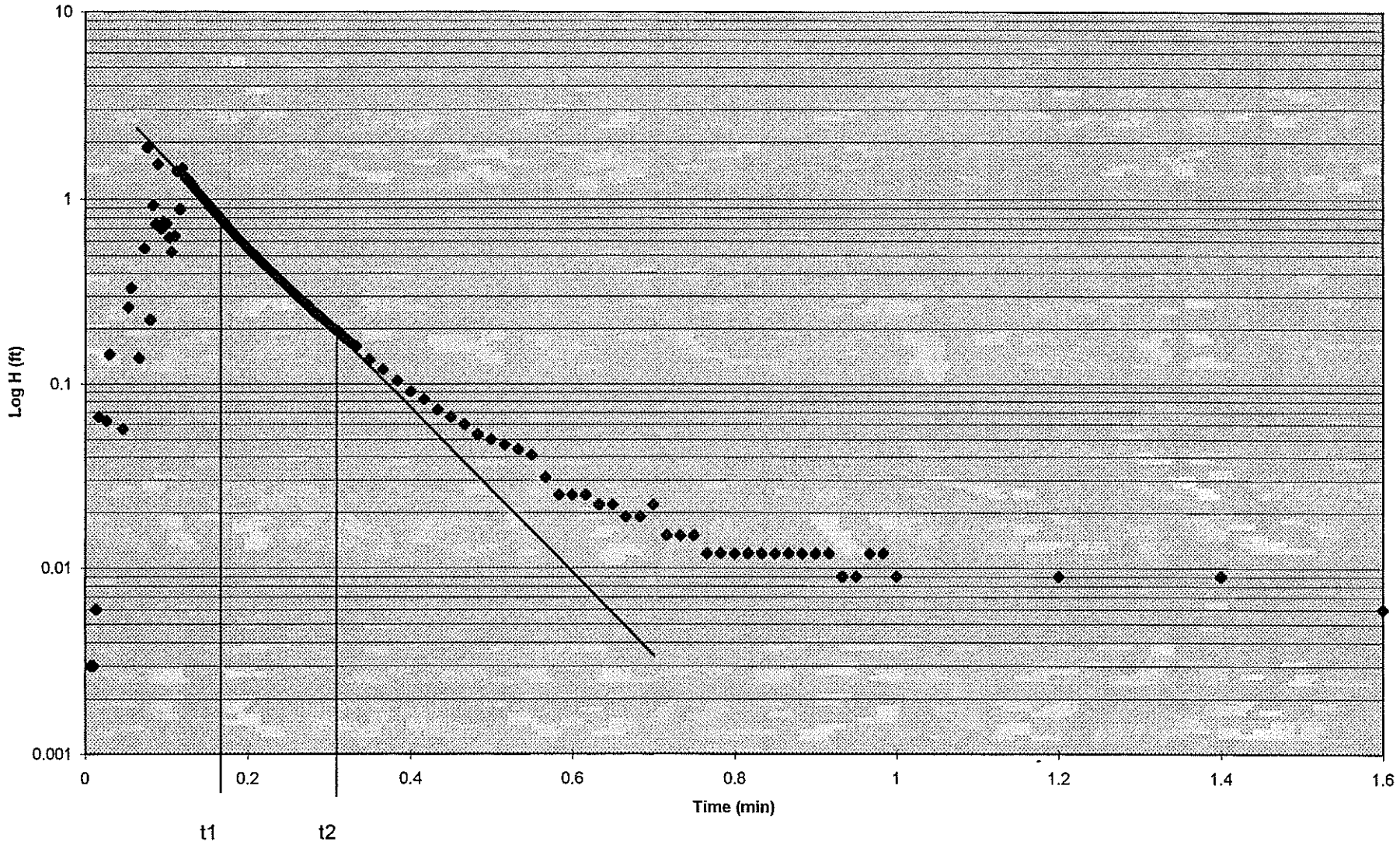
| Time (min) | delta H (ft.) | | | | | |
|---|---|---|---|---|---|---|
| 3 | 0.022 | | | | | |
| 3.2 | 0.022 | | | | | |
| 3.4 | 0.019 | | | | | |
| 3.6 | 0.022 | | | | | |
| 3.8 | 0.019 | | | | | |
| 4 | 0.019 | | | | | |
| 4.2 | 0.016 | | | | | |

| Time (min) | delta H (ft.) |
|---|---|
| 0.0066 | 0.003 |
| 0.01 | 0.003 |
| 0.0133 | 0.006 |
| 0.0166 | 0.066 |
| 0.0266 | 0.063 |
| 0.03 | 0.145 |
| 0.0466 | 0.057 |
| 0.0533 | 0.262 |
| 0.0566 | 0.332 |
| 0.0666 | 0.139 |
| 0.0733 | 0.547 |
| 0.0766 | 1.868 |
| 0.08 | 0.224 |
| 0.0833 | 0.927 |
| 0.0866 | 0.737 |
| 0.09 | 1.532 |
| 0.0933 | 0.696 |
| 0.0966 | 0.756 |
| 0.1 | 0.744 |
| 0.1033 | 0.627 |
| 0.1066 | 0.525 |
| 0.11 | 0.639 |
| 0.1133 | 1.402 |
| 0.1166 | 0.886 |
| 0.12 | 1.453 |
| 0.1233 | 1.298 |
| 0.1266 | 1.272 |
| 0.13 | 1.215 |
| 0.1333 | 1.165 |
| 0.1366 | 1.117 |
| 0.14 | 1.073 |
| 0.1433 | 1.035 |
| 0.1466 | 0.994 |
| 0.15 | 0.956 |
| 0.1533 | 0.918 |
| 0.1566 | 0.886 |
| 0.16 | 0.851 |
| 0.1633 | 0.82 |
| 0.1666 | 0.791 |
| 0.17 | 0.76 |
| 0.1733 | 0.734 |
| 0.1766 | 0.706 |
| 0.18 | 0.68 |
| 0.1833 | 0.658 |
| 0.1866 | 0.633 |
| 0.19 | 0.611 |
| 0.1933 | 0.592 |
| 0.1966 | 0.57 |
| 0.2 | 0.551 |
| 0.2033 | 0.531 |

Well ID: 57M-95-07X
Test Date: 11/16/95
Test Type: Rising Head
Well Diameter: 0.333 ft.
Boring Diameter: 0.833 ft.
Screened Interval (bgs): 3-13 ft.
Water Column Height: 11.37 ft.

| Time (min) | delta H (ft.) | | | | | |
|---|---|---|---|---|---|---|
| 0.5333 | 0.044 | | | | | |
| 0.55 | 0.041 | | | | | |
| 0.5666 | 0.031 | | | | | |
| 0.5833 | 0.025 | | | | | |
| 0.6 | 0.025 | | | | | |
| 0.6166 | 0.025 | | | | | |
| 0.6333 | 0.022 | | | | | |
| 0.65 | 0.022 | | | | | |
| 0.6666 | 0.019 | | | | | |
| 0.6833 | 0.019 | | | | | |
| 0.7 | 0.022 | | | | | |
| 0.7166 | 0.015 | | | | | |
| 0.7333 | 0.015 | | | | | |
| 0.75 | 0.015 | | | | | |
| 0.7666 | 0.012 | | | | | |
| 0.7833 | 0.012 | | | | | |
| 0.8 | 0.012 | | | | | |
| 0.8166 | 0.012 | | | | | |
| 0.8333 | 0.012 | | | | | |
| 0.85 | 0.012 | | | | | |
| 0.8666 | 0.012 | | | | | |
| 0.8833 | 0.012 | | | | | |
| 0.9 | 0.012 | | | | | |
| 0.9166 | 0.012 | | | | | |
| 0.9333 | 0.009 | | | | | |
| 0.95 | 0.009 | | | | | |
| 0.9666 | 0.012 | | | | | |
| 0.9833 | 0.012 | | | | | |
| 1 | 0.009 | | | | | |
| 1.2 | 0.009 | | | | | |
| 1.4 | 0.009 | | | | | |
| 1.6 | 0.006 | | | | | |

## 57M-95-07X RISING HEAD



| Time (min) | delta H (ft.) |
|---|---|
| 0 | 0.028 |
| 0.0033 | 0.449 |
| 0.0066 | 1.095 |
| 0.01 | 1.418 |
| 0.0133 | 1.022 |
| 0.0166 | 0.709 |
| 0.02 | 0.611 |
| 0.0233 | 0.959 |
| 0.0266 | 1.44 |
| 0.03 | 1.941 |
| 0.0333 | 1.83 |
| 0.0366 | 1.808 |
| 0.04 | 1.823 |
| 0.0433 | 1.817 |
| 0.0466 | 1.814 |
| 0.05 | 1.811 |
| 0.0533 | 1.811 |
| 0.0566 | 1.811 |
| 0.06 | 1.801 |
| 0.0633 | 1.804 |
| 0.0666 | 1.798 |
| 0.07 | 1.798 |
| 0.0733 | 1.795 |
| 0.0766 | 1.792 |
| 0.08 | 1.785 |
| 0.0833 | 1.785 |
| 0.0866 | 1.776 |
| 0.09 | 1.776 |
| 0.0933 | 1.77 |
| 0.0966 | 1.763 |
| 0.1 | 1.763 |
| 0.1033 | 1.76 |
| 0.1066 | 1.757 |
| 0.11 | 1.754 |
| 0.1133 | 1.754 |
| 0.1166 | 1.751 |
| 0.12 | 1.751 |
| 0.1233 | 1.747 |
| 0.1266 | 1.744 |
| 0.13 | 1.741 |
| 0.1333 | 1.741 |
| 0.1366 | 1.738 |
| 0.14 | 1.735 |
| 0.1433 | 1.728 |
| 0.1466 | 1.728 |
| 0.15 | 1.725 |
| 0.1533 | 1.722 |
| 0.1566 | 1.722 |
| 0.16 | 1.719 |
| 0.1633 | 1.719 |

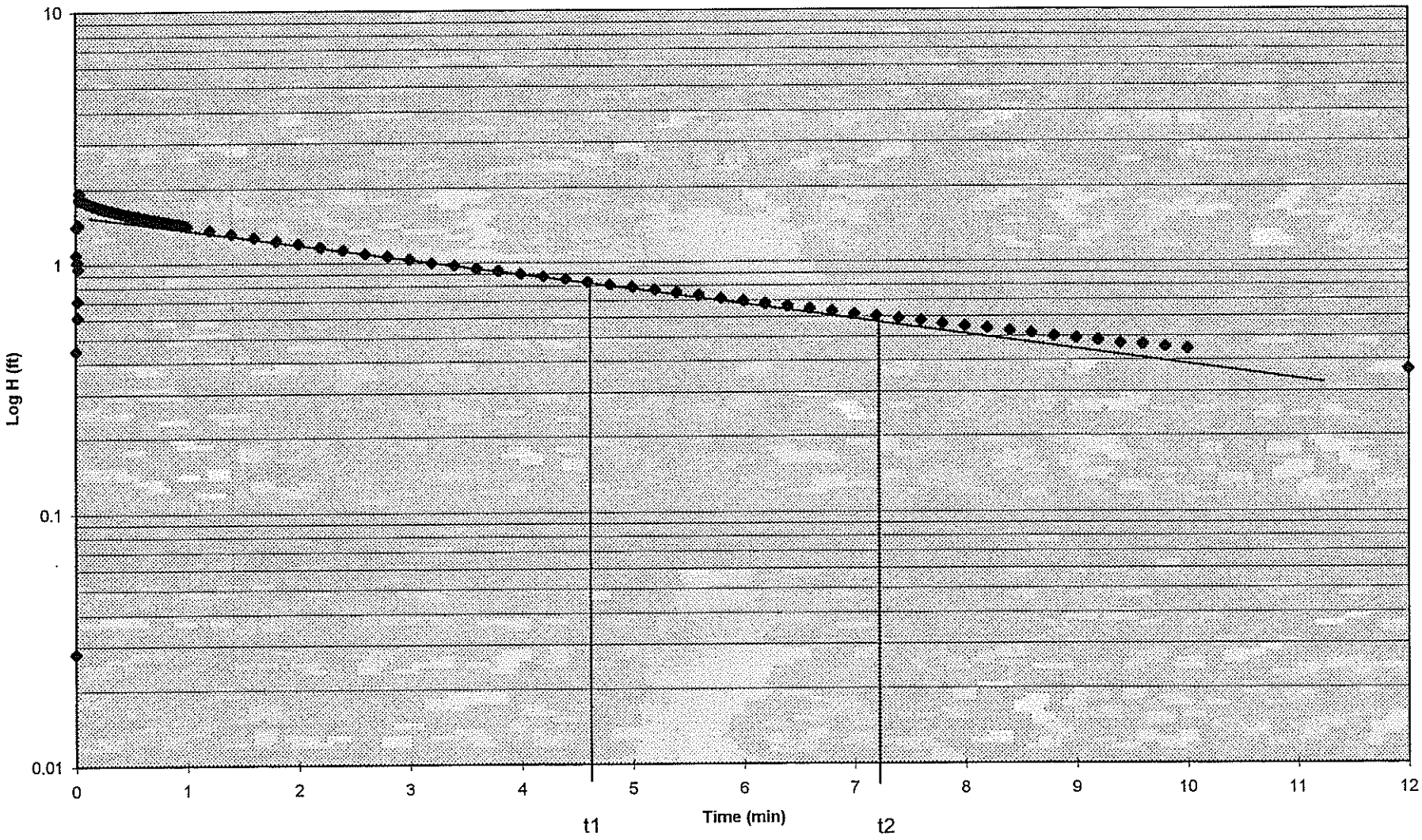
Well ID: 57M-95-08A
Test Date: 11/17/95
Test Type: Rising Head
Well Diameter: 0.333 ft.
Boring Diameter: 0.833 ft.
Screened Interval (bgs): 3-13 ft.
Water Column Height: 11.32 ft.

| Time (min) | delta H (ft.) | | | | | |
|---|---|---|---|---|---|---|
| 0.1666 | 1.716 | | | | | |
| 0.17 | 1.713 | | | | | |
| 0.1733 | 1.709 | | | | | |
| 0.1766 | 1.709 | | | | | |
| 0.18 | 1.709 | | | | | |
| 0.1833 | 1.706 | | | | | |
| 0.1866 | 1.706 | | | | | |
| 0.19 | 1.703 | | | | | |
| 0.1933 | 1.7 | | | | | |
| 0.1966 | 1.7 | | | | | |
| 0.2 | 1.697 | | | | | |
| 0.2033 | 1.694 | | | | | |
| 0.2066 | 1.694 | | | | | |
| 0.21 | 1.69 | | | | | |
| 0.2133 | 1.69 | | | | | |
| 0.2166 | 1.687 | | | | | |
| 0.22 | 1.687 | | | | | |
| 0.2233 | 1.684 | | | | | |
| 0.2266 | 1.684 | | | | | |
| 0.23 | 1.681 | | | | | |
| 0.2333 | 1.681 | | | | | |
| 0.2366 | 1.678 | | | | | |
| 0.24 | 1.675 | | | | | |
| 0.2433 | 1.675 | | | | | |
| 0.2466 | 1.671 | | | | | |
| 0.25 | 1.671 | | | | | |
| 0.2533 | 1.668 | | | | | |
| 0.2566 | 1.668 | | | | | |
| 0.26 | 1.668 | | | | | |
| 0.2633 | 1.665 | | | | | |
| 0.2666 | 1.665 | | | | | |
| 0.27 | 1.662 | | | | | |
| 0.2733 | 1.659 | | | | | |
| 0.2766 | 1.659 | | | | | |
| 0.28 | 1.656 | | | | | |
| 0.2833 | 1.656 | | | | | |
| 0.2866 | 1.656 | | | | | |
| 0.29 | 1.652 | | | | | |
| 0.2933 | 1.652 | | | | | |
| 0.2966 | 1.649 | | | | | |
| 0.3 | 1.649 | | | | | |
| 0.3033 | 1.649 | | | | | |
| 0.3066 | 1.643 | | | | | |
| 0.31 | 1.643 | | | | | |
| 0.3133 | 1.643 | | | | | |
| 0.3166 | 1.643 | | | | | |
| 0.32 | 1.64 | | | | | |
| 0.3233 | 1.637 | | | | | |
| 0.3266 | 1.637 | | | | | |
| 0.33 | 1.637 | | | | | |

| Time (min) | delta H (ft.) | | | | | |
|---|---|---|---|---|---|---|
| 0.3333 | 1.633 | | | | | |
| 0.35 | 1.627 | | | | | |
| 0.3666 | 1.621 | | | | | |
| 0.3833 | 1.611 | | | | | |
| 0.4 | 1.605 | | | | | |
| 0.4166 | 1.599 | | | | | |
| 0.4333 | 1.592 | | | | | |
| 0.45 | 1.586 | | | | | |
| 0.4666 | 1.58 | | | | | |
| 0.4833 | 1.573 | | | | | |
| 0.5 | 1.567 | | | | | |
| 0.5166 | 1.564 | | | | | |
| 0.5333 | 1.557 | | | | | |
| 0.55 | 1.551 | | | | | |
| 0.5666 | 1.545 | | | | | |
| 0.5833 | 1.538 | | | | | |
| 0.6 | 1.532 | | | | | |
| 0.6166 | 1.529 | | | | | |
| 0.6333 | 1.523 | | | | | |
| 0.65 | 1.519 | | | | | |
| 0.6666 | 1.513 | | | | | |
| 0.6833 | 1.507 | | | | | |
| 0.7 | 1.504 | | | | | |
| 0.7166 | 1.5 | | | | | |
| 0.7333 | 1.494 | | | | | |
| 0.75 | 1.491 | | | | | |
| 0.7666 | 1.485 | | | | | |
| 0.7833 | 1.481 | | | | | |
| 0.8 | 1.478 | | | | | |
| 0.8166 | 1.475 | | | | | |
| 0.8333 | 1.469 | | | | | |
| 0.85 | 1.462 | | | | | |
| 0.8666 | 1.459 | | | | | |
| 0.8833 | 1.456 | | | | | |
| 0.9 | 1.45 | | | | | |
| 0.9166 | 1.447 | | | | | |
| 0.9333 | 1.44 | | | | | |
| 0.95 | 1.437 | | | | | |
| 0.9666 | 1.434 | | | | | |
| 0.9833 | 1.431 | | | | | |
| 1 | 1.424 | | | | | |
| 1.2 | 1.364 | | | | | |
| 1.4 | 1.32 | | | | | |
| 1.6 | 1.279 | | | | | |
| 1.8 | 1.238 | | | | | |
| 2 | 1.2 | | | | | |
| 2.2 | 1.165 | | | | | |
| 2.4 | 1.13 | | | | | |
| 2.6 | 1.095 | | | | | |
| 2.8 | 1.063 | | | | | |

| Time (min) | delta H (ft.) | | | | | |
|---|---|---|---|---|---|---|
| 3 | 1.035 | | | | | |
| 3.2 | 1.003 | | | | | |
| 3.4 | 0.978 | | | | | |
| 3.6 | 0.949 | | | | | |
| 3.8 | 0.927 | | | | | |
| 4 | 0.899 | | | | | |
| 4.2 | 0.877 | | | | | |
| 4.4 | 0.854 | | | | | |
| 4.6 | 0.832 | | | | | |
| 4.8 | 0.807 | | | | | |
| 5 | 0.788 | | | | | |
| 5.2 | 0.769 | | | | | |
| 5.4 | 0.75 | | | | | |
| 5.6 | 0.731 | | | | | |
| 5.8 | 0.712 | | | | | |
| 6 | 0.693 | | | | | |
| 6.2 | 0.677 | | | | | |
| 6.4 | 0.661 | | | | | |
| 6.6 | 0.645 | | | | | |
| 6.8 | 0.63 | | | | | |
| 7 | 0.614 | | | | | |
| 7.2 | 0.601 | | | | | |
| 7.4 | 0.588 | | | | | |
| 7.6 | 0.576 | | | | | |
| 7.8 | 0.56 | | | | | |
| 8 | 0.547 | | | | | |
| 8.2 | 0.538 | | | | | |
| 8.4 | 0.525 | | | | | |
| 8.6 | 0.513 | | | | | |
| 8.8 | 0.5 | | | | | |
| 9 | 0.49 | | | | | |
| 9.2 | 0.481 | | | | | |
| 9.4 | 0.468 | | | | | |
| 9.6 | 0.462 | | | | | |
| 9.8 | 0.452 | | | | | |
| 10 | 0.443 | | | | | |
| 12 | 0.364 | | | | | |

## 57M-95-08A RISING HEAD



| Time (min) | delta H (ft.) |
|---|---|
| 0 | 1.393 |
| 0.0033 | 1.231 |
| 0.0066 | 1.282 |
| 0.01 | 1.459 |
| 0.0133 | 1.58 |
| 0.0166 | 1.709 |
| 0.02 | 1.694 |
| 0.0233 | 1.64 |
| 0.0266 | 1.605 |
| 0.03 | 1.583 |
| 0.0333 | 1.561 |
| 0.0366 | 1.535 |
| 0.04 | 1.516 |
| 0.0433 | 1.497 |
| 0.0466 | 1.475 |
| 0.05 | 1.456 |
| 0.0533 | 1.44 |
| 0.0566 | 1.418 |
| 0.06 | 1.399 |
| 0.0633 | 1.383 |
| 0.0666 | 1.361 |
| 0.07 | 1.342 |
| 0.0733 | 1.326 |
| 0.0766 | 1.31 |
| 0.08 | 1.292 |
| 0.0833 | 1.272 |
| 0.0866 | 1.257 |
| 0.09 | 1.241 |
| 0.0933 | 1.222 |
| 0.0966 | 1.209 |
| 0.1 | 1.193 |
| 0.1033 | 1.178 |
| 0.1066 | 1.162 |
| 0.11 | 1.146 |
| 0.1133 | 1.133 |
| 0.1166 | 1.117 |
| 0.12 | 1.105 |
| 0.1233 | 1.092 |
| 0.1266 | 1.076 |
| 0.13 | 1.064 |
| 0.1333 | 1.051 |
| 0.1366 | 1.038 |
| 0.14 | 1.022 |
| 0.1433 | 1.013 |
| 0.1466 | 1 |
| 0.15 | 0.987 |
| 0.1533 | 0.975 |
| 0.1566 | 0.962 |
| 0.16 | 0.949 |
| 0.1633 | 0.94 |

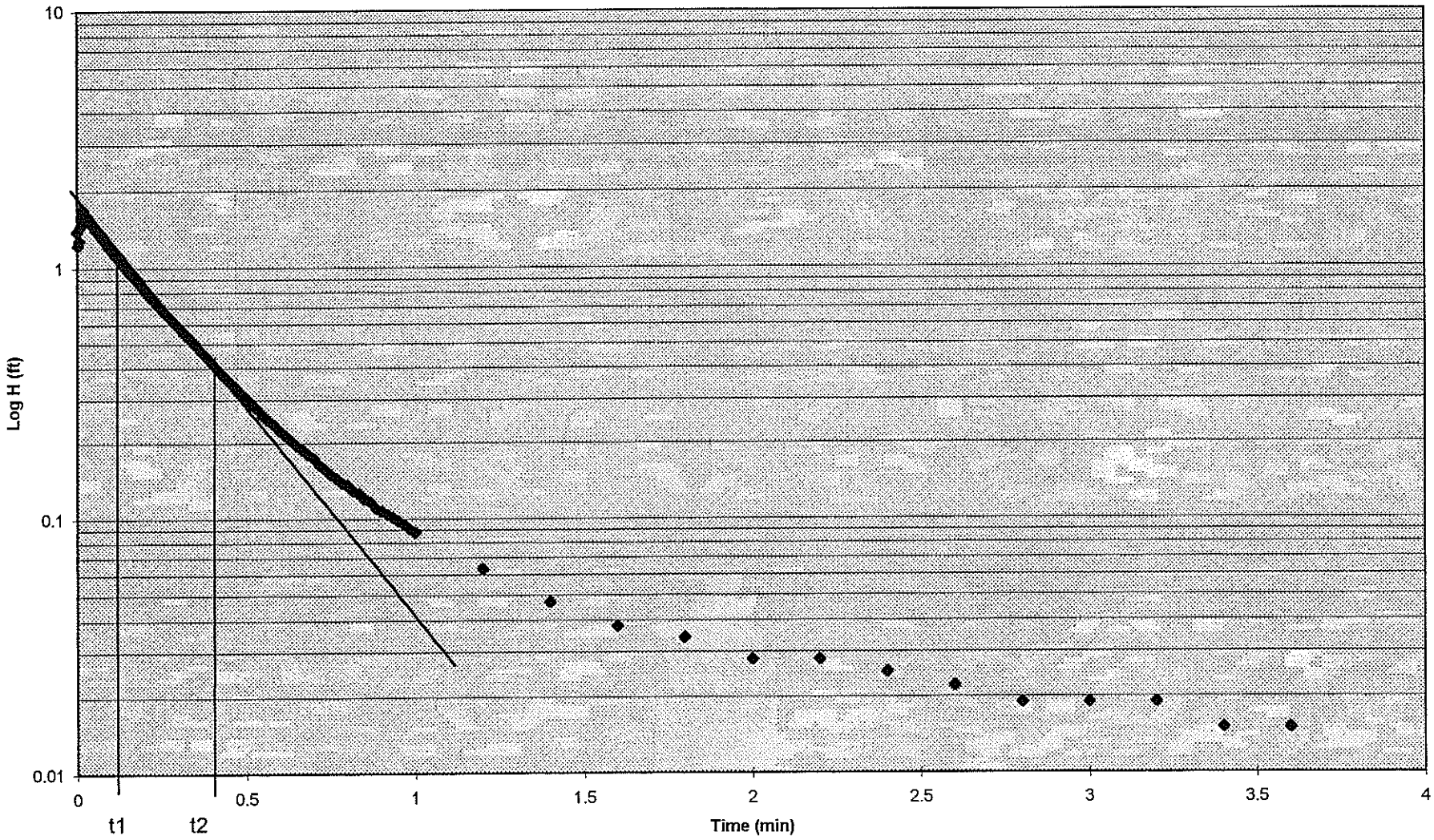
Well ID: 57M-95-08B
Test Date: 11/17/95
Test Type: Rising Head
Well Diameter: 0.333 ft.
Boring Diameter: 0.833 ft.
Screened Interval (bgs): 18-28 ft.
Water Column Height: 26.64 ft.

| Time (min) | delta H (ft.) | | | | | |
|---|---|---|---|---|---|---|
| 0.1666 | 0.927 | | | | | |
| 0.17 | 0.918 | | | | | |
| 0.1733 | 0.905 | | | | | |
| 0.1766 | 0.896 | | | | | |
| 0.18 | 0.886 | | | | | |
| 0.1833 | 0.877 | | | | | |
| 0.1866 | 0.864 | | | | | |
| 0.19 | 0.855 | | | | | |
| 0.1933 | 0.842 | | | | | |
| 0.1966 | 0.832 | | | | | |
| 0.2 | 0.823 | | | | | |
| 0.2033 | 0.813 | | | | | |
| 0.2066 | 0.804 | | | | | |
| 0.21 | 0.794 | | | | | |
| 0.2133 | 0.785 | | | | | |
| 0.2166 | 0.775 | | | | | |
| 0.22 | 0.769 | | | | | |
| 0.2233 | 0.76 | | | | | |
| 0.2266 | 0.75 | | | | | |
| 0.23 | 0.744 | | | | | |
| 0.2333 | 0.731 | | | | | |
| 0.2366 | 0.725 | | | | | |
| 0.24 | 0.715 | | | | | |
| 0.2433 | 0.709 | | | | | |
| 0.2466 | 0.703 | | | | | |
| 0.25 | 0.693 | | | | | |
| 0.2533 | 0.684 | | | | | |
| 0.2566 | 0.674 | | | | | |
| 0.26 | 0.668 | | | | | |
| 0.2633 | 0.661 | | | | | |
| 0.2666 | 0.655 | | | | | |
| 0.27 | 0.646 | | | | | |
| 0.2733 | 0.639 | | | | | |
| 0.2766 | 0.633 | | | | | |
| 0.28 | 0.627 | | | | | |
| 0.2833 | 0.617 | | | | | |
| 0.2866 | 0.611 | | | | | |
| 0.29 | 0.604 | | | | | |
| 0.2933 | 0.598 | | | | | |
| 0.2966 | 0.592 | | | | | |
| 0.3 | 0.585 | | | | | |
| 0.3033 | 0.579 | | | | | |
| 0.3066 | 0.573 | | | | | |
| 0.31 | 0.566 | | | | | |
| 0.3133 | 0.56 | | | | | |
| 0.3166 | 0.554 | | | | | |
| 0.32 | 0.547 | | | | | |
| 0.3233 | 0.541 | | | | | |
| 0.3266 | 0.538 | | | | | |
| 0.33 | 0.532 | | | | | |

| Time (min) | delta H (ft.) | | | | | |
|---|---|---|---|---|---|---|
| 0.3333 | 0.525 | | | | | |
| 0.35 | 0.497 | | | | | |
| 0.3666 | 0.468 | | | | | |
| 0.3833 | 0.443 | | | | | |
| 0.4 | 0.418 | | | | | |
| 0.4166 | 0.395 | | | | | |
| 0.4333 | 0.373 | | | | | |
| 0.45 | 0.354 | | | | | |
| 0.4666 | 0.338 | | | | | |
| 0.4833 | 0.319 | | | | | |
| 0.5 | 0.304 | | | | | |
| 0.5166 | 0.288 | | | | | |
| 0.5333 | 0.275 | | | | | |
| 0.55 | 0.259 | | | | | |
| 0.5666 | 0.247 | | | | | |
| 0.5833 | 0.237 | | | | | |
| 0.6 | 0.224 | | | | | |
| 0.6166 | 0.215 | | | | | |
| 0.6333 | 0.205 | | | | | |
| 0.65 | 0.196 | | | | | |
| 0.6666 | 0.189 | | | | | |
| 0.6833 | 0.18 | | | | | |
| 0.7 | 0.174 | | | | | |
| 0.7166 | 0.164 | | | | | |
| 0.7333 | 0.158 | | | | | |
| 0.75 | 0.151 | | | | | |
| 0.7666 | 0.145 | | | | | |
| 0.7833 | 0.139 | | | | | |
| 0.8 | 0.136 | | | | | |
| 0.8166 | 0.129 | | | | | |
| 0.8333 | 0.126 | | | | | |
| 0.85 | 0.12 | | | | | |
| 0.8666 | 0.117 | | | | | |
| 0.8833 | 0.11 | | | | | |
| 0.9 | 0.107 | | | | | |
| 0.9166 | 0.104 | | | | | |
| 0.9333 | 0.101 | | | | | |
| 0.95 | 0.098 | | | | | |
| 0.9666 | 0.095 | | | | | |
| 0.9833 | 0.091 | | | | | |
| 1 | 0.088 | | | | | |
| 1.2 | 0.063 | | | | | |
| 1.4 | 0.047 | | | | | |
| 1.6 | 0.038 | | | | | |
| 1.8 | 0.034 | | | | | |
| 2 | 0.028 | | | | | |
| 2.2 | 0.028 | | | | | |
| 2.4 | 0.025 | | | | | |
| 2.6 | 0.022 | | | | | |
| 2.8 | 0.019 | | | | | |

| Time (min) | delta H (ft.) | | | | | |
|---|---|---|---|---|---|---|
| 3 | 0.019 | | | | | |
| 3.2 | 0.019 | | | | | |
| 3.4 | 0.015 | | | | | |
| 3.6 | 0.015 | | | | | |

## 57M-95-08B RISING HEAD



| | |
|---|---|
| 0 | 0.028 |
| 0.0033 | 0.028 |
| 0.0066 | 0 |
| 0.01 | 0.431 |
| 0.0133 | 1.051 |
| 0.0166 | 1.689 |
| 0.02 | 1.229 |
| 0.0233 | 0.403 |
| 0.0266 | 0.647 |
| 0.03 | 1.135 |
| 0.0333 | 0.61 |
| 0.0366 | 0.591 |
| 0.04 | 1.426 |
| 0.0433 | 1.661 |
| 0.0466 | 1.088 |
| 0.05 | 1.398 |
| 0.0533 | 1.567 |
| 0.0566 | 1.473 |
| 0.06 | 1.257 |
| 0.0633 | 1.192 |
| 0.0666 | 1.069 |
| 0.07 | 0.985 |
| 0.0733 | 0.91 |
| 0.0766 | 0.825 |
| 0.08 | 0.76 |
| 0.0833 | 0.713 |
| 0.0866 | 0.638 |
| 0.09 | 0.591 |
| 0.0933 | 0.553 |
| 0.0966 | 0.497 |
| 0.1 | 0.469 |
| 0.1033 | 0.441 |
| 0.1066 | 0.403 |
| 0.11 | 0.384 |
| 0.1133 | 0.356 |
| 0.1166 | 0.337 |
| 0.12 | 0.328 |
| 0.1233 | 0.309 |
| 0.1266 | 0.3 |
| 0.13 | 0.281 |
| 0.1333 | 0.272 |
| 0.1366 | 0.262 |
| 0.14 | 0.253 |
| 0.1433 | 0.244 |
| 0.1466 | 0.244 |
| 0.15 | 0.234 |
| 0.1533 | 0.215 |
| 0.1566 | 0.225 |
| 0.16 | 0.215 |
| 0.1633 | 0.206 |
| 0.1666 | 0.215 |

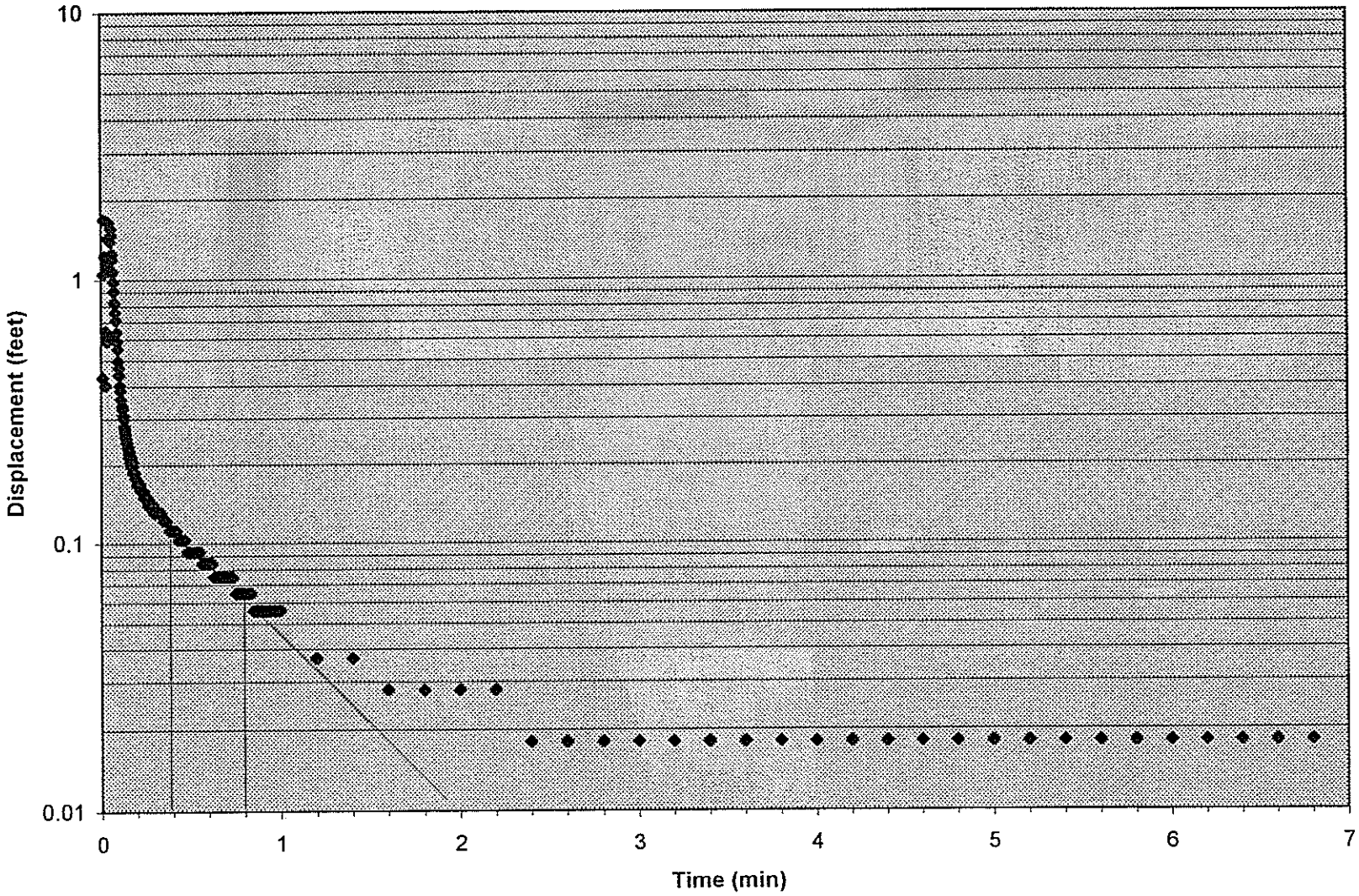
max. drawdown = 1.661 - 0.028 = 1.63 ft.

| | |
|---|---|
| 0.17 | 0.197 |
| 0.1733 | 0.197 |
| 0.1766 | 0.206 |
| 0.18 | 0.187 |
| 0.1833 | 0.187 |
| 0.1866 | 0.187 |
| 0.19 | 0.178 |
| 0.1933 | 0.178 |
| 0.1966 | 0.178 |
| 0.2 | 0.168 |
| 0.2033 | 0.168 |
| 0.2066 | 0.168 |
| 0.21 | 0.168 |
| 0.2133 | 0.168 |
| 0.2166 | 0.168 |
| 0.22 | 0.159 |
| 0.2233 | 0.159 |
| 0.2266 | 0.159 |
| 0.23 | 0.159 |
| 0.2333 | 0.159 |
| 0.2366 | 0.159 |
| 0.24 | 0.15 |
| 0.2433 | 0.15 |
| 0.2466 | 0.15 |
| 0.25 | 0.15 |
| 0.2533 | 0.15 |
| 0.2566 | 0.15 |
| 0.26 | 0.15 |
| 0.2633 | 0.14 |
| 0.2666 | 0.14 |
| 0.27 | 0.14 |
| 0.2733 | 0.14 |
| 0.2766 | 0.14 |
| 0.28 | 0.14 |
| 0.2833 | 0.14 |
| 0.2866 | 0.14 |
| 0.29 | 0.14 |
| 0.2933 | 0.131 |
| 0.2966 | 0.131 |
| 0.3 | 0.131 |
| 0.3033 | 0.131 |
| 0.3066 | 0.131 |
| 0.31 | 0.131 |
| 0.3133 | 0.131 |
| 0.3166 | 0.131 |
| 0.32 | 0.131 |
| 0.3233 | 0.131 |
| 0.3266 | 0.131 |
| 0.33 | 0.131 |
| 0.3333 | 0.131 |
| 0.35 | 0.122 |

| | |
|---|---|
| 0.3666 | 0.122 |
| 0.3833 | 0.112 |
| 0.4 | 0.112 |
| 0.4166 | 0.112 |
| 0.4333 | 0.103 |
| 0.45 | 0.103 |
| 0.4666 | 0.103 |
| 0.4833 | 0.093 |
| 0.5 | 0.093 |
| 0.5166 | 0.093 |
| 0.5333 | 0.093 |
| 0.55 | 0.093 |
| 0.5666 | 0.084 |
| 0.5833 | 0.084 |
| 0.6 | 0.084 |
| 0.6166 | 0.084 |
| 0.6333 | 0.075 |
| 0.65 | 0.075 |
| 0.6666 | 0.075 |
| 0.6833 | 0.075 |
| 0.7 | 0.075 |
| 0.7166 | 0.075 |
| 0.7333 | 0.075 |
| 0.75 | 0.065 |
| 0.7666 | 0.065 |
| 0.7833 | 0.065 |
| 0.8 | 0.065 |
| 0.8166 | 0.065 |
| 0.8333 | 0.065 |
| 0.85 | 0.056 |
| 0.8666 | 0.056 |
| 0.8833 | 0.056 |
| 0.9 | 0.056 |
| 0.9166 | 0.056 |
| 0.9333 | 0.056 |
| 0.95 | 0.056 |
| 0.9666 | 0.056 |
| 0.9833 | 0.056 |
| 1 | 0.056 |
| 1.2 | 0.037 |
| 1.4 | 0.037 |
| 1.6 | 0.028 |
| 1.8 | 0.028 |
| 2 | 0.028 |
| 2.2 | 0.028 |
| 2.4 | 0.018 |
| 2.6 | 0.018 |
| 2.8 | 0.018 |
| 3 | 0.018 |
| 3.2 | 0.018 |
| 3.4 | 0.018 |

| | |
|---|---|
| 3.6 | 0.018 |
| 3.8 | 0.018 |
| 4 | 0.018 |
| 4.2 | 0.018 |
| 4.4 | 0.018 |
| 4.6 | 0.018 |
| 4.8 | 0.018 |
| 5 | 0.018 |
| 5.2 | 0.018 |
| 5.4 | 0.018 |
| 5.6 | 0.018 |
| 5.8 | 0.018 |
| 6 | 0.018 |
| 6.2 | 0.018 |
| 6.4 | 0.018 |
| 6.6 | 0.018 |
| 6.8 | 0.018 |

## 57M-96-09X Rising Head Test #1



57M-96-09X Rising Head Test #2

| | |
|---|---|
| 0 | 0 |
| 0.0033 | 0.009 |
| 0.0066 | 0.065 |
| 0.01 | 1.023 |
| 0.0133 | 0.957 |
| 0.0166 | 0.966 |
| 0.02 | 0.929 |
| 0.0233 | 0.347 |
| 0.0266 | 0.403 |
| 0.03 | 0.825 |
| 0.0333 | 0.591 |
| 0.0366 | 0.938 |
| 0.04 | 1.304 max. drawdown = 1.30 ft |
| 0.0433 | 1.032 |
| 0.0466 | 0.75 |
| 0.05 | 1.088 |
| 0.0533 | 1.004 |
| 0.0566 | 0.882 |
| 0.06 | 1.051 |
| 0.0633 | 1.192 |
| 0.0666 | 0.994 |
| 0.07 | 1.21 |
| 0.0733 | 1.107 |
| 0.0766 | 0.957 |
| 0.08 | 0.891 |
| 0.0833 | 0.816 |
| 0.0866 | 0.732 |
| 0.09 | 0.685 |
| 0.0933 | 0.628 |
| 0.0966 | 0.572 |
| 0.1 | 0.534 |
| 0.1033 | 0.488 |
| 0.1066 | 0.45 |
| 0.11 | 0.431 |
| 0.1133 | 0.394 |
| 0.1166 | 0.375 |
| 0.12 | 0.356 |
| 0.1233 | 0.328 |
| 0.1266 | 0.319 |
| 0.13 | 0.309 |
| 0.1333 | 0.281 |
| 0.1366 | 0.281 |
| 0.14 | 0.262 |
| 0.1433 | 0.253 |
| 0.1466 | 0.253 |
| 0.15 | 0.244 |
| 0.1533 | 0.234 |
| 0.1566 | 0.225 |
| 0.16 | 0.225 |
| 0.1633 | 0.225 |
| 0.1666 | 0.206 |

| | |
|---|---|
| 0.17 | 0.215 |
| 0.1733 | 0.197 |
| 0.1766 | 0.206 |
| 0.18 | 0.187 |
| 0.1833 | 0.197 |
| 0.1866 | 0.178 |
| 0.19 | 0.187 |
| 0.1933 | 0.178 |
| 0.1966 | 0.178 |
| 0.2 | 0.178 |
| 0.2033 | 0.178 |
| 0.2066 | 0.168 |
| 0.21 | 0.168 |
| 0.2133 | 0.168 |
| 0.2166 | 0.168 |
| 0.22 | 0.168 |
| 0.2233 | 0.168 |
| 0.2266 | 0.159 |
| 0.23 | 0.159 |
| 0.2333 | 0.159 |
| 0.2366 | 0.159 |
| 0.24 | 0.159 |
| 0.2433 | 0.159 |
| 0.2466 | 0.159 |
| 0.25 | 0.15 |
| 0.2533 | 0.15 |
| 0.2566 | 0.15 |
| 0.26 | 0.15 |
| 0.2633 | 0.15 |
| 0.2666 | 0.15 |
| 0.27 | 0.14 |
| 0.2733 | 0.14 |
| 0.2766 | 0.14 |
| 0.28 | 0.14 |
| 0.2833 | 0.14 |
| 0.2866 | 0.14 |
| 0.29 | 0.14 |
| 0.2933 | 0.14 |
| 0.2966 | 0.14 |
| 0.3 | 0.14 |
| 0.3033 | 0.131 |
| 0.3066 | 0.131 |
| 0.31 | 0.131 |
| 0.3133 | 0.131 |
| 0.3166 | 0.131 |
| 0.32 | 0.131 |
| 0.3233 | 0.131 |
| 0.3266 | 0.131 |
| 0.33 | 0.131 |
| 0.3333 | 0.122 |
| 0.35 | 0.122 |

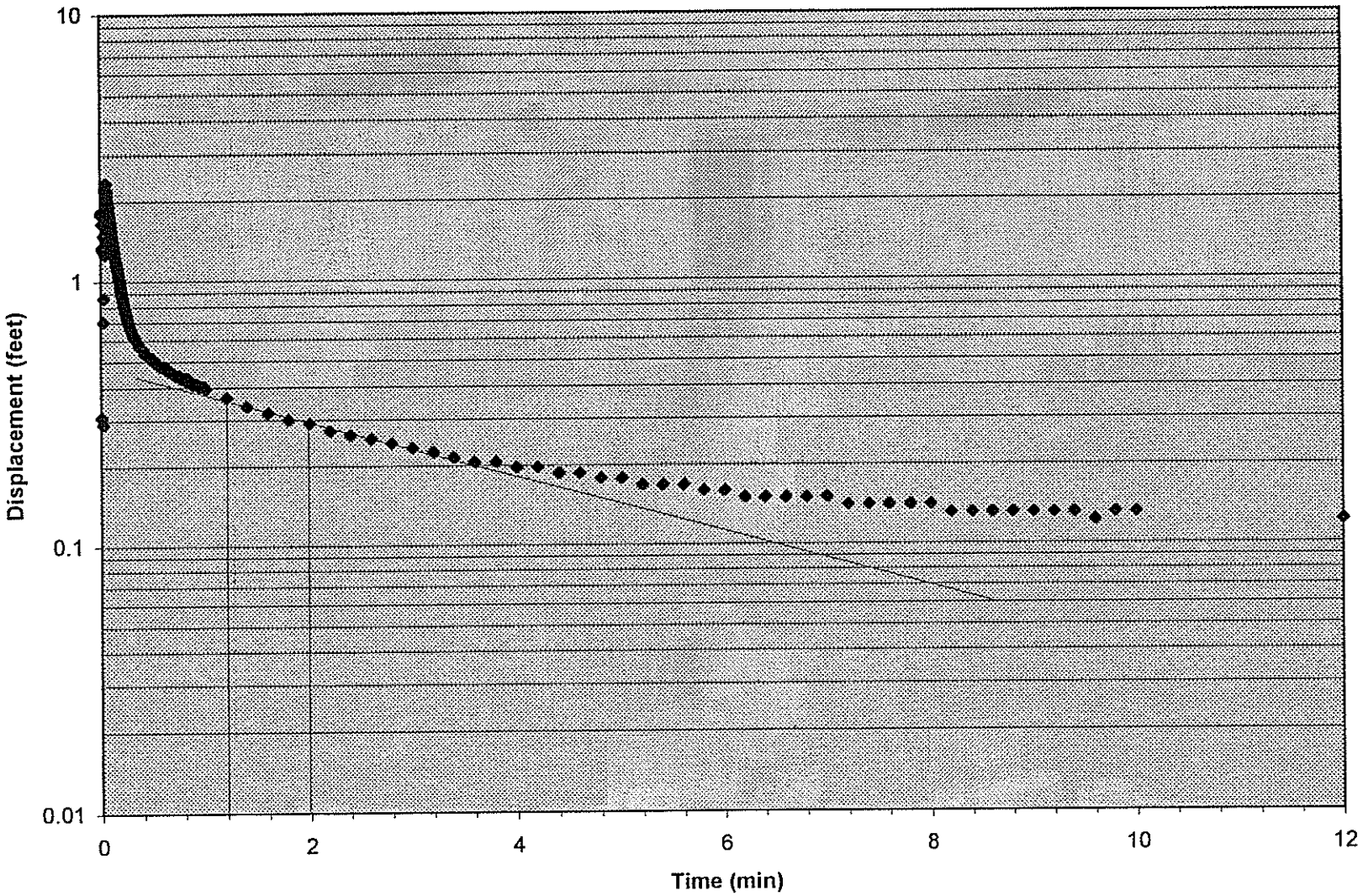
| | |
|---|---|
| 0.3666 | 0.122 |
| 0.3833 | 0.112 |
| 0.4 | 0.112 |
| 0.4166 | 0.103 |
| 0.4333 | 0.103 |
| 0.45 | 0.103 |
| 0.4666 | 0.103 |
| 0.4833 | 0.093 |
| 0.5 | 0.093 |
| 0.5166 | 0.093 |
| 0.5333 | 0.084 |
| 0.55 | 0.084 |
| 0.5666 | 0.084 |
| 0.5833 | 0.084 |
| 0.6 | 0.084 |
| 0.6166 | 0.084 |
| 0.6333 | 0.075 |
| 0.65 | 0.075 |
| 0.6666 | 0.075 |
| 0.6833 | 0.075 |
| 0.7 | 0.075 |
| 0.7166 | 0.065 |
| 0.7333 | 0.065 |
| 0.75 | 0.065 |
| 0.7666 | 0.065 |
| 0.7833 | 0.065 |
| 0.8 | 0.065 |
| 0.8166 | 0.065 |
| 0.8333 | 0.065 |
| 0.85 | 0.056 |
| 0.8666 | 0.056 |
| 0.8833 | 0.056 |
| 0.9 | 0.056 |
| 0.9166 | 0.056 |
| 0.9333 | 0.056 |
| 0.95 | 0.056 |
| 0.9666 | 0.056 |
| 0.9833 | 0.046 |
| 1 | 0.046 |
| 1.2 | 0.037 |
| 1.4 | 0.028 |
| 1.6 | 0.028 |
| 1.8 | 0.028 |
| 2 | 0.018 |
| 2.2 | 0.018 |
| 2.4 | 0.018 |
| 2.6 | 0.018 |

| | |
|---|---|
| 0.17 | 1.06 |
| 0.1733 | 1.041 |
| 0.1766 | 1.023 |
| 0.18 | 1.013 |
| 0.1833 | 0.985 |
| 0.1866 | 0.966 |
| 0.19 | 0.947 |
| 0.1933 | 0.929 |
| 0.1966 | 0.919 |
| 0.2 | 0.901 |
| 0.2033 | 0.882 |
| 0.2066 | 0.872 |
| 0.21 | 0.854 |
| 0.2133 | 0.844 |
| 0.2166 | 0.835 |
| 0.22 | 0.816 |
| 0.2233 | 0.807 |
| 0.2266 | 0.797 |
| 0.23 | 0.788 |
| 0.2333 | 0.779 |
| 0.2366 | 0.769 |
| 0.24 | 0.76 |
| 0.2433 | 0.75 |
| 0.2466 | 0.741 |
| 0.25 | 0.732 |
| 0.2533 | 0.722 |
| 0.2566 | 0.713 |
| 0.26 | 0.703 |
| 0.2633 | 0.703 |
| 0.2666 | 0.694 |
| 0.27 | 0.685 |
| 0.2733 | 0.685 |
| 0.2766 | 0.675 |
| 0.28 | 0.666 |
| 0.2833 | 0.666 |
| 0.2866 | 0.657 |
| 0.29 | 0.647 |
| 0.2933 | 0.647 |
| 0.2966 | 0.638 |
| 0.3 | 0.638 |
| 0.3033 | 0.638 |
| 0.3066 | 0.628 |
| 0.31 | 0.628 |
| 0.3133 | 0.619 |
| 0.3166 | 0.619 |
| 0.32 | 0.619 |
| 0.3233 | 0.61 |
| 0.3266 | 0.61 |
| 0.33 | 0.61 |
| 0.3333 | 0.6 |
| 0.35 | 0.591 |

| | |
|---|---|
| 0.3666 | 0.572 |
| 0.3833 | 0.563 |
| 0.4 | 0.553 |
| 0.4166 | 0.534 |
| 0.4333 | 0.534 |
| 0.45 | 0.525 |
| 0.4666 | 0.516 |
| 0.4833 | 0.516 |
| 0.5 | 0.506 |
| 0.5166 | 0.497 |
| 0.5333 | 0.497 |
| 0.55 | 0.488 |
| 0.5666 | 0.478 |
| 0.5833 | 0.478 |
| 0.6 | 0.478 |
| 0.6166 | 0.469 |
| 0.6333 | 0.469 |
| 0.65 | 0.459 |
| 0.6666 | 0.459 |
| 0.6833 | 0.45 |
| 0.7 | 0.45 |
| 0.7166 | 0.441 |
| 0.7333 | 0.441 |
| 0.75 | 0.441 |
| 0.7666 | 0.431 |
| 0.7833 | 0.431 |
| 0.8 | 0.431 |
| 0.8166 | 0.422 |
| 0.8333 | 0.431 |
| 0.85 | 0.422 |
| 0.8666 | 0.412 |
| 0.8833 | 0.412 |
| 0.9 | 0.412 |
| 0.9166 | 0.412 |
| 0.9333 | 0.403 |
| 0.95 | 0.403 |
| 0.9666 | 0.403 |
| 0.9833 | 0.403 |
| 1 | 0.394 |
| 1.2 | 0.366 |
| 1.4 | 0.337 |
| 1.6 | 0.319 |
| 1.8 | 0.3 |
| 2 | 0.29 |
| 2.2 | 0.272 |
| 2.4 | 0.262 |
| 2.6 | 0.253 |
| 2.8 | 0.244 |
| 3 | 0.234 |
| 3.2 | 0.225 |
| 3.4 | 0.215 |

| | |
|---|---|
| 3.6 | 0.206 |
| 3.8 | 0.206 |
| 4 | 0.197 |
| 4.2 | 0.197 |
| 4.4 | 0.187 |
| 4.6 | 0.187 |
| 4.8 | 0.178 |
| 5 | 0.178 |
| 5.2 | 0.168 |
| 5.4 | 0.168 |
| 5.6 | 0.168 |
| 5.8 | 0.159 |
| 6 | 0.159 |
| 6.2 | 0.15 |
| 6.4 | 0.15 |
| 6.6 | 0.15 |
| 6.8 | 0.15 |
| 7 | 0.15 |
| 7.2 | 0.14 |
| 7.4 | 0.14 |
| 7.6 | 0.14 |
| 7.8 | 0.14 |
| 8 | 0.14 |
| 8.2 | 0.131 |
| 8.4 | 0.131 |
| 8.6 | 0.131 |
| 8.8 | 0.131 |
| 9 | 0.131 |
| 9.2 | 0.131 |
| 9.4 | 0.131 |
| 9.6 | 0.122 |
| 9.8 | 0.131 |
| 10 | 0.131 |
| 12 | 0.122 |

## 57M-96-10X Rising Head Test #1



| | |
|---|---|
| 0 | 2.187 |
| 0.0033 | 2.187 |
| 0.0066 | 2.187 |
| 0.01 | 2.187 |
| 0.0133 | 2.431 |
| 0.0166 | 2.759 |
| 0.02 | 3.35 |
| 0.0233 | 3.566 |
| 0.0266 | 3.482 |
| 0.03 | 3.613 |
| 0.0333 | 3.726 |
| 0.0366 | 3.416 |
| 0.04 | 3.125 |
| 0.0433 | 3.379 |
| 0.0466 | 3.435 |
| 0.05 | 4.43 |
| 0.0533 | 4.27 |
| 0.0566 | 4.392 |
| 0.06 | 4.702 |
| 0.0633 | 4.477 |
| 0.0666 | 4.467 |
| 0.07 | 4.383 |
| 0.0733 | 4.326 |
| 0.0766 | 4.261 |
| 0.08 | 4.214 |
| 0.0833 | 4.158 |
| 0.0866 | 4.139 |
| 0.09 | 4.082 |
| 0.0933 | 4.017 |
| 0.0966 | 3.97 |
| 0.1 | 3.904 |
| 0.1033 | 3.867 |
| 0.1066 | 3.838 |
| 0.11 | 3.792 |
| 0.1133 | 3.754 |
| 0.1166 | 3.716 |
| 0.12 | 3.688 |
| 0.1233 | 3.651 |
| 0.1266 | 3.623 |
| 0.13 | 3.594 |
| 0.1333 | 3.585 |
| 0.1366 | 3.538 |
| 0.14 | 3.519 |
| 0.1433 | 3.501 |
| 0.1466 | 3.472 |
| 0.15 | 3.444 |
| 0.1533 | 3.425 |
| 0.1566 | 3.407 |
| 0.16 | 3.388 |
| 0.1633 | 3.369 |
| 0.1666 | 3.341 |

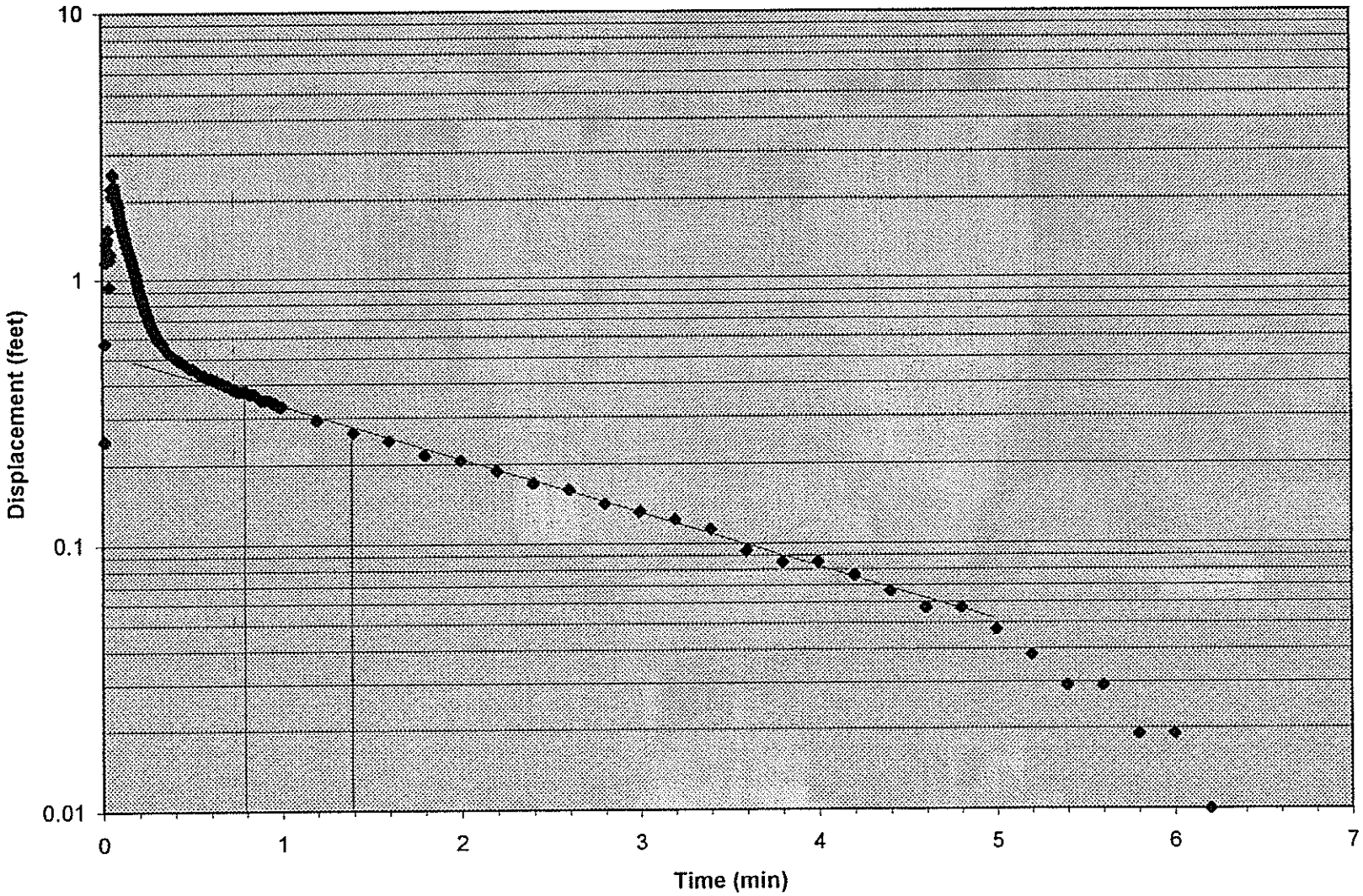
max. drawdown = 4.702 - 2.187 = 2.52 ft.

| | |
|---|---|
| 0.17 | 3.322 |
| 0.1733 | 3.303 |
| 0.1766 | 3.285 |
| 0.18 | 3.266 |
| 0.1833 | 3.238 |
| 0.1866 | 3.219 |
| 0.19 | 3.2 |
| 0.1933 | 3.172 |
| 0.1966 | 3.153 |
| 0.2 | 3.134 |
| 0.2033 | 3.106 |
| 0.2066 | 3.097 |
| 0.21 | 3.078 |
| 0.2133 | 3.059 |
| 0.2166 | 3.041 |
| 0.22 | 3.031 |
| 0.2233 | 3.012 |
| 0.2266 | 3.003 |
| 0.23 | 2.984 |
| 0.2333 | 2.975 |
| 0.2366 | 2.966 |
| 0.24 | 2.947 |
| 0.2433 | 2.937 |
| 0.2466 | 2.928 |
| 0.25 | 2.919 |
| 0.2533 | 2.9 |
| 0.2566 | 2.9 |
| 0.26 | 2.881 |
| 0.2633 | 2.872 |
| 0.2666 | 2.862 |
| 0.27 | 2.862 |
| 0.2733 | 2.853 |
| 0.2766 | 2.844 |
| 0.28 | 2.834 |
| 0.2833 | 2.825 |
| 0.2866 | 2.825 |
| 0.29 | 2.815 |
| 0.2933 | 2.806 |
| 0.2966 | 2.806 |
| 0.3 | 2.797 |
| 0.3033 | 2.797 |
| 0.3066 | 2.787 |
| 0.31 | 2.778 |
| 0.3133 | 2.778 |
| 0.3166 | 2.778 |
| 0.32 | 2.768 |
| 0.3233 | 2.768 |
| 0.3266 | 2.759 |
| 0.33 | 2.759 |
| 0.3333 | 2.759 |
| 0.35 | 2.731 |

| | |
|---|---|
| 0.3666 | 2.712 |
| 0.3833 | 2.703 |
| 0.4 | 2.693 |
| 0.4166 | 2.684 |
| 0.4333 | 2.675 |
| 0.45 | 2.665 |
| 0.4666 | 2.656 |
| 0.4833 | 2.646 |
| 0.5 | 2.646 |
| 0.5166 | 2.637 |
| 0.5333 | 2.628 |
| 0.55 | 2.618 |
| 0.5666 | 2.618 |
| 0.5833 | 2.609 |
| 0.6 | 2.609 |
| 0.6166 | 2.6 |
| 0.6333 | 2.6 |
| 0.65 | 2.59 |
| 0.6666 | 2.59 |
| 0.6833 | 2.581 |
| 0.7 | 2.581 |
| 0.7166 | 2.571 |
| 0.7333 | 2.571 |
| 0.75 | 2.562 |
| 0.7666 | 2.562 |
| 0.7833 | 2.562 |
| 0.8 | 2.562 |
| 0.8166 | 2.553 |
| 0.8333 | 2.553 |
| 0.85 | 2.553 |
| 0.8666 | 2.543 |
| 0.8833 | 2.534 |
| 0.9 | 2.534 |
| 0.9166 | 2.534 |
| 0.9333 | 2.534 |
| 0.95 | 2.524 |
| 0.9666 | 2.524 |
| 0.9833 | 2.515 |
| 1 | 2.515 |
| 1.2 | 2.478 |
| 1.4 | 2.449 |
| 1.6 | 2.431 |
| 1.8 | 2.402 |
| 2 | 2.393 |
| 2.2 | 2.374 |
| 2.4 | 2.355 |
| 2.6 | 2.346 |
| 2.8 | 2.327 |
| 3 | 2.318 |
| 3.2 | 2.309 |
| 3.4 | 2.299 |

| | |
|---|---|
| 3.6 | 2.28 |
| 3.8 | 2.271 |
| 4 | 2.271 |
| 4.2 | 2.262 |
| 4.4 | 2.252 |
| 4.6 | 2.243 |
| 4.8 | 2.243 |
| 5 | 2.233 |
| 5.2 | 2.224 |
| 5.4 | 2.215 |
| 5.6 | 2.215 |
| 5.8 | 2.205 |
| 6 | 2.205 |
| 6.2 | 2.196 |
| 6.4 | 2.187 |
| 6.6 | 2.187 |
| 6.8 | 2.177 |
| 7 | 2.177 |
| 7.2 | 2.177 |
| 7.4 | 2.168 |
| 7.6 | 2.158 |
| 7.8 | 2.158 |
| 8 | 2.158 |
| 8.2 | 2.158 |
| 8.4 | 2.149 |
| 8.6 | 2.149 |
| 8.8 | 2.14 |
| 9 | 2.14 |
| 9.2 | 2.13 |
| 9.4 | 2.13 |
| 9.6 | 2.13 |
| 9.8 | 2.121 |
| 10 | 2.121 |

## 57M-96-10X Rising Head Test #2



| | |
|---|---|
| 0 | 0.187 |
| 0.0033 | 0.872 |
| 0.0066 | 1.041 |
| 0.01 | 0.938 |
| 0.0133 | 0.797 |
| 0.0166 | 1.032 |
| 0.02 | 1.323 |
| 0.0233 | 1.051 |
| 0.0266 | 0.713 |
| 0.03 | 0.516 |
| 0.0333 | 0.685 |
| 0.0366 | 1.408 |
| 0.04 | 1.614 |
| 0.0433 | 1.811 |
| 0.0466 | 1.905 |
| 0.05 | 2.196 |
| 0.0533 | 2.44 |
| 0.0566 | 2.543 |
| 0.06 | 2.675 |
| 0.0633 | 2.459 |
| 0.0666 | 2.468 |
| 0.07 | 2.393 |
| 0.0733 | 2.365 |
| 0.0766 | 2.318 |
| 0.08 | 2.28 |
| 0.0833 | 2.243 |
| 0.0866 | 2.215 |
| 0.09 | 2.187 |
| 0.0933 | 2.158 |
| 0.0966 | 2.13 |
| 0.1 | 2.102 |
| 0.1033 | 2.083 |
| 0.1066 | 2.065 |
| 0.11 | 2.036 |
| 0.1133 | 2.018 |
| 0.1166 | 1.999 |
| 0.12 | 1.989 |
| 0.1233 | 1.971 |
| 0.1266 | 1.961 |
| 0.13 | 1.952 |
| 0.1333 | 1.943 |
| 0.1366 | 1.933 |
| 0.14 | 1.924 |
| 0.1433 | 1.914 |
| 0.1466 | 1.914 |
| 0.15 | 1.905 |
| 0.1533 | 1.896 |
| 0.1566 | 1.896 |
| 0.16 | 1.886 |
| 0.1633 | 1.877 |
| 0.1666 | 1.877 |

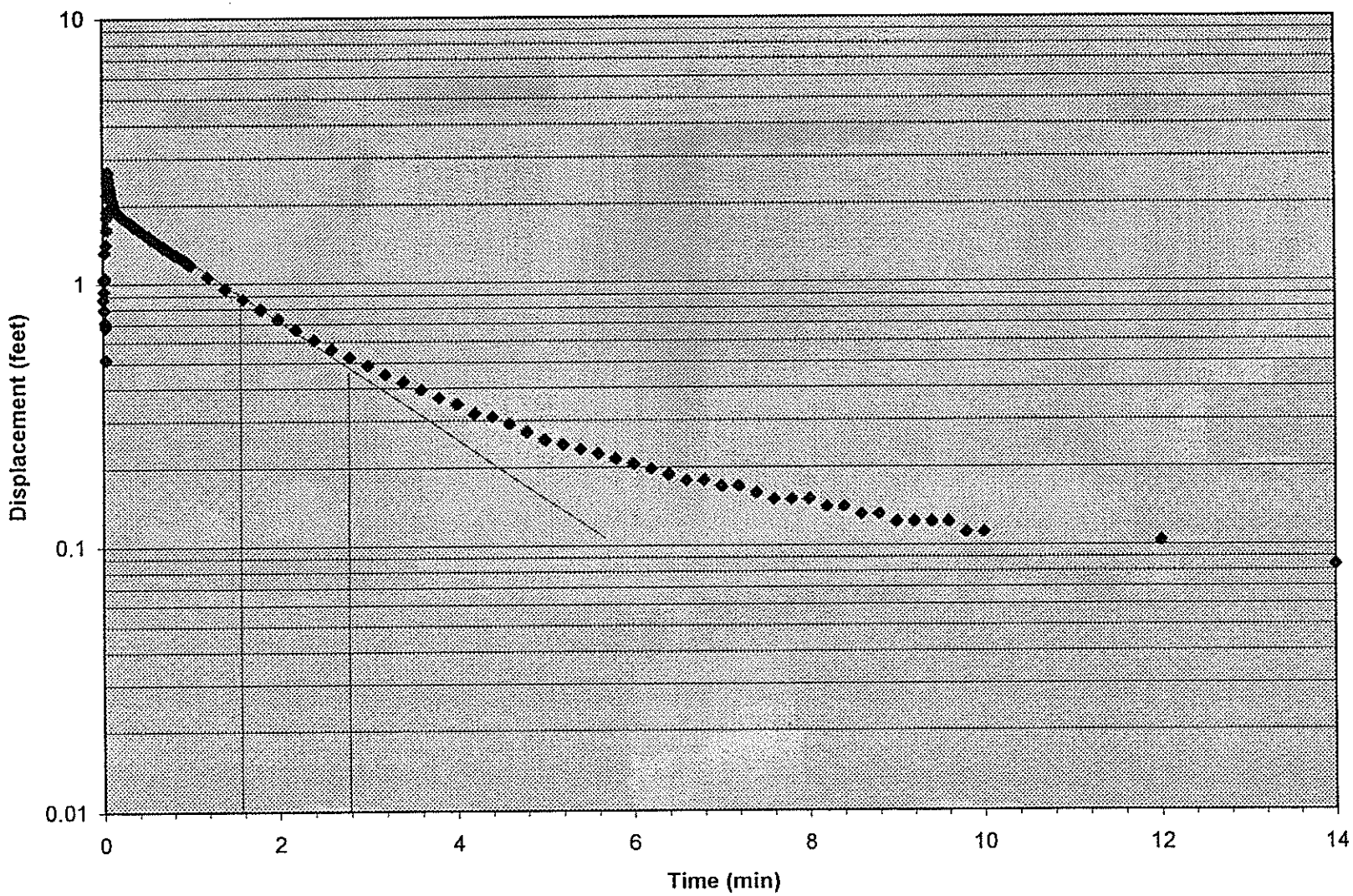
max. drawdown = 2.657 - 0.187 = 2.47 ft.

| | |
|---|---|
| 0.17 | 1.867 |
| 0.1733 | 1.858 |
| 0.1766 | 1.858 |
| 0.18 | 1.849 |
| 0.1833 | 1.849 |
| 0.1866 | 1.839 |
| 0.19 | 1.839 |
| 0.1933 | 1.839 |
| 0.1966 | 1.83 |
| 0.2 | 1.83 |
| 0.2033 | 1.821 |
| 0.2066 | 1.821 |
| 0.21 | 1.811 |
| 0.2133 | 1.811 |
| 0.2166 | 1.802 |
| 0.22 | 1.802 |
| 0.2233 | 1.802 |
| 0.2266 | 1.792 |
| 0.23 | 1.792 |
| 0.2333 | 1.783 |
| 0.2366 | 1.783 |
| 0.24 | 1.774 |
| 0.2433 | 1.774 |
| 0.2466 | 1.774 |
| 0.25 | 1.764 |
| 0.2533 | 1.764 |
| 0.2566 | 1.764 |
| 0.26 | 1.755 |
| 0.2633 | 1.755 |
| 0.2666 | 1.745 |
| 0.27 | 1.745 |
| 0.2733 | 1.745 |
| 0.2766 | 1.736 |
| 0.28 | 1.736 |
| 0.2833 | 1.736 |
| 0.2866 | 1.727 |
| 0.29 | 1.727 |
| 0.2933 | 1.727 |
| 0.2966 | 1.717 |
| 0.3 | 1.717 |
| 0.3033 | 1.717 |
| 0.3066 | 1.717 |
| 0.31 | 1.708 |
| 0.3133 | 1.708 |
| 0.3166 | 1.708 |
| 0.32 | 1.698 |
| 0.3233 | 1.698 |
| 0.3266 | 1.698 |
| 0.33 | 1.689 |
| 0.3333 | 1.689 |
| 0.35 | 1.661 |

| | |
|---|---|
| 0.3666 | 1.652 |
| 0.3833 | 1.633 |
| 0.4 | 1.623 |
| 0.4166 | 1.605 |
| 0.4333 | 1.586 |
| 0.45 | 1.576 |
| 0.4666 | 1.558 |
| 0.4833 | 1.539 |
| 0.5 | 1.529 |
| 0.5166 | 1.52 |
| 0.5333 | 1.501 |
| 0.55 | 1.492 |
| 0.5666 | 1.473 |
| 0.5833 | 1.464 |
| 0.6 | 1.445 |
| 0.6166 | 1.436 |
| 0.6333 | 1.426 |
| 0.65 | 1.408 |
| 0.6666 | 1.398 |
| 0.6833 | 1.389 |
| 0.7 | 1.37 |
| 0.7166 | 1.37 |
| 0.7333 | 1.351 |
| 0.75 | 1.342 |
| 0.7666 | 1.332 |
| 0.7833 | 1.314 |
| 0.8 | 1.304 |
| 0.8166 | 1.295 |
| 0.8333 | 1.286 |
| 0.85 | 1.276 |
| 0.8666 | 1.267 |
| 0.8833 | 1.257 |
| 0.9 | 1.248 |
| 0.9166 | 1.239 |
| 0.9333 | 1.229 |
| 0.95 | 1.21 |
| 0.9666 | 1.201 |
| 0.9833 | 1.192 |
| 1 | 1.182 |
| 1.2 | 1.06 |
| 1.4 | 0.957 |
| 1.6 | 0.872 |
| 1.8 | 0.797 |
| 2 | 0.732 |
| 2.2 | 0.666 |
| 2.4 | 0.61 |
| 2.6 | 0.563 |
| 2.8 | 0.525 |
| 3 | 0.488 |
| 3.2 | 0.45 |
| 3.4 | 0.422 |

| | |
|---|---|
| 3.6 | 0.394 |
| 3.8 | 0.366 |
| 4 | 0.347 |
| 4.2 | 0.319 |
| 4.4 | 0.309 |
| 4.6 | 0.291 |
| 4.8 | 0.272 |
| 5 | 0.253 |
| 5.2 | 0.244 |
| 5.4 | 0.234 |
| 5.6 | 0.225 |
| 5.8 | 0.215 |
| 6 | 0.206 |
| 6.2 | 0.197 |
| 6.4 | 0.187 |
| 6.6 | 0.178 |
| 6.8 | 0.178 |
| 7 | 0.169 |
| 7.2 | 0.169 |
| 7.4 | 0.159 |
| 7.6 | 0.15 |
| 7.8 | 0.15 |
| 8 | 0.15 |
| 8.2 | 0.14 |
| 8.4 | 0.14 |
| 8.6 | 0.131 |
| 8.8 | 0.131 |
| 9 | 0.122 |
| 9.2 | 0.122 |
| 9.4 | 0.122 |
| 9.6 | 0.122 |
| 9.8 | 0.112 |
| 10 | 0.112 |
| 12 | 0.103 |
| 14 | 0.084 |

## 57M-96-11X Rising Head Test #1



| | |
|---|---|
| 0 | 0.103 |
| 0.0033 | 0.863 |
| 0.0066 | 1.07 |
| 0.01 | 0.384 |
| 0.0133 | 0.225 |
| 0.0166 | 0.281 |
| 0.02 | 0.291 |
| 0.0233 | 0.685 |
| 0.0266 | 0.582 |
| 0.03 | 0.15 |
| 0.0333 | 0.422 |
| 0.0366 | 0.15 |
| 0.04 | 0.122 |
| 0.0433 | 1.21 |
| 0.0466 | 1.023 |
| 0.05 | 0.919 |
| 0.0533 | 1.445 |
| 0.0566 | 1.173 |
| 0.06 | 1.464 |
| 0.0633 | 1.661 |
| 0.0666 | 1.717 |
| 0.07 | 1.698 |
| 0.0733 | 1.886 |
| 0.0766 | 1.971 |
| 0.08 | 2.065 |
| 0.0833 | 2.111 |
| 0.0866 | 2.215 |
| 0.09 | 2.233 |
| 0.0933 | 2.29 |
| 0.0966 | 2.309 |
| 0.1 | 2.355 |
| 0.1033 | 2.327 |
| 0.1066 | 2.299 |
| 0.11 | 2.252 |
| 0.1133 | 2.224 |
| 0.1166 | 2.187 |
| 0.12 | 2.158 |
| 0.1233 | 2.13 |
| 0.1266 | 2.102 |
| 0.13 | 2.083 |
| 0.1333 | 2.055 |
| 0.1366 | 2.036 |
| 0.14 | 2.018 |
| 0.1433 | 1.999 |
| 0.1466 | 1.98 |
| 0.15 | 1.971 |
| 0.1533 | 1.952 |
| 0.1566 | 1.943 |
| 0.16 | 1.933 |
| 0.1633 | 1.924 |
| 0.1666 | 1.914 |

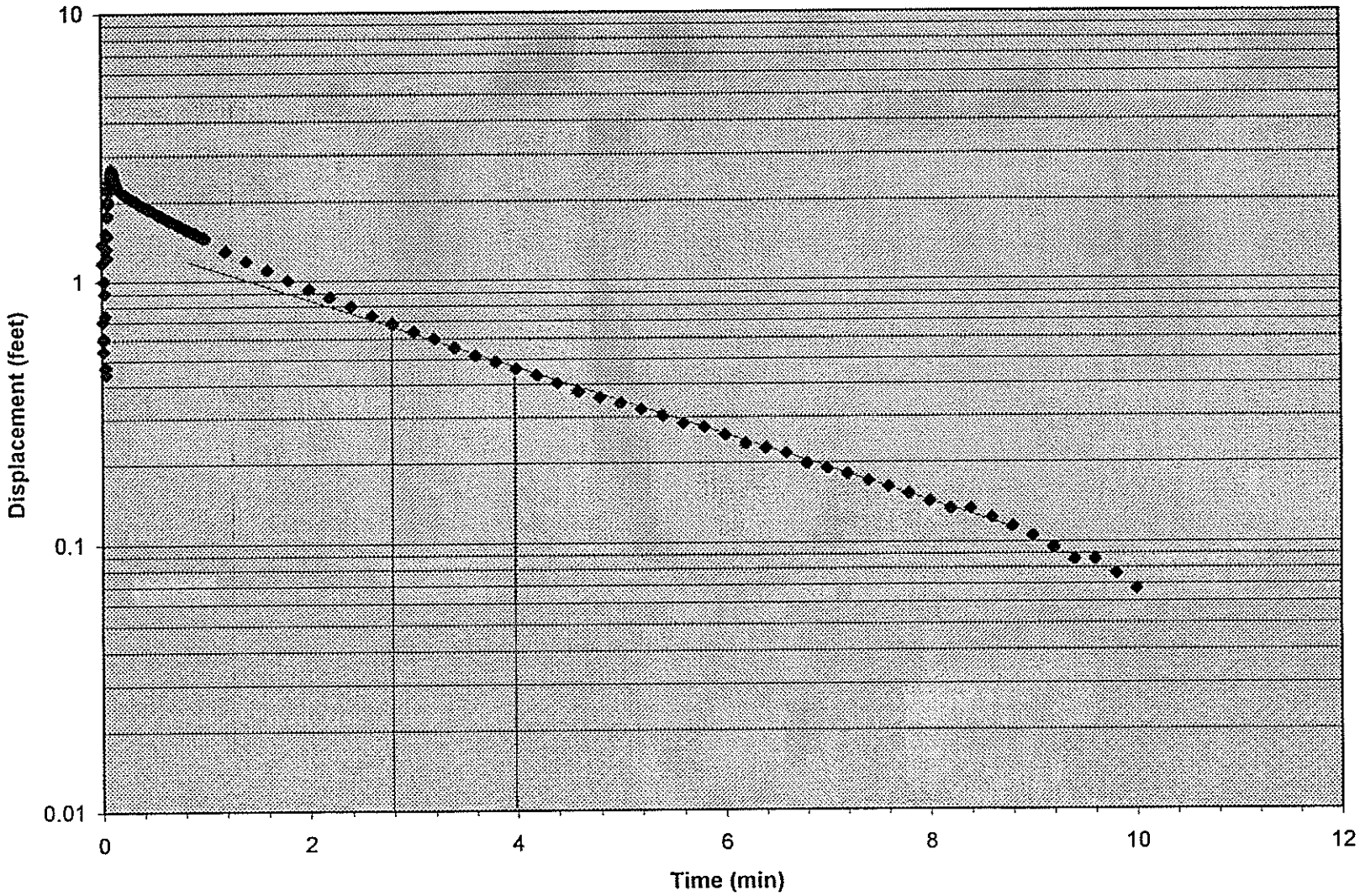
max. drawdown = 2.355 − (−0.319) = 2.67 ft.

| | |
|---|---|
| 0.17 | 1.905 |
| 0.1733 | 1.896 |
| 0.1766 | 1.896 |
| 0.18 | 1.886 |
| 0.1833 | 1.877 |
| 0.1866 | 1.877 |
| 0.19 | 1.867 |
| 0.1933 | 1.867 |
| 0.1966 | 1.858 |
| 0.2 | 1.849 |
| 0.2033 | 1.849 |
| 0.2066 | 1.839 |
| 0.21 | 1.839 |
| 0.2133 | 1.83 |
| 0.2166 | 1.83 |
| 0.22 | 1.821 |
| 0.2233 | 1.821 |
| 0.2266 | 1.811 |
| 0.23 | 1.811 |
| 0.2333 | 1.802 |
| 0.2366 | 1.802 |
| 0.24 | 1.792 |
| 0.2433 | 1.792 |
| 0.2466 | 1.792 |
| 0.25 | 1.783 |
| 0.2533 | 1.783 |
| 0.2566 | 1.774 |
| 0.26 | 1.764 |
| 0.2633 | 1.764 |
| 0.2666 | 1.764 |
| 0.27 | 1.755 |
| 0.2733 | 1.755 |
| 0.2766 | 1.755 |
| 0.28 | 1.745 |
| 0.2833 | 1.745 |
| 0.2866 | 1.736 |
| 0.29 | 1.736 |
| 0.2933 | 1.736 |
| 0.2966 | 1.736 |
| 0.3 | 1.727 |
| 0.3033 | 1.727 |
| 0.3066 | 1.727 |
| 0.31 | 1.717 |
| 0.3133 | 1.717 |
| 0.3166 | 1.708 |
| 0.32 | 1.708 |
| 0.3233 | 1.708 |
| 0.3266 | 1.698 |
| 0.33 | 1.698 |
| 0.3333 | 1.698 |
| 0.35 | 1.67 |

| | |
|---|---|
| 0.3666 | 1.652 |
| 0.3833 | 1.633 |
| 0.4 | 1.614 |
| 0.4166 | 1.595 |
| 0.4333 | 1.586 |
| 0.45 | 1.567 |
| 0.4666 | 1.548 |
| 0.4833 | 1.539 |
| 0.5 | 1.52 |
| 0.5166 | 1.501 |
| 0.5333 | 1.492 |
| 0.55 | 1.473 |
| 0.5666 | 1.454 |
| 0.5833 | 1.445 |
| 0.6 | 1.426 |
| 0.6166 | 1.417 |
| 0.6333 | 1.398 |
| 0.65 | 1.389 |
| 0.6666 | 1.37 |
| 0.6833 | 1.361 |
| 0.7 | 1.351 |
| 0.7166 | 1.332 |
| 0.7333 | 1.323 |
| 0.75 | 1.304 |
| 0.7666 | 1.295 |
| 0.7833 | 1.286 |
| 0.8 | 1.267 |
| 0.8166 | 1.257 |
| 0.8333 | 1.248 |
| 0.85 | 1.239 |
| 0.8666 | 1.22 |
| 0.8833 | 1.21 |
| 0.9 | 1.201 |
| 0.9166 | 1.192 |
| 0.9333 | 1.173 |
| 0.95 | 1.163 |
| 0.9666 | 1.154 |
| 0.9833 | 1.145 |
| 1 | 1.135 |
| 1.2 | 0.985 |
| 1.4 | 0.872 |
| 1.6 | 0.779 |
| 1.8 | 0.685 |
| 2 | 0.61 |
| 2.2 | 0.544 |
| 2.4 | 0.478 |
| 2.6 | 0.413 |
| 2.8 | 0.366 |
| 3 | 0.319 |
| 3.2 | 0.281 |
| 3.4 | 0.234 |

| | |
|---|---|
| 3.6 | 0.197 |
| 3.8 | 0.169 |
| 4 | 0.14 |
| 4.2 | 0.112 |
| 4.4 | 0.084 |
| 4.6 | 0.056 |
| 4.8 | 0.037 |
| 5 | 0.018 |
| 5.2 | 0 |
| 5.4 | -0.018 |
| 5.6 | -0.037 |
| 5.8 | -0.046 |
| 6 | -0.065 |
| 6.2 | -0.084 |
| 6.4 | -0.093 |
| 6.6 | -0.103 |
| 6.8 | -0.122 |
| 7 | -0.131 |
| 7.2 | -0.14 |
| 7.4 | -0.15 |
| 7.6 | -0.159 |
| 7.8 | -0.168 |
| 8 | -0.178 |
| 8.2 | -0.187 |
| 8.4 | -0.187 |
| 8.6 | -0.197 |
| 8.8 | -0.206 |
| 9 | -0.215 |
| 9.2 | -0.225 |
| 9.4 | -0.234 |
| 9.6 | -0.234 |
| 9.8 | -0.244 |
| 10 | -0.253 |
| 12 | -0.319 |

## 57M-96-11X Rising Head Test #2



| | |
|---|---|
| 0 | 0.056 |
| 0.0033 | 0.506 |
| 0.0066 | 0.572 |
| 0.01 | 0.516 |
| 0.0133 | 0.244 |
| 0.0166 | 0.028 |
| 0.02 | 0.075 |
| 0.0233 | 0.234 |
| 0.0266 | 0.112 |
| 0.03 | 0.056 |
| 0.0333 | 0.028 |
| 0.0366 | -0.056 |
| 0.04 | -0.084 |
| 0.0433 | -0.009 |
| 0.0466 | 0.272 |
| 0.05 | 0.337 |
| 0.0533 | 0.356 |
| 0.0566 | 0.197 |
| 0.06 | 0.178 |
| 0.0633 | 0.14 |
| 0.0666 | 0.168 |
| 0.07 | 0.384 |
| 0.0733 | 0.366 |
| 0.0766 | 0.281 |
| 0.08 | 0.272 |
| 0.0833 | 0.591 |
| 0.0866 | 0.938 |
| 0.09 | 0.966 |
| 0.0933 | 1.032 |
| 0.0966 | 0.985 |
| 0.1 | 0.976 |
| 0.1033 | 1.248 |
| 0.1066 | 1.332 |
| 0.11 | 1.351 |
| 0.1133 | 1.417 |
| 0.1166 | 1.539 |
| 0.12 | 1.67 |
| 0.1233 | 1.698 |
| 0.1266 | 1.792 |
| 0.13 | 1.811 |
| 0.1333 | 1.971 |
| 0.1366 | 2.13 |
| 0.14 | 2.046 |
| 0.1433 | 2.14 |
| 0.1466 | 2.168 |
| 0.15 | 2.177 |
| 0.1533 | 2.196 |
| 0.1566 | 2.158 |
| 0.16 | 2.158 |
| 0.1633 | 2.13 |
| 0.1666 | 2.102 |

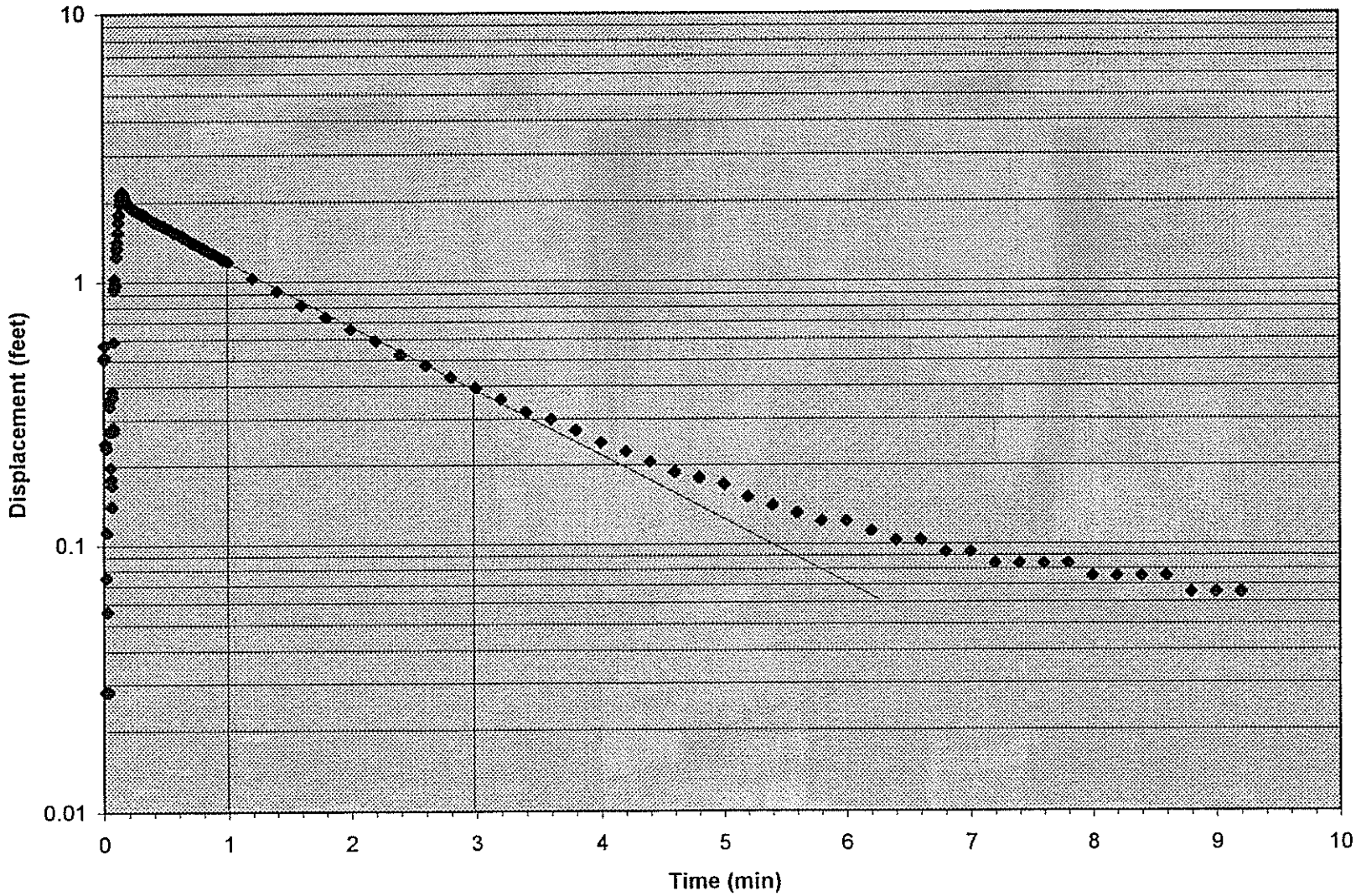
max. drawdown = 2.196 - 0.056 = 2.14 ft.

| | |
|---|---|
| 0.17 | 2.093 |
| 0.1733 | 2.074 |
| 0.1766 | 2.055 |
| 0.18 | 2.036 |
| 0.1833 | 2.027 |
| 0.1866 | 2.008 |
| 0.19 | 1.999 |
| 0.1933 | 1.98 |
| 0.1966 | 1.971 |
| 0.2 | 1.961 |
| 0.2033 | 1.952 |
| 0.2066 | 1.942 |
| 0.21 | 1.933 |
| 0.2133 | 1.924 |
| 0.2166 | 1.924 |
| 0.22 | 1.914 |
| 0.2233 | 1.905 |
| 0.2266 | 1.905 |
| 0.23 | 1.896 |
| 0.2333 | 1.886 |
| 0.2366 | 1.886 |
| 0.24 | 1.886 |
| 0.2433 | 1.877 |
| 0.2466 | 1.877 |
| 0.25 | 1.867 |
| 0.2533 | 1.867 |
| 0.2566 | 1.858 |
| 0.26 | 1.858 |
| 0.2633 | 1.858 |
| 0.2666 | 1.849 |
| 0.27 | 1.849 |
| 0.2733 | 1.839 |
| 0.2766 | 1.839 |
| 0.28 | 1.839 |
| 0.2833 | 1.83 |
| 0.2866 | 1.83 |
| 0.29 | 1.82 |
| 0.2933 | 1.82 |
| 0.2966 | 1.82 |
| 0.3 | 1.811 |
| 0.3033 | 1.811 |
| 0.3066 | 1.811 |
| 0.31 | 1.802 |
| 0.3133 | 1.802 |
| 0.3166 | 1.802 |
| 0.32 | 1.792 |
| 0.3233 | 1.792 |
| 0.3266 | 1.792 |
| 0.33 | 1.783 |
| 0.3333 | 1.783 |
| 0.35 | 1.764 |

| | |
|---|---|
| 0.3666 | 1.736 |
| 0.3833 | 1.717 |
| 0.4 | 1.698 |
| 0.4166 | 1.68 |
| 0.4333 | 1.661 |
| 0.45 | 1.651 |
| 0.4666 | 1.633 |
| 0.4833 | 1.623 |
| 0.5 | 1.605 |
| 0.5166 | 1.586 |
| 0.5333 | 1.576 |
| 0.55 | 1.558 |
| 0.5666 | 1.539 |
| 0.5833 | 1.529 |
| 0.6 | 1.511 |
| 0.6166 | 1.492 |
| 0.6333 | 1.483 |
| 0.65 | 1.464 |
| 0.6666 | 1.454 |
| 0.6833 | 1.436 |
| 0.7 | 1.417 |
| 0.7166 | 1.407 |
| 0.7333 | 1.389 |
| 0.75 | 1.379 |
| 0.7666 | 1.37 |
| 0.7833 | 1.351 |
| 0.8 | 1.342 |
| 0.8166 | 1.323 |
| 0.8333 | 1.314 |
| 0.85 | 1.295 |
| 0.8666 | 1.285 |
| 0.8833 | 1.276 |
| 0.9 | 1.267 |
| 0.9166 | 1.248 |
| 0.9333 | 1.238 |
| 0.95 | 1.22 |
| 0.9666 | 1.21 |
| 0.9833 | 1.201 |
| 1 | 1.192 |
| 1.2 | 1.032 |
| 1.4 | 0.919 |
| 1.6 | 0.816 |
| 1.8 | 0.732 |
| 2 | 0.657 |
| 2.2 | 0.591 |
| 2.4 | 0.525 |
| 2.6 | 0.478 |
| 2.8 | 0.431 |
| 3 | 0.394 |
| 3.2 | 0.356 |
| 3.4 | 0.319 |

| | |
|---|---|
| 3.6 | 0.3 |
| 3.8 | 0.272 |
| 4 | 0.244 |
| 4.2 | 0.225 |
| 4.4 | 0.206 |
| 4.6 | 0.187 |
| 4.8 | 0.178 |
| 5 | 0.168 |
| 5.2 | 0.15 |
| 5.4 | 0.14 |
| 5.6 | 0.131 |
| 5.8 | 0.122 |
| 6 | 0.122 |
| 6.2 | 0.112 |
| 6.4 | 0.103 |
| 6.6 | 0.103 |
| 6.8 | 0.093 |
| 7 | 0.093 |
| 7.2 | 0.084 |
| 7.4 | 0.084 |
| 7.6 | 0.084 |
| 7.8 | 0.084 |
| 8 | 0.075 |
| 8.2 | 0.075 |
| 8.4 | 0.075 |
| 8.6 | 0.075 |
| 8.8 | 0.065 |
| 9 | 0.065 |
| 9.2 | 0.065 |

## 57M-96-12X Rising Head Test #1



| | |
|---|---|
| 0 | 0.018 |
| 0.0033 | 0.244 |
| 0.0066 | 0.431 |
| 0.01 | 0.422 |
| 0.0133 | 0.206 |
| 0.0166 | -0.056 |
| 0.02 | -0.028 |
| 0.0233 | 0.037 |
| 0.0266 | 0.215 |
| 0.03 | 0.225 |
| 0.0333 | 0.272 |
| 0.0366 | 0.488 |
| 0.04 | 0.525 |
| 0.0433 | 0.309 |
| 0.0466 | 0.131 |
| 0.05 | 0.441 |
| 0.0533 | 0.75 |
| 0.0566 | 0.497 |
| 0.06 | 0.816 |
| 0.0633 | 0.994 |
| 0.0666 | 0.732 |
| 0.07 | 1.436 |
| 0.0733 | 1.558 |
| 0.0766 | 1.201 |
| 0.08 | 1.914 |
| 0.0833 | 2.224 |
| 0.0866 | 1.867 |
| 0.09 | 2.243 |
| 0.0933 | 2.506 |
| 0.0966 | 2.271 |
| 0.1 | 2.158 |
| 0.1033 | 2.271 |
| 0.1066 | 2.215 |
| 0.11 | 2.14 |
| 0.1133 | 2.177 |
| 0.1166 | 2.158 |
| 0.12 | 2.102 |
| 0.1233 | 2.102 |
| 0.1266 | 2.093 |
| 0.13 | 2.064 |
| 0.1333 | 2.046 |
| 0.1366 | 2.046 |
| 0.14 | 2.018 |
| 0.1433 | 2.008 |
| 0.1466 | 1.999 |
| 0.15 | 1.989 |
| 0.1533 | 1.98 |
| 0.1566 | 1.98 |
| 0.16 | 1.961 |
| 0.1633 | 1.952 |
| 0.1666 | 1.952 |

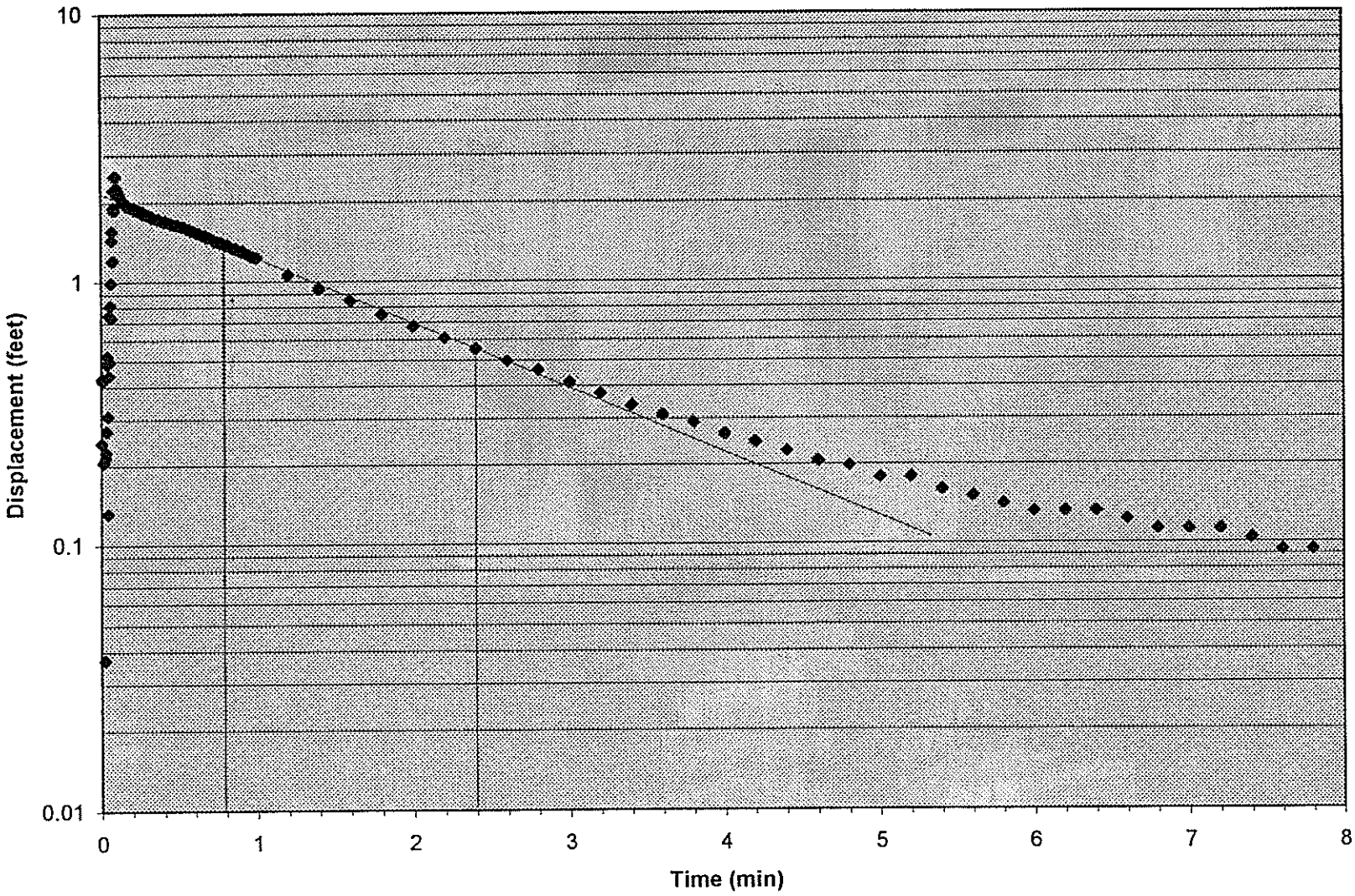
max. drawdown = 2.506 - 0.018 = 2.49 ft.

| | |
|---|---|
| 0.17 | 1.942 |
| 0.1733 | 1.942 |
| 0.1766 | 1.942 |
| 0.18 | 1.933 |
| 0.1833 | 1.933 |
| 0.1866 | 1.924 |
| 0.19 | 1.914 |
| 0.1933 | 1.914 |
| 0.1966 | 1.905 |
| 0.2 | 1.905 |
| 0.2033 | 1.905 |
| 0.2066 | 1.905 |
| 0.21 | 1.896 |
| 0.2133 | 1.896 |
| 0.2166 | 1.886 |
| 0.22 | 1.886 |
| 0.2233 | 1.886 |
| 0.2266 | 1.877 |
| 0.23 | 1.877 |
| 0.2333 | 1.867 |
| 0.2366 | 1.867 |
| 0.24 | 1.858 |
| 0.2433 | 1.858 |
| 0.2466 | 1.858 |
| 0.25 | 1.849 |
| 0.2533 | 1.849 |
| 0.2566 | 1.849 |
| 0.26 | 1.839 |
| 0.2633 | 1.83 |
| 0.2666 | 1.839 |
| 0.27 | 1.83 |
| 0.2733 | 1.83 |
| 0.2766 | 1.82 |
| 0.28 | 1.82 |
| 0.2833 | 1.811 |
| 0.2866 | 1.811 |
| 0.29 | 1.811 |
| 0.2933 | 1.792 |
| 0.2966 | 1.792 |
| 0.3 | 1.792 |
| 0.3033 | 1.792 |
| 0.3066 | 1.783 |
| 0.31 | 1.783 |
| 0.3133 | 1.773 |
| 0.3166 | 1.773 |
| 0.32 | 1.773 |
| 0.3233 | 1.764 |
| 0.3266 | 1.764 |
| 0.33 | 1.755 |
| 0.3333 | 1.755 |
| 0.35 | 1.736 |

| | |
|---|---|
| 0.3666 | 1.727 |
| 0.3833 | 1.708 |
| 0.4 | 1.698 |
| 0.4166 | 1.689 |
| 0.4333 | 1.68 |
| 0.45 | 1.661 |
| 0.4666 | 1.651 |
| 0.4833 | 1.642 |
| 0.5 | 1.633 |
| 0.5166 | 1.614 |
| 0.5333 | 1.614 |
| 0.55 | 1.586 |
| 0.5666 | 1.576 |
| 0.5833 | 1.558 |
| 0.6 | 1.548 |
| 0.6166 | 1.529 |
| 0.6333 | 1.52 |
| 0.65 | 1.501 |
| 0.6666 | 1.492 |
| 0.6833 | 1.473 |
| 0.7 | 1.464 |
| 0.7166 | 1.445 |
| 0.7333 | 1.426 |
| 0.75 | 1.417 |
| 0.7666 | 1.407 |
| 0.7833 | 1.398 |
| 0.8 | 1.379 |
| 0.8166 | 1.37 |
| 0.8333 | 1.351 |
| 0.85 | 1.332 |
| 0.8666 | 1.332 |
| 0.8833 | 1.314 |
| 0.9 | 1.304 |
| 0.9166 | 1.295 |
| 0.9333 | 1.276 |
| 0.95 | 1.267 |
| 0.9666 | 1.248 |
| 0.9833 | 1.238 |
| 1 | 1.229 |
| 1.2 | 1.06 |
| 1.4 | 0.938 |
| 1.6 | 0.844 |
| 1.8 | 0.75 |
| 2 | 0.675 |
| 2.2 | 0.61 |
| 2.4 | 0.553 |
| 2.6 | 0.497 |
| 2.8 | 0.459 |
| 3 | 0.413 |
| 3.2 | 0.375 |
| 3.4 | 0.337 |

| | |
|---|---|
| 3.6 | 0.309 |
| 3.8 | 0.29 |
| 4 | 0.262 |
| 4.2 | 0.244 |
| 4.4 | 0.225 |
| 4.6 | 0.206 |
| 4.8 | 0.197 |
| 5 | 0.178 |
| 5.2 | 0.178 |
| 5.4 | 0.159 |
| 5.6 | 0.15 |
| 5.8 | 0.14 |
| 6 | 0.131 |
| 6.2 | 0.131 |
| 6.4 | 0.131 |
| 6.6 | 0.122 |
| 6.8 | 0.112 |
| 7 | 0.112 |
| 7.2 | 0.112 |
| 7.4 | 0.103 |
| 7.6 | 0.093 |
| 7.8 | 0.093 |

## 57M-96-12X Rising Head Test #2



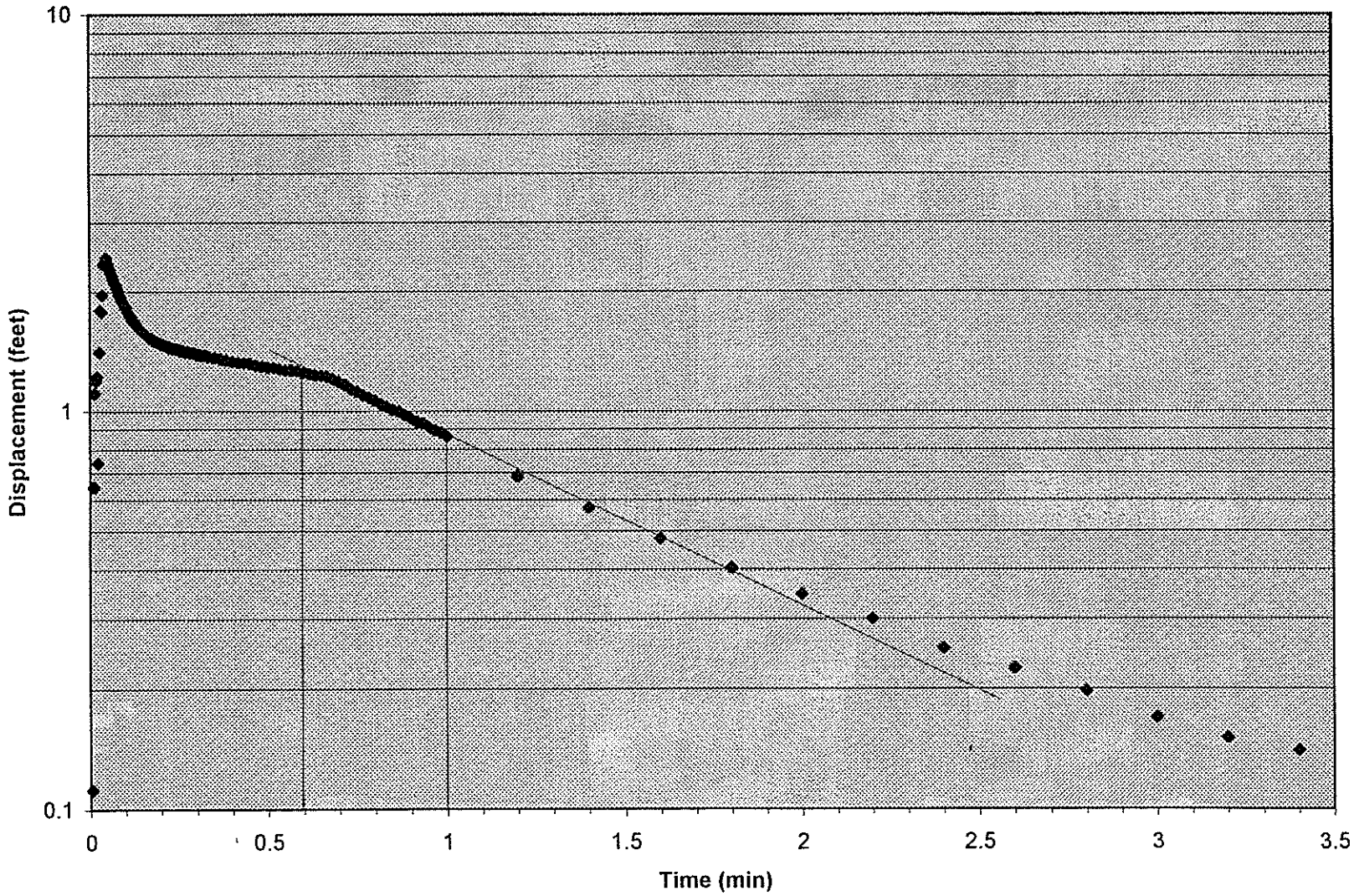
| | |
|---|---|
| 0 | 0.028 |
| 0.0033 | 0.028 |
| 0.0066 | 0.112 |
| 0.01 | 0.647 |
| 0.0133 | 1.107 |
| 0.0166 | 1.192 |
| 0.02 | 1.22 |
| 0.0233 | 0.741 |
| 0.0266 | 1.407 |
| 0.03 | 1.792 |
| 0.0333 | 1.783 |
| 0.0366 | 1.961 |
| 0.04 | 2.355 |
| 0.0433 | 2.393 |
| 0.0466 | 2.44 |
| 0.05 | 2.365 |
| 0.0533 | 2.327 |
| 0.0566 | 2.28 |
| 0.06 | 2.233 |
| 0.0633 | 2.196 |
| 0.0666 | 2.158 |
| 0.07 | 2.111 |
| 0.0733 | 2.083 |
| 0.0766 | 2.046 |
| 0.08 | 2.008 |
| 0.0833 | 1.971 |
| 0.0866 | 1.942 |
| 0.09 | 1.905 |
| 0.0933 | 1.886 |
| 0.0966 | 1.858 |
| 0.1 | 1.83 |
| 0.1033 | 1.83 |
| 0.1066 | 1.783 |
| 0.11 | 1.764 |
| 0.1133 | 1.745 |
| 0.1166 | 1.727 |
| 0.12 | 1.708 |
| 0.1233 | 1.689 |
| 0.1266 | 1.67 |
| 0.13 | 1.661 |
| 0.1333 | 1.642 |
| 0.1366 | 1.633 |
| 0.14 | 1.614 |
| 0.1433 | 1.605 |
| 0.1466 | 1.595 |
| 0.15 | 1.586 |
| 0.1533 | 1.576 |
| 0.1566 | 1.567 |
| 0.16 | 1.558 |
| 0.1633 | 1.548 |
| 0.1666 | 1.539 |

max. drawdown = 2.44 - 0.028 = 2.41 ft.

| | |
|---|---|
| 0.17 | 1.53 |
| 0.1733 | 1.53 |
| 0.1766 | 1.52 |
| 0.18 | 1.511 |
| 0.1833 | 1.501 |
| 0.1866 | 1.501 |
| 0.19 | 1.492 |
| 0.1933 | 1.492 |
| 0.1966 | 1.483 |
| 0.2 | 1.483 |
| 0.2033 | 1.473 |
| 0.2066 | 1.473 |
| 0.21 | 1.464 |
| 0.2133 | 1.464 |
| 0.2166 | 1.464 |
| 0.22 | 1.454 |
| 0.2233 | 1.445 |
| 0.2266 | 1.445 |
| 0.23 | 1.445 |
| 0.2333 | 1.436 |
| 0.2366 | 1.436 |
| 0.24 | 1.436 |
| 0.2433 | 1.436 |
| 0.2466 | 1.426 |
| 0.25 | 1.426 |
| 0.2533 | 1.426 |
| 0.2566 | 1.417 |
| 0.26 | 1.417 |
| 0.2633 | 1.417 |
| 0.2666 | 1.407 |
| 0.27 | 1.407 |
| 0.2733 | 1.407 |
| 0.2766 | 1.407 |
| 0.28 | 1.407 |
| 0.2833 | 1.398 |
| 0.2866 | 1.398 |
| 0.29 | 1.398 |
| 0.2933 | 1.398 |
| 0.2966 | 1.398 |
| 0.3 | 1.389 |
| 0.3033 | 1.389 |
| 0.3066 | 1.389 |
| 0.31 | 1.379 |
| 0.3133 | 1.379 |
| 0.3166 | 1.379 |
| 0.32 | 1.379 |
| 0.3233 | 1.379 |
| 0.3266 | 1.379 |
| 0.33 | 1.379 |
| 0.3333 | 1.37 |
| 0.35 | 1.361 |

| | |
|---|---|
| 0.3666 | 1.351 |
| 0.3833 | 1.342 |
| 0.4 | 1.332 |
| 0.4166 | 1.323 |
| 0.4333 | 1.323 |
| 0.45 | 1.314 |
| 0.4666 | 1.304 |
| 0.4833 | 1.295 |
| 0.5 | 1.285 |
| 0.5166 | 1.285 |
| 0.5333 | 1.276 |
| 0.55 | 1.267 |
| 0.5666 | 1.267 |
| 0.5833 | 1.257 |
| 0.6 | 1.248 |
| 0.6166 | 1.239 |
| 0.6333 | 1.229 |
| 0.65 | 1.229 |
| 0.6666 | 1.22 |
| 0.6833 | 1.201 |
| 0.7 | 1.182 |
| 0.7166 | 1.163 |
| 0.7333 | 1.135 |
| 0.75 | 1.117 |
| 0.7666 | 1.098 |
| 0.7833 | 1.079 |
| 0.8 | 1.06 |
| 0.8166 | 1.041 |
| 0.8333 | 1.023 |
| 0.85 | 1.004 |
| 0.8666 | 0.995 |
| 0.8833 | 0.976 |
| 0.9 | 0.957 |
| 0.9166 | 0.938 |
| 0.9333 | 0.929 |
| 0.95 | 0.91 |
| 0.9666 | 0.891 |
| 0.9833 | 0.882 |
| 1 | 0.863 |
| 1.2 | 0.685 |
| 1.4 | 0.572 |
| 1.6 | 0.478 |
| 1.8 | 0.403 |
| 2 | 0.347 |
| 2.2 | 0.3 |
| 2.4 | 0.253 |
| 2.6 | 0.225 |
| 2.8 | 0.197 |
| 3 | 0.169 |
| 3.2 | 0.15 |
| 3.4 | 0.14 |

## 57M-96-13X Rising Head Test #1



57M-96-13X Rising Head Test #2

| | |
|---|---|
| 0 | 0.741 |
| 0.0033 | 1.989 |
| 0.0066 | 2.609 |
| 0.01 | 1.896 |
| 0.0133 | 1.464 |
| 0.0166 | 2.29 |
| 0.02 | 2.675 |
| 0.0233 | 2.524 |
| 0.0266 | 3.022 |
| 0.03 | 3.078 |
| 0.0333 | 3.003 |
| 0.0366 | 2.947 |
| 0.04 | 2.9 |
| 0.0433 | 2.853 |
| 0.0466 | 2.815 |
| 0.05 | 2.778 |
| 0.0533 | 2.74 |
| 0.0566 | 2.693 |
| 0.06 | 2.656 |
| 0.0633 | 2.628 |
| 0.0666 | 2.59 |
| 0.07 | 2.562 |
| 0.0733 | 2.524 |
| 0.0766 | 2.496 |
| 0.08 | 2.468 |
| 0.0833 | 2.44 |
| 0.0866 | 2.412 |
| 0.09 | 2.393 |
| 0.0933 | 2.374 |
| 0.0966 | 2.346 |
| 0.1 | 2.327 |
| 0.1033 | 2.309 |
| 0.1066 | 2.299 |
| 0.11 | 2.28 |
| 0.1133 | 2.262 |
| 0.1166 | 2.252 |
| 0.12 | 2.243 |
| 0.1233 | 2.224 |
| 0.1266 | 2.215 |
| 0.13 | 2.205 |
| 0.1333 | 2.196 |
| 0.1366 | 2.177 |
| 0.14 | 2.177 |
| 0.1433 | 2.158 |
| 0.1466 | 2.158 |
| 0.15 | 2.149 |
| 0.1533 | 2.14 |
| 0.1566 | 2.14 |
| 0.16 | 2.13 |
| 0.1633 | 2.121 |
| 0.1666 | 2.111 |

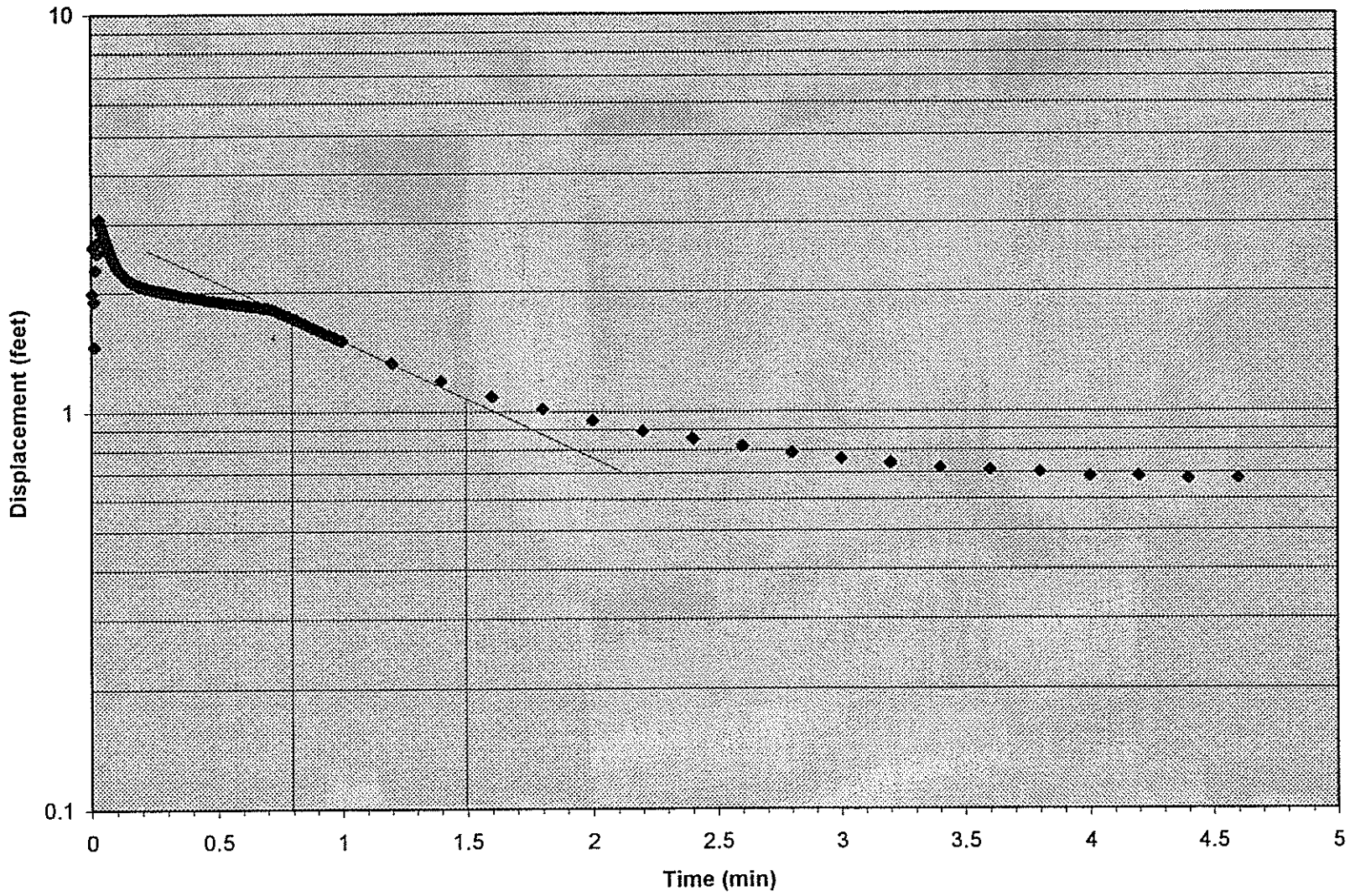
max. drawdown = 3.078 - 0.675 = 2.40 ft

| | |
|---|---|
| 0.17 | 2.111 |
| 0.1733 | 2.102 |
| 0.1766 | 2.102 |
| 0.18 | 2.093 |
| 0.1833 | 2.093 |
| 0.1866 | 2.083 |
| 0.19 | 2.083 |
| 0.1933 | 2.074 |
| 0.1966 | 2.074 |
| 0.2 | 2.064 |
| 0.2033 | 2.074 |
| 0.2066 | 2.064 |
| 0.21 | 2.055 |
| 0.2133 | 2.055 |
| 0.2166 | 2.046 |
| 0.22 | 2.055 |
| 0.2233 | 2.046 |
| 0.2266 | 2.046 |
| 0.23 | 2.046 |
| 0.2333 | 2.036 |
| 0.2366 | 2.036 |
| 0.24 | 2.036 |
| 0.2433 | 2.027 |
| 0.2466 | 2.027 |
| 0.25 | 2.027 |
| 0.2533 | 2.027 |
| 0.2566 | 2.018 |
| 0.26 | 2.018 |
| 0.2633 | 2.018 |
| 0.2666 | 2.018 |
| 0.27 | 2.018 |
| 0.2733 | 2.018 |
| 0.2766 | 2.008 |
| 0.28 | 2.008 |
| 0.2833 | 1.999 |
| 0.2866 | 2.008 |
| 0.29 | 1.999 |
| 0.2933 | 1.999 |
| 0.2966 | 1.999 |
| 0.3 | 1.999 |
| 0.3033 | 1.999 |
| 0.3066 | 1.989 |
| 0.31 | 1.989 |
| 0.3133 | 1.989 |
| 0.3166 | 1.989 |
| 0.32 | 1.989 |
| 0.3233 | 1.98 |
| 0.3266 | 1.98 |
| 0.33 | 1.98 |
| 0.3333 | 1.98 |
| 0.35 | 1.961 |

| | |
|---|---|
| 0.3666 | 1.952 |
| 0.3833 | 1.952 |
| 0.4 | 1.942 |
| 0.4166 | 1.933 |
| 0.4333 | 1.924 |
| 0.45 | 1.914 |
| 0.4666 | 1.905 |
| 0.4833 | 1.905 |
| 0.5 | 1.896 |
| 0.5166 | 1.886 |
| 0.5333 | 1.877 |
| 0.55 | 1.877 |
| 0.5666 | 1.867 |
| 0.5833 | 1.858 |
| 0.6 | 1.858 |
| 0.6166 | 1.849 |
| 0.6333 | 1.839 |
| 0.65 | 1.839 |
| 0.6666 | 1.83 |
| 0.6833 | 1.82 |
| 0.7 | 1.82 |
| 0.7166 | 1.811 |
| 0.7333 | 1.792 |
| 0.75 | 1.773 |
| 0.7666 | 1.755 |
| 0.7833 | 1.736 |
| 0.8 | 1.717 |
| 0.8166 | 1.698 |
| 0.8333 | 1.68 |
| 0.85 | 1.661 |
| 0.8666 | 1.642 |
| 0.8833 | 1.623 |
| 0.9 | 1.605 |
| 0.9166 | 1.586 |
| 0.9333 | 1.567 |
| 0.95 | 1.558 |
| 0.9666 | 1.539 |
| 0.9833 | 1.52 |
| 1 | 1.511 |
| 1.2 | 1.323 |
| 1.4 | 1.192 |
| 1.6 | 1.088 |
| 1.8 | 1.013 |
| 2 | 0.947 |
| 2.2 | 0.891 |
| 2.4 | 0.854 |
| 2.6 | 0.816 |
| 2.8 | 0.788 |
| 3 | 0.76 |
| 3.2 | 0.741 |
| 3.4 | 0.722 |

| | |
|---|---|
| 3.6 | 0.713 |
| 3.8 | 0.703 |
| 4 | 0.685 |
| 4.2 | 0.685 |
| 4.4 | 0.675 |
| 4.6 | 0.675 |

## 57M-96-13X Rising Head Test #2



# HYDRAULIC GRADIENT AND GROUNDWATER FLOW VELOCITY CALCULATIONS

ESTIMATES OF GROUNDWATER FLOW VELOCITY

$$V = \frac{Ki}{n}$$

NY_
V = Average Linear Velocity
K = Hydraulic Conductivity
L = Horizontal Conductivity
N = Porosity

**AREA 2**

Maximum Estimate

K = 2.4 x $10^{-1}$ ft/min = 345.6 feet/day
i = 0.0127 ft/ft maximum mean (July 23, 1996)
n = 0.3

$$V = \frac{(345.6 \text{ ft/day})\ (0.0127\text{ft/ft})}{0.3} = 14 \text{ feet/day}$$

Minimum Estimate

K = 8.3 x $10^{-4}$ ft/min = 1.19 ft/day (Bouwer and Rice Method 57m.95.08A)
i = 0.0095 Minimum Mean (Dec. 7, 1995)
n = 0.3

$$V = \frac{(1.19 \text{ ft/day})(0.0095 \text{ ft/ft})}{0.3} = 0.038 \text{ ft/day}$$

Mean

K = 3.24 x $10^{-2}$ ft/min = 46.7 ft/day
i = 0.01 ft/ft
n = 0.3

$$V = \frac{(46.7)\ (0.01 ft/ft)}{0.3} = 1.56\ ft/day$$

**AREA 3**

Minimum Estimate

K = 1.36 x $10^{-3}$ ft/min = 1.96 ft/day (as determined by Bouwer & Rice at 57m.96.10X)
i = 0.022 ft/ft mean of Jean. 15 gradients
n = 0.3

$$V = \frac{(1.96\ ft/day)\ (0.022)}{0.3} = 0.14\ ft/day$$

Maximum Estimate

K = 1.1 x $10^{-2}$ ft/min = 15.84 feet/day (as determined by Bouwer & Rich at 57m.95.03x)
i = 0.022 ft/ft
n = 0.3

$$V = \frac{(15.84\ ft/day)\ (0.022\ ft/ft)}{0.3} = 1.16\ feet/day$$

Mean

$K = 3.54 \times 10^{-3}$ ft/min = 5.1 ft/day
i = 0.022 ft/ft
n = 0.3

$$V = \frac{(5.1 \text{ ft/day})\ (0.022)}{0.3} = 0.37 \text{ ft/day}$$

# HYDRAULIC GRADIENT CALCULATIONS
## AOC 57 AREA 2

| Distance between wells | | December 7, 1995 Water Elevation (msl) | δh | / | Dist | = | Horizontal Gradient i | |
|---|---|---|---|---|---|---|---|---|
| G3M-92-02X | | 224.72 | | | | | | |
| | 456 ft | | 2.75 | / | 456 | = | **0.006** | |
| 57M-95-05X | | 221.97 | | | | | | |
| 57M-95-06X | | 223 | | | | | | |
| | 118 ft | | 1.81 | / | 118 | = | **0.015** | |
| 57M-95-08A | | 221.19 | | | | | | |
| G3M-92-02X | | 224.72 | | | | | | |
| | 564 ft | | 5.22 | / | 564 | = | **0.009** | |
| 57P-95-01A | | 219.5 | | | | | | |

| | |
|---|---|
| **Average** | **0.010** |
| **Geo. Mean** | **0.009** |
| **Median** | **0.009** |

**Vertical Gradients**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 57P-95-01A | | 219.5 | | | | | | |
| | 9 ft* | | 0.25 | / | 9 | = | **0.028** | upward |
| 57P-95-01B | | 219.75 | | | | | | |
| 57M-95-04A | | 220.82 | | | | | | |
| | 16.4 ft* | | 0.01 | | 16.4 | | **0.001** | upward |
| 57M-95-04B | | 220.83 | | | | | | |
| 57M-95-08A | | 221.19 | | | | | | |
| | 15.5 ft* | | 0.18 | | 15.5 | | **0.012** | downward |
| 57M-95-08B | | 221.01 | | | | | | |

Notes: * : Distance seperating middle of well screens
msl mean sea level

# HYDRAULIC GRADIENT CALCULATIONS
## AOC 57 AREA 2

| Distance between wells | | March 26, 1996 Water Elevation (msl) | δh | / | Dist | = | Horizontal Gradient i | |
|---|---|---|---|---|---|---|---|---|
| G3M-92-02X | | 225.5 | | | | | | |
| | 456 ft | | 3.08 | / | 456 | = | **0.007** | |
| 57M-95-05X | | 222.42 | | | | | | |
| 57M-95-06X | | 223.75 | | | | | | |
| | 118 ft | | 2.28 | / | 118 | = | **0.019** | |
| 57M-95-08A | | 221.47 | | | | | | |
| G3M-92-02X | | 225.5 | | | | | | |
| | 564 ft | | 4.85 | / | 564 | = | **0.009** | |
| 57P-95-01A | | 220.65 | | | | | | |
| | | | | | **Average** | | **0.012** | |
| | | | | | **Geo. Mean** | | **0.010** | |
| | | | | | **Median** | | **0.009** | |
| **Vertical Gradients** | | | | | | | | |
| 57P-95-01A | | 220.65 | | | | | | |
| | 9 ft* | | 0.28 | / | 9 | = | **0.031** | **upward** |
| 57P-95-01B | | 220.93 | | | | | | |
| 57M-95-04A | | 221.11 | | | | | | |
| | 16.4 ft* | | 0.02 | / | 16.4 | = | **0.001** | **upward** |
| 57M-95-04B | | 221.13 | | | | | | |
| 57M-95-08A | | 221.47 | | | | | | |
| | 15.5 ft* | | 0.11 | / | 15.5 | = | **0.007** | **downward** |
| 57M-95-08B | | 221.36 | | | | | | |

Notes:
* : Distance seperating middle of well screens
msl mean sea level

# HYDRAULIC GRADIENT CALCULATIONS
## AOC 57 AREA 2

| Distance between wells | | July 23, 1996 Water Elevation (msl) | δh | / | Dist | = | Horizontal Gradient i | |
|---|---|---|---|---|---|---|---|---|
| G3M-92-02X | | 226.19 | | | | | | |
| | 456 ft | | 4.65 | / | 456 | = | **0.010** | |
| 57M-95-05X | | 221.54 | | | | | | |
| 57M-95-06X | | 223.84 | | | | | | |
| | 118 ft | | 2.39 | / | 118 | = | **0.020** | |
| 57M-95-08A | | 221.45 | | | | | | |
| G3M-92-02X | | 226.19 | | | | | | |
| | 564 ft | | 5.56 | / | 564 | = | **0.010** | |
| 57P-95-01A | | 220.63 | | | | | | |
| | | | | | **Average** | | **0.013** | |
| | | | | | **Geo. Mean** | | **0.013** | |
| | | | | | **Median** | | **0.010** | |
| **Vertical Gradients** | | | | | | | | |
| 57P-95-01A | | 220.63 | | | | | | |
| | 9 ft* | | 0.29 | / | 9 | = | **0.032** | **upward** |
| 57P-95-01B | | 220.92 | | | | | | |
| 57M-95-04A | | 221.08 | | | | | | |
| | 16.4 ft* | | 0.01 | / | 16.4 | = | **0.001** | **upward** |
| 57M-95-04B | | 221.09 | | | | | | |
| 57M-95-08A | | 221.45 | | | | | | |
| | 15.5 ft* | | 0.1 | / | 15.5 | = | **0.006** | **downward** |
| 57M-95-08B | | 221.35 | | | | | | |

Notes: * : Distance seperating middle of well screens
msl mean sea level

# HYDRAULIC GRADIENT CALCULATIONS
## AOC 57 AREA 2

| Distance between wells | | January 15,1997 Water Elevation (msl) | δh | / | Dist | = | Horizontal Gradient i | |
|---|---|---|---|---|---|---|---|---|
| G3M-92-02X | | 226.71 | | | | | | |
| | 456 ft | | 3.89 | / | 456 | = | **0.009** | |
| 57M-95-05X | | 222.82 | | | | | | |
| 57M-95-06X | | 224.15 | | | | | | |
| | 118 ft | | 2.48 | / | 118 | = | **0.021** | |
| 57M-95-08A | | 221.67 | | | | | | |
| G3M-92-02X | | 226.71 | | | | | | |
| | 564 ft | | 6 | / | 564 | = | **0.011** | |
| 57P-95-01A | | 220.71 | | | | | | |

| | |
|---|---|
| **Average** | **0.013** |
| **Geo. Mean** | **0.012** |
| **Median** | **0.011** |

**Vertical Gradients**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 57P-95-01A | | 220.71 | | | | | | |
| | 9 ft* | | 0.35 | / | 9 | = | **0.039** | **upward** |
| 57P-95-01B | | 221.06 | | | | | | |
| 57M-95-04A | | 221.25 | | | | | | |
| | 16.4 ft* | | 0.02 | / | 16.4 | = | **0.001** | **upward** |
| 57M-95-04B | | 221.27 | | | | | | |
| 57M-95-08A | | 221.67 | | | | | | |
| | 15.5 ft* | | 0.1 | / | 15.5 | = | **0.006** | **downward** |
| 57M-95-08B | | 221.57 | | | | | | |

Notes: * : Distance seperating middle of well screens
msl mean sea level

## HYDRAULIC GRADIENT CALCULATIONS
## AOC 57 AREA 3

| Distance between wells | | January 15,1997 Water Elevation (msl) | δh | / | Dist | = | Horizontal Gradient i |
|---|---|---|---|---|---|---|---|
| 57M-96-09X | | 225.97 | | | | | |
| | 226 ft | | 4.88 | / | 226 | = | **0.022** |
| 57M-96-11X | | 221.09 | | | | | |
| 57M-96-09X | | 225.97 | | | | | |
| | 180 ft | | 2.49 | / | 180 | = | **0.014** |
| 57M-96-12X | | 223.48 | | | | | |
| 57M-95-03X | | 224.88 | | | | | |
| | 105 ft | | 3.79 | / | 105 | = | **0.036** |
| 57M-96-11X | | 221.09 | | | | | |

| | |
|---|---|
| **Average** | **0.024** |
| **Geo. Mean** | **0.022** |
| **Median** | **0.022** |

Notes: msl mean sea level

| HYDRAULIC GRADIENT CALCULATIONS | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AOC 57 AREA 2 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | June 2, 1997 | | | | | | Horizontal | | | |
| Distance between wells | | | | Water Levels | | | | | | Gradient | | | |
| | | | | | | δh | / | Dist | = | i | | | |
| G3M-92-02X | | : | | 226.79 | | | | | | | | | |
| | 456 | ft | | | | 3.99 | / | 456 | = | **0.00875** | | | |
| 57M-95-05X | | | | 222.8 | | | | | | | | | |
| | | | | | | | | | | | | | |
| 57M-95-06X | | : | | 224.04 | | | | | | | | | |
| | 118 | ft | | | | 2.46 | / | 118 | = | **0.020847** | | | |
| 57M-95-08A | | | | 221.58 | | | | | | | | | |
| | | | | | | | | | | | | | |
| G3M-92-02X | | | | 226.79 | | | | | | | | | |
| | 564 | ft | | | | 6.09 | / | 564 | = | **0.010798** | | | |
| 57P-95-01A | | | | 220.7 | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | **Average** | | **0.013465** | | | |
| **Vertical Gradients** | | | | | | | | **Geo. Mean** | | **0.012535** | | | |
| | | | | | | | | **Median** | | **0.010798** | | | |
| 57P-95-01A | | : | | 220.7 | | | | | | | | | |
| | 9 | ft* | | | | 0.34 | / | 9 | = | **0.037778** | **upward** | | |
| 57P-95-01B | | | | 221.04 | | | | | | | | | |
| | | | | | | | | | | | | | |
| 57M-95-04A | | | | 221.25 | | | | | | | | | |
| | 16.4 | ft* | | | | 0.04 | / | 16.4 | = | **0.002439** | **upward** | | |
| 57M-95-04B | | | | 221.29 | | | | | | | | | |
| | | | | | | | | | | | | | |
| 57M-95-08A | | : | | 221.58 | | | | | | | | | |
| | 15.5 | ft* | | | | 0.03 | / | 15.5 | = | **0.001935** | **downward** | | |
| 57M-95-08B | | | | 221.55 | | | | | | | | | |
| | | | | | | | | | | | | | |
| Notes: | * | : | Distance seperating middle of well screens | | | | | | | | | | |

| HYDRAULIC GRADIENT CALCULATIONS | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AOC 57 AREA 3 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | June 2, 1997 | | | | | | Horizontal | | | |
| Distance between wells | | | | Water Levels | | | | | | Gradient | | | |
| | | | | | | δh | / | Dist | = | i | | | |
| 57M-96-09X | | | | 225.82 | | | | | | | | | |
| | 226 | ft | | | | 4.81 | / | 226 | = | 0.021283 | | | |
| 57M-96-11X | | | | 221.01 | | | | | | | | | |
| | | | | | | | | | | | | | |
| 57M-96-09X | | | | 225.82 | | | | | | | | | |
| | 180 | ft | | | | 2.42 | / | 180 | = | 0.013444 | | | |
| 57M-96-12X | | | | 223.4 | | | | | | | | | |
| | | | | | | | | | | | | | |
| 57M-95-03X | | | | 224.55 | | | | | | | | | |
| | 105 | ft | | | | 3.54 | / | 105 | = | 0.033714 | | | |
| 57M-96-11X | | | | 221.01 | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | Average | | 0.022814 | | | |
| | | | | | | | | Geo. Mean | | 0.021288 | | | |
| | | | | | | | | Median | | 0.021283 | | | |

| HYDRAULIC GRADIENT CALCULATIONS | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AOC 57 AREA 2 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | September 23, 1998 | | | | | | Horizontal | | | |
| Distance between wells | | | | Water Levels | | | | | | Gradient | | | |
| | | | | | | δh | / | Dist | = | i | | | |
| G3M-92-02X | | | | 225.74 | | | | | | | | | |
| | 456 | ft | | | | 3.2 | / | 456 | = | **0.007018** | | | |
| 57M-95-05X | | | | 222.54 | | | | | | | | | |
| | | | | | | | | | | | | | |
| 57M-95-06X | | | | 223.5 | | | | | | | | | |
| | 118 | ft | | | | 1.85 | / | 118 | = | **0.015678** | | | |
| 57M-95-08A | | | | 221.65 | | | | | | | | | |
| | | | | | | | | | | | | | |
| G3M-92-02X | | | | 225.74 | | | | | | | | | |
| | 564 | ft | | | | 5.07 | / | 564 | = | **0.008989** | | | |
| 57P-95-01A | | | | 220.67 | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | **Average** | | **0.010562** | | | |
| **Vertical Gradients** | | | | | | | | **Geo. Mean** | | **0.009963** | | | |
| | | | | | | | | **Median** | | **0.008989** | | | |
| 57P-95-01A | | | | 220.67 | | | | | | | | | |
| | 9 | ft* | | | | 0.28 | / | 9 | = | **0.031111** | **upward** | | |
| 57P-95-01B | | | | 220.95 | | | | | | | | | |
| | | | | | | | | | | | | | |
| 57M-95-04A | | | | 221.19 | | | | | | | | | |
| | 16.4 | ft* | | | | 0.01 | / | 16.4 | = | **0.00061** | **downward** | | |
| 57M-95-04B | | | | 221.18 | | | | | | | | | |
| | | | | | | | | | | | | | |
| 57M-95-08A | | | | 221.65 | | | | | | | | | |
| | 15.5 | ft* | | | | 0.3 | / | 15.5 | = | **0.019355** | **downward** | | |
| 57M-95-08B | | | | 221.35 | | | | | | | | | |
| | | | | | | | | | | | | | |
| Notes: | * | : | Distance seperating middle of well screens | | | | | | | | | | |

| HYDRAULIC GRADIENT CALCULATIONS | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AOC 57 AREA 3 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | September 23, 1998 | | | | | | Horizontal | | | |
| Distance between wells | | | | Water Levels | | | | | | Gradient | | | |
| | | | | | | δh | / | Dist | = | i | | | |
| 57M-96-09X | | | | 224.54 | | | | | | | | | |
| | 226 | ft | | | | 3.32 | / | 226 | = | **0.01469** | | | |
| 57M-96-11X | | | | 221.22 | | | | | | | | | |
| | | | | | | | | | | | | | |
| 57M-96-09X | | | | 224.54 | | | | | | | | | |
| | 180 | ft | | | | 1.48 | / | 180 | = | **0.008222** | | | |
| 57M-96-12X | | | | 223.06 | | | | | | | | | |
| | | | | | | | | | | | | | |
| 57M-95-03X | | | | 224.31 | | | | | | | | | |
| | 105 | ft | | | | 3.09 | / | 105 | = | **0.029429** | | | |
| 57M-96-11X | | | | 221.22 | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | **Average** | | **0.017447** | | | |
| | | | | | | | | **Geo. Mean** | | **0.015261** | | | |
| | | | | | | | | **Median** | | **0.01469** | | | |

# WELL DEVELOPMENT RECORDS

# WELL DEVELOPMENT RECORD

| | | | |
|---|---|---|---|
| Project: Ft. Devens | Well Installation Date: ~~10~~ 09/22/95 | | Project No. 09144-02 |
| Client: USAEC | Well Development Date: 10/4/95 | Developed by: M. Lounsbury | Checked by:- |
| Well/Site I.D.: 57M-91-01Y | Weather: Rain, 65° | Start Date: 10/4/95 | Finish Date: 10/4/95 |
| | | Start Time: 1300 | Finish Time: 12 |

Well Construction Record Data:

Well Diameter: 4 in.

Bottom of Screen: 29 ft. — From Ground Surface ☒ From top of Riser ☐

Sediment Sump/Plug: N/A ft.

Screen Length: 10 ft.

Fluids Lost During Drilling: N/A gal.

Protective Casing Stick-up: 2.10 ft. Protective Casing/Well Diff.: -0.30 ft.

PID Readings: Ambient Air 0 ppm; Well Mouth 0 ppm

Water Levels:

Initial: 24.61 ft.

End of Development: 24.62 ft.

24 Hrs. After Development: ft. — Not measured

Sediment:

Well Depth Before Development: 30.81 ft. (from top of PVC)

Well Depth After Development: 30.81 ft.

Sediment Depth Removed: 0 ft.

HT of Water Column: 6.2 ft. x ☐ 1.68* ☐ ____ = 10 gal./vol. *For 4" HSA installed wells

Equipment:

☒ Dedicated Submersible Pump
☐ Surge Block
☐ Bailer ☐ 2" ☐ ____
☐ Grundfos Pump 2"___ 4"___

Approximate Recharge Rate: 1 gpm

Total Gallons Removed: 55 gal.

Well Development Criteria Met:

| | yes | no |
|---|---|---|
| • Well water clear to unaided eye | ☒ | ☐ |
| • Sediment thickness remaing in well is <1.0% of screen length | ☒ | ☐ |
| • Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost | ☒ | ☐ |

Notes: well recharges fine

End of Well Development Sample (1 pint) Collected? yes ☒ no ☐

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

| Time | Volume | Total Gallons | pH | Temp. | Conductivity | Turbidity | Pumping Rate |
|---|---|---|---|---|---|---|---|
| 1100 | 1 | 1 | 5.26 | 13.0 | .254 | over | 1 gpm |
| | 2 | 10 | 5.22 | 13.1 | .111 | 110 | " |
| | 3 | 20 | 5.03 | 13.1 | .119 | 21 | " |
| | 4 | 30 | 5.01 | 13.1 | .129 | 22 | " |
| | 5 | 40 | 5.07 | 13.0 | .121 | 90 | " |

Well Developer's Signature _____

ABB Environmental Services, Inc.

9312005S L6

# WELL DEVELOPMENT RECORD

| | | | |
|---|---|---|---|
| Project: Ft. Devens | Well Installation Date: 09/29/95 (sjm) | | Project No. 09144-02 |
| Client: USAEC (sjm) | Well Development Date: 10/4/95 | Developed by: M. Younsbury | Checked by: |
| Well/Site I.D.: 57M-95-02X | Weather: Rain 60° | Start Date: 10/4/95 | Finish Date: 10/4/95 |
| | | Start Time: 825 | Finish Time: 930 |

Well Construction Record Data:

Well Diameter: 4 in.

Bottom of Screen: 24 ft.

Sediment Sump/Plug: N/A ft. (sjm)

Screen Length: 10 ft.

From Ground Surface ☒ From top of Riser ☐

Fluids Lost During Drilling: 0 gal.

Protective Casing Stick-up: 2.80 ft. Protective Casing/Well Diff.: -0.50 ft.

PID Readings: Ambient Air — ppm; Well Mouth — ppm

Water Levels:

Initial: 19.04 ft.

End of Development: 19.19 ft.

24 Hrs. After Development: 19.01 ft.

Sediment:

Well Depth Before Development: 27.0 ft. (from top of PVC)

Well Depth After Development: 27.0 ft.

Sediment Depth Removed: 0 ft.

HT of Water Column: 8 ft. x ☐ 1.68* ☐ ____ = 13 gal./vol. *For 4" HSA installed wells

Equipment:

☒ Dedicated Submersible Pump
☐ Surge Block
☐ Bailer ☐ 2" ☐ ____
☐ Grundfos Pump 2"___ 4"___

Approximate Recharge Rate: ____ gpm

Total Gallons Removed: ____ gal.

Well Development Criteria Met:

Notes: ~~pu~~ well recharges good, pump was on bottom -

| | yes | no |
|---|---|---|
| • Well water clear to unaided eye | ☒ | ☐ |
| • Sediment thickness remaing in well is <1.0% of screen length | ☒ | ☐ |
| • Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost | ☒ | ☐ |

End of Well Development Sample (1 pint) Collected? (sjm) yes ☒ no ☐

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

| Time | Volume | Total Gallons | pH | Temp. | Conductivity | Turbidity | Pumping Rate |
|---|---|---|---|---|---|---|---|
| 825 | 1 | 1 | 5.78 | 13.5 | .381 | over | 1 GPM |
| | 2 | 13 | 6.21 | 13.9 | .289 | 133 | " |
| | 3 | 26 | 5.83 | 13.8 | .271 | 15 | " |
| | 4 | 39 | 5.84 | 13.5 | .285 | — | " |
| | 5 | 52 | 5.80 | 13.8 | .291 | — | |

turb. note Done

Well Developer's Signature: [signature]

ABB Environmental Services, Inc.

9312005S L 6

# WELL DEVELOPMENT RECORD

| | | | |
|---|---|---|---|
| Project: Ft. Devens | Well Installation Date: 10/3/95 | | Project No. 09144.02 |
| Client: USAEC | Well Development Date: 10/5/95 | Developed by: M. Lounsbury | Checked by: |
| Well/Site I.D.: 57M-95-03X | Weather: Cloudy, 60° | Start Date: 10/5/95 | Finish Date: 10/6/95 |
| | | Start Time: 1150 | Finish Time: 1030 |

Well Construction Record Data:

Bottom of Screen: 17 ft. — From Ground Surface ☑ From top of Riser ☐

Sediment Sump/Plug: N/A ft.

Screen Length: 10 ft.

Well Diameter: 4 in.

Fluids Lost During Drilling: N/A gal.

Protective Casing Stick-up: 3.0 ft. Protective Casing/Well Diff. -0.36 ft.

PID Readings: Ambient Air 0 ppm; Well Mouth 0 ppm

Water Levels:

| | | | | |
|---|---|---|---|---|
| Initial | 13.09 ft. | 10/4/95 13.19 | 10/5/95 12.37 | 10/6 12.33 |
| End of Development | 18.67 ft. | 10/10/95 11.75 | | |
| 24 Hrs. After Development | ~~8~~ ft. | | | |

Sediment:

| | | |
|---|---|---|
| Well Depth Before Development | 18.52 ft. | (from top of PVC) |
| Well Depth After Development | 18.67 ft. | |
| Sediment Depth Removed | .10 ft. | |

HT of Water Column: 5.43 ft. x ☐ 1.68" ☐ _____ = 1 gal./vol. *For 4" HSA installed wells

Equipment:

☒ Dedicated Submersible Pump
☐ Surge Block
☐ Bailer ☐ 2" ☐ _____
☐ Grundfos Pump 2"___ 4"___

Approximate Recharge Rate: 1/2 gpm

Total Gallons Removed: 50 gal.

Well Development Criteria Met:

| | yes | no |
|---|---|---|
| • Well water clear to unaided eye | ☒ | ☐ |
| • Sediment thickness remaing in well is <1.0% of screen length | ☒ | ☐ |
| • Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost | ☒ | ☐ |

Notes: recharge rate ≈ 1/2 gpm - Sweet odor on purge water - purge water contaminated because of odor.

End of Well Development Sample (1 pint) Collected? yes ☒ no ☐

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

| | Time | Volume | Total Gallons | pH | Temp. | Conductivity | Turbidity | Pumping Rate |
|---|---|---|---|---|---|---|---|---|
| 10/5/95 | 1110 | 1 | 1 | 6.31 | 12.8 | .188 | over | 1 gpm |
| | 1208 | 2 | 10 | 5.85 | 12.7 | .166 | over | 1 |
| | 1300 | 3 | 30 | 5.81 | 12.8 | .170 | 196 | 1 |
| 10/6/95 | 811 | 4 | 30 | 5.56 | 12.6 | .232 | 37 | 1 |
| | 915 | 5 | 40 | 5.73 | 12.7 | .203 | 21 | 1 |
| | 1030 | 6 | 50 | 5.65 | 12.7 | .175 | 22 | 1 |

Well Developer's Signature: [signature]

ABB Environmental Services, Inc.

9312005S L 6

# WELL DEVELOPMENT RECORD

| | | | |
|---|---|---|---|
| Project: Ft. Devens | Well Installation Date: 10/4/95 | | Project No. 09144-02 |
| Client: USAEC | Well Development Date: 10/10/95 | Developed by: M. Lounsbury | Checked by: - |
| Well/Site I.D.: 57M-9504A | Weather: Sunny 60° | Start Date: 10/10/95 | Finish Date: 10/10/95 |
| | | Start Time: 930 | Finish Time: 1045 |

Well Construction Record Data:

Bottom of Screen 12.4 ft. — From Ground Surface ☒ From top of Riser ☐

Sediment Sump/Plug N/A ft.

Screen Length 10 ft.

Well Diameter 4 in.

Fluids Lost During Drilling ~ gal.

Protective Casing Stick-up 1.35 ft. Protective Casing/Well Diff. -0.74 ft.

PID Readings: Ambient Air 0 ppm; Well Mouth 0 ppm

Water Levels:

Initial 3.27 ft.

End of Development 3.31 ft.

24 Hrs. After Development 3.25 ft.

Sediment:

Well Depth Before Development 12.82 ft. (from top of PVC)

Well Depth After Development 12.86 ft.

Sediment Depth Removed .04 ft.

HT of Water Column 10 ft. x ☐ 1.68" ☐ ____ = 16 gal./vol. "For 4" HSA installed wells

Equipment:

☒ Dedicated Submersible Pump

☐ Surge Block

☐ Bailer ☐ 2" ☐ ____

☐ Grundfos Pump 2"___ 4"___

Approximate Recharge Rate 1 gpm

Total Gallons Removed 90 gal.

Well Development Criteria Met:

| | yes | no |
|---|---|---|
| • Well water clear to unaided eye | ☒ | ☐ |
| • Sediment thickness remaing in well is <1.0% of screen length | ☒ | ☐ |
| • Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost | ☒ | ☐ |

Notes: Well Contaminated Due to Contaminated Soil Found In Hole

End of Well Development Sample (1 pint) Collected? yes ☒ no ☐

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

| Time | Volume | Total Gallons | pH | Temp. | Conductivity | Turbidity | Pumping Rate |
|---|---|---|---|---|---|---|---|
| 930 | 1 | 1 | 5.65 | 12.7 | .278 | Over | 1 GPM |
| | | | 5.67 | 13.5 | .123 | 742 | " |
| | | | 5.41 | 13.5 | .114 | 90 | " |
| | | | 5.31 | 13.6 | .093 | 98 | " |
| | | | 5.20 | 13.6 | .087 | 18 | " |
| 1035 | | | 5.19 | 13.7 | .088 | 13 | |

Well Developer's Signature [signature]

ABB Environmental Services, Inc.

9312005S L6

# WELL DEVELOPMENT RECORD

| | | | |
|---|---|---|---|
| Project: Ft. Dennis | Well Installation Date: 10/3/95 (gm) | | Project No. 9144.02 (gm) |
| Client: USAEC (gm) | Well Development Date: 10/10/95 | Developed by: M. Lounsbury | Checked by: |
| Well/Site I.D.: 57M-9500 04B | Weather: Sunny 65° | Start Date: 10/10/95 | Finish Date: 10/10/95 |
| | | Start Time: 1150 | Finish Time: 1330 (gm) |

Well Construction Record Data:

Bottom of Screen: 28.51 ft. (gm) — From Ground Surface ☑ — From top of Riser ☐

Sediment Sump/Plug: ~~28.91~~ ft. N/A (gm)

Screen Length: 10 ft.

Well Diameter: 4 in.

Fluids Lost During Drilling: — gal.

Protective Casing Stick-up: 2.41 ft. Protective Casing/Well Diff.: -0.16 ft.

PID Readings: Ambient Air 0 ppm; Well Mouth 0 ppm

Water Levels:

Initial: 4.09 ft.

End of Development: 4.09 ft.

24 Hrs. After Development: 4.10 ft.

Sediment:

Well Depth Before Development: 31.20 ft. (from top of PVC)

Well Depth After Development: 31.27 ft.

Sediment Depth Removed: .05 ft.

HT of Water Column: 27 ft. x ☑ 1.68* ☐ ____ = 70 gal./vol. *For 4" HSA installed wells

Equipment:

☑ Dedicated Submersible Pump
☐ Surge Block
☐ Bailer ☐ 2" ☐ ____
☐ Grundfos Pump 2"___ 4"___

Approximate Recharge Rate: 1T gpm

Total Gallons Removed: 200 gal.

Well Development Criteria Met:

| | yes | no |
|---|---|---|
| • Well water clear to unaided eye | ☑ | ☐ |
| • Sediment thickness remaing in well is <1.0% of screen length | ☑ | ☐ |
| • Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost | ☑ | ☐ |

Notes: well recharges extremely well

End of Well Development Sample (1 pint) Collected? yes ☑ no ☐

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

| Time | Volume | Total Gallons | pH | Temp. | Conductivity | Turbidity | Pumping Rate |
|---|---|---|---|---|---|---|---|
| 1150 | 1 | 1 | 5.63 | 12.9 | .231 | 860 | 2 GPm |
| | 2 | 40 | 5.59 | 12.5 | .235 | 43 | " |
| | 3 | 80 | 5.45 | 12.1 | .236 | 1 | " |
| | 4 | 120 | 5.42 | 12.4 | .233 | 8 | " |
| | 5 | 160 | 5.44 | 12.4 | .237 | 0 | " |
| 1330 | 6 | 200 | 5.44 | 12.4 | .235 | 0 | " |

Well Developer's Signature: [signature]

ABB Environmental Services, Inc.

9312005S L 6

# WELL DEVELOPMENT RECORD

| | | | |
|---|---|---|---|
| Project: Ft. Devens | Well Installation Date: 10/3/95 (SJM) | | Project No. 09146-02 |
| Client: USAEC (SJM) | Well Development Date: 10/10/95 | Developed by: M. Lounsbury | Checked by: |
| Well/Site I.D.: SJM-95-05X | Weather: Sunny - 65° | Start Date: 10/10/95 | Finish Date: 10/10/95 |
| | | Start Time: 1510 | Finish Time: 1610 |

Well Construction Record Data:

Bottom of Screen: 20 ft. ] From Ground Surface ☒ From top of Riser ☐

Sediment Sump/Plug: N/A ft. (SJM)

Screen Length: 10 ft.

Well Diameter: 4 in.

Fluids Lost During Drilling: — gal.

Protective Casing Stick-up: 3.10 ft. Protective Casing/Well Diff.: -0.50 ft.

PID Readings: Ambient Air 0 ppm; Well Mouth 0 ppm

Water Levels:

Initial: 15.70 ft.

End of Development: 15.79 ft.

24 Hrs. After Development: 15.70 ft.

Sediment:

Well Depth Before Development: 22.45 ft. (from top of PVC)

Well Depth After Development: 22.64 ft.

Sediment Depth Removed: 0.19 ft.

HT of Water Column: 6 ft. x ☐ 1.68* ☐ ____ = gal./vol. 10 (SJM) *For 4" HSA installed wells

Equipment:

☒ Dedicated Submersible Pump
☐ Surge Block
☐ Bailer ☐ 2" ☐ ____
☐ Grundfos Pump 2"___ 4"___

Approximate Recharge Rate: 1 gpm

Total Gallons Removed: 60 gal.

Well Development Criteria Met:

| | yes | no |
|---|---|---|
| • Well water clear to unaided eye | ☒ | ☐ |
| • Sediment thickness remaing in well is <1.0% of screen length | ☒ | ☐ |
| • Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost | ☒ | ☐ |

Notes: Very Little Sand/Silt in well

End of Well Development Sample (1 pint) Collected? yes ☒ no ☐

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

| Time | Volume | Total Gallons | pH | Temp. | Conductivity | Turbidity | Pumping Rate |
|---|---|---|---|---|---|---|---|
| 1510 | 1 | 1 | 9.40 | 14.6 | .298 | Over | 10 gpm |
| | 2 | 10 | 8.05 | 14.7 | .127 | 28 | " |
| | 3 | 20 | 6.81 | 14.4 | .135 | 10 | " |
| | 4 | 30 | 6.24 | 14.4 | .121 | 1 | " |
| | 5 | 40 | 5.87 | 14.4 | .117 | 24 | " |
| 1610 | 6 | 50 | 5.66 | 14.5 | .117 | 0 | " |

Well Developer's Signature: Mark H. Lounsbury

ABB Environmental Services, Inc.

9312005S L6

# WELL DEVELOPMENT RECORD

| | | | |
|---|---|---|---|
| Project: Ft. Owens | Well Installation Date: 10/4/95 (SJM) | | Project No. 09144-02 |
| Client: USAEC (SJM) | Well Development Date: 10/11/95 | Developed by: M. Lounsbury | Checked by: |
| Well/Site I.D.: 57M-95-06X | Weather: Sunny 65° | Start Date: 10/11/95 | Finish Date: 10/11/95 |
| | | Start Time: 740 | Finish Time: 855 |

Well Construction Record Data:

Bottom of Screen 21.87 ft. (SJM) ☐ From Ground Surface ☐ From top of Riser ☐

Sediment Sump/Plug ~~22.04 ft.~~ N/A (SJM)

Screen Length 10 ft.

Well Diameter 4 in.

Fluids Lost During Drilling — gal.

Protective Casing Stick-up 2.13 ft. Protective Casing/Well Diff. -0.16 ft.

PID Readings: Ambient Air 0 ppm; Well Mouth 0 ppm

Water Levels:

Initial 14.03 ft.

End of Development 15.15 ft.

24 Hrs. After Development 14.05 ft.

24.55
23.82
.73

Sediment:

Well Depth Before Development 23.82 ft. (from top of PVC)

Well Depth After Development 24.55 ft.

Sediment Depth Removed 0.73 ft.

HT of Water Column 10 ft. x ☐ 1.68* ☐ ____ = 16 gal./vol. *For 4" HSA installed wells

Equipment:

☒ Dedicated Submersible Pump
☐ Surge Block
☐ Bailer ☐ 2" ☐ ____
☐ Grundfos Pump 2"___ 4"___

Approximate Recharge Rate 1.5 gpm

Total Gallons Removed 80 gal.

Well Development Criteria Met:

Notes: well recharged very well

| | yes | no |
|---|---|---|
| • Well water clear to unaided eye | ☒ | ☐ |
| • Sediment thickness remaing in well is <1.0% of screen length | ☒ | ☐ |
| • Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost | ☒ | ☐ |

End of Well Development Sample (1 pint) Collected? yes ☒ no ☐

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

| Time | Volume | Total Gallons | pH | Temp. | Conductivity | Turbidity | Pumping Rate |
|---|---|---|---|---|---|---|---|
| 740 | 1 | 1 | 5.42 | 12.9 | .153 | — | 1.5 gpm |
| 813 | 2 | 15 | 5.35 | 13.3 | .109 | over | " |
| 825 | 3 | 30 | 5.50 | 13.6 | .106 | 60 | " |
| 833 | 4 | 45 | 5.41 | 13.8 | .104 | 0 | " |
| 842 | 5 | 60 | 5.46 | 13.5 | .104 | 0 | " |
| (*) turn meter not working properly | | | | | | | |
| 850 | 6 | 75 | 5.41 | 13.5 | .104 | 0 | " |

Well Developer's Signature [signature]

ABB Environmental Services, Inc.

9312005S L6

# WELL DEVELOPMENT RECORD

| | | | |
|---|---|---|---|
| Project: Ft. Devens | Well Installation Date: 10/5/95 | | Project No. 09144.02 |
| Client: USAEC | Well Development Date: 10/12/95 | Developed by: A. Lounsbury | Checked by: |
| Well/Site I.D.: 57m-95-07x | Weather: Sunny 60° | Start Date: 10/12/95 | Finish Date: 10/12/95 |
| | | Start Time: 745 | Finish Time: 955 |

Well Construction Record Data:

Bottom of Screen: 13 ft. — From Ground Surface ☑ From top of Riser ☐

Sediment Sump/Plug: N/A ft.

Screen Length: 10 ft.

Well Diameter: 4 in.

Fluids Lost During Drilling: — gal.

Protective Casing Stick-up: 1.57 ft. Protective Casing/Well Diff.: -0.33 ft.

PID Readings: Ambient Air 0 ppm; Well Mouth 0 ppm

Water Levels:

Initial: 3.68 ft.

End of Development: 3.70 ft.

24 Hrs. After Development: 3.71 ft.

Sediment:

Well Depth Before Development: 14.33 ft. (from top of PVC)

Well Depth After Development: 14.43 ft.

Sediment Depth Removed: .10 ft.

HT of Water Column: 10 ft. x ☐ 1.68* ☐ ____ = 16 gal./vol. *For 4" HSA installed wells

Equipment:

☑ Dedicated Submersible Pump
☐ Surge Block
☐ Bailer ☐ 2" ☐ ____
☐ Grundfos Pump 2"___ 4"___

Approximate Recharge Rate: 1.5 gpm

Total Gallons Removed: 90 gal.

Well Development Criteria Met:

| | yes | no |
|---|---|---|
| • Well water clear to unaided eye | ☑ | ☐ |
| • Sediment thickness remaing in well is <1.0% of screen length | ☑ | ☐ |
| • Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost | ☐ | ☐ |

Notes:

End of Well Development Sample (1 pint) Collected? yes ☑ no ☐

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

| Time | Volume | Total Gallons | pH | Temp. | Conductivity | Turbidity | Pumping Rate |
|---|---|---|---|---|---|---|---|
| 745 | 1 | 1 | 5.24 | 12.4 | .161 | over | 1.5 GPM |
| | 2 | 16 | 5.06 | 12.9 | .159 | 200 | " |
| | 3 | 32 | 5.16 | 12.7 | .153 | 0 | " |
| | 4 | 48 | 5.20 | 13.0 | .150 | 0 | " |
| | 5 | 64 | 5.24 | 12.9 | .156 | 0 | " |
| 848 | 6 | 80 | 5.25 | 12.8 | .151 | 0 | " |

Well Developer's Signature: Michael A. [illegible]

ABB Environmental Services, Inc.

9312005S L 6

# WELL DEVELOPMENT RECORD

| | | | |
|---|---|---|---|
| Project: Ft. Devens | Well Installation Date: 10/10/95 (SJM) | | Project No. 09144-L |
| Client: USAEC (SJM) | Well Development Date: 10/13/95 | Developed by: M. Laynsburg | Checked by: |
| Well/Site I.D.: 57M-95-08A | Weather: Sunny 70° | Start Date: 10/13/95 | Finish Date: 10/13/95 |
| | | Start Time: 920 | Finish Time: 1215 (SJM) |

Well Construction Record Data:

Bottom of Screen: 13 ft. — From Ground Surface ☒ — From top of Riser ☐

Sediment Sump/Plug: N/A ft. (SJM)

Screen Length: 10 ft.

Well Diameter: 4 in.

Fluids Lost During Drilling: < gal.

Protective Casing Stick-up: 1.65 ft. Protective Casing/Well Diff.: -0.23 ft.

PID Readings: Ambient Air — ppm; Well Mouth — ppm

Water Levels:

Initial: 3.17 ft.

End of Development: 12.57 ft.

24 Hrs. After Development: 3.14 ft. (10/16)

Sediment:

Well Depth Before Development: 13.35 ft. (from top of PVC)

Well Depth After Development: 14.30 ft.

Sediment Depth Removed: 0.95 ft.

HT of Water Column: 10 ft. x ☐ 1.68* ☐ ____ = 16 gal./vol. *For 4" HSA installed wells

Equipment:

☒ Dedicated Submersible Pump

☐ Surge Block

☐ Bailer ☐ 2" ☐ ____

☐ Grundfos Pump 2"___ 4"___

Approximate Recharge Rate: 1/2 gpm

Total Gallons Removed: gal.

Well Development Criteria Met:

(*) Notes: Battery Died after 1st Volume, had to recharge before continuing development

| | yes | no |
|---|---|---|
| • Well water clear to unaided eye | ☒ | ☐ |
| • Sediment thickness remaing in well is <1.0% of screen length | ☐ | ☐ |
| • Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost | ☐ | ☐ |

End of Well Development Sample (1 pint) Collected? yes ☐ no ☐

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

| Time | Volume | Total Gallons | pH | Temp. | Conductivity | Turbidity | Pumping Rate |
|---|---|---|---|---|---|---|---|
| 920 | 1 | 1 | 5.72 | 12.6 | .102 | over | 1 GPM |
| 935 | 2 | 16 | 5.80 | 13.0 | .100 | 158 | — |
| 1030 | 3 | 32 | 6.13 | 14.0 | .099 | 101 | — |
| 1052 | 4 | 48 | 5.89 | 13.7 | .088 | 0 | — |
| 1110 | 5th | 54 | 5.80 | 13.6 | .083 | 0 | — |
| 1215 | 6th | 80 | 6.05 | 15.1 | .084 | 0 | — |

(*) Battery Very Low pump 1-1/2 GPM well will run dry when pumping with Fully Charged battery. There still might be a little Sand Left In well.

Well Developer's Signature: [signature]

ABB Environmental Services, Inc.

9312005S L 6

# WELL DEVELOPMENT RECORD

| | | | |
|---|---|---|---|
| Project: Ft. Devens | Well Installation Date: 10/10/95 (gm) | | Project No. 07144402 |
| Client: USAEC (gm) | Well Development Date: 10/12/95 | Developed by: M. Lounsbury | Checked by: |
| Well/Site I.D.: 57M-95-08B | Weather: Sunny 70° | Start Date: 10/12/95 | Finish Date: 10/13/95 |
| | | Start Time: 1358 | Finish Time: 855 |

Well Construction Record Data:

Bottom of Screen 28 ~~13~~ ft. (gm) — From Ground Surface ☑ — Well Diameter 4 in.

Sediment Sump/Plug N/A ft. (gm) — From top of Riser ☐

Screen Length 10 ft. — Fluids Lost During Drilling — gal.

Protective Casing Stick-up 2.85 ft. — Protective Casing/Well Diff. -0.49 ft. — PID Readings: Ambient Air 0 ppm; Well Mouth 0 ppm

Water Levels:

| | |
|---|---|
| Initial | 4.00 ft. |
| End of Development | 4.32 ft. |
| 24 Hrs. After Development | 3.93 ft. |

Sediment:

| | | |
|---|---|---|
| Well Depth Before Development | 30.24 ft. | (from top of PVC) |
| Well Depth After Development | 30.32 ft. | |
| Sediment Depth Removed | 0.18 ft. | |

HT of Water Column 26 ft. x ☐ 1.68* ☐ ____ = 44 gal./vol. *For 4" HSA installed wells

Equipment:

☒ Dedicated Submersible Pump (gm)
☐ Surge Block
☐ Bailer ☐ 2" ☐ ____
☐ Grundfos Pump 2"___ 4"___

Approximate Recharge Rate 25 gpm

Total Gallons Removed 200 gal.

Well Development Criteria Met:

Notes: purged 90 gals on 10/12/95 - Battery ran dead at 1700, finished Development on 10/13/95

| | yes | no |
|---|---|---|
| • Well water clear to unaided eye | ☒ | ☐ |
| • Sediment thickness remaing in well is <1.0% of screen length | ☒ | ☐ |
| • Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost | ☒ | ☐ |

End of Well Development Sample (1 pint) Collected? yes ☒ no ☐ (gm)

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

| | Time | Volume | Total Gallons | pH | Temp. | Conductivity | Turbidity | Pumping Rate |
|---|---|---|---|---|---|---|---|---|
| 10/10/95 | 1358 | 1 | 1 | 7.52 | 13.4 | .216 | over | 1.5 GPM |
| | 1630 | 2 | 44 | 6.58 | 12.3 | .236 | 12 | — |
| | 1700 | 3 | 88 | 5.70 | 13.1 | .233 | 17 | — |
| 10/13/95 | 755 | 4 | 132 | 4.53 | 11.8 | .283 | 0 | — |
| | 825 | 5 | 176 | 5.08 | 11.6 | .251 | 6 | — |
| | 855 | 6 | 220 | 5.31 | 11.4 | .240 | 0 | — |

Well Developer's Signature Mark H. [signature]

ABB Environmental Services, Inc.

9312005S L 6

# WELL DEVELOPMENT RECORD

| | | | |
|---|---|---|---|
| Project: FT DEVENS | Well Installation Date: 08/28/96 | | Project No. 9144.08 |
| Client: USACE | Well Development Date: 09/11/96 | Developed by: C. DeLong | Checked by: RRR |
| Well/Site I.D.: 57~~W~~m-96-09X (MC) | Weather: OVERCAST | Start Date: 09/11/96 | Finish Date: 09/11/96 |
| | | Start Time: 1710 | Finish Time: 1736 |

Well Construction Record Data:

Bottom of Screen 22.8 ft.

Sediment Sump/Plug 23.0 ft.

Screen Length 10 ft.

From Ground Surface ☑ From top of Riser ☐

Well Diameter 2 in.

Fluids Lost During Drilling 0 gal.

Protective Casing Stick-up 2.74 ft. Protective Casing/Well Diff. 0.61 ft.

PID Readings: Ambient Air 0.0 ppm; Well Mouth 0.0 ppm

Water Levels:

Initial 18.08 ft.

End of Development 18.13 ft.

24 Hrs. After Development —— ft.

Sediment:

Well Depth Before Development 25.5 ft. (from top of PVC)

Well Depth After Development 25.73 ft.

Sediment Depth Removed 0.23 ft.

HT of Water Column 7.42 ft. x ☐ 1.68* ☑ 0.9 = gal./vol. 7 *For 4" HSA installed wells

Equipment:

☑ Dedicated Submersible Pump

☐ Surge Block

☐ Bailer ☐ 2" ☐ _____

☐ Grundfos Pump 2"___ 4"___

Approximate Recharge Rate 1.75 gpm

Total Gallons Removed 35 gal.

Well Development Criteria Met:

Notes:

| | yes | no |
|---|---|---|
| • Well water clear to unaided eye | ☑ | ☐ |
| • Sediment thickness remaing in well is <1.0% of screen length | ☑ | ☐ |
| • Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost (NA) | ☐ | ☐ |

End of Well Development Sample (1 pint) Collected? yes ☑ no ☐

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

| Time | Volume | Total Gallons | pH | Temp. | Conductivity | Turbidity | Rinse | Pumping Rate |
|---|---|---|---|---|---|---|---|---|
| 1715 | 7gal | 7gal | 5.69 | 13.6 | 42 | 60 | 230 | 1.5 |
| 1720 | 7 gal | 14gal | 5.51 | 12.8 | 42 | 5 | 257 | 1.5 |
| 1725 | 7gal | 21gal | 5.42 | 12.6 | 42 | 0 | 289 | 1.5 |
| 1730 | 7gal | 28gal | 5.42 | 12.4 | 42 | 0 | 302 | 1.5 |
| 1735 | 7gal | 35gal | 5.42 | 12.4 | 42 | 0 | 314 | 1.5 |

Well Developer's Signature [signature]

**WELL DEVELOPMENT RECORD**
**PROJECT OPERATIONS PLAN**
**FORT DEVENS, MASSACHUSETTS**

ABB Environmental Services, Inc.

9312005S L6

# WELL DEVELOPMENT RECORD

| | | | |
|---|---|---|---|
| Project: FT DEVENS | Well Installation Date: 08/30/96 | | Project No. 9144.08 |
| Client: USACE | Well Development Date: 09/11/96 | Developed by: C Decoyt | Checked by: RRR |
| Well/Site I.D.: 57M-96-10X | Weather: CLOUDY | Start Date: 09/11/96 | Finish Date: 09/11/96 |
| | | Start Time: 0900 | Finish Time: 1346 |

Well Construction Record Data:

Well Diameter: 2 in.

Bottom of Screen: 13 ft. — From Ground Surface ☑ — From top of Riser ☑

Sediment Sump/Plug: 13 ft.

Screen Length: 10 ft.

Fluids Lost During Drilling: 0 gal.

Protective Casing Stick-up: 2.21 ft. Protective Casing/Well Diff.: 0.2 ft. PID Readings: Ambient Air 0.0 ppm; Well Mouth 1.4 ppm

Water Levels:

Initial: 7.53 ft.

End of Development: 13.22 ft.

24 Hrs. After Development: ft.

Sediment:

Well Depth Before Development: ~~15.65~~ 15.56 ft. (from top of PVC)

Well Depth After Development: 15.56 ft.

Sediment Depth Removed: 0 ft.

HT of Water Column: 8.12 ft. x ☐ 1.68* ☑ 0.9 = gal./vol. 7 *For 4" HSA installed wells

Equipment:

☑ Dedicated Submersible Pump
☐ Surge Block
☐ Bailer ☐ 2" ☐ _____
☐ Grundfos Pump 2"___ 4"___

Approximate Recharge Rate: 0.1 gpm

Total Gallons Removed: 35 gal.

Well Development Criteria Met:

Notes: WELL GONE DRY AFTER ~5 gal SLOW RECHARGE

| | yes | no |
|---|---|---|
| • Well water clear to unaided eye | ☐ | ☑ |
| • Sediment thickness remaing in well is <1.0% of screen length | ☑ | ☐ |
| • Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost (NA) | ☐ | ☐ |

End of Well Development Sample (1 pint) Collected? yes ☑ no ☐

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

| Time | Volume | Total Gallons | pH | Temp. | Conductivity | Turbidity | RLOCK | Pumping Rate |
|---|---|---|---|---|---|---|---|---|
| 0900 | 7 gal | 7 gal | 5.58 | 12.7 | 68 | 667 | 320 | |
| 1010 | 7 gal | 14 gal | 5.63 | 11.6 | 36 | 503 | 316 | |
| 1240 | 7 gal | 21 gal | 5.85 | 12.5 | 69 | 707 | 161 | |
| 1315 | 7 gal | 28 gal | 5.54 | 12.1 | 33 | 591 | 177 | |
| 1345 | 7 gal | 35 gal | 5.54 | 11.6 | 32 | 663 | 208 | |

Well Developer's Signature: [signature]

**WELL DEVELOPMENT RECORD**
**PROJECT OPERATIONS PLAN**
**FORT DEVENS, MASSACHUSETTS**

ABB Environmental Services, Inc.

9312005S L6

# WELL DEVELOPMENT RECORD

| | | | |
|---|---|---|---|
| Project: FT DEVENS | Well Installation Date: 08/30/96 | | Project No. 9144.08 |
| Client: USACE | Well Development Date: 09/11/96 | Developed by: C. DeVogt | Checked by: RRR |
| Well/Site I.D.: 57M-96-11X | Weather: OVERCAST | Start Date: 09/11/96 | Finish Date: 09/11/96 |
| | | Start Time: 1140 | Finish Time: 1550 |

Well Construction Record Data:

Bottom of Screen 12 ft. — From Ground Surface ☑

Sediment Sump/Plug 12 ft.

Screen Length 10 ft.

Well Diameter 2 in.

From top of Riser ☐

Fluids Lost During Drilling 0 gal.

Protective Casing Stick-up 2.48 ft. Protective Casing/Well Diff. 0.54 ft.

PID Readings: Ambient Air 00 ppm; Well Mouth 0.5 ppm

Water Levels:

Initial 3.68 ft.

End of Development 9.13 ft.

24 Hrs. After Development —— ft.

Sediment:

Well Depth Before Development 14.59 ft. (from top of PVC)

Well Depth After Development 14.59 ft.

Sediment Depth Removed Ø ft.

HT of Water Column 10.91 ft. x ☐ 1.68* ☑ 0.9 = gal./vol. 10 *For 4" HSA installed wells

Equipment:

☑ Dedicated Submersible Pump

☐ Surge Block

☐ Bailer ☐ 2" ☐ _____

☐ Grundfos Pump 2"___ 4"___

Approximate Recharge Rate 0.17 gpm

Total Gallons Removed 50 gal.

Well Development Criteria Met:

Notes: WELL DRY AFTER ~5 gal

| | yes | no |
|---|---|---|
| • Well water clear to unaided eye | ☐ | ☑ |
| • Sediment thickness remaing in well is <1.0% of screen length | ☑ | ☐ |
| • Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost (NA) | ☐ | ☐ |

End of Well Development Sample (1 pint) Collected? yes ☑ no ☐

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

| Time | Volume | Total Gallons | pH | Temp. | Conductivity | Turbidity | DO | Pumping Rate |
|---|---|---|---|---|---|---|---|---|
| 1250 | 10 gal | 10 gal | 5.92 | 12.3 | 102 | >1000 | 56 | |
| 1358 | 10 gal | 20 gal | 6.02 | 13.6 | 99 | 467 | 90 | |
| 1450 | 10 gal | 30 gal | 5.99 | 12.4 | 106 | 479 | 57 | |
| 1525 | 10 gal | 40 gal | 5.85 | 12.4 | 98 | 408 | 38 | |
| 1550 | 10 gal | 50 gal | 5.81 | 12.5 | 103 | 175 | 60 | |

Well Developer's Signature [signature]

**WELL DEVELOPMENT RECORD**
**PROJECT OPERATIONS PLAN**
**FORT DEVENS, MASSACHUSETTS**

ABB Environmental Services, Inc.

9312005S L 6

# WELL DEVELOPMENT RECORD

| | | | |
|---|---|---|---|
| Project: FORT DEVENS | Well Installation Date: 08/29/94 | | Project No. 9144.08 |
| Client: USACE | Well Development Date: 09/11/94 | Developed by: C Dewey | Checked by: RRR |
| Well/Site I.D.: 57M-96-12X | Weather: OVERCAST | Start Date: 09/11/94 | Finish Date: 09/11/94 |
| | | Start Time: 1415 | Finish Time: 1641 |

Well Construction Record Data:

Bottom of Screen: 12 ft. — From Ground Surface ☑ / From top of Riser ☐

Sediment Sump/Plug: 12 ft.

Screen Length: 10 ft.

Well Diameter: 2 in.

Fluids Lost During Drilling: 0 gal.

Protective Casing Stick-up: 3.05 ft. Protective Casing/Well Diff.: 0.25 ft.

PID Readings: Ambient Air Ø.Ø ppm; Well Mouth Ø 5 ppm

Water Levels:

Initial: 5.35 ft.

End of Development: 9.12 ft.

24 Hrs. After Development: —— ft.

Sediment:

Well Depth Before Development: 15.13 ft. (from top of PVC)

Well Depth After Development: 15.13 ft.

Sediment Depth Removed: Ø ft.

HT of Water Column: 9.78 ft. x ☐ 1.68* ☑ 0.9 = gal./vol. 9 *For 4" HSA installed wells

Equipment:

☑ Dedicated Submersible Pump
☐ Surge Block
☐ Bailer ☐ 2" ☐ _____
☐ Grundfos Pump 2"___ 4"___

Approximate Recharge Rate: 0.375 gpm

Total Gallons Removed: 45 gal.

Well Development Criteria Met:

| | yes | no |
|---|---|---|
| • Well water clear to unaided eye | ☐ | ☑ |
| • Sediment thickness remaing in well is <1.0% of screen length | ☑ | ☐ |
| • Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost (NA) | ☐ | ☐ |

Notes: _____

End of Well Development Sample (1 pint) Collected? yes ☑ no ☐

Water Parameter Measurments

Record at the start, twice during and at the end of development (minimum):

| Time | Volume | Total Gallons | pH | Temp. | Conductivity | Turbidity | | Pumping Rate |
|---|---|---|---|---|---|---|---|---|
| 1440 | 9 gal | 9 gal | 6.00 | 12.8 | 50 | 566 | 70 | |
| 1505 | 9 gal | 18 gal | 5.72 | 11.9 | 51 | 812 | 122 | |
| 1540 | 9 gal | 27 gal | 5.79 | 11.9 | 51 | 630 | 59 | |
| 1605 | 9 gal | 36 gal | 5.74 | 12.2 | 50 | 574 | 79 | |
| 1640 | 9 gal | 45 gal | 5.74 | 12.5 | 49 | 471 | 208 | |

Well Developer's Signature: [signature]

WELL DEVELOPMENT RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

9312005S L 6

# WELL DEVELOPMENT RECORD

| | | | |
|---|---|---|---|
| Project: FORT DEVENS | Well Installation Date: 08/29/96 | | Project No. 9144.08 |
| Client: USACE | Well Development Date: 09/12/96 | Developed by: C. DeCoyst | Checked by: [illegible] |
| Well/Site I.D.: 57M-96-13X | Weather: OVERCAST | Start Date: 09/12/96 | Finish Date: 09/12/96 |
| | | Start Time: 0845 | Finish Time: 0946 |

Well Construction Record Data:

Well Diameter: 2 in.

Bottom of Screen: 12 ft.

Sediment Sump/Plug: 12 ft.

Screen Length: 18 ft.

From Ground Surface ☑ From top of Riser ☐

Fluids Lost During Drilling: Ø gal.

Protective Casing Stick-up: 2.62 ft. Protective Casing/Well Diff.: 0.37 ft.

PID Readings: Ambient Air Ø.Ø ppm; Well Mouth Ø.Ø ppm

Water Levels:

Initial: 5.11 ft.

End of Development: 5.8 ft.

24 Hrs. After Development: —— ft.

Sediment:

Well Depth Before Development: 14.95 ft. (from top of PVC)

Well Depth After Development: 14.89 ft.

Sediment Depth Removed: 0.06 ft.

HT of Water Column: 9.72 ft. x ☐ 1.68* ☑ 0.9 = gal./vol. 9 *For 4" HSA installed wells

Equipment:

☑ Dedicated Submersible Pump
☐ Surge Block
☐ Bailer ☐ 2" ☐ _____
☐ Grundfos Pump 2"___ 4"___

Approximate Recharge Rate: Ø.75 gpm

Total Gallons Removed: 45 gal.

Well Development Criteria Met:

| | yes | no |
|---|---|---|
| • Well water clear to unaided eye | ☑ | ☐ |
| • Sediment thickness remaing in well is <1.0% of screen length | ☑ | ☐ |
| • Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost (NA) | ☐ | ☐ |

Notes: SLOW RECHARGE

End of Well Development Sample (1 pint) Collected? yes ☑ no ☐

Water Parameter Measurements

Record at the start, twice during and at the end of development (minimum):

| Time | Volume | Total Gallons | pH | Temp. | Conductivity | Turbidity | EXCITED | Pumping Rate |
|---|---|---|---|---|---|---|---|---|
| 0845 | 9 gal | 9 gal | 7.00 | 12.5 | 80 | 220 | 261 | |
| 0900 | 9 gal | 18 gal | 6.18 | 12.3 | 71 | 250 | 233 | |
| 0915 | 9 gal | 27 gal | 5.97 | 12.4 | 68 | >1000 | 246 | |
| 0930 | 9 gal | 36 gal | 5.99 | 12.2 | 49 | 49 | 237 | |
| 0945 | 9 gal | 45 gal | 5.88 | 12.1 | 68 | 6 | 234 | |

Well Developer's Signature: [signature]

WELL DEVELOPMENT RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

9312005S L 6

# FIELD SAMPLE DATA RECORDS (GROUNDWATER AND 1998 SOILS)

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Sunny, 40s | LOCATION ACTIVITY: START 1254 END ~~1530~~ 1440

SITE ID: 57M--95--01X | FIELD SAMPLE NUMBER: MX5701X1 | DATE: 10-30-95 | STUDY AREA (AOC): 57

**WATER LEVEL / WELL DATA**

WELL DEPTH: 29.0 FT

WATER DEPTH: 22.31 FT

HEIGHT OF WATER COLUMN: 6.7 FT

MEASURED FROM: [X] TOP OF WELL (riser) [ ] TOP OF CASING

WELL DIAMETER = 4"

[X] x 1.68 gal/ft (4" well) = 11.3 gal, +3 (filter pack) = 14 gal GAL/VOL

[ ] x ____ gal/ft ( well)

**PID HEADSPACE READINGS**

BREATHING ZONE: 0.0 ppm

WELL HEAD: 0.0 ppm

PROTECTIVE CASING STICK-UP FROM GROUND: 2.3 FT

POTECTIVE CASINGE/WELL DIFFERENCE: 0.4 FT

**WELL INTEGRITY**

| | YES | NO |
|---|---|---|
| PROTECTIVE CASING SECURE | X | |
| WELL LOCKED | X | |
| PVC WELL CAP PRESENT | X | |

**PURGE DATA**

| VOLUME # / TIME | initial 13:02 | 1 13:18 | 2 13:35 | 3 13:57 | 4 14:13 | 5 14:30 | | |
|---|---|---|---|---|---|---|---|---|
| GALLONS | 0 | 14 | 28 | 42 | 56 | 70 | | |
| TEMPERATURE, deg. C | 13.8 | 13.8 | 13.9 | 13.8 | 13.8 | 13.7 | | |
| pH units | 6.5 | 5.6 | 5.75 | 5.87 | 5.80 | 5.87 | | |
| SPECIFIC CONDUCTIVITY, umho/cm | 110 | 104 | 98 | 81 | 85 | 84 | | |
| TURBIDITY' ntu | Not measured | | | | | | | |
| REDOX (AT COMPLETION OF PURGING) mV | | 327.9 | | | | | | |

**SAMPLE OBSERVATION**

[X] CLEAR
[ ] TURBID
[ ] COLORED ____
[ ] ODOR
[ ] OTHER (SEE NOTES)

| SAMPLE PARAMETERS | COLLECTED | METHOD # | FRACTION CODE | PRESERATIVE | VOLUME | SAMPLE BOTTLE NUMBER |
|---|---|---|---|---|---|---|
| SVOCS | X | UM18 | MS | 4C | 2- 1L AG | A, B |
| PEST./PCBS | X | UW19 | EC | 4C | 2- 1L AG | C, D |
| VOC | X | UM20 | VP | HCL,4C | 4- 40 ml AG | E, F, G, H |
| INORGANICS-UNFILTERED | X | * | N | HNO3 pH<2 | 1- 1L Poly | I |
| INORGANICS-FILTERED | X | * | NF | HNO3 pH<2 | 1- 1L Poly | J |
| WATER QUALITY PARAM. / TDS | X | * 160.1 | C | 4C | 1- 1L Poly | K |
| | | | S | H2SO4 pH<2 | 1- 1L Poly | L |
| TPHC | X | 418.1 | C | H2SO4 pH<2 | ~~1- 1L Poly~~ 2-1L AG | M, N |

CONTROL # 167

[X] IF MS/MSD COLLECTED
[ ] IF DUPLICATE COLLECTED

**SAMPLING EQUIPMENT**

WATER LEVEL EQUIPMENT USED:

[X] ELECTRIC CONDUCTIVITY PROBE
[ ] FLOAT ACTIVATED
[ ] OTHER ____

| | PURGING | SAMPLING |
|---|---|---|
| DEDICATED SUBMIRSABLE PUMP (WHALE) | X | X |
| DEDICATED TEFLON BAILER | | X |
| IN-LINE FILTER (INORGANICS) | | X |
| OTHER ____ | | |

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

Did not have a turbidity meter

SAMPLERS SIGNATURE: Sarah Montgomery

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Sunny, 40s | LOCATION ACTIVITY: START 1542 END ~~1722~~ 1658

SITE ID: 57M--95--02X | FIELD SAMPLE NUMBER: MX57O2X1 | DATE: 10-30-95 | STUDY AREA (AOC): 57

| WATER LEVEL / WELL DATA | | MEASURED FROM | PID HEADSPACE READINGS | | WELL INTEGRITY | YES | NO |
|---|---|---|---|---|---|---|---|
| WELL DEPTH | 25 FT | [X] TOP OF WELL (riser) | BREATHING ZONE | 0.0 ppm | PROTECTIVE CASING SECURE | [X] | [ ] |
| WATER DEPTH | 16.09 FT | [ ] TOP OF CASING | WELL HEAD | 0.0 ppm | WELL LOCKED | [X] | [ ] |
| HEIGHT OF WATER COLUMN | 8.9 FT | WELL DIAMETER = 4" | | | PVC WELL CAP PRESENT | [X] | [ ] |
| [X] x 1.68 gal/ft (4" well) = | 15 gal + ≈3 gal (filter pack) ≈ 18 gal GAL/VOL | | PROTECTIVE CASING STICK-UP FROM GROUND | 2.8 FT | POTECTIVE CASINGE/WELL DIFFERENCE | 0.5 FT | |
| [ ] x ____ gal/ft ( well) | | | | | | | |

| PURGE DATA | VOLUME # / TIME | 1 | 2 | 3 | 4 | 5 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 15:52 | 16:03 | 16:12 | 16:31 | 16:46 | | | |
| | GALLONS | 18 | 36 | 54 | 72 | 90 | | | |
| TEMPERATURE, deg. C | | 14.4 | 14.5 | 14.5 | 14.5 | 14.5 | | | |
| pH units | | 6.38 | 6.36 | 6.38 | 6.36 | 6.36 | | | |
| SPECIFIC CONDUCTIVITY, umho/cm | | 329 | 323 | 321 | 315 | 310 | | | |
| TURBIDITY' ntu | | 6 | 3 | 9 | 3 | 3 | | | |
| REDOX (AT COMPLETION OF PURGING) | mV | 284.1 | | | | | | | |

SAMPLE OBSERVATION: [X] CLEAR [ ] TURBID [ ] COLORED ____ [ ] ODOR [ ] OTHER (SEE NOTES)

| SAMPLE PARAMETERS | COLLECTED | METHOD # | FRACTION CODE | PRESERATIVE | VOLUME | SAMPLE BOTTLE NUMBER |
|---|---|---|---|---|---|---|
| SVOCS | [X] | UM18 | MS | 4C | 2- 1L AG | A B |
| PEST./PCBS | [X] | UW19 | EC | 4C | 2- 1L AG | C D |
| VOC | [X] | UM20 | VP | HCL,4C | 4- 40 ml AG | E F G H |
| INORGANICS-UNFILTERED | [X] | * | N | HNO3 pH<2 | 1- 1L Poly | I |
| INORGANICS-FILTERED | [X] | * | NF | HNO3 pH<2 | 1- 1L Poly | J |
| WATER QUALITY PARAM. / TDS | [X] | * 160.1 | C | 4C | 1- 1L Poly | K |
| | | | S | H2SO4 pH<2 | 1- 1L Poly | L |
| TPHC | [X] | 418.1 | C | H2SO4 pH<2 | ~~1- 1L Poly~~ 2-1L AG | M N |

CONTROL # 169

[ ] IF MS/MSD COLLECTED

[ ] IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

WATER LEVEL EQUIPMENT USED:

- [X] ELECTRIC CONDUCTIVITY PROBE
- [ ] FLOAT ACTIVATED
- [ ] OTHER ____

| | PURGING | SAMPLING |
|---|---|---|
| DEDICATED SUBMIRSABLE PUMP (WHALE) | [X] | [X] |
| DEDICATED TEFLON BAILER | [ ] | [X] |
| IN-LINE FILTER (INORGANICS) | [ ] | [X] |
| OTHER ____ | [ ] | [ ] |

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

SAMPLERS SIGNATURE: Sarah Montgomery

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Rain, 50s | LOCATION ACTIVITY: START 1330 END 1630*

SITE ID: 57M-95-03X | FIELD SAMPLE NUMBER: MX5703X1 | DATE: 11-2-95 | STUDY AREA (AOC): 57

| WATER LEVEL / WELL DATA | | MEASURED FROM | PID HEADSPACE READINGS | | WELL INTEGRITY | YES | NO |
|---|---|---|---|---|---|---|---|
| WELL DEPTH | FT | [X] TOP OF WELL | BREATHING ZONE | 0.0 ppm | PROTECTIVE CASING SECURE | [X] | |
| WATER DEPTH | 10.94 FT | [ ] TOP OF CASING | WELL HEAD | 0.0 ppm | WELL LOCKED | [X] | |
| HEIGHT OF WATER COLUMN | FT | WELL DIAMETER = 4" | | | PVC WELL CAP PRESENT | [X] | |
| [X] x 1.68 gal/ft (4" well) = | 15.4 GAL/VOL | | PROTECTIVE CASING STICK-UP FROM GROUND | 2.8 FT | POTECTIVE CASINGE/WELL DIFFERENCE | 0.3 FT | |
| [ ] x ____ gal/ft ( well) | | | | | | | |

| PURGE DATA | VOLUME # | initial (13:30) | 1 (13:49) | 2 (14:41) | 3 (14:57) | 4 (15:57) | 5 (16:25) | | |
|---|---|---|---|---|---|---|---|---|---|
| | GALLONS | 0 | 15.4 | 30.8 | 46.2 | 61.6 | 77.0 | | |
| TEMPERATURE, deg. C | | 11.8 | 12.2 | 12.0 | 12.1 | 12.0 | 12.0 | | |
| pH units | | 5.58 | 6.06 | 6.01 | 6.01 | 5.91 | 5.94 | | |
| SPECIFIC CONDUCTIVITY, umho/cm | | 0.114 | 0.152 | 0.160 | 0.156 | 0.152 | 0.151 | | |
| TURBIDITY' ntu | | 92 | 24 | 4 | 1 | 2 | 0 | | |
| REDOX (AT COMPLETION OF PURGING) | | not measured (lost KCl solution in redox probe) | | | | | | | |

SAMPLE OBSERVATION
- [X] CLEAR
- [ ] TURBID
- [ ] COLORED
- [X] ODOR **
- [ ] OTHER (SEE NOTES)

| SAMPLE PARAMETERS | COLLECTED | METHOD # | FRACTION CODE | PRESERATIVE | VOLUME | SAMPLE BOTTLE NUMBER |
|---|---|---|---|---|---|---|
| SVOCS | [X] | UM18 | MS | 4C | 2- 1L AG | A B CONTROL # 171 |
| PEST./PCBS | [X] | UW19 | EC | 4C | 2- 1L AG | C D |
| VOC | [X] | UM20 | VP | HCL,4C | 4- 40 ml AG | E F G H |
| INORGANICS-UNFILTERED | [X] | * | N | HNO3 pH<2 | 1- 1L Poly | I |
| INORGANICS-FILTERED | [X] | * | NF | HNO3 pH<2 | 1- 1L Poly | J |
| WATER QUALITY PARAM. / TDS | [X] | * 160.1 | C | 4C | 1- 1L Poly | K |
| | | | S | H2SO4 pH<2 | 1- 1L Poly | L |
| TPHC | [X] | 418.1 | C | H2SO4 pH<2 | 2- 1L AG | M N |

[ ] IF MS/MSD COLLECTED
[ ] IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

| WATER LEVEL EQUIPMENT USED: | PURGING | SAMPLING | |
|---|---|---|---|
| [X] ELECTRIC CONDUCTIVITY PROBE | [X] | [X] | DEDICATED SUBMIRSABLE PUMP (WHALE) |
| [ ] FLOAT ACTIVATED | [ ] | [X] | DEDICATED TEFLON BAILER |
| [ ] OTHER ____ | [ ] | [X] | IN-LINE FILTER (INORGANICS) |
| | | [ ] | OTHER ____ |

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

* Sample containers were mis-labelled with the incorrect time "17:30". The actual time of collection was 16:30.

** Very strong petroleum-like/solvent-like odor.

SAMPLERS SIGNATURE: Sarah Montgomery

Sam

Purged water was placed in drums

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Drizzle, windy, 50s | LOCATION ACTIVITY: START 1255 END 1345

SITE ID: 57M-95-04A | FIELD SAMPLE NUMBER: MX5704A1 | DATE: 11-1-95 | STUDY AREA (AOC): 57

| WATER LEVEL / WELL DATA | | MEASURED FROM | PID HEADSPACE READINGS | | WELL INTEGRITY | YES | NO |
|---|---|---|---|---|---|---|---|
| WELL DEPTH | FT | [X] TOP OF WELL | BREATHING ZONE | 0.0 ppm | PROTECTIVE CASING SECURE | [X] | [ ] |
| WATER DEPTH | 3.12 FT | [ ] TOP OF CASING | WELL HEAD | 0.1 ppm | WELL LOCKED | [X] | [ ] |
| HEIGHT OF WATER COLUMN | FT | WELL DIAMETER = 4" | | | PVC WELL CAP PRESENT | [X] | [ ] |
| [X] x 1.68 gal/ft (4" well) = | 18.0 GAL/VOL | | PROTECTIVE CASING STICK-UP FROM GROUND | 1.5 FT | POTECTIVE CASINGE/WELL DIFFERENCE | 0.4 FT | |
| [ ] x ___ gal/ft ( well) | | | | | | | |

| PURGE DATA | VOLUME # | 1 (13:03) | 2 (13:19) | 3 (14:01) | 4 (14:22) | 5 (14:54) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | GALLONS | 18 | 36 | 54 | 72 | 90 | | | |
| TEMPERATURE, deg. C | | 12.9 | 13.2 | 13.0 | 13.3 | 13.2 | | | |
| pH units | | 5.97 | 5.90 | 5.91 | 5.83 | 5.85 | | | |
| SPECIFIC CONDUCTIVITY, umho/cm | | 0.093 | 0.090 | 0.088 | 0.089 | 0.085 | | | |
| TURBIDITY' ntu | | 3 | 0 | 0 | 0 | 0 | | | |
| REDOX (AT COMPLETION OF PURGING) | | | 191.4 mV | | | | | | |

SAMPLE OBSERVATION: [X] CLEAR [ ] TURBID [ ] COLORED ___ [ ] ODOR [X] OTHER (SEE NOTES)

| SAMPLE PARAMETERS | COLLECTED | METHOD # | FRACTION CODE | PRESERATIVE | VOLUME | SAMPLE BOTTLE NUMBER |
|---|---|---|---|---|---|---|
| SVOCS | [X] | UM18 | MS | 4C | 2- 1L AG | A B CONTROL # 173 |
| PEST./PCBS | [X] | UW19 | EC | 4C | 2- 1L AG | C D |
| VOC | [X] | UM20 | VP | HCL,4C | 4- 40 ml AG | E F G H |
| INORGANICS-UNFILTERED | [X] | * | N | HNO3 pH<2 | 1- 1L Poly | I |
| INORGANICS-FILTERED | [X] | * | NF | HNO3 pH<2 | 1- 1L Poly | J |
| WATER QUALITY PARAM. / TDS | [X] | * 160.1 | C | 4C | 1- 1L Poly | K |
| | | | S | H2SO4 pH<2 | 1- 1L Poly | L |
| TPHC | [X] | 418.1 | C | H2SO4 pH<2 | 2- 1L AG | M N |

[ ] IF MS/MSD COLLECTED
[ ] IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

| WATER LEVEL EQUIPMENT USED: | PURGING | SAMPLING | |
|---|---|---|---|
| [X] ELECTRIC CONDUCTIVITY PROBE | [X] | [X] | DEDICATED SUBMIRSABLE PUMP (WHALE) |
| [ ] FLOAT ACTIVATED | [ ] | [X] | DEDICATED TEFLON BAILER |
| [ ] OTHER ___ | [ ] | [X] | IN-LINE FILTER (INORGANICS) |
| | [ ] | [ ] | OTHER ___ |

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

- Iridescent sheen on water surface. Purged water was placed in drums.
- Alternated between purging this well and purging 57M-95-08A.

SAMPLERS SIGNATURE: Sarah Montgomery

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Drizzle, windy, 50s | LOCATION ACTIVITY: START 15:00 END ~~14~~ 1650 (5/m)

SITE ID: 57M--95--04B | FIELD SAMPLE NUMBER: ~~57~~ MX 5704B1 (5/m) | DATE: 11-1-95 | STUDY AREA (AOC): 57

| WATER LEVEL / WELL DATA | | MEASURED FROM | PID HEADSPACE READINGS | | WELL INTEGRITY | YES | NO |
|---|---|---|---|---|---|---|---|
| WELL DEPTH | FT | [X] TOP OF WELL | BREATHING ZONE | 0.0 ppm | PROTECTIVE CASING SECURE | X | |
| WATER DEPTH | 3.96 FT | [ ] TOP OF CASING | WELL HEAD | 0.1 ppm | WELL LOCKED | X | |
| HEIGHT OF WATER COLUMN | FT | WELL DIAMETER = 4" | | | PVC WELL CAP PRESENT | X | |

[X] x 1.68 gal/ft (4" well) = 35 (34.8) GAL/VOL
[ ] x ___ gal/ft ( well)

PROTECTIVE CASING STICK-UP FROM GROUND: 2.5 FT

POTECTIVE CASINGE/WELL DIFFERENCE: 0.2 FT

| PURGE DATA | VOLUME # | 1 (15:20) | 2 (15:38) | 3 (15:56) | 4 (16:16) | 5 (17:00) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | GALLONS | 35 | 70 | 105 | 140 | 175 | | | |
| TEMPERATURE, deg. C | | 12.0 | 12.1 | 11.9 | 12.1 | 11.9 | | | |
| pH units | | 5.86 | 5.77 | 5.80 | 5.72 | 5.68 | | | |
| SPECIFIC CONDUCTIVITY, umho/cm | | 0.213 | 0.214 | ~~0.210~~ 0.213 (5/m) | 0.210 | 0.207 | | | |
| TURBIDITY' ntu | | 1 | 0 | 0 | 0 | 0 | | | |
| REDOX (AT COMPLETION OF PURGING) | | | 345 | | | | | | |

SAMPLE OBSERVATION
- [X] CLEAR
- [ ] TURBID
- [ ] COLORED
- [ ] ODOR
- [ ] OTHER (SEE NOTES)

| SAMPLE PARAMETERS | COLLECTED | METHOD # | FRACTION CODE | PRESERATIVE | VOLUME | SAMPLE BOTTLE NUMBER |
|---|---|---|---|---|---|---|
| SVOCS | X | UM18 | MS | 4C | 2- 1L AG | A B |
| PEST./PCBS | X | UW19 | EC | 4C | 2- 1L AG | C D |
| VOC | X | UM20 | VP | HCL,4C | 4- 40 ml AG | E F G H |
| INORGANICS-UNFILTERED | X | * | N | HNO3 pH<2 | 1- 1L Poly | I |
| INORGANICS-FILTERED | X | * | NF | HNO3 pH<2 | 1- 1L Poly | J |
| WATER QUALITY PARAM. / TDS | X | * 160.1 | C | 4C | 1- 1L Poly | K |
| | | | S | H2SO4 pH<2 | 1- 1L Poly | L |
| TPHC | X | 418.1 | C | H2SO4 pH<2 | 2- 1L AG | M N |

CONTROL # 185 pp

[ ] IF MS/MSD COLLECTED
[ ] IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

| WATER LEVEL EQUIPMENT USED: | PURGING | SAMPLING | |
|---|---|---|---|
| [X] ELECTRIC CONDUCTIVITY PROBE | X | X | DEDICATED SUBMIRSABLE PUMP (WHALE) |
| [ ] FLOAT ACTIVATED | | X | DEDICATED TEFLON BAILER |
| [ ] OTHER _____ | | X | IN-LINE FILTER (INORGANICS) |
| | | | OTHER _____ |

NUMBER OF IN-LINE FILTERS USED: [ ]

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

SAMPLERS SIGNATURE: Sarah Montgomery

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Rain, 50s | LOCATION ACTIVITY: START 0835 END 0935

SITE ID: 57M-95-05X | FIELD SAMPLE NUMBER: MX5705X1 | DATE: 11-2-95 | STUDY AREA (AOC): 57

| WATER LEVEL / WELL DATA | | MEASURED FROM | PID HEADSPACE READINGS | | WELL INTEGRITY | YES | NO |
|---|---|---|---|---|---|---|---|
| WELL DEPTH | FT | [X] TOP OF WELL | BREATHING ZONE | 0.0 ppm | PROTECTIVE CASING SECURE | [X] | [ ] |
| WATER DEPTH | 15.53 FT | [ ] TOP OF CASING | WELL HEAD | 0.0 ppm | WELL LOCKED | [X] | [ ] |
| HEIGHT OF WATER COLUMN | FT | WELL DIAMETER = 4" | | | PVC WELL CAP PRESENT | [X] | [ ] |

[X] x 1.68 gal/ft (4" well) = 11.4 GAL/VOL
[ ] x ____ gal/ft ( well)

PROTECTIVE CASING STICK-UP FROM GROUND: 2.9 FT

POTECTIVE CASINGE/WELL DIFFERENCE: 0.5 FT

| PURGE DATA | VOLUME # | 1 (08:39) | 2 (08:47) | 3 (08:50) | 4 (09:04) | 5 (09:13) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | GALLONS | 11.4 | 22.8 | 34.2 | 45.6 | 57.0 | | | |
| TEMPERATURE, deg. C | | 13.5 | 13.9 | 13.8 | 13.8 | 14.1 | | | |
| pH units | | 5.68 | 5.81 | 5.81 | 5.82 | 5.84 | | | |
| SPECIFIC CONDUCTIVITY, umho/cm | | 0.100 | 0.085 | 0.085 | 0.086 | 0.086 | | | |
| TURBIDITY' ntu | | 0 | 0 | 0 | 0 | 0 | | | |
| REDOX (AT COMPLETION OF PURGING) | | | 324.9 mV | | | | | | |

SAMPLE OBSERVATION
- [X] CLEAR
- [ ] TURBID
- [ ] COLORED ____
- [ ] ODOR
- [ ] OTHER (SEE NOTES)

| SAMPLE PARAMETERS | COLLECTED | METHOD # | FRACTION CODE | PRESERATIVE | VOLUME | SAMPLE BOTTLE NUMBER |
|---|---|---|---|---|---|---|
| SVOCS | [X] | UM18 | MS | 4C | 2- 1L AG | A B |
| PEST./PCBS | [X] | UW19 | EC | 4C | 2- 1L AG | C D |
| VOC | [X] | UM20 | VP | HCL,4C | 4- 40 ml AG | E F G H |
| INORGANICS-UNFILTERED | [X] | * | N | HNO3 pH<2 | 1- 1L Poly | I |
| INORGANICS-FILTERED | [X] | * | NF | HNO3 pH<2 | 1- 1L Poly | J |
| WATER QUALITY PARAM. / TDS | [X] | * 160.1 | C | 4C | 1- 1L Poly | K |
| | | | S | H2SO4 pH<2 | 1- 1L Poly | L |
| TPHC | [X] | 418.1 | C | H2SO4 pH<2 | 2- 1L AG | M N |

CONTROL # 175.2

[ ] IF MS/MSD COLLECTED
[ ] IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

| | PURGING | SAMPLING |
|---|---|---|
| WATER LEVEL EQUIPMENT USED: | | |
| [X] ELECTRIC CONDUCTIVITY PROBE | [X] | [X] DEDICATED SUBMIRSABLE PUMP (WHALE) |
| [ ] FLOAT ACTIVATED | [ ] | [X] DEDICATED TEFLON BAILER |
| [ ] OTHER ____ | [ ] | [X] IN-LINE FILTER (INORGANICS) |
| | | [ ] OTHER ____ |

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

SAMPLERS SIGNATURE: Sarah Montgomery

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Rain, 50s ? | LOCATION ACTIVITY: START ~~0835~~ 0952 | END 1110

SITE ID: 57M-95-06X | FIELD SAMPLE NUMBER: ~~57M~~ 06X1 MX 57 | DATE: 11-2-95 | STUDY AREA (AOC): 57

| WATER LEVEL / WELL DATA | | MEASURED FROM | PID HEADSPACE READINGS | | WELL INTEGRITY | YES | NO |
|---|---|---|---|---|---|---|---|
| WELL DEPTH | FT | [X] TOP OF WELL | BREATHING ZONE | 0.0 ppm | PROTECTIVE CASING SECURE | X | |
| WATER DEPTH | 13.83 FT | [ ] TOP OF CASING | WELL HEAD | 0.0 ppm | WELL LOCKED | X | |
| HEIGHT OF WATER COLUMN | FT | WELL DIAMETER = 4" | | | PVC WELL CAP PRESENT | X | |

[X] x 1.68 gal/ft (4" well) = 18.2 GAL/VOL
[ ] x ____ gal/ft ( well)

PROTECTIVE CASING STICK-UP FROM GROUND: 2.3 FT

POTECTIVE CASINGE/WELL DIFFERENCE: 0.2 FT

| PURGE DATA | VOLUME # | Initial (0952) | 1 (1005) | 2 (1016) | 3 (1032) | 4 (1049) | 5 (1101) | | |
|---|---|---|---|---|---|---|---|---|---|
| | GALLONS | 0 | 18.2 | 36.4 | 54.6 | 72.8 | 91.0 | | |
| TEMPERATURE, deg. C | | 12.4 | 13.2 | 13.4 | 13.5 | 13.4 | 13.0 | | |
| pH units | | 0.088 | 0.085 | 0.086 | 0.088 | 0.089 | 0.090 | | |
| SPECIFIC CONDUCTIVITY, umho/cm | | 5.87 | 5.96 | 5.97 | 6.00 | 5.97 | 5.93 | | |
| TURBIDITY' ntu | | 9 | 3 | 0 | 0 | 0 | 0 | | |
| REDOX (AT COMPLETION OF PURGING) | | | 277.4 | mV | | | | | |

SAMPLE OBSERVATION
- [X] CLEAR
- [ ] TURBID
- [ ] COLORED
- [ ] ODOR
- [ ] OTHER (SEE NOTES)

| SAMPLE PARAMETERS | COLLECTED | METHOD # | FRACTION CODE | PRESERATIVE | VOLUME | SAMPLE BOTTLE NUMBER |
|---|---|---|---|---|---|---|
| SVOCS | X | UM18 | MS | 4C | 2- 1L AG | A B |
| PEST./PCBS | X | UW19 | EC | 4C | 2- 1L AG | C D |
| VOC | X | UM20 | VP | HCL,4C | 4- 40 ml AG | E F G H |
| INORGANICS-UNFILTERED | X | * | N | HNO3 pH<2 | 1- 1L Poly | I |
| INORGANICS-FILTERED | X | * | NF | HNO3 pH<2 | 1- 1L Poly | J |
| WATER QUALITY PARAM. / TDS | X | * 160.1 | C | 4C | 1- 1L Poly | K |
| | | | S | H2SO4 pH<2 | 1- 1L Poly | L |
| TPHC | X | 418.1 | C | H2SO4 pH<2 | 2- 1L AG | M N |

177 PP

CONTROL # ~~177~~ PP

[ ] IF MS/MSD COLLECTED
[ ] IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

| WATER LEVEL EQUIPMENT USED: | PURGING | SAMPLING | |
|---|---|---|---|
| [X] ELECTRIC CONDUCTIVITY PROBE | X | X | DEDICATED SUBMIRSABLE PUMP (WHALE) |
| [ ] FLOAT ACTIVATED | | X | DEDICATED TEFLON BAILER |
| [ ] OTHER _____ | | X | IN-LINE FILTER (INORGANICS) |
| | | | OTHER _____ |

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

SAMPLERS SIGNATURE: Jack Montgomery

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Cloudy, 40s | LOCATION ACTIVITY START: 1536 END: 1640

SITE ID: 57M--95--07X | FIELD SAMPLE NUMBER: MX5707X1 | DATE: 10-31-95 | STUDY AREA (AOC): 57

| WATER LEVEL / WELL DATA | | MEASURED FROM | PID HEADSPACE READINGS | | WELL INTEGRITY | YES | NO |
|---|---|---|---|---|---|---|---|
| WELL DEPTH | FT | [X] TOP OF WELL | BREATHING ZONE | 0.0 ppm | PROTECTIVE CASING SECURE | [X] | |
| WATER DEPTH | 3.49 FT | [ ] TOP OF CASING | WELL HEAD | 0.1 ppm | WELL LOCKED | [X] | |
| HEIGHT OF WATER COLUMN | FT | WELL DIAMETER = 4" | | | PVC WELL CAP PRESENT | [X] | |

[X] x 1.68 gal/ft (4" well) = 19.0 GAL/VOL

[ ] x ____ gal/ft ( well)

PROTECTIVE CASING STICK-UP FROM GROUND: 1.5 FT

POTECTIVE CASINGE/WELL DIFFERENCE: 0.3 FT

| PURGE DATA | VOLUME # | initial (1536) | ~~19.0~~ 1 (1545) | ~~38.0~~ 2 (1557) | ~~57.0~~ 3 (1609) | ~~76.0~~ 4 (1624) | ~~95.0~~ 5 | | |
|---|---|---|---|---|---|---|---|---|---|
| | GALLONS | 0 | 19.0 | 38.0 | 57.0 | 76.0 | 95.0 | | |
| TEMPERATURE, deg. C | | 13.2 | 13.3 | 13.4 | 13.4 | 13.3 | | | |
| pH units | | 5.56 | 5.59 | 5.53 | 5.52 | 5.59 | | | |
| SPECIFIC CONDUCTIVITY, umho/cm | | 0.136 | 0.137 | 0.133 | 0.133 | 0.137 | | | |
| TURBIDITY' ntu | | 0 | 0 | 0 | 0 | 0 | | | |
| REDOX (AT COMPLETION OF PURGING) | | | | | | | | | |

SAMPLE OBSERVATION: [X] CLEAR [ ] TURBID [ ] COLORED ____ [ ] ODOR [ ] OTHER (SEE NOTES)

| SAMPLE PARAMETERS | COLLECTED | METHOD # | FRACTION CODE | PRESERATIVE | VOLUME | SAMPLE BOTTLE NUMBER |
|---|---|---|---|---|---|---|
| SVOCS | [X] | UM18 | MS | 4C | 2- 1L AG | A B |
| PEST./PCBS | [X] | UW19 | EC | 4C | 2- 1L AG | C D |
| VOC | [X] | UM20 | VP | HCL,4C | 4- 40 ml AG | E F G H |
| INORGANICS-UNFILTERED | [X] | * | N | HNO3 pH<2 | 1- 1L Poly | I |
| INORGANICS-FILTERED | [X] | * | NF | HNO3 pH<2 | 1- 1L Poly | J |
| WATER QUALITY PARAM. / TDS | [X] | * 160.1 | C | 4C | 1- 1L Poly | K |
| | | | S | H2SO4 pH<2 | 1- 1L Poly | L |
| TPHC | [X] | 418.1 | C | H2SO4 pH<2 | 2- 1L AG | M N |

CONTROL # 17

[ ] IF MS/MSD COLLECTED

[ ] IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

| WATER LEVEL EQUIPMENT USED: | PURGING | SAMPLING | |
|---|---|---|---|
| [X] ELECTRIC CONDUCTIVITY PROBE | [X] | [X] | DEDICATED SUBMIRSABLE PUMP (WHALE) |
| [ ] FLOAT ACTIVATED | [ ] | [X] | DEDICATED TEFLON BAILER |
| [ ] OTHER ____ | [ ] | [X] | IN-LINE FILTER (INORGANICS) |
| | | [ ] | OTHER ____ |

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

SAMPLERS SIGNATURE: Sarah Montgomery

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Drizzle, windy, 50s | LOCATION ACTIVITY: START 0800 END 1345

SITE ID: 57M--95--08A | FIELD SAMPLE NUMBER: MX5708A1 | DATE: 11-1-95 | STUDY AREA (AOC): 57

| WATER LEVEL / WELL DATA | | MEASURED FROM | PID HEADSPACE READINGS | | WELL INTEGRITY | YES | NO |
|---|---|---|---|---|---|---|---|
| WELL DEPTH | FT | [X] TOP OF WELL | BREATHING ZONE | 0.0 ppm | PROTECTIVE CASING SECURE | [X] | [ ] |
| WATER DEPTH | 3.0 FT | [ ] TOP OF CASING | WELL HEAD | 0.5 ~~0.0~~ ppm | WELL LOCKED | [X] | [ ] |
| HEIGHT OF WATER COLUMN | FT | WELL DIAMETER = 4" | | | PVC WELL CAP PRESENT | [X] | [ ] |
| [X] x 1.68 gal/ft (4" well) = | 20.8 GAL/VOL | | PROTECTIVE CASING STICK-UP FROM GROUND | 1.4' ~~0.3~~ FT | POTECTIVE CASINGE/WELL DIFFERENCE | 0.3 FT | |
| [ ] x ____ gal/ft ( well) | | | | | | | |

| PURGE DATA | VOLUME # | initial (0800) | 1 (0826) | 2 (0920) | 3 (1200) | 4 (1230) | 5 (1335) | | |
|---|---|---|---|---|---|---|---|---|---|
| | GALLONS | 0 | 20.8 | 41.6 | 62.4 | 83.2 | 104.0 | | |
| TEMPERATURE, deg. C | | 12.1 | 11.6 | 12.1 | 11.7 | 12.3 | 12.1 | | |
| pH units | | 5.36 | 5.57 | 5.55 | 5.87 | 5.93 | 5.89 | | |
| SPECIFIC CONDUCTIVITY, umho/cm | | 0.129 | ~~0.072~~ 0.075 | 0.078 | 0.076 | 0.069 | 0.075 | | |
| TURBIDITY' ntu | | 43 | ~~95~~ 1 | 3 | 4 | 9 | 0 | | |
| REDOX (AT COMPLETION OF PURGING) | | | 243.0 mV | | | | | | |

SAMPLE OBSERVATION
- [X] CLEAR
- [ ] TURBID
- [ ] COLORED ____
- [ ] ODOR
- [ ] OTHER (SEE NOTES)

| SAMPLE PARAMETERS | COLLECTED | METHOD # | FRACTION CODE | PRESERATIVE | VOLUME | SAMPLE BOTTLE NUMBER |
|---|---|---|---|---|---|---|
| SVOCS | [X] | UM18 | MS | 4C | 2- 1L AG | A B |
| PEST./PCBS | [X] | UW19 | EC | 4C | 2- 1L AG | C D |
| VOC | [X] | UM20 | VP | HCL,4C | 4- 40 ml AG | E F G H |
| INORGANICS-UNFILTERED | [X] | * | N | HNO3 pH<2 | 1- 1L Poly | I |
| INORGANICS-FILTERED | [X] | * | NF | HNO3 pH<2 | 1- 1L Poly | J |
| WATER QUALITY PARAM. / TDS | [X] | * 160.1 | C | 4C | 1- 1L Poly | K |
| | | | S | H2SO4 pH<2 | 1- 1L Poly | L |
| TPHC | [X] | 418.1 | C | H2SO4 pH<2 | 2- 1L AG | M N |

CONTROL # 181

- [ ] IF MS/MSD COLLECTED
- [ ] IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

WATER LEVEL EQUIPMENT USED:
- [X] ELECTRIC CONDUCTIVITY PROBE
- [ ] FLOAT ACTIVATED
- [ ] OTHER ____

| | PURGING | SAMPLING |
|---|---|---|
| DEDICATED SUBMIRSABLE PUMP (WHALE) | [X] | [X] |
| DEDICATED TEFLON BAILER | [ ] | [X] |
| IN-LINE FILTER (INORGANICS) | [ ] | [X] |
| OTHER ____ | [ ] | [ ] |

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

- Slow recharge; alternated between purging this well and purging 57M-95-08B.

SAMPLERS SIGNATURE: Sarah Montgomery

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Drizzle, windy, 50s | LOCATION ACTIVITY: START 0850 END 1155

SITE ID: 57M--95--08B | FIELD SAMPLE NUMBER: MX5708B1 | DATE: 11-1-95 | STUDY AREA (AOC): 57

| WATER LEVEL / WELL DATA | | MEASURED FROM | PID HEADSPACE READINGS | | WELL INTEGRITY | YES | NO |
|---|---|---|---|---|---|---|---|
| WELL DEPTH | FT | [X] TOP OF WELL | BREATHING ZONE | 0.0 ppm | PROTECTIVE CASING SECURE | [X] | |
| WATER DEPTH | 3.82 FT | [ ] TOP OF CASING | WELL HEAD | 0.0 ppm | WELL LOCKED | [X] | |
| HEIGHT OF WATER COLUMN | FT | WELL DIAMETER = 4" | | | PVC WELL CAP PRESENT | [X] | |
| [X] x 1.68 gal/ft (4" well) = | 34.7 GAL/VOL | PROTECTIVE CASING STICK-UP FROM GROUND | 2.8 FT | | POTECTIVE CASINGE/WELL DIFFERENCE | 0.5 FT | |
| [ ] x ____ gal/ft ( well) | | | | | | | |

| PURGE DATA | VOLUME # | 1 initial (0850) | 2 (0912) | 3 (0940) | 4 (1008) | 5 (1053) | (1134) | | |
|---|---|---|---|---|---|---|---|---|---|
| | GALLONS | 0 | 34.7 | 69.4 | 104.1 | 138.8 | 173.5 | | |
| TEMPERATURE, deg. C | | 10.9 | 11.1 | 11.3 | 11.3 | 11.3 | 11.0 | | |
| pH units | | 5.49 | 5.53 | 5.70 | 5.74 | 5.80 | 5.91 | | |
| SPECIFIC CONDUCTIVITY, umho/cm | | 0.228 | 0.224 | 0.222 | 0.217 | 0.218 | 0.219 | | |
| TURBIDITY' ntu | | 6 | 0 | 1 | 0 | 2 | 0 | | |
| REDOX (AT COMPLETION OF PURGING) | | | 277 mV | | | | | | |

SAMPLE OBSERVATION
- [X] CLEAR
- [ ] TURBID
- [ ] COLORED ____
- [ ] ODOR
- [ ] OTHER (SEE NOTES)

| SAMPLE PARAMETERS | COLLECTED | METHOD # | FRACTION CODE | PRESERATIVE | VOLUME | SAMPLE BOTTLE NUMBER |
|---|---|---|---|---|---|---|
| SVOCS | [X] | UM18 | MS | 4C | 2- 1L AG | A B |
| PEST./PCBS | [X] | UW19 | EC | 4C | 2- 1L AG | C D |
| VOC | [X] | UM20 | VP | HCL,4C | 4- 40 ml AG | E F G H |
| INORGANICS-UNFILTERED | [X] | * | N | HNO3 pH<2 | 1- 1L Poly | I |
| INORGANICS-FILTERED | [X] | * | NF | HNO3 pH<2 | 1- 1L Poly | J |
| WATER QUALITY PARAM. / TDS | [X] | * 160.1 | C | 4C | 1- 1L Poly | K |
| | | | S | H2SO4 pH<2 | 1- 1L Poly | L |
| TPHC | [X] | 418.1 | C | H2SO4 pH<2 | 2- 1L AG | M N |

CONTROL # 183

- [ ] IF MS/MSD COLLECTED
- [ ] IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

| WATER LEVEL EQUIPMENT USED: | PURGING | SAMPLING | |
|---|---|---|---|
| [X] ELECTRIC CONDUCTIVITY PROBE | [X] | [X] | DEDICATED SUBMIRSABLE PUMP (WHALE) |
| [ ] FLOAT ACTIVATED | [ ] | [X] | DEDICATED TEFLON BAILER |
| [ ] OTHER ____ | [ ] | [X] | IN-LINE FILTER (INORGANICS) |
| | | [ ] | OTHER ____ |

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

— Alternated between purging this well and purging 57M-95-08A

SAMPLERS SIGNATURE: Bob Montgomery

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Partly cloudy, 40s | LOCATION ACTIVITY: START 0900 END 1030

SITE ID: G3M--92--02X | FIELD SAMPLE NUMBER: MXG302X1 | DATE: 10-31-95 | STUDY AREA (AOC): 57

| WATER LEVEL / WELL DATA | | MEASURED FROM | PID HEADSPACE READINGS | | WELL INTEGRITY | YES | NO |
|---|---|---|---|---|---|---|---|
| WELL DEPTH | 33.38 FT | [X] TOP OF WELL | BREATHING ZONE | 0.0 ppm | PROTECTIVE CASING SECURE | [X] | [ ] |
| WATER DEPTH | 26.95 FT | [ ] TOP OF CASING | WELL HEAD | 0.0 ppm | WELL LOCKED | [X] | [ ] |
| HEIGHT OF WATER COLUMN | 6.43 FT | WELL DIAMETER = 4" | | | PVC WELL CAP PRESENT | [X] | [ ] |
| [X] x 1.68 gal/ft (4" well) = | 14.0 GAL/VOL | | PROTECTIVE CASING STICK-UP FROM GROUND | 2.3 FT | POTECTIVE CASINGE/WELL DIFFERENCE | 0.3 FT | |
| [ ] x ____ gal/ft ( well) | | | | | | | |

| PURGE DATA | VOLUME # | 1 initial (0900) | 2 (0916) | 3 (0931) | 4 (0946) | 5 (1003) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | GALLONS | 0 | 14 | 28 | 42 | 56 | 70 | | |
| TEMPERATURE, deg. C | | 12.8 | 12.9 | 12.9 | 12.9 | 12.9 | 12.9 | | |
| pH units | | 5.98 | 6.01 | 5.99 | 5.99 | 5.99 | 5.99 | | |
| SPECIFIC CONDUCTIVITY, umho/cm (mS/cm) | | 0.195 | 0.158 | 0.140 | 0.146 | 0.139 | 0.147 | | |
| TURBIDITY' ntu | | 2 | Ø | Ø | Ø | Ø | Ø | | |
| REDOX (AT COMPLETION OF PURGING) (mV) | | | 330.7 | | | | | | |

SAMPLE OBSERVATION
- [X] CLEAR
- [ ] TURBID
- [ ] COLORED ____
- [ ] ODOR
- [ ] OTHER (SEE NOTES)

| SAMPLE PARAMETERS | COLLECTED | METHOD # | FRACTION CODE | PRESERATIVE | VOLUME | SAMPLE BOTTLE NUMBER |
|---|---|---|---|---|---|---|
| SVOCS | [X] | UM18 | MS | 4C | 2- 1L AG | A B |
| PEST./PCBS | [X] | UW19 | EC | 4C | 2- 1L AG | C D |
| VOC | [X] | UM20 | VP | HCL,4C | 4- 40 ml AG | E F G H |
| INORGANICS-UNFILTERED | [X] | * | N | HNO3 pH<2 | 1- 1L Poly | I |
| INORGANICS-FILTERED | [X] | * | NF | HNO3 pH<2 | 1- 1L Poly | J |
| WATER QUALITY PARAM. / TDS | [X] | * 160.1 | C | 4C | 1- 1L Poly | K |
| | | | S | H2SO4 pH<2 | 1- 1L Poly | L |
| TPHC | [X] | 418.1 | C | H2SO4 pH<2 | 2- 1L AG | M N |

CONTROL # 163

[ ] IF MS/MSD COLLECTED

[ ] IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

| WATER LEVEL EQUIPMENT USED: | PURGING | SAMPLING | |
|---|---|---|---|
| [X] ELECTRIC CONDUCTIVITY PROBE | [X] | [X] | DEDICATED SUBMIRSABLE PUMP (WHALE) |
| [ ] FLOAT ACTIVATED | [ ] | [X] | DEDICATED TEFLON BAILER |
| [ ] OTHER ____ | [ ] | [X] | IN-LINE FILTER (INORGANICS) |
| | | [ ] | OTHER ____ |

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

SAMPLERS SIGNATURE: Sarah J. Montgomery

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Partly cloudy, 40s | LOCATION ACTIVITY: START 1136 END 13:15

SITE ID: G3M-92-07X | FIELD SAMPLE NUMBER: MXG307X1 | DATE: 10-31-95 | STUDY AREA (AOC): 57

| WATER LEVEL / WELL DATA | | MEASURED FROM | PID HEADSPACE READINGS | | WELL INTEGRITY | YES | NO |
|---|---|---|---|---|---|---|---|
| WELL DEPTH | 27.65 FT | [X] TOP OF WELL | BREATHING ZONE | 0.0 ppm | PROTECTIVE CASING SECURE | [X] | |
| WATER DEPTH | 34.42 FT | [ ] TOP OF CASING | WELL HEAD | 0.0 ppm | WELL LOCKED | [X] | |
| HEIGHT OF WATER COLUMN | 6.77 FT | WELL DIAMETER = 4" | | | PVC WELL CAP PRESENT | [X] | |
| [X] x 1.68 gal/ft (4" well) = | 14.7 GAL/VOL | PROTECTIVE CASING STICK-UP FROM GROUND | 2.3 FT | | POTECTIVE CASINGE/WELL DIFFERENCE | 0.2 FT | |
| [ ] x ___ gal/ft ( well) | | | | | | | |

| PURGE DATA | VOLUME # | initial (11:36) | 1 (12:50) | 2 (12:06) | 3 (12:23) | 4 (12:48) | 5 | | |
|---|---|---|---|---|---|---|---|---|---|
| | GALLONS | 0 | 14.7 | 29.4 | 44.1 | 58.8 | 73.5 | | |
| TEMPERATURE, deg. C | | 13.8 | 13.9 | 13.9 | 13.9 | 13.9 | | | |
| pH units | | 5.96 | 6.01 | 6.02 | 6.02 | 6.02 | | | |
| SPECIFIC CONDUCTIVITY, umho/cm | | 0.259 | 0.254 | 0.260 | 0.260 | 0.261 | | | |
| TURBIDITY' ntu | | 1 | 0 | 0 | 0 | 0 | | | |
| REDOX (AT COMPLETION OF PURGING) (mV) | | 291.5 | | | | | | | |

SAMPLE OBSERVATION
- [X] CLEAR
- [ ] TURBID
- [ ] COLORED ___
- [ ] ODOR
- [ ] OTHER (SEE NOTES)

| SAMPLE PARAMETERS | COLLECTED | METHOD # | FRACTION CODE | PRESERATIVE | VOLUME | SAMPLE BOTTLE NUMBER |
|---|---|---|---|---|---|---|
| SVOCS | [X] | UM18 | MS | 4C | 2- 1L AG | A B |
| PEST./PCBS | [X] | UW19 | EC | 4C | 2- 1L AG | C D |
| VOC | [X] | UM20 | VP | HCL,4C | 4- 40 ml AG | E F G H |
| INORGANICS-UNFILTERED | [X] | * | N | HNO3 pH<2 | 1- 1L Poly | I |
| INORGANICS-FILTERED | [X] | * | NF | HNO3 pH<2 | 1- 1L Poly | J |
| WATER QUALITY PARAM. / TDS | [X] | * 160.1 | C | 4C | 1- 1L Poly | K |
| | | | S | H2SO4 pH<2 | 1- 1L Poly | L |
| TPHC | [X] | 418.1 | C | H2SO4 pH<2 | 2- 1L AG | M N |

CONTROL # 165 (Dup: 448)

- [ ] IF MS/MSD COLLECTED
- [X] IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

| WATER LEVEL EQUIPMENT USED: | PURGING | SAMPLING | |
|---|---|---|---|
| [X] ELECTRIC CONDUCTIVITY PROBE | [X] | [X] | DEDICATED SUBMIRSABLE PUMP (WHALE) |
| [ ] FLOAT ACTIVATED | [ ] | [X] | DEDICATED TEFLON BAILER |
| [ ] OTHER ___ | [ ] | [X] | IN-LINE FILTER (INORGANICS) |
| | | [ ] | OTHER ___ |

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

SAMPLERS SIGNATURE: Sarah J. Montgomery

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: clear, windy, 10's | LOCATION ACTIVITY: START 1145 END 1330

SITE ID: 57M--95--01X | FIELD SAMPLE NUMBER: MD5701X2 | DATE: 2/13/96 | STUDY AREA (AOC): SA 57

| WATER LEVEL / WELL DATA | | MEASURED FROM | PID HEADSPACE READINGS | | WELL INTEGRITY | YES | NO |
|---|---|---|---|---|---|---|---|
| WELL DEPTH | FT | ☐ TOP OF WELL | BREATHING ZONE | ppm | PROTECTIVE CASING SECURE | ☐ | ☐ |
| WATER DEPTH | FT | ☐ TOP OF CASING | WELL HEAD | ppm | WELL LOCKED | ☐ | ☐ |
| HEIGHT OF WATER COLUMN | FT | WELL DIAMETER = _____ | | | PVC WELL CAP PRESENT | ☐ | ☐ |
| ☐ x 1.68 gal/ft (4" well) = | GAL/VOL | | PROTECTIVE CASING STICK-UP FROM GROUND | FT | POTECTIVE CASINGE/WELL DIFFERENCE | FT | |
| ☐ x ____ gal/ft ( well) | | | | | | | |

| PURGE DATA | VOLUME # | | | | | | | | | SAMPLE OBSERVATION |
|---|---|---|---|---|---|---|---|---|---|---|
| | GALLONS | | | | | | | | | ☐ CLEAR |
| TEMPERATURE, deg. C | | | | | | | | | | ☐ TURBID |
| pH units | | | | | | | | | | ☐ COLORED _____ |
| SPECIFIC CONDUCTIVITY, umho/cm | | | | | | | | | | ☐ ODOR |
| TURBIDITY, ntu | | | | | | | | | | ☐ OTHER (SEE NOTES) |
| REDOX (AT COMPLETION OF PURGING) | | | | | | | | | | |

NA

| SAMPLE PARAMETERS | COLLECTED | METHOD # | FRACTION CODE | PRESERATIVE | VOLUME | SAMPLE BOTTLE NUMBER |
|---|---|---|---|---|---|---|
| SVOCS | ☑ | UM18 | MS | 4C | 2- 1L AG | A B CONTROL # 455 |
| PEST./PCBS | ☑ | UW19 | EC | 4C | 2- 1L AG | C D |
| VOC | ☑ | UM20 | VP | HCL,4C | 4- 40 ml AG | E F G H |
| INORGANICS-UNFILTERED | ☑ | * | N | HNO3 pH<2 | 1- 1L Poly | I |
| INORGANICS-FILTERED | ☑ | * | NF | HNO3 pH<2 | 1- 1L Poly | J |
| WATER QUALITY PARAM. / TDS | ☑ | * 160.1 | C | 4C | 1- 1L Poly | K |
| | | | S | H2SO4 pH<2 | 1- 1L Poly | L |
| TPHC | ☑ | 418.1 | C | H2SO4 pH<2 | 1- 1L Poly | M N |

☐ IF MS/MSD COLLECTED

☐ IF DUPLICATE COLLECTED

| SAMPLING EQUIPMENT | PURGING | SAMPLING | | NUMBER OF IN-LINE FILTERS USED: |
|---|---|---|---|---|
| WATER LEVEL EQUIPMENT USED: | | | DEDICATED SUBMIRSABLE PUMP (WHALE) | |
| ☑ ELECTRIC CONDUCTIVITY PROBE | | | DEDICATED TEFLON BAILER | |
| ☐ FLOAT ACTIVATED | | | IN-LINE FILTER (INORGANICS) | |
| ☐ OTHER _____ | | | OTHER _____ | |

NA

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

Field duplicate for 57M-95-01X

SAMPLERS SIGNATURE: Nancy E. Rofa/SM

# GROUNDWATER FIELD SAMPLE DATA RECORD

Project: USATHAMA - Fort Devens
Study Area: SA 57
Project Number: 9144.02
Date: 2/12/96
Sample Location ID: 57M-95-01X
Time: Start: 1145 End: ~~1320~~ 1330 (NR)
Signature of Sampler: NR/SM

## Water Level/Well Data

Well Depth 31.1 Ft. ✓ Measured ___ Historical
✓ Top of Well ___ Top of Protective Casing
Well Riser Stick-up 1.78 Ft. (from ground)
Protective Casing/Well Difference -0.32 Ft.
Protective Casing 2.1 Ft.

Depth to Water 23.07 Ft.
Well Material: ✓ PVC ___ SS
Well Locked?: ✓ Yes ___ No
Well Dia. ✓ 2 inch ✓ 4 inch ___ 6 inch
Water Level Equip. Used: (taken 2/12/96) ✓ Elect. Cond. Probe ___ Float Activated ___ Press. Transducer

Height of Water Column 8.03 Ft. X ___ .16 Gal/Ft. (2 in.) ___ .65 Gal/Ft. (4 in.) ___ 1.5 Gal/Ft. (6 in.) ✓ 1.0 Gal/Ft. (4 in.) = 13.5 Gal/Vol; 70 Total Gal Purged

| Well Integrity: | Yes | No |
|---|---|---|
| Prot. Casing Secure | ✓ | |
| Concrete Collar Intact | ✓ | |
| Other | | |

## Equipment Documentation

**Purging/Sampling Equipment Used:**

(✓ If Used For)

| Purging | Sampling | | Equipment ID |
|---|---|---|---|
| | | Peristaltic Pump | |
| | | Submersible Pump | |
| | ✓ | Bailer | |
| | | PVC/Silicon Tubing | |
| | | Teflon/Silicon Tubing | |
| | | Airlift | |
| | | Hand Pump | |
| | ✓ | In-line Filter | |
| | | Press/Vac Filter | |
| ✓ | ✓ | whale pump | |

**Decontamination Fluids Used:**

(✓ All That Apply at Location)
___ Methanol (100%)
___ 25% Methanol/75% ASTM Type II water
___ Deionized Water
___ Liquinox Solution
___ Hexane
✓ $HNO_3$/D.I. Water Solution
✓ Potable Water
___ None

## Field Analysis Data

Ambient Air VOC bkg ppm Well Mouth bkg ppm Field Data Collected ___ In-line ___ In Container
Sample Observations: ___ Turbid ___ Clear ___ Cloudy ___ Colored ___ Odor
initially turbid

| Purge Data | @ 14 Gal. | @ 28 Gal. | @ 42 Gal. | @ 56 Gal. | @ 70 Gal. |
|---|---|---|---|---|---|
| Temperature, Deg. C | 10.4 | 11.9 | 11.8 | 11.9 | 11.6 |
| pH, units | 5.5 | 5.5 | 5.5 | 5.4 | 5.6 |
| Specific Conductivity (umhos/cm. @ 25 Deg. C.) | 103 | 105 | 109 | 110 | 115 |
| Oxidation - Reduction, +/- mv | | | | | 214 |
| Dissolved Oxygen, ppm | 9.0 | 7.9 | 7.5 | 7.8 | 7.5 |
| Turbidity (ntu's) | 1 | 0 | 0 | 0 | 0 |

0
(NR) ~~9.5~~ 9.7
5.5
8.7
9.0

## Sample Collection Requirements (✓ If Required at this Location)

| Analytical Parameter | ✓ If Field Filtered | Preservation Method | Volume Required | ✓ If Sample Collected | Sample Bottle IDs (168) |
|---|---|---|---|---|---|
| VOA | | HCL | 4040 ml | ✓ | E / F / G / H |
| SVOA | | 40C | 2- liter AG | ✓ | A / B / / |
| Pest/PCB | | 40C | 1-1 liter AG | ✓ | C / D / / |
| Inorganics | ✓ | $HNO_3$ | 3- 1 liter P | ✓ | I / J (NF) / / |
| Explosives | | 4°C | 2- 1 liter AG | | / / / |
| TPH | | $H_2SO_4$ | 2- 1 liter AG | ✓ | M / N / / |
| TOC | | $H_2SO_4$ | 1- 2 liter P | | / / / |
| Nitrate | | $H_2SO_4$ | 1- 2 liter P | | / / / |
| Notes: | | | | ✓ $H_2O$ Qual | K L |

92021590 (j)

ABB Environmental Services, Inc.

- Purge $H_2O$ headspace = 0.0 ppm
- Field duplicate collected at this location for all param.. (control # 455)

# GROUNDWATER FIELD SAMPLE DATA RECORD

Project: USATHAMA - Fort Devens
Study Area: SA 57
Project Number: 9144.02
Date: 2/~~13~~ (12) 13/96
Sample Location ID: 57M-95-02X
Time: Start: 1415 End: 1530
Signature of Sampler: MR/SM

## Water Level/Well Data

Well Depth 26.5 Ft ✓ Measured ___ Historical

✓ Top of Well ___ Top of Protective Casing ___ ___

Well Riser Stick-up (from ground) 1.92 Ft

Protective Casing/Well Difference -0.48 Ft

Protective Casing 2.4± Ft

Depth to Water 17.51 Ft

Well Material: ✓ PVC ___ SS ___

Well Locked?: ✓ Yes ___ No

Well Dia. ✓ 2 inch ✓ 4 inch ___ 6 inch

Water Level Equip. Used: (taken 2/12) ✓ Elect. Cond. Probe ___ Float Activated ___ Press. Transducer

Height of Water Column 8.99 Ft X ___ .16 Gal/Ft (2 in.) ___ .65 Gal/Ft (4 in.) ___ 1.5 Gal/Ft (6 in.) ✓ 1.65 Gal/Ft (4 in.) = 15.1 Gal/Vol; 75 Total Gal Purged

Well Integrity: Yes / No
Prot. Casing Secure: ✓ / ___
Concrete Collar Intact: ✓ / ___
Other ___ ___ / ___

## Equipment Documentation

Purging/Sampling Equipment Used:

| (✓ If Used For) Purging | Sampling | | Equipment ID |
|---|---|---|---|
| ___ | ___ | Peristaltic Pump | |
| ___ | ✓ | Submersible Pump | |
| ___ | ___ | Bailer | |
| ___ | ___ | PVC/Silicon Tubing | |
| ___ | ___ | Teflon/Silicon Tubing | |
| ___ | ___ | Airlift | |
| ___ | ✓ | Hand Pump | |
| ✓ | ✓ | In-line Filter | |
| | | Press/Vac Filter | |
| | | Whale pump | |

Decontamination Fluids Used:

(✓ All That Apply at Location)
___ Methanol (100%)
___ 25% Methanol/75% ASTM Type II water
___ Deionized Water
___ Liquinox Solution
___ Hexane
___ $HNO_3$/D.I. Water Solution
✓ Potable Water
___ None

## Field Analysis Data

Ambient Air VOC bkg ppm Well Mouth bkg ppm Field Data Collected ___ In-line ___ In Container

Sample Observations: ___ Turbid ___ Clear ___ Cloudy ___ Colored ___ Odor

| Purge Data | @ 0 Gal. | @ 15 Gal. | @ 30 Gal. | @ 45 Gal. | @ 60 Gal. | 75 |
|---|---|---|---|---|---|---|
| Temperature, Deg. C | 8.8 | 11.0 | 11.1 | 11.7 | 11.6 | 11.6 |
| pH, units | 5.9 | 5.9 | 5.8 | 5.8 | 5.8 | 5.9 |
| Specific Conductivity (umhos/cm. @ 25 Deg. C.) | 160 | 136 | 128 | 128 | 128 | 126 |
| Oxidation - Reduction, +/- mv | | | | | 219 | |
| Dissolved Oxygen, ppm | 7.36 | 7.8 | 9.3 | 9.0 | 9.1 | 8.4 |
| Turbidity (ntus) | 49 | 0 | 0 | 0 | 0 | 0 |

## Sample Collection Requirements

(✓ If Required at this Location)

| Analytical Parameter | ✓ If Field Filtered | Preservation Method | Volume Required | ✓ If Sample Collected | Sample Bottle IDs (170) |
|---|---|---|---|---|---|
| VOA | ___ | HCL | 4040 ml | ✓ | E / F / G / H |
| SVOA | ___ | 4°C | 2- liter AG | ✓ | A / B |
| Pest/PCB | ___ | 4°C | 1-1 liter AG | ✓ | C / D |
| Inorganics | ✓ | $HNO_3$ | 3- 1 liter P | ✓ | I / J (NF) |
| Explosives | ___ | 4°C | 2- 1 liter AG | | / |
| TPH | ___ | $H_2SO_4$ | 2- 1 liter AG | ✓ | M / N |
| TOC | ___ | $H_2SO_4$ | 1- 2 liter P | ___ | / |
| Nitrate | ___ | $H_2SO_4$ | 1- 2 liter P | | / |
| | | | | ✓ | $H_2O$ Qual K L |

Notes: ___

92021590 (j) ABB Environmental Services, Inc.

Purge $H_2O$ headspace ≈ 0.0 ppm

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Snow, 20's | LOCATION ACTIVITY: START | END 1300

SITE ID: 57M--95--03X | FIELD SAMPLE NUMBER: MD5703X2 | DATE: 2/14/96 | STUDY AREA (AOC): SA57

| WATER LEVEL / WELL DATA | | MEASURED FROM | PID HEADSPACE READINGS | | WELL INTEGRITY | YES | NO |
|---|---|---|---|---|---|---|---|
| WELL DEPTH | FT | ☐ TOP OF WELL | BREATHING ZONE | ppm | PROTECTIVE CASING SECURE | ☐ | ☐ |
| WATER DEPTH | FT | ☐ TOP OF CASING | WELL HEAD | ppm | WELL LOCKED | ☐ | ☐ |
| HEIGHT OF WATER COLUMN | FT | WELL DIAMETER = _____ | | | PVC WELL CAP PRESENT | ☐ | ☐ |
| ☐ x 1.68 gal/ft (4" well) = ☐ x ____ gal/ft ( well) | GAL/VOL | | PROTECTIVE CASING STICK-UP FROM GROUND | FT | POTECTIVE CASINGE/WELL DIFFERENCE | FT | |

| PURGE DATA | VOLUME # | | | | | | | | | SAMPLE OBSERVATION |
|---|---|---|---|---|---|---|---|---|---|---|
| | GALLONS | | | | | | | | | ☐ CLEAR |
| TEMPERATURE, deg. C | | | | | | | | | | ☐ TURBID |
| pH units | | | | | | | | | | ☐ COLORED _____ |
| SPECIFIC CONDUCTIVITY, umho/cm | | | | | | | | | | ☐ ODOR |
| TURBIDITY' ntu | | | | | | | | | | ☐ OTHER (SEE NOTES) |
| REDOX (AT COMPLETION OF PURGING) | | | | | | | | | | |

NA

| SAMPLE PARAMETERS | COLLECTED | METHOD # | FRACTION CODE | PRESERATIVE | VOLUME | SAMPLE BOTTLE NUMBER |
|---|---|---|---|---|---|---|
| SVOCS | ✓ | UM18 | MS | 4C | 2- 1L AG | A B |
| PEST./PCBS | ✓ | UW19 | EC | 4C | 2- 1L AG | C D |
| VOC | ✓ | UM20 | VP | HCL,4C | 4- 40 ml AG | E F G H |
| INORGANICS-UNFILTERED | ✓ | * | N | HNO3 pH<2 | 1- 1L Poly | I |
| INORGANICS-FILTERED | ✓ | * | NF | HNO3 pH<2 | 1- 1L Poly | J |
| WATER QUALITY PARAM. / TDS | ✓ | * 160.1 | C | 4C | 1- 1L Poly | K |
| | | | S | H2SO4 pH<2 | 1- 1L Poly | L |
| TPHC | ✓ | 418.1 | C | H2SO4 pH<2 | 1- 1L Poly | M N |

CONTROL # 458

☐ IF MS/MSD COLLECTED

☐ IF DUPLICATE COLLECTED

| SAMPLING EQUIPMENT | PURGING | SAMPLING | | NUMBER OF IN-LINE FILTERS USED: |
|---|---|---|---|---|
| WATER LEVEL EQUIPMENT USED: | ☐ | ☐ | DEDICATED SUBMIRSABLE PUMP (WHALE) | ☐ |
| ☐ ELECTRIC CONDUCTIVITY PROBE | ☐ | ☐ | DEDICATED TEFLON BAILER | |
| ☐ FLOAT ACTIVATED | ☐ | ☐ | IN-LINE FILTER (INORGANICS) | |
| ☐ OTHER _____ | ☐ | ☐ | OTHER _____ | |

NA

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

Duplicated of 57M-95-03X (MX5703X2)

SAMPLERS SIGNATURE: Nancy E. Rotta / JJ

# GROUNDWATER FIELD SAMPLE DATA RECORD

Project: USATHAMA - Fort Devens
Study Area: SA 57
Project Number: 9144.02
Date: 2/14/96
Sample Location ID: 57M-95-03X
Time: Start: 1110 End: 13:00
Signature of Sampler: MR/JJ

## Water Level/Well Data

Well Depth 19.5 Ft. ✓ Measured ___ Historical
✓ Top of Well ___ Top of Protective Casing
Well Riser Stick-up 2.03 Ft. (from ground)
Protective Casing/Well Difference -0.37 Ft.
Protective Casing 2.4± Ft.

Depth to Water 9.73 Ft.
Well Material: ✓ PVC ___ SS
Well Locked?: ✓ Yes ___ No
Well Dia. ___ 2 inch ✓ 4 inch ___ 6 inch
Water Level Equip. Used: (taken 2/12/96) (MR) ✓ Elect. Cond. Probe ___ Float Activated ___ Press. Transducer ✓ ORS phase indicator probe

Height of Water Column 9.77 Ft. X ___ .16 Gal/Ft. (2 in.) ___ .65 Gal/Ft. (4 in.) ___ 1.5 Gal/Ft. (6 in.) ✓ 1.68 Gal/Ft. (4 in.) = 16.4 Gal/Vol; 80 Total Gal Purged

| Well Integrity: | Yes | No |
|---|---|---|
| Prot. Casing Secure | ✓ | |
| Concrete Collar Intact | ✓ | |
| Other | | |

## Equipment Documentation

**Purging/Sampling Equipment Used:**

(✓ If Used For)

| Purging | Sampling | | Equipment ID |
|---|---|---|---|
| | | Peristaltic Pump | |
| | ✓ | Submersible Pump | |
| | | Bailer | |
| | | PVC/Silicon Tubing | |
| | | Teflon/Silicon Tubing | |
| | | Airlift | |
| | ✓ | Hand Pump | |
| | | In-line Filter | |
| ✓ | ✓ | Press/Vac Filter | |
| | | whale pump | |

**Decontamination Fluids Used:**

(✓ All That Apply at Location)
___ Methanol (100%)
___ 25% Methanol/75% ASTM Type II water
___ Deionized Water
___ Liquinox Solution
___ Hexane
___ $HNO_3$/D.I. Water Solution
✓ Potable Water
___ None

ORP = 11

## Field Analysis Data

Ambient Air VOC bkg ppm Well Mouth bkg ppm Field Data Collected ✓ In-line ✓ In Container
Sample Observations: ___ Turbid ___ Colored ✓ Clear ✓ Odor ✓ Cloudy (old fuel)

| Purge Data | @ 0 Gal. | @ 16 Gal. | @ 32 Gal. | @ 48 Gal. | @ 64 Gal. |
|---|---|---|---|---|---|
| Temperature, Deg. C | 6.1 | 7.3 | 5.9 | 6.3 | 6.6 |
| pH, units | 4.76 | 5.1 | 5.1 | 5.18 | 5.29 |
| Specific Conductivity (umhos/cm. @ 25 Deg. C.) | 68 | 81 | 84 | 84 | 92 |
| Oxidation - Reduction, +/- mv | | | | | |
| Dissolved Oxygen, ppm | 5.00 | 6.0 | 4.72 | 4.52 | 5.84 |
| Turb. | cloudy | cloudy | cl | cloudy | cloudy |

80
6.0
5.15
79
4.75
cloudy

## Sample Collection Requirements (✓ If Required at this Location)

| Analytical Parameter | ✓ If Field Filtered | Preservation Method | Volume Required | ✓ If Sample Collected | Sample Bottle IDs |
|---|---|---|---|---|---|
| VOA | | HCL | 4040 ml | ✓ | E / F / G / H |
| SVOA | | 4°C | 2- liter AG | ✓ | A / B / / |
| Pest/PCB | | 4°C | 1-1 liter AG | ✓ | C / D / / |
| Inorganics | ✓ | $HNO_3$ | 3- 1 liter P | ✓ | I / J (NF) / / |
| Explosives | | 4°C | 2- 1 liter AG | | / / / |
| TPH | | $H_2SO_4$ | 2- 1 liter AG | ✓ | M / N / / |
| TOC | | $H_2SO_4$ | 1- 2 liter P | | / / / |
| Nitrate | | $H_2SO_4$ | 1- 2 liter P | | / / / |

(172)

Notes: Had to replace pump (wouldnt start)

✓ $H_2O$ Qual K L

92021590 (j)

ABB Environmental Services, Inc.

- Purge $H_2O$ headspace = initial = bkg ∴ dumped vol. 1. Then smelled fuel odor.
- Field duplicate collected for ~~TDS~~ (MR) all parameters (control #458)
- [illegible] than pump [illegible] Headspace [illegible]

# GROUNDWATER FIELD SAMPLE DATA RECORD

Project: USATHAMA - Fort Devens
Study Area: SA 57
Project Number: 9144.02
Date: 2/14/96
Sample Location ID: 57M-95-04A
Time: Start: 0850 End: 0945
Signature of Sampler: NR/JJ

## Water Level/Well Data

Well Depth 13.2 Ft. ✓ Measured ___ Historical
✓ Top of Well ___ Top of Protective Casing
Well Riser Stick-up 0.80 Ft. (from ground)
Protective Casing/Well Difference -0.40 Ft.
Protective Casing 1.2± Ft.

Depth to Water 2.75 Ft.
Well Material: ✓ PVC ___ SS
Well Locked?: ✓ Yes ___ No
Well Dia. ___ 2 inch ✓ 4 inch ___ 6 inch
Water Level Equip. Used: (taken 2/12/96) ___ Elect. Cond. Probe ___ Float Activated ___ Press. Transducer ✓ ORS phase indicator

Height of Water Column 10.45 Ft. X ___ .16 Gal/Ft. (2 in.) ___ .65 Gal/Ft. (4 in.) ___ 1.5 Gal/Ft. (6 in.) ✓ 1.65 Gal/Ft. (4 in.) = 17.6 Gal/Vol; 90 Total Gal Purged

| Well Integrity: | Yes | No |
|---|---|---|
| Prot. Casing Secure | ✓ | |
| Concrete Collar Intact | ✓ | |
| Other | | |

## Equipment Documentation

**Purging/Sampling Equipment Used:**

(✓ If Used For)

| Purging | Sampling | | Equipment ID |
|---|---|---|---|
| | | Peristaltic Pump | |
| | ✓ | Submersible Pump | |
| | | Bailer | |
| | | PVC/Silicon Tubing | |
| | | Teflon/Silicon Tubing | |
| | | Airlift | |
| | | Hand Pump | |
| | ✓ | In-line Filter | |
| | | Press/Vac Filter | |
| ✓ | ✓ | whale pump | |

**Decontamination Fluids Used:**

(✓ All That Apply at Location)
___ Methanol (100%)
___ 25% Methanol/75% ASTM Type II water
___ Deionized Water
___ Liquinox Solution
___ Hexane
___ $HNO_3$/D.I. Water Solution
✓ Potable Water
___ None

## Field Analysis Data

Ambient Air VOC bkg ppm Well Mouth bkg ppm
Field Data Collected ✓ In-line ✓ In Container
Sample Observations: ___ Turbid ✓ Clear ___ Cloudy ___ Colored ___ Odor

| Purge Data | @ 0 Gal. | @ ~~18~~ 24 (NR) Gal. | @ ~~36~~ 45 Gal. | @ 54 Gal. | @ 72 Gal. | 90 |
|---|---|---|---|---|---|---|
| Temperature, Deg. C | 6.1 | 7.4 | 8.3 | 8.2 | 8.0 | 7.9 |
| pH, units | 5.01 | 5.2 | 5.08 | 5.27 | 5.03 | 5.05 |
| Specific Conductivity (umhos/cm, @ 25 Deg. C.) | 0.089 | 85 | 92 | 86 | 88 | 89 |
| Oxidation - Reduction, +/- mv | | | | | | |
| Dissolved Oxygen, ppm | — | 2.8 | 2.9 | 5.8 | 2.5 | 2.77 |
| Turb (ntu's) | 10 | 10 | 10 | 10 | 10 | 10 |

## Sample Collection Requirements

(✓ If Required at this Location)

| Analytical Parameter | ✓ If Field Filtered | Preservation Method | Volume Required | ✓ If Sample Collected | Sample Bottle IDs | | | |
|---|---|---|---|---|---|---|---|---|
| VOA | | HCL | 4040 ml | ✓ | E | I | G | H |
| SVOA | | 40C | 2- liter AG | ✓ | A | B | | |
| Pest/PCB | | 40C | 1-1 liter AG | ✓ | C | D | | |
| Inorganics | ✓ | $HNO_3$ | 3- 1 liter P | ✓ | L | J (NF) | | |
| Explosives | | 4°C | 2- 1 liter AG | | ~~L~~ | ~~N~~ | | |
| TPH | | $H_2SO_4$ | 2- 1 liter AG | ✓ | M | N | | |
| TOC | | $H_2SO_4$ | 1- 2 liter P | | | | | |
| Nitrate | | $H_2SO_4$ | 1- 2 liter P | | | | | |
| | | | | ✓ H2O Qual | K | L | | |

(174) 158 mV ORP

Notes:

92021590 (j)

ABB Environmental Services, Inc.

Purge H2O headspace = bkg
Turbidity not working?

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE_TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: overcast, snow 20's | LOCATION ACTIVITY: START 0840 END 10:30

SITE ID: 57M--95--04B | FIELD SAMPLE NUMBER: MX5704B2 | DATE: 2/14/96 | STUDY AREA (AOC): SA 57

| WATER LEVEL / WELL DATA | | MEASURED FROM | PID HEADSPACE READINGS | | WELL INTEGRITY | YES | NO |
|---|---|---|---|---|---|---|---|
| WELL DEPTH | 31.0± FT | ✓ TOP OF WELL | BREATHING ZONE | bkg ppm | PROTECTIVE CASING SECURE | ✓ | |
| WATER DEPTH | 3.56 FT | ☐ TOP OF CASING | | | WELL LOCKED | ✓ | |
| HEIGHT OF WATER COLUMN | 27.44 FT | WELL DIAMETER = 4" | WELL HEAD | bkg ppm | PVC WELL CAP PRESENT | ✓ | |
| ☑ x 1.68 gal/ft (4" well) = | 46.1 GAL/VOL | PROTECTIVE CASING STICK-UP FROM GROUND | 2.1± FT | | POTECTIVE CASINGE/WELL DIFFERENCE | -0.17 FT | |
| ☐ x ____ gal/ft ( well) | | | | | | | |

| PURGE DATA | VOLUME # | — | 1 | 2 | 3 | 4 | 5 | | |
|---|---|---|---|---|---|---|---|---|---|
| | GALLONS | 0 | 46 | 92 | 138 | 184 | 230 | | |
| TEMPERATURE, deg. C | | 5.9 | 11 | 11 | 10.6 | 10.7 | 11.0 | | |
| pH units | | 4.6 | 4.9 | 5.02 | 5.1 | 5.0 | 4.9 | | |
| SPECIFIC CONDUCTIVITY, umho/cm | | 300 | 277 | 266 | 263 | 257 | 254 | | |
| TURBIDITY' ntu | | 10 | 10 | 10 | 10 | 10 | 10 | | |
| REDOX (AT COMPLETION OF PURGING) | | | | | | | | | |

SAMPLE OBSERVATION: ✓ CLEAR; ☐ TURBID; ☐ COLORED ____; ☐ ODOR; ☐ OTHER (SEE NOTES)

ORP = 198

~~Turbidity (ntu's)~~ DO (mg/L) 10.0 8.9 8.6 8.5 8.8 8.75

| SAMPLE PARAMETERS | COLLECTED | METHOD # | FRACTION CODE | PRESERATIVE | VOLUME | SAMPLE BOTTLE NUMBER |
|---|---|---|---|---|---|---|
| SVOCS | ✓ | UM18 | MS | 4C | 2- 1L AG | A B |
| PEST./PCBS | ✓ | UW19 | EC | 4C | 2- 1L AG | C D |
| VOC | ✓ | UM20 | VP | HCL,4C | 4- 40 ml AG | E F G H |
| INORGANICS-UNFILTERED | ✓ | * | N | HNO3 pH<2 | 1- 1L Poly | I |
| INORGANICS-FILTERED | ✓ | * | NF | HNO3 pH<2 | 1- 1L Poly | J |
| WATER QUALITY PARAM. / TDS | ✓ | * 160.1 | C | 4C | 1- 1L Poly | K |
| | | | S | H2SO4 pH<2 | 1- 1L Poly | L |
| TPHC | ✓ | 418.1 | C | H2SO4 pH<2 | 1- 1L Poly | M N |

CONTROL # 459

☐ IF MS/MSD COLLECTED

☐ IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

| WATER LEVEL EQUIPMENT USED: | PURGING | SAMPLING | |
|---|---|---|---|
| ✓ ELECTRIC CONDUCTIVITY PROBE (taken 2/12/96) | ✓ | ✓ | DEDICATED SUBMIRSABLE PUMP (WHALE) |
| ☐ FLOAT ACTIVATED | ☐ | ✓ | DEDICATED TEFLON BAILER |
| ☐ OTHER ____ | ☐ | ✓ | IN-LINE FILTER (INORGANICS) |
| | | ☐ | OTHER ____ |

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

- Purge $H_2O$ headspace = bkg
- Turbidity not working?

SAMPLERS SIGNATURE: Nancy E. Rotta/W

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: clear, windy, 10°s | LOCATION ACTIVITY: START 1600 END 1715

SITE ID: 57M-95-05X | FIELD SAMPLE NUMBER: MX5705X2 | DATE: ~~2/12~~ 2/13/96 | STUDY AREA (AOC): SA 57

| WATER LEVEL / WELL DATA | | MEASURED FROM | PID HEADSPACE READINGS | | WELL INTEGRITY | YES | NO |
|---|---|---|---|---|---|---|---|
| WELL DEPTH | 22.3± FT | ☑ TOP OF WELL | BREATHING ZONE | bkg ppm | PROTECTIVE CASING SECURE | ✓ | |
| WATER DEPTH | 14.95 FT | ☐ TOP OF CASING | | | WELL LOCKED | ✓ | |
| HEIGHT OF WATER COLUMN | 7.35 FT | WELL DIAMETER = 4" | WELL HEAD | bkg ppm | PVC WELL CAP PRESENT | ✓ | |
| ☑ x 1.68 gal/ft (4" well) = | 12.3 GAL/VOL | | PROTECTIVE CASING STICK-UP FROM GROUND | 2.5± FT | POTECTIVE CASINGE/WELL DIFFERENCE | ~0.43 FT | |
| ☐ x ____ gal/ft ( well) | | | | | | | |

| PURGE DATA | VOLUME # | — | 1 | 2 | 3 | 4 | 5 | | |
|---|---|---|---|---|---|---|---|---|---|
| | GALLONS | 0 | 12 | 24 | 36 | 48 | 60 | | |
| TEMPERATURE, deg. C | | 8.3 | 10.1 | 10.1 | 9.7 | 10.2 | 10.3 | | |
| pH units | | 5.5 | 5.6 | 5.5 | 5.4 | 5.3 | 5.5 | | |
| SPECIFIC CONDUCTIVITY, umho/cm | | 88 | 82 | 76 | 75 | 77 | 75 | | |
| TURBIDITY' ntu | | 7 | 0 | 0 | 0 | 0 | 0 | | |
| REDOX (AT COMPLETION OF PURGING) | | | | | | | 240mV | | |
| D.O. (mg/L) | | 10.3 | 9.0 | 9.4 | 9.5 | 10.1 | 9.4 | | |

SAMPLE OBSERVATION: ☑ CLEAR ☐ TURBID ☐ COLORED ____ ☐ ODOR ☐ OTHER (SEE NOTES)

| SAMPLE PARAMETERS | COLLECTED | METHOD # | FRACTION CODE | PRESERATIVE | VOLUME | SAMPLE BOTTLE NUMBER |
|---|---|---|---|---|---|---|
| SVOCS | ✓ | UM18 | MS | 4C | 2- 1L AG | A B |
| PEST./PCBS | ✓ | UW19 | EC | 4C | 2- 1L AG | C D |
| VOC | ✓ | UM20 | VP | HCL,4C | 4- 40 ml AG | E F G H |
| INORGANICS-UNFILTERED | ✓ | * | N | HNO3 pH<2 | 1- 1L Poly | I |
| INORGANICS-FILTERED | ✓ | * | NF | HNO3 pH<2 | 1- 1L Poly | J |
| WATER QUALITY PARAM. / TDS | ✓ | * 160.1 | C | 4C | 1- 1L Poly | K |
| | | | S | H2SO4 pH<2 | 1- 1L Poly | L |
| TPHC | ✓ | 418.1 | C | H2SO4 pH<2 | 1- 1L Poly | M N |

CONTROL # 176

☐ IF MS/MSD COLLECTED ☐ IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

| WATER LEVEL EQUIPMENT USED: | PURGING | SAMPLING | |
|---|---|---|---|
| ☑ ELECTRIC CONDUCTIVITY PROBE (taken 2/12/96) | ✓ | ✓ | DEDICATED SUBMIRSABLE PUMP (WHALE) |
| ☐ FLOAT ACTIVATED | | ✓ | DEDICATED TEFLON BAILER |
| ☐ OTHER ____ | | ✓ | IN-LINE FILTER (INORGANICS) |
| | | | OTHER ____ |

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

Purge H2O headspace = bkg

SAMPLERS SIGNATURE: Nancy E. Rotta / SM

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Partly cloudy, 30's | LOCATION ACTIVITY: START 1035 END 1130

SITE ID: 57M-95-06X | FIELD SAMPLE NUMBER: MX5706X2 | DATE: 15 FEB 96 | STUDY AREA (AOC): SA 57

| WATER LEVEL / WELL DATA | | MEASURED FROM | PID HEADSPACE READINGS | | WELL INTEGRITY | YES | NO |
|---|---|---|---|---|---|---|---|
| WELL DEPTH | 24.3± FT | ✓ TOP OF WELL | BREATHING ZONE | bkg ppm | PROTECTIVE CASING SECURE | ✓ | |
| WATER DEPTH | 12.79 FT | TOP OF CASING | WELL HEAD | bkg ppm | WELL LOCKED | ✓ | |
| HEIGHT OF WATER COLUMN | 11.51 FT | WELL DIAMETER = 4" | | | PVC WELL CAP PRESENT | ✓ | |
| ✓ x 1.68 gal/ft (4" well) = | 19.3 GAL/VOL | | PROTECTIVE CASING STICK-UP FROM GROUND | 2.0± FT | POTECTIVE CASINGE/WELL DIFFERENCE | -0.19 FT | |
| x ____ gal/ft ( well) | | | | | | | |

| PURGE DATA | VOLUME # | — | 1 | 2 | 3 | 4 | 5 | | |
|---|---|---|---|---|---|---|---|---|---|
| | GALLONS | 0 | 19 | 33 | 57 | 76 | 95 | | |
| TEMPERATURE, deg. C | | 10.0° | 9.6° | 9.3° | 9.3° | 9.1° | 9.2° | | |
| pH units | | 4.43 | 4.44 | 4.44 | 4.44 | 4.47 | 4.51 | | |
| SPECIFIC CONDUCTIVITY, umho/cm | | .044 | .044 | .043 | .043 | .043 | .044 | | |
| TURBIDITY' ntu | | 0 | 0 | 0 | 0 | 0 | 0 | | |
| REDOX (AT COMPLETION OF PURGING) | | | 200 | | | | | | |

SAMPLE OBSERVATION
- ✓ CLEAR
- TURBID
- COLORED ____
- ODOR
- OTHER (SEE NOTES)

| SAMPLE PARAMETERS | COLLECTED | METHOD # | FRACTION CODE | PRESERATIVE | VOLUME | SAMPLE BOTTLE NUMBER |
|---|---|---|---|---|---|---|
| SVOCS | ✓ | UM18 | MS | 4C | 2- 1L AG | A B CONTROL # 178 |
| PEST./PCBS | ✓ | UW19 | EC | 4C | 2- 1L AG | C D |
| VOC | ✓ | UM20 | VP | HCL,4C | 4- 40 ml AG | E F G H |
| INORGANICS-UNFILTERED | ✓ | * | N | HNO3 pH<2 | 1- 1L Poly | I |
| INORGANICS-FILTERED | ✓ | * | NF | HNO3 pH<2 | 1- 1L Poly | J |
| WATER QUALITY PARAM. / TDS | ✓ | * 160.1 | C | 4C | 1- 1L Poly | K |
| | | | S | H2SO4 pH<2 | 1- 1L Poly | L |
| TPHC | ✓ | 418.1 | C | H2SO4 pH<2 | 1- 1L Poly | M N |

- ☐ IF MS/MSD COLLECTED
- ☐ IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

| WATER LEVEL EQUIPMENT USED: | PURGING | SAMPLING | |
|---|---|---|---|
| ✓ ELECTRIC CONDUCTIVITY PROBE (taken 2/12/96) | ✓ | ✓ | DEDICATED SUBMIRSABLE PUMP (WHALE) |
| FLOAT ACTIVATED | | ✓ | DEDICATED TEFLON BAILER |
| OTHER ____ | | ✓ | IN-LINE FILTER (INORGANICS) |
| | | | OTHER ____ |

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

Purge $H_2O$ headspace = 0 ppm

SAMPLERS SIGNATURE: [signature]

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: 20°s, snow | LOCATION ACTIVITY: START 1545 END 17:00

SITE ID: 57M--95--07X | FIELD SAMPLE NUMBER: MX5707X2 | DATE: 2/14/96 | STUDY AREA (AOC): SA 57

| WATER LEVEL / WELL DATA | | MEASURED FROM | PID HEADSPACE READINGS | | WELL INTEGRITY | YES | NO |
|---|---|---|---|---|---|---|---|
| WELL DEPTH | 14.4± FT | ✓ TOP OF WELL | BREATHING ZONE | bkg ppm | PROTECTIVE CASING SECURE | ✓ | |
| WATER DEPTH | 3.02 FT | TOP OF CASING | WELL HEAD | bkg ppm | WELL LOCKED | ✓ | |
| HEIGHT OF WATER COLUMN | 11.38 FT | WELL DIAMETER = 4" | | | PVC WELL CAP PRESENT | ✓ | |

✓ x 1.68 gal/ft (4" well) = 19.1 GAL/VOL
x ___ gal/ft ( well)

PROTECTIVE CASING STICK-UP FROM GROUND: 1.1± FT

POTECTIVE CASINGE/WELL DIFFERENCE: -0.34 FT

| PURGE DATA | VOLUME # | — | 1 | 2 | 3 | 4 | 5 | | |
|---|---|---|---|---|---|---|---|---|---|
| | GALLONS | 0 | 19 | 33 | 57 | 76 | 95 | | |
| TEMPERATURE, deg. C (See field book) | | 6.2 | 7.9 | 8.1 | 7.1 | 8.1 | 8.1 | | |
| pH units (calibration of Horiba may be faulty) | | 4.98 | 4.82(1) | 4.83 | 4.78 | 4.72 | 4.75* | | |
| SPECIFIC CONDUCTIVITY, umho/cm | | 50 | 60 | 88 | 69 | 66 | 66 | | |
| TURBIDITY' ntu | | 0.52 | 0.21 | 0.15 | 0.15 | 0.18 | 0.15 | | |
| REDOX (AT COMPLETION OF PURGING) | | | | | | | 224 mV | | |

SAMPLE OBSERVATION: ☒ CLEAR ☐ TURBID ☐ COLORED ☐ ODOR ☐ OTHER (SEE NOTES)

D.O 6.56 5.96 6.49 6.64 6.04 6.13

| SAMPLE PARAMETERS | COLLECTED | METHOD # | FRACTION CODE | PRESERATIVE | VOLUME | SAMPLE BOTTLE NUMBER |
|---|---|---|---|---|---|---|
| SVOCS | ✓ | UM18 | MS | 4C | 2- 1L AG | A B CONTROL # ___ |
| PEST./PCBS | ✓ | UW19 | EC | 4C | 2- 1L AG | C D |
| VOC | ✓ | UM20 | VP | HCL,4C | 4- 40 ml AG | E F G H |
| INORGANICS-UNFILTERED | ✓ | * | N | HNO3 pH<2 | 1- 1L Poly | I |
| INORGANICS-FILTERED | ✓ | * | NF | HNO3 pH<2 | 1- 1L Poly | J |
| WATER QUALITY PARAM. / TDS | ✓ | * 160.1 | C | 4C | 1- 1L Poly | K |
| | | | S | H2SO4 pH<2 | 1- 1L Poly | L |
| TPHC | ✓ | 418.1 | C | H2SO4 pH<2 | 1- 1L Poly | M N |

☐ IF MS/MSD COLLECTED
☐ IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

| WATER LEVEL EQUIPMENT USED: | PURGING | SAMPLING | |
|---|---|---|---|
| ✓ ELECTRIC CONDUCTIVITY PROBE (taken 2/12/96) | ✓ | ✓ | DEDICATED SUBMIRSABLE PUMP (WHALE) |
| ☐ FLOAT ACTIVATED | ☐ | ✓ | DEDICATED TEFLON BAILER |
| ☐ OTHER ___ | ☐ | ✓ | IN-LINE FILTER (INORGANICS) |
| | ☐ | ☐ | OTHER ___ |

NUMBER OF IN-LINE FILTERS USED: ___

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

Purge H2O headspace =

SAMPLERS SIGNATURE: Nancy E. Rofka / JJ

(1) 6.46 by Orion SA 210
*6.36 " " " "

VIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Cloudy, 30s | LOCATION ACTIVITY: START 0905 END 1300

SITE ID: 57M-95-08A | FIELD SAMPLE NUMBER: MX5708A2 | DATE: 2/15/96 | STUDY AREA (AOC): SA 57

| WATER LEVEL / WELL DATA | | MEASURED FROM | PID HEADSPACE READINGS | | WELL INTEGRITY | YES | NO |
|---|---|---|---|---|---|---|---|
| WELL DEPTH | 14.3± FT | ✓ TOP OF WELL | BREATHING ZONE | bkg ppm | PROTECTIVE CASING SECURE | ✓ | |
| WATER DEPTH | 2.63 FT | TOP OF CASING | WELL HEAD | bkg ppm | WELL LOCKED | ✓ | |
| HEIGHT OF WATER COLUMN | 11.67 FT | WELL DIAMETER = 4" | | | PVC WELL CAP PRESENT | ✓ | |

✓ x 1.68 gal/ft (4" well) = 19.6 GAL/VOL
x ____ gal/ft ( well)

PROTECTIVE CASING STICK-UP FROM GROUND: 1.1± FT

POTECTIVE CASINGE/WELL DIFFERENCE: -0.23 FT

| PURGE DATA | VOLUME # | — | 1 | 2 | 3 | 4 | 5 | | |
|---|---|---|---|---|---|---|---|---|---|
| | GALLONS | 0 | 20 | 40 | 60 | 80 | 100 | | |
| TEMPERATURE, deg. C | | 6.4 ~~7.5~~ | 7.5 | 7.1 | 7.8 | 7.8 | 7.7 | | |
| pH units | | 5.4 ~~2.64~~ | 5.62 | 5.6 | 5.65 | 5.63 | 5.60 | | |
| SPECIFIC CONDUCTIVITY, umho/cm | | 82 | 72 | 72 | 74 | 72 | 69 | | |
| TURBIDITY' ntu | | 190 | 107 | 23.9 | 7.66 | 6.31 | 1.30 | | |
| REDOX (AT COMPLETION OF PURGING) | | | | | | | 165mV | | |

SAMPLE OBSERVATION
- [X] CLEAR by 5th volume
- [ ] TURBID
- [ ] COLORED
- [ ] ODOR
- [ ] OTHER (SEE NOTES)

D.O. (mg/L) ~~7.7~~ 3.2 4.2 6.17 6.74 6.17 5.83

| SAMPLE PARAMETERS | COLLECTED | METHOD # | FRACTION CODE | PRESERATIVE | VOLUME | SAMPLE BOTTLE NUMBER |
|---|---|---|---|---|---|---|
| SVOCS | X | UM18 | MS | 4C | 2- 1L AG | A B |
| PEST./PCBS | X | UW19 | EC | 4C | 2- 1L AG | C D |
| VOC | X | UM20 | VP | HCL,4C | 4- 40 ml AG | E F G H |
| INORGANICS-UNFILTERED | X | * | N | HNO3 pH<2 | 1- 1L Poly | I |
| INORGANICS-FILTERED | X | * | NF | HNO3 pH<2 | 1- 1L Poly | J |
| WATER QUALITY PARAM. / TDS | X | * 160.1 | C | 4C | 1- 1L Poly | K |
| | | | S | H2SO4 pH<2 | 1- 1L Poly | L |
| TPHC | X | 418.1 | C | H2SO4 pH<2 | 1- 1L Poly | M N |

CONTROL # 182

- [ ] IF MS/MSD COLLECTED
- [ ] IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

| WATER LEVEL EQUIPMENT USED: | PURGING | SAMPLING | |
|---|---|---|---|
| ✓ ELECTRIC CONDUCTIVITY PROBE (taken 2/12/96) | ✓ | ✓ | DEDICATED SUBMIRSABLE PUMP (WHALE) |
| FLOAT ACTIVATED | | ✓ | DEDICATED TEFLON BAILER |
| OTHER ____ | | ✓ | IN-LINE FILTER (INORGANICS) |
| | | | OTHER ____ |

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

Purge H2O headspace = 0.0 ppm

SAMPLERS SIGNATURE [signature]

ABB ENVIRONMENTAL SERVICES, INC.

FIELD DATA RECORD - GROUNDWATER

FILE TYPE: CGW | SITE TYPE: WELL | JOB NUMBER: 9144-02

PROJECT: USAEC-FT. DEVENS | WEATHER: Cloudy, 30s | LOCATION ACTIVITY: START 8:50 END 11:55

SITE ID: 57M--95--08B | FIELD SAMPLE NUMBER: MX5708B2 | DATE: 2/15/96 | STUDY AREA (AOC): SA 57

| WATER LEVEL / WELL DATA | | MEASURED FROM | PID HEADSPACE READINGS | | WELL INTEGRITY | YES | NO |
|---|---|---|---|---|---|---|---|
| WELL DEPTH | 30.2± FT | ☑ TOP OF WELL | BREATHING ZONE | bkg ppm | PROTECTIVE CASING SECURE | ☑ | |
| WATER DEPTH | 3.36 FT | ☐ TOP OF CASING | | | WELL LOCKED | ☑ | |
| HEIGHT OF WATER COLUMN | 26.84 FT | WELL DIAMETER = 4" | WELL HEAD | bkg ppm | PVC WELL CAP PRESENT | ☑ | |
| ☑ x 1.68 gal/ft (4" well) = | 45.1 GAL/VOL | | PROTECTIVE CASING STICK-UP FROM GROUND | 2.5± FT | POTECTIVE CASINGE/WELL DIFFERENCE | -0.50 FT | |
| ☐ x ____ gal/ft ( well) | | | | | | | |

| PURGE DATA | VOLUME # | — | 1 | 2 | 3 | 4 | 5 | | |
|---|---|---|---|---|---|---|---|---|---|
| | GALLONS | 0 | 45 | 90 | 135 | 180 | 225 | | |
| TEMPERATURE, deg. C | | 7.5 | 9.3 | 9.7 | 9.9 | 9.7 | 9.9 | | |
| pH units | | 6.4 | 5.7 | 5.64 | 5.52 | 5.64 | 5.62 | | |
| SPECIFIC CONDUCTIVITY, umhos/cm | | 5.5 | 241 | 235 | 236 | 234 | 233 | | |
| TURBIDITY' ntu | | 0.23 | 0.11 | 0.13 | 0.15 | 0.18 | 0.20 | | |
| REDOX (AT COMPLETION OF PURGING) | | | 204 | | | | | | |

SAMPLE OBSERVATION: ☒ CLEAR ☐ TURBID ☐ COLORED ____ ☐ ODOR ☐ OTHER (SEE NOTES)

D.C. (mg/L) 7.7 6.4 6.80 6.5 6.32 6.88

| SAMPLE PARAMETERS | COLLECTED | METHOD # | FRACTION CODE | PRESERATIVE | VOLUME | SAMPLE BOTTLE NUMBER |
|---|---|---|---|---|---|---|
| SVOCS | ☒ | UM18 | MS | 4C | 2- 1L AG | A B CONTROL #____ |
| PEST./PCBS | ☒ | UW19 | EC | 4C | 2- 1L AG | C D |
| VOC | ☒ | UM20 | VP | HCL,4C | 4- 40 ml AG | E F G H |
| INORGANICS-UNFILTERED | ☒ | * | N | HNO3 pH<2 | 1- 1L Poly | I |
| INORGANICS-FILTERED | ☒ | * | NF | HNO3 pH<2 | 1- 1L Poly | J |
| WATER QUALITY PARAM. / TDS | ☒ | * 160.1 | C | 4C | 1- 1L Poly | K |
| | | | S | H2SO4 pH<2 | 1- 1L Poly | L |
| TPHC | ☒ | 418.1 | C | H2SO4 pH<2 | 1- 1L ~~Poly~~ AG | M N |

☐ IF MS/MSD COLLECTED ☐ IF DUPLICATE COLLECTED

SAMPLING EQUIPMENT

| WATER LEVEL EQUIPMENT USED: | PURGING | SAMPLING | |
|---|---|---|---|
| ☑ ELECTRIC CONDUCTIVITY PROBE (taken 2/12/96) | ☑ | ☑ | DEDICATED SUBMIRSABLE PUMP (WHALE) |
| ☐ FLOAT ACTIVATED | ☐ | ☑ | DEDICATED TEFLON BAILER |
| ☐ OTHER ____ | ☐ | ☑ | IN-LINE FILTER (INORGANICS) |
| | ☐ | ☐ | OTHER ____ |

NUMBER OF IN-LINE FILTERS USED: 1

Notes: * PAL inorganics: ICP metals (SS10), AS (SD21), SE (SD21), TL (SD09), SB (SD28), PB (SD20), HG (SB01).
Water Quality Parameters: PO4 (TF27), TKN (TF26), NIT (TF22), CL/SO4 (TT10), TSS (160.2), ALK (301.0), HARDNESS.

Purge H2O headspace = 0.1 ppm

SAMPLERS SIGNATURE: Sarah J. Montgomery

# GROUNDWATER FIELD SAMPLE DATA RECORD

Project: USATHAMA - Fort Devens
Study Area: SA 57
Project Number: 9144.02
Date: 2/13/96
Sample Location ID: G3M ~~39M~~-92-07X
Time: Start: 0815 End: 1045
Signature of Sampler: MR/SM

## Water Level/Well Data

Well Depth 43.5 Ft — ✓ Measured ___ Historical

✓ Top of Well ___ Top of Protective Casing

Well Riser Stick-up 1.88 Ft (from ground)

Protective Casing/Well Difference -0.22 Ft

Protective Casing 2.1± Ft

Depth to Water 26.34 Ft

Well Material: ✓ PVC ___ SS

Well Locked?: ✓ Yes ___ No

Well Dia. ___ 2 inch ✓ 4 inch ___ 6 inch

Water Level Equip. Used: (taken 2/12/96) ✓ Elect. Cond. Probe ___ Float Activated ___ Press. Transducer

Height of Water Column 17.16 Ft X ___ .16 Gal/Ft (2 in.) ___ .65 Gal/Ft (4 in.) ___ 1.5 Gal/Ft (6 in.) ___ 1.6 Gal/Ft (7 in.) = 28.8 Gal/Vol; 145 Total Gal Purged

| Well Integrity: | Yes | No |
|---|---|---|
| Prot. Casing Secure | ✓ | |
| Concrete Collar Intact | | |
| Other | | |

## Equipment Documentation

**Purging/Sampling Equipment Used:**

| (✓ If Used For) Purging | Sampling | | Equipment ID |
|---|---|---|---|
| | | Peristaltic Pump | |
| | | Submersible Pump | |
| | ✓ | Bailer | |
| | | PVC/Silicon Tubing | |
| | | Teflon/Silicon Tubing | |
| | | Airlift | |
| | | Hand Pump | |
| | ✓ | In-line Filter | |
| | | Press/Vac Filter | |
| ✓ | ✓ | whale pump | |

**Decontamination Fluids Used:**

(✓ All That Apply at Location)
___ Methanol (100%)
___ 25% Methanol/75% ASTM Type II water
___ Deionized Water
___ Liquinox Solution
___ Hexane
___ $HNO_3$/D.I. Water Solution
✓ Potable Water
___ None

## Field Analysis Data

Ambient Air VOC bkg ppm Well Mouth bkg ppm

Field Data Collected ___ In-line ___ In Container

Sample Observations: ___ Turbid ✓ Clear ___ Cloudy ___ Colored ___ Odor

| Purge Data | @ 0 Gal. | @ 29 Gal. | @ 58 Gal. | @ 87 Gal. | @ 116 Gal. | 145 |
|---|---|---|---|---|---|---|
| Temperature, Deg. C | 8.4 | 12.3 | 12.0 | 11.8 | 12.2 | 12.5 |
| pH, units | 5.5 | 5.6 | 5.3 | 5.7 | 5.6 | 5.6 |
| Specific Conductivity (umhos/cm. @ 25 Deg. C.) | 120 | 270 | 262 | 264 | 256 | 274 |
| Oxidation - Reduction, +/- mv | | | | | | 215 |
| Dissolved Oxygen, ppm | 9.21 | 8.3 | 3.5 | 3.5 | 3.2 | 3.4 |
| Turbidity (ntu's) | 0 | 0 | 0 | 0 | 0 | 0 |

## Sample Collection Requirements

(✓ If Required at this Location)

| Analytical Parameter | ✓ If Field Filtered | Preservation Method | Volume Required | ✓ If Sample Collected | Sample Bottle IDs (166) | | | |
|---|---|---|---|---|---|---|---|---|
| VOA | | HCL | 4040 ml | ✓ | E | F | G | H |
| SVOA | | 4°C | 2- liter AG | ✓ | A | B | | |
| Pest/PCB | | 4°C | 1-1 liter AG | ✓ | C | D | | |
| Inorganics | ✓ | $HNO_3$ | 3- 1 liter P | ✓ | I | J (NF) | | |
| Explosives | | 4°C | 2- 1 liter AG | | | | | |
| TPH | | $H_2SO_4$ | 2- 1 liter AG | ✓ | M | N | | |
| TOC | | $H_2SO_4$ | 1- 2 liter P | | | | | |
| Nitrate | | $H_2SO_4$ | 1- 2 liter P | | | | | |

Notes: ✓ $H_2O$ qual. K L

92021590 (j)

ABB Environmental Services, Inc.

Purge $H_2O$ Headspace = bkg

PROJECT: USAEC - FT. DEVENS

SITE ID: 57M-96-09X

FIELD SAMPLE NUMBER: MX5709X1

SITE TYPE: WELL

JOB NUMBER: 9144-08

STUDY AREA/AOC: AOC 57 10/1/96

SAMPLING DATE: 9/30/96

FILE TYPE: CGW

WEATHER: Sunny Mod 60s

LOCATION ACTIVITY: START 11:05 END 11:07

WATER LEVEL / WELL DATA

WELL DEPTH: 25.75 FT

WATER DEPTH: 17.82 FT

HEIGHT OF WATER COLUMN: 7.93 FT

☒ 1.68 gal/ft (4")
☐ ____ gal/ft

☒ MEASURED
☐ HISTORICAL

☒ TOP OF WELL
☒ TOP OF CASING PVC

NA GAL/VOL

15 TOTAL GAL PURGED

PROTECTIVE CASING STICK-UP (FROM GROUND): ____ FT

PROTECTIVE CASING/WELL DIFF.: ____ FT

WELL INTEGRITY:

| | YES | NO | N/A |
|---|---|---|---|
| PROT. CASING SECURE | ☒ | ☐ | ☐ |
| CONCRETE COLLAR INTACT | ☒ | ☐ | ☐ |
| WELL LOCKED | ☒ | ☐ | ☐ |
| PVC WELL CAP | ☒ | ☐ | ☐ |

WELL DIAMETER: (2 INCH) ☐ 4 INCH ☐ ____ INCH

PID READINGS: AMBIENT AIR 0 PPM; WELL MOUTH 0 PPM

Started purging 15:05
Started sampling 15:52

1/2 well screen: 21.78 ft

PURGE DATA

| VOLUME # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Time | 15:12 | 15:15 | 15:25 | 15:30 | 15:34 | 15:40 | 15:45 | 15:50 |
| Water Level | 17.92 | 17.92 | 17.92 | 17.92 | 17.92 | 17.92 | 17.92 | 17.92 |
| GALLONS | 4 | 4 | 5 | 6 | 6.5 | 9 | 13 | 15 |
| PUMPING RATE ~~(GPM)~~ mL/min | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| TEMP, DEG C | 13.6 | 13.2 | 13.2 | 13.1 | 13.1 | 13.2 | 13.0 | 12.9 |
| pH, UNITS ☐ pH PAPER | 5.61 | 5.59 | 5.56 | 5.82 | 5.80 | 5.65 | 5.55 | 5.51 |
| SPECIFIC CONDUCTIVITY, umhos/cm | 0.058 | 0.058 | 0.059 | 0.059 | 0.058 | 0.059 | 0.059 | 0.058 |
| TURBIDITY, ntu | 9 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| REDOX (~~2 COMPLETION OF PURGING~~) mv | 312 | 348 | 348 | 349 | 358 | 376 | 378 | 382 |
| | 9.06 | 7.29 | 7.81 | 7.76 | 7.93 | 7.59 | 7.78 | 8.08 |

Final water level 17.86

SAMPLE OBSERVATIONS 16:35

☒ CLEAR
☐ CLOUDY
☐ COLORED ____
☐ TURBID
☐ ODOR
☐ OTHER (SEE NOTES)

EQUIPMENT DOCUMENTATION

| PURGING | SAMPLING | |
|---|---|---|
| ☒ | ☒ | PERISTALTIC PUMP |
| ☐ | ☐ | DEDICATED SUBMERSIBLE PUMP |
| ☐ | ☐ | BAILER |
| ☒ | ☒ | PVC/SILICON TUBING |
| | ☒ | IN-LINE/DISPOSABLE FILTER 0.45 um |
| ☐ | ☐ | OTHER ____ |

EQUIPMENT ID: ISCO # ____ ☐ 2" ☐ 4" # ____

DECON FLUIDS USED:
☒ POTABLE WATER
☒ LIQUINOX
☒ STEAM CLEANING
☐ ____

WATER LEVEL EQUIP. USED:
☒ ELECTRIC COND. PROBE
☐ PRESSURE TRANSDUCER
☐ ____

NUMBER OF FILTERS USED ____

| ANALYTICAL PARAMETERS | METHOD NUMBER | FRACTION CODE | PRESERVATION METHOD | VOLUME REQUIRED | SAMPLE COLLECTED | SAMPLE BOTTLE ID NUMBERS (Refer to Sample Management System) | BOTTLE |
|---|---|---|---|---|---|---|---|
| ☐ VOC | UM20 | VP | HCL, 4 DEG C | (4) 60 ML | ☐ | | |
| ☐ SVOC | UM18 | MS | 4 DEG C | (2) 1 L AG | ☐ | | |
| ☐ PEST/PCBs | UH02 | EC | 4 DEG C | (3) 1 L AG | ☐ | | |
| | UH13 | | | | | | |
| ☐ PAL INORGANICS (see notes) | | N | HNO3 TO pH<2 | 1 L P-CUBE | ☐ | | |
| ☐ LEAD ONLY | SD20 | N | HNO3 TO pH<2 | | ☐ | | |
| ☐ EXPLOSIVES | UW19 | LC | 4 DEG C | (3) 1 L AG | ☐ | | |
| | UW32 | | | | | | |
| ☐ TPHC | 418.1 | O | H2SO4 TO pH<2 | 1 L AG | ☐ | | |
| ☐ TOC | 415.1 | O | H2SO4 TO pH<2 | 1 L AG | ☐ | | |
| ☐ ANIONS | TF22 | S | H2SO4 TO pH<2 | 1 L P-CUBE | ☐ | | |
| | TT10 | C | 4 DEG C | 1 L P-CUBE | ☐ | | |
| | 310.1 | N | HNO3 TO pH<2 | 1 L P-CUBE | ☐ | | |
| ☐ TSS ONLY | 160.2 | C | 4 DEG C | 1 L P-CUBE | ☐ | | |
| ☐ H2O QUALITY (see notes) | | S | H2SO4 TO pH<2 | 1 L P-CUBE | ☐ | | |
| | | C | 4 DEG C | 1 L P-CUBE | ☐ | | |
| | | N | HNO3 TO pH<2 | 1 L P-CUBE | ☐ | | |
| ☐ COLIFORM | 303, 909 | | 4 DEG C | (1) 4 OZ STERILE | ☐ | | |

NOTES (1) PURGING COMPLETE WHEN 5 WELL VOLUMES HAVE BEEN PURGED AND WHEN WATER PARAMETERS VARY BY LESS THAN APPROXIMATELY 10%.
(2) PAL INORGANICS: ICP METALS (SS10); AS (SD22); SE (SD21); TL (SD09); SB (SD28); PB (SD20); HG (SB01).
H2O QUALITY: PO4 (TF27); TKN (TF26); NIT (TF22); CL/SO4 (TT10); TSS (160.2); ALK (301.0); HARDNESS.
ALL PARAMETERS COLLECTED AS TOTALS, IE: NON-FILTERED

SAMPLED BY: P. BYRNES

RECEIVED BY: Z. RUSTAD

Note: very fine sand visible in pump tubing

| | | | | | |
|---|---|---|---|---|---|
| PROJECT | USAEC - FT. DEVENS | FIELD SAMPLE NUMBER | M X 5 7 0 3 X 3 | STUDY AREA/AOC | 10/2/96 |
| SITE ID | 57M-95-03X | SITE TYPE | WELL | SAMPLING DATE | ~~9/30/96~~ |
| | | JOB NUMBER | 09144-03 | FILE TYPE | CGW |
| LOCATION ACTIVITY | START 11:16 END 6:13 | | | WEATHER | |

WATER LEVEL / WELL DATA

☐ TOP OF WELL
☒ TOP OF CASING PVC

PROTECTIVE CASING STICK-UP (FROM GROUND) ____ FT

PROTECTIVE CASING/WELL DIFF. ____ FT

WELL DEPTH 19.55 FT ☐ MEASURED ☐ HISTORICAL

WATER DEPTH 10.72 FT

GAL/VOL

HEIGHT OF WATER COLUMN 8.83 FT

TOTAL GAL PURGED

| WELL INTEGRITY: | YES | NO | N/A |
|---|---|---|---|
| PROT. CASING SECURE | ☐ | ☐ | ☐ |
| CONCRETE COLLAR INTACT | ☐ | ☐ | ☐ |
| WELL LOCKED | ☐ | ☐ | ☐ |
| PVC WELL CAP | ☐ | ☐ | ☐ |

WELL DIAMETER ☐ 2 INCH ☒ 4 INCH ☐ ____ INCH

started purge 14:16
started sampling 15:00

☐ 1.68 gal/ft (4")
☐ ____ gal/ft

PID READINGS: AMBIENT AIR 0.3 PPM WELL MOUTH 0.0 PPM

Sample headspace = 9.8 ppm

mid screen = 15.1 ft

PURGE DATA

| TIME | 14:26 | 14:35 | 14:42 | 14:45 | 14:48 | 14:54 | 14:57 | 15:04 |
|---|---|---|---|---|---|---|---|---|
| ~~VOLUME #~~ water level | 10.98 | 10.98 | 11.12 | 11.08 | 11.04 | 11.04 | 11.04 | 11.07 |
| GALLONS | 0.1 | 0.3 | 1.0 | 1.2 | 1.4 | 1.6 | 1.8 | 2.2 |
| PUMPING RATE (GPM) | 500 | 300 | 500 | 350 | 400 | 400 | 400 | 400 |
| TEMP, DEG C | 15.9 | 15.5 | 15.5 | 15.3 | 15.3 | 15.4 | 15.4 | 15.4 ✓ |
| pH, UNITS ☐ pH PAPER | 5.07 | 5.04 | 5.10 | 5.18 | 5.22 | 5.25 | 5.26 | 5.30 ✓ |
| SPECIFIC CONDUCTIVITY, umhos/cm | 0.061 | 0.060 | 0.062 | 0.069 | 0.071 | 0.070 | 0.071 | 0.072 ✓ |
| TURBIDITY, ntu | 9 | 7 | 2 | 0 | 0 | 0 | 0 | 0 ✓ |
| REDOX (~~@ COMPLETION OF PURGING~~): | 253 | 252 +/- mv | 251 | 251 | 251 | 251 | 251 | 251 ✓ |
| DO (mg/L) | 1.53 | 0.88 | 0.53 | 0.30 | 0.27 | 0.24 | 0.24 | 0.24 ✓ |

finished sampling 15:53
final water level = 10.95

SAMPLE OBSERVATIONS

☐ CLEAR
☐ CLOUDY
☐ COLORED ____
☐ TURBID
☐ ODOR
☐ OTHER (SEE NOTES)

5 gal. of purge water discharged to drum.

EQUIPMENT DOCUMENTATION

| PURGING | SAMPLING | |
|---|---|---|
| ☐ | ☐ | PERISTALTIC PUMP |
| ☐ | ☐ | DEDICATED SUBMERSIBLE PUMP |
| ☐ | ☐ | BAILER |
| ☐ | ☐ | PVC/SILICON TUBING |
| | ☐ | IN-LINE/DISPOSABLE FILTER ____ |
| ☐ | ☐ | OTHER ____ |

EQUIPMENT ID
ISCO # ____
☐ 2" ☐ 4" # ____

DECON FLUIDS USED
☐ POTABLE WATER
☐ LIQUINOX
☐ STEAM CLEANING
☐ ____

WATER LEVEL EQUIP. USED
☐ ELECTRIC COND. PROBE
☐ PRESSURE TRANSDUCER
☐ ____

NUMBER OF FILTERS USED ____

| ANALYTICAL PARAMETERS | METHOD NUMBER | FRACTION CODE | PRESERVATION METHOD | VOLUME REQUIRED | SAMPLE COLLECTED | SAMPLE BOTTLE ID NUMBERS | BOTTLE |
|---|---|---|---|---|---|---|---|
| ☐ VOC | UM20 | VP | HCL, 4 DEG C | (4) 60 ML | ☐ | ____ | ____ |
| ☐ SVOC | UM18 | MS | 4 DEG C | (2) 1 L AG | ☐ | ____ | ____ |
| ☐ PEST/PCBs | UH02 | EC | 4 DEG C | (3) 1 L AG | ☐ | ____ | ____ |
| | UH13 | | | | | ____ | ____ |
| ☐ PAL INORGANICS (see notes) | | M | HNO3 TO pH<2 | 1 L P-CUBE | ☐ | ____ | ____ |
| ☐ LEAD ONLY | SD20 | M | HNO3 TO pH<2 | | ☐ | ____ | ____ |
| ☐ EXPLOSIVES | UW19 | LC | 4 DEG C | (3) 1 L AG | ☐ | ____ | ____ |
| | UW32 | | | | | ____ | ____ |
| ☐ TPHC | 418.1 | O | H2SO4 TO pH<2 | 1 L AG | ☐ | ____ | ____ |
| ☐ TOC | 415.1 | O | H2SO4 TO pH<2 | 1 L AG | ☐ | ____ | ____ |
| ☐ ANIONS | TF22 | S | H2SO4 TO pH<2 | 1 L P-CUBE | ☐ | ____ | ____ |
| | TT10 | C | 4 DEG C | 1 L P-CUBE | ☐ | ____ | ____ |
| | 310.1 | N | HNO3 TO pH<2 | 1 L P-CUBE | ☐ | ____ | ____ |
| ☐ TSS ONLY | 160.2 | C | 4 DEG C | 1 L P-CUBE | ☐ | ____ | ____ |
| ☐ H2O QUALITY (see notes) | | S | H2SO4 TO pH<2 | 1 L P-CUBE | ☐ | ____ | ____ |
| | | C | 4 DEG C | 1 L P-CUBE | ☐ | ____ | ____ |
| | | N | HNO3 TO pH<2 | 1 L P-CUBE | ☐ | ____ | ____ |
| ☐ COLIFORM | 303, 909 | | 4 DEG C | (1) 4 OZ STERILE | ☐ | ____ | ____ |

NOTES (1) PURGING COMPLETE WHEN 5 WELL VOLUMES HAVE BEEN PURGED AND WHEN WATER PARAMETERS VARY BY LESS THAN APPROXIMATELY 10%.
(2) PAL INORGANICS: ICP METALS (SS10); AS (SD22); SE (SD21); TL (SD09); SB (SD28); PB (SD20); HG (SB01).
H2O QUALITY: PO4 (TF27); TKN (TF26); NIT (TF22); CL/SO4 (TT10); TSS (160.2); ALK (301.0); HARDNESS.
ALL PARAMETERS COLLECTED AS TOTALS, IE: NON-FILTERED

SAMPLED BY: [signature]
RECEIVED BY: ____

| | | | |
|---|---|---|---|
| PROJECT | USAEC - FT. DEVENS | FIELD SAMPLE NUMBER | MX571OX1 |
| SITE ID | 57M-96-10X | SITE TYPE | WELL |
| | | JOB NUMBER | 09144-08 |
| LOCATION ACTIVITY | 10/2/96 9:12 START 11:16 END 11:17 | | |

| | | | |
|---|---|---|---|
| STUDY AREA/AOC | ABC 57 | | |
| SAMPLING DATE | 9/30/96 | | |
| FILE TYPE | CGW | | |
| WEATHER | | | |

WATER LEVEL / WELL DATA

WELL DEPTH 15.54 FT ☐ MEASURED ☐ HISTORICAL

WATER DEPTH 6.62 FT

HEIGHT OF WATER COLUMN 8.92 FT

☐ 1.68 gal/ft (4") 4.46
☐ ___ gal/ft

GAL/VOL 4.2 TOTAL GAL PURGED

☐ TOP OF WELL
☐ TOP OF CASING
☐ ___

PROTECTIVE CASING STICK-UP (FROM GROUND) ___ FT

PROTECTIVE CASING/WELL DIFF. ___ FT

| WELL INTEGRITY: | YES | NO | N/A |
|---|---|---|---|
| PROT. CASING SECURE | ☐ | ☐ | ☐ |
| CONCRETE COLLAR INTACT | ☐ | ☐ | ☐ |
| WELL LOCKED | ☐ | ☐ | ☐ |
| PVC WELL CAP | ☐ | ☐ | ☐ |

WELL DIAMETER ☒ 2 INCH ☐ 4 INCH ☐ ___ INCH

PID READINGS: AMBIENT AIR ___ PPM WELL MOUTH ___ PPM

Start Level 6.76 7.04 7.07 7.12 7.08 7.10 7.12 7.04 7.05 7.05

| PURGE DATA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Time ~~VOLUME~~ # | 925 | 930 | 935 | 940 | 945 | 9:50 | 9:55 | 10:00 | 1005 | |
| GALLONS | 1 | 1.2 | 1.6 | 1.8 | 2.0 | 2.2 | 2.4 | 2.6 | 2.7 | |
| 50 ml/m PUMPING RATE (GPM) | 50 ml/m | 750 ml/m | 750 ml/m | 750 ml/m | 750 ml/m | 750 ml/m | 50 ml/m | 50 ml/m | 50 ml/m | |
| TEMP, DEG C | 13.3 | 13.3 | 13.3 | 13.3 | 13.3 | 13.3 | 13.4 | 13.4 | 13.4 | |
| pH, UNITS ☐ pH PAPER | 4.42 | 4.37 | 4.43 | 4.50 | 4.56 | 4.80 | 4.98 | 5.00 | 4.95 | |
| SPECIFIC CONDUCTIVITY, umhos/cm | .024 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | |
| TURBIDITY, ntu | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| REDOX (~~a COMPLETION OF PURGING~~): | 226 | 321 | 321 | 332 | 322 | 321 | 322 | 322 | 321 | |
| D.O | -0.08 | -0.27 | -0.20 | -0.15 | -0.26 | -0.15 | -0.23 | -0.22 | -0.22 | |

SAMPLE OBSERVATIONS
☐ CLEAR
☐ CLOUDY
☐ COLORED ___
☐ TURBID
☐ ODOR
☐ OTHER (SEE NOTES)

Sample Time 10:06

EQUIPMENT DOCUMENTATION

| PURGING | SAMPLING | | EQUIPMENT ID | DECON FLUIDS USED | WATER LEVEL EQUIP. USED |
|---|---|---|---|---|---|
| ☐ | ☐ | PERISTALTIC PUMP | ISCO # ___ | ☐ POTABLE WATER | ☐ ELECTRIC COND. PROBE |
| ☐ | ☐ | DEDICATED SUBMERSIBLE PUMP | ☐ 2" ☐ 4" # ___ | ☐ LIQUINOX | ☐ PRESSURE TRANSDUCER |
| ☐ | ☐ | BAILER | | ☐ STEAM CLEANING | ☐ ___ |
| ☐ | ☐ | PVC/SILICON TUBING | | ☐ ___ | |
| | ☐ | IN-LINE/DISPOSABLE FILTER ___ | | | |
| ☐ | ☐ | OTHER ___ | | NUMBER OF FILTERS USED ___ | |

| ANALYTICAL PARAMETERS | METHOD NUMBER | FRACTION CODE | PRESERVATION METHOD | VOLUME REQUIRED | SAMPLE COLLECTED | SAMPLE BOTTLE ID NUMBERS | BOTTLE |
|---|---|---|---|---|---|---|---|
| ☐ VOC | UM20 | VP | HCL, 4 DEG C | (4) 60 ML | ☐ | ___ | ___ |
| ☐ SVOC | UM18 | MS | 4 DEG C | (2) 1 L AG | ☐ | ___ | ___ |
| ☐ PEST/PCBs | UH02 | EC | 4 DEG C | (3) 1 L AG | ☐ | ___ | ___ |
| | UH13 | | | | | ___ | ___ |
| ☐ PAL INORGANICS (see notes) | | N | HNO3 TO pH<2 | 1 L P-CUBE | ☐ | ___ | ___ |
| ☐ LEAD ONLY | SD20 | N | HNO3 TO pH<2 | | ☐ | ___ | ___ |
| ☐ EXPLOSIVES | UW19 | LC | 4 DEG C | (3) 1 L AG | ☐ | ___ | ___ |
| | UW32 | | | | | ___ | ___ |
| ☐ TPHC | 418.1 | O | H2SO4 TO pH<2 | 1 L AG | ☐ | ___ | ___ |
| ☐ TOC | 415.1 | O | H2SO4 TO pH<2 | 1 L AG | ☐ | ___ | ___ |
| ☐ ANIONS | TF22 | S | H2SO4 TO pH<2 | 1 L P-CUBE | ☐ | ___ | ___ |
| | TT10 | C | 4 DEG C | 1 L P-CUBE | ☐ | ___ | ___ |
| | 310.1 | N | HNO3 TO pH<2 | 1 L P-CUBE | ☐ | ___ | ___ |
| ☐ TSS ONLY | 160.2 | C | 4 DEG C | 1 L P-CUBE | ☐ | ___ | ___ |
| ☐ H2O QUALITY (see notes) | | S | H2SO4 TO pH<2 | 1 L P-CUBE | ☐ | ___ | ___ |
| | | C | 4 DEG C | 1 L P-CUBE | ☐ | ___ | ___ |
| | | N | HNO3 TO pH<2 | 1 L P-CUBE | ☐ | ___ | ___ |
| ☐ COLIFORM | 303, 909 | | 4 DEG C | (1) 4 OZ STERILE | ☐ | ___ | ___ |

NOTES (1) PURGING COMPLETE WHEN 5 WELL VOLUMES HAVE BEEN PURGED AND WHEN WATER PARAMETERS VARY BY LESS THAN APPROXIMATELY 10%.
(2) PAL INORGANICS: ICP METALS (SS10); AS (SD22); SE (SD21); TL (SD09); SB (SD28); PB (SD20); HG (SB01).
H2O QUALITY: PO4 (TF27); TKN (TF26); NIT (TF22); CL/SO4 (TT10); TSS (160.2); ALK (301.0); HARDNESS.
ALL PARAMETERS COLLECTED AS TOTALS, IE: NON-FILTERED

SAMPLED BY: ___
RECEIVED BY: ___

| | | | |
|---|---|---|---|
| PROJECT | USAEC - FT. DEVENS | FIELD SAMPLE NUMBER | M X 5 7 1 1 X 1 |
| SITE ID | 57M-96-11X | SITE TYPE | WELL |
| | | JOB NUMBER | 09144-08 |
| LOCATION ACTIVITY | START 11:18 END 11:20 | | |
| STUDY AREA/AOC | RB 10/2/96 | | |
| SAMPLING DATE | 9/30/96 | | |
| FILE TYPE | CGW | | |
| WEATHER | | | |

WATER LEVEL / WELL DATA

WELL DEPTH 14.62 FT ☐ MEASURED ☐ HISTORICAL

WATER DEPTH 3.42 FT 3.51 RB 10/2/96

HEIGHT OF WATER COLUMN 11.11 / 11.2 FT

☐ 1.68 gal/ft (4") ☐ ____ gal/ft

1/2 = 5.6

☐ TOP OF WELL ☒ TOP OF CASING PVC

PROTECTIVE CASING STICK-UP (FROM GROUND) ____ FT

PROTECTIVE CASING/WELL DIFF. ____ FT

GAL/VOL

4.5 TOTAL GAL PURGED

WELL INTEGRITY:

| | YES | NO | N/A |
|---|---|---|---|
| PROT. CASING SECURE | ☐ | ☐ | ☐ |
| CONCRETE COLLAR INTACT | ☐ | ☐ | ☐ |
| WELL LOCKED | ☐ | ☐ | ☐ |
| PVC WELL CAP | ☐ | ☐ | ☐ |

WELL DIAMETER ☒ 2 INCH ☐ 4 INCH ☐ ____ INCH

PID READINGS: AMBIENT AIR 000.3 PPM ~~WELL MOUTH~~ 0.8 PPM

drop pump to 9.0 ft

began purging 10:35

began sampling 11:45

Completed Sampling 12:46

PURGE DATA

Starting H2O level 3.51

| | 10:45 | 10:53 | 10:58 | 11:02 | 11:12 | 11:16 | 11:22 | 11:25 | 11:38 | 11:41 | 11:44 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ~~VOLUME #~~ water level | 4.00 | 4.04 | 4.02 | 4.02 | 4.02 | 4.06 | 4.14 | 4.10 | 4.00 | 4.00 | 4.00 3.70 |
| GALLONS | 0.3 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.2 | 1.5 | 1.6 | 1.65 | 1.75 4.5 |
| ml/min PUMPING RATE ~~(GPM)~~ | 200 | 200 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 |
| TEMP, DEG C | 13.2 | 13.1 | 13.2 | 13.2 | 13.2 | 13.2 | 13.1 | 13.1 | 13.4 | 13.4 | 13.4 |
| pH, UNITS ☐ pH PAPER | 6.03 | 6.08 | 6.09 | 6.10 | 6.09 | 6.09 | 6.10 | 6.10 | 6.10 | 6.10 | 6.10 |
| SPECIFIC CONDUCTIVITY, umhos/cm | 0.147 | 0.149 | 0.148 | 0.147 | 0.147 | 0.146 | 0.146 | 0.147 | 0.145 | 0.145 | 0.146 |
| TURBIDITY, ntu | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| REDOX ~~(@ COMPLETION OF PURGING)~~: | 253 | 251 +/- mv | 250 | 247 | 244 | 244 | 242 | 241 | 244 | 243 | 244 |
| | DO 0.34 | 0.34 | 0.27 | 0.26 | 0.22 | 0.18 | 0.17 | 0.10 | 0.09 | 0.10 | 0.10 |

SAMPLE OBSERVATIONS: ☐ CLEAR ☐ CLOUDY ☐ COLORED ☐ TURBID ☐ ODOR ☐ OTHER (SEE NOTES)

EQUIPMENT DOCUMENTATION

| PURGING | SAMPLING | |
|---|---|---|
| ☐ | ☐ | PERISTALTIC PUMP |
| ☐ | ☐ | DEDICATED SUBMERSIBLE PUMP |
| ☐ | ☐ | BAILER |
| ☐ | ☐ | PVC/SILICON TUBING |
| | ☐ | IN-LINE/DISPOSABLE FILTER |
| ☐ | ☐ | OTHER |

EQUIPMENT ID: ISCO # ____ ☐ 2" ☐ 4" # ____

DECON FLUIDS USED: ☐ POTABLE WATER ☐ LIQUINOX ☐ STEAM CLEANING ☐ ____

WATER LEVEL EQUIP. USED: ☐ ELECTRIC COND. PROBE ☐ PRESSURE TRANSDUCER ☐ ____

NUMBER OF FILTERS USED ____

| ANALYTICAL PARAMETERS | METHOD NUMBER | FRACTION CODE | PRESERVATION METHOD | VOLUME REQUIRED | SAMPLE COLLECTED | SAMPLE BOTTLE ID NUMBERS | BOTTLE |
|---|---|---|---|---|---|---|---|
| ☐ VOC | UM20 | VP | HCL, 4 DEG C | (4) 60 ML | ☐ | | |
| ☐ SVOC | UM18 | MS | 4 DEG C | (2) 1 L AG | ☐ | | |
| ☐ PEST/PCBs | UM02 | EC | 4 DEG C | (3) 1 L AG | ☐ | | |
| | UM13 | | | | | | |
| ☐ PAL INORGANICS (see notes) | | N | HNO3 TO pH<2 | 1 L P-CUBE | ☐ | | |
| ☐ LEAD ONLY | SD20 | N | HNO3 TO pH<2 | | ☐ | | |
| ☐ EXPLOSIVES | UM19 | LC | 4 DEG C | (3) 1 L AG | ☐ | | |
| | UM32 | | | | | | |
| ☐ TPHC | 418.1 | O | H2SO4 TO pH<2 | 1 L AG | ☐ | | |
| ☐ TOC | 415.1 | O | H2SO4 TO pH<2 | 1 L AG | ☐ | | |
| ☐ ANIONS | TF22 | S | H2SO4 TO pH<2 | 1 L P-CUBE | ☐ | | |
| | TT10 | C | 4 DEG C | 1 L P-CUBE | ☐ | | |
| | 310.1 | N | HNO3 TO pH<2 | 1 L P-CUBE | ☐ | | |
| ☐ TSS ONLY | 160.2 | C | 4 DEG C | 1 L P-CUBE | ☐ | | |
| ☐ H2O QUALITY (see notes) | | S | H2SO4 TO pH<2 | 1 L P-CUBE | ☐ | | |
| | | C | 4 DEG C | 1 L P-CUBE | ☐ | | |
| | | N | HNO3 TO pH<2 | 1 L P-CUBE | ☐ | | |
| ☐ COLIFORM | 303, 909 | | 4 DEG C | (1) 4 OZ STERILE | ☐ | | |

NOTES (1) PURGING COMPLETE WHEN 5 WELL VOLUMES HAVE BEEN PURGED AND WHEN WATER PARAMETERS VARY BY LESS THAN APPROXIMATELY 10%.
(2) PAL INORGANICS: ICP METALS (SS10); AS (SD22); SE (SD21); TL (SD09); SB (SD28); PB (SD20); HG (SB01).
H2O QUALITY: PO4 (TF27); TKN (TF26); NIT (TF22); CL/SO4 (TT10); TSS (160.2); ALK (301.0); HARDNESS.
ALL PARAMETERS COLLECTED AS TOTALS, IE: NON-FILTERED

SAMPLED BY: RB

RECEIVED BY: ____

| | | | |
|---|---|---|---|
| PROJECT | USAEC - FT. DEVENS | FIELD SAMPLE NUMBER | M X 5 7 1 2 X 1 |
| SITE ID | 5 7 M - 9 6 - 1 2 X | SITE TYPE | WELL |
| LOCATION | 10/2/96 1145 | JOB NUMBER | 09144.08 |
| ACTIVITY | START 11:22 END 11:24 | | |

| | | | |
|---|---|---|---|
| STUDY AREA/AOC | AOC 57 | | |
| SAMPLING DATE | 9/30/96 | | |
| FILE TYPE | CGW | | |
| WEATHER | SUNNY LOW 60s | | |

WATER LEVEL / WELL DATA

WELL DEPTH 15.15 FT — ☑ MEASURED ☐ HISTORICAL

WATER DEPTH 4.98 FT

HEIGHT OF WATER COLUMN 10.17 FT

☐ 1.68 gal/ft (4") (5.08)
☐ 0.9 gal/ft

☐ TOP OF WELL ☑ TOP OF CASING PVC ☐ _____

PROTECTIVE CASING STICK-UP (FROM GROUND) ____ FT

PROTECTIVE CASING/WELL DIFF. ____ FT

GAL/VOL

8 TOTAL GAL PURGED

PID READINGS: AMBIENT AIR 0 PPM — WELL MOUTH 0 PPM

| WELL INTEGRITY: | YES | NO | N/A |
|---|---|---|---|
| PROT. CASING SECURE | ☑ | ☐ | ☐ |
| CONCRETE COLLAR INTACT | ☑ | ☐ | ☐ |
| WELL LOCKED | ☑ | ☐ | ☐ |
| PVC WELL CAP | ☑ | ☐ | ☐ |

WELL DIAMETER ☑ 2 INCH ☐ 4 INCH ☐ ____ INCH

Start level 11:15 4.89 5.96 6.04 6.05 6.05 6.04 6.12 6.12 6.10

| PURGE DATA | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Time | 1150 | 1155 | 1200 | 1205 | 1210 | 1215 | 1218 | 1221 | 1224 | | 1227 |
| GALLONS | 1 | 2.2 | 2.3 | 2.4 | 2.5 | 3.0 | 3.3 | 3.4 | 3.5 | SAMPLE OBSERVATIONS | 3.8 |
| PUMPING RATE (GPM) | 50 ml/m | 50 ml/m | 750 ml/m | 750 ml/m | 750 ml/m | 750 ml/m | 750 ml/m | 750 ml/m | 750 ml/m | | 750 ml/m |
| TEMP, DEG C | 14.0 | 13.8 | 13.6 | 13.6 | 13.5 | 13.5 | 13.5 | 13.4 | 13.4 | | 13.4 |
| pH, UNITS ☐ pH PAPER | 5.15 | 5.12 | 5.09 | 5.13 | 5.10 | 5.12 | 5.12 | 5.14 | 5.15 | | 5.15 |
| SPECIFIC CONDUCTIVITY, umhos/cm | 0.78 | 0.77 | 0.71 | 0.74 | 0.72 | 0.72 | 0.74 | 0.74 | 0.75 | | 0.75 |
| TURBIDITY, ntu | 87 | 98 | 258 | 320 | 390 | 310 | 252 | 287 | 295 | | 244 |
| REDOX (~~@ COMPLETION OF PURGING~~): | 230 | 215 +/- | 211 | 198 | 187 | 201 | 214 | 214 | 205 | | 200 |
| DO | 1.35 | 0.69 | 1.03 | 0.69 | 0.67 | 0.78 | 0.18 | 0.29 | 0.26 | | 0.[illegible] |

☑ CLEAR ☐ CLOUDY ☐ COLORED ☐ TURBID ☐ ODOR ☐ OTHER (SEE NOTES)

EQUIPMENT DOCUMENTATION

| PURGING | SAMPLING | | EQUIPMENT ID | DECON FLUIDS USED | WATER LEVEL EQUIP. USED |
|---|---|---|---|---|---|
| ☐ | ☐ | PERISTALTIC PUMP | ISCO # ____ | ☑ POTABLE WATER | ☑ ELECTRIC COND. PROBE |
| ☐ | ☐ | DEDICATED SUBMERSIBLE PUMP | | ☐ LIQUINOX | ☐ PRESSURE TRANSDUCER |
| ☐ | ☐ | BAILER | ☐ 2" ☐ 4" # ____ | ☐ STEAM CLEANING | ☐ ____ |
| ☐ | ☐ | PVC/SILICON TUBING | | ☐ ____ | |
| | ☐ | IN-LINE/DISPOSABLE FILTER | ____ | | |
| ☐ | ☐ | OTHER ____ | | | |

NUMBER OF FILTERS USED 1

Sample Time 1230

| ANALYTICAL PARAMETERS | METHOD NUMBER | FRACTION CODE | PRESERVATION METHOD | VOLUME REQUIRED | SAMPLE COLLECTED | SAMPLE BOTTLE ID NUMBERS | BOTTLE |
|---|---|---|---|---|---|---|---|
| ☐ VOC | UM20 | VP | HCL, 4 DEG C | (4) 60 ML | ☐ | ____ | ____ |
| ☐ SVOC | UM18 | MS | 4 DEG C | (2) 1 L AG | ☐ | ____ | ____ |
| ☐ PEST/PCBs | UH02 | EC | 4 DEG C | (3) 1 L AG | ☐ | ____ | ____ |
| | UH13 | | | | | ____ | ____ |
| ☐ PAL INORGANICS (see notes) | | N | HNO3 TO pH<2 | 1 L P-CUBE | ☐ | ____ | ____ |
| ☐ LEAD ONLY | SD20 | N | HNO3 TO pH<2 | | ☐ | ____ | ____ |
| ☐ EXPLOSIVES | UW19 | LC | 4 DEG C | (3) 1 L AG | ☐ | ____ | ____ |
| | UW32 | | | | | ____ | ____ |
| ☐ TPHC | 418.1 | O | H2SO4 TO pH<2 | 1 L AG | ☐ | ____ | ____ |
| ☐ TOC | 415.1 | O | H2SO4 TO pH<2 | 1 L AG | ☐ | ____ | ____ |
| ☐ ANIONS | TF22 | S | H2SO4 TO pH<2 | 1 L P-CUBE | ☐ | ____ | ____ |
| | TT10 | C | 4 DEG C | 1 L P-CUBE | ☐ | ____ | ____ |
| | 310.1 | N | HNO3 TO pH<2 | 1 L P-CUBE | ☐ | ____ | ____ |
| ☐ TSS ONLY | 160.2 | C | 4 DEG C | 1 L P-CUBE | ☐ | ____ | ____ |
| ☐ H2O QUALITY (see notes) | | S | H2SO4 TO pH<2 | 1 L P-CUBE | ☐ | ____ | ____ |
| | | C | 4 DEG C | 1 L P-CUBE | ☐ | ____ | ____ |
| | | N | HNO3 TO pH<2 | 1 L P-CUBE | ☐ | ____ | ____ |
| ☐ COLIFORM | 303, 909 | | 4 DEG C | (1) 4 OZ STERILE | ☐ | ____ | ____ |

NOTES (1) PURGING COMPLETE WHEN 5 WELL VOLUMES HAVE BEEN PURGED AND WHEN WATER PARAMETERS VARY BY LESS THAN APPROXIMATELY 10%.
(2) PAL INORGANICS: ICP METALS (SS10); AS (SD22); SE (SD21); TL (SD09); SB (SD28); PB (SD20); HG (SB01).
H2O QUALITY: PO4 (TF27); TKN (TF26); NIT (TF22); CL/SO4 (TT10); TSS (160.2); ALK (301.0); HARDNESS.
ALL PARAMETERS COLLECTED AS TOTALS, IE: NON-FILTERED

SAMPLED BY: ____

RECEIVED BY: ____

AAB

| | | | |
|---|---|---|---|
| PROJECT | USAEC - FT. DEVENS | FIELD SAMPLE NUMBER | M X 5 7 1 3 X 1 |
| SITE ID | 5 7 M - 9 6 - 1 3 X | SITE TYPE | WELL |
| | | JOB NUMBER | 09144-08 |
| LOCATION ACTIVITY | START 11:26 END 11:29 | | |

| | |
|---|---|
| STUDY AREA/AOC | 10/2/96 |
| SAMPLING DATE | ~~9/30/96~~ |
| FILE TYPE | CGW |
| WEATHER | |

WATER LEVEL / WELL DATA

WELL DEPTH 15.12 FT ☒ MEASURED ☐ HISTORICAL

☐ TOP OF WELL ☒ TOP OF CASING ☐ PVC

PROTECTIVE CASING STICK-UP (FROM GROUND) ____ FT

PROTECTIVE CASING/WELL DIFF. ____ FT

WATER DEPTH 4.96 FT

HEIGHT OF WATER COLUMN 10.16 FT

NA GAL/VOL

TOTAL GAL PURGED

| WELL INTEGRITY: | YES | NO | N/A |
|---|---|---|---|
| PROT. CASING SECURE | ☐ | ☐ | ☐ |
| CONCRETE COLLAR INTACT | ☐ | ☐ | ☐ |
| WELL LOCKED | ☐ | ☐ | ☐ |
| PVC WELL CAP | ☐ | ☐ | ☐ |

WELL DIAMETER ☒ 2 INCH ☐ 4 INCH ☐ ____ INCH

☐ 1.68 gal/ft (4") 5.08
☐ ____ gal/ft

PID READINGS: AMBIENT AIR ____ PPM WELL MOUTH ____ PPM

Start my level 4.82 4.96 mg 5:40 5:36 5:45 5:43 5:39 5:44 5:45 5:49

| PURGE DATA | Time / VOLUME # | 2:30 | 235 | 240 | 245 | 250 | 255 | 300 | 3:05 | 310 |
|---|---|---|---|---|---|---|---|---|---|---|
| | GALLONS | 0.5 | 0.6 | 0.8 | 1.0 | 1.2 | 1.4 | 1.6 | 1.8 | 2.0 |
| | PUMPING RATE (GPM) | Trickle | <50 mg/m | <50 mg/m | <50 mg/m | <50 mg/m | <50 | <50 | <50 | <50 |
| TEMP, DEG C | | 14.7 | 14.6 | 14.3 | 14.2 | 14.2 | 14.2 | 14.1 | 14.1 | 14.0 |
| pH, UNITS ☐ pH PAPER | | 5.68 | 5.63 | 5.59 | 5.57 | 5.58 | 5.58 | 5.61 | 5.64 | 5.67 |
| SPECIFIC CONDUCTIVITY, umhos/cm | | .110 | .110 | .110 | .111 | .112 | .112 | .112 | .111 | .111 |
| TURBIDITY, ntu | | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| REDOX (~~@ COMPLETION OF PURGING~~): | | 136 | 105 mv | 100 | 64 | 53 | 65 | 45 | 25 mv | 48 |
| | | >.0 | -0.48 | -0.63 | -0.82 | -0.89 | -0.83 | -0.74 | -0.81 | -0.75 | -0.79 |

SAMPLE OBSERVATIONS
☐ CLEAR
☐ CLOUDY
☐ COLORED ____
☐ TURBID
☐ ODOR
☐ OTHER (SEE NOTES)

Rate: 250 mg/5 min

EQUIPMENT DOCUMENTATION

| PURGING | SAMPLING | |
|---|---|---|
| ☐ | ☐ | PERISTALTIC PUMP |
| ☐ | ☐ | DEDICATED SUBMERSIBLE PUMP |
| ☐ | ☐ | BAILER |
| ☐ | ☐ | PVC/SILICON TUBING |
| | ☐ | IN-LINE/DISPOSABLE FILTER ____ |
| ☐ | ☐ | OTHER ____ |

EQUIPMENT ID
ISCO # ____
☐ 2" ☐ 4" # ____

DECON FLUIDS USED
☐ POTABLE WATER
☐ LIQUINOX
☐ STEAM CLEANING
☐ ____

WATER LEVEL EQUIP. USED
☐ ELECTRIC COND. PROBE
☐ PRESSURE TRANSDUCER
____

NUMBER OF FILTERS USED ____

Sample Time 3:10

| ANALYTICAL PARAMETERS | METHOD NUMBER | FRACTION CODE | PRESERVATION METHOD | VOLUME REQUIRED | SAMPLE COLLECTED | SAMPLE BOTTLE ID NUMBERS | BOTTLE |
|---|---|---|---|---|---|---|---|
| ☐ VOC | UM20 | VP | HCL, 4 DEG C | (4) 60 ML | ☐ | ____ | |
| ☐ SVOC | UM18 | MS | 4 DEG C | (2) 1 L AG | ☐ | ____ | |
| ☐ PEST/PCBs | UH02 | EC | 4 DEG C | (3) 1 L AG | ☐ | ____ | |
| | UH13 | | | | | ____ | |
| ☐ PAL INORGANICS (see notes) | | M | HNO3 TO pH<2 | 1 L P-CUBE | ☐ | ____ | |
| ☐ LEAD ONLY | SD20 | M | HNO3 TO pH<2 | | ☐ | ____ | |
| ☐ EXPLOSIVES | UW19 | LC | 4 DEG C | (3) 1 L AG | ☐ | ____ | |
| | UW32 | | | | | ____ | |
| ☐ TPHC | 418.1 | O | H2SO4 TO pH<2 | 1 L AG | ☐ | ____ | |
| ☐ TOC | 415.1 | O | H2SO4 TO pH<2 | 1 L AG | ☐ | ____ | |
| ☐ ANIONS | TF22 | S | H2SO4 TO pH<2 | 1 L P-CUBE | ☐ | ____ | |
| | TT10 | C | 4 DEG C | 1 L P-CUBE | ☐ | ____ | |
| | 310.1 | N | HNO3 TO pH<2 | 1 L P-CUBE | ☐ | ____ | |
| ☐ TSS ONLY | 160.2 | C | 4 DEG C | 1 L P-CUBE | ☐ | ____ | |
| ☐ H2O QUALITY (see notes) | | S | H2SO4 TO pH<2 | 1 L P-CUBE | ☐ | ____ | |
| | | C | 4 DEG C | 1 L P-CUBE | ☐ | ____ | |
| | | N | HNO3 TO pH<2 | 1 L P-CUBE | ☐ | ____ | |
| ☐ COLIFORM | 303, 909 | | 4 DEG C | (1) 4 OZ STERILE | ☐ | ____ | |

NOTES (1) PURGING COMPLETE WHEN 5 WELL VOLUMES HAVE BEEN PURGED AND WHEN WATER PARAMETERS VARY BY LESS THAN APPROXIMATELY 10%.
(2) PAL INORGANICS: ICP METALS (SS10); AS (SD22); SE (SD21); TL (SD09); SB (SD28); PB (SD20); HG (SB01).
H2O QUALITY: PO4 (TF27); TKN (TF26); NIT (TF22); CL/SO4 (TT10); TSS (160.2); ALK (301.0); HARDNESS.
ALL PARAMETERS COLLECTED AS TOTALS, IE: NON-FILTERED

SAMPLED BY: ____
RECEIVED BY: ____

PROJECT: USAEC - FT. DEVENS

SITE ID: G3M-92-07X

LOCATION ACTIVITY: START 10:58 (10/1 2:42) END 11:02

FIELD SAMPLE NUMBER: MX63 07X3

SITE TYPE: WELL

JOB NUMBER: 9144-08

STUDY AREA/AOC: AOC 57

SAMPLING DATE: 9/30/96

FILE TYPE: CGW

WEATHER: Sunny High 60's

WATER LEVEL / WELL DATA

WELL DEPTH: 34.29 FT ☐ MEASURED ☐ HISTORICAL

WATER DEPTH: 25.92 FT

HEIGHT OF WATER COLUMN: 8.37 FT

☐ 1.68 gal/ft (4") ☐ ____ gal/ft

NA GAL/VOL

9+ TOTAL GAL PURGED

☐ TOP OF WELL ☒ TOP OF CASING PVC

PROTECTIVE CASING STICK-UP (FROM GROUND): ____ FT

PROTECTIVE CASING/WELL DIFF.: ____ FT

WELL INTEGRITY:

| | YES | NO | N/A |
|---|---|---|---|
| PROT. CASING SECURE | ☒ | ☐ | ☐ |
| CONCRETE COLLAR INTACT | ☒ | ☐ | ☐ |
| WELL LOCKED | ☒ | ☐ | ☐ |
| PVC WELL CAP | ☒ | ☐ | ☐ |

WELL DIAMETER: ☐ 2 INCH ☒ 4 INCH ☐ ____ INCH

PID READINGS: AMBIENT AIR 0 PPM (345 348) WELL MOUTH 0 PPM (25.96 25.96 25.97 25.97)

| PURGE DATA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Time ~~VOLUME #~~ | 325 | ~~330~~ | ~~335~~ | 351 | 354 | | | |
| GALLONS | ~~0~~ 1 | 3 | 4 | 4.5 | 5 | | | |
| PUMPING RATE (GPM) | 300 ml/m | 300 ml/m | 500 ml/m | 500 ml/m | | | | |
| TEMP, DEG C | 15.3 | 14.9 | 14.7 | 14.6 | 14.4 | | | |
| pH, UNITS ☐ pH PAPER | 6.04 | 6.03 | 6.01 | 6.01 | 6.01 | | | |
| SPECIFIC CONDUCTIVITY, umhos/cm | .308 | .338 | .343 | .349 | .350 | | | |
| TURBIDITY, ntu | 0 | 0 | 0 | 0 | 0 | | | |

REDOX (@ COMPLETION OF PURGING): 110 175 mv 195 205 207

D.O 6.07 7.09 7.22 7.26 7.30

SAMPLE OBSERVATIONS: ☒ CLEAR ☐ CLOUDY ☐ COLORED ____ ☐ TURBID ☐ ODOR ☐ OTHER (SEE NOTES)

3:55 (1555) Sample Time

EQUIPMENT DOCUMENTATION

| PURGING | SAMPLING | |
|---|---|---|
| ☐ | ☒ | PERISTALTIC PUMP |
| ☒ | ☐ | DEDICATED SUBMERSIBLE PUMP |
| ☐ | ☐ | BAILER |
| ☒ | ☒ | PVC/SILICON TUBING |
| | ☒ | IN-LINE/DISPOSABLE FILTER 0.45 um |
| ☐ | ☐ | OTHER ____ |

EQUIPMENT ID: ISCO # ____ ☐ 2" ☐ 4" # ____

DECON FLUIDS USED: ☒ POTABLE WATER ☐ LIQUINOX ☐ STEAM CLEANING ☐ ____

WATER LEVEL EQUIP. USED: ☒ ELECTRIC COND. PROBE ☐ PRESSURE TRANSDUCER ☐ ____

NUMBER OF FILTERS USED: 1

| ANALYTICAL PARAMETERS | METHOD NUMBER | FRACTION CODE | PRESERVATION METHOD | VOLUME REQUIRED | SAMPLE COLLECTED | SAMPLE BOTTLE ID NUMBERS | BOTTLE |
|---|---|---|---|---|---|---|---|
| | | | | | | REFER TO SAMP MGMNT SYSTEM | |
| ☐ VOC | UM20 | VP | HCL, 4 DEG C | (4) 60 ML | ☐ | | |
| ☐ SVOC | UM18 | MS | 4 DEG C | (2) 1 L AG | ☐ | | |
| ☐ PEST/PCBs | UH02 | EC | 4 DEG C | (3) 1 L AG | ☐ | | |
| | UH13 | | | | | | |
| ☐ PAL INORGANICS (see notes) | | N | HNO3 TO pH<2 | 1 L P-CUBE | ☐ | | |
| ☐ LEAD ONLY | SD20 | N | HNO3 TO pH<2 | | ☐ | | |
| ☐ EXPLOSIVES | UW19 | LC | 4 DEG C | (3) 1 L AG | ☐ | | |
| | UW32 | | | | | | |
| ☐ TPHC | 418.1 | O | H2SO4 TO pH<2 | 1 L AG | ☐ | | |
| ☐ TOC | 415.1 | O | H2SO4 TO pH<2 | 1 L AG | ☐ | | |
| ☐ ANIONS | TF22 | S | H2SO4 TO pH<2 | 1 L P-CUBE | ☐ | | |
| | TT10 | C | 4 DEG C | 1 L P-CUBE | ☐ | | |
| | 310.1 | N | HNO3 TO pH<2 | 1 L P-CUBE | ☐ | | |
| ☐ TSS ONLY | 160.2 | C | 4 DEG C | 1 L P-CUBE | ☐ | | |
| ☐ H2O QUALITY (see notes) | | S | H2SO4 TO pH<2 | 1 L P-CUBE | ☐ | | |
| | | C | 4 DEG C | 1 L P-CUBE | ☐ | | |
| | | N | HNO3 TO pH<2 | 1 L P-CUBE | ☐ | | |
| ☐ COLIFORM | 303, 909 | | 4 DEG C | (1) 4 OZ STERILE | ☐ | | |

NOTES (1) PURGING COMPLETE WHEN 5 WELL VOLUMES HAVE BEEN PURGED AND WHEN WATER PARAMETERS VARY BY LESS THAN APPROXIMATELY 10%.
(2) PAL INORGANICS: ICP METALS (SS10); AS (SD22); SE (SD21); TL (SD09); SB (SD28); PB (SD20); HG (SB01).
H2O QUALITY: PO4 (TF27); TKN (TF26); NIT (TF22); CL/SO4 (TT10); TSS (160.2); ALK (301.0); HARDNESS.
ALL PARAMETERS COLLECTED AS TOTALS, IE: NON-FILTERED

SAMPLED BY: M Rooney

RECEIVED BY: R. Rustad

# SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Site: AOC 57 Area 2
Project Number: 09144.08
Date: 5/19/98
Site Identification: 57S-98-01X
Time: Start: 0855 End: 0915
Signature of Sampler: Nancy E. Roka

**SOIL SAMPLE**

Field Sample No. See below

Depth of Sample See below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID _____

Equipment Used For Collection:
[✓] Hand Auger
[✓] S.S. Split Spoon (deep only) (MP)
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl (deep only)

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Observations:
[ ] Odor _____
[ ] Color _____
[ ] _____

Soil Type:
[ ] Clay
[ ] Sand
[✓] Organic
[ ] Gravel
[✓] Silt

Sample Location Sketch:
[ ] Yes
[✓] No See map

⊻ at ~1 ft bgs

**SAMPLES COLLECTED**

| Analysis | Method Number | Fraction Code | Volume Required | Preservation Method | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | LM19 | SV | (2) 2OZ AG | 4 DEG C | [✓] | ___/___/___/___ |
| [✓] SVOC | LM18 | SS | (1) 16 OZ AG | | [✓] | ___/___/___/___ |
| [✓] Pest/PCB | LH16 | SS | | | [✓] | ___/___/___/___ |
| | LH10 | | | | [ ] | ___/___/___/___ |
| [✓] PAL Inorganics | See Below | SS | | | [✓] | ___/___/___/___ |
| [ ] Explosives | LW12 | SS | | | [ ] | ___/___/___/___ |
| [✓] TPHC | 418.1 | SS | | | [✓] | ___/___/___/___ |
| [ ] Lead Only | JD17 | SS | | | [ ] | ___/___/___/___ |
| [✓] TOC (MP) | 415.1 | SS | | | [ ] | ___/___/___/___ |
| [ ] TCLP | 1311 | SS | | 4 DEG C + methanol | [✓] | ___/___/___/___ |
| [✓] EPH/VPH | | | (1) 16 OZ AG | | | |

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

**NOTES/SKETCH**

| | Samp ID | Time | Depth | PID | Descrip. |
|---|---|---|---|---|---|
| Field Screening Samples | SF570100 | 0900 | 0-6" bgs | 1.0 (momentary) | silt + org, dk |
| | SF570101 | 0915 (MP) | 1.5' bgs | 0.3 | sand, silt, + org med brown wet |

Collected confirmatory sample at SF570101 (SX570101)

HLADVISK1 = QST lab ID

**FIGURE 4-7**
**SURFACE SOIL SAMPLE DATA RECORD**
**PROJECT OPERATIONS PLAN**
**FORT DEVENS, MASSACHUSETTS**
**ABB Environmental Services, Inc.**

9505005S L 2

# SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Site: AOC 57 Area 2
Project Number: 09144.08
Date: 5/19/98
Site Identification: 57S-98-02X
Time: Start: 1035 End: 1050
Signature of Sampler: Nancy E. Rofka

**SOIL SAMPLE**

Field Sample No. see below

Depth of Sample see below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID _____

Equipment Used For Collection:
[✓] Hand Auger (deep only)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl (~~deep~~ shallow only) (MC)

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Observations:
[ ] Odor _____
[ ] Color _____
[ ] _____

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Sample Location Sketch:
[ ] Yes
[✓] No see map

$\underline{\nabla}$ = ~1 ft bgs (+ rising ?)

**SAMPLES COLLECTED**

| Analysis | Method Number | Fraction Code | Volume Required | Preservation Method | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | LM19 | SV | (2) 2OZ AG | 4 DEG C | [✓] | ___/___/___/___ |
| [✓] SVOC | LM18 | SS | (1) 16 OZ AG | | [✓] | ___/___/___/___ |
| [✓] Pest/PCB | LH16 | SS | | | [✓] | ___/___/___/___ |
| | LH10 | | | | [ ] | ___/___/___/___ |
| [✓] PAL Inorganics | See Below | SS | | | [✓] | ___/___/___/___ |
| [ ] Explosives | LW12 | SS | | | [ ] | ___/___/___/___ |
| [✓] TPHC | 418.1 | SS | | | [✓] | ___/___/___/___ |
| [ ] Lead Only | JD17 | SS | | | [ ] | ___/___/___/___ |
| [ ] TOC | 415.1 | SS | | | [ ] | ___/___/___/___ |
| [✓] TCLP | 1311 | SS | | 4 DEG C/methanol | [✓] | ___/___/___/___ |
| [✓] EPH/VPH | | | (1) 16 OZ AG | | ~~[✓]~~ (MC) | |

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

**NOTES/SKETCH**

| Samp ID | Time | (bgs) Depth | (ppm) PID | Obs. |
|---|---|---|---|---|
| SF570200 | 1040 | 0-0.5' | 8.5 (briefly) | sandy silt, org., med brown |
| SF570201 | 1045 | 1-~~1.5~~ 2 | 0.3 | 1-1.5 " " , high org. 1.5-2 light br. sand & silt |

Off-site sample collected ~~for~~ at (MC) 0-0.5' bgs
(QST lab # HLADV15X2)
SX570200

**FIGURE 4-7**
**SURFACE SOIL SAMPLE DATA RECORD**
**PROJECT OPERATIONS PLAN**
**FORT DEVENS, MASSACHUSETTS**
**ABB Environmental Services, Inc.**

9505005S L 2

# SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Site: AOC 57 Area 2
Project Number: 09144.08
Date: 5/19/98
Site Identification: 575-98-03X
Time: Start: 1115 End: 1140
Signature of Sampler: Nancy E. Rofea

**SOIL SAMPLE**

Field Sample No. See below

Depth of Sample See below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID _____

Equipment Used For Collection:
[✓] Hand Auger (deep only)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS Bowl

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Location Sketch:
[ ] Yes
[✓] No See map

Sample Observations:
[✓] Odor petroleum
[ ] Color _____
[ ] _____

$\underline{\nabla}$ = ~1.5' bgs

**SAMPLES COLLECTED**

| Analysis | Method Number | Fraction Code | Volume Required | Preservation Method | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | LM19 | SV | (2) 2OZ AG | 4 DEG C | [✓] | ___/___/___/___ |
| [✓] SVOC | LM18 | SS | (1) 16 OZ AG | | [✓] | ___/___/___/___ |
| [✓] Pest/PCB | LH16 | SS | | | [✓] | ___/___/___/___ |
| | LH10 | | | | [ ] | ___/___/___/___ |
| [✓] PAL Inorganics | See Below | SS | | | [✓] | ___/___/___/___ |
| [ ] Explosives | LW12 | SS | | | [ ] | ___/___/___/___ |
| [✓] TPHC | 418.1 | SS | | | [✓] | ___/___/___/___ |
| [ ] Lead Only | JD17 | SS | | | [ ] | ___/___/___/___ |
| [ ] TOC | 415.1 | SS | | | [ ] | ___/___/___/___ |
| [ ] TCLP | 1311 | SS | | 4 DEG C/meoH | [✓] | ___/___/___/___ |
| [✓] ΣPH/VPH | | | (1) 16 OZ AG | | | |

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

**NOTES/SKETCH**

| Samp ID | Time | (ft bgs) Depth | (ppm) PID | Obs. |
|---|---|---|---|---|
| SF570300 | 1120 | 0-0.5' | 0.3 | sandy silt, little org., red brown |
| SF570302 | 1130 | 2-2.5' | 1.3 | drk brown sandy silt w/ org (woody) |

Off-site sample (SX570302) collected from 2-2.5 ft. bgs (petr. odor).
QST lab # = HLADV15*3

FIGURE 4-7
SURFACE SOIL SAMPLE DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

# SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Project Number: 09144.08
Site Identification: NR 57S-98-04X
Time: Start: NR ~~1200~~ 1150 End: 1200

Site: AOC 57 Area 2
Date: 5/19/98
Signature of Sampler: Nancy E. Rofka

**SOIL SAMPLE**

Field Sample No. see below

Depth of Sample see below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID _____

$\underline{V}$ ≈ 1 ft. bgs

Equipment Used For Collection:
[✓] Hand Auger deep only
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl (deep only)

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Observations:
[ ] Odor _____
[ ] Color _____
[ ] _____

Soil Type:
[ ] Clay
[✓] Sand
[ ] Organic
[ ] Gravel

Sample Location Sketch:
[ ] Yes
[✓] No see map

**SAMPLES COLLECTED**

| Analysis | Method Number | Fraction Code | Volume Required | Preservation Method | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | LM19 | SV | (2) 2OZ AG | 4 DEG C | [✓] | ___/___/___/___ |
| [✓] SVOC | LM18 | SS | (1) 16 OZ AG | | [✓] | ___/___/___/___ |
| [✓] Pest/PCB | LH16 | SS | | | [✓] | ___/___/___/___ |
| | LH10 | | | | [ ] | ___/___/___/___ |
| [✓] PAL Inorganics | See Below | SS | | | [✓] | ___/___/___/___ |
| [ ] Explosives | LW12 | SS | | | [ ] | ___/___/___/___ |
| [✓] TPHC | 418.1 | SS | | | [✓] | ___/___/___/___ |
| [ ] Lead Only | JD17 | SS | | | [ ] | ___/___/___/___ |
| [ ] TOC | 415.1 | SS | | | [ ] | ___/___/___/___ |
| [ ] TCLP | 1311 | SS | | 4 DEG C / MeOH | [✓] | ___/___/___/___ |
| [✓] EPH/VPH | | | (1) 16 OZ AG | | | |

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

**NOTES/SKETCH**

| Samp ID | Time | Depth (ft. bgs) | (ppm) PID | Obs. |
|---|---|---|---|---|
| SF570~~3~~4 (NR) 00 | 1155 | 0 ~~6~~ (NR) 0.5 | 0.3 | poorly gr. sand |
| SF570401 | 1200 | 1-1.5 | 0.3 | poorly gr. sand |

Off-site sample (SX570401) collected from 1-1.5 ft bgs.
QST lab # HLADV15 * 4

**FIGURE 4-7**
**SURFACE SOIL SAMPLE DATA RECORD**
**PROJECT OPERATIONS PLAN**
**FORT DEVENS, MASSACHUSETTS**
**ABB Environmental Services, Inc.**

# SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Project Number: 09144.08
Site Identification: (MR) ~~SX~~ 57S-98-05X
Time: Start: 1355 End: 1410

Site: AOC 57 Area 2
Date: ~~4~~ (MR) 5/19/98
Signature of Sampler: Nancy E. Rofka

**SOIL SAMPLE**

Field Sample No. See below

Depth of Sample See below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID _____

Equipment Used For Collection:
[✓] Hand Auger (deep only)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Location Sketch:
[ ] Yes
[✓] No see map

Sample Observations:
[ ] Odor _____
[ ] Color _____
[ ] _____

$\underline{V}$ = 3.5-4 (moist)

**SAMPLES COLLECTED**

| Analysis | Method Number | Fraction Code | Volume Required | Preservation Method | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | LM19 | SV | (2) 2OZ AG | 4 DEG C | [✓] | / / / |
| [✓] SVOC | LM18 | SS | (1) 16 OZ AG | | [✓] | / / / |
| [✓] Pest/PCB | LH16 | SS | ↓ | | [✓] | / / / |
| | LH10 | | | | [ ] | / / / |
| [✓] PAL Inorganics | See Below | SS | | | [✓] | / / / |
| [ ] Explosives | LW12 | SS | | | [ ] | / / / |
| [✓] TPHC | 418.1 | SS | | | [✓] | / / / |
| [ ] Lead Only | JD17 | SS | | | [ ] | / / / |
| [ ] TOC | 415.1 | SS | | | [ ] | / / / |
| [ ] TCLP | 1311 | SS | | 4 DEG C/MeOH | [✓] | / / / |
| [✓] EPH/VPH | | | (1) 16 OZ AG | | | |

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

**NOTES/SKETCH**

| Samp ID | Time | Depth (ft. bgs) | PID (ppm) | Obs. |
|---|---|---|---|---|
| (MR) S~~X~~F570500 | 1355 | 0-0.5 | — | well ~~graded~~ ~~sorted~~ STET sand |
| S~~X~~570503 (MR) F | 1410 | 3-4.5 | 0.3 | well graded sand (fine to course) rocky fill from 0.5-3 ft bgs) |

Off-site sample (SX570503) (MR) collected ~~for~~ from 2-2.5 ft bgs.

QST lab # = HLADV15 * 5

**FIGURE 4-7**
**SURFACE SOIL SAMPLE DATA RECORD**
**PROJECT OPERATIONS PLAN**
**FORT DEVENS, MASSACHUSETTS**
ABB Environmental Services, Inc.

9505005S L 2

# SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Site: AOC 57 Area 2
Project Number: 09144.08
Date: 5/19/98
Site Identification: 57S-98-06X
Time: Start: 0950 End: 1010
Signature of Sampler: Nancy E Rofe

**SOIL SAMPLE**

Field Sample No. See below

Depth of Sample See below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID _____

Equipment Used For Collection:
[✓] Hand Auger (deep only)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl (deep only)

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Location Sketch:
[ ] Yes
[✓] No see map

Sample Observations:
[ ] Odor _____
[ ] Color _____
[ ] _____

✓ ~ 6" bgs

**SAMPLES COLLECTED**

| Analysis | Method Number | Fraction Code | Volume Required | Preservation Method | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | LM19 | SV | (2) 2OZ AG | 4 DEG C | [✓] | ___/___/___/___ |
| [✓] SVOC | LM18 | SS | (1) 16 OZ AG | | [✓] | ___/___/___/___ |
| [✓] Pest/PCB | LH16 | SS | | | [✓] | ___/___/___/___ |
| | LH10 | | | | [ ] | ___/___/___/___ |
| [✓] PAL Inorganics | See Below | SS | | | [✓] | ___/___/___/___ |
| [ ] Explosives | LW12 | SS | | | [ ] | ___/___/___/___ |
| [✓] TPHC | 418.1 | SS | | | [✓] | ___/___/___/___ |
| [ ] Lead Only | JD17 | SS | | | [ ] | ___/___/___/___ |
| [ ] TOC | 415.1 | SS | | | [ ] | ___/___/___/___ |
| [ ] TCLP | 1311 | SS | | 4 DEG C + methanol | [✓] | ___/___/___/___ |
| [✓] EPH/VPH | | | (1) 16 OZ AG | | | |

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

**NOTES/SKETCH**

| Samp ID | Time | Depth | PID | Obs. |
|---|---|---|---|---|
| SF570600 | 0955 | 0-6" | 1 ppm | Org. roots + some slt |
| SF570601 | 1010 | 1-1.5' | 1.7 ppm (7.5 ppm momentarily) | sand, silt, + org. wet |
| Hole | | | ~20 ppm | |

Collected off-site sample from 1-1.5' bgs
(QST lab # HLADVIS18)
SX570601

FIGURE 4-7
SURFACE SOIL SAMPLE DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

# SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Site: AOC 57 Area 2
Project Number: 09144.08
Date: 5/19/98
Site Identification: 57S-98-07X
Time: Start: 1425 End: 1500
Signature of Sampler: Nancy E. Roka

**SOIL SAMPLE**

Field Sample No. See below

Depth of Sample See below

Field GC Data: [✓] Field Duplicate Collected
Duplicate ID SD570700
(QST lab. # HLADV1S*27)

✓ = 1 ft. bgs

Equipment Used For Collection:
[✓] Hand Auger (deep only)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl (shallow + deep)

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Observations:
[ ] Odor
[ ] Color
[ ]

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Sample Location Sketch:
[ ] Yes
[✓] No see map

**SAMPLES COLLECTED**

| Analysis | Method Number | Fraction Code | Volume Required | Preservation Method | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | LM19 | SV | (2) 2OZ AG | 4 DEG C | [✓] | ___/___/___/___ |
| [✓] SVOC | LM18 | SS | (1) 16 OZ AG | | [✓] | ___/___/___/___ |
| [✓] Pest/PCB | LH16 | SS | | | [✓] | ___/___/___/___ |
| | LH10 | | | | [ ] | ___/___/___/___ |
| [✓] PAL Inorganics | See Below | SS | | | [✓] | ___/___/___/___ |
| [ ] Explosives | LW12 | SS | | | [ ] | ___/___/___/___ |
| [✓] TPHC | 418.1 | SS | | | [✓] | ___/___/___/___ |
| [ ] Lead Only | JD17 | SS | | | [ ] | ___/___/___/___ |
| [ ] TOC | 415.1 | SS | | | [ ] | ___/___/___/___ |
| [ ] TCLP | 1311 | SS | | 4 DEG C/MeOH | [✓] | ___/___/___/___ |
| [✓] EPH/VPH | | | (1) 16 OZ AG | | | |

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

**NOTES/SKETCH**

| Samp ID | Time | Depth (ft. bgs) | PID (ppm) | Obs. |
|---|---|---|---|---|
| (MS) SX570700 | 1430 | 0-0.5 | 7.5 | dark br. org. and silt |
| (MSD) SX570701 | 1500 | 1-1.5 | ~28 (Hot + Simmy) | organic silt, black wet |

- Off-site sample collected at SX570700 (0-0.5 ft bgs).
QST lab # = HLADV1S*7
- Off-site sample collected at SX570701 (1-1.5 ft bgs)
QST lab # = HLADV1S*8

FIGURE 4-7
SURFACE SOIL SAMPLE DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

9505005S L 2

# SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Site: AOC 57 Area 2
Project Number: 09144.08
Date: 5/19/98
Site Identification: (MR) ~~SX570800~~ 575-98-08X
Time: Start: 1545 End: _____
Signature of Sampler: Nancy E. Rofa

**SOIL SAMPLE**

Field Sample No. See below

Depth of Sample See below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID _____

Equipment Used For Collection:
[✓] Hand Auger (deep only)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS trowel (shallow only)

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Location Sketch:
[ ] Yes
[✓] No see map

Sample Observations:
[ ] Odor _____
[ ] Color _____
[ ] _____

$\underline{\nabla}$ = ~ 0.5 ft bgs

**SAMPLES COLLECTED**

| Analysis | Method Number | Fraction Code | Volume Required | Preservation Method | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | LM19 | SV | (2) 2OZ AG | 4 DEG C | [✓] | ___/___/___/___ |
| [✓] SVOC | LM18 | SS | (1) 16 OZ AG | | [✓] | ___/___/___/___ |
| [✓] Pest/PCB | LH16 | SS | | | [✓] | ___/___/___/___ |
| | LH10 | | | | [ ] | ___/___/___/___ |
| [✓] PAL Inorganics | See Below | SS | | | [✓] | ___/___/___/___ |
| [ ] Explosives | LW12 | SS | | | [ ] | ___/___/___/___ |
| [✓] TPHC | 418.1 | SS | | | [✓] | ___/___/___/___ |
| [ ] Lead Only | JD17 | SS | | | [ ] | ___/___/___/___ |
| [ ] TOC | 415.1 | SS | | | [ ] | ___/___/___/___ |
| [ ] TCLP | 1311 | SS | | 4 DEG C/MeOH | [✓] | ___/___/___/___ |
| [✓] EPH/VPH | | | (1) 16 OZ AG | | | |

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

**NOTES/SKETCH**

| Samp ID | Time | Depth (ft. bgs) | PID (ppm) | Obs. |
|---|---|---|---|---|
| (MR) F SX570800 | 1550 | 0-0.5 | 17 | Dk brown org. + silt (moist) |
| SX570801 (MR) F | 1560 | 1-1.5 | 0.8 | same, w/ sand at ~1.5 ft bgs (moist) |

off-site sample collected at SX570800 (0-0.5' bgs).

QST lab # = HLADV15*9

- Dense root mat

**FIGURE 4-7**
**SURFACE SOIL SAMPLE DATA RECORD**
**PROJECT OPERATIONS PLAN**
**FORT DEVENS, MASSACHUSETTS**
**ABB Environmental Services, Inc.**

# SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Site: AOC 57 Area 2
Project Number: 09144.08
Date: 5/19/98
Site Identification: 57S-98-09X
Time: Start: 1600 End: 1625
Signature of Sampler: Nancy F. Rofea

**SOIL SAMPLE**

Field Sample No. see below

Depth of Sample see below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID _____

Equipment Used For Collection:
[✓] Hand Auger (deep only)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl (shallow only)

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Location Sketch:
[ ] Yes
[✓] No see map

Sample Observations:
[ ] Odor _____
[ ] Color _____
[ ] _____

≤ = 1 ft. bgs

**SAMPLES COLLECTED**

| Analysis | Method Number | Fraction Code | Volume Required | Preservation Method | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | LM19 | SV | (2) 2OZ AG | 4 DEG C | [✓] | ___/___/___/___ |
| [✓] SVOC | LM18 | SS | (1) 16 OZ AG | | [✓] | ___/___/___/___ |
| [✓] Pest/PCB | LH16 | SS | | | [✓] | ___/___/___/___ |
| | LH10 | | | | [ ] | ___/___/___/___ |
| [✓] PAL Inorganics | See Below | SS | | | [✓] | ___/___/___/___ |
| [ ] Explosives | LW12 | SS | | | [ ] | ___/___/___/___ |
| [✓] TPHC | 418.1 | SS | | | [✓] | ___/___/___/___ |
| [ ] Lead Only | JD17 | SS | | | [ ] | ___/___/___/___ |
| [ ] TOC | 415.1 | SS | | | [ ] | ___/___/___/___ |
| [ ] TCLP | 1311 | SS | | 4 DEG C/MeOH | [✓] | ___/___/___/___ |
| [✓] EPH/VPH | | | (1) 16 OZ AG | | | |

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

**NOTES/SKETCH**

| Samp ID | Time | Depth (ft. bgs) | PID (ppm) | Obs |
|---|---|---|---|---|
| (MR) SX570900 F | 1605 | 0-0.5 | 9.4 | |
| SX570901 (MR) F | 1620 | 1-2 | 0.8 | Black org. indicat by brown f sand |

Off-site sample collected at SX570900 (0-0.5 ft bgs)

QST lab # = HLADV1S*10

Dense root mat (~4" thick) overlying pockets of $H_2O$ (i.e., spongy stepping)

**FIGURE 4-7**
**SURFACE SOIL SAMPLE DATA RECORD**
**PROJECT OPERATIONS PLAN**
**FORT DEVENS, MASSACHUSETTS**
**ABB Environmental Services, Inc.**

9505005S L 2

# SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Site: AOC 57 Area 2
Project Number: 09144.08
Date: 5/19/98
Site Identification: 57S-98-10X
Time: Start: 1630 End: 1645
Signature of Sampler: Nancy E. Rofa

**SOIL SAMPLE**

Field Sample No. see below

Depth of Sample See below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID _____

Equipment Used For Collection:
[✓] Hand Auger (deep only)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[ ] _____

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Location Sketch:
[ ] Yes
[✓] No see map

Sample Observations:
[ ] Odor _____
[ ] Color _____
[ ] _____

$\underline{\underline{V}}$ = 0.5 ft bgs

**SAMPLES COLLECTED**

| Analysis | Method Number | Fraction Code | Volume Required | Preservation Method | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | LM19 | SV | (2) 2OZ AG | 4 DEG C | [✓] | |
| [✓] SVOC | LM18 | SS | (1) 16 OZ AG | | [✓] | |
| [✓] Pest/PCB | LH16 | SS | | | [✓] | |
| | LH10 | | | | [ ] | |
| [✓] PAL Inorganics | See Below | SS | | | [✓] | |
| [ ] Explosives | LW12 | SS | | | [ ] | |
| [✓] TPHC | 418.1 | SS | | | [✓] | |
| [ ] Lead Only | JD17 | SS | | | [ ] | |
| [ ] TOC | 415.1 | SS | | | [ ] | |
| [ ] TCLP | 1311 | SS | | 4 DEG C/MeOH | [✓] | |
| [✓] VPH/EPH | | | (1) 16 OZ AG | | | |

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

NR

NR

No off-site samples collected at 57S-98-10X

**NOTES/SKETCH**

| Samp ID | Time | Depth (ft bgs) | PID* (ppm) | Obs. |
|---|---|---|---|---|
| NR S~~X~~F571000 | 1635 | 0-0.5 | 0.3 | Black silt & org. |
| S~~X~~F571001 NR | 1640 | 1-2 | 0.3 | Black silt & org w/ sand at ~1 ft bgs (somewhat gravelly) |

* Dense root mat (~4" thick) overlying pockets of $H_2O$ (i.e., spongy stepping)

* PID malfunctioning (reading 13 ppm NR ~~w/o~~ in ambient air.)

**FIGURE 4-7**
**SURFACE SOIL SAMPLE DATA RECORD**
**PROJECT OPERATIONS PLAN**
**FORT DEVENS, MASSACHUSETTS**
**ABB Environmental Services, Inc.**

9505005S L 2

# SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Site: AOC 57 Area 3
Project Number: 09144.08
Date: 5/20/98
Site Identification: (MZ) 57S-98-11X
Time: Start: 1015 End: 1025
Signature of Sampler: Nancy F. Poko

**SOIL SAMPLE**

Field Sample No. see below

Depth of Sample see below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID _____

Equipment Used For Collection:
[✓] Hand Auger (deep only)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[ ] _____

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Location Sketch:
[ ] Yes
[✓] No see below

Sample Observations:
[ ] Odor _____
[ ] Color _____
[ ] _____

$\underline{V}$ = ~3 ft. bgs
(see note below)

**SAMPLES COLLECTED**

| Analysis | Method Number | Fraction Code | Volume Required | Preservation Method | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | LM19 | SV | (2) 2OZ AG | 4 DEG C | [ ] | ___/___/___/___ |
| [✓] SVOC | LM18 | SS | (1) 16 OZ AG | | [ ] | ___/___/___/___ |
| [✓] Pest/PCB | LH16 | SS | | | [ ] | ___/___/___/___ |
| | LH10 | | | | [ ] | ___/___/___/___ |
| [✓] PAL Inorganics | See Below | SS | | | [ ] | ___/___/___/___ |
| [ ] Explosives | LW12 | SS | | | [ ] | ___/___/___/___ |
| [✓] TPHC | 418.1 | SS | | | [ ] | ___/___/___/___ |
| [ ] Lead Only | JD17 | SS | | | [ ] | ___/___/___/___ |
| [ ] TOC | 415.1 | SS | | | [ ] | ___/___/___/___ |
| [ ] TCLP | 1311 | SS | | 4 DEG C/MeOH | [ ] | ___/___/___/___ |
| [✓] EPH/VPH | | | (1) 16 OZ AG | | | |

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

(MZ) No off-site sample collected

**NOTES/SKETCH**

| Samp ID | Time | Depth (ft bgs) | Obs. |
|---|---|---|---|
| SF571100 | 1020 | 0-0.5 | black, org., sandy silt |
| SF571103 | 1025 | 3-3.5 | sand, wet, poorly graded f-m, light brown |

* PID not working. Judged off-site samp. locations by look, odor, + historical info.

$\underline{V}$ in MW-12 is ~2 ft. bgs (~15' N of 57S-98-11)

No off-site sample

FIGURE 4-7
SURFACE SOIL SAMPLE DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

9505005S L 2

# SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Site: AOC 57 Area 3
Project Number: 09144.08
Date: 5/20/98
Site Identification: 57S-98-12X
Time: Start: 1030 End: 1040
Signature of Sampler: Nancy E. Rofea

**SOIL SAMPLE**

Field Sample No. See below

Depth of Sample See below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID _____

Equipment Used For Collection:
[✓] Hand Auger (deep)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[ ] _____

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Location Sketch:
[ ] Yes
[✓] No see map

Sample Observations:
[ ] Odor _____
[ ] Color _____
[ ] _____

$\underline{\nabla}$ = ~1 ft. bgs

**SAMPLES COLLECTED**

| Analysis | Method Number | Fraction Code | Volume Required | Preservation Method | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [ ] VOC | LM19 | SV | (2) 2OZ AG | 4 DEG C | [ ] | ___/___/___/___ |
| [ ] SVOC | LM18 | SS | (1) 16 OZ AG | | [ ] | ___/___/___/___ |
| [ ] Pest/PCB | LH16 | SS | | | [ ] | ___/___/___/___ |
| | LH10 | | | | [ ] | ___/___/___/___ |
| [ ] PAL Inorganics | See Below | SS | | | [ ] | ___/___/___/___ |
| [ ] Explosives | LW12 | SS | | | [ ] | ___/___/___/___ |
| [ ] TPHC | 418.1 | SS | | | [ ] | ___/___/___/___ |
| [ ] Lead Only | JD17 | SS | | | [ ] | ___/___/___/___ |
| [ ] TOC | 415.1 | SS | | | [ ] | ___/___/___/___ |
| [ ] TCLP | 1311 | SS | (1) 16 OZ AG | 4 DEG C | [ ] | ___/___/___/___ |

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

**NOTES/SKETCH**

| Samp ID | Time | Depth (ft bgs) | Obs. |
|---|---|---|---|
| SF571200 | 1035 | 0-0.5 | black, org. silt - root mat |
| SF571201 | 1040 | 1-1.5 | sand, wet, poorly graded f-m, light brown |

* PID not working - off-site sample loc.s chosen by sight, odor, & historical info.

No off-site sample collected

**FIGURE 4-7**
**SURFACE SOIL SAMPLE DATA RECORD**
**PROJECT OPERATIONS PLAN**
**FORT DEVENS, MASSACHUSETTS**
**ABB Environmental Services, Inc.**

9505005S L 2

# SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Site: AOC 57 Area 3
Project Number: 09144.08
Date: 5/20/98
Site Identification: 57S-98-13X
Time: Start: 1045 End: 1055
Signature of Sampler: Nancy E. Rofa

**SOIL SAMPLE**

Field Sample No. See below

Depth of Sample See below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID _____

Equipment Used For Collection:
[✓] Hand Auger (deep)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl (deep only)

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Location Sketch:
[ ] Yes
[✓] No see map

Sample Observations:
[✓] Odor petroleum
[ ] Color _____
[ ] _____

$\underline{\nabla}$ = ~ 0.5 ft. bgs

**SAMPLES COLLECTED**

| Analysis | Method Number | Fraction Code | Volume Required | Preservation Method | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | LM19 | SV | (2) 2OZ AG | 4 DEG C | [✓] | ___/___/___/___ |
| [✓] SVOC | LM18 | SS | (1) 16 OZ AG | | [✓] | ___/___/___/___ |
| [✓] Pest/PCB | LH16 | SS | | | [✓] | ___/___/___/___ |
| | LH10 | | | | [ ] | ___/___/___/___ |
| [✓] PAL Inorganics | See Below | SS | | | [✓] | ___/___/___/___ |
| [ ] Explosives | LW12 | SS | | | [ ] | ___/___/___/___ |
| [✓] TPHC | 418.1 | SS | | | [✓] | ___/___/___/___ |
| [ ] Lead Only | JD17 | SS | | | [ ] | ___/___/___/___ |
| [ ] TOC | 415.1 | SS | | | [ ] | ___/___/___/___ |
| [ ] TCLP | 1311 | SS | | 4 DEG C/NaOH | [ ] | ___/___/___/___ |
| [✓] VPH/EPH | | | (1) 16 OZ AG | | [✓] | |

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

**NOTES/SKETCH**

| Samp ID | Time | Depth (ft. bgs) | Obs. |
|---|---|---|---|
| SF571300 | 1050 | 0-0.5 | dk br. org. + sandy si moist |
| SF571301 | 1055 | 1-1.5 | brown and reddish orange wet sand + interlayered w/ black silt + peat - petroleum odor |

* PID not working. - off-site sample loc.s chosen by sight, odor, + historical info.
off-site sample collected at SX571301 (1-1.5 ft. bgs)
QST lab # = HLADV1S*11

**FIGURE 4-7**
**SURFACE SOIL SAMPLE DATA RECORD**
**PROJECT OPERATIONS PLAN**
**FORT DEVENS, MASSACHUSETTS**
**ABB Environmental Services, Inc.**

9505005S L 2

# SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Site: AOC 57 Area 3
Project Number: 09144.08
Date: 5/20/98
Site Identification: 575-98-14X
Time: Start: 1110 End: 1120
Signature of Sampler: Nancy E. Popa

**SOIL SAMPLE**

Field Sample No. see below

Depth of Sample See below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID _____

Equipment Used For Collection:
[✓] Hand Auger (deep only)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl (deep only)

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Location Sketch:
[ ] Yes
[✓] No see map

Sample Observations:
[ ] Odor _____
[ ] Color _____
[ ] _____

$\underline{\vee}$ = 1 ft. bgs

**SAMPLES COLLECTED**

| Analysis | Method Number | Fraction Code | Volume Required | Preservation Method | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | LM19 | SV | (2) 2OZ AG | 4 DEG C | [✓] | ___/___/___/___ |
| [✓] SVOC | LM18 | SS | (1) 16 OZ AG | | [✓] | ___/___/___/___ |
| [✓] Pest/PCB | LH16 | SS | | | [✓] | ___/___/___/___ |
| | LH10 | | | | [ ] | ___/___/___/___ |
| [✓] PAL Inorganics | See Below | SS | | | [✓] | ___/___/___/___ |
| [ ] Explosives | LW12 | SS | | | [ ] | ___/___/___/___ |
| [✓] TPHC | 418.1 | SS | | | [✓] | ___/___/___/___ |
| [ ] Lead Only | JD17 | SS | | | [ ] | ___/___/___/___ |
| [ ] TOC | 415.1 | SS | | | [ ] | ___/___/___/___ |
| [ ] TCLP | 1311 | SS | | 4 DEG C/MeOH | [✓] | ___/___/___/___ |
| [✓] EPH/VPH | | | (1) 16 OZ AG | | | |

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

**NOTES/SKETCH**

| Samp ID | Time | Depth (ft. bgs) | Obs. |
|---|---|---|---|
| SF571400 | 1105 | 0-0.5 | ~~org~~ (MR) 0.5-1 ft - orange sand black org. layer on top (0-0.5 ft) |
| SF571401 | 1120 | 1-~~1.5~~ 1.3 (MR) | 2 ft. orangish-grey sand wet - poorly gr. fine |

- No (MR) ~~peat~~ root layer on surface - dense root layer at ~ 6" bgs.

* PID not working - off-site samples chosen by sight, odor, + historical info.

off-site sample collected at SX571401 (1-~~1.5~~ 1.3 ft bgs), including an (MR) MS/MSD

- QST lab # = HLADV1S*12

FIGURE 4-7
SURFACE SOIL SAMPLE DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

9505005S L 2

# SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Site: AOC 37 Area 3
Project Number: 09174.08
Date: 5/20/98
Site Identification: 57S-98-15X
Time: Start: 1140 End: 1150
Signature of Sampler: Nancy E. Rofa

**SOIL SAMPLE**

Field Sample No. See below

Depth of Sample See below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID _____

Equipment Used For Collection:
[✓] Hand Auger (deep only)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl (deep only)

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Location Sketch:
[ ] Yes
[✓] No see map

Sample Observations:
[ ] Odor _____
[ ] Color _____
[ ] _____

$\underline{\nabla}$ = 3 ft. bgs

**SAMPLES COLLECTED**

| Analysis | Method Number | Fraction Code | Volume Required | Preservation Method | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | LM19 | SV | (2) 2OZ AG | 4 DEG C | [✓] | / / / |
| [✓] SVOC | LM18 | SS | (1) 16 OZ AG | | [✓] | / / / |
| [✓] Pest/PCB | LH16 | SS | | | [✓] | / / / |
| | LH10 | | | | [ ] | / / / |
| [✓] PAL Inorganics | See Below | SS | | | [✓] | / / / |
| [ ] Explosives | LW12 | SS | | | [ ] | / / / |
| [✓] TPHC | 418.1 | SS | | | [✓] | / / / |
| [ ] Lead Only | JD17 | SS | | | [ ] | / / / |
| [ ] TOC | 415.1 | SS | | | [ ] | / / / |
| [ ] TCLP | 1311 | SS | | 4 DEG C / MeOH | [✓] | / / / |
| [✓] EPH/VPH | | | (1) 16 OZ AG | | | |

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

**NOTES/SKETCH**

| Samp ID | Time | Depth (ft bgs) | obs |
|---|---|---|---|
| SF571500 | 1145 | 0-0.5 | black org. sandy silt - dense tree root layer at. |
| SF571503 | 1150 | 3-~~3.5~~ 4 (MR) | orange f-m poorly gr. Sand - wet |

* PID not working - off-site samples chosen by sight, odor, + historical info.

Off-site sample collected at SX571503 (3-3.5ft bgs).

QST lab # = HLADV1S*13

**FIGURE 4-7**
**SURFACE SOIL SAMPLE DATA RECORD**
**PROJECT OPERATIONS PLAN**
**FORT DEVENS, MASSACHUSETTS**
**ABB Environmental Services, Inc.**

9505005S L 2

# SURFACE SOIL SAMPLE FIELD DATA RECORD

Project: Devens
Site: AOC 57 Area 3
Project Number: 09144.08
Date: 5/20/98
Site Identification: 575-98-165
Time: Start: 1155 End: 1205
Signature of Sampler: Nancy E. Rolea

**SOIL SAMPLE**

Field Sample No. see below

Depth of Sample See below

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID _____

Equipment Used For Collection:
[✓] Hand Auger (deep only)
[ ] S.S. Split Spoon
[ ] Shovel
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[ ] _____

Soil Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Location Sketch:
[ ] Yes
[✓] No see map

Sample Observations:
[ ] Odor _____
[ ] Color _____
[ ] _____

**SAMPLES COLLECTED**

| Analysis | Method Number | Fraction Code | Volume Required | Preservation Method | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [ ] VOC | LM19 | SV | (2) 2OZ AG | 4 DEG C | [ ] | ___/___/___/___ |
| [ ] SVOC | LM18 | SS | (1) 16 OZ AG | | [ ] | ___/___/___/___ |
| [ ] Pest/PCB | LH16 | SS | | | [ ] | ___/___/___/___ |
| | LH10 | | | | [ ] | ___/___/___/___ |
| [ ] PAL Inorganics | See Below | SS | | | [ ] | ___/___/___/___ |
| [ ] Explosives | LW12 | SS | | | [ ] | ___/___/___/___ |
| [ ] TPHC | 418.1 | SS | | | [ ] | ___/___/___/___ |
| [ ] Lead Only | JD17 | SS | | | [ ] | ___/___/___/___ |
| [ ] TOC | 415.1 | SS | | | [ ] | ___/___/___/___ |
| [ ] TCLP | 1311 | SS | (1) 16 OZ AG | 4 DEG C | [ ] | ___/___/___/___ |

PAL Inorganics: ICP Metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

**NOTES/SKETCH**

| Samp ID | Time | Depth (ft bgs) | Obs. |
|---|---|---|---|
| SF571600 | 1200 | 0-0.5 | - black org. sandy silt (erosional sand at surf.) tree root layer at 0.5 ft bgs |
| SF571602 | 1205 | 2-2.5 | - orange mod. graded sand - wet |

* PID not working - chose off-site samples based on sight, odor, + historical info.

No off-site sample collected

**FIGURE 4-7**
**SURFACE SOIL SAMPLE DATA RECORD**
**PROJECT OPERATIONS PLAN**
**FORT DEVENS, MASSACHUSETTS**
**ABB Environmental Services, Inc.**

9505005S L 2

# SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD

Project: Devens
Site: AOC 57
Project Number: 09144.08
Date: 5/20/98
Site Identification: SBR-98-01X
Time: Start: 0835 End: 0845
Signature of Sampler: _____

## SURFACE WATER INFORMATION

Field Sample No. SBR98 01X Water Depth NA (ft)

Depth of Sample From Top of Water NA (ft) Temperature NA Deg. C.

Spec. Cond. NA µMHOS/CM PpH NA Units

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID _____

Type of Surface Water:
[ ] Stream [ ] River
[ ] Pond/Lake [ ] Seep

Sample Location Sketch: [ ] Yes [ ] No

Equipment Used For Collection:
[ ] None, Grab Into Bottle
[ ] Bomb Sampler
[ ] Pump _____

Velocity Measurements Obtained?
[ ] Yes, See Flow Measurement Data Record _____

## SEDIMENT INFORMATION

Field Sample No. _____

Depth of Sediment Sample _____ (ft)

Field Gc Data: [ ] Field Duplicate Collected
Duplicate Id _____

Equipment Used For Collection:
[ ] Gravity Corer
[ ] S.S. Split Spoon
[ ] Dredge
[ ] Hand Spoon
[ ] Aluminum Parts
[ ] SS Bucket
[ ] _____

Type Of Sample Collected:
[ ] Discrete
[ ] Composite

Sediment Type:
[ ] Clay
[ ] Sand
[ ] Organic
[ ] Gravel

Sample Observations:
[ ] Odor _____
[ ] Color _____
[ ] _____

## SAMPLES COLLECTED

| Analysis | Method Number | Faction Code | Preservation Method | Volume Required | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | UM20 | VP | HCL, 4 DEG C | (4) 40 ML | [ ] | ___/___/___/___ |
| [✓] SVOC | UM18 | MS | 4 DEG C | (2) 1 L AG | [ ] | ___/___/___/___ |
| [✓] Pest/PCB | UH02 | EC | 4 DEG C | (2) 1 L AG | [ ] | ___/___/___/___ |
| | UH13 | | | | | ___/___/___/___ |
| [✓] PAL Inorganics (Specified Below) | Un (Filtered) | N | HNO3 TO pH<2 | 1 L P-CUBE | [ ] | ___/___/___/___ |
| [ ] Lead Only | SD20 | N | HNO3 TO pH<2 | | [ ] | ___/___/___/___ |
| [ ] Explosives | UW19 | LC | 4 DEG C | (3) 1 L AG | [ ] | ___/___/___/___ |
| | UW32 | | | | | ___/___/___/___ |
| [ ] TPHC | 418.1 | O | H2SO4 TO pH<2 | 1 L AG | [ ] | ___/___/___/___ |
| [ ] TOC | 415.1 | O | H2SO4 TO pH<2 | 1 L P-CUBE | [ ] | ___/___/___/___ |
| [ ] Anions | TF22 | S | H2SO4 TO pH<2 | 1 L P-CUBE | [ ] | ___/___/___/___ |
| | TT10 | C | 4 DEG C | 1 L P-CUBE | [ ] | ___/___/___/___ |
| | 310.1 | N | HNO3 TO pH<2 | 1 L P-CUBE | [ ] | ___/___/___/___ |
| [ ] TSS Only | 160.2 | C | 4 DEG C | 1 L P-CUBE | [ ] | ___/___/___/___ |
| [ ] H2O Quality (Specified Below) | | S | H2SO4 TO pH<2 | 1 L P-CUBE | [ ] | ___/___/___/___ |
| | | C | 4 DEG C | 1 L P-CUBE | [ ] | ___/___/___/___ |
| | | N | HNO3 TO pH<2 | 1 L P-CUBE | [ ] | ___/___/___/___ |
| [ ] Coliform | 303,909 | | 4 DEG C | (1) 4 OZ Stenie | [ ] | ___/___/___/___ |
| [✓] EPH/VPH | | | HCl/$H_2SO_4$/4 DEG C VPH EPH | | [ ] | ___/___/___/___ |

| Analysis | Method Number | Fraction Code | Preservation Method | Volume Required | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [ ] VOC | LM19 | SV | 4 DEG C | (2) 2OZ AG | [ ] | ___/___/___/___ |
| [ ] SVOC | LM18 | SS | | (1) 16 OZ AG | [ ] | ___/___/___/___ |
| [ ] Pest/PCB | LH16 | SS | | | [ ] | ___/___/___/___ |
| | LH10 | | | | [ ] | ___/___/___/___ |
| [ ] PAL Inorganics | See Below | SS | | | [ ] | ___/___/___/___ |
| [ ] Explosives | LW12 | SS | | | [ ] | ___/___/___/___ |
| [ ] TPHC | 418.1 | SS | | | [ ] | ___/___/___/___ |
| [ ] Lead Only | JD17 | SS | | | [ ] | ___/___/___/___ |
| [ ] TOC | 415.1 | SS | | | [ ] | ___/___/___/___ |
| [ ] TCLP | 1311 | SS | 4 DEG C | (1) 16 OZ AG | [ ] | ___/___/___/___ |

## NOTES

PAL Inorganics: ICP metals (SS10); AS (SS22); SE (SD21); TL (SD09); SB (SD20); HG (SB01).
H2O Quality: PO4 (TF27); TKN (TF26); NIT (TF22); CL/S04 (TT10); TSS (160.2); ALK (301.0); Hardness.
All parameters collected as totals, ie: non Filtered

PAL Inorganics: ICP metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

Rinseate blank to represent decon procedures after sampling ~~in~~ (MR) at Area 2.

Soil ~~sediment~~ (MR)

Equipment: soil auger, SS bowl, SS spoon

(MR) D.I. $H_2O$ Source: $H_2O$ point decon $H_2O$

FIGURE 4-10
SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

9505005S L 3

# FIELD DATA RECORD - GROUNDWATER SAMPLING

| | | | | | |
|---|---|---|---|---|---|
| PROJECT | USAEC / Devens AOC 57 | FIELD SAMPLE NUMBER | MX5702XX | STUDY AREA / AOC | AOC 57 |
| SITE ID | 57P-98-02X | SITE TYPE | WELL | DATE | 5-26-98 |
| ACTIVITY | START 1500 END ~~1430~~ 1730 (RR) | JOB NUMBER | 09144-08 | FILE TYPE | CGW |
| | | | | WEATHER | CLOUDY / 60° |

## WATER LEVEL / WELL DATA

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| MEASURED WELL DEPTH | 4.35 FT (TOR) | HISTORICAL WELL DEPTH | 4.35 FT (TOR) | PROTECTIVE CASING STICKUP (FROM GROUND) (TOC) | 2.05 FT | PROTECTIVE CASING / WELL DIFFERENCE | NA FT |
| DEPTH TO WATER | 3.2 FT (TOR) | SCREEN LENGTH | 2 FT | WELL DIAMETER | 1 IN | WELL MATERIAL | PVC SCH 40 |
| HEIGHT OF WATER COLUMN | 1.15 FT | x ___ GAL/FT (___ INCH WELL) = | GAL/VOL | | | | |
| PID AMBIENT AIR | BKG PPM | PID WELL MOUTH | BKG PPM | TOTAL VOLUME PURGED | GAL | | |

| WELL INTEGRITY: | YES | NO | N/A |
|---|---|---|---|
| CAP | ✓ | | |
| CASING | | | ✓ |
| COLLAR | | | ✓ |
| LOCKED | | | ✓ |

## PURGE DATA

| | | | | | | |
|---|---|---|---|---|---|---|
| PURGE VOLUME (gallons) | 0.25 | 0.75 | 1.5 | | | |
| PURGE RATE (gpm) | | | | | | |
| TEMPERATURE (degreesC) | 16.3 | 14.2 | 14.1 | | | |
| pH (units) | 5.9 | 6.1 | 6.1 | | | |
| ~~TURBIDITY (ntu)~~ D.O. | 5.3 ↓ | 3.2 ↓ | 2.8 ↓ | | | |
| SPEC. COND. (uhmos/cm) | 0.135 | 0.95 | 0.90 | | | |
| TURBIDITY (ntu) | 999 | 438 | 380 | | | |
| REDOX POTENTIAL (+/- mv) | | | | | | |

SAMPLE OBSERVATIONS:

- [ ] CLEAR
- [✓] COLORED GREY
- [ ] CLOUDY
- [✓] TURBID
- [✓] ODOR SWAMPY
- [ ] OTHER (see notes)

## EQUIPMENT DOCUMENTATION

| PURGING | SAMPLING | |
|---|---|---|
| [✓] | [✓] | PERISTALTIC PUMP |
| [ ] | [ ] | SUBMERSIBLE PUMP |
| [ ] | [ ] | BLADDER PUMP |
| [✓] | [✓] | PVC/SILICON TUBING |
| [ ] | [ ] | TEFLON/SILICON TUBING |
| [ ] | [ ] | BAILER |
| [ ] | [✓] | IN LINE FILTER |
| [ ] | [ ] | |

| DECON FLUIDS USED | |
|---|---|
| [ ] | METHANOL |
| [ ] | LIQUINOX |
| [✓] | POTABLE WATER |
| [ ] | DEIONIZED WATER |
| [ ] | STEAM CLEANING |
| [ ] | NITRIC ACID |
| [ ] | |

| WATER LEVEL EQUIPMENT USED | |
|---|---|
| [✓] | ELECTRIC COND. PROBE |
| [ ] | FLOAT ACTIVATED |
| [ ] | KECK INTERFACE PROBE |
| [ ] | |

NUMBER OF FILTERS USED 1

## ANALYTICAL PARAMETERS

| EPA/VPA | | METHOD NUMBER | FRACTION CODE | PRESERVATION METHOD | VOLUME REQUIRED | SAMPLE COLLECTED | SAMPLE BOTTLE ID NUMBERS |
|---|---|---|---|---|---|---|---|
| [✓] | VOC | VMS3-WA | | HCL / 4 DEG. C | 3 X 40 ML | [✓] | / / |
| [ ] | VOC | VMS1-WA | | HCL / 4 DEG. C | 3 X 40 ML | [ ] | / / |
| [✓] | SVOC | SMV1-WA | | 4 DEG. C | 2 X 1 L AG | [✓] | / / |
| [ ] | SVOC | SMV3-WA | | 4 DEG. C | 2 X 1 L AG | [ ] | / / |
| [✓] | PEST / PCBs | PST1-WA | | 4 DEG. C | 2 X 1 L AG | [✓] | / / |
| [ ] | HERBICIDES | HB61-WA | | 4 DEG. C | 2 X 1 L AG | [ ] | / / |
| [✓] | PAL INORGANICS (TOTAL + FILTERED) | (see notes) | | HNO3 to pH <2 | 1 x 1 L P | [✓] | / / |
| [ ] | SULFATE NITRATE/NITRITE | USEPA 300 | | 4 DEG. C | 1 X 50 ML P | [ ] | / / |
| [ ] | SULFIDE | USEPA 376.1 | | NAOH to pH >9 | 1 X 500 ML P | [ ] | / / |
| [ ] | IRON ONLY | ICP1-WA | | HNO3 to pH <2 | 1 x 1 L P-Cube | [ ] | / / |
| [ ] | FERROUS IRON | FIELD METHOD | | -- | -- | [ ] | / / |
| [ ] | TOTAL PHOSPHORUS | USEPA-365.4 | | H2SO4 to pH <2 | 1 X 50 ML P | [ ] | / / |
| [ ] | AMMONIA NIROGEN | USEPA-350.1 | | H2SO4 to pH <2 | 1 X 400 ML P | [ ] | / / |
| [ ] | TOC | USEPA-415.1 | | H2SO4 to pH <2 | 1 X 500 ML AG | [ ] | |
| [ ] | TSS ONLY | USEPA-160.2 | | 4 DEG. C | 1 X 1 L P | [ ] | / / |
| [ ] | METHANE / CARBON DIOXIDE | | | | | [ ] | / / |

## NOTES

(1) PAL INORGANICS: ICP METALS (ICP1-WA AND ICP2-WA) , HG (HGC1-WA)

WELL PURGES DRY AT 1 WELL VOLUME
RECHARGE AT a 1/2 LITRE/MIN OR LESS

~~MD5702XX DUPLICATE COLLECTED~~

~~CAS WILL~~ AS

~~MS/MSD FOR EPA/VPA, PEST/PCB, SVOC~~

~~INORG~~ UNABLE TO COLLECT QA/QC DUE TO SMALL WELL VOLUME AND SLOW RECHARGE

SIGNATURE: [signature]

RECEIVED BY: ___

# FIELD DATA RECORD - GROUNDWATER SAMPLING

| | | | | | |
|---|---|---|---|---|---|
| PROJECT | USAEC / Devens AOC 57 | FIELD SAMPLE NUMBER | MX5703XX | STUDY AREA / AOC | AOC 57 |
| SITE ID | 57P-98-03X | SITE TYPE | WELL | DATE | 5-20-98 |
| ACTIVITY | START 1745 END 1845 | JOB NUMBER | 9144-08 | FILE TYPE | CGW |
| | | | | WEATHER | CLEAR 70° |

## WATER LEVEL / WELL DATA

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| MEASURED WELL DEPTH | 6.8 FT (TOR) | HISTORICAL WELL DEPTH | ~~6.8~~ 7.5 (AV) FT (TOR) | PROTECTIVE CASING STICKUP (FROM GROUND) | 2.0 FT | PROTECTIVE CASING / WELL DIFFERENCE | NA FT |
| DEPTH TO WATER | 2.45 FT (TOR) | SCREEN LENGTH | 3.0 FT | WELL DIAMETER | 1 IN | WELL MATERIAL | PVC |
| HEIGHT OF WATER COLUMN | 4.4 FT | x ___ GAL/FT (___ INCH WELL) = | GAL/VOL | | | | |
| PID AMBIENT AIR | BKG PPM | PID WELL MOUTH | BKG PPM | TOTAL VOLUME PURGED | GAL | | |

| WELL INTEGRITY: | YES | NO | N/A |
|---|---|---|---|
| CAP | Y | | |
| CASING | | | ✓ |
| COLLAR | | | ✓ |
| LOCKED | | | ✓ |

## PURGE DATA

| | | | | | | |
|---|---|---|---|---|---|---|
| PURGE VOLUME (gallons) | 1 L | 3 L | 5 L | | | |
| PURGE RATE (gpm) | 0.25 L/m | 250 ml/min | | | | |
| TEMPERATURE (degreesC) | 14.7 | 14.2 | 14.1 | | | |
| pH (units) | 6.12 | 6.6 | 6.6 | | | |
| ~~TURBIDITY (ntu)~~ D.O. | 1.75 ↓ | 6.1 ↓ | 5.9 | | | |
| SPEC. COND. (uhmos/cm) | 0.91 | .096 | 0.09 | | | |
| TURBIDITY (ntu) | 999 | 4 | 4 | | | |
| REDOX POTENTIAL (+/- mv) | | | | | | |

SAMPLE OBSERVATIONS:

- [ ] CLEAR
- [ ] COLORED _____
- [ ] CLOUDY _____
- [✓] TURBID CLEARING
- [ ] ODOR _____
- [ ] OTHER (see notes)

## EQUIPMENT DOCUMENTATION

| PURGING | SAMPLING | | DECON FLUIDS USED | | WATER LEVEL EQUIPMENT USED | |
|---|---|---|---|---|---|---|
| ✓ | ✓ | PERISTALTIC PUMP | | METHANOL | ✓ | ELECTRIC COND. PROBE |
| | | SUBMERSIBLE PUMP | | LIQUINOX | | FLOAT ACTIVATED |
| | | BLADDER PUMP | ✓ | POTABLE WATER | | KECK INTERFACE PROBE |
| ✓ | ✓ | PVC/SILICON TUBING | | DEIONIZED WATER | | |
| | | TEFLON/SILICON TUBING | | STEAM CLEANING | | |
| | | BAILER | | NITRIC ACID | | |
| | ✓ | IN LINE FILTER | | | | |

NUMBER OF FILTERS USED _____

## ANALYTICAL PARAMETERS

| EPH/VPH | METHOD NUMBER | FRACTION CODE | PRESERVATION METHOD | VOLUME REQUIRED | SAMPLE COLLECTED | SAMPLE BOTTLE ID NUMBERS |
|---|---|---|---|---|---|---|
| ✓ VOC | VMS3-WA | | HCL / 4 DEG. C | 3 X 40 ML | | / / |
| VOC | VMS1-WA | | HCL / 4 DEG. C | 3 X 40 ML | | / / |
| ✓ SVOC | SMV1-WA | | 4 DEG. C | 2 X 1 L AG | | / / |
| SVOC | SMV3-WA | | 4 DEG. C | 2 X 1 L AG | | / / |
| ✓ PEST / PCBs | PST1-WA | | 4 DEG. C | 2 X 1 L AG | | / / |
| HERBICIDES | HB61-WA | | 4 DEG. C | 2 X 1 L AG | | / / |
| ✓ PAL INORGANICS | (see notes) | | HNO3 to pH <2 | 1 x 1 L P | | / / |
| SULFATE NITRATE/NITRITE | USEPA 300 | | 4 DEG. C | 1 X 50 ML P | | / / |
| SULFIDE | USEPA 376.1 | | NAOH to pH >9 | 1 X 500 ML P | | / / |
| IRON ONLY | ICP1-WA | | HNO3 to pH <2 | 1 x 1 L P-Cube | | / / |
| FERROUS IRON | FIELD METHOD | | -- | -- | | / / |
| TOTAL PHOSPHORUS | USEPA-365.4 | | H2SO4 to pH <2 | 1 X 50 ML P | | / / |
| AMMONIA NIROGEN | USEPA-350.1 | | H2SO4 to pH <2 | 1 X 400 ML P | | / / |
| TOC | USEPA-415.1 | | H2SO4 to pH <2 | 1 X 500 ML AG | | |
| TSS ONLY | USEPA-160.2 | | 4 DEG. C | 1 X 1 L P | | / / |
| METHANE / CARBON DIOXIDE | | | | | | / / |

NOTES

(1) PAL INORGANICS: ICP METALS (ICP1-WA AND ICP2-WA) , HG (HGC1-WA)

LOW FLOW SAMPLE COLLECTION FOR ALL SAMPLES

SIGNATURE: _____

RECEIVED BY: _____

# FIELD DATA RECORD - GROUNDWATER SAMPLING

| | | | | | |
|---|---|---|---|---|---|
| PROJECT | USAEC / Devens AOC 57 | FIELD SAMPLE NUMBER | MX5704XX | STUDY AREA / AOC | AOC57 |
| SITE ID | 57P-98-04X | SITE TYPE | WELL | DATE | 5-27-9 |
| ACTIVITY | START 0735 END 0930 | JOB NUMBER | 09144-03 | FILE TYPE | CGW |
| | | | | WEATHER | CLEAR 65° |

## WATER LEVEL / WELL DATA

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| MEASURED WELL DEPTH | 7.5 FT (TOR) | HISTORICAL WELL DEPTH | 7.5 FT (TOR) | PROTECTIVE CASING STICKUP (FROM GROUND) | 2.5 FT | PROTECTIVE CASING / WELL DIFFERENCE | NA FT |
| DEPTH TO WATER | 2.95 FT (TOR) | SCREEN LENGTH | 3 FT | WELL DIAMETER | IN | WELL MATERIAL | PVC |
| HEIGHT OF WATER COLUMN | 4.55 FT | x ___ GAL/FT (___ INCH WELL) = | | GAL/VOL | | | |
| PID AMBIENT AIR | BKG PPM | PID WELL MOUTH | BKG PPM | TOTAL VOLUME PURGED | GAL | | |

| WELL INTEGRITY: | YES | NO | N/A |
|---|---|---|---|
| CAP | ✓ | | |
| CASING | | | ✓ |
| COLLAR | | | ✓ |
| LOCKED | | | ✓ |

## PURGE DATA

| | | | | | | |
|---|---|---|---|---|---|---|
| PURGE VOLUME (gallons) | 2 L | 6 L | 8 L | | | |
| PURGE RATE (gpm) | 500 ml/min | 500 ml/min | 500 ml/min | | | |
| TEMPERATURE (degreesC) | 12.0 | 11.0 | 10.9 | | | |
| pH (units) | 6.0 | 6.10 | 6.12 | | | |
| TURBIDITY (ntu) | [illegible] | 25 | 16 | | | |
| SPEC. COND. (uhmos/cm) | 0.1[illegible] | 0.092 | 0.088 | | | |
| ~~TURBIDITY (ntu)~~ D.O. (mg/L) | 1.6 | 2.5 | 3.5 | | | |
| REDOX POTENTIAL (+/- mv) | | | | | | |

SAMPLE OBSERVATIONS:

- [ ] CLEAR
- [ ] COLORED _____
- [ ] CLOUDY _____
- [✓] TURBID CLEARING
- [✓] ODOR SWAMPY
- [ ] OTHER (see notes)

## EQUIPMENT DOCUMENTATION

| PURGING | SAMPLING | |
|---|---|---|
| [✓] | [✓] | PERISTALTIC PUMP |
| [ ] | [ ] | SUBMERSIBLE PUMP |
| [ ] | [ ] | BLADDER PUMP |
| [✓] | [✓] | PVC/SILICON TUBING |
| [ ] | [ ] | TEFLON/SILICON TUBING |
| [ ] | [ ] | BAILER |
| [ ] | [✓] | IN LINE FILTER |
| [ ] | [ ] | _____ |

| DECON FLUIDS USED | |
|---|---|
| [ ] | METHANOL |
| [ ] | LIQUINOX |
| [✓] | POTABLE WATER |
| [ ] | DEIONIZED WATER |
| [ ] | STEAM CLEANING |
| [ ] | NITRIC ACID |
| [ ] | _____ |

| WATER LEVEL EQUIPMENT USED | |
|---|---|
| [✓] | ELECTRIC COND. PROBE |
| [ ] | FLOAT ACTIVATED |
| [ ] | KECK INTERFACE PROBE |
| [ ] | _____ |

NUMBER OF FILTERS USED _____

## ANALYTICAL PARAMETERS

EPH-VPH

| | METHOD NUMBER | FRACTION CODE | PRESERVATION METHOD | VOLUME REQUIRED | SAMPLE COLLECTED | SAMPLE BOTTLE ID NUMBERS |
|---|---|---|---|---|---|---|
| [✓] VOC | VMS3-WA | | HCL / 4 DEG. C | 3 X 40 ML | [ ] | ___/___/___ |
| [ ] VOC | VMS1-WA | | HCL / 4 DEG. C | 3 X 40 ML | [ ] | ___/___/___ |
| [✓] SVOC | SMV1-WA | | 4 DEG. C | 2 X 1 L AG | [ ] | ___/___/___ |
| [ ] SVOC | SMV3-WA | | 4 DEG. C | 2 X 1 L AG | [ ] | ___/___/___ |
| [✓] PEST / PCBs | PST1-WA | | 4 DEG. C | 2 X 1 L AG | [ ] | ___/___/___ |
| [ ] HERBICIDES | HB61-WA | | 4 DEG. C | 2 X 1 L AG | [ ] | ___/___/___ |
| [✓] PAL INORGANICS | (see notes) | | HNO3 to pH <2 | 1 x 1 L P | [ ] | ___/___/___ |
| [ ] SULFATE NITRATE/NITRITE | USEPA 300 | | 4 DEG. C | 1 X 50 ML P | [ ] | ___/___/___ |
| [ ] SULFIDE | USEPA 376.1 | | NAOH to pH >9 | 1 X 500 ML P | [ ] | ___/___/___ |
| [ ] IRON ONLY | ICP1-WA | | HNO3 to pH <2 | 1 x 1 L P-Cube | [ ] | ___/___/___ |
| [ ] FERROUS IRON | FIELD METHOD | | -- | -- | [ ] | ___/___/___ |
| [ ] TOTAL PHOSPHORUS | USEPA-365.4 | | H2SO4 to pH <2 | 1 X 50 ML P | [ ] | ___/___/___ |
| [ ] AMMONIA NIROGEN | USEPA-350.1 | | H2SO4 to pH <2 | 1 X 400 ML P | [ ] | ___/___/___ |
| [ ] TOC | USEPA-415.1 | | H2SO4 to pH <2 | 1 X 500 ML AG | [ ] | |
| [ ] TSS ONLY | USEPA-160.2 | | 4 DEG. C | 1 X 1 L P | [ ] | ___/___/___ |
| [ ] METHANE / CARBON DIOXIDE | | | | | [ ] | ___/___/___ |

## NOTES

(1) PAL INORGANICS: ICP METALS (ICP1-WA AND ICP2-WA) , HG (HGC1-WA)

SIGNATURE: _____

RECEIVED BY: _____

# FIELD DATA RECORD - GROUNDWATER SAMPLING

| | | | | | |
|---|---|---|---|---|---|
| PROJECT | USAEC / Devens AOC 57 | FIELD SAMPLE NUMBER | MX5711XX | STUDY AREA / AOC | AOC 57 |
| SITE ID | 57M-96-11X | SITE TYPE | WELL | DATE | 05.27.98 |
| ACTIVITY | START 0835 END 0900 | JOB NUMBER | 09144-08 | FILE TYPE | CGW |
| | | | | WEATHER | CLEAR 65° |

## WATER LEVEL / WELL DATA

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| MEASURED WELL DEPTH | 15.10 FT (TOR) | HISTORICAL WELL DEPTH | 15.10 FT (TOR) | PROTECTIVE CASING STICKUP (FROM GROUND) | 2.30 FT | PROTECTIVE CASING / WELL DIFFERENCE | 0.60 FT |
| DEPTH TO WATER | 4.05 FT (TOR) | SCREEN LENGTH | 10 FT | WELL DIAMETER | IN | WELL MATERIAL | PVC |
| HEIGHT OF WATER COLUMN | 11.95 FT | x ___ GAL/FT (___ INCH WELL) = | GAL/VOL | | | | |
| PID AMBIENT AIR | BKG PPM | PID WELL MOUTH | BKG PPM | TOTAL VOLUME PURGED | GAL | | |

| WELL INTEGRITY: | YES | NO | N/A |
|---|---|---|---|
| CAP | ✓ | | |
| CASING | | | ✓ |
| COLLAR | | | ✓ |
| LOCKED | | | ✓ |

## PURGE DATA

| | | | | | | |
|---|---|---|---|---|---|---|
| PURGE VOLUME (gallons) | 4L | 12L | 18L | | | |
| PURGE RATE (gpm) | 2L/min | 2L/min | 2L/min | | | |
| TEMPERATURE (degreesC) | 9.3° | 9 | 8.8° | | | |
| pH (units) | 6.18 | 6.23 | 6.21 | | | |
| TURBIDITY (ntu) | 56 | 14 | 9 | | | |
| SPEC. COND. (uhmos/cm) | 0.157 | 0.145 | 0.145 | | | |
| ~~TURBIDITY (ntu)~~ DO (mg/L) | 1.13 | 1.86 | 1.10 | | | |
| REDOX POTENTIAL (+/- mv) | | | | | | |

SAMPLE OBSERVATIONS:

- [ ] CLEAR
- [x] COLORED Lt. orange/clear
- [ ] CLOUDY
- [ ] TURBID
- [x] ODOR SWAMPY
- [ ] OTHER (see notes)

## EQUIPMENT DOCUMENTATION

| PURGING | SAMPLING | |
|---|---|---|
| | ✓ | PERISTALTIC PUMP |
| | | SUBMERSIBLE PUMP |
| | | BLADDER PUMP |
| ✓ | ✓ | PVC/SILICON TUBING |
| | | TEFLON/SILICON TUBING |
| | | BAILER |
| | ✓ | IN LINE FILTER |

DECON FLUIDS USED

- [ ] METHANOL
- [ ] LIQUINOX
- [✓] POTABLE WATER
- [ ] DEIONIZED WATER
- [ ] STEAM CLEANING
- [ ] NITRIC ACID

WATER LEVEL EQUIPMENT USED

- [✓] ELECTRIC COND. PROBE
- [ ] FLOAT ACTIVATED
- [ ] KECK INTERFACE PROBE

NUMBER OF FILTERS USED ___

## ANALYTICAL PARAMETERS

EPA - VPH

| | | METHOD NUMBER | FRACTION CODE | PRESERVATION METHOD | VOLUME REQUIRED | SAMPLE COLLECTED | SAMPLE BOTTLE ID NUMBERS |
|---|---|---|---|---|---|---|---|
| ✓ | VOC | VMS3-WA | | HCL / 4 DEG. C | 3 X 40 ML | | / / |
| | VOC | VMS1-WA | | HCL / 4 DEG. C | 3 X 40 ML | | / / |
| ✓ | SVOC | SMV1-WA | | 4 DEG. C | 2 X 1 L AG | | / / |
| | SVOC | SMV3-WA | | 4 DEG. C | 2 X 1 L AG | | / / |
| ✓ | PEST / PCBs | PST1-WA | | 4 DEG. C | 2 X 1 L AG | | / / |
| | HERBICIDES | HB61-WA | | 4 DEG. C | 2 X 1 L AG | | / / |
| ✓ | PAL INORGANICS | (see notes) | | HNO3 to pH <2 | 1 x 1 L P | | / / |
| | SULFATE NITRATE/NITRITE | USEPA 300 | | 4 DEG. C | 1 X 50 ML P | | / / |
| | SULFIDE | USEPA 376.1 | | NAOH to pH >9 | 1 X 500 ML P | | / / |
| | IRON ONLY | ICP1-WA | | HNO3 to pH <2 | 1 x 1 L P-Cube | | / / |
| | FERROUS IRON | FIELD METHOD | | -- | -- | | / / |
| | TOTAL PHOSPHORUS | USEPA-365.4 | | H2SO4 to pH <2 | 1 X 50 ML P | | / / |
| | AMMONIA NIROGEN | USEPA-350.1 | | H2SO4 to pH <2 | 1 X 400 ML P | | / / |
| | TOC | USEPA-415.1 | | H2SO4 to pH <2 | 1 X 500 ML AG | | |
| | TSS ONLY | USEPA-160.2 | | 4 DEG. C | 1 X 1 L P | | / / |
| | METHANE / CARBON DIOXIDE | | | | | | / / |

NOTES

(1) PAL INORGANICS: ICP METALS (ICP1-WA AND ICP2-WA), HG (HGC1-WA)

DUPLICATE MX5711XX COLLECTED

MS/MSD COLLECTED

SIGNATURE: ___

RECEIVED BY: ___

# SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD

Project: Devens
Site: AOC 57 Area 2
Project Number: 09144.08
Date: 5/21/98
Site Identification: 57W-98-01X/57D-98-01X
Time: Start: 0830 End: 0850
Signature of Sampler: Nancy E. Rofe

## SURFACE WATER INFORMATION

Field Sample No. WX57010 Water Depth 1" (ft)
Depth of Sample From Top of Water — (ft) Temperature 11.2 Deg. C.
Spec. Cond. 74 µMHOS/CM pH 5.56 Units
Turb. 999+ NTUs
DO 1.41 mg/L
Field GC Data: [ ] Field Duplicate Collected
Duplicate ID

Type of Surface Water:
[ ] Stream
[ ] Pond/Lake
[✓] Marsh
[ ] River
[✓] Seep

Sample Location Sketch: [ ] Yes [✓] No see map

Equipment Used For Collection:
[✓] ~~None~~, Grab Into Bottle
[ ] Bomb Sampler
[✓] Pump/Si tubing/inline filter
[✓] SS spoon + bowl (turbiler from shallow see

Velocity Measurements Obtained?
[ ] Yes, See Flow Measurement Data Record

## SEDIMENT INFORMATION

Field Sample No. DX57010
Depth of Sediment Sample 0-4" (ft)
Field Gc Data: [ ] Field Duplicate Collected
Duplicate Id

Equipment Used For Collection:
[ ] Gravity Corer
[ ] S.S. Split Spoon
[ ] Dredge
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl

Sediment Type:
[ ] Clay
[✓] Sand
[✓] Organic
[ ] Gravel
[✓] Silt

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Observations:
[ ] Odor
[ ] Color
[ ]

## SAMPLES COLLECTED

| Analysis | Method Number | Faction Code | Preservation Method | Volume Required | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | UM20 | VP | HCL, 4 DEG C | (4) 40 ML | [✓] | / / / |
| [✓] SVOC | UM18 | MS | 4 DEG C | (2) 1 L AG | [✓] | / / / |
| [✓] Pest/PCB | UH02 | EC | 4 DEG C | (2) 1 L AG | [✓] | / / / |
| | UH13 | | | | | / / / |
| [✓] PAL Inorganics (Specified Below) | | N/NF | HNO3 TO pH<2 | 1 L P-CUBE | [✓] | / / / |
| [ ] Lead Only | SD20 | N | HNO3 TO pH<2 | | [ ] | / / / |
| [ ] Explosives | UW19 | LC | 4 DEG C | (3) 1 l. AG | [ ] | / / / |
| | UW32 | | | | | / / / |
| [ ] TPHC | 418.1 | O | H2SO4 TO pH<2 | 1 L AG | [ ] | / / / |
| [ ] TOC | 415.1 | O | H2SO4 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| [ ] Anions | TF22 | S | H2SO4 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| | TT10 | C | 4 DEG C | 1 L P-CUBE | [ ] | / / / |
| | 310.1 | N | HNO3 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| [✓] TSS Only | 160.2 | C | 4 DEG C | 1 L P-CUBE | [✓] | / / / |
| [ ] H2O Quality (Specified Below) | | S | H2SO4 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| | | C | 4 DEG C | 1 L P-CUBE | [ ] | / / / |
| | | N | HNO3 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| [ ] Coliform | 303,909 | | 4 DEG C | (1) 4 OZ | [ ] | / / / |
| [✓] EPH/VPH | | | HCl/$H_2SO_4$/ice (VPH) (EPH) | Sterile | [✓] | / / / |

| Analysis | Method Number | Fraction Code | Preservation Method | Volume Required | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | LM19 | SV | 4 DEG C | (2) 2OZ AG | [✓] | / / / |
| [✓] SVOC | LM18 | SS | | (1) 16 OZ AG | [✓] | / / / |
| [✓] Pest/PCB | LH16 | SS | | | [✓] | / / / |
| | LH10 | | | | [ ] | / / / |
| [✓] PAL Inorganics | See Below | SS | | | [✓] | / / / |
| [ ] Explosives | LW12 | SS | | | [ ] | / / / |
| [✓] TPHC | 418.1 | SS | | | [✓] | / / / |
| [ ] Lead Only | JD17 | SS | | | [ ] | / / / |
| [✓] TOC | 415.1 | SS | | | [✓] | / / / |
| [ ] TCLP | 1311 | SS | 4 DEG C | (1) 16 OZ AG | [✓] | / / / |
| [✓] EPH/VPH | | | 4°C/MeOH | | [✓] | / / / |

## NOTES

PAL Inorganics: ICP metals (SS10); AS (SS22); SE (SD21); TL (SD09); SB (SD20); HG (SB01).
H2O Quality: PO4 (TF27); TKN (TF26); NIT (TF22); CL/SO4 (TT10); TSS (160.2); ALK (301.0); Hardness.
All parameters collected as totals, ie: non Filtered

PAL Inorganics: ICP metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

*"big" (~1-2 oz) glob of SD/murky $H_2O$ got in filtered sample

**FIGURE 4-10**
**SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD**
**PROJECT OPERATIONS PLAN**
**FORT DEVENS, MASSACHUSETTS**
**ABB Environmental Services, Inc.**

9505005S L 3

# SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD

Project: Devens
Site: AOC 57 Area 2
Project Number: 09144.08
Date: 5/21/98
Site Identification: 57W-98-02X/57D-98-02X
Time: Start: See below End: 0915
Signature of Sampler: Nancy E. Rotta

## SURFACE WATER INFORMATION

Field Sample No. WX570200 Water Depth 6" (ft)

Depth of Sample From Top of Water 0 (ft) Temperature 13.5 Deg. C.

Spec. Cond. 150 µMHOS/CM pH 6.09 Units

Turb. 999+ ntus

DO 0.14 mg/L

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID

Type of Surface Water:
[ ] Stream [ ] River
[ ] Pond/Lake [ ] Seep
[✓] Marsh

Sample Location Sketch: [ ] Yes [✓] No see map

Equipment Used For Collection:
[✓] ~~None~~, Grab Into Bottle
[✓] Bomb Sampler
[✓] Pump / Si - PVC tubing / inline filte

Velocity Measurements Obtained?
[ ] Yes, See Flow Measurement Data Record

## SEDIMENT INFORMATION

Field Sample No. DX570200

Depth of Sediment Sample 1-1 1/3* (ft)

Field Gc Data: [ ] Field Duplicate Collected
Duplicate Id

*sed is ~1' under vegetation + H2O

Equipment Used For Collection:
[ ] Gravity Corer
[ ] S.S. Split Spoon
[ ] Dredge
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sediment Type:
[ ] Clay
[ ] Sand
[✓] Organic (thick tussock sedge + ~~grass~~ cattail grow over SD)
[ ] Gravel
[✓] Silt

Sample Observations:
[ ] Odor
[ ] Color
[ ]

## SAMPLES COLLECTED

| Analysis | Method Number | Faction Code | Preservation Method | Volume Required | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | UM20 | VP | HCL, 4 DEG C | (4) 40 ML | [✓] | / / / |
| [✓] SVOC | UM18 | MS | 4 DEG C | (2) 1 L AG | [✓] | / / / |
| [✓] Pest/PCB | UH02 | EC | 4 DEG C | (2) 1 L AG | [✓] | / / / |
| | UH13 | | | | | / / / |
| [✓] PAL Inorganics (Specified Below) | | N/NF | HNO3 TO pH<2 | 1 L P-CUBE | [✓] | / / / |
| [ ] Lead Only | SD20 | N | HNO3 TO pH<2 | | [ ] | / / / |
| [ ] Explosives | UW19 | LC | 4 DEG C | (3) 1 L AG | [ ] | / / / |
| | UW32 | | | | | / / / |
| [ ] TPHC | 418.1 | O | H2SO4 TO pH<2 | 1 L AG | [ ] | / / / |
| [ ] TOC | 415.1 | O | H2SO4 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| [ ] Anions | TF22 | S | H2SO4 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| | TT10 | C | 4 DEG C | 1 L P-CUBE | [ ] | / / / |
| | 310.1 | N | HNO3 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| [✓] TSS Only | 160.2 | C | 4 DEG C | 1 L P-CUBE | [✓] | / / / |
| [ ] H2O Quality (Specified Below) | | S | H2SO4 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| | | C | 4 DEG C | 1 L P-CUBE | [ ] | / / / |
| | | N | HNO3 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| [ ] Coliform | 303,909 | | 4 DEG C | (1) 4 OZ | [ ] | / / / |
| [✓] EPH/VPH | | | HCl/H2SO4/4°C (VPH) (EPH) | Sterile | [✓] | / / / |

| Analysis | Method Number | Fraction Code | Preservation Method | Volume Required | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | LM19 | SV | 4 DEG C | (2) 2OZ AG | [✓] | / / / |
| [✓] SVOC | LM18 | SS | | (1) 16 OZ AG | [✓] | / / / |
| [✓] Pest/PCB | LH16 | SS | | | [✓] | / / / |
| | LH10 | | | | [ ] | / / / |
| [✓] PAL Inorganics | See Below | SS | | | [✓] | / / / |
| [ ] Explosives | LW12 | SS | | | [ ] | / / / |
| [✓] TPHC | 418.1 | SS | | | [✓] | / / / |
| [ ] Lead Only | JD17 | SS | | | [ ] | / / / |
| [✓] TOC | 415.1 | SS | | | [✓] | / / / |
| [ ] TCLP | 1311 | SS | 4 DEG C | (1) 16 OZ AG | [ ] | / / / |
| [✓] EPH/VPH | | | 4°C/MeOH | | [✓] | / / / |

## NOTES

PAL Inorganics: ICP metals (SS10); AS (SS22); SE (SD21); TL (SD09); SB (SD20); HG (SB01).
H2O Quality: PO4 (TF27); TKN (TF26); NIT (TF22); CL/SO4 (TT10); TSS (160.2); ALK (301.0); Hardness.
All parameters collected as totals, ie: non Filtered

PAL Inorganics: ICP metals (JS16, AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

*actual start time = 0935
actual end time = 1000

FIGURE 4-10
SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD
PROJECT OPERATIONS PLAN
FORT DEVENS, MASSACHUSETTS
ABB Environmental Services, Inc.

9505005S L 3

# SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD

Project: Devens
Site: AOC 57 Area 2
Project Number: 09144.08
Date: 5/21/98
Site Identification: 57W-98-03X/57D-98-03X
Time: Start: See notes End: 1930
Signature of Sampler: Nancy E. Rob

## SURFACE WATER INFORMATION

Field Sample No. WX570300 Water Depth 1"
Depth of Sample From Top of Water 0 (ft) Temperature 15.0 Deg. C.
Spec. Cond. 94 µMHOS/CM pH 6.01 Units
Turb. 999+ ntus
DO 0 mg/L
Field GC Data: [ ] Field Duplicate Collected
Duplicate ID

Type of Surface Water:
[ ] Stream [ ] River
[ ] Pond/Lake [ ] Seep
[✓] Marsh

Sample Location Sketch: [ ] Yes [✓] No see map

Equipment Used For Collection:
[✓] ~~None~~, Grab Into Bottle
[ ] Bomb Sampler
[✓] Pump / Si + PVC tubing / inline filter
* used for 1 L AG because too shallow
* Dug a Sump (ground is saturated)

Velocity Measurements Obtained?
[ ] Yes, See Flow Measurement Data Record

## SEDIMENT INFORMATION

Field Sample No. DX570300
Depth of Sediment Sample 1-1.5 (ft)
Field Gc Data: [ ] Field Duplicate Collected
Duplicate Id

SD located ~ 1 foot under dense tussock & marsh mat

Equipment Used For Collection:
[ ] Gravity Corer
[ ] S.S. Split Spoon
[ ] Dredge
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sediment Type:
[ ] Clay
[✓] Sand (Some)
[✓] Organic
[ ] Gravel
[✓] Silt

Sample Observations:
[ ] Odor
[✓] Color black
[ ]

## SAMPLES COLLECTED

| Analysis | Method Number | Faction Code | Preservation Method | Volume Required | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | UM20 | VP | HCL, 4 DEG C | (4) 40 ML | [✓] | / / / |
| [✓] SVOC | UM18 | MS | 4 DEG C | (2) 1 L AG | [✓] | / / / |
| [✓] Pest/PCB | UH02 | EC | 4 DEG C | (2) 1 L AG | [✓] | / / / |
| | UH13 | | | | | / / / |
| [✓] PAL Inorganics (Specified Below) | | N/NF | HNO3 TO pH<2 | 1 L P-CUBE | [✓] | / / / |
| [ ] Lead Only | SD20 | N | HNO3 TO pH<2 | | [ ] | / / / |
| [ ] Explosives | UW19 | LC | 4 DEG C | (3) 1 L AG | [ ] | / / / |
| | UW32 | | | | | / / / |
| [ ] TPHC | 418 1 | O | H2SO4 TO pH<2 | 1 L AG | [ ] | / / / |
| [ ] TOC | 415.1 | O | H2SO4 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| [ ] Anions | TF22 | S | H2SO4 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| | TT10 | C | 4 DEG C | 1 L P-CUBE | [ ] | / / / |
| | 310.1 | N | HNO3 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| [✓] TSS Only | 160.2 | C | 4 DEG C | 1 L P-CUBE | [✓] | / / / |
| [ ] H2O Quality (Specified Below) | | S | H2SO4 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| | | C | 4 DEG C | 1 L P-CUBE | [ ] | / / / |
| | | N | HNO3 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| [ ] Coliform | 303,909 | | 4 DEG C | (1) 4 OZ | [ ] | / / / |
| [✓] EPH/VPH | | | HCl/H2SO4/4°C (VPH) (EPH) | Sterile | [✓] | / / / |

| Analysis | Method Number | Fraction Code | Preservation Method | Volume Required | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | LM19 | SV | 4 DEG C | (2) 2OZ AG | [✓] | / / / |
| [✓] SVOC | LM18 | SS | | (1) 16 OZ AG | [✓] | / / / |
| [✓] Pest/PCB | LH16 | SS | | | [✓] | / / / |
| | LH10 | | | | [ ] | / / / |
| [✓] PAL Inorganics | See Below | SS | | | [✓] | / / / |
| [ ] Explosives | LW12 | SS | | | [ ] | / / / |
| [✓] TPHC | 418.1 | SS | | | [✓] | / / / |
| [ ] Lead Only | JD17 | SS | | | [ ] | / / / |
| [✓] TOC | 415.1 | SS | | | [✓] | / / / |
| [ ] TCLP | 1311 | SS | 4 DEG C | (1) 16 OZ AG | [ ] | / / / |
| [✓] EPH/VPH | | | 4°C/HCl | | [✓] | |

## NOTES

PAL Inorganics: ICP metals (SS10); AS (SS22); SE (SD21); TL (SD09); SB (SD20); HG (SB01).
H2O Quality: PO4 (TF27); TKN (TF26); NIT (TF22); CL/S04 (TT10); TSS (160.2); ALK (301.0); Hardness.
All parameters collected as totals, ie: non Filtered

PAL Inorganics: ICP metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

actual start time = 1015
actual end time = 1045

**FIGURE 4-10**
**SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD**
**PROJECT OPERATIONS PLAN**
**FORT DEVENS, MASSACHUSETTS**
**ABB Environmental Services, Inc.**

9505005S L 3

# SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD

Project: Devens
Site: AOC 57 Area 3
Project Number: 09144.08
Date: 5/21/98
Site Identification: 57W-98-04 / 57D-98-04X
Time: Start: 1200 End: 1220
Signature of Sampler: Nancy E. Rofra

## SURFACE WATER INFORMATION

Field Sample No. WX570400 Water Depth <1" dug out a sump + let H2O in (ground is saturated)

Type of Surface Water: [ ] Stream [ ] River [✓] Seep [ ] Pond/Lake

Equipment Used For Collection: [✓] ~~None~~ Grab Into Bottle [ ] Bomb Sampler [✓] Pump / Sit PVC tubing / in-line filter w/ SS bowl & spoon (~~sh~~ b/c too shallow)

Depth of Sample From Top of Water 0 (ft) Temperature 17.3 Deg. C.

Sample Location Sketch: [ ] Yes [✓] No See map

Spec. Cond. 56 µMHOS/CM pH 6.35 Units

Turb 999 ntus

DO 0 mg/L

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID

Velocity Measurements Obtained?
[ ] Yes, See Flow Measurement Data Record

## SEDIMENT INFORMATION

Field Sample No. WD570400

Depth of Sediment Sample 0-1 (ft)

Field Gc Data: [ ] Field Duplicate Collected
Duplicate Id

Equipment Used For Collection:
[ ] Gravity Corer
[ ] S.S. Split Spoon
[ ] Dredge
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl

Sediment Type:
[ ] Clay
[ ] Sand
[✓] Organic
[ ] Gravel
[✓] sandy silt - black to grey bl
~2" soft org. ~~silt~~ mat over org. sandy sil

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Observations:
[ ] Odor
[ ] Color
[ ]

## SAMPLES COLLECTED

| Analysis | Method Number | Faction Code | Preservation Method | Volume Required | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | UM20 | VP | HCL, 4 DEG C | (4) 40 ML | [✓] | / / / |
| [✓] SVOC | UM18 | MS | 4 DEG C | (2) 1 L AG | [✓] | / / / |
| [✓] Pest/PCB | UH02 | EC | 4 DEG C | (2) 1 L AG | [✓] | / / / |
| | UH13 | | | | | / / / |
| [✓] PAL Inorganics (Specified Below) | | N/NF | HNO3 TO pH<2 | 1 L P-CUBE | [✓] | / / / |
| [ ] Lead Only | SD20 | N | HNO3 TO pH<2 | | [ ] | / / / |
| [ ] Explosives | UW19 | LC | 4 DEG C | (3) 1 L AG | [ ] | / / / |
| | UW32 | | | | | / / / |
| [ ] TPHC | 418.1 | O | H2SO4 TO pH<2 | 1 L AG | [ ] | / / / |
| [ ] TOC | 415.1 | O | H2SO4 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| [ ] Anions | TF22 | S | H2SO4 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| | TT10 | C | 4 DEG C | 1 L P-CUBE | [ ] | / / / |
| | 310.1 | N | HNO3 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| [✓] TSS Only | 160.2 | C | 4 DEG C | 1 L P-CUBE | [✓] | / / / |
| [ ] H2O Quality (Specified Below) | | S | H2SO4 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| | | C | 4 DEG C | 1 L P-CUBE | [ ] | / / / |
| | | N | HNO3 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| [ ] Coliform | 303,909 | | 4 DEG C | (1) 4 OZ | [✓] | / / / |
| [✓] EPH/VPH | | | HCl/H2SO4/4°C (VPH) (EPH) | Sterile | | / / / |

| Analysis | Method Number | Fraction Code | Preservation Method | Volume Required | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | LM19 | SV | 4 DEG C | (2) 2OZ AG | [✓] | / / / |
| [✓] SVOC | LM18 | SS | | (1) 16 OZ AG | [✓] | / / / |
| [✓] Pest/PCB | LH16 | SS | | | [✓] | / / / |
| | LH10 | | | | [ ] | / / / |
| [✓] PAL Inorganics | See Below | SS | | | [✓] | / / / |
| [ ] Explosives | LW12 | SS | | | [ ] | / / / |
| [✓] TPHC | 418.1 | SS | | | [✓] | / / / |
| [ ] Lead Only | JD17 | SS | | | [ ] | / / / |
| [✓] TOC | 415.1 | SS | | | [✓] | / / / |
| [ ] TCLP | 1311 | SS | 4 DEG C | (1) 16 OZ AG | [✓] | / / / |
| [✓] EPH/VPH | | | 4°C/MeOH | | | |

## NOTES

PAL Inorganics: ICP metals (SS10); AS (SS22); SE (SD21); TL (SD09); SB (SD20); HG (SB01).
H2O Quality: PO4 (TF27); TKN (TF26); NIT (TF22); CL/S04 (TT10); TSS (160.2); ALK (301.0); Hardness.
All parameters collected as totals, ie: non Filtered

PAL Inorganics: ICP metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

**FIGURE 4-10**
**SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD**
**PROJECT OPERATIONS PLAN**
**FORT DEVENS, MASSACHUSETTS**
**ABB Environmental Services, Inc.**

# SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD

Project: Devens
Site: AOC 57 Area 3
Project Number: 09144.08
Date: 5/21/98
Site Identification: 57W-98-05X/ 57D-98-05X
Time: Start: 1350 End: 1300
Signature of Sampler: Nancy E. Rot

## SURFACE WATER INFORMATION

Field Sample No. WX570500 Water Depth 6"
Depth of Sample From Top of Water 0" Temperature 18.3 Deg. C.
Spec. Cond. 158 µMHOS/CM pH 6.63 Units
Turb. 999+ ntus
DO 0 mg/L

Type of Surface Water:
[ ] Stream [ ] River
[ ] Pond/Lake [✓] Seep

Equipment Used For Collection:
[ ] None, Grab Into Bottle
[ ] Bomb Sampler
[✓] Pump / Silt PVC tubing/in-line filter

Sample Location Sketch: [ ] Yes [✓] No see map

*heavy floc

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID

Velocity Measurements Obtained?
[ ] Yes, See Flow Measurement Data Record

## SEDIMENT INFORMATION

Field Sample No. DX570500
Depth of Sediment Sample 0-4"
Field Gc Data: [ ] Field Duplicate Collected
Duplicate Id

Equipment Used For Collection:
[ ] Gravity Corer
[ ] S.S. Split Spoon
[ ] Dredge
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl

Sediment Type:
[ ] Clay
[✓] Sand
[✓] Organic
[ ] Gravel
[✓] Silt

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Observations:
[ ] Odor
[ ] Color
[✓] Fe Floc

## SAMPLES COLLECTED

| Analysis | Method Number | Faction Code | Preservation Method | Volume Required | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | UM20 | VP | HCL, 4 DEG C | (4) 40 ML | [✓] | / / / |
| [✓] SVOC | UM18 | MS | 4 DEG C | (2) 1 L AG | [✓] | / / / |
| [✓] Pest/PCB | UH02 | EC | 4 DEG C | (2) 1 L AG | [✓] | / / / |
| | UH13 | | | | | / / / |
| [✓] PAL Inorganics (Specified Below) | | N/NF | HNO3 TO pH<2 | 1 L P-CUBE | [✓] | / / / |
| [ ] Lead Only | SD20 | N | HNO3 TO pH<2 | | [ ] | / / / |
| [ ] Explosives | UW19 | LC | 4 DEG C | (3) 1 L AG | [ ] | / / / |
| | UW32 | | | | | / / / |
| [ ] TPHC | 418.1 | O | H2SO4 TO pH<2 | 1 L AG | [ ] | / / / |
| [ ] TOC | 415.1 | O | H2SO4 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| [ ] Anions | TF22 | S | H2SO4 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| | TT10 | C | 4 DEG C | 1 L P-CUBE | [ ] | / / / |
| | 310.1 | N | HNO3 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| [✓] TSS Only | 160.2 | C | 4 DEG C | 1 L P-CUBE | [✓] | / / / |
| [ ] H2O Quality (Specified Below) | | S | H2SO4 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| | | C | 4 DEG C | 1 L P-CUBE | [ ] | / / / |
| | | N | HNO3 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| [ ] Coliform | 303,909 | | 4 DEG C | (1) 4 OZ | [ ] | / / / |
| [✓] EPH/VPH | | HCl/H2SO4/4°C (VPH) (EPH) | | Sterile | [✓] | / / / |

| Analysis | Method Number | Fraction Code | Preservation Method | Volume Required | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | LM19 | SV | 4 DEG C | (2) 2OZ AG | [✓] | / / / |
| [✓] SVOC | LM18 | SS | | (1) 16 OZ AG | [✓] | / / / |
| [✓] Pest/PCB | LH16 | SS | | | [✓] | / / / |
| | LH10 | | | | [ ] | / / / |
| [✓] PAL Inorganics | See Below | SS | | | [✓] | / / / |
| [ ] Explosives | LW12 | SS | | | [ ] | / / / |
| [✓] TPHC | 418.1 | SS | | | [✓] | / / / |
| [ ] Lead Only | JD17 | SS | | | [ ] | / / / |
| [✓] TOC | 415.1 | SS | | | [✓] | / / / |
| [ ] TCLP | 1311 | SS | 4 DEG C | (1) 16 OZ AG | [✓] | / / / |
| [✓] EPH/VPH | | | 4°C/MeOH | | | |

## NOTES

PAL Inorganics: ICP metals (SS10); AS (SS22); SE (SD21); TL (SD09); SB (SD20); HG (SB01).
H2O Quality: PO4 (TF27); TKN (TF26); NIT (TF22); CL/S04 (TT10); TSS (160.2); ALK (301.0); Hardness.
All parameters collected as totals, ie: non Filtered

PAL Inorganics: ICP metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

- Frog observed jumping into H2O
- Heavy floc in H2O

**FIGURE 4-10**
**SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD**
**PROJECT OPERATIONS PLAN**
**FORT DEVENS, MASSACHUSETTS**
**ABB Environmental Services, Inc.**

# SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD

Project: Devens
Project Number: 09144.08
Site Identification: 57W-98-06X/ 57D-98-06X
Time: Start: 1345 End: 1400

Site: AOC 57 Area 3
Date: 5/21/98
Signature of Sampler: Nancy E. Roffa

## SURFACE WATER INFORMATION

Field Sample No. WX570600 Water Depth 4" ~~(ft)~~

Depth of Sample From Top of Water 0 (ft) Temperature 17.7 Deg. C.

Spec. Cond. 51 µMHOS/CM pH 6.00 Units

Turb. 999+ ntus
DO 0.36 mg/L

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID

Type of Surface Water:
[ ] Stream [ ] River
[ ] Pond/Lake [✓] Seep

Sample Location Sketch: [ ] Yes [✓] No see map

Velocity Measurements Obtained?
[ ] Yes, See Flow Measurement Data Record

Equipment Used For Collection:
[✓] ~~Phone~~ Grab Into Bottle
[ ] Bomb Sampler
[✓] Pump/ Si+ PVC tubing/ in-line filt
[✓] SS bowl (shallow)

dug a sump (ground is saturated)

## SEDIMENT INFORMATION

Field Sample No. PX570600

Depth of Sediment Sample 0-1 (ft)

Field Gc Data: [ ] Field Duplicate Collected
Duplicate Id

Equipment Used For Collection:
[ ] Gravity Corer
[ ] S.S. Split Spoon
[ ] Dredge
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl

Sediment Type:
[ ] Clay
[✓] Sand
[✓] Organic
[ ] Gravel
[✓] Silt

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Observations:
[ ] Odor
[ ] Color
[ ]

## SAMPLES COLLECTED

| Analysis | Method Number | Faction Code | Preservation Method | Volume Required | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | UM20 | VP | HCL, 4 DEG C | (4) 40 ML | [✓] | ___/___/___/___ |
| [✓] SVOC | UM18 | MS | 4 DEG C | (2) 1 L AG | [✓] | ___/___/___/___ |
| [✓] Pest/PCB | UH02 | EC | 4 DEG C | (2) 1 L AG | [✓] | ___/___/___/___ |
| | UH13 | | | | | ___/___/___/___ |
| [✓] PAL Inorganics (Specified Below) | | N/NF | HNO3 TO pH<2 | 1 L P-CUBE | [✓] | ___/___/___/___ |
| [ ] Lead Only | SD20 | N | HNO3 TO pH<2 | | [ ] | ___/___/___/___ |
| [ ] Explosives | UW19 | LC | 4 DEG C | (3) 1 L AG | [ ] | ___/___/___/___ |
| | UW32 | | | | | ___/___/___/___ |
| [ ] TPHC | 418.1 | O | H2SO4 TO pH<2 | 1 L AG | [ ] | ___/___/___/___ |
| [ ] TOC | 415.1 | O | H2SO4 TO pH<2 | 1 L P-CUBE | [ ] | ___/___/___/___ |
| [ ] Anions | TF22 | S | H2SO4 TO pH<2 | 1 L P-CUBE | [ ] | ___/___/___/___ |
| | TT10 | C | 4 DEG C | 1 L P-CUBE | [ ] | ___/___/___/___ |
| | 310.1 | N | HNO3 TO pH<2 | 1 L P-CUBE | [ ] | ___/___/___/___ |
| [✓] TSS Only | 160.2 | C | 4 DEG C | 1 L P-CUBE | [✓] | ___/___/___/___ |
| [ ] H2O Quality (Specified Below) | | S | H2SO4 TO pH<2 | 1 L P-CUBE | [ ] | ___/___/___/___ |
| | | C | 4 DEG C | 1 L P-CUBE | [ ] | ___/___/___/___ |
| | | N | HNO3 TO pH<2 | 1 L P-CUBE | [ ] | ___/___/___/___ |
| [ ] Coliform | 303,909 | | 4 DEG C | (1) 4 OZ | [✓] | ___/___/___/___ |
| [✓] EPH/VPH | | | HCl/H2SO4/4°C (VPH) (EPH) | Sterile | | ___/___/___/___ |

| Analysis | Method Number | Fraction Code | Preservation Method | Volume Required | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | LM19 | SV | 4 DEG C | (2) 2OZ AG | [✓] | ___/___/___/___ |
| [✓] SVOC | LM18 | SS | | (1) 16 OZ AG | [✓] | ___/___/___/___ |
| [✓] Pest/PCB | LH16 | SS | | | [✓] | ___/___/___/___ |
| | LH10 | | | | [ ] | ___/___/___/___ |
| [✓] PAL Inorganics | See Below | SS | | | [✓] | ___/___/___/___ |
| [ ] Explosives | LW12 | SS | | | [ ] | ___/___/___/___ |
| [✓] TPHC | 418.1 | SS | | | [✓] | ___/___/___/___ |
| [ ] Lead Only | JD17 | SS | | | [ ] | ___/___/___/___ |
| [✓] TOC | 415.1 | SS | | | [✓] | ___/___/___/___ |
| [ ] TCLP | 1311 | SS | 4 DEG C | (1) 16 OZ AG | [ ] | ___/___/___/___ |
| [✓] EPH/VPH | | | 4°C/NaOH | | [✓] | |

## NOTES

PAL Inorganics: ICP metals (SS10); AS (SS22); SE (SD21); TL (SD09); SB (SD20); HG (SB01).
H2O Quality: PO4 (TF27); TKN (TF26); NIT (TF22); CL/S04 (TT10); TSS (160.2); ALK (301.0); Hardness.
All parameters collected as totals, ie: non Filtered

PAL Inorganics: ICP metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

**FIGURE 4-10**
**SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD**
**PROJECT OPERATIONS PLAN**
**FORT DEVENS, MASSACHUSETTS**
**ABB Environmental Services, Inc.**

# SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD

Project: Devens
Site: AOC 57 Area 3
Project Number: 09144.08
Date: 5/21/98
Site Identification: 57D-98-07X / 57W-98-07X
Time: Start: 1430 End: 1445
Signature of Sampler: Nancy E. Rofra

## SURFACE WATER INFORMATION

Field Sample No. WX570700 Water Depth 6" (ft)

Depth of Sample From Top of Water 0 (ft) Temperature 20.2 Deg. C.

Spec. Cond. 50 µMHOS/CM pH 6.14 Units

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID

Type of Surface Water:
[ ] Stream [ ] River
[ ] Pond/Lake [✓] Seep

Equipment Used For Collection:
[✓] Scoop, Grab Into Bottle
[ ] Bomb Sampler
[✓] Pump / Six PVC tubing/in-line filter

Sample Location Sketch: [ ] Yes [✓] No see map

Turb. 999+ NTUs
DO 0 mg/L

Velocity Measurements Obtained?
[ ] Yes, See Flow Measurement Data Record

dug a sump (ground is saturated)

## SEDIMENT INFORMATION

Field Sample No. DX570700

Depth of Sediment Sample 0-6" (ft)

Field Gc Data: [ ] Field Duplicate Collected
Duplicate Id

Equipment Used For Collection:
[ ] Gravity Corer
[ ] S.S. Split Spoon
[ ] Dredge
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl

Sediment Type:
[ ] Clay
[✓] Sand
[✓] Organic
[ ] Gravel
[✓] Silt

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Observations:
[✓] Odor H2S
[ ] Color
[ ]

## SAMPLES COLLECTED

| Analysis | Method Number | Faction Code | Preservation Method | Volume Required | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | UM20 | VP | HCL, 4 DEG C | (4) 40 ML | [✓] | / / / |
| [✓] SVOC | UM18 | MS | 4 DEG C | (2) 1 L AG | [✓] | / / / |
| [✓] Pest/PCB | UH02 | EC | 4 DEG C | (2) 1 L AG | [✓] | / / / |
| | UH13 | | | | | / / / |
| [✓] PAL Inorganics (Specified Below) | | N/NF | HNO3 TO pH<2 | 1 L P-CUBE | [✓] | / / / |
| [ ] Lead Only | SD20 | N | HNO3 TO pH<2 | | [ ] | / / / |
| [ ] Explosives | UW19 | LC | 4 DEG C | (3) 1 L AG | [ ] | / / / |
| | UW32 | | | | | / / / |
| [ ] TPHC | 418.1 | O | H2SO4 TO pH<2 | 1 L AG | [ ] | / / / |
| [ ] TOC | 415.1 | O | H2SO4 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| [ ] Anions | TF22 | S | H2SO4 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| | TT10 | C | 4 DEG C | 1 L P-CUBE | [ ] | / / / |
| | 310.1 | N | HNO3 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| [✓] TSS Only | 160.2 | C | 4 DEG C | 1 L P-CUBE | [✓] | / / / |
| [ ] H2O Quality (Specified Below) | | S | H2SO4 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| | | C | 4 DEG C | 1 L P-CUBE | [ ] | / / / |
| | | N | HNO3 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| [ ] Coliform | 303,909 | | 4 DEG C | (1) 4 OZ | [✓] | / / / |
| [✓] EPH/VPH | | | HCl (VPH) / $H_2SO_4$ (EPH) / 4°C | Sterile | | / / / |

| Analysis | Method Number | Fraction Code | Preservation Method | Volume Required | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | LM19 | SV | 4 DEG C | (2) 2OZ AG | [✓] | / / / |
| [✓] SVOC | LM18 | SS | | (1) 16 OZ AG | [✓] | / / / |
| [✓] Pest/PCB | LH16 | SS | | | [✓] | / / / |
| | LH10 | | | | [ ] | / / / |
| [✓] PAL Inorganics | See Below | SS | | | [✓] | / / / |
| [ ] Explosives | LW12 | SS | | | [ ] | / / / |
| [✓] TPHC | 418.1 | SS | | | [✓] | / / / |
| [ ] Lead Only | JD17 | SS | | | [ ] | / / / |
| [✓] TOC | 415.1 | SS | | | [✓] | / / / |
| [ ] TCLP | 1311 | SS | 4 DEG C | (1) 16 OZ AG | [✓] | / / / |
| [✓] EPH/VPH | | | 4°C/MeOH | | | |

## NOTES

PAL Inorganics: ICP metals (SS10); AS (SS22); SE (SD21); TL (SD09); SB (SD20); HG (SB01).
H2O Quality: PO4 (TF27); TKN (TF26); NIT (TF22); CL/SO4 (TT10); TSS (160.2); ALK (301.0); Hardness.
All parameters collected as totals, ie. non Filtered

PAL Inorganics: ICP metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

**FIGURE 4-10**
**SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD**
**PROJECT OPERATIONS PLAN**
**FORT DEVENS, MASSACHUSETTS**
**ABB Environmental Services, Inc.**

# SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD

Project: Devens
Site: AOC 57 Area 3
Project Number: 09144.08
Date: 5/21/98
Site Identification: 57W-98-08X / 57D-98-08X
Time: Start: 1310 End: 1330
Signature of Sampler: Nancy E Roka

**SURFACE WATER INFORMATION**

Field Sample No. WX570800 Water Depth 6" (ft)

Depth of Sample From Top of Water 0 (ft) Temperature 20.6 Deg. C.

Spec. Cond. 103 µMHOS/CM pH 6.63 Units

Turb. 999+ ntus
DO 0 mg/L

Field GC Data: [ ] Field Duplicate Collected
Duplicate ID

Type of Surface Water:
[ ] Stream [ ] River
[ ] Pond/Lake [✓] Seep

Equipment Used For Collection:
[ ] None, Grab Into Bottle
[ ] Bomb Sampler
[✓] Pump / Silt PVC tubing / in-line filt

Sample Location Sketch: [ ] Yes [✓] No see map

Velocity Measurements Obtained?
[ ] Yes, See Flow Measurement Data Record

**SEDIMENT INFORMATION**

Field Sample No. DX570800

Depth of Sediment Sample 0-6" (ft)

Field Gc Data: [ ] Field Duplicate Collected
Duplicate Id

Equipment Used For Collection:
[ ] Gravity Corer
[ ] S.S. Split Spoon
[ ] Dredge
[✓] Hand Spoon
[ ] Aluminum Pans
[ ] SS Bucket
[✓] SS bowl

Sediment Type:
[ ] Clay
[✓] Sand
[✓] Organic
[ ] Gravel
[✓] silt

Type Of Sample Collected:
[✓] Discrete
[ ] Composite

Sample Observations:
[ ] Odor
[ ] Color
[ ]

**SAMPLES COLLECTED**

| Analysis | Method Number | Faction Code | Preservation Method | Volume Required | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | UM20 | VP | HCL, 4 DEG C | (4) 40 ML | [✓] | / / / |
| [✓] SVOC | UM18 | MS | 4 DEG C | (2) 1 L AG | [✓] | / / / |
| [✓] Pest/PCB | UH02 | EC | 4 DEG C | (2) 1 L AG | [✓] | / / / |
| | UH13 | | | | | / / / |
| [✓] PAL Inorganics (Specified Below) | | N/NF | HNO3 TO pH<2 | 1 L P-CUBE | [✓] | / / / |
| [ ] Lead Only | SD20 | N | HNO3 TO pH<2 | | [ ] | / / / |
| [ ] Explosives | UW19 | LC | 4 DEG C | (3) 1 l. AG | [ ] | / / / |
| | UW32 | | | | | / / / |
| [ ] TPHC | 418.1 | O | H2SO4 TO pH<2 | 1 L AG | [ ] | / / / |
| [ ] TOC | 415.1 | O | H2SO4 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| [ ] Anions | TF22 | S | H2SO4 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| | TT10 | C | 4 DEG C | 1 L P-CUBE | [ ] | / / / |
| | 310 1 | N | HNO3 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| [✓] TSS Only | 160.2 | C | 4 DEG C | 1 L P-CUBE | [✓] | / / / |
| [ ] H2O Quality (Specified Below) | | S | H2SO4 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| | | C | 4 DEG C | 1 L P-CUBE | [ ] | / / / |
| | | N | HNO3 TO pH<2 | 1 L P-CUBE | [ ] | / / / |
| [ ] Coliform | 303,909 | | 4 DEG C | (1) 4 OZ | [ ] | / / / |
| [✓] EPH/VPH | | | HCl/H2SO4/4°C (VPH) (EPH) | Sterile | [✓] | / / / |

| Analysis | Method Number | Fraction Code | Preservation Method | Volume Required | Sample Collected | Sample Bottle ID Numbers |
|---|---|---|---|---|---|---|
| [✓] VOC | LM19 | SV | 4 DEG C | (2) 2OZ AG | [✓] | / / / |
| [✓] SVOC | LM18 | SS | | (1) 16 OZ AG | [✓] | / / / |
| [✓] Pest/PCB | LH16 | SS | | | [✓] | / / / |
| | LH10 | | | | [ ] | / / / |
| [✓] PAL Inorganics | See Below | SS | | | [✓] | / / / |
| [ ] Explosives | LW12 | SS | | | [ ] | / / / |
| [✓] TPHC | 418.1 | SS | | | [✓] | / / / |
| [ ] Lead Only | JD17 | SS | | | [ ] | / / / |
| [✓] TOC | 415.1 | SS | | | [✓] | / / / |
| [ ] TCLP | 1311 | SS | 4 DEG C | (1) 16 OZ AG | [ ] | / / / |
| [✓] EPH/VPH | | | 4°C/MeOH | | [✓] | |

**NOTES**

PAL Inorganics: ICP metals (SS10); AS (SS22); SE (SD21); TL (SD09); SB (SD20); HG (SB01).
H2O Quality: PO4 (TF27); TKN (TF26); NIT (TF22); CL/S04 (TT10); TSS (160.2); ALK (301.0); Hardness.
All parameters collected as totals, ie: non Filtered

PAL Inorganics: ICP metals (JS16; AS (JD19); SE (JD15); TL (JD24); SB (JD25); PB (JD17); HG (JB10).

**FIGURE 4-10**
**SURFACE WATER AND SEDIMENT SAMPLE FIELD DATA RECORD**
**PROJECT OPERATIONS PLAN**
**FORT DEVENS, MASSACHUSETTS**
**ABB Environmental Services, Inc.**

# SURVEY DATA

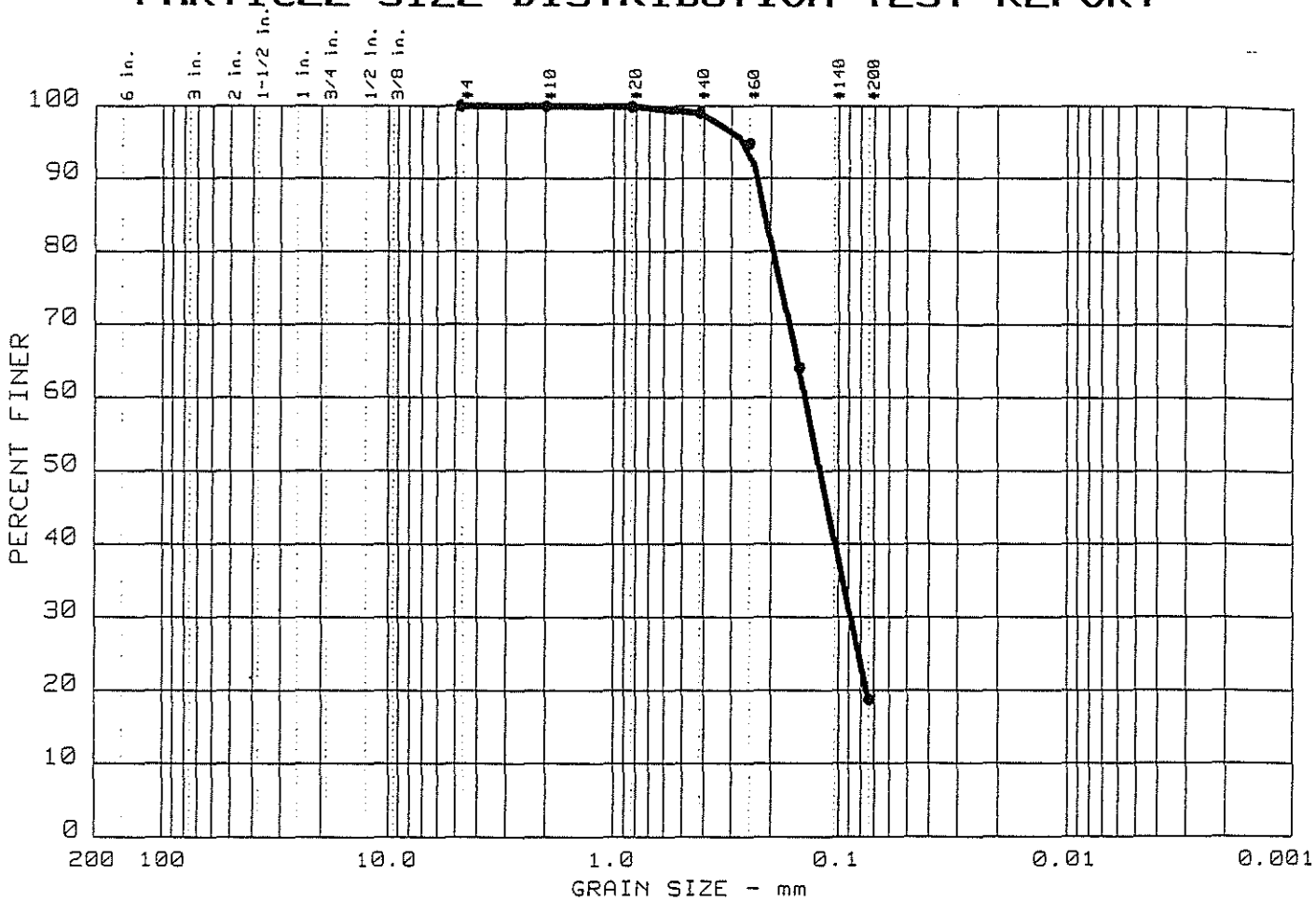
Table I–1
MONITORING WELL AND PIEZOMETER DATA
AOC 57

REMEDIAL INVESTIGATION REPORT
FORT DEVENS, MA

| WELL | NORTH | EAST | TOP OF PVC | GROUND ELEVATION |
|---|---|---|---|---|
| G3M–92–02X | 562277 | 575908 | 251 | 249.11 |
| G3M–92–07X | 562586 | 576145 | 251.88 | 249.97 |
| 57M–95–01X | 562062.51 | 576806.44 | 248.19 | 245.70 |
| 57M–95–02X | 561853.36 | 575850.79 | 242.16 | 239.97 |
| 57M–95–03X | 562331.40 | 576954.31 | 234.97 | 232.48 |
| 57M–95–04A | 561870.62 | 576382.18 | 223.83 | 222.68 |
| 57M–95–04B | 561863.18 | 576381.34 | 224.67 | 222.38 |
| 57M–95–05X | 561952.54 | 576228.93 | 237.31 | 234.87 |
| 57M–95–06X | 562051.57 | 576463.95 | 236.56 | 234.42 |
| 57M–95–07X | 561825.75 | 576248.67 | 224.57 | 223.36 |
| 57M–95–08A | 561934.81 | 576468.16 | 224.11 | 222.67 |
| 57M–95–08B | 561932.96 | 576475.11 | 224.70 | 222.24 |
| 57M–96–09X | 562419.79 | 576853.00 | 242.62 | 240.24 |
| 57M–96–10X | 562293.21 | 577012.99 | 229.55 | 227.09 |
| 57M–96–11X | 562225.94 | 576968.72 | 224.38 | 222.18 |
| 57M–96–12X | 562240.19 | 576870.69 | 227.87 | 224.82 |
| 57M–96–13X | 562193.54 | 576811.74 | 227.73 | 225.06 |
| 57P–95–01A | 561695.11 | 576211.02 | 223.29 | 222.00 |
| 57P–95–01B | 561695.11 | 576211.02 | 223.10 | 222.00 |

GEOTECHNICAL DATA (GRAIN SIZE)

# PARTICLE SIZE DISTRIBUTION TEST REPORT




| | % +3" | % GRAVEL | % SAND | % SILT | % CLAY | USCS | LL | PI |
|---|---|---|---|---|---|---|---|---|
| ● | 0.0 | 0.0 | 81.2 | 18.8 | | SP-SM | | |
| | | | | | | | | |
| | | | | | | | | |

| SIEVE inches size | PERCENT FINER ● | | |
|---|---|---|---|
| | | | |
| | GRAIN SIZE | | |
| $D_{60}$ | 0.14 | | |
| $D_{30}$ | 0.09 | | |
| $D_{10}$ | | | |
| | COEFFICIENTS | | |
| $C_c$ | | | |
| $C_u$ | | | |

| SIEVE number size | PERCENT FINER ● | | |
|---|---|---|---|
| 4 | 100.0 | | |
| 10 | 100.0 | | |
| 20 | 99.9 | | |
| 40 | 99.0 | | |
| 60 | 94.8 | | |
| 100 | 64.1 | | |
| 200 | 18.8 | | |

Sample information:

● BX570805
F SAND; Lttl Si;
Tr M and C Sa.

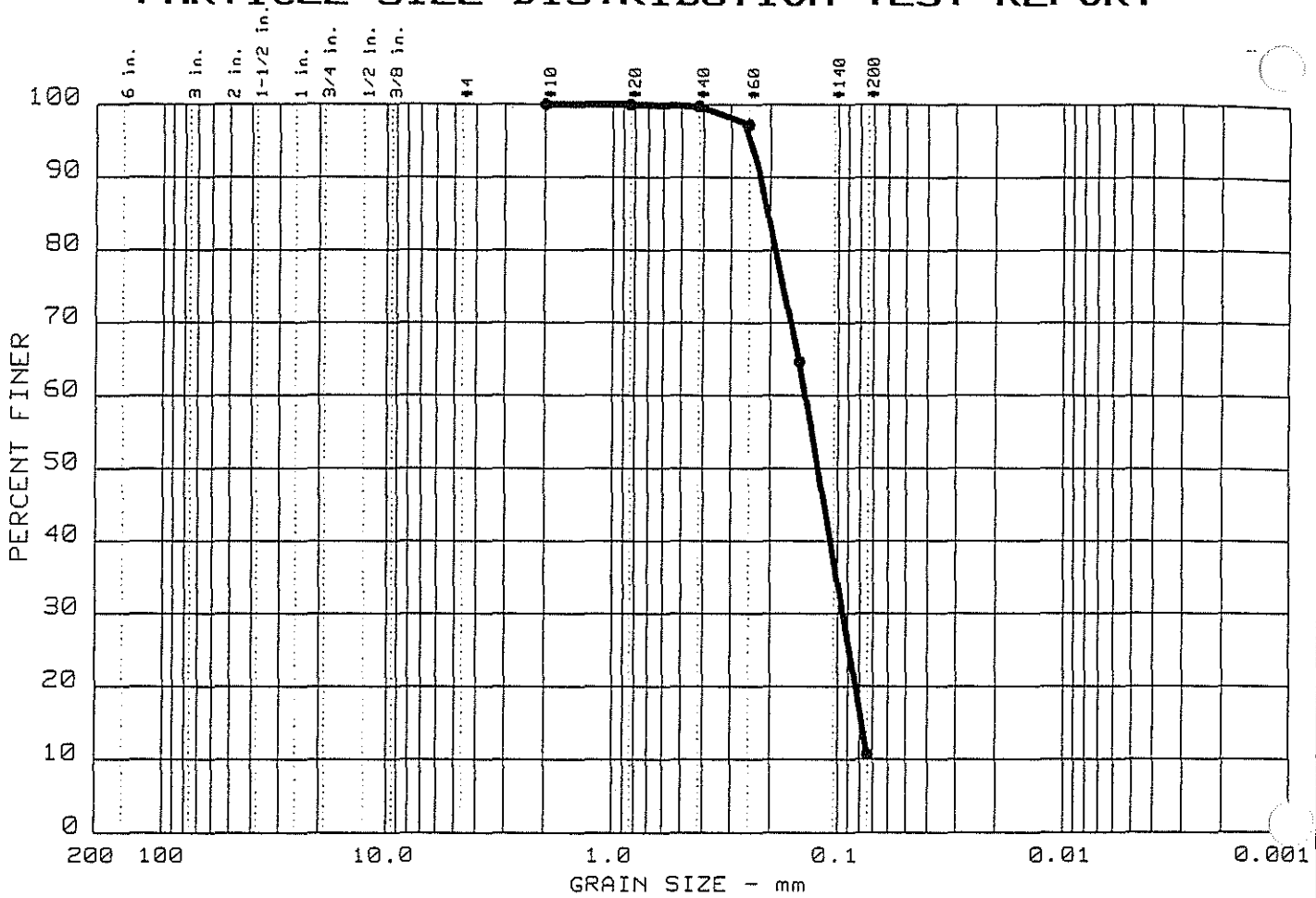
Remarks:
SIEVE ANALYSIS

**ABB Environmental Services, Inc.**

Project No.: 09144.08
Project: FORT DEVENS

Date: 10/10/96 Data Sheet No. 21

# PARTICLE SIZE DISTRIBUTION TEST REPORT




| | % +3" | % GRAVEL | % SAND | % SILT | % CLAY | USCS | LL | PI |
|---|---|---|---|---|---|---|---|---|
| ● | 0.0 | 0.0 | 89.3 | 10.7 | | SP | | |
| | | | | | | | | |
| | | | | | | | | |

| SIEVE inches size | PERCENT FINER ● | | |
|---|---|---|---|
| | | | |
| | GRAIN SIZE | | |
| $D_{60}$ | 0.14 | | |
| $D_{30}$ | 0.10 | | |
| $D_{10}$ | | | |
| | COEFFICIENTS | | |
| $C_c$ | | | |
| $C_u$ | | | |

| SIEVE number size | PERCENT FINER ● | | |
|---|---|---|---|
| 10 | 100.0 | | |
| 20 | 99.9 | | |
| 40 | 99.7 | | |
| 60 | 97.2 | | |
| 100 | 64.7 | | |
| 200 | 10.7 | | |

Sample information:

● BX570905
F SAND; Lttl Si; Tr M Sa.

Remarks:
SIEVE ANALYSIS

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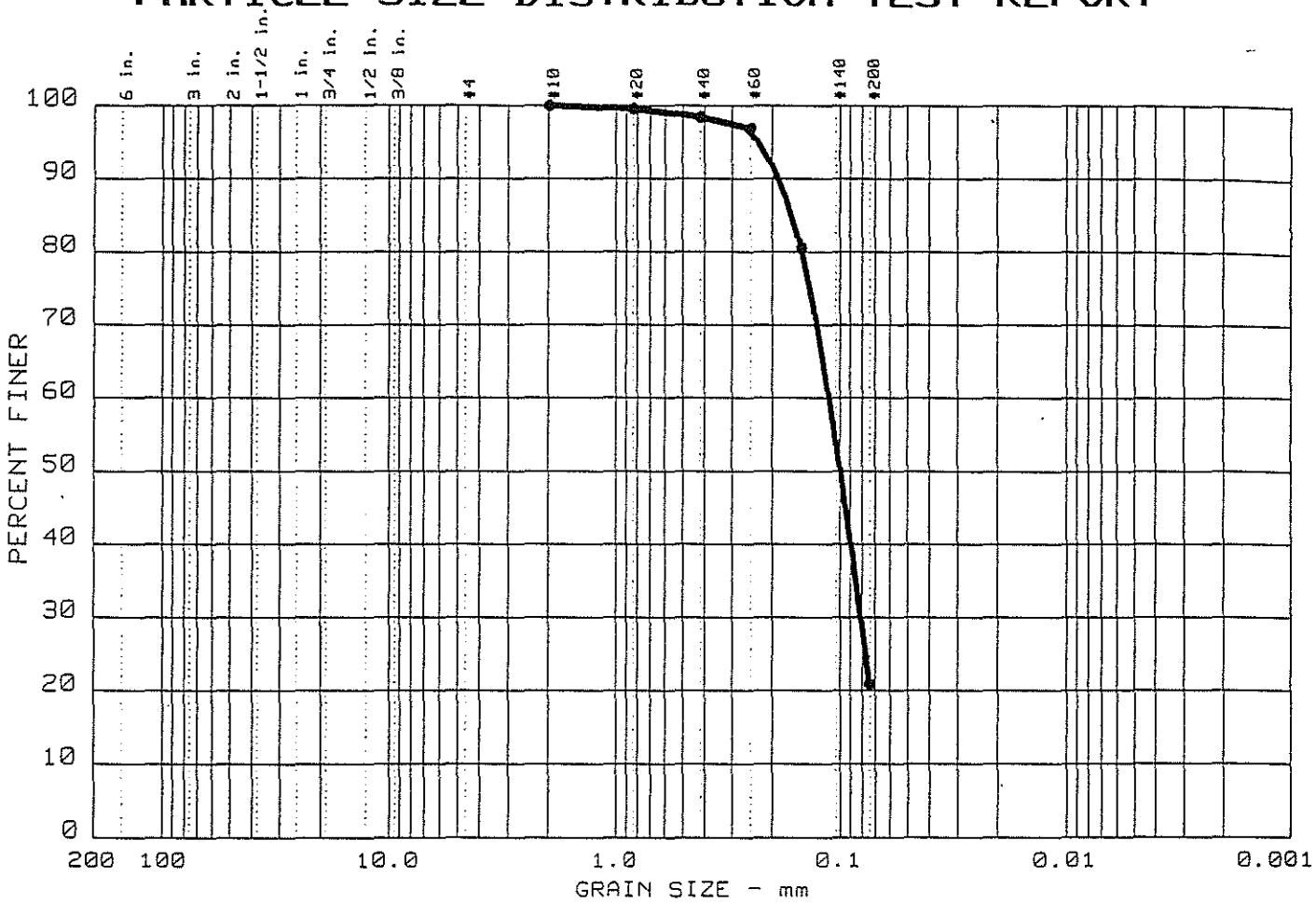
Project: FORT DEVENS

Date: 10/10/96 Data Sheet No. 21

# PARTICLE SIZE DISTRIBUTION TEST REPORT




| | % +3" | % GRAVEL | % SAND | % SILT | % CLAY | USCS | LL | PI |
|---|---|---|---|---|---|---|---|---|
| ● | 0.0 | 0.0 | 79.1 | 20.9 | | SM | | |
| | | | | | | | | |
| | | | | | | | | |

| SIEVE inches size | PERCENT FINER ● | | |
|---|---|---|---|
| | | | |
| | GRAIN SIZE | | |
| $D_{60}$ | 0.11 | | |
| $D_{30}$ | 0.08 | | |
| $D_{10}$ | | | |
| | COEFFICIENTS | | |
| $C_c$ | | | |
| $C_u$ | | | |

| SIEVE number size | PERCENT FINER ● | | |
|---|---|---|---|
| 10 | 100.0 | | |
| 20 | 99.6 | | |
| 40 | 98.4 | | |
| 60 | 96.8 | | |
| 100 | 80.5 | | |
| 200 | 20.9 | | |

Sample information:

● BX571005
F SAND; Sm Si; Tr M Sa.

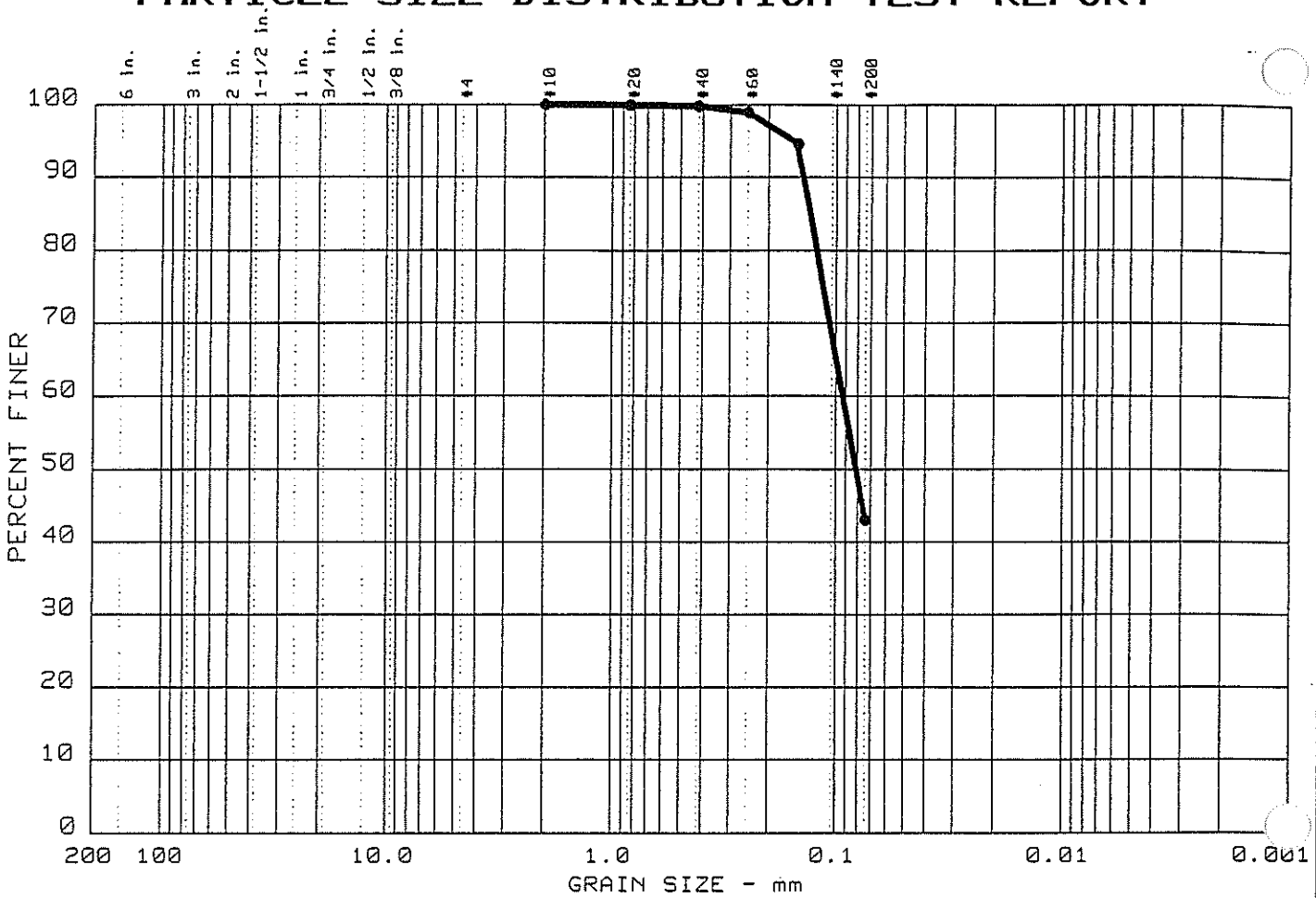
Remarks:
SIEVE ANALYSIS

**ABB Environmental Services, Inc.**

Project No.: 09144.08
Project: FORT DEVENS

Date: 10/10/96 Data Sheet No. 21

# PARTICLE SIZE DISTRIBUTION TEST REPORT




| | % +3" | % GRAVEL | % SAND | % SILT | % CLAY | USCS | LL | PI |
|---|---|---|---|---|---|---|---|---|
| ● | 0.0 | 0.0 | 57.0 | 43.0 | | SM | | |
| | | | | | | | | |
| | | | | | | | | |

| SIEVE inches size | PERCENT FINER ● | | |
|---|---|---|---|
| | | | |
| | GRAIN SIZE | | |
| $D_{60}$ | 0.09 | | |
| $D_{30}$ | | | |
| $D_{10}$ | | | |
| | COEFFICIENTS | | |
| $C_c$ | | | |
| $C_u$ | | | |

| SIEVE number size | PERCENT FINER ● | | |
|---|---|---|---|
| 10 | 100.0 | | |
| 20 | 99.9 | | |
| 40 | 99.8 | | |
| 60 | 98.9 | | |
| 100 | 94.5 | | |
| 200 | 43.0 | | |

Sample information:
● BX571105
Silty F SAND; Tr M Sa.

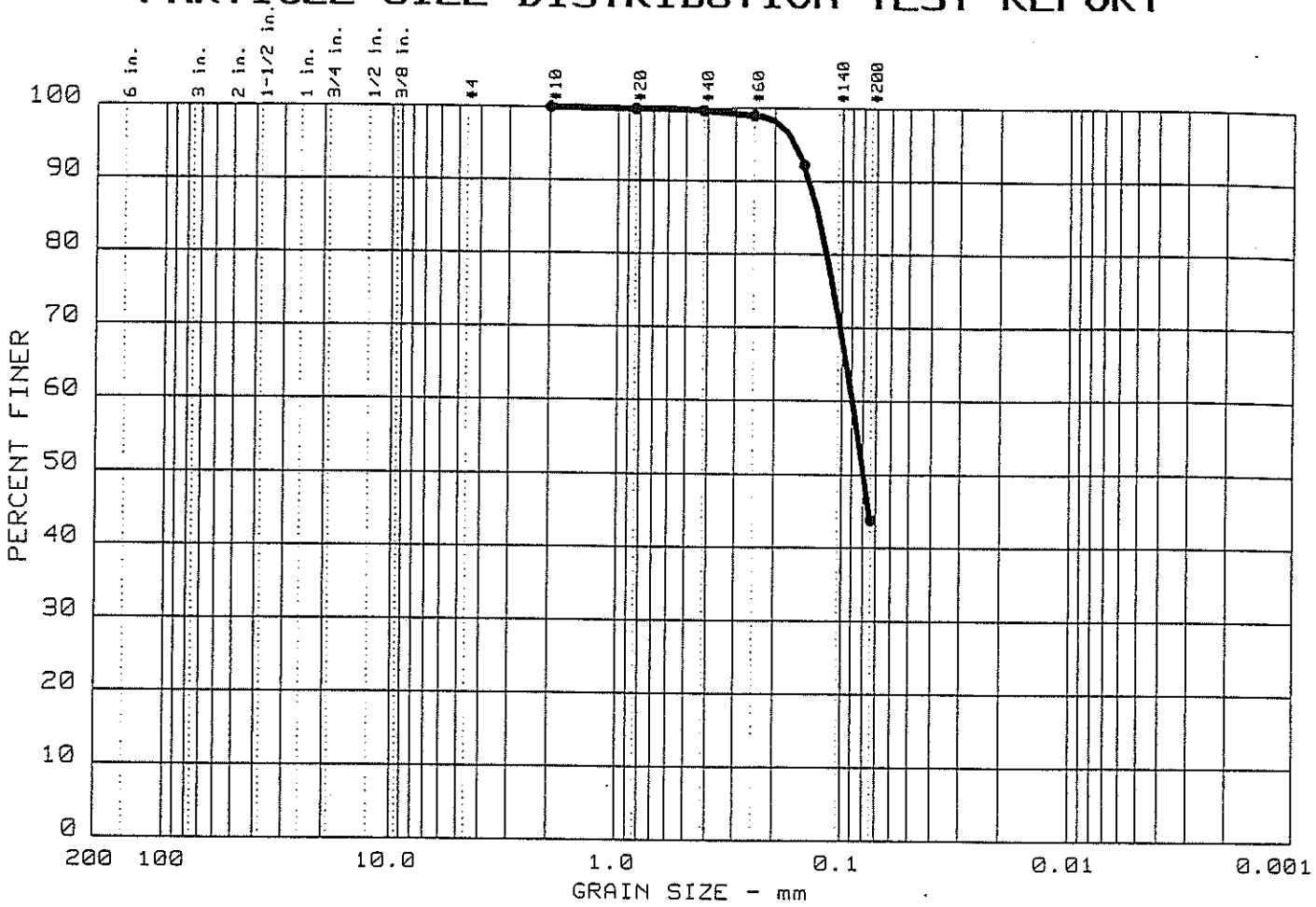
Remarks:
SIEVE ANALYSIS

**ABB Environmental Services, Inc.**

Project No.: 09144.08
Project: FORT DEVENS

Date: 10/10/96 Data Sheet No. 21

# PARTICLE SIZE DISTRIBUTION TEST REPORT




| | % +3" | % GRAVEL | % SAND | % SILT | % CLAY | USCS | LL | PI |
|---|---|---|---|---|---|---|---|---|
| ● | 0.0 | 0.0 | 56.2 | 43.8 | | SM | | |
| | | | | | | | | |
| | | | | | | | | |

| SIEVE inches size | PERCENT FINER ● | | |
|---|---|---|---|
| | | | |
| | GRAIN SIZE | | |
| $D_{60}$ | 0.09 | | |
| $D_{30}$ | | | |
| $D_{10}$ | | | |
| | COEFFICIENTS | | |
| $C_c$ | | | |
| $C_u$ | | | |

| SIEVE number size | PERCENT FINER ● | | |
|---|---|---|---|
| 10 | 100.0 | | |
| 20 | 99.8 | | |
| 40 | 99.6 | | |
| 60 | 99.0 | | |
| 100 | 92.2 | | |
| 200 | 43.8 | | |

Sample information:
● BX571204
Silty F SAND; Tr M Sa.

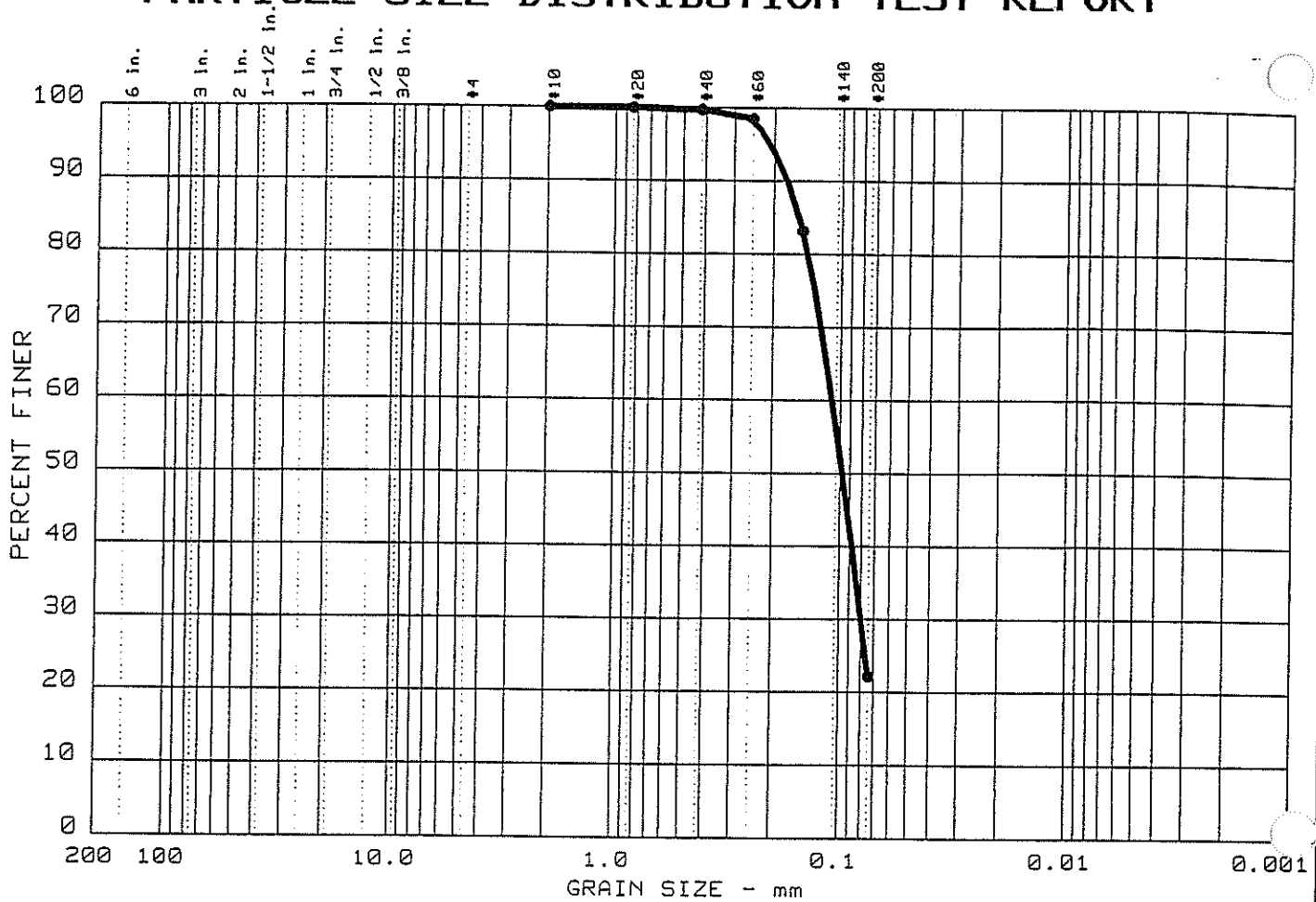
Remarks:
SIEVE ANALYSIS

**ABB Environmental Services, Inc.**

Project No.: 09144.08
Project: FORT DEVENS

Date: 10/10/96 Data Sheet No. 21

# PARTICLE SIZE DISTRIBUTION TEST REPORT




| | % +3" | % GRAVEL | % SAND | % SILT | % CLAY | USCS | LL | PI |
|---|---|---|---|---|---|---|---|---|
| ● | 0.0 | 0.0 | 77.8 | 22.2 | | SM | | |
| | | | | | | | | |
| | | | | | | | | |

| SIEVE inches size | PERCENT FINER ● | | |
|---|---|---|---|
| | | | |
| | GRAIN SIZE | | |
| $D_{60}$ | 0.11 | | |
| $D_{30}$ | 0.08 | | |
| $D_{10}$ | | | |
| | COEFFICIENTS | | |
| $C_c$ | | | |
| $C_u$ | | | |

| SIEVE number size | PERCENT FINER ● | | |
|---|---|---|---|
| 10 | 100.0 | | |
| 20 | 100.0 | | |
| 40 | 99.7 | | |
| 60 | 98.4 | | |
| 100 | 83.1 | | |
| 200 | 22.2 | | |

Sample information:

● BX571305
F SAND; Sm Si; Tr M Sa.

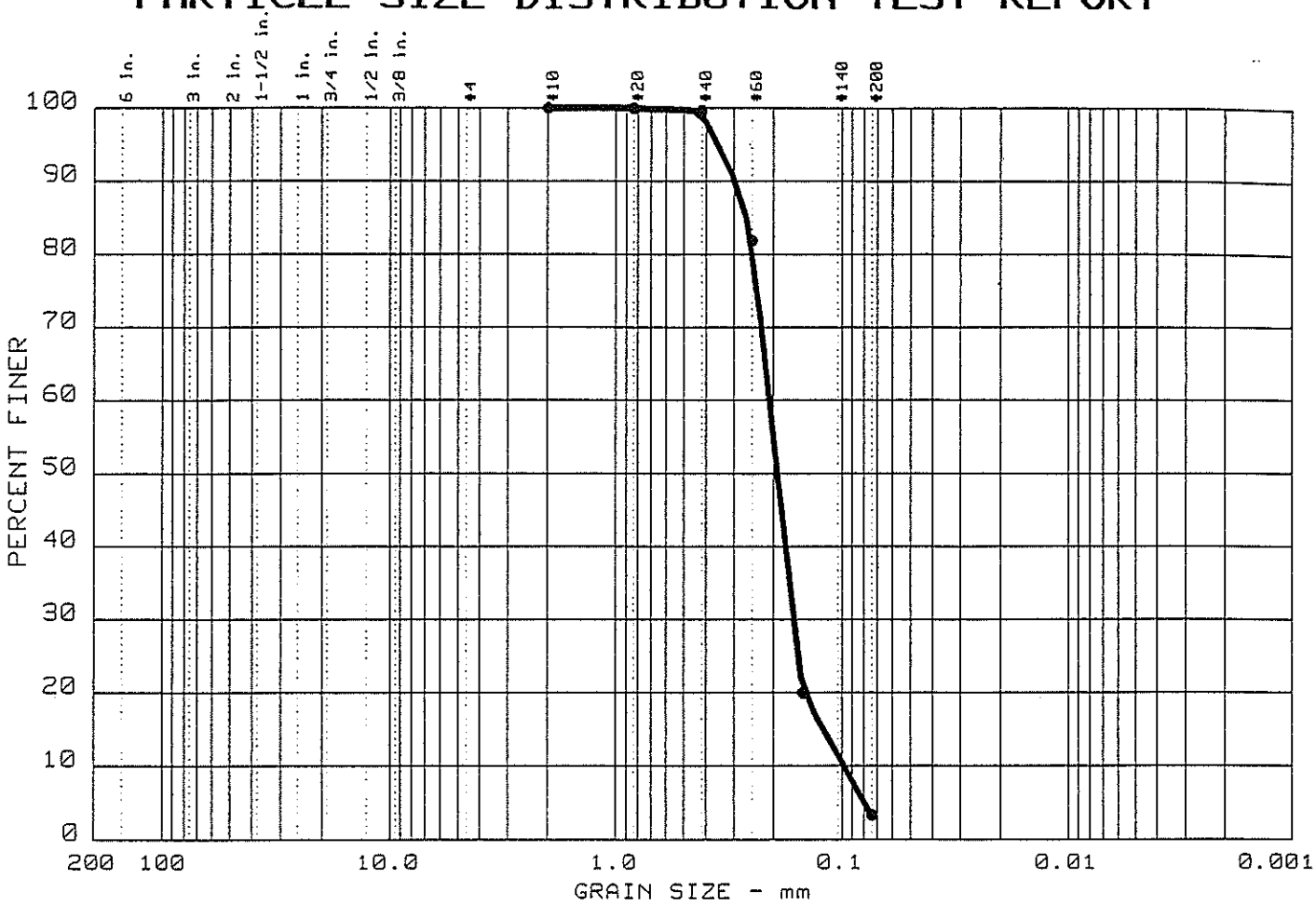
Remarks:
SIEVE ANALYSIS

**ABB Environmental Services, Inc.**

Project No.: 09144.08
Project: FORT DEVENS

Date: 10/10/96 Data Sheet No. 21

# PARTICLE SIZE DISTRIBUTION TEST REPORT




| | % +3" | % GRAVEL | % SAND | % SILT | % CLAY | USCS | LL | PI |
|---|---|---|---|---|---|---|---|---|
| ● | 0.0 | 0.0 | 96.7 | 3.3 | | SP | | |
| | | | | | | | | |
| | | | | | | | | |

| SIEVE inches size | PERCENT FINER ● | | |
|---|---|---|---|
| | | | |
| | GRAIN SIZE | | |
| $D_{60}$ | 0.21 | | |
| $D_{30}$ | 0.16 | | |
| $D_{10}$ | 0.09 | | |
| | COEFFICIENTS | | |
| $C_c$ | 1.29 | | |
| $C_u$ | 2.1 | | |

| SIEVE number size | PERCENT FINER ● | | |
|---|---|---|---|
| 10 | 100.0 | | |
| 20 | 99.9 | | |
| 40 | 99.6 | | |
| 60 | 81.9 | | |
| 100 | 20.0 | | |
| 200 | 3.3 | | |

Sample information:

● EF572810
F SAND; Tr Si and M Sa.

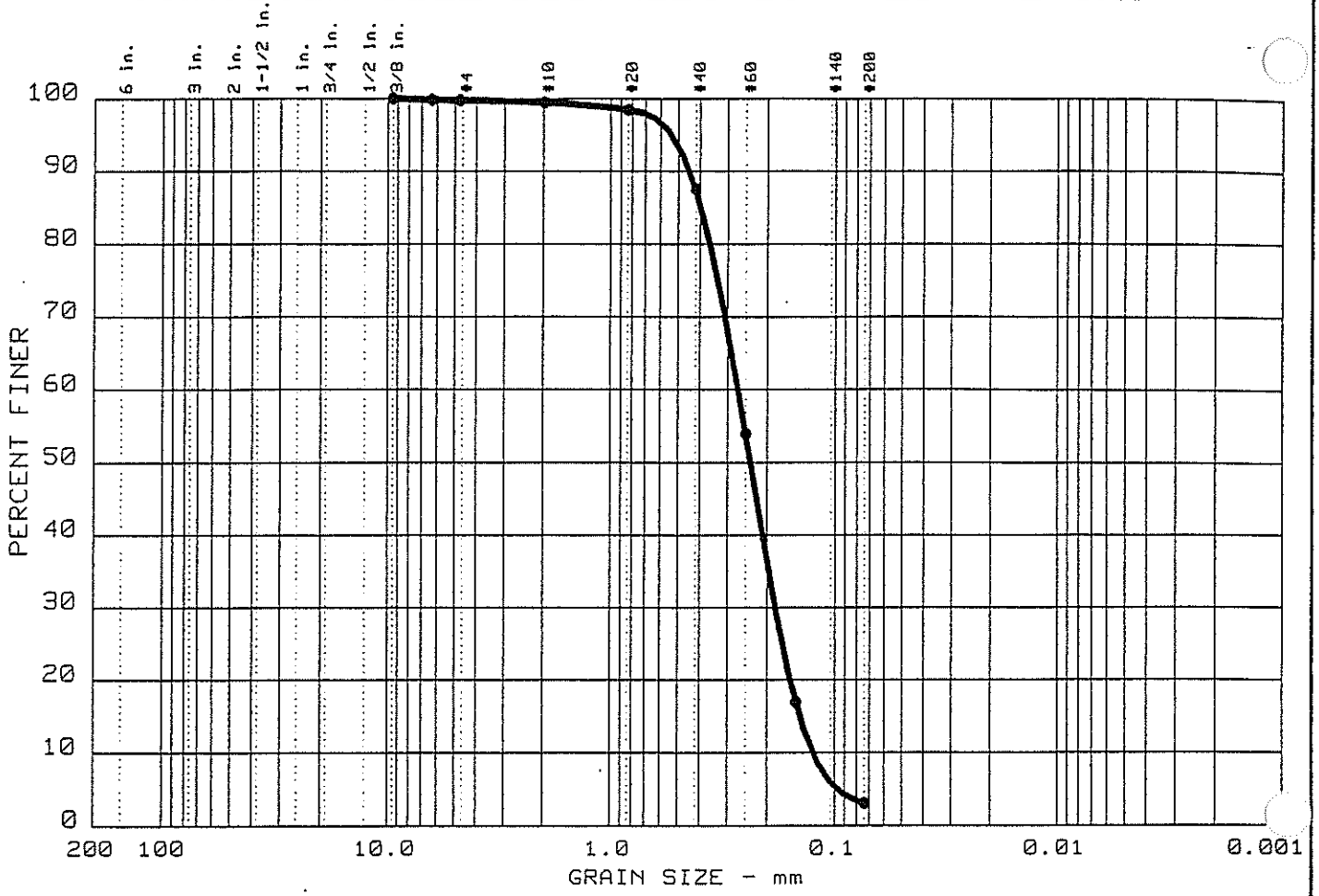
Remarks:
SIEVE ANALYSIS

**ABB Environmental Services, Inc.**

Project No.: 09144.08
Project: FORT DEVENS

Date: 10/10/96 Data Sheet No. 21

# PARTICLE SIZE DISTRIBUTION TEST REPORT




| | % +3" | % GRAVEL | % SAND | % SILT | % CLAY | USCS | LL | PI |
|---|---|---|---|---|---|---|---|---|
| ● | 0.0 | 0.3 | 96.7 | 3.0 | | SP | | |
| | | | | | | | | |
| | | | | | | | | |

| SIEVE inches size | PERCENT FINER ● | | |
|---|---|---|---|
| 0.375 | 100.0 | | |
| 0.25 | 99.8 | | |
| | GRAIN SIZE | | |
| $D_{60}$ | 0.27 | | |
| $D_{30}$ | 0.18 | | |
| $D_{10}$ | 0.12 | | |
| | COEFFICIENTS | | |
| $C_c$ | 1.00 | | |
| $C_u$ | 2.2 | | |

| SIEVE number size | PERCENT FINER ● | | |
|---|---|---|---|
| 4 | 99.7 | | |
| 10 | 99.4 | | |
| 20 | 98.4 | | |
| 40 | 87.5 | | |
| 60 | 54.0 | | |
| 100 | 16.9 | | |
| 200 | 3.1 | | |

Sample information:

● EX572911
F SAND; Tr M Sa and Si.

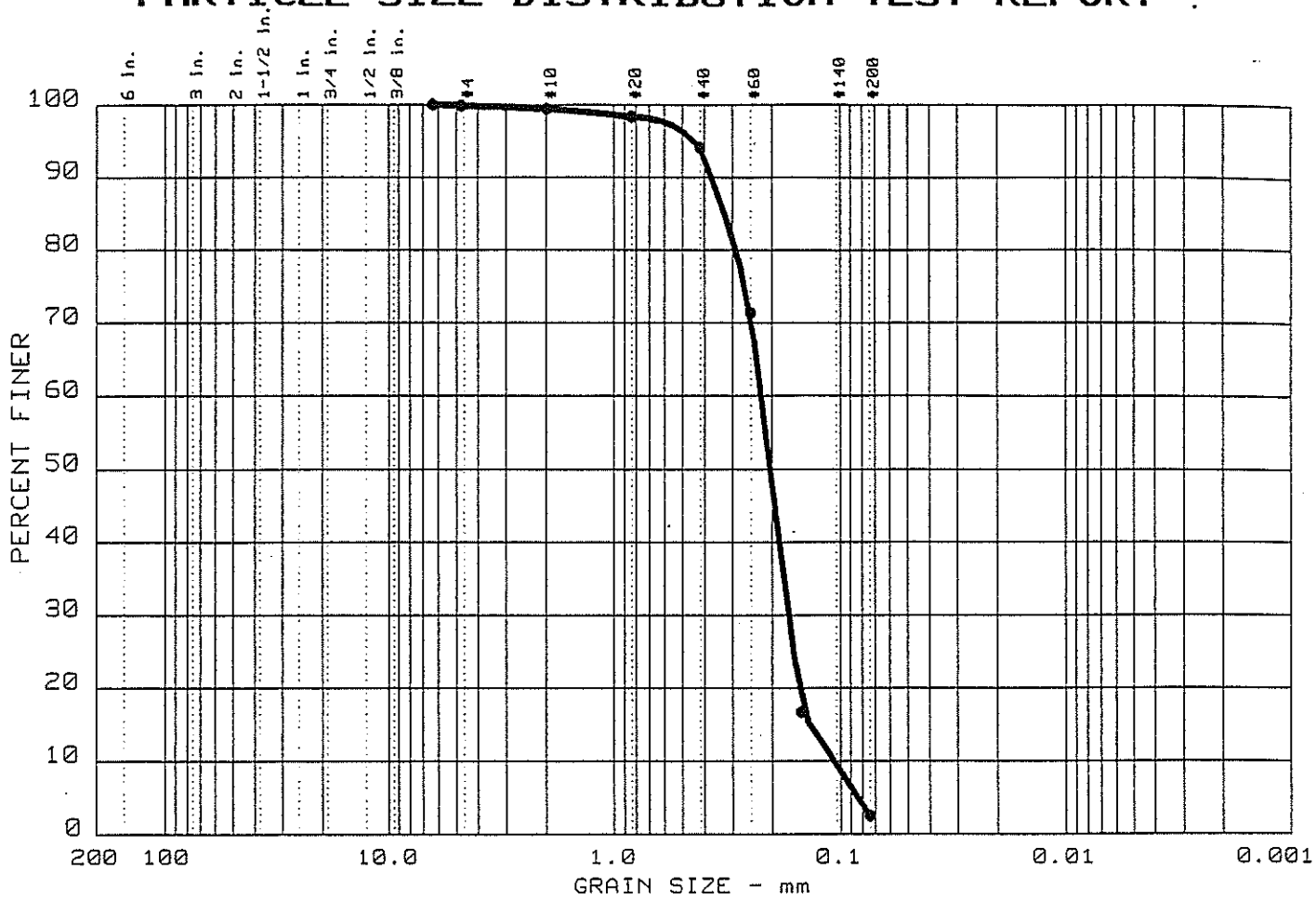
Remarks:
SIEVE ANALYSIS

**ABB Environmental Services, Inc.**

Project No.: 09144.08
Project: FORT DEVENS

Date: 10/10/96 Data Sheet No. 21

# PARTICLE SIZE DISTRIBUTION TEST REPORT




| | % +3" | % GRAVEL | % SAND | % SILT | % CLAY | USCS | LL | PI |
|---|---|---|---|---|---|---|---|---|
| ● | 0.0 | 0.2 | 97.4 | 2.4 | | SP | | |
| | | | | | | | | |
| | | | | | | | | |

| SIEVE inches size | PERCENT FINER ● | | |
|---|---|---|---|
| 0.25 | 100.0 | | |
| | GRAIN SIZE | | |
| $D_{60}$ | 0.22 | | |
| $D_{30}$ | 0.17 | | |
| $D_{10}$ | 0.10 | | |
| | COEFFICIENTS | | |
| $C_c$ | 1.19 | | |
| $C_u$ | 2.1 | | |

| SIEVE number size | PERCENT FINER ● | | |
|---|---|---|---|
| 4 | 99.8 | | |
| 10 | 99.4 | | |
| 20 | 98.4 | | |
| 40 | 94.1 | | |
| 60 | 71.4 | | |
| 100 | 16.8 | | |
| 200 | 2.5 | | |

Sample information:

● EX573106
F SAND; Tr M and C Sa and Si.

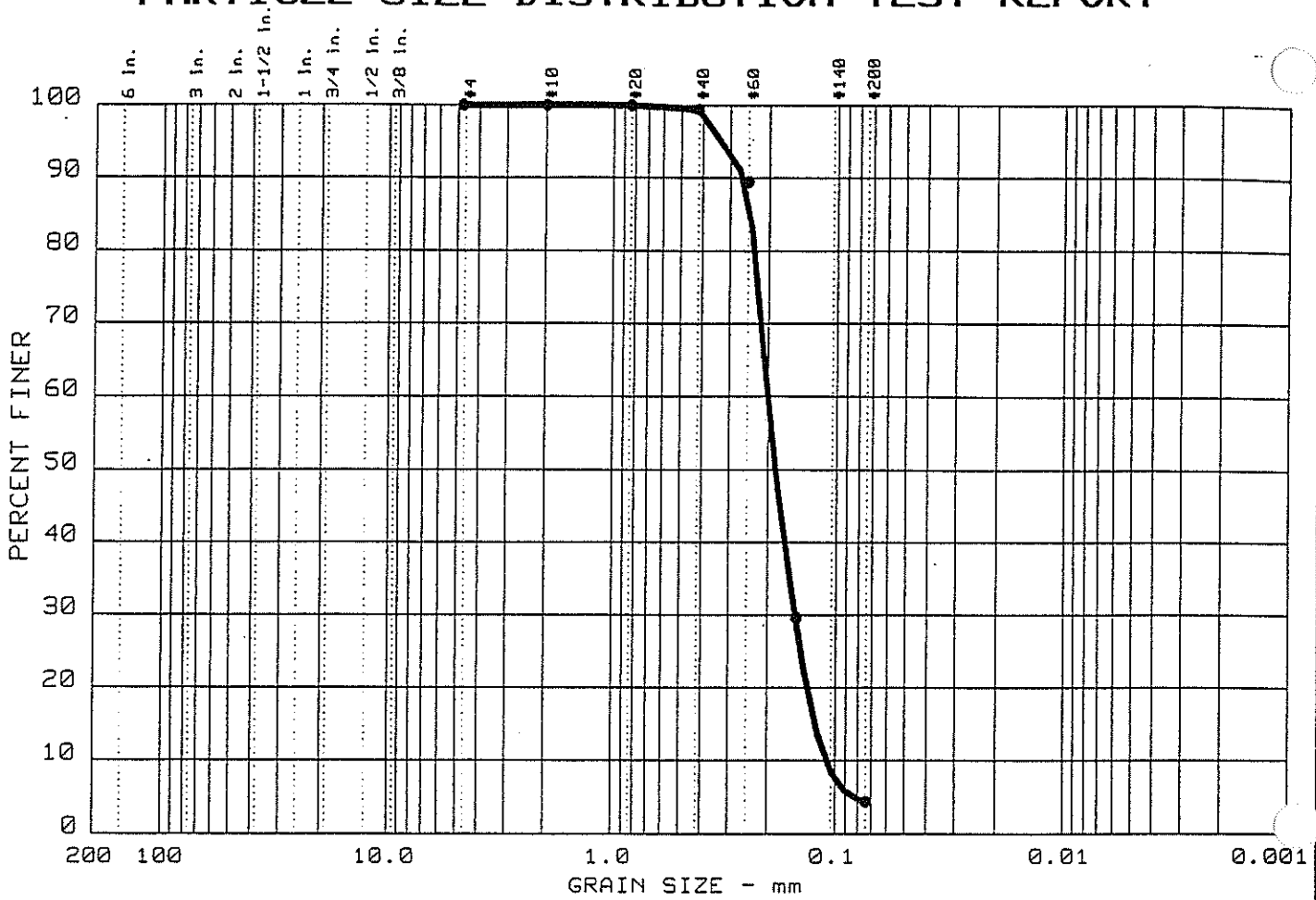
Remarks:
SIEVE ANALYSIS

**ABB Environmental Services, Inc.**

Project No.: 09144.08
Project: FORT DEVENS

Date: 10/10/96 Data Sheet No. 21

# PARTICLE SIZE DISTRIBUTION TEST REPORT




| | % +3" | % GRAVEL | % SAND | % SILT | % CLAY | USCS | LL | PI |
|---|---|---|---|---|---|---|---|---|
| ● | 0.0 | 0.0 | 95.6 | 4.4 | | SP | | |
| | | | | | | | | |
| | | | | | | | | |

| SIEVE inches size | PERCENT FINER ● | | |
|---|---|---|---|
| | | | |
| | GRAIN SIZE | | |
| $D_{60}$ | 0.20 | | |
| $D_{30}$ | 0.15 | | |
| $D_{10}$ | 0.10 | | |
| | COEFFICIENTS | | |
| $C_c$ | 1.01 | | |
| $C_u$ | 1.8 | | |

| SIEVE number size | PERCENT FINER ● | | |
|---|---|---|---|
| 4 | 100.0 | | |
| 10 | 100.0 | | |
| 20 | 100.0 | | |
| 40 | 99.4 | | |
| 60 | 89.4 | | |
| 100 | 29.6 | | |
| 200 | 4.4 | | |

Sample information:

● 57M-96-09X
F SAND; Tr M and C Sa and Si.

Remarks:
SIEVE ANALYSIS

**ABB Environmental Services, Inc.**

Project No.: 09144.08
Project: FORT DEVENS

Date: 10/10/96 Data Sheet No. 21

# PROJECT ANALYTE LIST

APPENDIX K
PROJECT ANALYTE LIST

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

| TEST NAME | PARAMETER NAME | SOIL | | WATER | |
|---|---|---|---|---|---|
| | | CRL | UNIT | CRL | UNIT |
| **PAL INORGANICS** | | | | | |
| AL | ALUMINUM | 2.35 | ug/g | 141 | ug/l |
| SB | ANTIMONY | 0.109 | ug/g | 3.03 | ug/l |
| AS | ARSENIC | 0.25 | ug/g | 2.54 | ug/l |
| BA | BARIUM | 5.18 | ug/g | 5 | ug/l |
| BE | BERYLLIUM | 0.5 | ug/g | 5 | ug/l |
| CD | CADMIUM | 0.7 | ug/g | 4.01 | ug/l |
| CA | CALCIUM | 100 | ug/g | 500 | ug/l |
| CR | CHROMIUM | 4.05 | ug/g | 6.02 | ug/l |
| CO | COBALT | 1.42 | ug/g | 25 | ug/l |
| CU | COPPER | 0.965 | ug/g | 8.09 | ug/l |
| FE | IRON | 3.68 | ug/g | 38.8 | ug/l |
| PB | LEAD | 0.177 | ug/g | 1.26 | ug/l |
| MG | MAGNESIUM | 100 | ug/g | 500 | ug/l |
| MN | MANGANESE | 2.05 | ug/g | 2.75 | ug/l |
| HG | MERCURY | 0.05 | ug/g | 0.243 | ug/l |
| NI | NICKEL | 1.71 | ug/g | 34.3 | ug/l |
| K | POTASSIUM | 100 | ug/g | 375 | ug/l |
| SE | SELENIUM | 0.25 | ug/g | 3.02 | ug/l |

continued

# APPENDIX K
# PROJECT ANALYTE LIST

## REMEDIAL INVESTIGATION REPORT
## DEVENS, MASSACHUSETTS

| TEST NAME | PARAMETER NAME | SOIL | | WATER | |
|---|---|---|---|---|---|
| | | CRL | UNIT | CRL | UNIT |
| AG | SILVER | 0.589 | ug/g | 4.6 | ug/l |
| NA | SODIUM | 100 | ug/g | 500 | ug/l |
| TL | THALLIUM | 0.319 | ug/g | 6.99 | ug/l |
| V | VANADIUM | 3.39 | ug/g | 11 | ug/l |
| ZN | ZINC | 8.03 | ug/g | 21 | ug/l |
| **PAL EXPLOSIVES** | | | | | |
| 135TNB | 1,3,5-TRINITROBENZENE | 0.488 | ug/g | 0.449 | ug/l |
| 13DNB | 1,3-DINITROBENZENE | 0.496 | ug/g | 0.611 | ug/l |
| 246TNT | 2,4,6-TRINITROTOLUENE | 0.456 | ug/g | 0.635 | ug/l |
| 24DNT | 2,4-DINITROTOLUENE | 0.424 | ug/g | 0.0637 | ug/l |
| 26DNT | 2,6-DINITROTOLUENE | 0.524 | ug/g | 0.0738 | ug/l |
| HMX | CYCLOTETRAMETHYLENETETRANITRAMINE | 0.666 | ug/g | 1.21 | ug/l |
| NB | NITROBENZENE | 2.41 | ug/g | 0.645 | ug/l |
| RDX | CYCLONITE | 0.587 | ug/g | 1.17 | ug/l |
| TETRYL | NITRAMINE | 0.731 | ug/g | 1.56 | ug/l |
| NG | NITROGLYCERINE | 4 | ug/g | 10 | ug/l |
| PETN | PENTAERYTHRITOL TETRANITRATE | 4 | ug/g | 20 | ug/l |

continued

# APPENDIX K
# PROJECT ANALYTE LIST

## REMEDIAL INVESTIGATION REPORT
## DEVENS, MASSACHUSETTS

| TEST NAME | PARAMETER NAME | SOIL | | WATER | |
|---|---|---|---|---|---|
| | | CRL | UNIT | CRL | UNIT |
| **PAL ANIONS/CATIONS** | | | | | |
| HCO3 | BICARBONATE | NA | | NA | ug/l |
| CL | CHLORIDE | NA | | 2,120 | ug/l |
| SO4 | SULFATE | NA | | 10,000 | ug/l |
| NO3 | NITRATE | NA | | 10 | ug/l |
| CA | CALCIUM | NA | | 500 | ug/l |
| K | POTASSIUM | NA | | 375 | ug/l |
| MG | MAGNESIUM | NA | | 500 | ug/l |
| **PAL WATER QUALITY PARAMETERS** | | | | | |
| CL | CHLORIDES | NA | | 2,120 | ug/l |
| N2KJEL | TOTAL NITROGEN | NA | | 183 | ug/l |
| NIT | NO3-N | NA | | 10 | ug/l |
| SO4 | SULFATES | NA | | 10,000 | ug/l |
| TPO4 | TOTAL PHOSPHORUS | NA | | 13.3 | ug/l |
| -- | HARDNESS | NA | | NA | ug/l |
| ALK | ALKALINITY | NA | | NA | ug/l |
| TSS | TOTAL SUSPENDED SOLIDS | NA | | NA | ug/l |
| DO | DISSOLVED OXYGEN | NA | | NA | ug/l |

continued

# APPENDIX K
# PROJECT ANALYTE LIST

## REMEDIAL INVESTIGATION REPORT
## DEVENS, MASSACHUSETTS

| TEST NAME | PARAMETER NAME | SOIL | | WATER | |
|---|---|---|---|---|---|
| | | CRL | UNIT | CRL | UNIT |
| **PAL ORGANICS VOLATILE COMPOUNDS** | | | | | |
| 111TCE | 1,1,1-TRICHLOROETHANE | 0.0044 | ug/g | 0.5 | ug/l |
| 112TCE | 1,1,2-TRICHLOROETHANE | 0.0054 | ug/g | 1.2 | ug/l |
| 11DCE | 1,1-DICHLOROETHYLENE/ 1,1-DICHLOROETHENE | 0.0039 | ug/g | 0.5 | ug/l |
| 11DCLE | 1,1-DICHLOROETHANE | 0.0023 | ug/g | 0.68 | ug/l |
| 12DCE | 1,2-DICHLOROETHYLENES, TOTAL (CIS AND TRANS ISOMERS) | 0.003 | ug/g | 0.5 | ug/l |
| 12DCLE | 1,2-DICHLOROETHANE | 0.0017 | ug/g | 0.5 | ug/l |
| 12DCLP | 1,2-DICHLOROPROPANE | 0.0029 | ug/g | 0.5 | ug/l |
| ACET | ACETONE | 0.017 | ug/g | 13 | ug/l |
| BRDCLM | BROMODICHLOROMETHANE | 0.0029 | ug/g | 0.59 | ug/l |
| C2H3CL | CHLOROETHENE/VINYL CHLORIDE | 0.0062 | ug/g | 2.6 | ug/l |
| C2H5CL | CHLOROETHANE | 0.012 | ug/g | 1.9 | ug/l |
| C6H6 | BENZENE | 0.0015 | ug/g | 0.5 | ug/l |
| CCL4 | CARBON TETRACHLORIDE | 0.007 | ug/g | 0.5 | ug/l |
| CH2CL2 | METHYLENE CHLORIDE | 0.012 | ug/g | 2.3 | ug/l |
| CH3BR | BROMOMETHANE | 0.0057 | ug/g | 5.8 | ug/l |
| CH3CL | CHLOROMETHANE | 0.0088 | ug/g | 3.2 | ug/l |

continued

# APPENDIX K
# PROJECT ANALYTE LIST

## REMEDIAL INVESTIGATION REPORT
## DEVENS, MASSACHUSETTS

| TEST NAME | PARAMETER NAME | SOIL | | WATER | |
|---|---|---|---|---|---|
| | | CRL | UNIT | CRL | UNIT |
| CHBR3 | BROMOFORM | 0.0069 | ug/g | 2.6 | ug/l |
| C13DCP | CIS-1,3-DICHLOROPROPYLENE C+S-1,3-DICHLOROPROPENE | 0.0032 | ug/g | 0.58 | ug/l |
| CHCL3 | CHLOROFORM | 0.00087 | ug/g | 0.5 | ug/l |
| CL2CH2 | DICHLOROMETHANE | 12 | ug/g | 2.3 | ug/l |
| CLC6H5 | CHLOROBENZENE | 0.00086 | ug/g | 0.5 | ug/l |
| CS2 | CARBON DISULFIDE | 0.0044 | ug/g | 0.5 | ug/l |
| DBRCLM | DIBROMOCHLOROMETHANE | 0.0031 | ug/g | 0.67 | ug/l |
| ETC6H5 | ETHYLBENZENE | 0.0017 | ug/g | 0.5 | ug/l |
| MEC6H5 | TOLUENE | 0.00078 | ug/g | 0.5 | ug/l |
| MEK | METHYLETHYL KETONE/2-BUTANONE | 0.07 | ug/g | 6.4 | ug/l |
| MIBK | METHYLISOBUTYL KETONE | 0.027 | ug/g | 3 | ug/l |
| MNBK | METHYL-N-BUTYL KETONE/2-HEXANONE | 0.032 | ug/g | 3.6 | ug/l |
| STYR | STYRENE | 0.0026 | ug/g | 0.5 | ug/l |
| T13DCP | TRANS-1,3-DICHLOROPROPENE | 0.0028 | ug/g | 0.7 | ug/l |
| TCLEA | 1,1,2,2-TETRACHLOROETHANE | 0.0024 | ug/g | 0.51 | ug/l |
| TCLEE | TETRACHLOROETHYLENE/ TETRACHLOROETHENE | 0.00081 | ug/g | 1.6 | ug/l |

continued

# APPENDIX K
# PROJECT ANALYTE LIST

## REMEDIAL INVESTIGATION REPORT
## DEVENS, MASSACHUSETTS

| TEST NAME | PARAMETER NAME | SOIL | | WATER | |
|---|---|---|---|---|---|
| | | CRL | UNIT | CRL | UNIT |
| TRCLE | TRICHLOROTHYLENE/TRICHLOROETHENE | 0.0028 | ug/g | 0.5 | ug/l |
| TXYLEN | XYLENES, TOTAL COMBINED | 1.5 | ug/g | 0.84 | ug/l |
| **PAL ORGANICS SEMIVOLATILE COMPOUNDS** | | | | | |
| 124TCB | 1,2,4-TRICHLOROBENZENE | 0.04 | ug/g | 1.8 | ug/l |
| 12DCLB | 1,2-DICHLOROBENEZENE | 0.11 | ug/g | 1.7 | ug/l |
| 13DCLB | 1,3-DICHLOROBENZENE | 0.13 | ug/g | 1.7 | ug/l |
| 14DCLB | 1,4-DICHLOROBENZENE | 0.098 | ug/g | 1.7 | ug/l |
| 245TCP | 2,4,5-TRICHLOROPHENOL | 0.1 | ug/g | 5.2 | ug/l |
| 246TCP | 2,4,6-TRICHLOROPHENOL | 0.17 | ug/g | 13 | ug/l |
| 24DCLP | 2,4-DICHLOROPHENOL | 0.18 | ug/g | 2.9 | ug/l |
| 24DMPN | 2,4-DIMETHYLPHENOL | 0.69 | ug/g | 5.8 | ug/l |
| 24DNP | 2,4-DINITROPHENOL | 1.2 | ug/g | 21 | ug/l |
| 24DNT | 2,4-DINITROTOLUENE | 0.14 | ug/g | 4.5 | ug/l |
| 26DNT | 2,6-DINITROTOLUENE | 0.085 | ug/g | 0.79 | ug/l |
| 2CLP | 2-CHLOROPHENOL | 0.06 | ug/g | 0.99 | ug/l |
| 2CNAP | 2-CHLORONAPHTHALENE | 0.036 | ug/g | 0.5 | ug/l |
| 2MNAP | 2-METHYLNAPHTHALENE | 0.049 | ug/g | 1.7 | ug/l |
| 2MP | 2-METHYLPHENOL/2-CRESOL | 0.029 | ug/g | 3.9 | ug/l |

continued

# APPENDIX K
# PROJECT ANALYTE LIST

## REMEDIAL INVESTIGATION REPORT
## DEVENS, MASSACHUSETTS

| TEST NAME | PARAMETER NAME | SOIL | | WATER | |
|---|---|---|---|---|---|
| | | CRL | UNIT | CRL | UNIT |
| 2NANIL | 2-NITROANILINE | 0.062 | ug/g | 4.3 | ug/l |
| 2NP | 2-NITROPHENOL | 0.14 | ug/g | 3.7 | ug/l |
| 33DCBD | 3,3'-DICHLOROBENZIDINE | 6.3 | ug/g | 12 | ug/l |
| 3NANIL | 3-NITROANILINE | 0.45 | ug/g | 4.9 | ug/l |
| 46DN2C | 4,6-DINITRO-2-CRESOL/ METHYL-4,6-DINITROPHENOL | 0.55 | ug/g | 17 | ug/l |
| 4BRPPE | 4-BROMOPHENYLPHENYL ETHER | 0.033 | ug/g | 4.2 | ug/l |
| 4CANIL | 4-CHLOROANILINE | 0.81 | ug/g | 7.3 | ug/l |
| 4CL3C | 4-CHLORO-3-CRESOL/ 3-METHYL-4-CHLOROPHENOL | 0.095 | ug/g | 4 | ug/l |
| 4CLPPE | 4-CHLOROPHENYLPHENYL ETHER | 0.033 | ug/g | 5.1 | ug/l |
| 4MP | 4-METHYLPHENOL/4-CRESOL | 0.24 | ug/g | 0.52 | ug/l |
| 4NANIL | 4-NITROANILINE | 0.41 | ug/g | 5.2 | ug/l |
| 4NP | 4-NITROPHENOL | 1.4 | ug/g | 12 | ug/l |
| ANAPNE | ACENAPHTHENE | 0.036 | ug/g | 1.7 | ug/l |
| ANAPYL | ACENAPHTHYLENE | 0.033 | ug/g | 0.5 | ug/l |
| ANTRC | ANTHRACENE | 0.033 | ug/g | 0.5 | ug/l |
| B2CEXM | BIS (2-CHLOROETHOXY) METHANE | 0.059 | ug/g | 1.5 | ug/l |
| B2CIPE | BIS (2-CHLOROISOPROPYL) ETHER | 0.2 | ug/g | 5.3 | ug/l |

continued

# APPENDIX K
# PROJECT ANALYTE LIST

## REMEDIAL INVESTIGATION REPORT
## DEVENS, MASSACHUSETTS

| TEST NAME | PARAMETER NAME | SOIL | | WATER | |
|---|---|---|---|---|---|
| | | CRL | UNIT | CRL | UNIT |
| B2CLEE | BIS ( 2-CHLOROETHYL) ETHER/ 2,2-OXYBIS(1-CHLOROPROPANE) | 0.033 | ug/g | 1.9 | ug/l |
| B2EHP | BIS (2-ETHYLHEXYL) PHTHALATE | 0.62 | ug/g | 4.8 | ug/l |
| BAANTR | BENZO [A] ANTHRACENE | 0.17 | ug/g | 1.6 | ug/l |
| BAPYR | BENZO [A] PYRENE | 0.25 | ug/g | 4.7 | ug/l |
| BBFANT | BENZO [B] FLUORANTHENE | 0.21 | ug/g | 5.4 | ug/l |
| BBZP | BUTYLBENZYL PHTHALATE | 0.17 | ug/g | 3.4 | ug/l |
| BGHIPY | BENZO [G,H,I] PERYLENE | 0.25 | ug/g | 6.1 | ug/l |
| BKFANT | BENZO [K] FLUORANTHENE | 0.066 | ug/g | 0.87 | ug/l |
| BZALC | BENZYL ALCOHOL | 0.19 | ug/g | 0.72 | ug/l |
| CARBAZ | CARBAZOLE | No certified limit | | No certified limit | |
| CHRY | CHRYSENE | 0.12 | ug/g | 2.4 | ug/l |
| CL6BZ | HEXACHLOROBENZENE | 0.033 | ug/g | 1.6 | ug/l |
| CL6CP | HEXACHLOROCYCLOPNTADIENE | 6.2 | ug/g | 8.6 | ug/l |
| CL6ET | HEXACHLOROETHANE | 0.15 | ug/g | 1.5 | ug/l |
| DBAHA | DIBENZ [A,H] ANTHRACENE | 0.21 | ug/g | 6.5 | ug/l |
| DBZFUR | DIBENZOFURAN | 0.035 | ug/g | 1.7 | ug/l |
| DEP | DIETHYL PHTHALATE | 0.24 | ug/g | 2 | ug/l |
| DMP | DIMETHYL PHTHALATE | 0.17 | ug/g | 1.5 | ug/l |

continued

# APPENDIX K
# PROJECT ANALYTE LIST

## REMEDIAL INVESTIGATION REPORT
## DEVENS, MASSACHUSETTS

| TEST NAME | PARAMETER NAME | SOIL | | WATER | |
|---|---|---|---|---|---|
| | | CRL | UNIT | CRL | UNIT |
| DNBP | DI-N-BUTYL PHTHALATE | 0.061 | ug/g | 3.7 | ug/l |
| DNOP | DI-N-OCTYL PHTHALATE | 0.19 | ug/g | 15 | ug/l |
| FANT | FLUORANTHENE | 0.068 | ug/g | 3.3 | ug/l |
| FLRENE | FLUORENE | 0.033 | ug/g | 3.7 | ug/l |
| HCBD | HEXACHLOROBUTADIENE | 0.23 | ug/g | 3.4 | ug/l |
| ICDPYR | INDENO [1,2,3-C,D] PYRENE | 0.29 | ug/g | 8.6 | ug/l |
| ISOPHR | ISOPHORONE | 0.033 | ug/g | 4.8 | ug/l |
| NAP | NAPHTHALENE | 0.037 | ug/g | 0.5 | ug/l |
| NB | NITROBENZENE | 0.045 | ug/g | 0.5 | ug/l |
| NNDNPA | N-NITROSO DI-N-PROPYLAMINE | 0.2 | ug/g | 4.4 | ug/l |
| NNDPA | N-NITROSO DIPHENYLAMINE | 0.19 | ug/g | 3 | ug/l |
| PCP | PENTACHLOROPHENOL | 1.3 | ug/g | 18 | ug/l |
| PHANTR | PHENANTHRENE | 0.033 | ug/g | 0.5 | ug/l |
| PHENOL | PHENOL | 0.11 | ug/g | 9.2 | ug/l |
| PYR | PYRENE | 0.033 | ug/g | 2.8 | ug/l |
| **PAL ORGANICS PESTICIDES AND PCBS** | | | | | |
| ABHC | ALPHA-BENZENEHEXACHLORIDE/ ALPHA-HEXACHLOROCYCLOHEXANE | 0.00907 | ug/g | 0.0385 | ug/l |
| ACLDAN | ALPHA CHLORDANE | 0.005 | ug/g | 0.075 | ug/l |

continued

# APPENDIX K
# PROJECT ANALYTE LIST

## REMEDIAL INVESTIGATION REPORT
## DEVENS, MASSACHUSETTS

| TEST NAME | PARAMETER NAME | SOIL | | WATER | |
|---|---|---|---|---|---|
| | | CRL | UNIT | CRL | UNIT |
| AENSLF | ALPHA-ENDOSULFAN/ENDOSULFAN I | 0.00602 | ug/g | 0.023 | ug/l |
| ALDRN | ALDRIN | 0.00729 | ug/g | 0.0918 | ug/l |
| BBHC | BETA-BENZENEHEXACHLORIDE/ BETA-HEXACHLOROCYCLOHEXANE | 0.00257 | ug/g | 0.024 | ug/l |
| BENSLF | BETA-ENDOSULFAN/ENDOSULFAN II | 0.00663 | ug/g | 0.023 | ug/l |
| DBHC | DELTA-BENZENEHEXACHLORIDE/ DELTA-HEXACHLOROCYCLOHEXANE | 0.00555 | ug/g | 0.0293 | ug/l |
| DLDRN | DIELDRIN | 0.00629 | ug/g | 0.024 | ug/l |
| ENDRN | ENDRIN | 0.00657 | ug/g | 0.0238 | ug/l |
| ENDRNA | ENDRIN ALDEHYDE | 0.024 | ug/g | 0.0285 | ug/l |
| ENDRNK | ENDRIN KETONE | Not certified | | Not certified | |
| ESFS04 | ENDOSULFAN SULFATE | 0.00763 | ug/g | 0.0786 | ug/l |
| GCLDAN | GAMA-CHLORDANE | 0.005 | ug/g | 0.075 | ug/l |
| HPCL | HEPTACHLOR | 0.00618 | ug/g | 0.0423 | ug/l |
| HPCLE | HEPTACHLOR EPOXIDE | 0.0062 | ug/g | 0.0245 | ug/l |
| LIN | LINDANE/GAMMA-BENZENEHEXACHLORIDE/ GAMMA-HEXACHLOROCYCLOHEXANE | 0.00638 | ug/g | 0.0507 | ug/l |
| MEXCLR | METHOXYCHLOR | 0.0711 | ug/g | 0.057 | ug/l |
| PCB016 | PCB 1016 | 0.0666 | ug/g | 0.16 | ug/l |
| PCB221 | PCB 1221 | 0.0666 | ug/g | 0.16 | ug/l |

continued

# APPENDIX K
# PROJECT ANALYTE LIST

## REMEDIAL INVESTIGATION REPORT
## DEVENS, MASSACHUSETTS

| TEST NAME | PARAMETER NAME | SOIL | | WATER | |
|---|---|---|---|---|---|
| | | CRL | UNIT | CRL | UNIT |
| PCB232 | PCB 1232 | 0.0666 | ug/g | 0.16 | ug/l |
| PCB242 | PCB 1242 | 0.0804 | ug/g | 0.19 | ug/l |
| PCB248 | PCB 1248 | 0.0804 | ug/g | 0.19 | ug/l |
| PCB254 | PCB 1254 | 0.0804 | ug/g | 0.19 | ug/l |
| PCB260 | PCB 1260 | 0.0804 | ug/g | 0.19 | ug/l |
| PPDDD | 2,2-BIS (PARA-CHLOROPHENYL)-1,1DICHLOROETHANE | 0.00826 | ug/g | 0.0233 | ug/l |
| PPDDE | 2,2-BIS (PARA-CHLOROPHENYL)-1,1-DICHLOROETHENE | 0.00765 | ug/g | 0.027 | ug/l |
| PPDDT | 2,2-BIS (PARA-CHLOROPHENYL)-1,1,1-TRICHLOROETHANE | 0.00707 | ug/g | 0.034 | ug/l |
| TXPHEN | TOXAPHENE | 0.444 | ug/g | 1.35 | ug/l |

**Notes:**

CRL = Certified Reporting Limit
NA = Not Applicable

# CALCULATION OF BACKGROUND CONCENTRATIONS

**TABLE L-1**
**AOC 57**

**REMEDIAL INVESTIGATION REPORT**
**DEVENS, MASSACHUSETTS**

| SOIL | | GROUNDWATER | |
|---|---|---|---|
| **Analyte** | **Concentration µg/g** | **Analyte** | **Concentration µg/L** |
| Aluminum | 18000 | Aluminum | 6870 |
| Antimony | 0.5 | Antimony | 3.03 |
| Arsenic | 19 | Arsenic | 10.5 |
| Barium | 54 | Barium | 39.6 |
| Beryllium | 0.81 | Beryllium | 5 |
| Cadmium | 1.28 | Cadmium | 4.01 |
| Calcium | 810 | Calcium | 14700 |
| Chromium | 33 | Chromium | 14.7 |
| Cobalt | 4.7 | Cobalt | 25 |
| Copper | 13.5 | Copper | 8.09 |
| Iron | 18000 | Iron | 9100 |
| Lead | 48 | Lead | 4.25 |
| Magnesium | 5500 | Magnesium | 3480 |
| Manganese | 380 | Manganese | 291 |
| Mercury | -- | Mercury | 0.243 |
| Nickel | 14.6 | Nickel | 34.3 |
| Potassium | 2400 | Potassium | 2370 |
| Selenium | -- | Selenium | 3.02 |
| Silver | 0.086 | Silver | 4.6 |
| Sodium | 131 | Sodium | 10800 |
| Thallium | -- | Thallium | 6.99 |
| Vanadium | 32.3 | Vanadium | 11 |
| Zinc | 43.9 | Zinc | 21.1 |

U.S. Army
Environmental
Center

# Remedial Investigations Report
# Functional Area II
# Volume IV of IV
# Appendices

## Fort Devens, Massachusetts

August 1994
Contract No. DAAA15-90-D-0012
Delivery Order No. 0003
ELIN A009

Prepared for:
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U.S. Army Environmental Center
Aberdeen Proving Ground, Maryland 21010-5401

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Arlington, Virginia 22209

*Printed on Recycled Paper*

Final

2&7RI1.PM4

AEC Form 45, 1 Feb 93 replaces THAMA Form 45 which is obsolete

# APPENDIX K

# BACKGROUND DATA RATIONALE

## INTRODUCTION

On 10 September 1993, representatives from Ecology and Environment, Inc. (E & E), Arthur D. Little (ADL), ABB Engineering Services (ABB), and the U.S. Army Environmental Center (USAEC) met at ADL's office in Cambridge, MA to discuss methods for determining background concentrations of organic and inorganic analytes in groundwater, soil, sediment, and surface water at Fort Devens. The objective of the meeting was to initiate the development of a uniform set of background values that could be used by all contractors to identify organic and inorganic contamination at the base. This appendix summarizes the current background values being used for this report, incorporating data from all available sources.

Appendix K is divided into three sections based on matrix. The sections are:

- Section K1: Background Concentrations of Inorganic Analytes in Sediment;
- Section K2: Background Concentrations of Inorganic Analytes in Soil and Background Concentrations of Organic Analytes in soil; and
- Section K3: Background Concentrations of Inorganic Analytes in Surface Water.

Background concentration ranges for inorganic analytes in each matrix were determined from designated background samples collected at Fort Devens. The background sediment database was augmented with regional data from the peer-reviewed scientific literature. The background surface-water database was augmented with additional surface-water samples from IRDMIS.

There are no background data for groundwater on a regional scale from areas known to be unaffected by human activity. Wells that are upgradient of specific sites, such as 32M-92-01X at the DRMO Yard, have been compared with on-site wells.



recycled paper

SECTION K2

**Background Concentrations of Inorganic Analytes in Soil**

Background soil samples for inorganic analytes were collected in August 1991, October 1992, and June 1993. Thirty-three samples in all were collected. The samples were collected from all three of the major soil associations on the base and from each of Main Post, North Post, and South Post. Sample locations are shown in Figure K2-1. Note that no AOCs occur on the fourth soil association mapped, which lies outside the present boundaries of the facility. The background soil samples were all collected from sites that were, as far as could be determined visually, undisturbed, that were at least 50 feet from any road and at least 300 feet from any known or suspected Study Area. In most cases the distance was greater, especially in South Post.

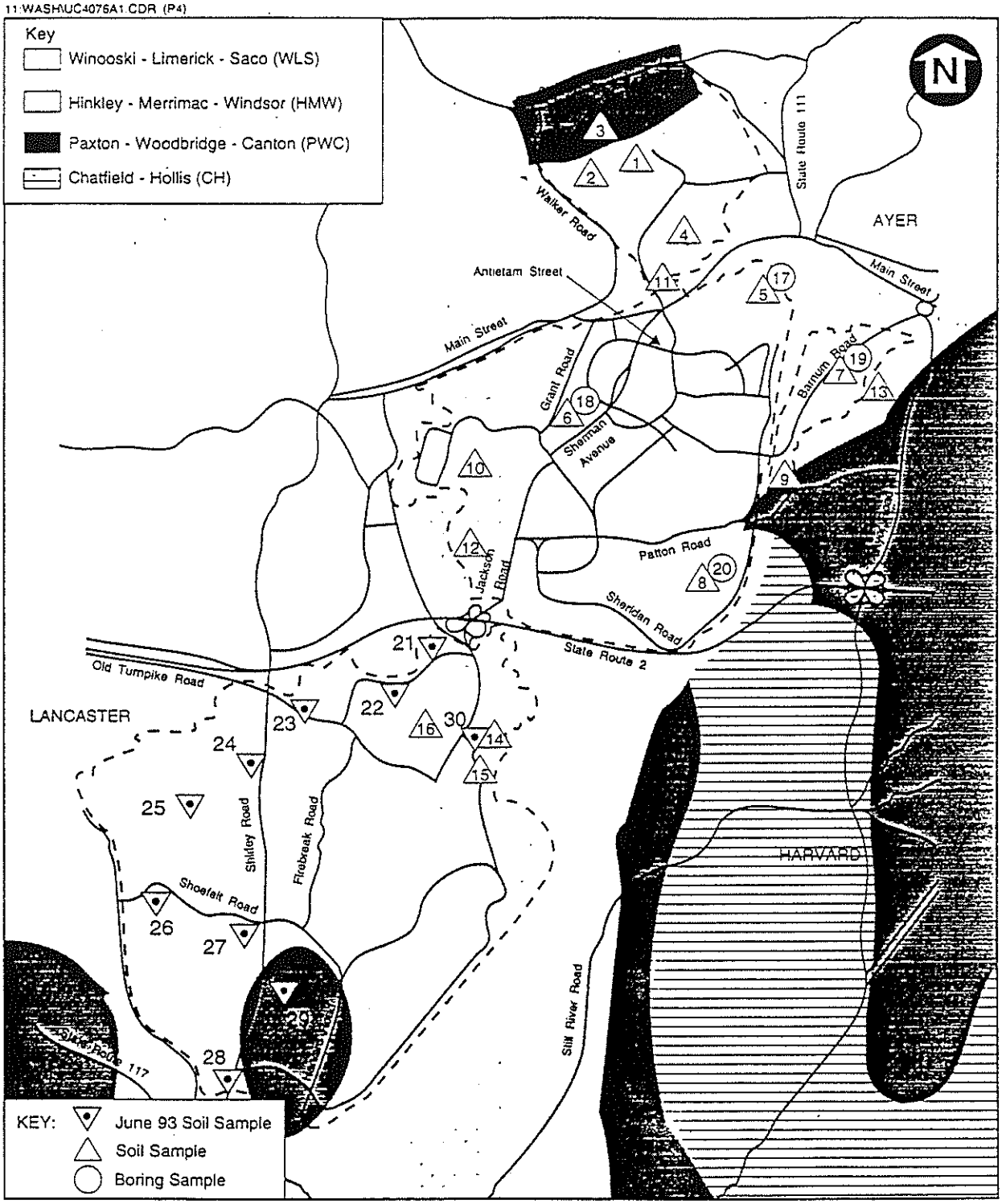
Table K2-1 is the background database for inorganic analytes in soil. Sampling date, post, and soil association are listed for the samples. There are two columns in the table for each analyte: one column for the measured concentration and one for notes. The note column indicates which data points were entered as one-half the LOD and which are outliers. For calculation purposes, values that appeared in IRDMIS as less than the LOD were converted to one-half the LOD. Outliers were identified by the method of Dixon or Grubbs as described by Sokal and Rohlf (1981), graphically, or by judgment. Dixon's test is valid for sample sizes of 3 to 25. Grubbs' test was used for sample sizes greater than 25.

Grubbs' method was applied to the data for the following sixteen analytes: aluminum, arsenic, barium, cadmium, calcium, chromium, copper, iron, lead, magnesium, manganese, nickel, potassium, sodium, vanadium, and zinc. Dixon's test for outliers was applied to the data for beryllium, cobalt, and selenium after omitting 10 samples for beryllium, 10 samples for cobalt, and 20 samples for selenium that were reported as less than the LOD, but that had unusually high LODs. For example, 10 samples had a reported cobalt concentration of < 14 mg/kg (see Table K2-1); this LOD is greater than the highest measured value for cobalt of 4.69 mg/kg.

Outliers for mercury were determined graphically. A normal probability plot showed the mercury data to be bimodally distributed; the four values in the upper cluster were judged to be outliers (see Table K2-1). Silver was detected in only two background soil samples; the "detects" were judged to be outliers (see Table K2-1). In all, 35 outliers were identified in the background soil database.

Table K2-2 lists concentration ranges for inorganic analytes for the Fort Devens background soil database, excluding outliers. Inorganic analyte levels in AOC samples were compared with the maximum of the background range; exceedances were considered site-related contamination. For comparison, Table K2-2 also lists concentration ranges for inorganic analytes in uncontaminated soils of the eastern United States. For all analytes, the maximum concentration in the Fort Devens background database lies within the range for the eastern United States, usually toward the low end of the range. This suggests that comparing

11:WASH\UC4076A1.CDR (P4)




SOURCE: USDA.SCS Soils Survey Worcester County NE Part.

Scale in miles
1 3/4 1/2 1/4 0 1

Legend —— Road - - - Installation Boundary.

Figure K2-1 BACKGROUND SAMPLING SITES FOR SOIL

TABLE K2-1. BACKGROUND DATABASE FOR INORGANIC ANALYTES IN SOIL AT FORT DEVENS. ALL VALUES ARE mg/kg.

| SAMP_ID$ | DATE$ | POST$ | ASSOC$ | TYPE$ | AL | ALNOTE$ | SB | SBNOTE$ | AS | ASNOTE$ | BA | BANOTE$ | BE | BENOTE$ | CD | CDNOTE$ | CA | CANOTE$ | CR | CRNOTE$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SOIL-01 | AUG91 | NORTH | IMW | AREA | 6400 | | 1.71 | 1/2 LOD | 9.6 | | 14.2 | | 0.119 | | 0.212 | 1/2 LOD | 610 | | 7.11 | |
| SOIL-02 | AUG91 | NORTH | IMW | AREA | 14000 | | 17 | 1/2 LOD | 13 | | 35 | | 0.126 | | 0.212 | 1/2 LOD | 610 | | 11.1 | |
| SOIL-03 | AUG91 | NORTH | FWC | AREA | 12000 | | 1.71 | 1/2 LOD | 9.3 | | 14.5 | | 0.039 | | 0.212 | 1/2 LOD | 330 | | 7.57 | |
| SOIL-04 | AUG91 | NORTH | WLS | AREA | 8800 | | 1.71 | 1/2 LOD | 9.4 | | 14.2 | | 0.141 | | 0.212 | 1/2 LOD | 630 | | 10.2 | |
| SOIL-05 | AUG91 | MAIN | IMW | AREA | 9900 | | 1.71 | 1/2 LOD | 12 | | 15.5 | | 0.124 | | 0.212 | 1/2 LOD | 430 | | 8.2 | |
| SOIL-06 | AUG91 | MAIN | IMW | AREA | 13000 | | 1.71 | 1/2 LOD | 32 | OUTLIER | 11.5 | 1/2 LOD | 0.108 | | 1.28 | | 710 | | 30.3 | |
| SOIL-07 | AUG91 | MAIN | IMW | AREA | 12000 | | 1.71 | 1/2 LOD | 15 | | 36 | | 0.133 | | 1.06 | | 1400 | OUTLIER | 29 | |
| SOIL-08 | AUG91 | MAIN | IMW | AREA | 2500 | 1/2 LOD | 1.71 | 1/2 LOD | 15 | | 15.6 | | 0.142 | | 0.212 | 1/2/LOD | 310 | | 9.59 | |
| SOIL-09 | AUG91 | MAIN | FWC | AREA | 24000 | OUTLIER | 17 | 1/2 LOD | 25 | OUTLIER | 54 | | 0.335 | | 1.06 | | 650 | 1/2 LOD | 56.5 | OUTLIER |
| SOIL-10 | AUG91 | MAIN | WLS | AREA | 8500 | | 17 | 1/2 LOD | 14 | | 11.5 | 1/2 LOD | 0.390 | 1/2 LOD | 2.1 | 1/2 LOD | 2100 | OUTLIER | 19.5 | 1/2 LOD |
| SOIL-11 | AUG91 | MAIN | WLS | AREA | 11000 | | 1.71 | 1/2 LOD | 13 | | 52 | | 0.350 | | 4.48 | OUTLIER | 2800 | OUTLIER | 27.1 | |
| SOIL-12 | AUG91 | MAIN | WLS | AREA | 7400 | | 1.71 | 1/2 LOD | 7.1 | | 12.9 | | 0.172 | | 0.212 | 1/2 LOD | 810 | | 6.02 | |
| SOIL-13 | AUG91 | MAIN | IMW | AREA | 18000 | | 1.71 | 1/2 LOD | 28 | OUTLIER | 67.2 | OUTLIER | 0.672 | | 3.52 | OUTLIER | 1500 | 1/2 LOD | 33 | |
| SOIL-14 | AUG91 | SOUTH | WLS | AREA | 6900 | | 1.71 | 1/2 LOD | 11 | | 16.6 | | 0.146 | | 0.212 | 1/2 LOD | 740 | | 13.8 | |
| SOIL-15 | AUG91 | SOUTH | WLS | AREA | 8000 | | 1.71 | 1/2 LOD | 4.6 | | 16.2 | | 0.145 | | 0.212 | 1/2 LOD | 144 | | 1.95 | 1/2 LOD |
| SOIL-16 | AUG91 | SOUTH | FWC | AREA | 13000 | | 1.71 | 1/2 LOD | 11 | | 46 | | 0.533 | | 0.212 | 1/2 LOD | 720 | | 12.5 | |
| SOIL-17 | AUG91 | MAIN | IMW | BORE | 4300 | | 1.71 | 1/2 LOD | 9.5 | | 9.67 | | 0.039 | 1/2 LOD | 0.212 | 1/2 LOD | 350 | | 7.71 | |
| SOIL-18 | AUG91 | MAIN | IMW | BORE | 11000 | | 1.71 | 1/2 LOD | 99 | OUTLIER | 29 | | 0.039 | | 0.212 | 1/2 LOD | 650 | | 39.5 | OUTLIER |
| SOIL-19 | AUG91 | MAIN | IMW | BORE | 7100 | | 1.71 | 1/2 LOD | 11 | | 14.2 | | 0.104 | | 0.212 | 1/2 LOD | 710 | | 14.1 | |
| SOIL-20 | AUG91 | MAIN | IMW | BORE | 7100 | | 1.71 | 1/2 LOD | 19 | | 31 | | 0.188 | | 0.212 | 1/2 LOD | 810 | | 9.25 | |
| BKS-21 | JUN93 | SOUTH | FWC | AREA | 7800 | | 0.25 | 1/2 LOD | 7.03 | | 21.4 | | 0.25 | 1/2 LOD | 0.602 | | 250 | 1/2 LOD | 7.13 | |
| BKS-22 | JUN93 | SOUTH | FWC | AREA | 9600 | | 0.25 | 1/2 LOD | 7.8 | | 15 | | 0.25 | 1/2 LOD | 0.647 | | 250 | 1/2 LOD | 10.6 | |
| BKS-23 | JUN93 | SOUTH | IMW | AREA | 9800 | | 0.25 | 1/2 LOD | 11.0 | | 11.8 | | 0.25 | 1/2 LOD | 0.551 | | 250 | 1/2 LOD | 10.4 | |
| BKS-24 | JUN93 | SOUTH | IMW | AREA | 7400 | | 0.25 | 1/2 LOD | 14.4 | | 12.3 | | 0.25 | 1/2 LOD | 1.21 | | 250 | 1/2 LOD | 12.5 | |
| BKS-25 | JUN93 | SOUTH | IMW | AREA | 387 | | 0.25 | 1/2 LOD | 6.04 | | 2.5 | 1/2 LOD | 0.25 | 1/2 LOD | 0.25 | 1/2 LOD | 250 | 1/2 LOD | 1.0 | 1/2 LOD |
| BKS-26 | JUN93 | SOUTH | IMW | AREA | 1800 | | 0.25 | 1/2 LOD | 8.31 | | 2.5 | 1/2 LOD | 0.25 | 1/2 LOD | 0.25 | 1/2 LOD | 250 | 1/2 LOD | 2.67 | |
| BKS-27 | JUN93 | SOUTH | IMW | AREA | 797 | | 0.25 | 1/2 LOD | 5.19 | | 2.5 | 1/2 LOD | 0.25 | 1/2 LOD | 0.25 | 1/2 LOD | 250 | 1/2 LOD | 1.0 | 1/2 LOD |
| BKS-28 | JUN93 | SOUTH | WLS | AREA | 398 | | 0.25 | 1/2 LOD | 2.06 | | 2.5 | 1/2 LOD | 0.25 | 1/2 LOD | 0.25 | 1/2 LOD | 250 | 1/2 LOD | 1.0 | 1/2 LOD |
| BKS-29 | JUN93 | SOUTH | FWC | AREA | 1460 | | 0.25 | 1/2 LOD | 8.04 | | 2.5 | 1/2 LOD | 0.25 | 1/2 LOD | 0.25 | 1/2 LOD | 250 | 1/2 LOD | 1.0 | 1/2 LOD |
| BKS-30 | JUN93 | SOUTH | WLS | AREA | 603 | | 0.25 | 1/2 LOD | 3.3 | | 2.5 | 1/2 LOD | 0.25 | 1/2 LOD | 0.25 | 1/2 LOD | 250 | 1/2 LOD | 1.0 | 1/2 LOD |
| 25S-92-12X | OCT92 | SOUTH | | | 2920 | | 0.55 | 1/2 LOD | 3.17 | | 18 | | 0.25 | 1/2 LOD | 0.35 | 1/2 LOD | 50 | 1/2 LOD | 2.03 | 1/2 LOD |
| 25S-92-13X | OCT92 | SOUTH | | | 11400 | | 0.55 | 1/2 LOD | 7.87 | | 28 | | 0.81 | | 0.35 | 1/2 LOD | 50 | 1/2 LOD | 9.43 | |
| 26S-92-10X | OCT92 | SOUTH | | | 7380 | | 0.55 | 1/2 LOD | 10.7 | | 30.1 | | 0.698 | | 0.35 | 1/2 LOD | 50 | 1/2 LOD | 9.09 | |

TABLE K2-1. CONTINUED.

| SAMP_ID$ | DATE$ | POST$ | ASSOC$ | TYPE$ | K | KNOTE$ | SE | SENOTE$ | AG | AGNOTE$ | NA | NANOTE$ | V | VNOTE$ | ZN | ZNNOTE$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SOIL-01 | AUG91 | NORTH | HMW | AREA | 620 | | 2.88 | 1/2 LOD | 0.043 | 1/2 LOD | 26 | 1/2 LOD | 7.57 | | 16.5 | |
| SOIL-02 | AUG91 | NORTH | HMW | AREA | 660 | | 2.88 | 1/2 LOD | 0.043 | 1/2 LOD | 58.6 | | 16.6 | | 27.7 | |
| SOIL-03 | AUG91 | NORTH | PWC | AREA | 530 | | 2.88 | 1/2 LOD | 0.043 | 1/2 LOD | 26 | 1/2 LOD | 17.9 | | 14.6 | |
| SOIL-04 | AUG91 | NORTH | WLS | AREA | 314 | | 2.88 | 1/2 LOD | 0.043 | 1/2 LOD | 26 | 1/2 LOD | 11.7 | | 13.6 | |
| SOIL-05 | AUG91 | MAIN | HMW | AREA | 470 | | 2.88 | 1/2 LOD | 0.043 | 1/2 LOD | 71.2 | | 7.91 | | 14.7 | |
| SOIL-06 | AUG91 | MAIN | HMW | AREA | 1100 | | 2.88 | 1/2 LOD | 0.208 | OUTLIER | 79.8 | | 32.3 | | 40 | 1/2 LOD |
| SOIL-07 | AUG91 | MAIN | HMW | AREA | 1700 | | 2.88 | 1/2 LOD | 0.043 | 1/2 LOD | 117 | | 23.4 | | 40 | 1/2 LOD |
| SOIL-08 | AUG91 | MAIN | HMW | AREA | 630 | | 2.88 | 1/2 LOD | 0.043 | 1/2 LOD | 26 | 1/2 LOD | 8.03 | | 13.2 | |
| SOIL-09 | AUG91 | MAIN | PWC | AREA | 2400 | | 2.88 | 1/2 LOD | 0.043 | 1/2 LOD | 85.8 | | 44.3 | OUTLIER | 130 | OUTLIER |
| SOIL-10 | AUG91 | MAIN | WLS | AREA | 990 | | 2.88 | 1/2 LOD | 0.043 | 1/2 LOD | 680 | OUTLIER | 6.5 | 1/2 LOD | 40 | 1/2 LOD |
| SOIL-11 | AUG91 | MAIN | WLS | AREA | 1100 | | 2.88 | 1/2 LOD | 0.582 | OUTLIER | 123 | | 18.1 | | 40 | 1/2 LOD |
| SOIL-12 | AUG91 | MAIN | WLS | AREA | 600 | | 2.88 | 1/2 LOD | 0.043 | 1/2 LOD | 26 | 1/2 LOD | 16.3 | | 17.7 | |
| SOIL-13 | AUG91 | MAIN | HMW | AREA | 2200 | | 2.88 | 1/2 LOD | 0.043 | 1/2 LOD | 231 | | 46.6 | OUTLIER | 40 | 1/2 LOD |
| SOIL-14 | AUG91 | SOUTH | WLS | AREA | 700 | | 2.88 | 1/2 LOD | 0.043 | 1/2 LOD | 100 | | 13.8 | | 22.2 | |
| SOIL-15 | AUG91 | SOUTH | WLS | AREA | 248 | | 2.88 | 1/2 LOD | 0.043 | 1/2 LOD | 26 | 1/2 LOD | 6.19 | | 11.7 | |
| SOIL-16 | AUG91 | SOUTH | PWC | AREA | 2400 | | 2.88 | 1/2 LOD | 0.043 | 1/2 LOD | 130 | | 17.5 | | 23.4 | |
| SOIL-17 | AUG91 | MAIN | HMW | DORE | 590 | | 2.88 | 1/2 LOD | 0.043 | 1/2 LOD | 57.5 | | 6.12 | | 11.2 | |
| SOIL-18 | AUG91 | MAIN | HMW | DORE | 1700 | | 2.88 | 1/2 LOD | 0.043 | 1/2 LOD | 124 | | 22.8 | | 40 | 1/2 LOD |
| SOIL-19 | AUG91 | MAIN | HMW | DORE | 880 | | 2.88 | 1/2 LOD | 0.043 | 1/2 LOD | 86.7 | | 9.89 | | 14.2 | |
| SOIL-20 | AUG91 | MAIN | HMW | DORE | 1000 | | 2.88 | 1/2 LOD | 0.043 | 1/2 LOD | 93.9 | | 7.2 | | 13.5 | |
| BKS-21 | JUN93 | SOUTH | PWC | AREA | 341 | | 0.1 | 1/2 LOD | 0.1 | 1/2 LOD | 100 | 1/2 LOD | 10.5 | | 43.9 | |
| BKS-22 | JUN93 | SOUTH | PWC | AREA | 100 | 1/2 LOD | 0.1 | 1/2 LOD | 0.1 | 1/2 LOD | 100 | 1/2 LOD | 11.4 | | 32.3 | |
| BKS-23 | JUN93 | SOUTH | HMW | AREA | 100 | 1/2 LOD | 0.1 | 1/2 LOD | 0.1 | 1/2 LOD | 100 | 1/2 LOD | 10.5 | | 28.7 | |
| BKS-24 | JUN93 | SOUTH | HMW | AREA | 100 | 1/2 LOD | 0.603 | | 0.1 | 1/2 LOD | 100 | 1/2 LOD | 28.5 | | 35.2 | |
| BKS-25 | JUN93 | SOUTH | HMW | AREA | 100 | 1/2 LOD | 0.279 | | 0.1 | 1/2 LOD | 100 | 1/2 LOD | 1.0 | 1/2 LOD | 3.69 | |
| BKS-26 | JUN93 | SOUTH | HMW | AREA | 100 | 1/2 LOD | 0.489 | | 0.1 | 1/2 LOD | 100 | 1/2 LOD | 1.0 | 1/2 LOD | 5.26 | |
| BKS-27 | JUN93 | SOUTH | HMW | AREA | 100 | 1/2 LOD | 0.388 | | 0.1 | 1/2 LOD | 100 | 1/2 LOD | 1.0 | 1/2 LOD | 5.33 | |
| BKS-28 | JUN93 | SOUTH | WLS | AREA | 100 | 1/2 LOD | 0.246 | | 0.1 | 1/2 LOD | 100 | 1/2 LOD | 1.0 | 1/2 LOD | 3.52 | |
| BKS-29 | JUN93 | SOUTH | PWC | AREA | 100 | 1/2 LOD | 0.33 | | 0.1 | 1/2 LOD | 100 | 1/2 LOD | 3.3 | | 7.8 | |
| BKS-30 | JUN93 | SOUTH | WLS | AREA | 100 | 1/2 LOD | 0.1 | 1/2 LOD | 0.1 | 1/2 LOD | 100 | 1/2 LOD | 1.0 | 1/2 LOD | 4.87 | |
| 25S-92-12X | OCT92 | SOUTH | | | 215 | BK | 0.601 | | 0.29 | 1/2 LOD | 208 | | 4.7 | | 4.015 | 1/2 LOD |
| 25S-92-13X | OCT92 | SOUTH | | | 260 | BK | 1.23 | OUTLIER | 0.29 | 1/2 LOD | 191 | | 13.3 | | 25.3 | |
| 26S-92-10X | OCT92 | SOUTH | | | 143 | DU | 0.992 | | 0.29 | 1/2 LOD | 234 | | 19.8 | | 33.3 | |

## Table K2-3

## PESTICIDE CONCENTRATION RANGES
## FORT DEVENS MAIN POST SITE INVESTIGATION

| Compounds | Total Samples | Total Detects | Minimum Detect | Maximum Detect | Average | 95th Percentile (3) | Approximate Range of Detection Limits (2) |
|---|---|---|---|---|---|---|---|
| Soils | | | | | | | |
| Chlordane | 241 | 1 | 0.136 | 0.136 | 0.136 | - | 0.04 - 1 |
| p,p'-DDD | 719 (1) | 40 | 0.004 | 6.6 | 0.53 | 2.85 | 0.003 - 0.27 |
| p,p'-DDE | 726 (1) | 70 | 0.003 | 2.7 | 0.10 | 0.76 | 0.003 - 0.31 |
| p,p'-DDT | 727 (1) | 148 | 0.004 | 5.6 | 0.25 | 1.53 | 0.004 - 0.41 |
| Sediments | | | | | | | |
| Chlordane | 97 | 0 | - | - | - | - | 0.016 - 1 |
| p,p'-DDD | 444 | 77 | 0.008 | 6.2 | 0.39 | 2.25 | 0.008 - 2 |
| p,p'-DDE | 449 | 81 | 0.003 | 1.3 | 0.092 | 0.44 | 0.004 - 2 |
| p,p'-DDT | 449 | 50 | 0.009 | 15 | 0.42 | 4.66 | 0.004 - 2 |

* Composite of results from multiple data sets of Level III data for non-entomology shop locations at Main, South, and North Posts, Fort Devens, Massachusetts.

All results in mg/kg (ppm).

(1) Sample set with higher detection limit of three removed from data set (total of six samples).
(2) Only includes detection limits for results reported in database as "LT".
(3) 95th percentile formula - mean + (2 x standard deviations) for all detected results.

Source: ADL 1993.

# GROUNDWATER BACKGROUND CONCENTRATIONS
# REPRESENTATIVE SAMPLES
# FORT DEVENS, MASSACHUSETTS

| MONITORING WELL | LOCATION | TOTAL SUSPENDED SOLIDS (ug/L) | ALUMINUM (ug/L) |
|---|---|---|---|
| G6M-92-09X | NORTH POST | 37,000 | 230 |
| G6M-92-11X | NORTH POST | 53,000 | 1,920 |
| WWTMW-01 | NORTH POST | 20,000 | 2,330 |
| WWTMW-13 | NORTH POST | 30,000 | 3,150 |
| WWTMW-14 | NORTH POST | 25,000 | 9,130 |
| G3M-92-01X | MAIN POST | <4,000 | 71 |
| 13M-92-01X | MAIN POST | – | 7,270 |
| 12M-92-01X | SOUTH POST | – | 179 |
| 27M-92-04X | SOUTH POST | – | 8,700 |
| 28M-92-01X | SOUTH POST | – | 2,280 |

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05-Mar-93

# INORGANIC ANALYTES IN WATER
# FORT DEVENS, MASSACHUSETTS

| DATA | | CALCULATIONS | |
|---|---|---|---|
| **ALUMINUM** | | | |
| MONITORING WELL | CONCENTRATION (ug/L) | Minimum – | 71 |
| G3M-92-01X | 71 | | |
| 12M-92-01X | 179 | Maximum – | 9140 |
| G6M-92-09X | 230 | | |
| G6M-92-11X | 1920 | Mean – | 3527 |
| 28M-92-01X | 2280 | | |
| WWTMW-01 | 2330 | 95th %ile – | 6874 |
| WWTMW-13 | 3150 | | |
| 13M-92-01X | 7270 | Background Concentration – | 6870 |
| 27M-92-04X | 8700 | | |
| WWTMW-14 | 9140 | | |
| **ANTIMONY** | | | |
| MONITORING WELL | CONCENTRATION (ug/L) | Minimum – | 1.52 |
| WWTMW-14 | 1.52 | | |
| WWTMW-13 | 1.52 | Maximum – | 1.52 |
| WWTMW-01 | 1.52 | | |
| G6M-92-11X | 1.52 | Mean – | 1.52 |
| G6M-92-09X | 1.52 | | |
| G3M-92-01X | 1.52 | 95th %ile – | NA |
| 28M-92-01X | 1.52 | | |
| 27M-92-04X | 1.52 | Background Concentration – | 3.03 * |
| 13M-92-01X | 1.52 | | |
| 12M-92-01X | 1.52 | | |
| **ARESNIC** | | | |
| MONITORING WELL | CONCENTRATION (ug/L) | Minimum – | 1.27 |
| G6M-92-11X | 1.27 | | |
| 12M-92-01X | 1.27 | Maximum – | 15.20 |
| G6M-92-09X | 1.27 | | |
| G3M-92-01X | 1.77 | Mean – | 5.65 |
| 28M-92-01X | 3.94 | | |
| WWTMW-13 | 5.39 | 95th %ile – | 10.5 |
| WWTMW-01 | 9.81 | | |
| 13M-92-01X | 10.9 | Background Concentration – | 10.5 |
| WWTMW-14 | 15.2 | | |
| 27M-92-04X | 32.3 ** | | |
| **BARIUM** | | | |
| MONITORING WELL | CONCENTRATION (ug/L) | Minimum – | 2.5 |
| 12M-92-01X | 2.5 | | |
| G6M-92-09X | 7.6 | Maximum – | 52.0 |
| G3M-92-01X | 10.7 | | |
| WWTMW-01 | 12.4 | Mean – | 22.6 |
| 28M-92-01X | 14.4 | | |
| G6M-92-11X | 16.1 | 95th %ile – | 39.6 |
| WWTMW-13 | 19.5 | | |
| 13M-92-01X | 44.5 | Background Concentration – | 39.6 |
| WWTMW-14 | 46.3 | | |
| 27M-92-04X | 52.0 | | |

* Method Detection Limit
** Likely Statistical Outlier

# INORGANIC ANALYTES IN WATER
# FORT DEVENS, MASSACHUSETTS

| DATA | | CALCULATIONS | |
|---|---|---|---|
| **BERYLLIUM** | | | |
| MONITORING WELL | CONCENTRATION (ug/L) | Minimum – | 2.50 |
| G3M-92-01X | 2.50 | | |
| 12M-92-01X | 2.50 | Maximum – | 2.50 |
| G6M-92-09X | 2.50 | | |
| G6M-92-11X | 2.50 | Mean – | 2.50 |
| 28M-92-01X | 2.50 | | |
| WWTMW-01 | 2.50 | 95th %ile – | NA |
| WWTMW-13 | 2.50 | | |
| 13M-92-01X | 2.50 | Background | |
| 27M-92-04X | 2.50 | Concentration – | 5.00 * |
| WWTMW-14 | 2.50 | | |
| **CADMIUM** | | | |
| MONITORING WELL | CONCENTRATION (ug/L) | Minimum – | 2.01 |
| WWTMW-14 | 2.01 | | |
| WWTMW-13 | 2.01 | Maximum – | 2.01 |
| WWTMW-01 | 2.01 | | |
| G6M-92-11X | 2.01 | Mean – | 2.01 |
| G6M-92-09X | 2.01 | | |
| G3M-92-01X | 2.01 | 95th %ile – | NA |
| 28M-92-01X | 2.01 | | |
| 27M-92-04X | 2.01 | Background | |
| 13M-92-01X | 2.01 | Concentration – | 4.01 * |
| 12M-92-01X | 2.01 | | |
| **CALCIUM** | | | |
| MONITORING WELL | CONCENTRATION (ug/L) | Minimum – | 179 |
| 12M-92-01X | 179 | | |
| 28M-92-01X | 1910 | Maximum – | 23200 |
| WWTMW-14 | 2490 | | |
| WWTMW-13 | 3280 | Mean – | 7801 |
| G6M-92-11X | 5780 | | |
| WWTMW-01 | 6940 | 95th %ile – | 14747 |
| G3M-92-01X | 7710 | | |
| 27M-92-04X | 8820 | Background | |
| G6M-92-09X | 17700 | Concentration – | 14700 |
| 13M-92-01X | 23200 | | |
| **CHROMIUM** | | | |
| MONITORING WELL | CONCENTRATION (ug/L) | Minimum – | 3.0 |
| G3M-92-01X | 3.01 | | |
| G6M-92-09X | 3.01 | Maximum – | 18.7 |
| 28M-92-01X | 3.01 | | |
| 12M-92-01X | 3.01 | Mean – | 8.7 |
| WWTMW-01 | 6.04 | | |
| G6M-92-11X | 6.36 | 95th %ile – | 14.7 |
| WWTMW-13 | 10.1 | | |
| 27M-92-04X | 16.4 | Background | |
| 13M-92-01X | 16.9 | Concentration – | 14.7 |
| WWTMW-14 | 18.7 | | |

* Method Detection Limit
** Likely Statistical Outlier

# INORGANIC ANALYTES IN WATER
# FORT DEVENS, MASSACHUSETTS

| DATA | | CALCULATIONS | |
|---|---|---|---|
| **COBALT** | | | |
| MONITORING WELL | CONCENTRATION (ug/L) | Minimum – | 12.5 |
| G3M-92-01X | 12.5 | | |
| 12M-92-01X | 12.5 | Maximum – | 12.5 |
| G6M-92-09X | 12.5 | | |
| G6M-92-11X | 12.5 | Mean – | 12.5 |
| 28M-92-01X | 12.5 | | |
| WWTMW-01 | 12.5 | 95th %ile – | NA |
| WWTMW-13 | 12.5 | | |
| 13M-92-01X | 12.5 | Background Concentration – | 25.0 * |
| 27M-92-04X | 12.5 | | |
| WWTMW-14 | 12.5 | | |
| **COPPER** | | | |
| MONITORING WELL | CONCENTRATION (ug/L) | Minimum – | 4.05 |
| G3M-92-01X | 4.05 | | |
| WWTMW-14 | 4.05 | Maximum – | 6.52 |
| 28M-92-01X | 4.05 | | |
| WWTMW-01 | 4.05 | Mean – | 4.36 |
| G6M-92-09X | 4.05 | | |
| 12M-92-01X | 4.05 | 95th %ile – | 5.2 |
| G6M-92-11X | 4.05 | | |
| WWTMW-13 | 6.52 | Background Concentration – | 8.09 * |
| 13M-92-01X | 18.60 ** | | |
| 27M-92-04X | 19.00 ** | | |
| **IRON** | | | |
| MONITORING WELL | CONCENTRATION (ug/L) | Minimum – | 171 |
| G3M-92-01X | 171 | | |
| G6M-92-09X | 331 | Maximum – | 12900 |
| 12M-92-01X | 373 | | |
| G6M-92-11X | 2390 | Mean – | 4611 |
| 28M-92-01X | 2410 | | |
| WWTMW-01 | 3250 | 95th %ile – | 9104 |
| WWTMW-13 | 3830 | | |
| WWTMW-14 | 9250 | Background Concentration – | 9100 |
| 27M-92-04X | 11200 | | |
| 13M-92-01X | 12900 | | |
| **LEAD** | | | |
| MONITORING WELL | CONCENTRATION (ug/L) | Minimum – | 0.65 |
| G6M-92-09X | 0.65 | | |
| WWTMW-01 | 2.00 | Maximum – | 5.70 |
| 28M-92-01X | 2.17 | | |
| G3M-92-01X | 2.30 | Mean – | 2.81 |
| G6M-92-11X | 2.30 | | |
| WWTMW-13 | 3.10 | 95th %ile – | 4.25 |
| 12M-92-01X | 4.23 | | |
| WWTMW-14 | 5.70 | Background Concentration – | 4.25 |
| 13M-92-01X | 12.10 ** | | |
| 27M-92-04X | 12.40 ** | | |

* Method Detection Limit
** Likely Statistical Outlier

# INORGANIC ANALYTES IN WATER
# FORT DEVENS, MASSACHUSETTS

| DATA | | CALCULATIONS | |
|---|---|---|---|
| **MAGNESIUM** | | | |
| MONITORING WELL | CONCENTRATION (ug/L) | | |
| 28M-92-01X | 693 | Minimum – | 693 |
| G6M-92-11X | 857 | Maximum – | 4500 |
| G3M-92-01X | 1000 | | |
| WWTMW-13 | 1390 | Mean – | 2157 |
| G6M-92-09X | 1600 | | |
| WWTMW-01 | 1900 | 95th %ile – | 3477 |
| WWTMW-14 | 1970 | | |
| 27M-92-04X | 3550 | Background | |
| 12M-92-01X | 4110 | Concentration – | 3480 |
| 13M-92-01X | 4500 | | |
| **MANGANESE** | | | |
| MONITORING WELL | CONCENTRATION (ug/L) | | |
| G6M-92-09X | 23.4 | Minimum – | 23.40 |
| 12M-92-01X | 69.9 | Maximum – | 486.00 |
| WWTMW-01 | 77.7 | | |
| 28M-92-01X | 86.4 | Mean – | 156.93 |
| G6M-92-11X | 102 | | |
| WWTMW-13 | 107 | 95th %ile – | 290.7 |
| 13M-92-01X | 227 | | |
| WWTMW-14 | 233 | Background | |
| G3M-92-01X | 486 | Concentration – | 291 |
| 27M-92-04X | 1110 ** | | |
| **MERCURY** | | | |
| MONITORING WELL | CONCENTRATION (ug/L) | | |
| WWTMW-01 | 0.12 | Minimum – | 0.12 |
| G3M-92-01X | 0.12 | Maximum – | 0.70 |
| 12M-92-01X | 0.12 | | |
| 13M-92-01X | 0.12 | Mean – | 0.18 |
| WWTMW-14 | 0.12 | | |
| 28M-92-01X | 0.12 | 95th %ile – | 0.35 |
| G6M-92-11X | 0.12 | | |
| G6M-92-09X | 0.12 | Background | |
| 27M-92-04X | 0.12 | Concentration – | 0.243 * |
| WWTMW-13 | 0.70 | | |
| **NICKEL** | | | |
| MONITORING WELL | CONCENTRATION (ug/L) | | |
| G6M-92-09X | 17.2 | Minimum – | 17.20 |
| WWTMW-01 | 17.2 | Maximum – | 17.20 |
| 28M-92-01X | 17.2 | | |
| G3M-92-01X | 17.2 | Mean – | 17.20 |
| G6M-92-11X | 17.2 | | |
| WWTMW-13 | 17.2 | 95th %ile – | NA |
| 12M-92-01X | 17.2 | | |
| WWTMW-14 | 17.2 | Background | |
| 13M-92-01X | 17.2 | Concentration – | 34.3 * |
| 27M-92-04X | 17.2 | | |

* Method Detection Limit
** Likely Statistical Outlier

# INORGANIC ANALYTES IN WATER
# FORT DEVENS, MASSACHUSETTS

| DATA | | CALCULATIONS | |
|---|---|---|---|
| **POTASSIUM** | | | |
| MONITORING WELL | CONCENTRATION (ug/L) | Minimum – | 461 |
| 28M-92-01X | 461 | | |
| G6M-92-11X | 645 | Maximum – | 2790 |
| WWTMW-13 | 1080 | | |
| G3M-92-01X | 1450 | Mean – | 1644 |
| 12M-92-01X | 1500 | | |
| WWTMW-01 | 1980 | 95th %ile – | 2370 |
| WWTMW-14 | 1980 | | |
| G6M-92-09X | 1980 | Background | |
| 13M-92-01X | 2570 | Concentration – | 2370 |
| 27M-92-04X | 2790 | | |
| **SELENIUM** | | | |
| MONITORING WELL | CONCENTRATION (ug/L) | Minimum – | 1.51 |
| G6M-92-09X | 1.51 | | |
| 12M-92-01X | 1.51 | Maximum – | 1.51 |
| WWTMW-01 | 1.51 | | |
| 28M-92-01X | 1.51 | Mean – | 1.51 |
| G6M-92-11X | 1.51 | | |
| WWTMW-13 | 1.51 | 95th %ile – | NA |
| 13M-92-01X | 1.51 | | |
| WWTMW-14 | 1.51 | Background | |
| G3M-92-01X | 1.51 | Concentration – | 3.02 * |
| 27M-92-04X | 1.51 | | |
| **SILVER** | | | |
| MONITORING WELL | CONCENTRATION (ug/L) | Minimum – | 2.30 |
| WWTMW-01 | 2.30 | | |
| G3M-92-01X | 2.30 | Maximum – | 2.30 |
| 12M-92-01X | 2.30 | | |
| 13M-92-01X | 2.30 | Mean – | 2.30 |
| WWTMW-14 | 2.30 | | |
| 28M-92-01X | 2.30 | 95th %ile – | NA |
| G6M-92-11X | 2.30 | | |
| G6M-92-09X | 2.30 | Background | |
| 27M-92-04X | 2.30 | Concentration – | 4.60 * |
| WWTMW-13 | 2.30 | | |
| **SODIUM** | | | |
| MONITORING WELL | CONCENTRATION (ug/L) | Minimum – | 1380 |
| 28M-92-01X | 1380 | | |
| G6M-92-09X | 2000 | Maximum – | 18000 |
| WWTMW-14 | 2100 | | |
| G6M-92-11X | 2430 | Mean – | 5771 |
| 27M-92-04X | 3070 | | |
| 12M-92-01X | 4250 | 95th %ile – | 10841 |
| WWTMW-13 | 4610 | | |
| G3M-92-01X | 8570 | Background | |
| WWTMW-01 | 11300 | Concentration – | 10800 |
| 13M-92-01X | 18000 | | |

* Method Detection Limit
** Likely Statistical Outlier

# INORGANIC ANALYTES IN WATER
# FORT DEVENS, MASSACHUSETTS

| DATA | | CALCULATIONS | |
|---|---|---|---|
| **THALLIUM** | | | |
| MONITORING WELL | CONCENTRATION (ug/L) | Minimum – | 3.50 |
| 28M-92-01X | 3.50 | | |
| G6M-92-11X | 3.50 | Maximum – | 3.50 |
| WWTMW-13 | 3.50 | | |
| G3M-92-01X | 3.50 | Mean – | 3.50 |
| 12M-92-01X | 3.50 | | |
| WWTMW-01 | 3.50 | 95th %ile – | 3.50 |
| WWTMW-14 | 3.50 | | |
| G6M-92-09X | 3.50 | Background Concentration – | 6.99 |
| 13M-92-01X | 3.50 | | |
| 27M-92-04X | 3.50 | | |
| **VANADIUM** | | | |
| MONITORING WELL | CONCENTRATION (ug/L) | Minimum – | 5.50 |
| G6M-92-09X | 5.50 | | |
| 12M-92-01X | 5.50 | Maximum – | 14.50 |
| WWTMW-01 | 5.50 | | |
| 28M-92-01X | 5.50 | Mean – | 7.13 |
| G6M-92-11X | 5.50 | | |
| WWTMW-13 | 5.50 | 95th %ile – | 10.41 |
| 13M-92-01X | 5.50 | | |
| G3M-92-01X | 5.50 | Background Concentration – | 11.0 * |
| 27M-92-04X | 12.8 | | |
| WWTMW-14 | 14.5 | | |
| **ZINC** | | | |
| MONITORING WELL | CONCENTRATION (ug/L) | Minimum – | 10.6 |
| WWTMW-13 | 10.6 | | |
| G6M-92-09X | 10.6 | Maximum – | 47.0 |
| WWTMW-01 | 10.6 | | |
| 28M-92-01X | 10.6 | Mean – | 20.5 |
| G6M-92-11X | 10.6 | | |
| G3M-92-01X | 10.6 | 95th %ile – | 34.9 |
| WWTMW-14 | 32.0 | | |
| 27M-92-04X | 41.7 | Background Concentration – | 21.1 * |
| 12M-92-01X | 47.0 | | |
| 13M-92-01X | 78.5 ** | | |

* Method Detection Limit
** Likely Statistical Outlier

# FIELD ANALYTICAL DATA AND OFF-SITE ANALYTICAL LABORATORY DATA

HUMAN HEALTH RISK ASSESSMENT

N-1 RISK CHARACTERIZATION FOR AREA 1

N-2 CALCULATION OF EPH/VPH EXPOSURE POINT CONCENTRATIONS

N-3 SOIL ADHERENCE FACTOR CALCULATONS

N-4 TOXICITY PROFILES

N-5 RISK CALCULATIONS

N-6 RISK SUMMARY TABLES

# N-1 RISK CHARACTERIZATION FOR AREA 1

**Risk Characterization for AOC 57 Area 1**

Area 1 was investigated and addressed as part of the Area Requiring Environmental Evaluation (AREE) 70 investigation (ADL, 1995). This area underwent a soil removal action to address total petroleum hydrocarbon (TPHC) and polynuclear aromatic hydrocarbon (PAH) contamination from parking lot runoff. Although some residual TPHC and PAH concentrations remained in Area 1 soils after the removal action, the contamination was determined to be consistent with soil and sediment at stormwater outfall sediments throughout Devens. Therefore, Area 1 was recommended for no further action (Weston, 1998); the decision is to be formalized in the AOC 57 Record of Decision. However, in accordance with recent USEPA requirements for site closure, a no further action decision must be supported by the demonstration that a site does not pose an unacceptable risk for future unrestricted land use. The assessment of risks associated with unrestricted future land use at Area 1 is presented in this appendix; the assessment indicates that residual contamination at Area 1 does not pose an unacceptable risk for future unrestricted land use.

**Methods**

Consistent with USEPA guidance for evaluating unrestricted land use, risks were characterized for child and adult residents who are assumed to live at Area 1 in the future. Exposures to soil via incidental ingestion, dermal uptake, and particulate inhalation were evaluated. Exposures were quantified using the residential exposure scenarios described in Section 9.1.3. The exposure point concentrations used to quantify potential soil exposures at Area 1 are the maximum detected concentrations measured in the confirmatory soil samples (post-removal conditions) collected at Area 1. Tables 1 through 4 present the exposure parameters, intake equations, exposure point concentrations, and intake estimates.

Dose-response values were obtained from USEPA sources, as described in Section 9.1.4. The oral RfD for pyrene, and the inhalation RfD for naphthalene, were used as surrogate dose-response values for PAHs with no published values. Toxicity associated with petroleum compounds (e.g., EPH and VPH) was evaluated using dose-response values published the MADEP.

**Results**

As shown in the table below, the total resident cancer risk does not exceed the USEPA target cancer risk range of $1x10^{-6}$ to $1x10^{-4}$. The non-cancer hazard index values are below the USEPA threshold HI of 1. These results indicate that residual contamination at Area 1 does not pose a risk above USEPA risk limits for the unrestricted future land use.

| **Exposure pathway** | **Excess lifetime cancer risk** | **Hazard index** |
|---|---|---|
| **Adult** | | |
| Incidental ingestion | 2E-05 | 0.002 |
| Dermal contact | 8E-06 | 0.001 |
| Dust inhalation | 2E-10 | 0.000002 |
| *Total* | *3E-05* | *0.003* |
| **Child** | | |
| Incidental ingestion | 3E-05 | 0.02 |
| Dermal contact | 4E-05 | 0.02 |
| Dust inhalation | 1E-10 | 0.000001 |
| *Total* | *7E-05* | *0.04* |
| | | |
| **Total Resident Risk** | **1E-04** | **Not additive** |

TABLE 1
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 1
FORT DEVENS, MA

13-Oct-99

August 1992

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 100 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.08 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 5,800 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 24 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 24 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

TABLE 1
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 1
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Benzo(a)anthracene | 5.1 | 1.0E-06 | 0.13 | 6.2E-07 | 7.3E-01 | 8.2E-01 | 7.5E-07 | 5.1E-07 | 1.3E-06 | 6.58% |
| Benzo(a)pyrene | 6.1 | 1.2E-06 | 0.13 | 7.4E-07 | 7.3E+00 | 8.2E+00 | 9.0E-06 | 6.1E-06 | 1.5E-05 | 78.66% |
| Benzo(b)fluoranthene | 6.1 | 1.2E-06 | 0.13 | 7.4E-07 | 7.3E-01 | 8.2E-01 | 9.0E-07 | 6.1E-07 | 1.5E-06 | 7.87% |
| Benzo(k)fluoranthene | 5.8 | 1.2E-06 | 0.13 | 7.0E-07 | 7.3E-02 | 8.2E-02 | 8.5E-08 | 5.8E-08 | 1.4E-07 | 0.75% |
| Chrysene | 6.9 | 1.4E-06 | 0.13 | 8.4E-07 | 7.3E-03 | 8.2E-03 | 1.0E-08 | 6.9E-09 | 1.7E-08 | 0.09% |
| Indeno(1,2,3-cd)pyrene | 4.7 | 9.5E-07 | 0.13 | 5.7E-07 | 7.3E-01 | 8.2E-01 | 6.9E-07 | 4.7E-07 | 1.2E-06 | 6.06% |
| | | | | | | SUMMARY CANCER RISK | 1E-05 | 8E-06 | 2E-05 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 5.42 | 3.2E-06 | 0.13 | 1.9E-06 | 2.0E-02 | 1.8E-02 | 1.6E-04 | 1.1E-04 | 2.7E-04 | |
| Benzo(g,h,I)perylene | 4.4 | 2.6E-06 | 0.13 | 1.55817E-06 | 3.0E-02 | 2.7E-02 | 8.6E-05 | 5.8E-05 | 1.4E-04 | |
| Fluoranthene | 14 | 8.2E-06 | 0.13 | 5.0E-06 | 4.0E-02 | 3.6E-02 | 2.1E-04 | 1.4E-04 | 3.4E-04 | |
| Phenanthrene | 8.2 | 4.8E-06 | 0.13 | 2.9E-06 | 3.0E-02 | 2.7E-02 | 1.6E-04 | 1.1E-04 | 2.7E-04 | |
| Pyrene | 11 | 6.5E-06 | 0.13 | 3.9E-06 | 3.0E-02 | 2.7E-02 | 2.2E-04 | 1.5E-04 | 3.6E-04 | |
| Benzo(a)anthracene | 5.1 | 3.0E-06 | 0.13 | 1.8E-06 | 3.0E-02 | 2.7E-02 | 1.0E-04 | 6.8E-05 | 1.7E-04 | |
| Benzo(a)pyrene | 6.1 | 3.6E-06 | 0.13 | 2.2E-06 | 3.0E-02 | 2.7E-02 | 1.2E-04 | 8.1E-05 | 2.0E-04 | |
| Benzo(b)fluoranthene | 6.1 | 3.6E-06 | 0.13 | 2.2E-06 | 3.0E-02 | 2.7E-02 | 1.2E-04 | 8.1E-05 | 2.0E-04 | |
| Benzo(k)fluoranthene | 5.8 | 3.4E-06 | 0.13 | 2.1E-06 | 3.0E-02 | 2.7E-02 | 1.1E-04 | 7.7E-05 | 1.9E-04 | |
| Chrysene | 6.9 | 4.1E-06 | 0.13 | 2.4E-06 | 3.0E-02 | 2.7E-02 | 1.4E-04 | 9.2E-05 | 2.3E-04 | |
| Indeno(1,2,3-cd)pyrene | 4.7 | 2.8E-06 | 0.13 | 1.7E-06 | 3.0E-02 | 2.7E-02 | 9.2E-05 | 6.2E-05 | 1.5E-04 | |
| C9-C12 Aliphatics | 2.41 | 1.4E-06 | 0.17 | 1.1E-06 | 6.0E-01 | 5.5E-01 | 2.4E-06 | 2.0E-06 | 4.4E-06 | |
| C9-C10 Aromatics | 0.386 | 2.3E-07 | 0.17 | 1.8E-07 | 3.0E-02 | 2.7E-02 | 7.6E-06 | 6.6E-06 | 1.4E-05 | |
| C9-C18 Aliphatics | 10 | 6.0E-06 | 0.17 | 4.7E-06 | 6.0E-01 | 5.5E-01 | 1.0E-05 | 8.6E-06 | 1.9E-05 | |
| C5-C8 Aliphatics | 10 | 5.9E-06 | 0.17 | 4.7E-06 | 6.0E-02 | 5.5E-01 | 9.9E-05 | 8.5E-06 | 1.1E-04 | |
| | | | | | | SUMMARY HAZARD INDEX | 0.002 | 0.001 | 0.003 | |

TABLE 2
INHLATION OF PARTICULATES FROM SURFACE SOIL
UNRESTRICTED LAND USE - CHILD RESIDENT
AOC 57 AREA 1
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 0.31 | m³/hour |
| BODY WEIGHT | BW | 15 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 6 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 24 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

TABLE 2
INHLATION OF PARTICULATES FROM SURFACE SOIL
UNRESTRICTED LAND USE - CHILD RESIDENT
AOC 57 AREA 1
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF ($m^3$/kg) | AIR CONCENTRATION VOLATILES (mg/$m^3$) | AIR CONCENTRATION PARTICULATES (mg/$m^3$) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Benzo(a)anthracene | 5.1 | NA | | 3.9E-09 | 2.3E-11 | 3.1E-01 | 7.0E-12 | 6.58% |
| Benzo(a)pyrene | 6.1 | NA | | 4.6E-09 | 2.7E-11 | 3.1E+00 | 8.3E-11 | 78.66% |
| Benzo(b)fluoranthene | 6.1 | NA | | 4.6E-09 | 2.7E-11 | 3.1E-01 | 8.3E-12 | 7.87% |
| Benzo(k)fluoranthene | 5.8 | NA | | 4.4E-09 | 2.6E-11 | 3.1E-02 | 7.9E-13 | 0.75% |
| Chrysene | 6.9 | NA | | 5.2E-09 | 3.0E-11 | 3.1E-03 | 9.4E-14 | 0.09% |
| Indeno(1,2,3-cd)pyrene | 4.7 | NA | | 3.6E-09 | 2.1E-11 | 3.1E-01 | 6.4E-12 | 6.06% |
| | | | | | | SUMMARY CANCER RISK | 1E-10 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF ($m^3$/kg) | AIR CONCENTRATION VOLATILES (mg/$m^3$) | AIR CONCENTRATION PARTICULATES (mg/$m^3$) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 5.42 | NA | | 4.1E-09 | 7.0E-11 | 8.6E-04 | 8.1E-08 | 6.96% |
| Benzo(g,h,I)perylene | 4.4 | NA | | 3.3E-09 | 5.7E-11 | 8.6E-04 | 6.6E-08 | 5.65% |
| Fluoranthene | 14 | NA | | 1.1E-08 | 1.8E-10 | 8.6E-04 | 2.1E-07 | 17.99% |
| Phenanthrene | 8.2 | NA | | 6.2E-09 | 1.1E-10 | 8.6E-04 | 1.2E-07 | 10.54% |
| Pyrene | 11 | NA | | 8.3E-09 | 1.4E-10 | 8.6E-04 | 1.6E-07 | 14.13% |
| Benzo(a)anthracene | 5.1 | NA | | 3.9E-09 | 6.6E-11 | 8.6E-04 | 7.6E-08 | 6.55% |
| Benzo(a)pyrene | 6.1 | NA | | 4.6E-09 | 7.8E-11 | 8.6E-04 | 9.1E-08 | 7.84% |
| Benzo(b)fluoranthene | 6.1 | NA | | 4.6E-09 | 7.8E-11 | 8.6E-04 | 9.1E-08 | 7.84% |
| Benzo(k)fluoranthene | 5.8 | NA | | 4.4E-09 | 7.5E-11 | 8.6E-04 | 8.7E-08 | 7.45% |
| Chrysene | 6.9 | NA | | 5.2E-09 | 8.9E-11 | 8.6E-04 | 1.0E-07 | 8.87% |
| Indeno(1,2,3-cd)pyrene | 4.7 | NA | | 3.6E-09 | 6.0E-11 | 8.6E-04 | 7.0E-08 | 6.04% |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 2.41 | NA | | 1.8E-09 | 3.1E-11 | 5.7E-01 | 5.4E-11 | 0.00467% |
| C9-C10 Aromatics | 0.386 | NA | | 2.9E-10 | 5.0E-12 | 1.7E-02 | 2.9E-10 | 0.0251% |
| C5-C8 Aliphatics | 5.77 | NA | | 4.4E-09 | 7.4E-11 | 5.7E-02 | 1.3E-09 | 0.11% |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 2.5 | NA | | 1.9E-09 | 3.2E-11 | 5.7E-01 | 5.6E-11 | 0.0048% |
| | | | | | | SUMMARY HAZARD INDEX | 0.000001 | |

TABLE 2
INHLATION OF PARTICULATES FROM SURFACE SOIL
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 1
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 0 63 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 24 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 24 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

TABLE 2
INHLATION OF PARTICULATES FROM SURFACE SOIL
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 1
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Benzo(a)anthracene | 5.1 | NA | | 3.9E-09 | 3.9E-11 | 3.1E-01 | 1.2E-11 | 6.58% |
| Benzo(a)pyrene | 6.1 | NA | | 4.6E-09 | 4.7E-11 | 3.1E+00 | 1.5E-10 | 78.66% |
| Benzo(b)fluoranthene | 6.1 | NA | | 4.6E-09 | 4.7E-11 | 3.1E-01 | 1.5E-11 | 7.87% |
| Benzo(k)fluoranthene | 5.8 | NA | | 4.4E-09 | 4.5E-11 | 3.1E-02 | 1.4E-12 | 0.75% |
| Chrysene | 6.9 | NA | | 5.2E-09 | 5.3E-11 | 3.1E-03 | 1.6E-13 | 0.09% |
| Indeno(1,2,3-cd)pyrene | 4.7 | NA | | 3.6E-09 | 3.6E-11 | 3.1E-01 | 1.1E-11 | 6.06% |
| | | | | | | SUMMARY CANCER RISK | 2E-10 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 5.42 | NA | | 4.1E-09 | 1.2E-10 | 8.6E-04 | 1.4E-07 | 6.96% |
| Benzo(g,h,I)perylene | 4.4 | NA | | 3.3E-09 | 9.9E-11 | 8.6E-04 | 1.1E-07 | 5.65% |
| Fluoranthene | 14 | NA | | 1.1E-08 | 3.1E-10 | 8.6E-04 | 3.6E-07 | 17.99% |
| Phenanthrene | 8.2 | NA | | 6.2E-09 | 1.8E-10 | 8.6E-04 | 2.1E-07 | 10.54% |
| Pyrene | 11 | NA | | 8.3E-09 | 2.5E-10 | 8.6E-04 | 2.9E-07 | 14.13% |
| Benzo(a)anthracene | 5.1 | NA | | 3.9E-09 | 1.1E-10 | 8.6E-04 | 1.3E-07 | 6.55% |
| Benzo(a)pyrene | 6.1 | NA | | 4.6E-09 | 1.4E-10 | 8.6E-04 | 1.6E-07 | 7.84% |
| Benzo(b)fluoranthene | 6.1 | NA | | 4.6E-09 | 1.4E-10 | 8.6E-04 | 1.6E-07 | 7.84% |
| Benzo(k)fluoranthene | 5.8 | NA | | 4.4E-09 | 1.3E-10 | 8.6E-04 | 1.5E-07 | 7.45% |
| Chrysene | 6.9 | NA | | 5.2E-09 | 1.5E-10 | 8.6E-04 | 1.8E-07 | 8.87% |
| Indeno(1,2,3-cd)pyrene | 4.7 | NA | | 3.6E-09 | 1.1E-10 | 8.6E-04 | 1.2E-07 | 6.04% |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 2.41 | NA | | 1.8E-09 | 5.4E-11 | 5.7E-01 | 9.5E-11 | 0.00467% |
| C9-C10 Aromatics | 0.386 | NA | | 2.9E-10 | 8.7E-12 | 1.7E-02 | 5.1E-10 | 0.0251% |
| C5-C8 Aliphatics | 5.77 | NA | | 4.4E-09 | 1.3E-10 | 5.7E-02 | 2.3E-09 | 0.11% |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 2.5 | NA | | 1.9E-09 | 5.6E-11 | 5.7E-01 | 9.8E-11 | 0.0048% |
| | | | | | | SUMMARY HAZARD INDEX | 0.000002 | |

TABLE 3
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 1
FORT DEVENS, MA

13-Oct-99

August 1992

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 200 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 1 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 2,045 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 15 | kg |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 6 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 6 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

TABLE 3
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 1
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Benzo(a)anthracene | 5.1 | 2.4E-06 | 0.13 | 3.2E-06 | 7.3E-01 | 8.2E-01 | 1.7E-06 | 2.6E-06 | 4.4E-06 | 6.58% |
| Benzo(a)pyrene | 6.1 | 2.9E-06 | 0.13 | 3.8E-06 | 7.3E+00 | 8.2E+00 | 2.1E-05 | 3.1E-05 | 5.2E-05 | 78.66% |
| Benzo(b)fluoranthene | 6.1 | 2.9E-06 | 0.13 | 3.8E-06 | 7.3E-01 | 8.2E-01 | 2.1E-06 | 3.1E-06 | 5.2E-06 | 7.86% |
| Benzo(k)fluoranthene | 5.8 | 2.7E-06 | 0.13 | 3.6E-06 | 7.3E-02 | 8.2E-02 | 2.0E-07 | 3.0E-07 | 5.0E-07 | 0.75% |
| Chrysene | 6.9 | 3.2E-06 | 0.13 | 4.3E-06 | 7.3E-03 | 8.2E-03 | 2.4E-08 | 3.5E-08 | 5.9E-08 | 0.09% |
| Indeno(1,2,3-cd)pyrene | 4.7 | 2.2E-06 | 0.13 | 2.9E-06 | 7.3E-01 | 8.2E-01 | 1.6E-06 | 2.4E-06 | 4.0E-06 | 6.06% |
| SUMMARY CANCER RISK | | | | | | | 3E-05 | 4E-05 | 7E-05 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 5.42 | 3.0E-05 | 0.13 | 3.9E-05 | 2.0E-02 | 1.8E-02 | 1.5E-03 | 2.2E-03 | 3.7E-03 | 10.10% |
| Benzo(g,h,I)perylene | 4.4 | 2.4E-05 | 0.13 | 3.2E-05 | 3.0E-02 | 2.7E-02 | 8.0E-04 | 1.2E-03 | 2.0E-03 | 5.46% |
| Fluoranthene | 14 | 7.7E-05 | 0.13 | 1.0E-04 | 4.0E-02 | 3.6E-02 | 1.9E-03 | 2.9E-03 | 4.8E-03 | 13.04% |
| Phenanthrene | 8.2 | 4.5E-05 | 0.13 | 6.0E-05 | 3.0E-02 | 2.7E-02 | 1.5E-03 | 2.2E-03 | 3.7E-03 | 10.18% |
| Pyrene | 11 | 6.0E-05 | 0.13 | 8.0E-05 | 3.0E-02 | 2.7E-02 | 2.0E-03 | 3.0E-03 | 5.0E-03 | 13.66% |
| Benzo(a)anthracene | 5.1 | 2.8E-05 | 0.13 | 3.7E-05 | 3.0E-02 | 2.7E-02 | 9.3E-04 | 1.4E-03 | 2.3E-03 | 6.33% |
| Benzo(a)pyrene | 6.1 | 3.3E-05 | 0.13 | 4.4E-05 | 3.0E-02 | 2.7E-02 | 1.1E-03 | 1.7E-03 | 2.8E-03 | 7.58% |
| Benzo(b)fluoranthene | 6.1 | 3.3E-05 | 0.13 | 4.4E-05 | 3.0E-02 | 2.7E-02 | 1.1E-03 | 1.7E-03 | 2.8E-03 | 7.58% |
| Benzo(k)fluoranthene | 5.8 | 3.2E-05 | 0.13 | 4.2E-05 | 3.0E-02 | 2.7E-02 | 1.1E-03 | 1.6E-03 | 2.6E-03 | 7.20% |
| Chrysene | 6.9 | 3.8E-05 | 0.13 | 5.0E-05 | 3.0E-02 | 2.7E-02 | 1.3E-03 | 1.9E-03 | 3.1E-03 | 8.57% |
| Indeno(1,2,3-cd)pyrene | 4.7 | 2.6E-05 | 0.13 | 3.4E-05 | 3.0E-02 | 2.7E-02 | 8.6E-04 | 1.3E-03 | 2.1E-03 | 5.84% |
| C9-C12 Aliphatics | 2.41 | 1.3E-05 | 0.17 | 2.3E-05 | 6.0E-01 | 5.5E-01 | 2.2E-05 | 4.2E-05 | 6.4E-05 | 0.17% |
| C9-C10 Aromatics | 0.386 | 2.1E-06 | 0.17 | 3.7E-06 | 3.0E-02 | 2.7E-02 | 7.1E-05 | 1.4E-04 | 2.1E-04 | 0.56% |
| C9-C18 Aliphatics | 10 | 5.6E-05 | 0.17 | 9.7E-05 | 6.0E-01 | 5.5E-01 | 9.3E-05 | 1.8E-04 | 2.7E-04 | 0.74% |
| C5-C8 Aliphatics | 10 | 5.5E-05 | 0.17 | 9.6E-05 | 6.0E-02 | 5.5E-01 | 9.2E-04 | 1.7E-04 | 1.1E-03 | 2.99% |
| SUMMARY HAZARD INDEX | | | | | | | 0.02 | 0.02 | 0.04 | |

# N-2 CALCULATION OF EPH/VPH EXPOSURE POINT CONCENTRATIONS

**Calculation of EPH and VPH Exposure Point Concentrations**

Exposures to petroleum contamination in soil were evaluated using EPH and VPH data, as opposed to TPHC data. Use of EPH and VPH data permits a site-specific assessment of the petroleum-related constituents, and is consistent with the MADEP petroleum policy (MADEP, 1997). Because some soil samples collected near soil source areas during the 1995/1996 field program were analyzed for TPHC (the EPH/VPH methodology had not been promulgated at the time), it was necessary to convert the TPHC concentrations to EPH/VPH concentrations for development of exposure point concentrations (EPCs). The TPHC data were converted to EPH/VPH by calculating the average composition of EPH/VPH in site soils (based on measured EPH/VPH concentrations), and then applying the compositional information to the measured TPHC concentrations. Statistical parameters for deriving EPCs were then calculated using data sets composed of the measured and estimated EPH/VPH concentrations. This appendix provides documentation of the EPH/VPH EPC calculations.

The calculation of EPCs for EPH and VPH hydrocarbon fractions was performed in a three-step process:

1) Petroleum hydrocarbons analytical data for samples used in the risk assessment were grouped by site area (i.e., Area 2 and Area 3), exposure area (i.e., upland and wetland), and exposure medium (i.e., surface soil and subsurface soil). Tables 1 through 8 present the available TPH, EPH, and VPH data. These data summaries were used to identify samples for which only TPH data were available (i.e., samples for which no EPH or VPH analyses were performed).

2) The petroleum composition of each sample for which EPH/VPH data were available was identified by calculating the percent composition of each EPH and VPH carbon chain as a fraction of the total EPH/VPH concentration. Tables 9 and 10 show the compositional data for soils at Areas 2 and 3, respectively (shaded values in tables). One-half the sample quantitation limit was used to represent the hydrocarbon fraction concentration for results reported as not-detected. To increase the available data base of directly measured EPH/VPH data, data for surface and subsurface soil samples, as well as upland and wetland soil samples, were combined for each area. Because the same source of petroleum contamination affected soils at each of the areas, combining soil data from surface and subsurface soils and upland and wetland areas within each area should not bias the results.

3) The average percent-composition of each EPH and VPH fraction was calculated (Tables 9 and 10). The average percent composition (and range of percent composition for detected concentrations) for each EPH/VPH fraction at Areas 2 and 3 is presented below. As shown, the average percent compositions indicate that the petroleum contamination is primarily associated with heavy-end EPH fractions (e.g., C19-C36 aliphatic EPH). The narrow range of percent compositions indicates that the petroleum composition among the samples at each area is similar. Although a wide range of percent compositions is evident in the VPH fractions at Area 3, the detected EPH and VPH concentrations for the samples with elevated VPH composition was low (e.g., less than 100 mg/kg).

| Area 2 | Area 3 |
|---|---|
| C5-C8 aliphatic VPH – Not Detected | C5-C8 aliphatic VPH – Not Detected |
| C9-C12 aliphatic VPH – 0.41% (0.04% - 4.3%) | C9-C12 aliphatic VPH – 3.3% (1.4% - 50%) |
| C9-C10 aromatic VPH – 0.29% (0.08% - 0.6%) | C9-C10 aromatic VPH – 1.3% (0.2% - 36%) |
| C9-C18 aliphatic EPH – 5.8% (2.5% - 11.6%) | C9-C18 aliphatic EPH – 6.4% (1.8% - 9.7%) |
| C19-C36 aliphatic EPH – 71% (57% - 79%) | C19-C36 aliphatic EPH – 76% (64% - 89%) |
| C11-C22 aromatic EPH – 22% (17% - 38%) | C11-C22 aromatic EPH – 12% (9.5% - 13%) |

4) The petroleum compositional information calculated in Step 2 was used to calculate EPH and VPH equivalent concentrations in samples for which only TPH data was available. EPH/VPH equivalent concentrations were calculated by multiplying the measured TPH concentrations (in samples for which only TPH data were available) by the average percent-composition of petroleum at the appropriate area. These calculations, as well as the EPH and VPH concentrations estimated from the compositional information, are shown in Tables 9 and 10.

5) Exposure point concentrations were calculated for each exposure point using the measured EPH/VPH concentrations (when available) and calculated EPH/VPH concentrations (samples for which TPH data was converted to EPH/VPH concentrations). Exposure point concentrations for use in the risk assessment were the lesser of the 95% upper confidence limit (for data sets with 10 or more samples) and the maximum detected concentration. EPC calculations are shown in Tables 11 through 17.

TABLE 1
SUMMARY OF PETROLEUM HYDROCARBONS RESULTS IN SURFACE SOIL
AREA 2 INDUSTRIAL
AOC 57 RF

| SAMPLE ID | BX570100 | BX570200 | EX570200 | EX571000 | EX572500 | | MIN | MAX | |
|---|---|---|---|---|---|---|---|---|---|
| SAMPLE LOCATION | 57B-95-01X | 57B-95-02X | 57E-95-02X | 57E-95-10X | 57E-95-25X | FOD | DETECT | DETECT | AVERAGE[1] |
| **ANALYTES** | | | | | | | | | |
| TPH (mg/Kg) | 81 | 7970 | 454 | 25 | 81 | 5/5 | 25 | 7970 | 1722 |
| VPH RANGES (mg/Kg) | | | | | | | | | |
| C5 - C8 Aliphatics | NA | NA | NA | NA | NA | N/A | N/A | N/A | N/A |
| C9 - C12 Aliphatics | NA | NA | NA | NA | NA | N/A | N/A | N/A | N/A |
| C9 - C10 Aromatics | NA | NA | NA | NA | NA | N/A | N/A | N/A | N/A |
| EPH RANGES (mg/Kg) | | | | | | | | | |
| C9 - C18 Aliphatics | NA | NA | NA | NA | NA | N/A | N/A | N/A | N/A |
| C19 -C36 Aliphatics | NA | NA | NA | NA | NA | N/A | N/A | N/A | N/A |
| C11 - C22 Aromatics | NA | NA | NA | NA | NA | N/A | N/A | N/A | N/A |

NOTES:
NA = Not analyzed
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
FOD = Frequency of detection
mg/Kg = milligrams per kilograms
N/A = Not applicable
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.

TABLE 2
SUMMARY OF PETROLEUM HYDROCARBONS RESULTS IN SUBSURFACE SOIL
AREA 2 INDUSTRIAL
AOC 57 RF

| SAMPLE ID | BX570105 | EX570106 | BX570205 | EX570405 | | MIN | MAX | |
|---|---|---|---|---|---|---|---|---|
| SAMPLE LOCATION | 57B-95-01X | 57E-95-01X | 57B-95-02X | 57E-95-04X(+ dup) | FOD | DETECT | DETECT | AVERAGE[1] |
| **ANALYTES** | | | | | | | | |
| | | | | | | | | |
| TPH (mg/Kg) | 26 | 141 | 87 | 19 | 4/4 | 19 | 141 | 68 |
| | | | | | | | | |
| VPH RANGES (mg/Kg) | | | | | | | | |
| C5 - C8 Aliphatics | NA | NA | NA | NA | N/A | N/A | N/A | N/A |
| C9 - C12 Aliphatics | NA | NA | NA | NA | N/A | N/A | N/A | N/A |
| C9 - C10 Aromatics | NA | NA | NA | NA | N/A | N/A | N/A | N/A |
| | | | | | | | | |
| EPH RANGES (mg/Kg) | | | | | | | | |
| C9 - C18 Aliphatics | NA | NA | NA | NA | N/A | N/A | N/A | N/A |
| C19 -C36 Aliphatics | NA | NA | NA | NA | N/A | N/A | N/A | N/A |
| C11 - C22 Aromatics | NA | NA | NA | NA | N/A | N/A | N/A | N/A |

NOTES:
NA = Not analyzed
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
mg/Kg = milligrams per kilograms
N/A = Not applicable
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.

TABLE 3
SUMMARY OF PETROLEUM HYDROCARBONS RESULT IN SURFACE SOIL
AREA 2 RECREATIONAL
AOC 57 RF

| SAMPLE ID | EX571200 | EX571600 | EX571700 | SF570101 | SF570200 | SF570401 | SF570601 | SF570700 | SF570701 | SF570800 | SF570900 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE LOCATION | 57E-95-12X | 57E-95-16X | 57E-95-17X | 57S-98-01F | 57S-98-02F | 57S-98-04F | 57S-98-06X | 57S-98-07X(+ dup) | 57S-98-07X | 57S-98-08X | 57S-98-09X |
| ANALYTES | | | | | | | | | | | |
| TPH (mg/Kg) | 5110 | 169 | 2390 | 393 | 1200 | 1150 | 4620 | 4000 | 17000 | 494 | 1930 |
| VPH RANGES (mg/Kg) | | | | | | | | | | | |
| C5 - C8 Aliphatics | NA | NA | NA | <1.3 | <2.5 | <1.3 | <2.3 | <9.0 | <3.5 | <5.3 | <3.6 |
| C9 - C12 Aliphatics | NA | NA | NA | 4.3 | 2.5 | <1.3 | 3.9 | 9.82 | 15 | 6.4 | 6.4 |
| C9 - C10 Aromatics | NA | NA | NA | <1.3 | <2.5 | <1.3 | <2.3 | 16.5 | <3.5 | 13 | <3.6 |
| EPH RANGES (mg/Kg) | | | | | | | | | | | |
| C9 - C18 Aliphatics | NA | NA | NA | <44 | <55 | <37 | 120 | <165 | 270 | <100 | <83 |
| C19 -C36 Aliphatics | NA | NA | NA | 68 | 360 | 260 | 830 | 1950 | 1600 | <100 | 240 |
| C11 - C22 Aromatics | NA | NA | NA | <44 | 240 | 140 | 190 | 550 | 450 | <100 | 110 |

NOTES:
NA = Not analyzed
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
mg/Kg = milligrams per kilograms
FOD = Frequency of detection
N/A = Not applicable
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.

TABLE 3
SUMMARY OF PETROLEUM HYDROCARBONS RESULT IN SURFACE SOIL
AREA 2 RECREATIONAL
AOC 57 RF

| SAMPLE ID | | MIN | MAX | |
|---|---|---|---|---|
| SAMPLE LOCATION | FOD | DETECT | DETECT | AVERAGE[1] |
| ANALYTES | | | | |
| TPH (mg/Kg) | 11/11 | 169 | 17,000 | 3496 |
| VPH RANGES (mg/Kg) | | | | |
| C5 - C8 Aliphatics | 0/8 | N/A | N/A | 1.8 |
| C9 - C12 Aliphatics | 7/8 | 2.5 | 15 | 6.1 |
| C9 - C10 Aromatics | 2/8 | 13 | 16.5 | 4.6 |
| EPH RANGES (mg/Kg) | | | | |
| C9 - C18 Aliphatics | 2/8 | 120 | 270 | 79 |
| C19 -C36 Aliphatics | 7/8 | 68 | 1950 | 670 |
| C11 - C22 Aromatics | 6/8 | 110 | 550 | 247 |

NOTES:
NA = Not analyzed
TPH = Total Petroleum Hydrocar
VPH = Volatile Petroleum Hydro
EPH = Extractable Petroleum Hy
mg/Kg = milligrams per kilogram
FOD = Frequency of detection
N/A = Not applicable
[1] The average represents the ari

TABLE 4
SUMMARY OF PETROLEUM HYDROCARBONS RESULTS IN SUBSURFACE SOIL
AREA 2 RECREATIONAL
AOC 57 RF

| SAMPLE ID | EX570704 | EX570804 | EX570905 | EX571305 | EX571406 | EX571502 | EX571602 | EX571802 | EX571902 | EX572005 | SF570302 | SF570503 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE LOCATION | 57E-95-07X | 57E-95-08X | 57E-95-09X | 57E-95-13X | 57E-95-14X | 57E-95-15X | 57E-95-16X | 57E-95-18X | 57E-95-19X | 57E-95-20X | 57S-98-03F | 57S-98-05F |
| ANALYTES | | | | | | | | | | | | |
| TPH (mg/Kg) | 31,800 | 58 | 79 | <28 | 49 | 26,100 | 30,000 | 50 | 130 | 63 | 14,800 | 1750 |
| VPH RANGES (mg/Kg) | | | | | | | | | | | | |
| C5 - C8 Aliphatics | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | <1.6 | <1.0 |
| C9 - C12 Aliphatics | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 1.9 | 2.1 |
| C9 - C10 Aromatics | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | <1.6 | <1.0 |
| EPH RANGES (mg/Kg) | | | | | | | | | | | | |
| C9 - C18 Aliphatics | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 110 | <33 |
| C19 -C36 Aliphatics | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 3300 | 610 |
| C11 - C22 Aromatics | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 990 | 140 |

NOTES:
NA = Not analyzed
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
N/A = Not applicable
mg/Kg = milligrams per kilograms
FOD = Frequency of detection
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.

TABLE 4
SUMMARY OF PETROLEUM HYDROCARBONS RESULTS IN SUBSURFACE SOIL
AREA 2 RECREATIONAL
AOC 57 RF

| SAMPLE ID<br>SAMPLE LOCATION | FOD | MIN<br>DETECT | MAX<br>DETECT | AVERAGE[1] |
|---|---|---|---|---|
| ANALYTES | | | | |
| TPH (mg/Kg) | 11/12 | 49 | 31,800 | 8741 |
| VPH RANGES (mg/Kg) | | | | |
| C5 - C8 Aliphatics | 0/2 | N/A | N/A | 1.3 |
| C9 - C12 Aliphatics | 2/2 | 1.9 | 2.1 | 2 |
| C9 - C10 Aromatics | 0/2 | N/A | N/A | 1.3 |
| EPH RANGES (mg/Kg) | | | | |
| C9 - C18 Aliphatics | 1/2 | 110 | 110 | 63.2 |
| C19 -C36 Aliphatics | 2/2 | 610 | 3300 | 1955 |
| C11 - C22 Aromatics | 2/2 | 140 | 990 | 565 |

NOTES:
NA = Not analyzed
TPH = Total Petroleum Hydrocar
VPH = Volatile Petroleum Hydro
EPH = Extractable Petroleum Hy
N/A = Not applicable
mg/Kg = milligrams per kilogram
FOD = Frequency of detection
[1] The average represents the ari

TABLE 5
SUMMARY OF PETROLEUM HYDROCARBONS RESULTS IN SURFACE SOIL
AREA 3 INDUSTRIAL
AOC 57 RF

| SAMPLE ID | BX570800 | BX570900 | EX57W05X | EX57W10X | EX57W02X | EX57W17X | | MIN | MAX | |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE LOCATION | 57B-95-08X | 57B-95-09X | | | | | FOD | DETECT | DETECT | AVERAGE[1] |
| **ANALYTES** | | | | | | | | | | |
| TPH (mg/Kg) | 50 | 39 | NA | NA | NA | NA | 2/2 | 39 | 50 | 44.5 |
| VPH RANGES (mg/Kg) | | | | | | | | | | |
| C5 - C8 Aliphatics | NA | NA | <19 | <15.5 | <21.5 | <16 | 0/4 | N/A | N/A | N/A |
| C9 - C12 Aliphatics | NA | NA | <4.7 | <3.85 | <5.35 | 16 | 1/4 | 16 | 16 | 5.74 |
| C9 - C10 Aromatics | NA | NA | <4.7 | <3.85 | 4.85 | <4 | 1/4 | 4.85 | 4.85 | 2.78 |
| EPH RANGES (mg/Kg) | | | | | | | | | | |
| C9 - C18 Aliphatics | NA | NA | <6.4 | <6.95 | <7.25 | <3.6 | 0/4 | N/A | N/A | N/A |
| C19 -C36 Aliphatics | NA | NA | <6.4 | <6.95 | 7.28 | <4.8 | 1/4 | 7.28 | 7.28 | 4.09 |
| C11 - C22 Aromatics | NA | NA | <17 | <18.5 | <19.5 | <19 | 0/4 | N/A | N/A | N/A |

NOTES:
NA = Not analyzed
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
N/A = Not applicable
mg/Kg = milligrams per kilograms
FOD = Frequency of Detection
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.

TABLE 6
SUMMARY OF PETROLEUM HYDROCARBONS RESULTS IN SUBSURFACE SOIL
AREA 3 INDUSTRIAL
AOC 57 RF

| SAMPLE ID | BX570805 | BX570905 | BX571110 | EX57W06X | EX57W07X | EX57W08X | EX57W09X | EX57F01X | EX57F02X |
|---|---|---|---|---|---|---|---|---|---|
| SAMPLE LOCATION | 57B-96-08X | 57B-96-09X | 57B-96-11X (+dup) | | | | | | |
| **ANALYTES** | | | | | | | | | |
| TPH (mg/Kg) | <28 | <28 | 25 | NA | NA | NA | NA | NA | NA |
| VPH RANGES (mg/Kg) | | | | | | | | | |
| C5 - C8 Aliphatics | NA | NA | NA | <18 | <18 | <18 | <15 | <18 | <18 |
| C9 - C12 Aliphatics | NA | NA | NA | <4.6 | <4.5 | <4.5 | <3.7 | <4.6 | <4.6 |
| C9 - C10 Aromatics | NA | NA | NA | <4.6 | <4.5 | <4.5 | <3.7 | <4.6 | <4.6 |
| EPH RANGES (mg/Kg) | | | | | | | | | |
| C9 - C18 Aliphatics | NA | NA | NA | <6.4 | 9 | <6.3 | <6.3 | 78 | <7.6 |
| C19 -C36 Aliphatics | NA | NA | NA | 20 | 440 | 10 | <6.3 | 990 | 12 |
| C11 - C22 Aromatics | NA | NA | NA | <17 | 37 | <17 | <17 | 110 | <20 |

NOTES:
NA = Not analyzed
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
N/A = Not applicable
mg/Kg = milligrams per kilograms
FOD = Frequency of detection
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.

TABLE 6
SUMMARY OF PETROLEUM HYDROCARBONS RESULTS IN SUBSURFACE SOIL
AREA 3 INDUSTRIAL
AOC 57 RF

| SAMPLE ID<br>SAMPLE LOCATION | FOD | MIN DETECT | MAX DETECT | AVERAGE[1] |
|---|---|---|---|---|
| **ANALYTES** | | | | |
| TPH (mg/Kg) | 1/3 | 25 | 25 | 17.7 |
| VPH RANGES (mg/Kg) | | | | |
| C5 - C8 Aliphatics | 0/6 | N/A | N/A | N/A |
| C9 - C12 Aliphatics | 0/6 | N/A | N/A | N/A |
| C9 - C10 Aromatics | 0/6 | N/A | N/A | N/A |
| EPH RANGES (mg/Kg) | | | | |
| C9 - C18 Aliphatics | 2/6 | 9 | 78 | 16.7 |
| C19 -C36 Aliphatics | 5/6 | 10 | 990 | 246 |
| C11 - C22 Aromatics | 2/6 | 37 | 110 | 30.4 |

NOTES:
NA = Not analyzed
TPH = Total Petroleum Hydrocarbo
VPH = Volatile Petroleum Hydrocar
EPH = Extractable Petroleum Hydr
N/A = Not applicable
mg/Kg = milligrams per kilograms
FOD = Frequency of detection
[1] The average represents the arith

TABLE 7
SUMMARY OF PETROLEUM HYDROCARBONS RESULTS IN SURFACE SOIL
AREA 3 RECREATIONAL
AOC 57 RF

| SAMPLE ID | SF571301 | SF571401 | EX5703X | EX57W14X | EX57W15X | EX57W16X | | MIN | MAX | |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE LOCATION | 57S-98-13F | 57S-98-14F | | | | | FOD | DETECT | DETECT | AVERAGE[1] |
| ANALYTES | | | | | | | | | | |
| TPH (mg/Kg) | 951 | 895 | NA | NA | NA | NA | 2/2 | 895 | 951 | 923 |
| VPH RANGES (mg/Kg) | | | | | | | | | | |
| C5 - C8 Aliphatics | <1.8 | <1.4 | <15 | <17 | <23 | <150 | 0/6 | N/A | N/A | N/A |
| C9 - C12 Aliphatics | 3.7 | <1.4 | 47 | 110 | <5.7 | 1500 | 4/6 | 3.7 | 1500 | 277 |
| C9 - C10 Aromatics | <1.8 | <1.4 | 37 | 55 | <5.7 | 600 | 3/6 | 37 | 600 | 116 |
| EPH RANGES (mg/Kg) | | | | | | | | | | |
| C9 - C18 Aliphatics | <46 | <40 | <7.5 | 920 | 765 | 1300 | 3/6 | 765 | 1300 | 505 |
| C19 -C36 Aliphatics | 180 | 150 | <7.5 | 20,000 | 7200 | 8600 | 5/6 | 150 | 20,000 | 6022 |
| C11 - C22 Aromatics | 60 | 75 | <20 | 3100 | 1200 | 1400 | 5/6 | 60 | 3100 | 974 |

NOTES:
NA = Not analyzed
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
N/A = Not applicable
mg/Kg = milligrams per kilograms
FOD = Frequency of detection
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.

TABLE 8
SUMMARY OF PETROLEUM HYDROCARBONS RESULTS IN SUBSURFACE SOIL
AREA 3 RECREATIONAL
AOC 57 RF

| SAMPLE ID | SX571503 | | MIN | MAX | |
|---|---|---|---|---|---|
| SAMPLE LOCATION | 57S-98-15X | FOD | DETECT | DETECT | AVERAGE[1] |
| ANALYTES | | | | | |
| TPH (mg/Kg) | <27.9 | 0/1 | N/A | N/A | N/A |
| VPH RANGES (mg/Kg) | | | | | |
| C5 - C8 Aliphatics | <1.3 | 0/1 | N/A | N/A | N/A |
| C9 - C12 Aliphatics | <1.3 | 0/1 | N/A | N/A | N/A |
| C9 - C10 Aromatics | <1.3 | 0/1 | N/A | N/A | N/A |
| EPH RANGES (mg/Kg) | | | | | |
| C9 - C18 Aliphatics | <37 | 0/1 | N/A | N/A | N/A |
| C19 -C36 Aliphatics | <37 | 0/1 | N/A | N/A | N/A |
| C11 - C22 Aromatics | <37 | 0/1 | N/A | N/A | N/A |

NOTES:
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
mg/Kg = milligrams per kilograms
N/A = Not applicable
FOD = Frequency of detection
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.

TABLE 9
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 2
AOC 57 RI

| ON-SITE SAMPLE ID | SF570101 | | | | SF570200 | | | | SF570302 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OFF-SITE SAMPLE ID | SX570101 | | | | SX570200 | | | | SX570302 | | | |
| DATE COLLECTED | 19-May-98 | | | | 19-May-98 | | | | 19-May-98 | | | |
| DATE ANALYZED | 19-May-98 | | ADJ | % | 19-May-98 | | ADJ | % | 19-May-98 | | ADJ | % |
| Off-Site TPH (mg/Kg-dry) | 393 | | | | 1200 | | | | 14800 | | | |
| VPH Ranges (mg/Kg) | | | | | | | | | | | | |
| n-C5 to n-C8 Aliphatic* | <1.3 | | | | < 2.5 | J | | | < 1.6 | J | | |
| n-C9 to n-C12 Aliphatic* | 4.3 | | 4.3 | 3.7% | 2.5 | J | 2.5 | 0.4% | 1.9 | J | 1.9 | 0.043% |
| n-C9 to n-C10 Aromatic | <1.3 | | 0.65 | 0.6% | < 2.5 | J | 1.25 | 0.2% | < 1.6 | J | 0.8 | 0.018% |
| EPH Ranges (mg/Kg) | | | | | | | | | | | | |
| n-C9 to n-C18 Aliphatic | <44 | J | 22 | 18.8% | <55 | J | 27.5 | 4.4% | 110 | J | 110 | 2.5% |
| n-C19 to n-C36 Aliphatic | 68 | | 68 | 58.1% | 360 | | 360 | 57.0% | 3300 | | 3300 | 75.0% |
| n-C11 to n-C22 Aromatic** | <44 | | 22 | 18.8% | 240 | | 240 | 38.0% | 990 | | 990 | 22.5% |
| TOTAL EPH/VPH | | | 116.95 | | | | 631.25 | 100% | | | 4402.7 | 100% |

TABLE 9
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 2
AOC 57 RI

| ON-SITE SAMPLE ID | SF570401 | | | | SF570503 | | | | SF570601 | | | | SF570700(+dup) | | | | SF570701 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OFF-SITE SAMPLE ID | SX570401 | | | | SX570503 | | | | SX570601 | | | | SX570700(+dup) | | | | SX570701 |
| DATE COLLECTED | 19-May-98 | | | | 19-May-98 | | | | 19-May-98 | | | | 19-May-98 | | | | 19-May-98 |
| DATE ANALYZED | 19-May-98 | | ADJ | % | 19-May-98 | | ADJ | % | 19-May-98 | | ADJ | % | 19-May-98 | | ADJ | % | 20-May-98 |
| Off-Site TPH (mg/Kg-dry) | 1150 | | | | 1750 | | | | 4620 | | | | 4000 | D | | | 17000 |
| VPH Ranges (mg/Kg) | | | | | | | | | | | | | | | | | |
| n-C5 to n-C8 Aliphatic* | < 1.3 | | | | < 1.0 | | | | <2.3 | J | | | <9.0 | J | | | < 3.5 |
| n-C9 to n-C12 Aliphatic* | < 1.3 | | 0.65 | 0.155% | 2.1 | | 2.1 | 0.273% | 3.9 | J | 3.9 | 0.341% | 9.825 | J | 9.825 | 0.377% | 15 |
| n-C9 to n-C10 Aromatic | < 1.3 | | 0.65 | 0.155% | < 1.0 | | 0.5 | 0.065% | <2.3 | J | 1.15 | 0.100% | 16.5 | J | 16.5 | 0.632% | < 3.5 |
| EPH Ranges (mg/Kg) | | | | | | | | | | | | | | | | | |
| n-C9 to n-C18 Aliphatic | <37 | J | 18.5 | 4.4% | <33 | | 16.5 | 2.1% | 120 | J | 120 | 10.5% | <165 | J | 82.5 | 3.2% | 270 |
| n-C19 to n-C36 Aliphatic | 260 | | 260 | 61.9% | 610 | | 610 | 79.3% | 830 | | 830 | 72.5% | 1950 | | 1950 | 74.7% | 1600 |
| n-C11 to n-C22 Aromatic** | 140 | | 140 | 33.3% | 140 | | 140 | 18.2% | 190 | | 190 | 16.6% | 550 | | 550 | 21.1% | 450 |
| TOTAL EPH/VPH | | | 419.8 | 100% | | | 769.1 | 100% | | | 1145.05 | 100% | | | 2608.83 | 100% | |

TABLE 9
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 2
AOC 57 RI

| ON-SITE SAMPLE ID | | | | SF570800 | | | | SF570900 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| OFF-SITE SAMPLE ID | | | | SX570800 | | | | SX570900 | | | |
| DATE COLLECTED | | | | 19-May-98 | | | | 19-May-98 | | | |
| DATE ANALYZED | | ADJ | % | 20-May-98 | | ADJ | % | 20-May-98 | | ADJ | % |
| Off-Site TPH (mg/Kg-dry) | | | | 494 | | | | 1930 | | | |
| VPH Ranges (mg/Kg) | | | | | | | | | | | |
| n-C5 to n-C8 Aliphatic* | J | | | <5.3 | J | | | <3.6 | J | | |
| n-C9 to n-C12 Aliphatic* | J | 15 | 0.642% | 6.4 | J | 6.4 | 3.778% | 6.4 | J | 6.4 | 1.601% |
| n-C9 to n-C10 Aromatic | J | 1.75 | 0.075% | 13 | J | 13 | 7.674% | <3.6 | J | 1.8 | 0.450% |
| EPH Ranges (mg/Kg) | | | | | | | | | | | |
| n-C9 to n-C18 Aliphatic | J | 270 | 11.6% | <100 | J | 50 | 29.5% | <83 | J | 41.5 | 10.4% |
| n-C19 to n-C36 Aliphatic | | 1600 | 68.5% | <100 | | 50 | 29.5% | 240 | | 240 | 60.0% |
| n-C11 to n-C22 Aromatic** | | 450 | 19.3% | <100 | | 50 | 29.5% | 110 | | 110 | 27.5% |
| TOTAL EPH/VPH | | 2336.75 | 100% | | | 169.4 | | | | 399.7 | 100% |

TABLE 9
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 2
AOC 57 RI

| ON-SITE SAMPLE ID<br>OFF-SITE SAMPLE ID<br>DATE COLLECTED<br>DATE ANALYZED | AVE<br>ADJ | AVE<br>% | 57B-95-01X<br>BX570100<br>9/26/95 | VPH/EPH USING<br>CORRELATION | 57B-95-02X<br>BX570200<br>9/27/95 | VPH/EPH USING<br>CORRELATION | 57E-95-02X<br>EX570200<br>9/18/96 |
|---|---|---|---|---|---|---|---|
| **Off-Site TPH (mg/Kg-dry)** | | | 81 | | 7970 | | 454 |
| **VPH Ranges (mg/Kg)** | | | | | | | |
| **n-C5 to n-C8 Aliphatic*** | | | | 0 | | 0 | |
| **n-C9 to n-C12 Aliphatic*** | 5.3 | **0.41%** | | 0.33 | | 32 | |
| **n-C9 to n-C10 Aromatic** | 3.8 | **0.29%** | | 0.24 | | 23 | |
| **EPH Ranges (mg/Kg)** | | | | | | | |
| **n-C9 to n-C18 Aliphatic** | 75.9 | **5.83%** | | 4.7 | | 465 | |
| **n-C19 to n-C36 Aliphatic** | 926.8 | **71.29%** | | 58 | | 5682 | |
| **n-C11 to n-C22 Aromatic**** | 288.2 | **22.17%** | | 18 | | 1767 | |
| TOTAL EPH/VPH | 1300 | **100%** | | 81 | | 7970 | |

TABLE 9
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 2
AOC 57 RI

| ON-SITE SAMPLE ID<br>OFF-SITE SAMPLE ID<br>DATE COLLECTED<br>DATE ANALYZED | VPH/EPH USING CORRELATION | 57E-95-10X<br>EX571000<br>9/19/95 | VPH/EPH USING CORRELATION | 57E-95-25X<br>EX572500<br>9/22/95 | VPH/EPH USING CORRELATION | 57E-95-12X<br>EX571200<br>9/20/95 | VPH/EPH USING CORRELATION | 57E-95-16X<br>EX571600<br>9/21/95 |
|---|---|---|---|---|---|---|---|---|
| **Off-Site TPH (mg/Kg-dry)** | | 25 | | 81 | | 5110 | | 169 |
| **VPH Ranges (mg/Kg)** | | | | | | | | |
| **n-C5 to n-C8 Aliphatic*** | 0 | | 0 | | 0 | | 0 | |
| **n-C9 to n-C12 Aliphatic*** | 1.9 | | 0.102 | | 0.33 | | 21 | |
| **n-C9 to n-C10 Aromatic** | 1.3 | | 0.073 | | 0.24 | | 15 | |
| **EPH Ranges (mg/Kg)** | | | | | | | | |
| **n-C9 to n-C18 Aliphatic** | 26 | | 1.5 | | 4.7 | | 298 | |
| **n-C19 to n-C36 Aliphatic** | 324 | | 18 | | 58 | | 3643 | |
| **n-C11 to n-C22 Aromatic**** | 101 | | 6 | | 18 | | 1133 | |
| TOTAL EPH/VPH | 454 | | 25 | | 81 | | 5110 | |

TABLE 9
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 2
AOC 57 RI

| ON-SITE SAMPLE ID<br>OFF-SITE SAMPLE ID<br>DATE COLLECTED<br>DATE ANALYZED | VPH/EPH USING CORRELATION | 57E-95-17X<br>EX571700<br>9/21/95 | VPH/EPH USING CORRELATION | 57B-95-01X<br>BX570105<br>9/26/95 | VPH/EPH USING CORRELATION | 57B-95-02X<br>BX570205<br>9/27/95 | VPH/EPH USING CORRELATION |
|---|---|---|---|---|---|---|---|
| **Off-Site TPH (mg/Kg-dry)** | | 2390 | | 26 | | 87 | |
| **VPH Ranges (mg/Kg)** | | | | | | | |
| **n-C5 to n-C8 Aliphatic*** | 0 | | 0 | | 0 | | 0 |
| **n-C9 to n-C12 Aliphatic*** | 0.69 | | 10 | | 0.108 | | 0.35 |
| **n-C9 to n-C10 Aromatic** | 0.49 | | 7.0 | | 0.077 | | 0.25 |
| **EPH Ranges (mg/Kg)** | | | | | | | |
| **n-C9 to n-C18 Aliphatic** | 9.9 | | 139 | | 1.5 | | 5.1 |
| **n-C19 to n-C36 Aliphatic** | 120 | | 1704 | | 19 | | 62 |
| **n-C11 to n-C22 Aromatic**** | 37 | | 530 | | 5.9 | | 19 |
| TOTAL EPH/VPH | 169 | | 2390 | | 26 | | 87 |

TABLE 9
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 2
AOC 57 RI

| ON-SITE SAMPLE ID | 57B-95-04X | | 57E-95-01X | | 57E-95-07X | | 57E-95-08X | |
|---|---|---|---|---|---|---|---|---|
| OFF-SITE SAMPLE ID | BX570405 | VPH/EPH USING | EX570106 | VPH/EPH USING | EX570704 | VPH/EPH USING | EX570804 | VPH/EPH USING |
| DATE COLLECTED | 9/19/95 | CORRELATION | 9/18/95 | CORRELATION | 9/19/95 | CORRELATION | 9/20/95 | CORRELATION |
| DATE ANALYZED | | | | | | | | |
| **Off-Site TPH (mg/Kg-dry)** | 19 | | 141 | | 31,800 | | 58 | |
| **VPH Ranges (mg/Kg)** | | | | | | | | |
| **n-C5 to n-C8 Aliphatic*** | | 0 | | 0 | | 0 | | 0 |
| **n-C9 to n-C12 Aliphatic*** | | 0.076 | | 0.57 | | 130 | | 0.23 |
| **n-C9 to n-C10 Aromatic** | | 0.055 | | 0.41 | | 93 | | 0.17 |
| **EPH Ranges (mg/Kg)** | | | | | | | | |
| **n-C9 to n-C18 Aliphatic** | | 1.1 | | 8.2 | | 1855 | | 3.4 |
| **n-C19 to n-C36 Aliphatic** | | 13 | | 101 | | 22672 | | 41 |
| **n-C11 to n-C22 Aromatic**** | | 4 | | 31 | | 7050 | | 13 |
| TOTAL EPH/VPH | | 19 | | 141 | | 31800 | | 58 |

TABLE 9
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 2
AOC 57 RI

| ON-SITE SAMPLE ID | 57E-95-09X | | 57E-95-13X | 57E-95-13X | | 57E-95-14X | | 57E-95-15X |
|---|---|---|---|---|---|---|---|---|
| OFF-SITE SAMPLE ID | EX570905 | VPH/EPH USING | EX571305 | 1/2 DETECT | VPH/EPH USING | EX571406 | VPH/EPH USING | EX571502 |
| DATE COLLECTED | 9/20/95 | CORRELATION | 9/21/95 | | CORRELATION | 9/21/95 | CORRELATION | 9/21/95 |
| DATE ANALYZED | | | | | | | | |
| **Off-Site TPH (mg/Kg-dry)** | 79 | | <28 | 14 | | 49 | | 26100 |
| **VPH Ranges (mg/Kg)** | | | | | | | | |
| **n-C5 to n-C8 Aliphatic*** | | 0 | | | 0 | | | |
| **n-C9 to n-C12 Aliphatic*** | | 0.32 | | | 0.06 | | 0.20 | |
| **n-C9 to n-C10 Aromatic** | | 0.23 | | | 0.04 | | 0.14 | |
| **EPH Ranges (mg/Kg)** | | | | | | | | |
| **n-C9 to n-C18 Aliphatic** | | 4.6 | | | 0.82 | | 2.9 | |
| **n-C19 to n-C36 Aliphatic** | | 56 | | | 9.98 | | 35 | |
| **n-C11 to n-C22 Aromatic**** | | 18 | | | 3.10 | | 11 | |
| TOTAL EPH/VPH | | 79 | | | 14 | | 49 | |

TABLE 9
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 2
AOC 57 RI

| ON-SITE SAMPLE ID<br>OFF-SITE SAMPLE ID<br>DATE COLLECTED<br>DATE ANALYZED | VPH/EPH USING CORRELATION |
|---|---|
| **Off-Site TPH (mg/Kg-dry)** | |
| **VPH Ranges (mg/Kg)** | |
| **n-C5 to n-C8 Aliphatic*** | |
| **n-C9 to n-C12 Aliphatic*** | 106 |
| **n-C9 to n-C10 Aromatic** | 76 |
| **EPH Ranges (mg/Kg)** | |
| **n-C9 to n-C18 Aliphatic** | 1523 |
| **n-C19 to n-C36 Aliphatic** | 18608 |
| **n-C11 to n-C22 Aromatic**** | 5786 |
| TOTAL EPH/VPH | 26100 |

TABLE 9
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 2
AOC 57 RI

| ON-SITE SAMPLE ID | 57E-95-16X | | 57E-95-18X | | 57E-95-19X | | 57E-95-20X | |
|---|---|---|---|---|---|---|---|---|
| OFF-SITE SAMPLE ID | EX571602 | VPH/EPH USING | EX571802 | VPH/EPH USING | EX571902 | VPH/EPH USING | EX572005 | VPH/EPH USING |
| DATE COLLECTED | 9/21/95 | CORRELATION | 9/21/95 | CORRELATION | 9/21/95 | CORRELATION | 9/21/95 | CORRELATION |
| DATE ANALYZED | | | | | | | | |
| **Off-Site TPH (mg/Kg-dry)** | 30000 | | 50 | | 130 | | 63 | |
| **VPH Ranges (mg/Kg)** | | | | | | | | |
| **n-C5 to n-C8 Aliphatic*** | | | | | | | | |
| **n-C9 to n-C12 Aliphatic*** | | 122 | | 0.20 | | 0.53 | | 0.25 |
| **n-C9 to n-C10 Aromatic** | | 88 | | 0.14 | | 0.38 | | 0.18 |
| **EPH Ranges (mg/Kg)** | | | | | | | | |
| **n-C9 to n-C18 Aliphatic** | | 1750 | | 2.9 | | 7.6 | | 3.6 |
| **n-C19 to n-C36 Aliphatic** | | 21388 | | 35 | | 93 | | 45 |
| **n-C11 to n-C22 Aromatic**** | | 6651 | | 11 | | 29 | | 14 |
| TOTAL EPH/VPH | | 30000 | | 50 | | 130 | | 63 |

TABLE 10
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 3
AOC 57 RI

| OFF-SITE SAMPLE ID | | SX571301 | | | | SX571401 | | | |
|---|---|---|---|---|---|---|---|---|---|
| DATE COLLECTED | S-1 | 20-May-98 | | | | 20-May-98 | | | |
| DATE ANALYZED | (ug/g) | 20-May-98 | | ADJ | % | 20-May-98 | | ADJ | % |
| **Off-Site TPH (mg/Kg-dry)** | 200 | 951 | | | | 895 | | | |
| **VPH Ranges (mg/Kg)** | | | | | | | | | |
| **n-C5 to n-C8 Aliphatic*** | 100 | <1.8 | J | | | <1.4 | | | |
| **n-C9 to n-C12 Aliphatic*** | 1000 | 3.7 | J | 3.7 | 1.38% | <1.4 | | 0.7 | 0.28% |
| **n-C9 to n-C10 Aromatic** | 100 | <1.8 | J | 0.9 | 0.34% | <1.4 | | 0.7 | 0.28% |
| **EPH Ranges (mg/Kg)** | | | | | | | | | |
| **n-C9 to n-C18 Aliphatic** | 1000 | <46 | J | 23 | 8.59% | <40 | J | 20 | 8.12% |
| **n-C19 to n-C36 Aliphatic** | 2500 | 180 | | 180 | 67.26% | 150 | | 150 | 60.88% |
| **n-C11 to n-C22 Aromatic**** | 200 | 60 | | 60 | 22.42% | 75 | J | 75 | 30.44% |
| TOTAL EPH/VPH | | | | 267.6 | 100% | | | 246.4 | 100% |

Notes:
* concentrations of target compounds including n-pentane, 2-methylpentane, MTBE, 2,2,4-trimethylpentane, n-noname, BTEX, 1,2,4-trimethyl and naphthalene have been subtacted when determining concentration.
** concentrations of PAH target compounds have been subtracted when determining concentration.

TABLE 10
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 3
AOC 57 RI

| OFF-SITE SAMPLE ID | SX571503 | | | EX57W05X | | | EX57W10X | | |
|---|---|---|---|---|---|---|---|---|---|
| DATE COLLECTED | 20-May-98 | | | 25-Mar-99 | | | 16-Apr-99 | | |
| DATE ANALYZED | 20-May-98 | ADJ | % | | ADJ | % | | ADJ | % |
| Off-Site TPH (mg/Kg-dry) | <27.9 | | | NA | | | NA | | |
| **VPH Ranges (mg/Kg)** | | | | | | | | | |
| n-C5 to n-C8 Aliphatic* | <1.3 | | | <19 | | | <15.5 | | |
| n-C9 to n-C12 Aliphatic* | <1.3 | 0.65 | 1.14% | <4.7 | 2.35 | 11.99% | <3.85 | 1.92 | 13.45% |
| n-C9 to n-C10 Aromatic | <1.3 | 0.65 | 1.14% | <4.7 | 2.35 | 11.99% | <3.85 | 1.92 | 13.45% |
| **EPH Ranges (mg/Kg)** | | | | | | | | | |
| n-C9 to n-C18 Aliphatic | <37 J | 18.5 | 32.57% | <6.4 | 3.2 | 16.33% | <6.95 | 3.48 | 24.37% |
| n-C19 to n-C36 Aliphatic | <37 | 18.5 | 32.57% | <6.4 | 3.2 | 16.33% | <6.95 | 3.48 | 24.37% |
| n-C11 to n-C22 Aromatic** | <37 | 18.5 | 32.57% | <17 | 8.5 | 43.37% | <18.5 | 3.48 | 24.37% |
| TOTAL EPH/VPH | | 56.8 | 100% | | 19.6 | 100% | | 14.28 | 100% |

Notes:
* concentrations of target compounds includi enzene,
and naphthalene have been subtacted when
** concentrations of PAH target compounds

TABLE 10
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 3
AOC 57 RI

| OFF-SITE SAMPLE ID | EX57W02X | | | EX57W17X | | | EX57W14X | | |
|---|---|---|---|---|---|---|---|---|---|
| DATE COLLECTED | 25-Mar-99 | | | | | | | | |
| DATE ANALYZED | | ADJ | % | | ADJ | % | | ADJ | % |
| **Off-Site TPH (mg/Kg-dry)** | | | | | | | | | |
| **VPH Ranges (mg/Kg)** | | | | | | | | | |
| **n-C5 to n-C8 Aliphatic*** | <21.5 | | | <16 | | | <17 | | |
| **n-C9 to n-C12 Aliphatic*** | <5.35 | 2.68 | 9.51% | 16 | 16 | 50.47% | 110 | 110 | 0.45% |
| **n-C9 to n-C10 Aromatic** | 4.85 | 4.85 | 17.20% | <4.0 | 2 | 6.31% | 55 | 55 | 0.23% |
| **EPH Ranges (mg/Kg)** | | | | | | | | | |
| **n-C9 to n-C18 Aliphatic** | <7.25 | 3.63 | 12.88% | <3.6 | 1.8 | 5.68% | 920 | 920 | 3.80% |
| **n-C19 to n-C36 Aliphatic** | 7.28 | 7.28 | 25.82% | <4.8 | 2.4 | 7.57% | 20,000 | 20,000 | 82.70% |
| **n-C11 to n-C22 Aromatic**** | <19.5 | 9.75 | 34.59% | <19 | 9.5 | 29.97% | 3100 | 3100 | 12.82% |
| TOTAL EPH/VPH | | 28.19 | 100% | | 31.7 | 100% | | 24185 | 100% |

Notes:
* concentrations of target compounds includi
and naphthalene have been subtacted when
** concentrations of PAH target compounds

TABLE 10
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 3
AOC 57 RI

| OFF-SITE SAMPLE ID | EX57W15X | | | EX57W16X | | | EX57W06X | | |
|---|---|---|---|---|---|---|---|---|---|
| DATE COLLECTED | | | | | | | 25-Mar-99 | | |
| DATE ANALYZED | | ADJ | % | | ADJ | % | | ADJ | % |
| **Off-Site TPH (mg/Kg-dry)** | | | | | | | | | |
| **VPH Ranges (mg/Kg)** | | | | | | | | | |
| **n-C5 to n-C8 Aliphatic*** | <23 | | | <150 | | | <18 | | |
| **n-C9 to n-C12 Aliphatic*** | <5.7 | 2.85 | 0.03% | 1500 | 1500 | 11.19% | <4.6 | 2.3 | 6.34% |
| **n-C9 to n-C10 Aromatic** | <5.7 | 2.85 | 0.03% | 600 | 600 | 4.48% | <4.6 | 2.3 | 6.34% |
| **EPH Ranges (mg/Kg)** | | | | | | | | | |
| **n-C9 to n-C18 Aliphatic** | 765 | 765 | 8.34% | 1300 | 1300 | 9.70% | <6.4 | 3.2 | 8.82% |
| **n-C19 to n-C36 Aliphatic** | 7200 | 7200 | 78.51% | 8600 | 8600 | 64.18% | 20 | 20 | 55.10% |
| **n-C11 to n-C22 Aromatic**** | 1200 | 1200 | 13.09% | 1400 | 1400 | 10.45% | <17 | 8.5 | 23.42% |
| TOTAL EPH/VPH | | 9170.7 | 100% | | 13400 | 100% | | 36.3 | 100% |

Notes:
* concentrations of target compounds includi
and naphthalene have been subtacted when
** concentrations of PAH target compounds

TABLE 10
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 3
AOC 57 RI

| OFF-SITE SAMPLE ID | EX57W07X | | | EX57W08X | | | EX57W09X | | |
|---|---|---|---|---|---|---|---|---|---|
| DATE COLLECTED | 25-Mar-99 | | | 25-Mar-99 | | | 16-Apr-99 | | |
| DATE ANALYZED | | ADJ | % | | ADJ | % | | ADJ | % |
| **Off-Site TPH (mg/Kg-dry)** | | | | | | | | | |
| **VPH Ranges (mg/Kg)** | | | | | | | | | |
| **n-C5 to n-C8 Aliphatic*** | <18 | | | <18 | | | <15 | | |
| **n-C9 to n-C12 Aliphatic*** | <4.5 | 2.25 | 0.46% | <4.5 | 2.25 | 8.60% | <3.7 | 1.85 | 10.00% |
| **n-C9 to n-C10 Aromatic** | <4.5 | 2.25 | 0.46% | <4.5 | 2.25 | 8.60% | <3.7 | 1.85 | 10.00% |
| **EPH Ranges (mg/Kg)** | | | | | | | | | |
| **n-C9 to n-C18 Aliphatic** | 9 | 9 | 1.83% | <6.3 | 3.15 | 12.05% | <6.3 | 3.15 | 17.03% |
| **n-C19 to n-C36 Aliphatic** | 440 | 440 | 89.70% | 10 | 10 | 38.24% | <6.3 | 3.15 | 17.03% |
| **n-C11 to n-C22 Aromatic**** | 37 | 37 | 7.54% | <17 | 8.5 | 32.50% | <17 | 8.5 | 45.95% |
| TOTAL EPH/VPH | | 490.5 | 100% | | 26.15 | 100% | | 18.5 | 100% |

Notes:
* concentrations of target compounds includi
and naphthalene have been subtacted when
** concentrations of PAH target compounds

TABLE 10
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 3
AOC 57 RI

| OFF-SITE SAMPLE ID | EX57F01X | | | EX57F02X | | | EX57F03X | | |
|---|---|---|---|---|---|---|---|---|---|
| DATE COLLECTED | 25-Mar-99 | | | 25-Mar-99 | | | 15-Apr-99 | | |
| DATE ANALYZED | | ADJ | % | | ADJ | % | | ADJ | % |
| **Off-Site TPH (mg/Kg-dry)** | | | | | | | | | |
| **VPH Ranges (mg/Kg)** | | | | | | | | | |
| **n-C5 to n-C8 Aliphatic*** | <18 | | | <18 | | | <15 | | |
| **n-C9 to n-C12 Aliphatic*** | <4.6 | 2.3 | 0.19% | <4.6 | 2.3 | 7.57% | 47 | 47 | 46.31% |
| **n-C9 to n-C10 Aromatic** | <4.6 | 2.3 | 0.19% | <4.6 | 2.3 | 7.57% | 37 | 37 | 36.45% |
| **EPH Ranges (mg/Kg)** | | | | | | | | | |
| **n-C9 to n-C18 Aliphatic** | 78 | 78 | 6.60% | <7.6 | 3.8 | 12.50% | <7.5 | 3.75 | 3.69% |
| **n-C19 to n-C36 Aliphatic** | 990 | 990 | 83.71% | 12 | 12 | 39.47% | <7.5 | 3.75 | 3.69% |
| **n-C11 to n-C22 Aromatic**** | 110 | 110 | 9.30% | <20 | 10 | 32.89% | <20 | 10 | 9.85% |
| TOTAL EPH/VPH | 1178 | 1182.6 | 100% | 12 | 30.4 | 100% | | 102 | 100% |

Notes:
* concentrations of target compounds includi
and naphthalene have been subtacted when
** concentrations of PAH target compounds

TABLE 10
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 3
AOC 57 RI

| OFF-SITE SAMPLE ID<br>DATE COLLECTED<br>DATE ANALYZED | ADJ<br>AVE | AVE<br>% | BX570800<br>8/28/96 | VPH/EPH USING<br>CORRELATION | BX570900<br>8/29/96 | VPH/EPH USING<br>CORRELATION |
|---|---|---|---|---|---|---|
| **Off-Site TPH (mg/Kg-dry)** | | | 50 | | 39 | |
| **VPH Ranges (mg/Kg)** | | | | | | |
| **n-C5 to n-C8 Aliphatic*** | | | | | | |
| **n-C9 to n-C12 Aliphatic*** | 103 | 3.36% | | 1.7 | | 1.3 |
| **n-C9 to n-C10 Aromatic** | 43 | 1.39% | | 0.70 | | 0.55 |
| **EPH Ranges (mg/Kg)** | | | | | | |
| **n-C9 to n-C18 Aliphatic** | 197 | 6.42% | | 3.2 | | 2.5 |
| **n-C19 to n-C36 Aliphatic** | 2353 | 76.50% | | 38 | | 30 |
| **n-C11 to n-C22 Aromatic**** | 379 | 12.33% | | 6.2 | | 4.9 |
| TOTAL EPH/VPH | 3075 | 100% | | 50 | | 39 |

Notes:
* concentrations of target compounds includi
and naphthalene have been subtacted when
** concentrations of PAH target compounds

TABLE 10
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 3
AOC 57 RI

| OFF-SITE SAMPLE ID<br>DATE COLLECTED<br>DATE ANALYZED | BX570805<br>8/29/96 | BX570805<br>1/2 DETECT | VPH/EPH USING<br>CORRELATION | BX570905<br>8/29/96 | BX570905<br>1/2 DETECT | VPH/EPH USING<br>CORRELATION |
|---|---|---|---|---|---|---|
| **Off-Site TPH (mg/Kg-dry)** | <28 | 14 | | <28 | 14 | |
| **VPH Ranges (mg/Kg)** | | | | | | |
| **n-C5 to n-C8 Aliphatic*** | | | | | | |
| **n-C9 to n-C12 Aliphatic*** | | | 0.47 | | | 0.47 |
| **n-C9 to n-C10 Aromatic** | | | 0.19 | | | 0.19 |
| **EPH Ranges (mg/Kg)** | | | | | | |
| **n-C9 to n-C18 Aliphatic** | | | 0.90 | | | 0.90 |
| **n-C19 to n-C36 Aliphatic** | | | 11 | | | 11 |
| **n-C11 to n-C22 Aromatic**** | | | 1.7 | | | 1.7 |
| TOTAL EPH/VPH | | | 14 | | | 14 |

Notes:
* concentrations of target compounds includi
and naphthalene have been subtacted when
** concentrations of PAH target compounds

TABLE 10
CALCULATION OF EPH/UPH CONCENTRATIONS FROM TPH DATA
AREA 3
AOC 57 RI

| OFF-SITE SAMPLE ID<br>DATE COLLECTED<br>DATE ANALYZED | EX570106<br>9/18/95 | VPH/EPH USING CORRELATION | BX571110<br>9/3/96 | VPH/EPH USING CORRELATION |
|---|---|---|---|---|
| **Off-Site TPH (mg/Kg-dry)** | 141 | | 25 | |
| **VPH Ranges (mg/Kg)** | | | | |
| **n-C5 to n-C8 Aliphatic*** | | | | |
| **n-C9 to n-C12 Aliphatic*** | | 4.7 | | 0.84 |
| **n-C9 to n-C10 Aromatic** | | 2.0 | | 0.35 |
| **EPH Ranges (mg/Kg)** | | | | |
| **n-C9 to n-C18 Aliphatic** | | 9.1 | | 1.6 |
| **n-C19 to n-C36 Aliphatic** | | 108 | | 19 |
| **n-C11 to n-C22 Aromatic**** | | 17 | | 3.1 |
| TOTAL EPH/VPH | | 141 | | 25 |

Notes:
* concentrations of target compounds includi
and naphthalene have been subtacted when
** concentrations of PAH target compounds

TABLE 11

EXPOSURE POINT CONCENTRATIONS
PETROLEUM HYDROCARBONS IN SURFACE SOIL
AREA 2 INDUSTRIAL
AOC 57 RI

| SAMPLE ID | BX570100 | BX570200 | EX570200 | EX571000 | EX572500 | | MAX | 95% | |
|---|---|---|---|---|---|---|---|---|---|
| SAMPLE LOCATION | 57B-95-01X | 57B-95-02X | 57E-95-02X | 57E-95-10X | 57E-95-25X | AVERAGE[1] | DETECT | UCL | EPC[2] |
| ANALYTES | | | | | | | | | |
| TPH (mg/Kg)[3] | 81 | 7970 | 454 | 25 | 81 | N/A | N/A | N/A | N/A |
| VPH RANGES (mg/Kg)* | | | | | | | | | |
| C5 - C8 Aliphatics | ND | ND | ND | ND | ND | N/A | N/A | N/A | N/A |
| C9 - C12 Aliphatics | 0.33 | 32 | 1.9 | 0.1 | 0.33 | 6.9 | 32 | NC | 32 |
| C9 - C10 Aromatics | 0.24 | 23 | 1.3 | 0.073 | 0.24 | 5.0 | 23 | NC | 23 |
| EPH RANGES (mg/Kg)* | | | | | | | | | |
| C9 - C18 Aliphatics | 4.7 | 465 | 26 | 1.5 | 4.7 | 100 | 465 | NC | 465 |
| C19 -C36 Aliphatics | 58 | 5682 | 324 | 18 | 58 | 1228 | 5682 | NC | 5682 |
| C11 - C22 Aromatics | 18 | 1767 | 101 | 6 | 18 | 382 | 1767 | NC | 1767 |

NOTES:
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
ND = No data
mg/Kg = milligrams per kilograms
ULC = The 95% upper confidence limit of the airthmetic mean.
EPC = Exposure point concentration
N/A = Not applicable
NC = Not calculated because there are fewer than 10 samples.
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.
[2] THE EPC is the lesser of the maximum detected concentration and the 95% UCL.
[3] The EPC for TPH is not calculated because petroleum hydrocarbon fractions are evaluated instead of TPH.
* Values for 1995 data have been calculated from EPH/VPH compositional data. See Table @.

TABLE 12

EXPOSURE POINT CONCENTRATIONS
PETROLEUM HYDROCARBONS IN SUBSURFACE SOIL
AREA 2 INDUSTRIAL
AOC 57 RI

| SAMPLE ID<br>SAMPLE LOCATION | BX570105<br>57B-95-01X | EX570106<br>57E-95-01X | BX570205<br>57B-95-02X | EX570405<br>57E-95-04X(+ dup) | AVERAGE[1] | MAX DETECT | 95% UCL | EPC[2] |
|---|---|---|---|---|---|---|---|---|
| **ANALYTES** | | | | | | | | |
| TPH (mg/Kg)[3] | 26 | 141 | 87 | 19 | N/A | N/A | N/A | N/A |
| VPH RANGES (mg/Kg)* | | | | | | | | |
| C5 - C8 Aliphatics | ND | ND | ND | ND | N/A | N/A | N/A | N/A |
| C9 - C12 Aliphatics | 0.11 | 0.57 | 0.35 | 0.076 | 0.28 | 0.57 | NC | 0.57 |
| C9 - C10 Aromatics | 0.077 | 0.41 | 0.25 | 0.055 | 0.20 | 0.41 | NC | 0.41 |
| EPH RANGES (mg/Kg)* | | | | | | | | |
| C9 - C18 Aliphatics | 1.5 | 8.2 | 5.1 | 1.1 | 4.0 | 8.2 | NC | 8.2 |
| C19 -C36 Aliphatics | 19 | 101 | 62 | 13 | 49 | 101 | NC | 101 |
| C11 - C22 Aromatics | 5.9 | 31 | 19 | 4 | 15 | 31 | NC | 31 |

NOTES:
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
ND = No data
mg/Kg = milligrams per kilograms
ULC = The 95% upper confidence limit of the airthmetic mean.
EPC = Exposure point concentration
N/A = Not applicable
NC = Not calculated because there are fewer than 10 samples.
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.
[2] THE EPC is the lesser of the maximum detected concentration and the 95% UCL.
[3] The EPC for TPH is not calculated because petroleum hydrocarbon fractions are evaluated instead of TPH.
* Values for 1995 data have been calculated from EPH/VPH compositional data. See Table @.

TABLE 13
EXPOSURE POINT CONCENTRATIONS
PETROLEUM HYDROCARBONS IN SURFACE SOIL
AREA 2 RECREATIONAL
AOC 57 RI

| SAMPLE ID | EX571200 | EX571600 | EX571700 | SF570101 | SF570200 | SF570401 | SF570601 | SF570700 | SF570701 | SF570800 | SF570900 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE LOCATION | 57E-95-12X | 57E-95-16X | 57E-95-17X | 57S-98-01F | 57S-98-02F | 57S-98-04F | 57S-98-06X | 57S-98-07X(+ dup) | 57S-98-07X | 57S-98-08X | 57S-98-09X |
| ANALYTES | | | | | | | | | | | |
| TPH (mg/Kg)[3] | 5110 | 169 | 2390 | 393 | 1200 | 1150 | 4620 | 4000 | 17000 | 494 | 1930 |
| VPH RANGES (mg/Kg)* | | | | | | | | | | | |
| C5 - C8 Aliphatics | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| C9 - C12 Aliphatics | 21 | 0.69 | 10 | 4.3 | 2.5 | 0.65 | 3.9 | 9.82 | 15 | 6.4 | 6.4 |
| C9 - C10 Aromatics | 15 | 0.49 | 7 | 0.65 | 1.25 | 0.65 | 1.15 | 16.5 | 1.75 | 13 | 1.8 |
| EPH RANGES (mg/Kg)* | | | | | | | | | | | |
| C9 - C18 Aliphatics | 298 | 9.9 | 139 | 22 | 27.5 | 18.5 | 120 | 82.5 | 270 | 50 | 41.5 |
| C19 -C36 Aliphatics | 3640 | 120 | 1700 | 68 | 360 | 260 | 830 | 1950 | 1600 | 50 | 240 |
| C11 - C22 Aromatics | 1130 | 37 | 530 | 22 | 240 | 140 | 190 | 550 | 450 | 50 | 110 |

NOTES:
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
ND = No data
mg/Kg = milligrams per kilograms
ULC = The 95% upper confidence limit of the airthmetic mean.
EPC = Exposure point concentration
N/A = Not applicable
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.
[2] THE EPC is the lesser of the maximum detected concentration and the 95% UCL.
[3] The EPC for TPH is not calculated because petroleum hydrocarbon fractions are evaluated instead of TPH.
* Values for 1995 data have been calculated from EPH/VPH compositional data. See Table @.

TABLE 13
EXPOSURE POINT CONCENTRATIONS
PETROLEUM HYDROCARBONS IN SURFACE SOIL
AREA 2 RECREATIONAL
AOC 57 RI

| SAMPLE ID<br>SAMPLE LOCATION | AVERAGE[1] | MAX DETECT | 95% UCL | EPC[2] |
|---|---|---|---|---|
| ANALYTES | | | | |
| TPH (mg/Kg)[3] | N/A | N/A | N/A | N/A |
| VPH RANGES (mg/Kg)* | | | | |
| C5 - C8 Aliphatics | N/A | N/A | N/A | N/A |
| C9 - C12 Aliphatics | 7.3 | 21 | 29 | 21 |
| C9 - C10 Aromatics | 5.4 | 17 | 24 | 17 |
| EPH RANGES (mg/Kg)* | | | | |
| C9 - C18 Aliphatics | 98 | 298 | 343 | 298 |
| C19 -C36 Aliphatics | 983 | 3640 | 5763 | 3640 |
| C11 - C22 Aromatics | 314 | 1130 | 1361 | 1130 |

NOTES:
TPH = Total Petroleum Hydrocarb
VPH = Volatile Petroleum Hydroc
EPH = Extractable Petroleum Hyd
ND = No data
mg/Kg = milligrams per kilograms
ULC = The 95% upper confidence
EPC = Exposure point concentrati
N/A = Not applicable
[1] The average represents the arit
[2] THE EPC is the lesser of the m
[3] The EPC for TPH is not calculat
* Values for 1995 data have been

TABLE 14
EXPOSURE POINT CONCENTRATIONS
PETROLEUM HYDROCARBONS IN SUBSURFACE SOIL
AREA 2 RECREATIONAL
AOC 57 RI

| SAMPLE ID | EX570704 | EX570804 | EX570905 | EX571305 | EX571406 | EX571502 | EX571602 | EX571802 | EX571902 | EX572005 | SF570302 | SF570503 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE LOCATION | 57E-95-07X | 57E-95-08X | 57E-95-09X | 57E-95-13X | 57E-95-14X | 57E-95-15X | 57E-95-16X | 57E-95-18X | 57E-95-19X | 57E-95-20X | 57S-98-03F | 57S-98-05F |
| ANALYTES | | | | | | | | | | | | |
| TPH (mg/Kg) | 31,800 | 58 | 79 | <28 | 49 | 26,100 | 30,000 | 50 | 130 | 63 | 14,800 | 1750 |
| VPH RANGES (mg/Kg) | | | | | | | | | | | | |
| C5 - C8 Aliphatics | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| C9 - C12 Aliphatics | 130 | 0.23 | 0.32 | 0.06 | 0.2 | 106 | 122 | 0.2 | 0.53 | 0.25 | 1.9 | 2.1 |
| C9 - C10 Aromatics | 93 | 0.17 | 0.23 | 0.04 | 0.14 | 76 | 88 | 0.14 | 0.38 | 0.18 | <1.6 | <1.0 |
| EPH RANGES (mg/Kg) | | | | | | | | | | | | |
| C9 - C18 Aliphatics | 1855 | 3.4 | 4.6 | 0.82 | 2.9 | 1523 | 1750 | 2.9 | 7.6 | 3.6 | 110 | <33 |
| C19 -C36 Aliphatics | 22,700 | 41 | 56 | 10 | 35 | 18,600 | 21,400 | 35 | 93 | 45 | 3300 | 610 |
| C11 - C22 Aromatics | 7050 | 13 | 18 | 3.1 | 11 | 5786 | 6651 | 11 | 29 | 14 | 990 | 140 |

NOTES:
NA = Not analyzed
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
N/A = Not applicable
mg/Kg = milligrams per kilograms
FOD = Frequency of detection
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.

TABLE 14
EXPOSURE POINT CONCENTRATIONS
PETROLEUM HYDROCARBONS IN SUBSURFACE SOIL
AREA 2 RECREATIONAL
AOC 57 RI

| SAMPLE ID<br>SAMPLE LOCATION | AVERAGE[1] | MAX<br>DETECT | 95%<br>UCL | EPC[2] |
|---|---|---|---|---|
| **ANALYTES** | | | | |
| TPH (mg/Kg) | N/A | N/A | N/A | N/A |
| VPH RANGES (mg/Kg) | | | | |
| C5 - C8 Aliphatics | N/A | N/A | N/A | N/A |
| C9 - C12 Aliphatics | 364 | 130 | 33,200 | 130 |
| C9 - C10 Aromatics | 22 | 93 | 22,200 | 93 |
| EPH RANGES (mg/Kg) | | | | |
| C9 - C18 Aliphatics | 440 | 1855 | 625,000 | 1855 |
| C19 -C36 Aliphatics | 5577 | 22,700 | 12,200,000 | 22,700 |
| C11 - C22 Aromatics | 1726 | 7050 | 3,510,000 | 7050 |

NOTES:
NA = Not analyzed
TPH = Total Petroleum Hydrocar
VPH = Volatile Petroleum Hydro
EPH = Extractable Petroleum Hy
N/A = Not applicable
mg/Kg = milligrams per kilogram
FOD = Frequency of detection
[1] The average represents the ar

TABLE 15

EXPOSURE POINT CONCENTRATIONS
PETROLEUM HYDROCARBONS IN SURFACE SOIL
AREA 3 INDUSTRIAL
AOC 57 RI

| SAMPLE ID | BX570800 | BX570900 | EX57W05X | EX57W10X | EX57W02X | EX57W17X | | MAX | 95% | |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE LOCATION | 57B-95-08X | 57B-95-09X | | | | | AVERAGE[1] | DETECT | UCL | EPC[2] |
| ANALYTES | | | | | | | | | | |
| TPH (mg/Kg)[3] | 50 | 39 | ND | ND | ND | ND | N/A | N/A | N/A | N/A |
| VPH RANGES (mg/Kg)* | | | | | | | | | | |
| C5 - C8 Aliphatics | ND | ND | ND | ND | ND | ND | N/A | N/A | N/A | N/A |
| C9 - C12 Aliphatics | 1.7 | 1.3 | 2.35 | 1.92 | 2.68 | 16 | 4.33 | 16 | NC | 16 |
| C9 - C10 Aromatics | 0.7 | 0.55 | 2.35 | 1.92 | 4.85 | 2 | 2.06 | 4.85 | NC | 4.85 |
| EPH RANGES (mg/Kg)* | | | | | | | | | | |
| C9 - C18 Aliphatics | 3.2 | 2.5 | 3.2 | 3.48 | 3.63 | 1.8 | 2.97 | 3.63 | NC | 3.63 |
| C19 -C36 Aliphatics | 38 | 30 | 3.2 | 3.48 | 7.28 | 2.4 | 14 | 38 | NC | 38 |
| C11 - C22 Aromatics | 6.2 | 4.9 | 8.5 | 3.48 | 9.75 | 9.5 | 7.06 | 9.75 | NC | 9.75 |

NOTES:
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
ND = No data
mg/Kg = milligrams per kilograms
ULC = The 95% upper confidence limit of the airthmetic mean.
EPC = Exposure point concentration
N/A = Not applicable
NC = Not calculated because there are fewer than 10 samples.
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.
[2] THE EPC is the lesser of the maximum detected concentration and the 95% UCL.
[3] The EPC for TPH is not calculated because petroleum hydrocarbon fractions are evaluated instead of TPH.
* Values for 1995 data have been calculated from EPH/VPH compositional data. See Table @.

TABLE 16

EXPOSURE POINT CONCENTRATIONS
PETROLEUM HYDROCARBONS IN SUBSURFACE SOIL
AREA 3 INDUSTRIAL
AOC 57 RI

| SAMPLE ID | BX570805 | BX570905 | BX571110 | EX57W06X | EX57W07X | EX57W08X | EX57W09X | EX57F01X | EX57F02X | | MAX | 95% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE LOCATION | 57B-96-08X | 57B-96-09X | 57B-96-11X (+dup) | | | | | | | AVERAGE[1] | DETECT | UCL | EPC[2] |
| ANALYTES | | | | | | | | | | | | | |
| TPH (mg/Kg)[3] | 14* | 14* | 25 | ND | ND | ND | ND | ND | ND | N/A | N/A | N/A | N/A |
| VPH RANGES (mg/Kg)* | | | | | | | | | | | | | |
| C5 - C8 Aliphatics | ND | ND | ND | ND | ND | ND | ND | ND | ND | N/A | N/A | N/A | N/A |
| C9 - C12 Aliphatics | 0.47 | 0.47 | 0.84 | 2.3 | 2.25 | 2.25 | 1.85 | 2.3 | 2.3 | 1.67 | 2.3 | NC | 2.3 |
| C9 - C10 Aromatics | 0.19 | 0.19 | 0.35 | 2.3 | 2.25 | 2.25 | 1.85 | 2.3 | 2.3 | 1.55 | 2.3 | NC | 2.3 |
| EPH RANGES (mg/Kg)* | | | | | | | | | | | | | |
| C9 - C18 Aliphatics | 0.9 | 0.9 | 1.6 | 3.2 | 9 | 3.15 | 3.15 | 78 | 3.8 | 12 | 78 | NC | 78 |
| C19 -C36 Aliphatics | 11 | 11 | 19 | 20 | 440 | 10 | 3.15 | 990 | 12 | 168 | 990 | NC | 990 |
| C11 - C22 Aromatics | 1.7 | 1.7 | 3.1 | 8.5 | 37 | 8.5 | 8.5 | 110 | 10 | 21 | 110 | NC | 110 |

NOTES:
* This value represents 1/2 the non-detect value.
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
ND = No data
mg/Kg = milligrams per kilograms
ULC = The 95% upper confidence limit of the airthmetic mean.
EPC = Exposure point concentration
N/A = Not applicable
NC = Not calculated because there are fewer than 10 samples.
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.
[2] THE EPC is the lesser of the maximum detected concentration and the 95% UCL.
[3] The EPC for TPH is not calculated because petroleum hydrocarbon fractions are evaluated instead of TPH.
* Values for 1995 data have been calculated from EPH/VPH compositional data. See Table @.

TABLE 17

EXPOSURE POINT CONCENTRATIONS
PETROLEUM HYDROCARBONS IN SURFACE SOIL
AREA 3 RECREATIONAL
AOC 57 RI

| SAMPLE ID | SF571301 | SF571401 | EX5703X | EX57W14X | EX57W15X | EX57W16X | | MAX | 95% | |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE LOCATION | 57S-98-13F | 57S-98-14F | | | | | AVERAGE[1] | DETECT | UCL | EPC[2] |
| ANALYTES | | | | | | | | | | |
| TPH (mg/Kg)[3] | 951 | 895 | ND | ND | ND | ND | N/A | N/A | N/A | N/A |
| VPH RANGES (mg/Kg)* | | | | | | | | | | |
| C5 - C8 Aliphatics | ND | ND | ND | ND | ND | ND | N/A | N/A | N/A | N/A |
| C9 - C12 Aliphatics | 3.7 | 0.7 | 47 | 110 | 2.85 | 1500 | 277 | 1500 | NC | 1500 |
| C9 - C10 Aromatics | 0.9 | 0.7 | 37 | 55 | 2.85 | 600 | 116 | 600 | NC | 600 |
| EPH RANGES (mg/Kg)* | | | | | | | | | | |
| C9 - C18 Aliphatics | 23 | 20 | 3.75 | 920 | 765 | 1300 | 505 | 1300 | NC | 1300 |
| C19 -C36 Aliphatics | 180 | 150 | 3.75 | 20,000 | 7200 | 8600 | 6020 | 20,000 | NC | 20,000 |
| C11 - C22 Aromatics | 60 | 75 | 10 | 3100 | 1200 | 1400 | 974 | 3100 | NC | 3100 |

NOTES:
TPH = Total Petroleum Hydrocarbons
VPH = Volatile Petroleum Hydrocarbons
EPH = Extractable Petroleum Hydrocarbons
ND = No data
mg/Kg = milligrams per kilograms
ULC = The 95% upper confidence limit of the airthmetic mean.
EPC = Exposure point concentration
N/A = Not applicable
NC = Not calculated because there are fewer than 10 samples.
[1] The average represents the arithmetic mean of all the sample results, with one-half the detection limit used for non-detects.
[2] THE EPC is the lesser of the maximum detected concentration and the 95% UCL.
[3] The EPC for TPH is not calculated because petroleum hydrocarbon fractions are evaluated instead of TPH.
* Values for 1995 data have been calculated from EPH/VPH compositional data. See Table @.

# N-3 SOIL ADHERENCE FACTOR CALCULATONS

**Table N-3**
**Calculation of Soil Adherence Factors**

| Receptor | Representative Scenario [1] | Soil Adherence (mg/cm2) [1] Hands | Arms | Legs | Faces | Feet | Surface Area-Weighted AF ($mg/cm^2$) [2] | Total Surface Area ($cm^2$) [2] |
|---|---|---|---|---|---|---|---|---|
| Adult Excavation Worker | Construction/Utility/ Equipment [5] | 0.32 | 0.3 | 0.066 | 0.23 | NA | 0.29 | 5200 |
| Adult Commercial Worker | Groundskeepers [6] | 0.098 | 0.022 | 0.001 | 0.01 | 0.018 | 0.016 | 12731 |
| Adult Maintenance Worker / Groundskeeper | Irrigation Installers | 0.19 | 0.018 | 0.0054 | 0.0063 | NA | 0.024 | 11600 |
| Child Resident | USEPA, 1998 [7] | | | | | | 1 | 2045 |
| Recreational Visitor (6 thru 16) | (8) | | | | | | 1 | 3850 |
| Adult Resident | USEPA, 1998 [7] | | | | | | 0.08 | 5800 |
| Body Surface Areas ($cm^2$) [3] | | Hands | Arms | Legs | Faces | Feet | Total Surface Area | |
| Adult | | 990 | 2910 | 6400 | 1300 | 1131 | 12731 | |
| Child (ages 6 -16) | | 687 | 1752 | 4035 | 910 | 989 | 8373 | |

Notes:

1 - Kissel, J.; Richter, K.; Fenske,R. (1996). Field measurements of dermal soil loading attributable to various activities: Implications for Exposure Assessment. Risk Anal. 16(1):115-125. Data excerpted from the Exposure Factors Handbook (USEPA, 1997. EPA\600\P-95\002F)

2 - Calculated as: Sum[(SAi...SA*n* x AFi...AF*n*) / Sum (SAi...SA*n*), where AF is AF presented in scenario, and SA is for body part associated with AF measurement

3 - From Exposure Factors Handbook (USEPA, 1997). All values are 50% percentile values for males. Values for children are averages for the age periods included in receptor scenario.

4 - AF values for this scenario are higher than AF values for Gardners No. 2

5 - For each body part, the highest dermal loading value among construction worker, utility worker, and equipment operator scenarios is selected. The dermal loading for legs was not included because dermal loading was only measured (soil was only present) on legs in one scenario.

6 - For each body part, the highest dermal loading value among Groundskeepers Nos. 2 through 5 is selected; values for Groundskeepers No. 1 are not used because the measurements are based on only 2 persons.

7 - Values recommended for residential exposures in Supplemental Guidance to RAGS - Dermal Exposure Assessment (USEPA, 1998)

8 - Assumes adherence factor for child resident (USEPA, 1998). Surface area is for arms, lower legs, and hands.

# N-4 TOXICITY PROFILES

**1,2-Dichloroethene**. 1,2-Dichloroethene is a volatile organic compound which exists as cis- and trans-isomers. The commercially used material is usually a mixture of the two isomers. In the past, it was used as a general inhalation anesthetic. It is currently used as an extraction solvent or as a component of dyes, perfume oils, waxes, resins, and plastics. It is also used as an intermediate in the synthesis of polymers.

1,2-Dichloroethene is absorbed by all routes of administration. Distribution is rapid and, due to its lipophilic nature, occurs to all organ systems. It is extensively metabolized to dichloroacetaldehyde and chloroacetic acids which are excreted primarily through urine.

Dermal contact to 1,2-dichloroethene may result in defatting of the skin and dermatitis. Exposure to airborne 1,2-dichloroethene causes irritation to eyes, mucous membranes and the upper respiratory tract. Systemically, the trans-isomer is believed to be more toxic than the cis-isomer. However, both have been reported to produce central nervous system depression and toxicity to liver and lungs. No data on the reproductive toxicity of 1,2-dichloroethene exists. Both isomers have tested negative for mutagenicity in vitro tests. Cancer effects have not been studied in humans or animals.

References:
Agency for Toxic Substances and Disease Registry (ATSDR), 1990. "Toxicological Profile for 1,2-Dichloroethene"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, February 1990.

Mycroft, F.J., Jones, J.R., and Olson, K.R. 1990. Environmental and Occupational Toxicology. In: Poisoning and Drug Overdose. Ed. K.R. Olson. Appleton & Lange, CT. p. 397.

**1,2/1,4-Dichlorobenzene.** 1,4-Dichlorobenzene has been used as mothballs, an insecticidal fumigant, a germicide, and a space deodorant. Human exposure to 1,4-dichlorobenzene has produced irritation to skin, throat, and eyes; prolonged exposure to high concentrations may cause weakness, dizziness, loss of weight, or liver injury. In several studies involving female rats and mice, no overt signs of toxicity were apparent at any exposure level. Non-tumor and tumor pathology did not indicate any treatment related effect of either species. An embryotoxicity and teratology study on rats did not demonstrate any signs of embryo- or phytotoxicity or teratogenicity at any exposure level (Loeser, 1983). In a series of mutagenicity tests, 1,4-dichlorobenzene did not produce a mutagenic response. (Loeser, 1983). Other exposure studies in rats have produced developmental abnormalities, phytotoxicity, and kidney tumors. Additional exposure studies in animals have produced histological changes in the lung, cirrhosis and necrosis of the liver, swelling of the tubular epithelium of the kidneys. 1,4-dichlorobenzene has been classified by the USEPA as a group C carcinogen, possibly carcinogenic to humans.

References:
Heath Effects Summary Tables (HEAST), 1993. United States Environmental Protection Agency.

Loeser E, Litchfield MH; Food Chem Toxicol 21 (6): 825-32 (1983)

**Aluminum.** Aluminum occurs naturally in the soil and makes up approximately 8 percent of the earths crust. Higher soil concentrations are associated with industries which burn coal and aluminum mining and smelting. Human exposures to aluminum may occur through ingestion of foods grown in soil that contains aluminum and use of antacids, antiperspirants, and other drug store items. Aluminum in antiperspirants can cause skin rashes in some people. Factory workers who inhale large amounts of aluminum dust may develop lung problems. Aluminum has caused lower birth weights in some animals. Studies have shown that aluminum accumulates in the brains of people with Alzheimer's disease. However, any causal link between aluminum exposure and this disease is yet to be demonstrated. Both human epidemiological studies and animal experiments strongly suggests that aluminum is not a carcinogen.

References:
Agency for Toxic Substances and Disease Registry (ATSDR), 1989. "Toxicological Profile for Aluminum"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, October 1989.

**Antimony.** Antimony enters the environment during the mining and processing of its ores and other related compounds. Small amounts of antimony are also released into the environment by incinerators and coal burning power plants. Antimony will strongly adhere to soil which contains iron, manganese, or aluminum. Antimony was used for medicinal purposes to treat people infected with parasites. However, chronic exposure can cause eye, skin, and lung irritation, as well as heart problems, vomiting and diarrhea. The oral RfD, based on an oral drinking water study in rats, showed changes in glucose and cholesterol metabolism. Antimony has not been evaluated by the USEPA for evidence of human carcinogenic potential.

References:
Agency for Toxic Substances and Disease Registry (ATSDR), 1991. "Toxicological Profile for Antimony"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, February 1991.

Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

**Aroclors.** Aroclors (polychlorinated biphenyls [PCBs]) are organic compounds composed of two chlorinated aromatic rings. The amount of chlorination of the rings determines the specific structure, or congener, of the aroclor and, subsequently, the specific chemical, physical, and toxicological properties. The excellent dielectric properties, thermal stability, and nonflamability of aroclors has made them ideal for use in electrical transformers and capacitors. Therefore, they have been used in these applications extensively in the past. Humans may be exposed to aroclors when an aroclor-containing electrical component burns or is dismantled. Although the production of aroclors in the U.S. was banned in 1977, aroclors do not readily breakdown, and they may still be present in older electrical equipment, and environmental media.

Following dermal exposure, aroclors have caused a skin rash called chloracne. Aroclors have also produced developmental defects in humans, which have mainly consisted of behavioral abnormalities. These effects have also been observed in animals. Epidemiological studies on occupationally-exposed humans do not conclusively link exposure to aroclors with an increased incidence of cancer. However, chronic oral exposure to aroclors has produced liver cancer in laboratory animals. The potency of the carcinogenic action of aroclors appears to increase as the chlorination of the aroclors increases. Although cancer in laboratory animals has only been conclusively demonstrated for aroclors with the highest percent chlorination (aroclors-1260 and 1254), the USEPA has classified all aroclor congeners as B2, probable human carcinogens.

References:
MADEP, 1992. "Risk Assessment Shortform Residential Exposure Scenario, Version 1.6"; Policy #WSC/ORS-142-92; Office of Research and Standards and the Bureau of Waste Site Cleanup, Boston, MA; September 1992.

**Arsenic.** Arsenic has been used in pesticide formulations and has industrial uses in tanneries, as well as the glass and wine making industries. Toxicity depends on its chemical form. Arsenic is an irritant of the skin, mucous membranes, and gastrointestinal tract. Symptoms of acute toxicity include vomiting, diarrhea, convulsions, and a severe drop in blood pressure. Subchronic effects include hyperpigmentation, sensory-motor polyneuropathy, persistent headache, and lethargy. Chronic oral exposure has caused skin lesions, peripheral vascular disease, and peripheral neuropathy. The USEPA has classified arsenic in Group A, human carcinogen, based on increased incidence of lung cancer in occupational studies.

References:
Agency for Toxic Substances and Disease Registry (ATSDR), 1992. "Toxicological Profile for Arsenic"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, February 1992.

**Barium.** Barium is used in paints, soap, paper, rubber, and in the manufacture of glass. Some compounds of barium have been used as insecticides. Acute exposure to barium through ingestion can cause gastroenteritis, muscular paralysis, as well as cardiovascular effects. Chronic inhalation of barium containing dust can cause a reversible, benign pneumoconiosis. There is no evidence for carcinogenicity for barium.

References:
Amdur, Mary O., John Doull, Curtis D. Klaassen, 1991. Toxicology: The Basic Science of Poisons, 4th edition; Pergamon Press, Inc. New York.

**Benzo(k)fluoranthene**. Benzo(k)fluoranthene is a member of the polycyclic aromatic hydrocarbons (PAH) class of compounds which contain two or more aromatic rings. PAHs are ubiquitous in nature and are also manmade. Benzo(k)fluoranthene occurs naturally in coal tar, crude oil, and is formed from incomplete combustion of organic material.

Although there are no human data that specifically link exposure to benzo(k)fluoranthene to human cancers, benzo(k)fluoranthene is a component of mixtures that have been associated with human cancer. These include coal tar, soots, coke oven emissions and cigarette smoke. Benzo(k)fluoranthene produced tumors after lung implantation in mice and when administered with a promoting agent in skin-painting studies. Benzo(k)fluoranthene is mutagenic in bacteria. Benzo(k)fluoranthene has been classified by USEPA as a B2, probable human carcinogen.

References:
MADEP, 1992. "Risk Assessment Shortform Residential Exposure Scenario, Version 1.6"; Policy #WSC/ORS-142-92; Office of Research and Standards and the Bureau of Waste Site Cleanup, Boston, MA; September 1992.

**Bis(2-ethylhexyl)phthalate (DEHP).** DEHP is used industrially as a plasticizer for resins and is found in many plastic materials as it makes them more flexible. It is also used in manufacturing organic pump fluids in electrical capacitors. Acute exposure to DEHP has produced eye and mucous membrane irritation, nausea, and diarrhea. Chronic exposure of laboratory animals to DEHP indicate that the target organs are the liver, causing morphological and biochemical changes, as well as the testes, producing damage to the seminiferous tubules. DEHP has produced developmental and reproductive effects in laboratory animals including spina bifida and reduced fertility. DEHP has been shown to cause a dose-related increase in liver tumors in mice and rats. Thus, the USEPA has designated DEHP as a B2, probable human carcinogen.

References:
ATSDR, 1991. Toxicological Profile for Di(2-ethylhexyl)phthalate. Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, October, 1991.

**Cadmium.** Cadmium is commonly used in electroplating and galvanizing due to its non-corrosive properties. It is a local respiratory tract irritant following exposure to cadmium dust or fumes. Acute exposure to cadmium dust/fumes may produce an acute chemical pneumonitis. Acute, oral exposure to cadmium results in nausea, vomiting, salivation, abdominal pain, cramps, and diarrhea. Chronic exposure to cadmium results in osteomalacia and osteoporosis (Itai-Itai disease) secondary to renal damage. The USEPA has classified cadmium as a B1 carcinogen via inhalation based on epidemiological data from Japan and China.

References:
Amdur, Mary O., John Doull, Curtis D. Klaassen, 1991. Toxicology: The Basic Science of Poisons, 4th edition; Pergamon Press, Inc. New York.

Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

**Carbon Tetrachloride**

Carbon tetrachloride is currently used as a fumigant, refrigerant, a propellant, and as a solvent for oil, fats, lacquers, varnishes, rubber, waxes, and resins. In the past, it was used as an industrial degreaser and a fire-extinguishing agent. Acute exposure is associated with dizziness, headache, confusion, and CNS depression. Liver and kidney damage result from chronic exposures. Symptoms of liver damage can include nausea, vomiting, enlarged and tender liver, jaundice, and fatty liver. Kidney failure, resulting in accumulation of waste products in the blood and water in the lungs is a

major cause of death from carbon tetrachloride. The liver and kidney have also been proven to be targets of toxicity in animals. Carbon tetrachloride has been designated as a B2, probable human carcinogen.

References:
Clayton, George D. and Florence E. Clayton, editors, 1981. Patty's Industrial Hygiene and Toxicology, 3rd Revised Edition; John Wiley & Sons; New York.

Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

**Chloroform.** Originally used as a general anesthetic, chloroform is used now in the production of air conditioning coolant, as a solvent, and in the manufacture of pesticides and dyes. It can also be found in dry cleaning agents, plastics, and floor polishes, and as a by product of drinking water purification. Acute exposure to chloroform via inhalation produced dizziness and gastrointestinal upset. Dermal contact with chloroform produces burns. It is a CNS depressant and chronic exposure has been shown to cause liver and kidney toxicity as well as cardiac arrhythmias. Several studies indicate that chloroform is carcinogenic via the oral route causing liver carcinoma in mice and kidney tumors. The USEPA has designated chloroform as a B2 carcinogen, a probable human carcinogen.

References:
Amdur, Mary O., John Doull, Curtis D. Klaassen, 1991. Toxicology: The Basic Science of Poisons, 4th edition; Pergamon Press, Inc. New York.

Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

**Chromium.** Chromium has been used in plating for corrosion resistance and decorative purposes, in the manufacture of alloys, and in printing, dying, and photography. The toxicity of chromium depends upon its valence state. Hexavalent chromium is more toxic via inhalation than trivalent chromium. The effects of inhalation exposure to hexavalent chromium include ulcers of the upper respiratory tract, nasal inflammation, perforation of the nasal septa and lung cancer. Most trivalent chromium compounds are inactive in short-term genotoxicity assays. Trivalent chromium compounds have not been found to be carcinogenic by any route of exposure. There is epidemiological evidence of an association between chromium and lung cancer. The USEPA has classified hexavalent chromium as an Class A, human carcinogen, by the inhalation route.

References:
Amdur, Mary O., John Doull, Curtis D. Klaassen, 1991. Toxicology: The Basic Science of Poisons, 4th edition; Pergamon Press, Inc. New York.

Integrated Risk Information System (IRIS), 1993. United States Environmental Protection Agency.

**Copper.** Copper is widely distributed in nature and is an essential element. Copper deficiency is characterized by anemia and is used for medicinal purposes as an emetic and an astringent. Acute exposure to copper ingestion causes vomiting, hematesis, hypotension, coma, and jaundice. Chronic exposure of children to elevated concentrations of copper causes liver cirrhosis. Copper is not believed to be a human carcinogen.

References:
Amdur, Mary O., John Doull, Curtis D. Klaassen, 1991. Toxicology: The Basic Science of Poisons, 4th edition; Pergamon Press, Inc. New York.

**Dieldrin.** Dieldrin is a man-made chlorinated insecticide that was widely used in agriculture, and for termite-proofing of wooden building material and residential dwellings, until it was banned for use in the U.S. in 1974. However, it is highly persistent in the environment and bioaccumulates in terrestrial and aquatic food chains. This, combined with extensive past use, has made dieldrin ubiquitous in the environment. Humans may be exposed to dieldrin from

consumption of animal and agricultural products exposed to contaminated soil and from exposure associated with the use of dieldrin as a termite-proofing agent.

Exposure to high levels of dieldrin has been associated with central nervous system excitation that resulted in convulsions, and renal toxicity. Long-term low-level exposure to dieldrin has also been associated with occasional cases of nervous system intoxication. In addition, hepatic degeneration, immunosuppression, and possible reproductive/developmental toxicity have been observed in laboratory animals exposed to dieldrin. Chronic oral exposure to dieldrin has produced liver cancer in laboratory mice and rats. Epidemiological investigations have been of insufficient quality to assess dieldrin carcinogenicity in humans. Based on animal data, the USEPA has placed dieldrin into group B2, probable human carcinogen.

References

Agency for Toxic Substances and Disease Registry (ATSDR), 1991. "Toxicological Profile for Aldrin/Dieldrin"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, October 1991.

**Iron**. Iron is a metal which is required for a variety of physiological functions such as heme biosynthesis, oxidative phosphorylation and mixed-function oxidase-mediated metabolic reactions. Only divalent forms of iron are absorbed. As absorption occurs, divalent iron is biochemically converted to trivalent iron, the biologically active form. Under normal conditions, absorbed dietary iron is complexed to hemoglobin and transported to the liver for storage until needed for physiological reactions. The balance of iron is regulated only by the amount of dietary intake and the degree of intestinal absorption. Intestinal absorption tends to be low (2 - 15%) except during periods of increased iron need when absorption efficiency increases dramatically.

Acute iron toxicity has been well characterized following the accidental ingestion of iron-containing preparations by children. Shortly after ingestion, the corrosive effects of iron cause vomiting and diarrhea, often bloody. Later signs include shock, metabolic acidosis, seizures, liver and/or kidney failure, coma, and death. Chronic iron overload manifests as disturbances in liver function, diabetes mellitus, and endocrine and cardiovascular effects. Inhalation of iron containing dust or fumes in occupational settings may result in deposition of iron particles in the lungs leading to interstitial fibrosis. Autopsies of hematite miners noted an increase in lung cancer. However, the etiology of the lung cancer may be related to factors other than iron exposure such as cigarette, silica or PAH exposures.

References:

Aisen, P., Cohen, G. and Kang, J.O., 1990. Iron Toxicosis. Int. Rev. Exp. Pathol. 31:1-46.

Goyer, R.A., 1991. Toxic Effects of Metals. In: Casarett and Doull's Toxicology: The Basic Science of Poisons, 3rd edition. Eds. C.D. Klaassen, M.O. Amdur and J. Doull. Macmillan Publishing Co. N.Y.

**Lead.** Lead is used as a component in storage batteries and was widely used in gasoline and paints. It is the most ubiquitous toxic metal in the environment. The most serious effects of chronic exposure are encephalopathy, renal damage, and changes in the hematopoietic system, which is the most sensitive indicator of lead exposure. Peripheral nerve dysfunction is observed in adults at blood lead levels of 30 to 50 mg/dL-blood. The nervous systems of children are reported to be affected at levels of 15 mg/dL-blood (Benignus and others, 1981). Chronic lead exposure by workers through inhalation has resulted in statistically significant increases in tumors. Oral exposures of lead salts in animals has been shown to increase tumor formation.

References:

Amdur, Mary O., John Doull, Curtis D. Klaassen, 1991. Toxicology: The Basic Science of Poisons, 4th edition; Pergamon Press, Inc. New York.

Benignus, V.A., Otto, D.A., Muller, K.E., Seiple, K.J., 1981. "Effects of Age and Body Lead Burden on CNS Function in Young Children. II:EEG Spectra." Electroencephalograph. Clin. Neurophysiol. 52:240-248.

**Manganese.** Manganese is a naturally occurring substance found in many types of rock. It does not generally occur in the environment as the pure metal, rather, it is found combined with other chemicals such as sulfur, oxygen, and chlorine. Manganese is mixed with iron to make various types of steel. Manganese is a component of some ceramics, pesticides, fertilizers, and in nutritional supplements. In small doses manganese is beneficial to human health. Manganese miners and steel workers exposed to elevated concentrations of manganese have evidenced mental and emotional disturbances, and slow and clumsy body movements. Target organs of manganese are the lung and CNS. When inhaled, manganese dust can also cause lung irritation. EPA has classified manganese as a Class D, not classifiable as to human carcinogenicity.

References:
Agency for Toxic Substances and Disease Registry (ATSDR), 1991. "Toxicological Profile for Manganese"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, February 1991.

**Naphthalene.** Naphthalene is a member of the polycyclic aromatic hydrocarbons (PAH) class of compounds which contain two or more aromatic rings. PAHs are ubiquitous in nature and are also manmade. Naphthalene occurs naturally in coal tar, crude oil, and is formed from incomplete combustion of organic material. It is also product of pyrolysis in tobacco smoke. Naphthalene is used for the production of phthalic anhydride, which is used for the production of plasticizers. Naphthalene is also used in moth balls, for the production of the insecticide carbaryl, and in numerous resins, dyes, pharmaceuticals, and other organic materials.

Naphthalene is absorbed through the inhalation, oral, and dermal routes, and appears to be more toxic to humans than laboratory animals. The principal toxic effect of naphthalene in humans and animals is hemolysis of red blood cells, which can lead to anemia, decreased oxygen carrying capacity, and jaundice. Humans pre-disposed to anemia, such as those with G6DP enzyme deficiency, may be particularly sensitive to naphthalene toxicity. Exposure to naphthalene has also been correlated with increased risk of cataract formation. Animal studies were negative for naphthalene reproductive toxicity. Although no human epidemiological data are available for assessing naphthalene carcinogenicity, animal data investigating naphthalene toxicity are equivocal. The USEPA has placed naphthalene in weight-of-evidence Group D, not classifiable as to human carcinogenicity.

References:
Agency for Toxic Substances and Disease Registry (ATSDR), 1990. "Toxicological Profile for Naphthalene"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service. October, 1990.

**Tetrachloroethene (Perchlorethene).** Tetrachloroethene is a man-made volatile chlorinated solvent that is used extensively in the textile and dry cleaning industries as a cleanser and degreaser. Tetrachloroethene is also used as a degreaser in the electronics and metal industry. Since tetrachloroethene effectively cleans and decreases without adversely affecting what is being cleansed, tetrachloroethene is used extensively in a multitude of commercially available cleansers.

Tetrachloroethene is nearly completely absorbed via the inhalation and oral routes; dermal exposure represents a minor pathway. Oral and inhalation exposure to tetrachloroethene in humans and animals indicates that the liver, kidney, and nervous system are target organs. Long-term exposures to tetrachloroethene produced proliferative changes in the mouse livers, renal nephropathy in animals and occupationally exposed workers, and irreversible nervous system damage in laboratory animals. Additionally, an increased incidence of menstrual disorders and spontaneous abortions have been observed in women occupationally exposed to tetrachloroethene in the dry cleaning business. Epidemiological data in humans is insufficient to make conclusions regarding the potential carcinogenicity of tetrachloroethene. However, tetrachloroethene has produced hepatic cancer in laboratory animals exposed orally and by inhalation. Therefore, the USEPA has placed tetrachloroethene in weight-of-evidence group B2, probable human carcinogen.

References: .
Agency for Toxic Substances and Disease Registry (ATSDR), 1991. "Toxicological Profile for Tetrachloroethene"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service. October, 1991.

**Trichloroethene**. Trichloroethene is a man-made chlorinated solvent that is used extensively in industry as a metal decreasing agent. Trichloroethene is also used in dry cleaning and as a solvent in paints and adhesives.

Several human deaths and acute neurotoxic effects have been attributed to oral and inhalation exposure to trichloroethene. In animals, oral and inhalation exposure to trichloroethene have produce neurotoxic effects, including behavioral changes, and renal toxicity. Additionally, inhalation and oral exposures to trichloroethene in animals have produced lung, liver, and testicular cancers. Epidemiological data in humans is insufficient to conclude whether trichloroethene is a human carcinogen. However, studies on trichloroethene metabolism suggest that it is metabolized similarly
in humans and laboratory animals. Therefore, the USEPA has place trichloroethene in weight-of-evidence group B2, probable human carcinogen.

References:
MADEP, 1992. "Risk Assessment Shortform Residential Exposure Scenario, Version 1.6"; Policy #WSC/ORS-142-92; Office of Research and Standards and the Bureau of Waste Site Cleanup, Boston, MA; September 1992.

**Vanadium.** Vanadium is widely, but sparsely, distributed in the earth's crust and in the environment. It is invaluable as an alloying agent with steel; ferrovanadium alloys are used in high-stress applications such as bearings, jet engines, and cutting tools. Human and animal studies indicate that vanadium is readily absorbed from the lungs and poorly absorbed from the gastrointestinal tract. It distributes primarily to the bone and kidney. Vanadium is a respiratory irritant. Inhalation of vanadium dusts in both animals and occupationally-exposed workers induces mild to moderate respiratory irritation. The effects are reversible and subside when exposure is discontinued. No studies were located regarding cancer in humans or animals following inhalation, oral, or dermal exposures. However, vanadium has been found to induce DNA damage in human cell cultures, suggesting that vanadium may have the potential to be genotoxic to humans.

References:
ATSDR, 1990. Toxicological Profile for Vanadium. Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, October, 1990.

## VPH/EPH FRACTIONS

Chemical surrogates were chosen to represent the different aliphatic and aromatic fractions of TPH. Appropriate surrogates are referenced below for each fraction.

**C5-C8 Aliphatics.** n-Hexane is the reference compound for the TPH fraction containing C5-C8 alkanes/cycloalkanes. Through epidemiological studies on n-hexane-exposed workers, sensorimotor polyneuropathy has been observed as the main toxic effect of long-term exposure. Other noted effects include cranial neuropathy, blurred vision, and abnormal color vision. The onset of symptoms may be delayed for several months to a year after exposure. Affected individuals may recover completely, but some may retain sensorimotor deficits. A number of animal studies have been conducted that document n-hexane's neuropathic effects.

Reference:
MADEP, 1994. Interim Final Petroleum Report: Development of Health-Based Alternative to the Total Petroleum Hydrocarbon (TPH) Parameter. August.

**C9-C12 Aliphatics.** See profile for n-Hexane provided for C5-C8 Aliphatics above.

**C9-C18 Aliphatics.** See profile for n-Hexane provided for C5-C8 Aliphatics above.

**C19-C36 Aliphatics.** See profile for n-Hexane provided for C5-C8 Aliphatics above.

**C9-C10 Aromatics.** See profile for pyrene and profile for xylene below.

*Xylenes.* Xylene is a volatile organic compound that is generally composed of a mixture of the meta, ortho, and para isomers. Xylenes are used as solvents, in paints, thinners, cleaners, degreasers, and as a component in gasoline.

Xylenes are absorbed by oral, inhalation, and dermal exposures, and distribute to all tissues, particularly those with high fat contents. All three isomers produce similar effects, although the potency with which various effects are produced may vary from effect to effect with each isomer. In both humans and animals, xylene exposure has been associated with central nervous system depression, impaired learning and memory, and tremors. In humans, inhalation of xylene may produce prolonged respiratory tract inflammation and edema. In laboratory animals, exposures to xylenes have produced adverse reproductive effects, including increased fetal death rate and retarded development. There is no evidence of carcinogenicity in humans or animals.

References:
MADEP, 1992. "Risk Assessment Shortform Residential Exposure Scenario, Version 1.6"; Policy #WSC/ORS-142-92; Office of Research and Standards and the Bureau of Waste Site Cleanup, Boston, MA; September 1992.

**C10-C22 Aromatics.** See profiles for naphthalene and pyrene.

*Naphthalene.* Naphthalene is a member of the polycyclic aromatic hydrocarbon (PAH) class of compounds, which contain two or more aromatic rings. PAHs are ubiquitous in nature and are also man-made. Naphthalene occurs naturally in coal tar, crude oil, and is formed from incomplete combustion of organic material. It is also product of pyrolysis in tobacco smoke. Naphthalene is used for the production of phthalic anhydride, which is used for the production of plasticizers. Naphthalene is also used in moth balls, for the production of the insecticide carbaryl, and in numerous resins, dyes, pharmaceuticals, and other organic materials.

Naphthalene is absorbed through the inhalation, oral, and dermal routes, and appears to be more toxic to humans than laboratory animals. The principal toxic effect of naphthalene in humans and animals is hemolysis of red blood cells, which can lead to anemia, decreased oxygen-carrying capacity, and jaundice. Humans pre-disposed to anemia, such as those with G6DP enzyme deficiency, may be particularly sensitive to naphthalene toxicity. Exposure to naphthalene has also been correlated with increased risk of cataract formation. Animal studies were negative for naphthalene reproductive toxicity. Although no human epidemiological data are available for assessing naphthalene carcinogenicity, animal data investigating naphthalene toxicity are equivocal. The USEPA has placed naphthalene in weight-of-evidence Group D, not classifiable as to human carcinogenicity.

References:
Agency for Toxic Substances and Disease Registry (ATSDR), 1990. "Toxicological Profile for Naphthalene"; Agency for Toxic Substances and Disease Registry, U.S. Public Health Service. October, 1990.

*Pyrene.* Pyrene is a member of the polycyclic aromatic hydrocarbons (PAH) class of compounds which contain two or more aromatic rings. They are ubiquitous in nature and are also man made. It occurs naturally in coal tar, crude oil, and is formed from incomplete combustion of organic material. Pyrene is reported to be a skin irritant to humans. Rats administered pyrene exhibited blood chemistry changes, as well as liver and kidney damage. Pyrene was shown to be inactive as an initiating agent and thus has been classified as a D carcinogen.

References:
ATSDR, 1989. Toxicological Profile for Polycyclic Aromatic Hydrocarbons. Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, October, 1989.

# N-5 RISK CALCULATIONS

MAIN-SS2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
CURRENT/FUTURE MAINTENANCE WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

August 1992

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 100 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.024 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 11,600 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 52 | days/year |
| EXPOSURE DURATION | ED | 25 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 25 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
The exposure frequency is assumed to be 1 day a week from May 1st to Ocober 31st.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

MAIN-SS2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
CURRENT/FUTURE MAINTENANCE WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | 1.5E-06 | 0.03 | 1.3E-07 | 1.5E+00 | 1.60E+00 | 2.3E-06 | 2.0E-07 | 2.5E-06 | 100.00% |
| SUMMARY CANCER RISK | | | | | | | 2E-06 | 2E-07 | 2E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | 4.3E-06 | 0.03 | 3.6E-07 | 3.0E-04 | 2.9E-04 | 1.4E-02 | 1.2E-03 | 1.5E-02 | 40.95% |
| Chromium | 27 | 5.5E-06 | ND | | 3.0E-03 | ND | 1.8E-03 | | 1.8E-03 | 4.85% |
| Iron | 16,400 | 3.3E-03 | ND | | ND | ND | | | | |
| Manganese | 481 | 9.8E-05 | ND | | 7.1E-02 | ND | 1.4E-03 | | 1.4E-03 | 3.65% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 32 | 6.5E-06 | 0.17 | 3.1E-06 | 6.0E-01 | 5.5E-01 | 1.1E-05 | 5.6E-06 | 1.6E-05 | |
| C9-C10 Aromatics | 23 | 4.7E-06 | 0.17 | 2.2E-06 | 3.0E-02 | 2.7E-02 | 1.6E-04 | 8.2E-05 | 2.4E-04 | 0.63% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 465 | 9.5E-05 | 0.17 | 4.5E-05 | 6.0E-01 | 5.5E-01 | 1.6E-04 | 8.1E-05 | 2.4E-04 | 0.63% |
| C19-C36 Aliphatics | 5,680 | 1.2E-03 | 0.17 | 5.5E-04 | 6.0E+00 | 5.5E+00 | 1.9E-04 | 9.9E-05 | 2.9E-04 | 0.77% |
| C11-C22 Aromatics | 1770 | 3.6E-04 | 0.17 | 1.7E-04 | 3.0E-02 | 2.7E-02 | 1.2E-02 | 6.3E-03 | 1.8E-02 | 48.48% |
| SUMMARY HAZARD INDEX | | | | | | | 0.03 | 0.008 | 0.04 | |

MAIN-SS2I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
CURRENT/FUTURE MAINTENANCE WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 1.6 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 52 | days/year |
| EXPOSURE DURATION | ED | 25 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 25 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

MAIN-SS2I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
CURRENT/FUTURE MAINTENANCE WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | NA | | 1.6E-08 | 1.5E-10 | 1.5E+01 | 2.2E-09 | 22.15% |
| Chromium | 27 | NA | | 2.0E-08 | 1.9E-10 | 4.1E+01 | 7.8E-09 | 77.85% |
| | | | | | | SUMMARY CANCER RISK | 1E-08 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | NA | | 1.6E-08 | 4.1E-10 | ND | | |
| Chromium | 27 | NA | | 2.0E-08 | 5.3E-10 | 2.9E-05 | 1.8E-05 | 2.63% |
| Iron | 16,400 | NA | | 1.2E-05 | 3.2E-07 | ND | | |
| Manganese | 481 | NA | | 3.6E-07 | 9.5E-09 | 1.4E-05 | 6.8E-04 | 97.11% |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 32 | NA | | 2.4E-08 | 6.3E-10 | 5.7E-01 | 1.1E-09 | 0.00016% |
| C9-C10 Aromatics | 23 | NA | | 1.7E-08 | 4.5E-10 | 1.7E-02 | 2.7E-08 | 0.0038% |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 465 | NA | | 3.5E-07 | 9.2E-09 | 5.7E-01 | 1.6E-08 | 0.0023% |
| C19-C36 Aliphatics | 5680 | NA | | 4.3E-06 | 1.1E-07 | ND | | |
| C11-C22 Aromatics | 1,770 | NA | | 1.3E-06 | 3.5E-08 | 2.0E-02 | 1.7E-06 | 0.25% |
| | | | | | | SUMMARY HAZARD INDEX | 0.0007 | |

MAIN-SS2I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
CURRENT/FUTURE MAINTENANCE WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 50 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.024 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 11,600 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 26 | days/year |
| EXPOSURE DURATION | ED | 6.6 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 6.6 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
The exposure frequency is assumed to be 1 day a week from May 1st to Ocober 31st.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

MAIN-SS2I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
CURRENT/FUTURE MAINTENANCE WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | 1.0E-07 | 0.03 | 1.7E-08 | 1.5E+00 | 1.60E+00 | 1.5E-07 | 2.7E-08 | 1.8E-07 | 100.00% |
| SUMMARY CANCER RISK | | | | | | | 2E-07 | 3E-08 | 2E-07 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | 1.1E-06 | 0.03 | 1.8E-07 | 3.0E-04 | 2.9E-04 | 3.6E-03 | 6.2E-04 | 4.2E-03 | 36.63% |
| Chromium | 27 | 1.4E-06 | ND | | 3.0E-03 | ND | 4.6E-04 | | 4.6E-04 | 4.02% |
| Iron | 16,400 | 8.3E-04 | ND | | ND | ND | | | | |
| Manganese | 481 | 2.4E-05 | ND | | 7.1E-02 | ND | 3.4E-04 | | 3.4E-04 | 3.02% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 32 | 1.6E-06 | 0.17 | 1.5E-06 | 6.0E-01 | 5.5E-01 | 2.7E-06 | 2.8E-06 | 5.5E-06 | |
| C9-C10 Aromatics | 23 | 1.2E-06 | 0.17 | 1.1E-06 | 3.0E-02 | 2.7E-02 | 3.9E-05 | 4.1E-05 | 8.0E-05 | 0.70% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 465 | 2.4E-05 | 0.17 | 2.2E-05 | 6.0E-01 | 5.5E-01 | 3.9E-05 | 4.1E-05 | 8.0E-05 | 0.70% |
| C19-C36 Aliphatics | 5,680 | 2.9E-04 | 0.17 | 2.7E-04 | 6.0E+00 | 5.5E+00 | 4.8E-05 | 5.0E-05 | 9.8E-05 | 0.86% |
| C11-C22 Aromatics | 1770 | 9.0E-05 | 0.17 | 8.5E-05 | 3.0E-02 | 2.7E-02 | 3.0E-03 | 3.2E-03 | 6.2E-03 | 54.02% |
| SUMMARY HAZARD INDEX | | | | | | | 0.007 | 0.004 | 0.011 | |

MAIN-SS2I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
CURRENT/FUTURE MAINTENANCE WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 1.6 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 26 | days/year |
| EXPOSURE DURATION | ED | 6.6 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 6.6 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

MAIN-SS2I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
CURRENT/FUTURE MAINTENANCE WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF ($m^3$/kg) | AIR CONCENTRATION VOLATILES (mg/$m^3$) | AIR CONCENTRATION PARTICULATES (mg/$m^3$) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | NA | | 1.6E-08 | 2.0E-11 | 1.5E+01 | 2.9E-10 | 22.15% |
| Chromium | 27 | NA | | 2.0E-08 | 2.5E-11 | 4.1E+01 | 1.0E-09 | 77.85% |
| | | | | | | SUMMARY CANCER RISK | 1E-09 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF ($m^3$/kg) | AIR CONCENTRATION VOLATILES (mg/$m^3$) | AIR CONCENTRATION PARTICULATES (mg/$m^3$) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | NA | | 1.6E-08 | 2.1E-10 | ND | | |
| Chromium | 27 | NA | | 2.0E-08 | 2.7E-10 | 2.9E-05 | 9.2E-06 | 2.63% |
| Iron | 16,400 | NA | | 1.2E-05 | 1.6E-07 | ND | | |
| Manganese | 481 | NA | | 3.6E-07 | 4.7E-09 | 1.4E-05 | 3.4E-04 | 97.11% |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 32 | NA | | 2.4E-08 | 3.2E-10 | 5.7E-01 | 5.5E-10 | 0.00016% |
| C9-C10 Aromatics | 23 | NA | | 1.7E-08 | 2.3E-10 | 1.7E-02 | 1.3E-08 | 0.0038% |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 465 | NA | | 3.5E-07 | 4.6E-09 | 5.7E-01 | 8.1E-09 | 0.0023% |
| C19-C36 Aliphatics | 5680 | NA | | 4.3E-06 | 5.6E-08 | ND | | |
| C11-C22 Aromatics | 1,770 | NA | | 1.3E-06 | 1.7E-08 | 2.0E-02 | 8.7E-07 | 0.25% |
| | | | | | | SUMMARY HAZARD INDEX | 0.0003 | |

CwIW-SS2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 100 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.016 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 12,731 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 25 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 25 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

CWIW-SS2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | 4.4E-06 | 0.03 | 2.7E-07 | 1.5E+00 | 1.60E+00 | 6.6E-06 | 4.3E-07 | 7.0E-06 | 100.00% |
| SUMMARY CANCER RISK | | | | | | | 7E-06 | 4E-07 | 7E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | 1.2E-05 | 0.03 | 7.5E-07 | 3.0E-04 | 2.9E-04 | 4.1E-02 | 2.6E-03 | 4.4E-02 | 44.36% |
| Chromium | 27 | 1.6E-05 | ND | | 2.0E-02 | ND | 7.9E-04 | | 7.9E-04 | 0.80% |
| Iron | 16,400 | 9.6E-03 | ND | | ND | ND | | | | |
| Manganese | 481 | 2.8E-04 | ND | | 7.1E-02 | ND | 4.0E-03 | | 4.0E-03 | 4.04% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 32 | 1.9E-05 | 0.17 | 6.5E-06 | 6.0E-01 | 5.5E-01 | 3.1E-05 | 1.2E-05 | 4.3E-05 | 0.04% |
| C9-C10 Aromatics | 23 | 1.4E-05 | 0.17 | 4.7E-06 | 3.0E-02 | 2.7E-02 | 4.5E-04 | 1.7E-04 | 6.2E-04 | 0.63% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 465 | 2.7E-04 | 0.17 | 9.5E-05 | 6.0E-01 | 5.5E-01 | 4.5E-04 | 1.7E-04 | 6.3E-04 | 0.64% |
| C19-C36 Aliphatics | 5,680 | 3.3E-03 | 0.17 | 1.2E-03 | 6.0E+00 | 5.5E+00 | 5.6E-04 | 2.1E-04 | 7.7E-04 | 0.78% |
| C11-C22 Aromatics | 1770 | 1.0E-03 | 0.17 | 3.6E-04 | 3.0E-02 | 2.7E-02 | 3.5E-02 | 1.3E-02 | 4.8E-02 | 48.70% |
| SUMMARY HAZARD INDEX | | | | | | | 0.08 | 0.02 | 0.10 | |

CWIW-SS2I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

16-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 1.6 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 25 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 25 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CWIW-SS2I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF ($m^3$/kg) | AIR CONCENTRATION VOLATILES (mg/$m^3$) | AIR CONCENTRATION PARTICULATES (mg/$m^3$) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | NA | | 1.6E-08 | 4.3E-10 | 1.5E+01 | 6.4E-09 | 22.15% |
| Chromium | 27 | NA | | 2.0E-08 | 5.5E-10 | 4.1E+01 | 2.3E-08 | 77.85% |
| | | | | | | SUMMARY CANCER RISK | 3E-08 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF ($m^3$/kg) | AIR CONCENTRATION VOLATILES (mg/$m^3$) | AIR CONCENTRATION PARTICULATES (mg/$m^3$) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | NA | | 1.6E-08 | 1.2E-09 | ND | | |
| Chromium | 27 | NA | | 2.0E-08 | 1.5E-09 | 2.9E-05 | 5.3E-05 | 2.63% |
| Iron | 16,400 | NA | | 1.2E-05 | 9.3E-07 | ND | | |
| Manganese | 481 | NA | | 3.6E-07 | 2.7E-08 | 1.4E-05 | 2.0E-03 | 97.11% |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 32 | NA | | 2.4E-08 | 1.8E-09 | 5.7E-01 | 3.2E-09 | 0.00016% |
| C9-C10 Aromatics | 23 | NA | | 1.7E-08 | 1.3E-09 | 1.7E-02 | 7.7E-08 | 0.0038% |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 465 | NA | | 3.5E-07 | 2.6E-08 | 5.7E-01 | 4.6E-08 | 0.0023% |
| C19-C36 Aliphatics | 5680 | NA | | 4.3E-06 | 3.2E-07 | ND | | |
| C11-C22 Aromatics | 1,770 | NA | | 1.3E-06 | 1.0E-07 | 2.0E-02 | 5.0E-06 | 0.25% |
| | | | | | | SUMMARY HAZARD INDEX | 0.002 | |

CWIW-SS2I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 50 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.016 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 13,731 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 6.6 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 6.6 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

CWIW-SS2I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | 5.8E-07 | 0.03 | 7.7E-08 | 1.5E+00 | 1.60E+00 | 8.7E-07 | 1.2E-07 | 9.9E-07 | 100.00% |
| SUMMARY CANCER RISK | | | | | | | 9E-07 | 1E-07 | 1E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | 6.2E-06 | 0.03 | 8.1E-07 | 3.0E-04 | 2.9E-04 | 2.1E-02 | 2.8E-03 | 2.3E-02 | 39.72% |
| Chromium | 27 | 7.9E-06 | ND | | 2.0E-02 | ND | 4.0E-04 | | 4.0E-04 | 0.67% |
| Iron | 16,400 | 4.8E-03 | ND | | ND | ND | | | | |
| Manganese | 481 | 1.4E-04 | ND | | 7.1E-02 | ND | 2.0E-03 | | 2.0E-03 | 3.38% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 32 | 9.4E-06 | 0.17 | 7.0E-06 | 6.0E-01 | 5.5E-01 | 1.6E-05 | 1.3E-05 | 2.8E-05 | 0.05% |
| C9-C10 Aromatics | 23 | 6.8E-06 | 0.17 | 5.0E-06 | 3.0E-02 | 2.7E-02 | 2.3E-04 | 1.9E-04 | 4.1E-04 | 0.70% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 465 | 1.4E-04 | 0.17 | 1.0E-04 | 6.0E-01 | 5.5E-01 | 2.3E-04 | 1.9E-04 | 4.1E-04 | 0.70% |
| C19-C36 Aliphatics | 5,680 | 1.7E-03 | 0.17 | 1.2E-03 | 6.0E+00 | 5.5E+00 | 2.8E-04 | 2.3E-04 | 5.0E-04 | 0.86% |
| C11-C22 Aromatics | 1770 | 5.2E-04 | 0.17 | 3.9E-04 | 3.0E-02 | 2.7E-02 | 1.7E-02 | 1.4E-02 | 3.2E-02 | 53.91% |
| SUMMARY HAZARD INDEX | | | | | | | 0.04 | 0.02 | 0.06 | |

CWIW-SS2I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

16-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 1.6 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 6.6 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 6.6 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CWIW-SS2I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | NA | | 1.6E-08 | 1.1E-10 | 1.5E+01 | 1.7E-09 | 22.15% |
| Chromium | 27 | NA | | 2.0E-08 | 1.4E-10 | 4.1E+01 | 5.9E-09 | 77.85% |
| | | | | | | SUMMARY CANCER RISK | 8E-09 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | NA | | 1.6E-08 | 1.2E-09 | ND | | |
| Chromium | 27 | NA | | 2.0E-08 | 1.5E-09 | 2.9E-05 | 5.3E-05 | 2.63% |
| Iron | 16,400 | NA | | 1.2E-05 | 9.3E-07 | ND | | |
| Manganese | 481 | NA | | 3.6E-07 | 2.7E-08 | 1.4E-05 | 2.0E-03 | 97.11% |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 32 | NA | | 2.4E-08 | 1.8E-09 | 5.7E-01 | 3.2E-09 | 0.00016% |
| C9-C10 Aromatics | 23 | NA | | 1.7E-08 | 1.3E-09 | 1.7E-02 | 7.7E-08 | 0.0038% |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 465 | NA | | 3.5E-07 | 2.6E-08 | 5.7E-01 | 4.6E-08 | 0.0023% |
| C19-C36 Aliphatics | 5680 | NA | | 4.3E-06 | 3.2E-07 | ND | | |
| C11-C22 Aromatics | 1,770 | NA | | 1.3E-06 | 1.0E-07 | 2.0E-02 | 5.0E-06 | 0.25% |
| | | | | | | SUMMARY HAZARD INDEX | 0.002 | |

CWIW-GW2I
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - RME
CURRENT/FUTURE LAND USE - COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION WATER | CW | chemical-specific | ug/liter |
| INGESTION RATE | IR | 1 | liters/day |
| BODY WEIGHT | BW | 70 | kg |
| CONVERSION FACTOR | CF | 0.001 | mg/ug |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 25 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 25 | years |

Notes:
For noncarcinogenic effects: AT = ED

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOITIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

$$\text{INTAKE} = \frac{\text{CW x IR x EF x ED x CF}}{\text{BW x AT x 365 days/year}}$$

CWIW-GW2I
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - RME
CURRENT/FUTURE LAND USE - COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | WATER CONCENTRATION | UNITS | INTAKE INGESTION (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)^-1 | CANCER RISK INGESTION |
|---|---|---|---|---|---|
| No Carcinogenic CPCs | | | | | |
| | | | | TOTAL CANCER RISK | 0E+00 |

NONCARCINOGENIC EFFECTS

| COMPOUND | WATER CONCENTRATION | UNITS | INTAKE INGESTION (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT INGESTION |
|---|---|---|---|---|---|
| Aluminum | 204 | ug/Liter | 2.0E-03 | 1.0E+00 | 2.0E-03 |
| Manganese | 177 | ug/Liter | 1.7E-03 | 2.4E-02 | 7.2E-02 |
| | | | | TOTAL HAZARD INDEX | 0.07 |

CWIW-GW2I(CT)
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - CENTRAL TENDENCY
CURRENT/FUTURE LAND USE - COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION WATER | CW | chemical-specific | ug/liter |
| INGESTION RATE | IR | 1 | liters/day |
| BODY WEIGHT | BW | 70 | kg |
| CONVERSION FACTOR | CF | 0.001 | mg/ug |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 6.6 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 6.6 | years |

Notes:
For noncarcinogenic effects: AT = ED

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOITIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

$$\text{INTAKE} = \frac{CW \times IR \times EF \times ED \times CF}{BW \times AT \times 365 \text{ days/year}}$$

CWIW-GW2I(CT)
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - CENTRAL TENDENCY
CURRENT/FUTURE LAND USE - COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | WATER CONCENTRATION | UNITS | INTAKE INGESTION (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)^-1 | CANCER RISK INGESTION |
|---|---|---|---|---|---|
| No Carcinogenic CPCs | | | | | |
| | | | | TOTAL CANCER RISK | 0E+00 |

NONCARCINOGENIC EFFECTS

| COMPOUND | WATER CONCENTRATION | UNITS | INTAKE INGESTION (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT INGESTION |
|---|---|---|---|---|---|
| Aluminum | 204 | ug/Liter | 2.0E-03 | 1.0E+00 | 2.0E-03 |
| Manganese | 177 | ug/Liter | 1.7E-03 | 2.4E-02 | 7.2E-02 |
| | | | | TOTAL HAZARD INDEX | 0.07 |

CON-SS2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 480 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.28 | mg/cm² |
| SURFACE AREA | SA | 5200 | $cm^2$ |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.5 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.5 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

CON-SS2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | 7.0E-07 | 0.03 | 6.4E-08 | 1.5E+00 | 1.60E+00 | 1.1E-06 | 1.0E-07 | 1.2E-06 | 100.00% |
| SUMMARY CANCER RISK | | | | | | | 1E-06 | 1E-07 | 1E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | 9.9E-05 | 0.03 | 9.0E-06 | 3.0E-04 | 2.9E-04 | 3.3E-01 | 3.1E-02 | 3.6E-01 | 81.14% |
| Chromium | 27 | 1.3E-04 | ND | 0.0E+00 | 2.0E-02 | 5.0E-04 | 6.3E-03 | 0.0E+00 | 6.3E-03 | 1.43% |
| Iron | 16,400 | 7.7E-02 | ND | 0.0E+00 | ND | ND | | | | |
| Manganese | 481 | 2.3E-03 | ND | 0.0E+00 | 7.1E-02 | 4.30E-03 | 3.2E-02 | 0.0E+00 | 3.2E-02 | 7.18% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 32 | 1.5E-04 | 0.17 | 7.8E-05 | 6.0E+00 | 5.5E+00 | 2.5E-05 | 1.4E-05 | 3.9E-05 | 0.01% |
| C9-C10 Aromatics | 23 | 1.1E-04 | 0.17 | 5.6E-05 | 3.0E-01 | 2.7E-01 | 3.6E-04 | 2.1E-04 | 5.7E-04 | 0.13% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 465 | 2.2E-03 | 0.17 | 1.1E-03 | 6.0E+00 | 5.5E+00 | 3.6E-04 | 2.0E-04 | 5.7E-04 | 0.13% |
| C19-C36 Aliphatics | 5680 | 2.7E-02 | 0.17 | 1.4E-02 | 6.0E+01 | 5.5E+01 | 4.4E-04 | 2.5E-04 | 6.9E-04 | 0.16% |
| C11-C22 Aromatics | 1,770 | 8.3E-03 | 0.17 | 4.3E-03 | 3.0E-01 | 2.7E-01 | 2.8E-02 | 1.6E-02 | 4.4E-02 | 9.83% |
| SUMMARY HAZARD INDEX | | | | | | | 0.4 | 0.05 | 0.4 | |

CON-SS2i
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 3.3 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.5 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.50 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SS2I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | NA | | 1.6E-08 | 2.9E-11 | 1.5E+01 | 4.4E-10 | 22.15% |
| Chromium | 27 | NA | | 2.0E-08 | 3.8E-11 | 4.1E+01 | 1.5E-09 | 77.85% |
| | | | | | | SUMMARY CANCER RISK | 2E-09 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | NA | | 1.6E-08 | 4.1E-09 | ND | | |
| Chromium | 27 | NA | | 2.0E-08 | 5.3E-09 | 2.9E-05 | 1.8E-04 | |
| Iron | 16,400 | NA | | 1.2E-05 | 3.2E-06 | ND | | |
| Manganese | 481 | NA | | 3.6E-07 | 9.4E-08 | 1.4E-05 | 6.7E-03 | 97.34% |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 32 | NA | | 2.4E-08 | 6.3E-09 | 5.7E+00 | 1.1E-09 | 0.00002% |
| C9-C10 Aromatics | 23 | NA | | 1.7E-08 | 4.5E-09 | 1.7E-01 | 2.6E-08 | |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 465 | NA | | 3.5E-07 | 9.1E-08 | 5.7E+00 | 1.6E-08 | |
| C19-C36 Aliphatics | 5680 | NA | | 4.3E-06 | 1.1E-06 | ND | | |
| C11-C22 Aromatics | 1,770 | NA | | 1.3E-06 | 3.5E-07 | 2.0E-01 | 1.7E-06 | 0.025% |
| | | | | | | SUMMARY HAZARD INDEX | 0.007 | |

CON-SB2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 480 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.28 | mg/cm² |
| SURFACE AREA | SA | 5200 | $cm^2$ |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.5 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.5 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

CON-SB2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.87 | 3.3E-07 | 0.03 | 3.0E-08 | 1.5E+00 | 1.60E+00 | 5.0E-07 | 4.8E-08 | 5.4E-07 | 100.00% |
| SUMMARY CANCER RISK | | | | | | | 5E-07 | 5E-08 | 5E-07 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.87 | 4.6E-05 | 0.03 | 4.2E-06 | 3.0E-04 | 2.9E-04 | 1.5E-01 | 1.5E-02 | 1.7E-01 | 91.33% |
| Iron | 8080 | 3.8E-02 | ND | 0.0E+00 | ND | ND | | | | |
| Manganese | 231 | 1.1E-03 | ND | 0.0E+00 | 7.1E-02 | 4.30E-03 | 1.5E-02 | 0.0E+00 | 1.5E-02 | 8.25% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 0.57 | 2.7E-06 | 0.17 | 1.4E-06 | 6.0E+00 | 5.5E+00 | 4.5E-07 | 2.5E-07 | 7.0E-07 | 0.0004% |
| C9-C10 Aromatics | 0.41 | 1.9E-06 | 0.17 | 9.9E-07 | 3.0E-01 | 2.7E-01 | 6.4E-06 | 3.7E-06 | 1.0E-05 | 0.01% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 8.2 | 3.9E-05 | 0.17 | 2.0E-05 | 6.0E+00 | 5.5E+00 | 6.4E-06 | 3.6E-06 | 1.0E-05 | 0.01% |
| C19-C36 Aliphatics | 101 | 4.7E-04 | 0.17 | 2.4E-04 | 6.0E+01 | 5.5E+01 | 7.9E-06 | 4.4E-06 | 1.2E-05 | 0.01% |
| C11-C22 Aromatics | 31 | 1.5E-04 | 0.17 | 7.5E-05 | 3.0E-01 | 2.7E-01 | 4.9E-04 | 2.5E-04 | 7.4E-04 | 0.40% |
| SUMMARY HAZARD INDEX | | | | | | | 0.2 | 0.01 | 0.2 | |

CON-SBI
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 3.3 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.5 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.50 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SB2I
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.87 | NA | | 7.5E-09 | 1.4E-11 | 1.5E+01 | 2.1E-10 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 2E-10 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.87 | NA | | 7.5E-09 | 1.9E-09 | ND | | |
| Iron | 8080 | NA | | 6.1E-06 | 1.6E-06 | ND | | |
| Manganese | 231 | NA | | 1.8E-07 | 4.5E-08 | 1.4E-05 | 3.2E-03 | 100.00% |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 0.57 | NA | | 4.3E-10 | 1.1E-10 | 5.7E+00 | 2.0E-11 | 0.000001% |
| C9-C10 Aromatics | 0.41 | NA | | 3.1E-10 | 8.0E-11 | 1.7E-01 | 4.7E-10 | |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 8.2 | NA | | 6.2E-09 | 1.6E-09 | 5.7E+00 | 2.8E-10 | |
| C19-C36 Aliphatics | 101 | NA | | 7.7E-08 | 2.0E-08 | ND | | |
| C11-C22 Aromatics | 31 | NA | | 2.3E-08 | 6.1E-09 | 2.0E-01 | 3.0E-08 | 0.001% |
| | | | | | | SUMMARY HAZARD INDEX | 0.003 | |

C-SS2I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 480 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.28 | $mg/cm^2$ |
| SURFACE AREA | SA | 5200 | $cm^2$ |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.25 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.25 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

CON-SS2I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | 3.5E-07 | 0.03 | 3.2E-08 | 1.5E+00 | 1.60E+00 | 5.3E-07 | 5.1E-08 | 5.8E-07 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 5E-07 | 5E-08 | 6E-07 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | 9.9E-05 | 0.03 | 9.0E-06 | 3.0E-04 | 2.9E-04 | 3.3E-01 | 3.1E-02 | 3.6E-01 | 81.14% |
| Chromium | 27 | 1.3E-04 | ND | 0.0E+00 | 2.0E-02 | 5.0E-04 | 6.3E-03 | 0.0E+00 | 6.3E-03 | 1.43% |
| Iron | 16,400 | 7.7E-02 | ND | 0.0E+00 | ND | ND | | | | |
| Manganese | 481 | 2.3E-03 | ND | 0.0E+00 | 7.1E-02 | 4.30E-03 | 3.2E-02 | 0.0E+00 | 3.2E-02 | 7.18% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 32 | 1.5E-04 | 0.17 | 7.8E-05 | 6.0E+00 | 5.5E+00 | 2.5E-05 | 1.4E-05 | 3.9E-05 | 0.01% |
| C9-C10 Aromatics | 23 | 1.1E-04 | 0.17 | 5.6E-05 | 3.0E-01 | 2.7E-01 | 3.6E-04 | 2.1E-04 | 5.7E-04 | 0.13% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 465 | 2.2E-03 | 0.17 | 1.1E-03 | 6.0E+00 | 5.5E+00 | 3.6E-04 | 2.0E-04 | 5.7E-04 | 0.13% |
| C19-C36 Aliphatics | 5680 | 2.7E-02 | 0.17 | 1.4E-02 | 6.0E+01 | 5.5E+01 | 4.4E-04 | 2.5E-04 | 6.9E-04 | 0.16% |
| C11-C22 Aromatics | 1,770 | 8.3E-03 | 0.17 | 4.3E-03 | 3.0E-01 | 2.7E-01 | 2.8E-02 | 1.6E-02 | 4.4E-02 | 9.83% |
| | | | | | | SUMMARY HAZARD INDEX | 0.4 | 0.05 | 0.4 | |

CON-SS2I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 3.3 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.25 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.25 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SS2I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | NA | | 1.6E-08 | 1.5E-11 | 1.5E+01 | 2.2E-10 | 22.15% |
| Chromium | 27 | NA | | 2.0E-08 | 1.9E-11 | 4.1E+01 | 7.7E-10 | 77.85% |
| | | | | | | SUMMARY CANCER RISK | 1E-09 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | NA | | 1.6E-08 | 4.1E-09 | ND | | |
| Chromium | 27 | NA | | 2.0E-08 | 5.3E-09 | 2.9E-05 | 1.8E-04 | |
| Iron | 16,400 | NA | | 1.2E-05 | 3.2E-06 | ND | | |
| Manganese | 481 | NA | | 3.6E-07 | 9.4E-08 | 1.4E-05 | 6.7E-03 | 97.34% |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 32 | NA | | 2.4E-08 | 6.3E-09 | 5.7E+00 | 1.1E-09 | 0.00002% |
| C9-C10 Aromatics | 23 | NA | | 1.7E-08 | 4.5E-09 | 1.7E-01 | 2.6E-08 | |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 465 | NA | | 3.5E-07 | 9.1E-08 | 5.7E+00 | 1.6E-08 | |
| C19-C36 Aliphatics | 5680 | NA | | 4.3E-06 | 1.1E-06 | ND | | |
| C11-C22 Aromatics | 1,770 | NA | | 1.3E-06 | 3.5E-07 | 2.0E-01 | 1.7E-06 | 0.025% |
| | | | | | | SUMMARY HAZARD INDEX | 0.007 | |

CC..-SB2I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 480 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.28 | mg/cm² |
| SURFACE AREA | SA | 5200 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.25 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.25 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

CON-SB2I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.87 | 1.7E-07 | 0.03 | 1.5E-08 | 1.5E+00 | 1.60E+00 | 2.5E-07 | 2.4E-08 | 2.7E-07 | 100.00% |
| SUMMARY CANCER RISK | | | | | | | 2E-07 | 2E-08 | 3E-07 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.87 | 4.6E-05 | 0.03 | 4.2E-06 | 3.0E-04 | 2.9E-04 | 1.5E-01 | 1.5E-02 | 1.7E-01 | 91.33% |
| Iron | 8080 | 3.8E-02 | ND | 0.0E+00 | ND | ND | | | | |
| Manganese | 231 | 1.1E-03 | ND | 0.0E+00 | 7.1E-02 | 4.30E-03 | 1.5E-02 | 0.0E+00 | 1.5E-02 | 8.25% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 0.57 | 2.7E-06 | 0.17 | 1.4E-06 | 6.0E+00 | 5.5E+00 | 4.5E-07 | 2.5E-07 | 7.0E-07 | 0.0004% |
| C9-C10 Aromatics | 0.41 | 1.9E-06 | 0.17 | 9.9E-07 | 3.0E-01 | 2.7E-01 | 6.4E-06 | 3.7E-06 | 1.0E-05 | 0.01% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 8.2 | 3.9E-05 | 0.17 | 2.0E-05 | 6.0E+00 | 5.5E+00 | 6.4E-06 | 3.6E-06 | 1.0E-05 | 0.01% |
| C19-C36 Aliphatics | 101 | 4.7E-04 | 0.17 | 2.4E-04 | 6.0E+01 | 5.5E+01 | 7.9E-06 | 4.4E-06 | 1.2E-05 | 0.01% |
| C11-C22 Aromatics | 31 | 1.5E-04 | 0.17 | 7.5E-05 | 3.0E-01 | 2.7E-01 | 4.9E-04 | 2.5E-04 | 7.4E-04 | 0.40% |
| SUMMARY HAZARD INDEX | | | | | | | 0.2 | 0.01 | 0.2 | |

CON-SB2I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 3.3 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.25 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.25 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SB2I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF ($m^3$/kg) | AIR CONCENTRATION VOLATILES (mg/$m^3$) | AIR CONCENTRATION PARTICULATES (mg/$m^3$) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.87 | NA | | 7.5E-09 | 6.9E-12 | 1.5E+01 | 1.0E-10 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 1E-10 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF ($m^3$/kg) | AIR CONCENTRATION VOLATILES (mg/$m^3$) | AIR CONCENTRATION PARTICULATES (mg/$m^3$) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.87 | NA | | 7.5E-09 | 1.9E-09 | ND | | |
| Iron | 8080 | NA | | 6.1E-06 | 1.6E-06 | ND | | |
| Manganese | 231 | NA | | 1.8E-07 | 4.5E-08 | 1.4E-05 | 3.2E-03 | 100.00% |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 0.57 | NA | | 4.3E-10 | 1.1E-10 | 5.7E+00 | 2.0E-11 | 0.000001% |
| C9-C10 Aromatics | 0.41 | NA | | 3.1E-10 | 8.0E-11 | 1.7E-01 | 4.7E-10 | |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 8.2 | NA | | 6.2E-09 | 1.6E-09 | 5.7E+00 | 2.8E-10 | |
| C19-C36 Aliphatics | 101 | NA | | 7.7E-08 | 2.0E-08 | ND | | |
| C11-C22 Aromatics | 31 | NA | | 2.3E-08 | 6.1E-09 | 2.0E-01 | 3.0E-08 | 0.001% |
| | | | | | | SUMMARY HAZARD INDEX | 0.003 | |

RES-SS2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

August 1992

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 100 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.08 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 5,800 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 24 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 24 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RES-SS2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | 4.2E-06 | 0.03 | 5.9E-07 | 1.5E+00 | 1.6E+00 | 6.3E-06 | 9.4E-07 | 7.3E-06 | 100.00% |
| SUMMARY CANCER RISK | | | | | | | 6E-06 | 9E-07 | 7E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | 1.2E-05 | 0.03 | 1.7E-06 | 3.0E-04 | 2.9E-04 | 4.1E-02 | 5.9E-03 | 4.7E-02 | 37.90% |
| Chromium | 27 | 1.6E-05 | ND | | 3.0E-03 | ND | 5.3E-03 | | 5.3E-03 | 4.26% |
| Iron | 16,400 | 9.6E-03 | ND | | ND | ND | | | | |
| Manganese | 481 | 2.8E-04 | ND | | 7.1E-02 | ND | 4.0E-03 | | 4.0E-03 | 3.21% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 32 | 1.9E-05 | 0.17 | 1.5E-05 | 6.0E-01 | 5.5E-01 | 3.1E-05 | 2.7E-05 | 5.8E-05 | 0.05% |
| C9-C10 Aromatics | 23 | 1.4E-05 | 0.17 | 1.1E-05 | 3.0E-02 | 2.7E-02 | 4.5E-04 | 3.9E-04 | 8.4E-04 | 0.68% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 465 | 2.7E-04 | 0.17 | 2.2E-04 | 6.0E-01 | 5.5E-01 | 4.5E-04 | 3.9E-04 | 8.5E-04 | 0.68% |
| C19-C36 Aliphatics | 5,680 | 3.3E-03 | 0.17 | 2.6E-03 | 6.0E+00 | 5.5E+00 | 5.6E-04 | 4.8E-04 | 1.0E-03 | 0.83% |
| C11-C22 Aromatics | 1770 | 1.0E-03 | 0.17 | 8.2E-04 | 3.0E-02 | 2.7E-02 | 3.5E-02 | 3.0E-02 | 6.5E-02 | 52.39% |
| SUMMARY HAZARD INDEX | | | | | | | 0.09 | 0.04 | 0.1 | |

RES-SS2I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 0.63 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 24 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 24 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SS2I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | NA | | 1.6E-08 | 1.6E-10 | 1.5E+01 | 2.4E-09 | 22.15% |
| Chromium | 27 | NA | | 2.0E-08 | 2.1E-10 | 4.1E+01 | 8.5E-09 | 77.85% |
| | | | | | | SUMMARY CANCER RISK | 1E-08 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | NA | | 1.6E-08 | 4.7E-10 | ND | | |
| Chromium | 27 | NA | | 2.0E-08 | 6.1E-10 | 2.9E-05 | 2.1E-05 | 2.63% |
| Iron | 16,400 | NA | | 1.2E-05 | 3.7E-07 | ND | | |
| Manganese | 481 | NA | | 3.6E-07 | 1.1E-08 | 1.4E-05 | 7.7E-04 | 97.11% |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 32 | NA | | 2.4E-08 | 7.2E-10 | 5.7E-01 | 1.3E-09 | 0.00016% |
| C9-C10 Aromatics | 23 | NA | | 1.7E-08 | 5.2E-10 | 1.7E-02 | 3.0E-08 | 0.0038% |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 465 | NA | | 3.5E-07 | 1.0E-08 | 5.7E-01 | 1.8E-08 | 0.0023% |
| C19-C36 Aliphatics | 5680 | NA | | 4.3E-06 | 1.3E-07 | ND | | |
| C11-C22 Aromatics | 1,770 | NA | | 1.3E-06 | 4.0E-08 | 2.0E-02 | 2.0E-06 | 0.25% |
| | | | | | | SUMMARY HAZARD INDEX | 0.001 | |

RES-SS2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 200 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 1 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 2,045 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 15 | kg |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 6 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 6 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RES-SS2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | 9.9E-06 | 0.03 | 3.0E-06 | 1.5E+00 | 1.60E+00 | 1.5E-05 | 4.8E-06 | 2.0E-05 | 100.00% |
| SUMMARY CANCER RISK | | | | | | | 1E-05 | 5E-06 | 2E-05 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | 1.2E-04 | 0.03 | 3.5E-05 | 3.0E-04 | 2.9E-04 | 3.8E-01 | 1.2E-01 | 5.1E-01 | 31.98% |
| Chromium | 27 | 1.5E-04 | ND | | 3.0E-03 | ND | 4.9E-02 | | 4.9E-02 | 3.12% |
| Iron | 16,400 | 9.0E-02 | ND | | ND | ND | | | | |
| Manganese | 481 | 2.6E-03 | ND | | 7.1E-02 | ND | 3.7E-02 | | 3.7E-02 | 2.35% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 32 | 1.8E-04 | 0.17 | 3.0E-04 | 6.0E-01 | 5.5E-01 | 2.9E-04 | 5.5E-04 | 8.5E-04 | 0.05% |
| C9-C10 Aromatics | 23 | 1.3E-04 | 0.17 | 2.2E-04 | 3.0E-02 | 2.7E-02 | 4.2E-03 | 8.1E-03 | 1.2E-02 | 0.78% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 465 | 2.5E-03 | 0.17 | 4.4E-03 | 6.0E-01 | 5.5E-01 | 4.2E-03 | 8.1E-03 | 1.2E-02 | 0.78% |
| C19-C36 Aliphatics | 5,680 | 3.1E-02 | 0.17 | 5.4E-02 | 6.0E+00 | 5.5E+00 | 5.2E-03 | 9.8E-03 | 1.5E-02 | 0.95% |
| C11-C22 Aromatics | 1770 | 9.7E-03 | 0.17 | 1.7E-02 | 3.0E-02 | 2.7E-02 | 3.2E-01 | 6.2E-01 | 9.5E-01 | 59.98% |
| SUMMARY HAZARD INDEX | | | | | | | 0.8 | 0.8 | 2 | |

RES-SS2I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 0.31 | m³/hour |
| BODY WEIGHT | BW | 15 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 6 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 6 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CARCINOGENIC EFFECTS

RES-SS2I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF ($m^3$/kg) | AIR CONCENTRATION VOLATILES (mg/$m^3$) | AIR CONCENTRATION PARTICULATES (mg/$m^3$) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | NA | | 1.6E-08 | 9.3E-11 | 1.5E+01 | 1.4E-09 | 22.15% |
| Chromium | 27 | NA | | 2.0E-08 | 1.2E-10 | 4.1E+01 | 4.9E-09 | 77.85% |
| | | | | | | SUMMARY CANCER RISK | 6E-09 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF ($m^3$/kg) | AIR CONCENTRATION VOLATILES (mg/$m^3$) | AIR CONCENTRATION PARTICULATES (mg/$m^3$) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | NA | | 1.6E-08 | 1.1E-09 | ND | | |
| Chromium | 27 | NA | | 2.0E-08 | 1.4E-09 | 2.9E-05 | 4.8E-05 | 2.63% |
| Iron | 16,400 | NA | | 1.2E-05 | 8.4E-07 | ND | | |
| Manganese | 481 | NA | | 3.6E-07 | 2.5E-08 | 1.4E-05 | 1.8E-03 | 97.11% |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 32 | NA | | 2.4E-08 | 1.6E-09 | 5.7E-01 | 2.9E-09 | 0.00016% |
| C9-C10 Aromatics | 23 | NA | | 1.7E-08 | 1.2E-09 | 1.7E-02 | 7.0E-08 | 0.0038% |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 465 | NA | | 3.5E-07 | 2.4E-08 | 5.7E-01 | 4.2E-08 | 0.0023% |
| C19-C36 Aliphatics | 5680 | NA | | 4.3E-06 | 2.9E-07 | ND | | |
| C11-C22 Aromatics | 1,770 | NA | | 1.3E-06 | 9.1E-08 | 2.0E-02 | 4.6E-06 | 0.25% |
| | | | | | | SUMMARY HAZARD INDEX | 0.002 | |

RES-SB2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

03-Feb-00

August 1992

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 100 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.08 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 5,800 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 24 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 24 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RES-SB2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.87 | 2.0E-06 | 0.03 | 2.8E-07 | 1.5E+00 | 1.60E+00 | 3.0E-06 | 4.4E-07 | 3.4E-06 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 3E-06 | 4E-07 | 3E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.87 | 5.8E-06 | 0.03 | 8.1E-07 | 3.0E-04 | 2.9E-04 | 1.9E-02 | 2.8E-03 | 2.2E-02 | 87.70% |
| Iron | 8080 | 4.7E-03 | ND | | ND | ND | | | | |
| Manganese | 231 | 1.4E-04 | ND | | 7.1E-02 | 4.3E-03 | 1.9E-03 | 0.0E+00 | 1.9E-03 | 7.58% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 0.57 | 3.3E-07 | 0.17 | 2.6E-07 | 6.0E-01 | 5.5E-01 | 5.6E-07 | 4.8E-07 | 1.0E-06 | 0.004% |
| C9-C10 Aromatics | 0.41 | 2.4E-07 | 0.17 | 1.9E-07 | 3.0E-02 | 2.7E-02 | 8.0E-06 | 7.0E-06 | 1.5E-05 | 0.06% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 8.2 | 4.8E-06 | 0.17 | 3.8E-06 | 6.0E-01 | 5.5E-01 | 8.0E-06 | 6.9E-06 | 1.5E-05 | 0.06% |
| C19-C36 Aliphatics | 101 | 5.9E-05 | 0.17 | 4.7E-05 | 6.0E+00 | 5.5E+00 | 9.9E-06 | 8.5E-06 | 1.8E-05 | 0.07% |
| C11-C22 Aromatics | 31 | 1.8E-05 | 0.17 | 1.4E-05 | 3.0E-02 | 2.7E-02 | 6.1E-04 | 5.3E-04 | 1.1E-03 | 4.52% |
| | | | | | | SUMMARY HAZARD INDEX | 0.02 | 0.003 | 0.03 | |

RES-SB2I
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 0.63 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 24 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 24 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SB2I
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.87 | NA | | 7.5E-09 | 7.6E-11 | 1.5E+01 | 1.1E-09 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 1E-09 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.87 | NA | | 7.5E-09 | 2.2E-10 | ND | | |
| Iron | 8080 | NA | | 6.1E-06 | 1.8E-07 | ND | | |
| Manganese | 231 | NA | | 1.8E-07 | 5.2E-09 | 1.4E-05 | 3.7E-04 | 99.99% |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 0.57 | NA | | 4.3E-10 | 1.3E-11 | 5.7E-01 | 2.2E-11 | 0.000006% |
| C9-C10 Aromatics | 0.41 | NA | | 3.1E-10 | 9.2E-12 | 1.7E-02 | 5.4E-10 | 0.0001% |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 8.2 | NA | | 6.2E-09 | 1.8E-10 | 5.7E-01 | 3.2E-10 | 0.00009% |
| C19-C36 Aliphatics | 101 | NA | | 7.7E-08 | 2.3E-09 | ND | | |
| C11-C22 Aromatics | 31 | NA | | 2.3E-08 | 6.9E-10 | 2.0E-02 | 3.5E-08 | 0.009% |
| | | | | | | SUMMARY HAZARD INDEX | 0.0004 | |

RES-SB2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

03-Feb-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 200 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 1 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 2,045 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 15 | kg |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 6 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 6 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RES-SB2I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.87 | 4.6E-06 | 0.03 | 1.4E-06 | 1.5E+00 | 1.60E+00 | 7.0E-06 | 2.3E-06 | 9.2E-06 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 7E-06 | 2E-06 | 9E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.87 | 5.4E-05 | 0.03 | 1.7E-05 | 3.0E-04 | 2.9E-04 | 1.8E-01 | 5.7E-02 | 2.4E-01 | 87.11% |
| Iron | 8080 | 4.4E-02 | ND | | ND | ND | | | | |
| Manganese | 231 | 1.3E-03 | ND | | 7.1E-02 | 4.3E-03 | 1.8E-02 | 0.0E+00 | 1.8E-02 | 6.54% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 0.57 | 3.1E-06 | 0.17 | 5.4E-06 | 6.0E-01 | 5.5E-01 | 5.2E-06 | 9.9E-06 | 1.5E-05 | 0.006% |
| C9-C10 Aromatics | 0.41 | 2.2E-06 | 0.17 | 3.9E-06 | 3.0E-02 | 2.7E-02 | 7.5E-05 | 1.4E-04 | 2.2E-04 | 0.08% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 8.2 | 4.5E-05 | 0.17 | 7.8E-05 | 6.0E-01 | 5.5E-01 | 7.5E-05 | 1.4E-04 | 2.2E-04 | 0.08% |
| C19-C36 Aliphatics | 101 | 5.5E-04 | 0.17 | 9.6E-04 | 6.0E+00 | 5.5E+00 | 9.2E-05 | 1.7E-04 | 2.7E-04 | 0.10% |
| C11-C22 Aromatics | 31 | 1.7E-04 | 0.17 | 3.0E-04 | 3.0E-02 | 2.7E-02 | 5.7E-03 | 1.1E-02 | 1.7E-02 | 6.09% |
| | | | | | | SUMMARY HAZARD INDEX | 0.2 | 0.1 | 0.3 | |

RES-SB2I
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 0.31 | m³/hour |
| BODY WEIGHT | BW | 15 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 6 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 6 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CARCINOGENIC EFFECTS

RES-SB2I
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.87 | NA | | 7.5E-09 | 4.4E-11 | 1.5E+01 | 6.5E-10 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 7E-10 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.87 | NA | | 7.5E-09 | 5.1E-10 | ND | | |
| Iron | 8080 | NA | | 6.1E-06 | 4.2E-07 | ND | | |
| Manganese | 231 | NA | | 1.8E-07 | 1.2E-08 | 1.4E-05 | 8.5E-04 | 99.99% |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 0.57 | NA | | 4.3E-10 | 2.9E-11 | 5.7E-01 | 5.1E-11 | 0.000006% |
| C9-C10 Aromatics | 0.41 | NA | | 3.1E-10 | 2.1E-11 | 1.7E-02 | 1.2E-09 | 0.0001% |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 8.2 | NA | | 6.2E-09 | 4.2E-10 | 5.7E-01 | 7.4E-10 | 0.00009% |
| C19-C36 Aliphatics | 101 | NA | | 7.7E-08 | 5.2E-09 | ND | | |
| C11-C22 Aromatics | 31 | NA | | 2.3E-08 | 1.6E-09 | 2.0E-02 | 8.0E-08 | 0.009% |
| | | | | | | SUMMARY HAZARD INDEX | 0.001 | |

RES-GW2I
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION WATER | CW | chemical-specific | ug/liter |
| INGESTION RATE | IR | 2 | liters/day |
| BODY WEIGHT | BW | 70 | kg |
| CONVERSION FACTOR | CF | 0.001 | mg/ug |
| EXPOSURE FREQUENCY | EF | 350 | days/year |
| EXPOSURE DURATION | ED | 30 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 30 | years |

Notes:
For noncarcinogenic effects: AT = ED

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOITIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

$$\text{INTAKE} = \frac{CW \times IR \times EF \times ED \times CF}{BW \times AT \times 365 \text{ days/year}}$$

RES-GW2I
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | WATER CONCENTRATION | UNITS | INTAKE INGESTION (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)^-1 | CANCER RISK INGESTION |
|---|---|---|---|---|---|
| No Carcinogenic CPCs | | | | | |
| | | | | TOTAL CANCER RISK | 0E+00 |

NONCARCINOGENIC EFFECTS

| COMPOUND | WATER CONCENTRATION | UNITS | INTAKE INGESTION (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT INGESTION |
|---|---|---|---|---|---|
| Aluminum | 204 | ug/Liter | 5.6E-03 | 1.0E+00 | 5.6E-03 |
| Manganese | 177 | ug/Liter | 4.8E-03 | 2.4E-02 | 2.0E-01 |
| | | | | TOTAL HAZARD INDEX | 0.2 |

RECCH-SS2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
CURRENT/FUTURE RECREATIONAL CHILD (6 TO 16 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 100 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 1 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 3,850 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 38 | kg |
| EXPOSURE FREQUENCY | EF | 52 | days/year |
| EXPOSURE DURATION | ED | 11 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 11 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RECCH-SS2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
CURRENT/FUTURE RECREATIONAL CHILD (6 TO 16 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 47.9 | 2.8E-06 | 0.03 | 3.3E-06 | 1.5E+00 | 1.60E+00 | 4.2E-06 | 5.2E-06 | 9.4E-06 | 74.22% |
| Aroclor-1260 | 3.6 | 2.1E-07 | 0.14 | 1.1E-06 | 2.0E+00 | 2.50E+00 | 4.2E-07 | 2.9E-06 | 3.3E-06 | 25.78% |
| | | | | | | SUMMARY CANCER RISK | 5E-06 | 8E-06 | 1E-05 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 47.9 | 1.8E-05 | 0.03 | 2.1E-05 | 3.0E-04 | 2.9E-04 | 6.0E-02 | 7.2E-02 | 1.3E-01 | 16.91% |
| Iron | 7920 | 3.0E-03 | ND | | ND | ND | | | | |
| Manganese | 273 | 1.0E-04 | ND | | 7.1E-02 | ND | 1.4E-03 | | 1.4E-03 | 0.19% |
| Aroclor-1260 | 3.6 | 1.3E-06 | 0.14 | 7.3E-06 | 2.0E-05 | 1.6E-05 | 6.7E-02 | 4.5E-01 | 5.2E-01 | 67.20% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 21 | 7.9E-06 | 0.17 | 5.2E-05 | 6.0E-01 | 5.5E-01 | 1.3E-05 | 9.4E-05 | 1.1E-04 | 0.01% |
| C9-C10 Aromatics | 17 | 6.4E-06 | 0.17 | 4.2E-05 | 3.0E-02 | 2.7E-02 | 2.1E-04 | 1.5E-03 | 1.8E-03 | 0.23% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 298 | 1.1E-04 | 0.17 | 7.3E-04 | 6.0E-01 | 5.5E-01 | 1.9E-04 | 1.3E-03 | 1.5E-03 | 0.20% |
| C19-C36 Aliphatics | 3640 | 1.4E-03 | 0.17 | 8.9E-03 | 6.0E+00 | 5.5E+00 | 2.3E-04 | 1.6E-03 | 1.9E-03 | 0.24% |
| C11-C22 Aromatics | 1,130 | 4.2E-04 | 0.17 | 2.8E-03 | 3.0E-02 | 2.7E-02 | 1.4E-02 | 1.0E-01 | 1.2E-01 | 15.03% |
| | | | | | | SUMMARY HAZARD INDEX | 0.1 | 0.6 | 0.8 | |

RECCH-SD2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SEDIMENT - RME
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SEDIMENT | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 25 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 1 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 3,850 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 38 | kg |
| EXPOSURE FREQUENCY | EF | 52 | days/year |
| EXPOSURE DURATION | ED | 11 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 11 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RECCH-SD2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SEDIMENT - RME
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SEDIMENT CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 220 | 3.2E-06 | 0.03 | 1.5E-05 | 1.5E+00 | 1.6E+00 | 4.9E-06 | 2.4E-05 | 2.9E-05 | 99.96% |
| Lead | 410 | 6.0E-06 | ND | 0.0E+00 | ND | ND | | | | 0.00% |
| Dieldrin | 0.046 | 6.8E-10 | ND | 0.0E+00 | 1.6E+01 | ND | 1.1E-08 | | 1.1E-08 | 0.038% |
| SUMMARY CANCER RISK | | | | | | | 5E-06 | 2E-05 | 3E-05 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SEDIMENT CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 15,900 | 1.5E-03 | ND | | 1.0E+00 | ND | 1.5E-03 | | 1.5E-03 | 0.21% |
| Arsenic | 220 | 2.1E-05 | 0.03 | 9.5E-05 | 3.0E-04 | 2.9E-04 | 6.9E-02 | 3.3E-01 | 4.0E-01 | 56.36% |
| Chromium | 49 | 4.6E-06 | ND | | 3.0E-03 | 7.5E-05 | 1.5E-03 | 0.0E+00 | 1.5E-03 | 0.22% |
| Iron | 30400 | 2.8E-03 | ND | | ND | ND | | | | |
| Lead | 410 | 3.8E-05 | ND | | ND | ND | | | | |
| Manganese | 3940 | 3.7E-04 | ND | | 7.1E-02 | 4.3E-03 | 5.2E-03 | 0.0E+00 | 5.2E-03 | 0.74% |
| Dieldrin | 0.046 | 4.3E-09 | ND | | 5.0E-05 | ND | 8.6E-05 | | 8.6E-05 | 0.012% |
| Total Petroleum Hydrocarbons | 3200 | 3.0E-04 | 0.17 | 7.9E-03 | 3.0E-02 | 2.7E-02 | 1.0E-02 | 2.9E-01 | 3.0E-01 | 42.68% |
| SUMMARY HAZARD INDEX | | | | | | | 0.1 | 0.6 | 0.7 | |

RECCH-SW2R

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE WATER - RME
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION WATER | CW | average | mg/liter |
| INGESTION RATE | IR | 0.013 | liters/hour |
| SURFACE AREA EXPOSED | SA | 2,518 | $cm^2$/day |
| CONVERSION FACTOR | CF | 0.001 | liter/$cm^3$ |
| BODY WEIGHT | BW | 38 | kg |
| EXPOSURE TIME | ET | 2 | hours/day |
| EXPOSURE FREQUENCY | EF | 52 | days/year |
| EXPOSURE DURATION | ED | 11 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 11 | years |
| PERMEABILITY COEFFICIENT | Kpevent | Chemical-specific | cm/day |

Notes:
For noncarcinogenic effects: AT = ED
ND - Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR $(mg/kg\text{-}day)^{-1}$

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CW \times IR \times ET \times EF \times ED}{BW \times AT \times 365\ days/yr}$$

$$\text{INTAKE-DERMAL} = \frac{CW \times Kpevent \times ET \times SA \times CF \times EF \times ED}{BW \times AT \times 365\ days/yr}$$

RECCH-SW2R

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE WATER - RME
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA
CARCINOGENIC EFFECTS

| COMPOUND | WATER CONCENTRATION (mg/L) | INTAKE INGESTION (mg/kg-day) | PERMEABILITY COEFFICIENT (cm/hour) | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)$^{-1}$ | CANCER SLOPE FACTOR DERMAL (mg/kg-day)$^{-1}$ | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 0.198 | 3.0E-06 | 1.0E-03 | 5.9E-07 | 1.5E+00 | 1.6E+00 | 4.5E-06 | 9.4E-07 | 5.5E-06 | 99.86% |
| Lead | 0.967 | 1.5E-05 | 1.0E-03 | 2.9E-06 | NA | NA | | | | |
| Bis(2-ethylhexyl)phthalate | 0.024 | 3.7E-07 | 3.3E-02 | 2.3E-06 | 1.4E-02 | NA | 5.1E-09 | | 5.1E-09 | 0.09% |
| Chloroform | 0.00072 | 1.1E-08 | 1.3E-01 | 2.8E-07 | 6.1E-03 | NA | 6.7E-11 | | 6.7E-11 | 0.0012% |
| Tetrachloroethylene | 0.0026 | 4.0E-08 | 3.7E-01 | 2.9E-06 | 5.2E-02 | NA | 2.1E-09 | | 2.1E-09 | 0.04% |
| Trichloroethylene | 0.0035 | 5.4E-08 | 2.3E-01 | 2.4E-06 | 1.1E-02 | NA | 5.9E-10 | | 5.9E-10 | 0.01% |
| | | | | | | SUMMARY CANCER RISK | 5E-06 | 9E-07 | 5E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | WATER CONCENTRATION (mg/L) | INTAKE INGESTION (mg/kg-day) | PERMEABILITY COEFFICIENT (cm/hour) | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 15.1 | 1.5E-03 | 1.0E-03 | 2.9E-04 | 1.0E+00 | NA | 1.47E-03 | | 1.5E-03 | 1.08% |
| Arsenic | 0.198 | 1.9E-05 | 1.0E-03 | 3.7E-06 | 3.0E-04 | 2.9E-04 | 6.43E-02 | 1.29E-02 | 7.7E-02 | 56.45% |
| Barium | 0.553 | 5.4E-05 | 1.0E-03 | 1.0E-05 | 7.0E-02 | 4.9E-03 | 7.70E-04 | 2.13E-03 | 2.9E-03 | 2.12% |
| Cadmium | 0.025 | 2.4E-06 | 1.0E-03 | 4.7E-07 | 5.0E-04 | 2.5E-05 | 4.87E-03 | 1.89E-02 | 2.4E-02 | 17.36% |
| Chromium | 0.036 | 3.5E-06 | 1.0E-03 | 6.8E-07 | 3.0E-03 | 7.5E-05 | 1.17E-03 | 9.06E-03 | 1.0E-02 | 7.48% |
| Copper | 0.375 | 3.7E-05 | 1.0E-03 | 7.1E-06 | NA | NA | | | | |
| Iron | 17.6 | 1.7E-03 | 1.0E-03 | 3.3E-04 | NA | NA | | | | |
| Lead | 0.967 | 9.4E-05 | 1.0E-03 | 1.8E-05 | NA | NA | | | | |
| Manganese | 0.433 | 4.2E-05 | 1.0E-03 | 8.2E-06 | 2.4E-02 | 1.4E-03 | 1.76E-03 | 5.84E-03 | 7.6E-03 | 5.55% |
| Vanadium | 0.072 | 7.0E-06 | 1.0E-03 | 1.4E-06 | 7.0E-03 | 1.8E-04 | 1.00E-03 | 7.55E-03 | 8.6E-03 | 6.25% |
| Bis(2-ethylhexyl)phthalate | 0.024 | 2.3E-06 | 3.3E-02 | 1.5E-05 | 2.0E-02 | NA | 1.17E-04 | | 1.2E-04 | 0.086% |
| 1,2-Dichloroethylenes | 0.026 | 2.5E-06 | 1.0E-02 | 4.9E-06 | 9.0E-03 | NA | 2.82E-04 | | 2.8E-04 | 0.21% |
| Chloroform | 0.00072 | 7.0E-08 | 1.3E-01 | 1.8E-06 | 1.0E-02 | NA | 7.02E-06 | | 7.0E-06 | 0.0051% |
| Tetrachloroethylene | 0.0026 | 2.5E-07 | 3.7E-01 | 1.8E-05 | 1.0E-02 | NA | 2.53E-05 | | 2.5E-05 | 0.019% |
| Trichloroethylene | 0.0035 | 3.4E-07 | 2.3E-01 | 1.5E-05 | 6.0E-03 | NA | 5.69E-05 | | 5.7E-05 | 0.042% |
| EPH Fractions | | | | | | | | | | |
| C10-C22 Aromatics | 1.4 | 1.4E-04 | NA | | 3.0E-02 | 2.7E-02 | 4.55E-03 | | 4.5E-03 | 3.33% |
| C19-C36 Aliphatics | 1.7 | 1.7E-04 | NA | | 6.0E+00 | 5.5E+00 | 2.76E-05 | | 2.8E-05 | 0.020% |
| | | | | | | SUMMARY HAZARD INDEX | 0.1 | 0.06 | 0.1 | |

RECCH-SS2R(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
CURRENT/FUTURE RECREATIONAL CHILD (6 TO 16 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 50 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 1 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 3,850 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 38 | kg |
| EXPOSURE FREQUENCY | EF | 26 | days/year |
| EXPOSURE DURATION | ED | 11 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 11 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RECCH-SS2R(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
CURRENT/FUTURE RECREATIONAL CHILD (6 TO 16 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 47.9 | 7.1E-07 | 0.03 | 1.6E-06 | 1.5E+00 | 1.60E+00 | 1.1E-06 | 2.6E-06 | 3.7E-06 | 70.48% |
| Aroclor-1260 | 3.6 | 5.3E-08 | 0.14 | 5.7E-07 | 2.0E+00 | 2.50E+00 | 1.1E-07 | 1.4E-06 | 1.5E-06 | 29.52% |
| | | | | | | SUMMARY CANCER RISK | 1E-06 | 4E-06 | 5E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 47.9 | 4.5E-06 | 0.03 | 1.0E-05 | 3.0E-04 | 2.9E-04 | 1.5E-02 | 3.6E-02 | 5.1E-02 | 14.39% |
| Iron | 7920 | 7.4E-04 | ND | | ND | ND | | | | |
| Manganese | 273 | 2.6E-05 | ND | | 7.1E-02 | ND | 3.6E-04 | | 3.6E-04 | 0.10% |
| Aroclor-1260 | 3.6 | 3.4E-07 | 0.14 | 3.6E-06 | 2.0E-05 | 1.6E-05 | 1.7E-02 | 2.3E-01 | 2.4E-01 | 69.25% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 21 | 2.0E-06 | 0.17 | 2.6E-05 | 6.0E-01 | 5.5E-01 | 3.3E-06 | 4.7E-05 | 5.0E-05 | 0.01% |
| C9-C10 Aromatics | 17 | 1.6E-06 | 0.17 | 2.1E-05 | 3.0E-02 | 2.7E-02 | 5.3E-05 | 7.7E-04 | 8.3E-04 | 0.23% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 298 | 2.8E-05 | 0.17 | 3.7E-04 | 6.0E-01 | 5.5E-01 | 4.7E-05 | 6.6E-04 | 7.1E-04 | 0.20% |
| C19-C36 Aliphatics | 3640 | 3.4E-04 | 0.17 | 4.5E-03 | 6.0E+00 | 5.5E+00 | 5.7E-05 | 8.1E-04 | 8.7E-04 | 0.25% |
| C11-C22 Aromatics | 1,130 | 1.1E-04 | 0.17 | 1.4E-03 | 3.0E-02 | 2.7E-02 | 3.5E-03 | 5.1E-02 | 5.5E-02 | 15.56% |
| | | | | | | SUMMARY HAZARD INDEX | 0.04 | 0.3 | 0.4 | |

RECCH-SD2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SEDIMENT - CENTRAL TENDENCY
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SEDIMENT | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 25 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 1 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 3,850 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 38 | kg |
| EXPOSURE FREQUENCY | EF | 26 | days/year |
| EXPOSURE DURATION | ED | 11 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 11 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RECCH-SD2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SEDIMENT - CENTRAL TENDENCY
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SEDIMENT CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 220 | 1.6E-06 | 0.03 | 7.5E-06 | 1.5E+00 | 1.6E+00 | 2.4E-06 | 1.2E-05 | 1.4E-05 | 99.96% |
| Lead | 410 | 3.0E-06 | ND | 0.0E+00 | ND | ND | | | | 0.00% |
| Dieldrin | 0.046 | 3.4E-10 | ND | 0.0E+00 | 1.6E+01 | ND | 5.4E-09 | | 5.4E-09 | 0.038% |
| SUMMARY CANCER RISK | | | | | | | 2E-06 | 1E-05 | 1E-05 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SEDIMENT CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 15,900 | 7.5E-04 | ND | | 1.0E+00 | ND | 7.5E-04 | | 7.5E-04 | 0.21% |
| Arsenic | 220 | 1.0E-05 | 0.03 | 4.8E-05 | 3.0E-04 | 2.9E-04 | 3.4E-02 | 1.6E-01 | 2.0E-01 | 56.36% |
| Chromium | 49 | 2.3E-06 | ND | | 3.0E-03 | 7.5E-05 | 7.7E-04 | 0.0E+00 | 7.7E-04 | 0.22% |
| Iron | 30400 | 1.4E-03 | ND | | ND | ND | | | | |
| Lead | 410 | 1.9E-05 | ND | | ND | ND | | | | |
| Manganese | 3940 | 1.8E-04 | ND | | 7.1E-02 | 4.3E-03 | 2.6E-03 | 0.0E+00 | 2.6E-03 | 0.74% |
| Dieldrin | 0.046 | 2.2E-09 | ND | | 5.0E-05 | ND | 4.3E-05 | | 4.3E-05 | 0.012% |
| Total Petroleum Hydrocarbons | 3200 | 1.5E-04 | 0.17 | 3.9E-03 | 3.0E-02 | 2.7E-02 | 5.0E-03 | 1.5E-01 | 1.5E-01 | 42.68% |
| SUMMARY HAZARD INDEX | | | | | | | 0.04 | 0.3 | 0.4 | |

RECCH-SW2R

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE WATER - CT
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION WATER | CW | average | mg/liter |
| INGESTION RATE | IR | 0.013 | liters/hour |
| SURFACE AREA EXPOSED | SA | 2,518 | $cm^2$/day |
| CONVERSION FACTOR | CF | 0.001 | liter/$cm^3$ |
| BODY WEIGHT | BW | 38 | kg |
| EXPOSURE TIME | ET | 2 | hours/day |
| EXPOSURE FREQUENCY | EF | 26 | days/year |
| EXPOSURE DURATION | ED | 11 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 11 | years |
| PERMEABILITY COEFFICIENT | Kpevent | Chemical-specific | cm/day |

Notes:
For noncarcinogenic effects: AT = ED
ND - Value not determined
TPHC - Total Petroleum Hydrocarbons

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR $(mg/kg\text{-}day)^{-1}$

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CW \times IR \times ET \times EF \times ED}{BW \times AT \times 365\ days/yr}$$

$$\text{INTAKE-DERMAL} = \frac{CW \times Kpevent \times ET \times SA \times CF \times EF \times ED}{BW \times AT \times 365\ days/yr}$$

RECCH-SW2R

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE WATER - CT
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA
CARCINOGENIC EFFECTS

| COMPOUND | WATER CONCENTRATION (mg/L) | INTAKE INGESTION (mg/kg-day) | PERMEABILITY COEFFICIENT (cm/hour) | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)$^{-1}$ | CANCER SLOPE FACTOR DERMAL (mg/kg-day)$^{-1}$ | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 0.198 | 1.5E-06 | 1.0E-03 | 2.9E-07 | 1.5E+00 | 1.6E+00 | 2.3E-06 | 4.7E-07 | 2.7E-06 | 99.86% |
| Lead | 0.967 | 7.4E-06 | 1.0E-03 | 1.4E-06 | NA | NA | | | | |
| Bis(2-ethylhexyl)phthalate | 0.024 | 1.8E-07 | 3.3E-02 | 1.2E-06 | 1.4E-02 | NA | 2.6E-09 | | 2.6E-09 | 0.09% |
| Chloroform | 0.00072 | 5.5E-09 | 1.3E-01 | 1.4E-07 | 6.1E-03 | NA | 3.4E-11 | | 3.4E-11 | 0.0012% |
| Tetrachloroethylene | 0.0026 | 2.0E-08 | 3.7E-01 | 1.4E-06 | 5.2E-02 | NA | 1.0E-09 | | 1.0E-09 | 0.04% |
| Trichloroethylene | 0.0035 | 2.7E-08 | 2.3E-01 | 1.2E-06 | 1.1E-02 | NA | 2.9E-10 | | 2.9E-10 | 0.01% |
| | | | | | | SUMMARY CANCER RISK | 2E-06 | 5E-07 | 3E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | WATER CONCENTRATION (mg/L) | INTAKE INGESTION (mg/kg-day) | PERMEABILITY COEFFICIENT (cm/hour) | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 15.1 | 7.4E-04 | 1.0E-03 | 1.4E-04 | 1.0E+00 | NA | 7.36E-04 | | 7.4E-04 | 1.08% |
| Arsenic | 0.198 | 9.7E-06 | 1.0E-03 | 1.9E-06 | 3.0E-04 | 2.9E-04 | 3.22E-02 | 6.45E-03 | 3.9E-02 | 56.45% |
| Barium | 0.553 | 2.7E-05 | 1.0E-03 | 5.2E-06 | 7.0E-02 | 4.9E-03 | 3.85E-04 | 1.07E-03 | 1.5E-03 | 2.12% |
| Cadmium | 0.025 | 1.2E-06 | 1.0E-03 | 2.4E-07 | 5.0E-04 | 2.5E-05 | 2.44E-03 | 9.44E-03 | 1.2E-02 | 17.36% |
| Chromium | 0.036 | 1.8E-06 | 1.0E-03 | 3.4E-07 | 3.0E-03 | 7.5E-05 | 5.85E-04 | 4.53E-03 | 5.1E-03 | 7.48% |
| Copper | 0.375 | 1.8E-05 | 1.0E-03 | 3.5E-06 | NA | NA | | | | |
| Iron | 17.6 | 8.6E-04 | 1.0E-03 | 1.7E-04 | NA | NA | | | | |
| Lead | 0.967 | 4.7E-05 | 1.0E-03 | 9.1E-06 | NA | NA | | | | |
| Manganese | 0.433 | 2.1E-05 | 1.0E-03 | 4.1E-06 | 2.4E-02 | 1.4E-03 | 8.79E-04 | 2.92E-03 | 3.8E-03 | 5.55% |
| Vanadium | 0.072 | 3.5E-06 | 1.0E-03 | 6.8E-07 | 7.0E-03 | 1.8E-04 | 5.01E-04 | 3.78E-03 | 4.3E-03 | 6.25% |
| Bis(2-ethylhexyl)phthalate | 0.024 | 1.2E-06 | 3.3E-02 | 7.5E-06 | 2.0E-02 | NA | 5.85E-05 | | 5.8E-05 | 0.086% |
| 1,2-Dichloroethylenes | 0.026 | 1.3E-06 | 1.0E-02 | 2.5E-06 | 9.0E-03 | NA | 1.41E-04 | | 1.4E-04 | 0.21% |
| Chloroform | 0.00072 | 3.5E-08 | 1.3E-01 | 8.8E-07 | 1.0E-02 | NA | 3.51E-06 | | 3.5E-06 | 0.0051% |
| Tetrachloroethylene | 0.0026 | 1.3E-07 | 3.7E-01 | 9.1E-06 | 1.0E-02 | NA | 1.27E-05 | | 1.3E-05 | 0.019% |
| Trichloroethylene | 0.0035 | 1.7E-07 | 2.3E-01 | 7.6E-06 | 6.0E-03 | NA | 2.84E-05 | | 2.8E-05 | 0.042% |
| EPH Fractions | | | | | | | | | | |
| C10-C22 Aromatics | 1.4 | 6.8E-05 | NA | | 3.0E-02 | 2.7E-02 | 2.27E-03 | | 2.3E-03 | 3.33% |
| C19-C36 Aliphatics | 1.7 | 8.3E-05 | NA | | 6.0E+00 | 5.5E+00 | 1.38E-05 | | 1.4E-05 | 0.020% |
| | | | | | | SUMMARY HAZARD INDEX | 0.04 | 0.03 | 0.07 | |

CON-SS2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

03-Feb-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 480 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.28 | $mg/cm^2$ |
| SURFACE AREA | SA | 5200 | $cm^2$ |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.5 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.5 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

CON-SS2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 47.9 | 1.6E-06 | 0.03 | 1.5E-07 | 1.5E+00 | 1.60E+00 | 2.4E-06 | 2.3E-07 | 2.6E-06 | 87.73% |
| Aroclor-1260 | 3.6 | 1.2E-07 | 0.14 | 5.1E-08 | 2.0E+00 | 2.50E+00 | 2.4E-07 | 1.3E-07 | 3.7E-07 | 12.27% |
| SUMMARY CANCER RISK | | | | | | | 3E-06 | 4E-07 | 3E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 47.9 | 2.2E-04 | 0.03 | 2.0E-05 | 3.0E-04 | 2.9E-04 | 7.5E-01 | 7.1E-02 | 8.2E-01 | 59.23% |
| Iron | 7,920 | 3.7E-02 | ND | 0.0E+00 | ND | ND | | | | |
| Manganese | 273 | 1.3E-03 | ND | 0.0E+00 | 7.1E-02 | 4.30E-03 | 1.8E-02 | 0.0E+00 | 1.8E-02 | 1.30% |
| Aroclor-1260 | 3.6 | 1.7E-05 | 0.14 | 7.2E-06 | 5.0E-05 | 4.0E-05 | 3.4E-01 | 1.8E-01 | 5.2E-01 | 37.37% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 21 | 9.9E-05 | 0.17 | 5.1E-05 | 6.0E+00 | 5.5E+00 | 1.6E-05 | 9.2E-06 | 2.6E-05 | 0.002% |
| C9-C10 Aromatics | 17 | 8.0E-05 | 0.17 | 4.1E-05 | 3.0E-01 | 2.7E-01 | 2.7E-04 | 1.5E-04 | 4.2E-04 | 0.03% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 298 | 1.4E-03 | 0.17 | 7.2E-04 | 6.0E+00 | 5.5E+00 | 2.3E-04 | 1.3E-04 | 3.6E-04 | 0.03% |
| C19-C36 Aliphatics | 3640 | 1.7E-02 | 0.17 | 8.8E-03 | 6.0E+01 | 5.5E+01 | 2.8E-04 | 1.6E-04 | 4.5E-04 | 0.03% |
| C11-C22 Aromatics | 1,130 | 5.3E-03 | 0.17 | 2.7E-03 | 3.0E-01 | 2.7E-01 | 1.8E-02 | 1.0E-02 | 2.8E-02 | 2.01% |
| SUMMARY HAZARD INDEX | | | | | | | 1 | 0.3 | 1 | |

CON-SS2R
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 3.3 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.5 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.50 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SS2R
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 47.9 | NA | | 3.6E-08 | 6.7E-11 | 1.5E+01 | 1.0E-09 | 99.01% |
| Aroclor-1260 | 3.6 | NA | | 2.7E-09 | 5.0E-12 | 2.0E+00 | 1.0E-11 | 0.99% |
| | | | | | | SUMMARY CANCER RISK | 1E-09 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 47.9 | NA | | 3.6E-08 | 9.4E-09 | ND | | |
| Iron | 7,920 | NA | | 6.0E-06 | 1.5E-06 | ND | | |
| Manganese | 273 | NA | | 2.1E-07 | 5.3E-08 | 1.4E-05 | 3.8E-03 | 99.97% |
| Aroclor-1260 | 3.6 | NA | | 2.7E-09 | 7.0E-10 | ND | | |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 21 | NA | | 1.6E-08 | 4.1E-09 | 5.7E+00 | 7.2E-10 | 0.0000189% |
| C9-C10 Aromatics | 17 | NA | | 1.3E-08 | 3.3E-09 | 1.7E-01 | 2.0E-08 | 0.000513% |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 298 | NA | | 2.3E-07 | 5.8E-08 | 5.7E+00 | 1.0E-08 | 0.000268% |
| C19-C36 Aliphatics | 3640 | NA | | 2.8E-06 | 7.1E-07 | ND | | |
| C11-C22 Aromatics | 1,130 | NA | | 8.6E-07 | 2.2E-07 | 2.0E-01 | 1.1E-06 | 0.0290% |
| | | | | | | SUMMARY HAZARD INDEX | 0.00 | |

CON-Sbsr
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 480 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.28 | mg/cm² |
| SURFACE AREA | SA | 5200 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.5 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.5 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

CON-SB2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | 7.0E-07 | 0.03 | 6.4E-08 | 1.5E+00 | 1.60E+00 | 1.1E-06 | 1.0E-07 | 1.2E-06 | 47.37% |
| Lead | 5060 | 1.7E-04 | ND | 0.0E+00 | ND | ND | | | | |
| Dieldrin | 0.0113 | 3.8E-10 | ND | 0.0E+00 | 1.6E+01 | ND | 6.1E-09 | | 6.1E-09 | 0.25% |
| Aroclor- 1248 | 0.482 | 1.6E-08 | 0.14 | 6.9E-09 | 2.0E+00 | 2.50E+00 | 3.2E-08 | 1.7E-08 | 5.0E-08 | 2.02% |
| Aroclor-1260 | 12 | 4.0E-07 | 0.14 | 1.7E-07 | 2.0E+00 | 2.50E+00 | 8.1E-07 | 4.3E-07 | 1.2E-06 | 50.36% |
| | | | | | | SUMMARY CANCER RISK | 2E-06 | 5E-07 | 2E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6970 | 3.3E-02 | ND | 0.0E+00 | 1.0E+00 | ND | 3.3E-02 | | 3.3E-02 | |
| Arsenic | 21 | 9.9E-05 | 0.03 | 9.0E-06 | 3.0E-04 | 2.9E-04 | 3.3E-01 | 3.1E-02 | 3.6E-01 | 12.21% |
| Chromium | 2410 | 1.1E-02 | ND | 0.0E+00 | 2.0E-02 | 5.0E-04 | 5.7E-01 | 0.0E+00 | 5.7E-01 | 19.21% |
| Iron | 6880 | 3.2E-02 | ND | 0.0E+00 | ND | ND | | | | |
| Lead | 5060 | 2.4E-02 | ND | 0.0E+00 | ND | ND | | | | |
| Manganese | 169 | 7.9E-04 | ND | 0.0E+00 | 7.1E-02 | 4.3E-03 | 1.1E-02 | 0.0E+00 | 1.1E-02 | 0.38% |
| Dieldrin | 0.0113 | 5.3E-08 | ND | 0.0E+00 | 5.0E-05 | ND | 1.1E-03 | | 1.1E-03 | 0.04% |
| Aroclor-1248 | 0.482 | 2.3E-06 | 0.14 | 9.6E-07 | 5.0E-05 | 4.0E-05 | 4.5E-02 | 2.4E-02 | 6.9E-02 | 2.35% |
| Aroclor-1260 | 12 | 5.6E-05 | 0.14 | 2.4E-05 | 5.0E-05 | 4.0E-05 | 1.1E+00 | 6.0E-01 | 1.7E+00 | 58.56% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 130 | 6.1E-04 | 0.17 | 3.1E-04 | 6.0E+00 | 5.5E+00 | 1.0E-04 | 5.7E-05 | 1.6E-04 | 0.005% |
| C9-C10 Aromatics | 93 | 4.4E-04 | 0.17 | 2.3E-04 | 3.0E-01 | 2.7E-01 | 1.5E-03 | 8.3E-04 | 2.3E-03 | 0.08% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 1860 | 8.7E-03 | 0.17 | 4.5E-03 | 6.0E+00 | 5.5E+00 | 1.5E-03 | 8.2E-04 | 2.3E-03 | 0.08% |
| C19-C36 Aliphatics | 22,700 | 1.1E-01 | 0.17 | 5.5E-02 | 6.0E+01 | 5.5E+01 | 1.8E-03 | 1.0E-03 | 2.8E-03 | 0.09% |
| C11-C22 Aromatics | 7050 | 3.3E-02 | 0.17 | 1.7E-02 | 3.0E-01 | 2.7E-01 | 1.1E-01 | 6.3E-02 | 1.7E-01 | 5.89% |
| | | | | | | SUMMARY HAZARD INDEX | 2 | 0.7 | 3 | |

CON-Sb...
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 3.3 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.5 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.50 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SB2R
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | NA | | 1.6E-08 | 2.9E-11 | 1.5E+01 | 4.4E-10 | 0.32% |
| Chromium | 2410 | NA | | 1.8E-06 | 3.4E-09 | 4.1E+01 | 1.4E-07 | 99.66% |
| Lead | 5060 | NA | | 3.8E-06 | 7.1E-09 | ND | | |
| Dieldrin | 0.0113 | NA | | 8.6E-12 | 1.6E-14 | 1.6E+01 | 2.5E-13 | 0.00018% |
| Aroclor- 1248 | 0.482 | NA | | 3.7E-10 | 6.7E-13 | 2.0E+00 | 1.3E-12 | 0.00097% |
| Aroclor-1260 | 12 | NA | | 9.1E-09 | 1.7E-11 | 2.0E+00 | 3.4E-11 | 0.024% |
| | | | | | | SUMMARY CANCER RISK | 1E-07 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Aluminum | 6970 | NA | | 5.3E-06 | 1.4E-06 | 1.0E-03 | 1.4E-03 | 6.82% |
| Arsenic | 21 | NA | | 1.6E-08 | 4.1E-09 | ND | | |
| Chromium | 2410 | NA | | 1.8E-06 | 4.7E-07 | 2.9E-05 | 1.6E-02 | 81.33% |
| Iron | 6880 | NA | | 5.2E-06 | 1.3E-06 | ND | | |
| Lead | 5060 | NA | | 3.8E-06 | 9.9E-07 | ND | | |
| Manganese | 169 | NA | | 1.3E-07 | 3.3E-08 | 1.4E-05 | 2.4E-03 | 11.81% |
| Dieldrin | 0.0113 | NA | | 8.6E-12 | 2.2E-12 | ND | | |
| Aroclor-1248 | 0.482 | NA | | 3.7E-10 | 9.4E-11 | ND | | |
| Aroclor-1260 | 12 | NA | | 9.1E-09 | 2.3E-09 | ND | | |
| VPH | | NA | | | | | | |
| C9-C12 Aliphatics | 130 | NA | | 9.8E-08 | 2.5E-08 | 5.7E+00 | 4.5E-09 | 0.000022% |
| C9-C10 Aromatics | 93 | NA | | 7.0E-08 | 1.8E-08 | 1.7E-01 | 1.1E-07 | 0.00054% |
| EPH | | NA | | | | | | |
| C9-C18 Aliphatics | 1860 | NA | | 1.4E-06 | 3.6E-07 | 5.7E+00 | 6.4E-08 | 0.00032% |
| C19-C36 Aliphatics | 22,700 | NA | | 1.7E-05 | 4.4E-06 | ND | | |
| C11-C22 Aromatics | 7050 | NA | | 5.3E-06 | 1.4E-06 | 2.0E-01 | 6.9E-06 | 0.034% |
| | | | | | | SUMMARY HAZARD INDEX | 0.02 | |

CON-SS2R(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

03-Feb-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 480 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.28 | mg/cm² |
| SURFACE AREA | SA | 5200 | $cm^2$ |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.25 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.25 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

CON-SS2R(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 47.9 | 8.0E-07 | 0.03 | 7.3E-08 | 1.5E+00 | 1.60E+00 | 1.2E-06 | 1.2E-07 | 1.3E-06 | 87.73% |
| Aroclor-1260 | 3.6 | 6.0E-08 | 0.14 | 2.6E-08 | 2.0E+00 | 2.50E+00 | 1.2E-07 | 6.4E-08 | 1.8E-07 | 12.27% |
| | | | | | | SUMMARY CANCER RISK | 1E-06 | 2E-07 | 2E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 47.9 | 2.2E-04 | 0.03 | 2.0E-05 | 3.0E-04 | 2.9E-04 | 7.5E-01 | 7.1E-02 | 8.2E-01 | 59.23% |
| Iron | 7,920 | 3.7E-02 | ND | | ND | ND | | | | |
| Manganese | 273 | 1.3E-03 | ND | | 7.1E-02 | 4.30E-03 | 1.8E-02 | 0.0E+00 | 1.8E-02 | 1.30% |
| Aroclor-1260 | 3.6 | 1.7E-05 | 0.14 | 7.2E-06 | 5.0E-05 | 4.0E-05 | 3.4E-01 | 1.8E-01 | 5.2E-01 | 37.37% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 21 | 9.9E-05 | 0.17 | 5.1E-05 | 6.0E+00 | 5.5E+00 | 1.6E-05 | 9.2E-06 | 2.6E-05 | 0.002% |
| C9-C10 Aromatics | 17 | 8.0E-05 | 0.17 | 4.1E-05 | 3.0E-01 | 2.7E-01 | 2.7E-04 | 1.5E-04 | 4.2E-04 | 0.03% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 298 | 1.4E-03 | 0.17 | 7.2E-04 | 6.0E+00 | 5.5E+00 | 2.3E-04 | 1.3E-04 | 3.6E-04 | 0.03% |
| C19-C36 Aliphatics | 3640 | 1.7E-02 | 0.17 | 8.8E-03 | 6.0E+01 | 5.5E+01 | 2.8E-04 | 1.6E-04 | 4.5E-04 | 0.03% |
| C11-C22 Aromatics | 1,130 | 5.3E-03 | 0.17 | 2.7E-03 | 3.0E-01 | 2.7E-01 | 1.8E-02 | 1.0E-02 | 2.8E-02 | 2.01% |
| | | | | | | SUMMARY HAZARD INDEX | 1 | 0.3 | 1 | |

CON-SS2R(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 3.3 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.25 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.25 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SS2R(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 47.9 | NA | | 3.6E-08 | 3.3E-11 | 1.5E+01 | 5.0E-10 | 99.01% |
| Aroclor-1260 | 3.6 | NA | | 2.7E-09 | 2.5E-12 | 2.0E+00 | 5.0E-12 | 0.99% |
| | | | | | | SUMMARY CANCER RISK | 5E-10 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 47.9 | NA | | 3.6E-08 | 9.4E-09 | ND | | |
| Iron | 7,920 | NA | | 6.0E-06 | 1.5E-06 | ND | | |
| Manganese | 273 | NA | | 2.1E-07 | 5.3E-08 | 1.4E-05 | 3.8E-03 | 99.97% |
| Aroclor-1260 | 3.6 | NA | | 2.7E-09 | 7.0E-10 | ND | | |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 21 | NA | | 1.6E-08 | 4.1E-09 | 5.7E+00 | 7.2E-10 | 0.00002% |
| C9-C10 Aromatics | 17 | NA | | 1.3E-08 | 3.3E-09 | 1.7E-01 | 2.0E-08 | 0.0005% |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 298 | NA | | 2.3E-07 | 5.8E-08 | 5.7E+00 | 1.0E-08 | 0.0003% |
| C19-C36 Aliphatics | 3640 | NA | | 2.8E-06 | 7.1E-07 | ND | | |
| C11-C22 Aromatics | 1,130 | NA | | 8.6E-07 | 2.2E-07 | 2.0E-01 | 1.1E-06 | 0.03% |
| | | | | | | SUMMARY HAZARD INDEX | 0.004 | |

CON-SB2R(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 480 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.28 | mg/cm² |
| SURFACE AREA | SA | 5200 | $cm^2$ |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.25 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.25 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

CON-SB2R(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | 3.5E-07 | 0.03 | 3.2E-08 | 1.5E+00 | 1.60E+00 | 5.3E-07 | 5.1E-08 | 5.8E-07 | 47.37% |
| Lead | 5060 | 8.5E-05 | ND | 0.0E+00 | ND | ND | | | | |
| Dieldrin | 0.0113 | 1.9E-10 | ND | 0.0E+00 | 1.6E+01 | ND | 3.0E-09 | | 3.0E-09 | 0.25% |
| Aroclor- 1248 | 0.482 | 8.1E-09 | 0.14 | 3.4E-09 | 2.0E+00 | 2.50E+00 | 1.6E-08 | 8.6E-09 | 2.5E-08 | 2.02% |
| Aroclor-1260 | 12 | 2.0E-07 | 0.14 | 8.5E-08 | 2.0E+00 | 2.50E+00 | 4.0E-07 | 2.1E-07 | 6.2E-07 | 50.36% |
| SUMMARY CANCER RISK | | | | | | | 1E-06 | 3E-07 | 1E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6970 | 3.3E-02 | ND | 0.0E+00 | ND | ND | | | | |
| Arsenic | 21 | 9.9E-05 | 0.03 | 9.0E-06 | 3.0E-04 | 2.9E-04 | 3.3E-01 | 3.1E-02 | 3.6E-01 | 12.34% |
| Chromium | 2410 | 1.1E-02 | ND | 0.0E+00 | 2.0E-02 | 5.0E-04 | 5.7E-01 | 0.0E+00 | 5.7E-01 | 19.42% |
| Iron | 6880 | 3.2E-02 | ND | 0.0E+00 | ND | ND | | | | |
| Lead | 5060 | 2.4E-02 | ND | 0.0E+00 | ND | ND | | | | |
| Manganese | 169 | 7.9E-04 | ND | 0.0E+00 | 7.1E-02 | 4.30E-03 | 1.1E-02 | 0.0E+00 | 1.1E-02 | 0.38% |
| Dieldrin | 0.0113 | 5.3E-08 | ND | 0.0E+00 | 5.0E-05 | ND | 1.1E-03 | | 1.1E-03 | 0.04% |
| Aroclor-1248 | 0.482 | 2.3E-06 | 0.14 | 9.6E-07 | 5.0E-05 | 4.0E-05 | 4.5E-02 | 2.4E-02 | 6.9E-02 | 2.38% |
| Aroclor-1260 | 12 | 5.6E-05 | 0.14 | 2.4E-05 | 5.0E-05 | 4.0E-05 | 1.1E+00 | 6.0E-01 | 1.7E+00 | 59.22% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 130 | 6.1E-04 | 0.17 | 3.1E-04 | 6.0E+00 | 5.5E+00 | 1.0E-04 | 5.7E-05 | 1.6E-04 | 0.005% |
| C9-C10 Aromatics | 93 | 4.4E-04 | 0.17 | 2.3E-04 | 3.0E-01 | 2.7E-01 | 1.5E-03 | 8.3E-04 | 2.3E-03 | 0.08% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 1860 | 8.7E-03 | 0.17 | 4.5E-03 | 6.0E+00 | 5.5E+00 | 1.5E-03 | 8.2E-04 | 2.3E-03 | 0.08% |
| C19-C36 Aliphatics | 22,700 | 1.1E-01 | 0.17 | 5.5E-02 | 6.0E+01 | 5.5E+01 | 1.8E-03 | 1.0E-03 | 2.8E-03 | 0.10% |
| C11-C22 Aromatics | 7050 | 3.3E-02 | 0.17 | 1.7E-02 | 3.0E-01 | 2.7E-01 | 1.1E-01 | 6.3E-02 | 1.7E-01 | 5.96% |
| SUMMARY HAZARD INDEX | | | | | | | 2 | 0.7 | 3 | |

CON-SB2R(CT)
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 3.3 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.25 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.25 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SB2R(CT)
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (ug/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | NA | | 1.6E-08 | 1.5E-11 | 1.5E+01 | 2.2E-10 | 0.32% |
| Chromium | 2410 | NA | | 1.8E-06 | 1.7E-09 | 4.1E+01 | 6.9E-08 | 99.66% |
| Lead | 5060 | NA | | 3.8E-06 | 3.5E-09 | ND | | |
| Dieldrin | 0.0113 | NA | | 8.6E-12 | 7.9E-15 | 1.6E+01 | 1.3E-13 | 0.00018% |
| Aroclor- 1248 | 0.482 | NA | | 3.7E-10 | 3.4E-13 | 2.0E+00 | 6.7E-13 | 0.00097% |
| Aroclor-1260 | 12 | NA | | 9.1E-09 | 8.4E-12 | 2.0E+00 | 1.7E-11 | 0.024% |
| | | | | | | SUMMARY CANCER RISK | 7E-08 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Aluminum | 6970 | NA | | 5.3E-06 | 1.4E-06 | 1.0E-03 | 1.4E-03 | 7.32% |
| Arsenic | 21 | NA | | 1.6E-08 | 4.1E-09 | ND | | |
| Chromium | 2410 | NA | | 1.8E-06 | 4.7E-07 | 2.9E-05 | 1.6E-02 | 87.28% |
| Iron | 6880 | NA | | 5.2E-06 | 1.3E-06 | ND | | |
| Lead | 5060 | NA | | 3.8E-06 | 9.9E-07 | ND | | |
| Manganese | 169 | NA | | 1.3E-07 | 3.3E-08 | 1.4E-05 | 2.4E-03 | 12.68% |
| Dieldrin | 0.0113 | NA | | 8.6E-12 | 2.2E-12 | ND | | |
| Aroclor-1248 | 0.482 | NA | | 3.7E-10 | 9.4E-11 | ND | | |
| Aroclor-1260 | 12 | NA | | 9.1E-09 | 2.3E-09 | ND | | |
| VPH | | NA | | | | | | |
| C9-C12 Aliphatics | 130 | NA | | 9.8E-08 | 2.5E-08 | 5.7E+00 | 4.5E-09 | 0.000024% |
| C9-C10 Aromatics | 93 | NA | | 7.0E-08 | 1.8E-08 | 1.7E-01 | 1.1E-07 | 0.00057% |
| EPH | | NA | | | | | | |
| C9-C18 Aliphatics | 1860 | NA | | 1.4E-06 | 3.6E-07 | 5.7E+00 | 6.4E-08 | 0.00034% |
| C19-C36 Aliphatics | 22,700 | NA | | 1.7E-05 | 4.4E-06 | ND | | |
| C11-C22 Aromatics | 7050 | NA | | 5.3E-06 | 1.4E-06 | 2.0E-01 | 6.9E-06 | 0.037% |
| | | | | | | SUMMARY HAZARD INDEX | 0.02 | |

RES-SS2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 100 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.08 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 5,800 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 24 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 24 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RES-SS2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 47.9 | 9.6E-06 | 0.03 | 1.3E-06 | 1.5E+00 | 1.6E+00 | 1.4E-05 | 2.1E-06 | 1.7E-05 | 86.35% |
| Aroclor-1260 | 3.6 | 7.2E-07 | 0.14 | 4.7E-07 | 2.0E+00 | 2.5E+00 | 1.4E-06 | 1.2E-06 | 2.6E-06 | 13.65% |
| | | | | | | SUMMARY CANCER RISK | 2E-05 | 3E-06 | 2E-05 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 47.9 | 2.8E-05 | 0.03 | 3.9E-06 | 3.0E-04 | 2.9E-04 | 9.4E-02 | 1.3E-02 | 1.1E-01 | 31.14% |
| Iron | 7920 | 4.6E-03 | ND | | ND | ND | | | | |
| Manganese | 273 | 1.6E-04 | ND | | 7.1E-02 | ND | 2.3E-03 | | 2.3E-03 | 0.66% |
| Aroclor-1260 | 3.6 | 2.1E-06 | 0.14 | 1.4E-06 | 2.0E-05 | 1.6E-05 | 1.1E-01 | 8.6E-02 | 1.9E-01 | 55.61% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 21 | 1.2E-05 | 0.17 | 9.7E-06 | 6.0E-01 | 5.5E-01 | 2.1E-05 | 1.8E-05 | 3.8E-05 | 0.01% |
| C9-C10 Aromatics | 17 | 1.0E-05 | 0.17 | 7.9E-06 | 3.0E-02 | 2.7E-02 | 3.3E-04 | 2.9E-04 | 6.2E-04 | 0.18% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 298 | 1.7E-04 | 0.17 | 1.4E-04 | 6.0E-01 | 5.5E-01 | 2.9E-04 | 2.5E-04 | 5.4E-04 | 0.16% |
| C19-C36 Aliphatics | 3,640 | 2.1E-03 | 0.17 | 1.7E-03 | 6.0E+00 | 5.5E+00 | 3.6E-04 | 3.1E-04 | 6.6E-04 | 0.19% |
| C11-C22 Aromatics | 1130 | 6.6E-04 | 0.17 | 5.2E-04 | 3.0E-02 | 2.7E-02 | 2.2E-02 | 1.9E-02 | 4.1E-02 | 12.05% |
| | | | | | | SUMMARY HAZARD INDEX | 0.2 | 0.1 | 0.3 | |

RES-SS2R
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 0.63 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 24 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 24 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SS2R
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 47.9 | NA | | 3.6E-08 | 3.7E-10 | 1.5E+01 | 5.5E-09 | 99.01% |
| Aroclor-1260 | 3.6 | NA | | 2.7E-09 | 2.8E-11 | 2.0E+00 | 5.5E-11 | 0.99% |
| | | | | | | SUMMARY CANCER RISK | 6E-09 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 47.9 | NA | | 3.6E-08 | 1.1E-09 | ND | | |
| Iron | 7920 | NA | | 6.0E-06 | 1.8E-07 | ND | | |
| Manganese | 273 | NA | | 2.1E-07 | 6.1E-09 | 1.4E-05 | 4.4E-04 | 99.70% |
| Aroclor-1260 | 3.6 | NA | | 2.7E-09 | 8.1E-11 | ND | | |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 21 | NA | | 1.6E-08 | 4.7E-10 | 5.7E-01 | 8.3E-10 | 0.00019% |
| C9-C10 Aromatics | 17 | NA | | 1.3E-08 | 3.8E-10 | 1.7E-02 | 2.2E-08 | 0.0051% |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 298 | NA | | 2.3E-07 | 6.7E-09 | 5.7E-01 | 1.2E-08 | 0.0027% |
| C19-C36 Aliphatics | 3,640 | NA | | 2.8E-06 | 8.2E-08 | ND | | |
| C11-C22 Aromatics | 1130 | NA | | 8.6E-07 | 2.5E-08 | 2.0E-02 | 1.3E-06 | 0.29% |
| | | | | | | SUMMARY HAZARD INDEX | 0.0004 | |

RES-SS2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 200 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 1 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 2,045 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 15 | kg |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 6 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 6 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RES-SS2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 47.9 | 2.2E-05 | 0.03 | 6.9E-06 | 1.5E+00 | 1.6E+00 | 3.4E-05 | 1.1E-05 | 4.5E-05 | 82.60% |
| Aroclor-1260 | 3.6 | 1.7E-06 | 0.14 | 2.4E-06 | 2.0E+00 | 2.5E+00 | 3.4E-06 | 6.1E-06 | 9.4E-06 | 17.40% |
| SUMMARY CANCER RISK | | | | | | | 4E-05 | 2E-05 | 5E-05 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 47.9 | 2.6E-04 | 0.03 | 8.05E-05 | 3.0E-04 | 2.9E-04 | 8.7E-01 | 2.8E-01 | 1.2E+00 | 25.29% |
| Iron | 7920 | 4.3E-02 | ND | | ND | ND | | | | |
| Manganese | 273 | 1.5E-03 | ND | | 7.1E-02 | ND | 2.1E-02 | | 2.1E-02 | 0.46% |
| Aroclor-1260 | 3.6 | 2.0E-05 | 0.14 | 2.8E-05 | 2.0E-05 | 1.6E-05 | 9.9E-01 | 1.8E+00 | 2.8E+00 | 60.37% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 21 | 1.2E-04 | 0.17 | 2.0E-04 | 6.0E-01 | 5.5E-01 | 1.9E-04 | 3.6E-04 | 5.6E-04 | 0.01% |
| C9-C10 Aromatics | 17 | 9.3E-05 | 0.17 | 1.6E-04 | 3.0E-02 | 2.7E-02 | 3.1E-03 | 6.0E-03 | 9.1E-03 | 0.20% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 298 | 1.6E-03 | 0.17 | 2.8E-03 | 6.0E-01 | 5.5E-01 | 2.7E-03 | 5.2E-03 | 7.9E-03 | 0.17% |
| C19-C36 Aliphatics | 3,640 | 2.0E-02 | 0.17 | 3.5E-02 | 6.0E+00 | 5.5E+00 | 3.3E-03 | 6.3E-03 | 9.6E-03 | 0.21% |
| C11-C22 Aromatics | 1130 | 6.2E-03 | 0.17 | 1.1E-02 | 3.0E-02 | 2.7E-02 | 2.1E-01 | 4.0E-01 | 6.1E-01 | 13.28% |
| SUMMARY HAZARD INDEX | | | | | | | 2 | 2 | 5 | |

RES-SS2R
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 0.31 | m³/hour |
| BODY WEIGHT | BW | 15 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 6 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 6 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SS2R
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 47.9 | NA | | 3.6E-08 | 2.1E-10 | 1.5E+01 | 3.2E-09 | 99.01% |
| Aroclor-1260 | 3.6 | NA | | 2.7E-09 | 1.6E-11 | 2.0E+00 | 3.2E-11 | 0.99% |
| | | | | | | SUMMARY CANCER RISK | 3E-09 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 47.9 | NA | | 3.6E-08 | 2.5E-09 | ND | | |
| Iron | 7920 | NA | | 6.0E-06 | 4.1E-07 | ND | | |
| Manganese | 273 | NA | | 2.1E-07 | 1.4E-08 | 1.4E-05 | 1.0E-03 | 99.70% |
| Aroclor-1260 | 3.6 | NA | | 2.7E-09 | 1.9E-10 | ND | | |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 21 | NA | | 1.6E-08 | 1.1E-09 | 5.7E-01 | 1.9E-09 | 0.00019% |
| C9-C10 Aromatics | 17 | NA | | 1.3E-08 | 8.8E-10 | 1.7E-02 | 5.1E-08 | 0.0051% |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 298 | NA | | 2.3E-07 | 1.5E-08 | 5.7E-01 | 2.7E-08 | 0.0027% |
| C19-C36 Aliphatics | 3,640 | NA | | 2.8E-06 | 1.9E-07 | ND | | |
| C11-C22 Aromatics | 1130 | NA | | 8.6E-07 | 5.8E-08 | 2.0E-02 | 2.9E-06 | 0.29% |
| | | | | | | SUMMARY HAZARD INDEX | 0.001 | |

RES-SB2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

03-Feb-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 100 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.08 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 5,800 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 24 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 24 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RES-SB2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | 4.2E-06 | 0.03 | 5.9E-07 | 1.5E+00 | 1.60E+00 | 6.3E-06 | 9.4E-07 | 7.3E-06 | 44.34% |
| Lead | 5060 | 1.0E-03 | ND | | ND | ND | | | | |
| Dieldrin | 0.0113 | 2.3E-09 | ND | | 1.6E+01 | ND | 3.6E-08 | | 3.6E-08 | 0.22% |
| Aroclor-1248 | 0.482 | 9.7E-08 | 0.14 | 6.3E-08 | 2.0E+00 | 2.50E+00 | 1.9E-07 | 1.6E-07 | 3.5E-07 | 2.14% |
| Aroclor-1260 | 12 | 2.4E-06 | 0.14 | 1.6E-06 | 2.0E+00 | 2.50E+00 | 4.8E-06 | 3.9E-06 | 8.8E-06 | 53.30% |
| | | | | | | SUMMARY CANCER RISK | 1E-05 | 5E-06 | 2E-05 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6970 | 4.1E-03 | ND | | ND | ND | | | | |
| Arsenic | 21 | 1.2E-05 | 0.03 | 1.7E-06 | 3.0E-04 | 2.9E-04 | 4.1E-02 | 5.9E-03 | 4.7E-02 | 3.23% |
| Chromium | 2410 | 1.4E-03 | ND | | 3.0E-03 | 7.5E-05 | 4.7E-01 | 0.0E+00 | 4.7E-01 | 32.43% |
| Iron | 6880 | 4.0E-03 | ND | | ND | ND | | | | |
| Lead | 5060 | 3.0E-03 | ND | | ND | ND | | | | |
| Manganese | 169 | 9.9E-05 | ND | | 7.1E-02 | 4.3E-03 | 1.4E-03 | 0.0E+00 | 1.4E-03 | 0.10% |
| Dieldrin | 0.0113 | 6.6E-09 | ND | | 5.0E-05 | ND | 1.3E-04 | | 1.3E-04 | 0.01% |
| Aroclor-1248 | 0.482 | 2.8E-07 | 0.14 | 1.8E-07 | 2.0E-05 | 1.6E-05 | 1.4E-02 | 1.1E-02 | 2.6E-02 | 1.76% |
| Aroclor-1260 | 12 | 7.0E-06 | 0.14 | 4.6E-06 | 2.0E-05 | 1.6E-05 | 3.5E-01 | 2.9E-01 | 6.4E-01 | 43.89% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 130 | 7.6E-05 | 0.17 | 6.0E-05 | 6.0E-01 | 5.5E-01 | 1.3E-04 | 1.1E-04 | 2.4E-04 | 0.02% |
| C9-C10 Aromatics | 93 | 5.5E-05 | 0.17 | 4.3E-05 | 3.0E-02 | 2.7E-02 | 1.8E-03 | 1.6E-03 | 3.4E-03 | 0.23% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 1860 | 1.1E-03 | 0.17 | 8.6E-04 | 6.0E-01 | 5.5E-01 | 1.8E-03 | 1.6E-03 | 3.4E-03 | 0.23% |
| C19-C36 Aliphatics | 22700 | 1.3E-02 | 0.17 | 1.1E-02 | 6.0E+00 | 5.5E+00 | 2.2E-03 | 1.9E-03 | 4.1E-03 | 0.28% |
| C11-C22 Aromatics | 7050 | 4.1E-03 | 0.17 | 3.3E-03 | 3.0E-02 | 2.7E-02 | 1.4E-01 | 1.2E-01 | 2.6E-01 | 17.80% |
| | | | | | | SUMMARY HAZARD INDEX | 1.0 | 0.4 | 1.5 | |

RES-SB...
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 0.63 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 24 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 24 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SB2R
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | NA | | 1.6E-08 | 1.6E-10 | 1.5E+01 | 2.4E-09 | 0.32% |
| Chromium | 2410 | NA | | 1.8E-06 | 1.9E-08 | 4.1E+01 | 7.6E-07 | 99.66% |
| Lead | 5060 | NA | | 3.8E-06 | 3.9E-08 | ND | | |
| Dieldrin | 0.0113 | NA | | 8.6E-12 | 8.7E-14 | 1.6E+01 | 1.4E-12 | 0.0002% |
| Aroclor-1248 | 0.482 | NA | | 3.7E-10 | 3.7E-12 | 2.0E+00 | 7.4E-12 | 0.001% |
| Aroclor-1260 | 12 | NA | | 9.1E-09 | 9.2E-11 | 2.0E+00 | 1.8E-10 | 0.02% |
| | | | | | | SUMMARY CANCER RISK | 8E-07 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QEOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Aluminum | 6970 | NA | | 5.3E-06 | 1.6E-07 | 1.0E-03 | 1.6E-04 | 6.80% |
| Arsenic | 21 | NA | | 1.6E-08 | 4.7E-10 | ND | | |
| Chromium | 2410 | NA | | 1.8E-06 | 5.4E-08 | 2.9E-05 | 1.9E-03 | 81.07% |
| Iron | 6880 | NA | | 5.2E-06 | 1.5E-07 | ND | | |
| Lead | 5060 | NA | | 3.8E-06 | 1.1E-07 | ND | | |
| Manganese | 169 | NA | | 1.3E-07 | 3.8E-09 | 1.4E-05 | 2.7E-04 | |
| Dieldrin | 0.0113 | NA | | 8.6E-12 | 2.5E-13 | ND | | |
| Aroclor-1248 | 0.482 | NA | | 3.7E-10 | 1.1E-11 | ND | | |
| Aroclor-1260 | 12 | NA | | 9.1E-09 | 2.7E-10 | ND | | |
| VPH | | NA | | | | | | |
| C9-C12 Aliphatics | 130 | NA | | 9.8E-08 | 2.9E-09 | 5.7E-01 | 5.1E-09 | 0.0002% |
| C9-C10 Aromatics | 93 | NA | | 7.0E-08 | 2.1E-09 | 1.7E-02 | 1.2E-07 | 0.005% |
| EPH | | NA | | | | | | |
| C9-C18 Aliphatics | 1860 | NA | | 1.4E-06 | 4.2E-08 | 5.7E-01 | 7.3E-08 | 0.003% |
| C19-C36 Aliphatics | 22,700 | NA | | 1.7E-05 | 5.1E-07 | ND | | |
| C11-C22 Aromatics | 7050 | NA | | 5.3E-06 | 1.6E-07 | 2.0E-02 | 7.9E-06 | 0.34% |
| | | | | | | SUMMARY HAZARD INDEX | 0.0025 | |

RES-SB2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

03-Feb-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 200 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 1 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 2,045 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 15 | kg |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 6 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 6 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RES-SB2R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | 9.9E-06 | 0.03 | 3.0E-06 | 1.5E+00 | 1.60E+00 | 1.5E-05 | 4.8E-06 | 2.0E-05 | 37.45% |
| Lead | 5060 | 2.4E-03 | ND | | ND | ND | | | | |
| Dieldrin | 0.0113 | 5.3E-09 | ND | | 1.6E+01 | ND | 8.5E-08 | | 8.5E-08 | 0.16% |
| Aroclor-1248 | 0.482 | 2.3E-07 | 0.14 | 3.2E-07 | 2.0E+00 | 2.50E+00 | 4.5E-07 | 8.1E-07 | 1.3E-06 | 2.41% |
| Aroclor-1260 | 12 | 5.6E-06 | 0.14 | 8.1E-06 | 2.0E+00 | 2.50E+00 | 1.1E-05 | 2.0E-05 | 3.1E-05 | 59.97% |
| | | | | | SUMMARY CANCER RISK | | 3E-05 | 3E-05 | 5E-05 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6970 | 3.8E-02 | ND | | ND | ND | | | | |
| Arsenic | 21 | 1.2E-04 | 0.03 | 3.5E-05 | 3.0E-04 | 2.9E-04 | 3.8E-01 | 1.2E-01 | 5.1E-01 | 2.75% |
| Chromium | 2410 | 1.3E-02 | ND | | 3.0E-03 | 7.5E-05 | 4.4E+00 | 0.0E+00 | 4.4E+00 | 23.93% |
| Iron | 6880 | 3.8E-02 | ND | | ND | ND | | | | |
| Lead | 5060 | 2.8E-02 | ND | | ND | ND | | | | |
| Manganese | 169 | 9.3E-04 | ND | | 7.1E-02 | 4.3E-03 | 1.3E-02 | 0.0E+00 | 1.3E-02 | 0.07% |
| Dieldrin | 0.0113 | 6.2E-08 | ND | | 5.0E-05 | ND | 1.2E-03 | | 1.2E-03 | 0.01% |
| Aroclor-1248 | 0.482 | 2.6E-06 | 0.14 | 3.8E-06 | 2.0E-05 | 1.6E-05 | 1.3E-01 | 2.4E-01 | 3.7E-01 | 2.00% |
| Aroclor-1260 | 12 | 6.6E-05 | 0.14 | 9.4E-05 | 2.0E-05 | 1.6E-05 | 3.3E+00 | 5.9E+00 | 9.2E+00 | 49.85% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 130 | 7.1E-04 | 0.17 | 1.2E-03 | 6.0E-01 | 5.5E-01 | 1.2E-03 | 2.3E-03 | 3.4E-03 | 0.02% |
| C9-C10 Aromatics | 93 | 5.1E-04 | 0.17 | 8.9E-04 | 3.0E-02 | 2.7E-02 | 1.7E-02 | 3.3E-02 | 5.0E-02 | 0.27% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 1860 | 1.0E-02 | 0.17 | 1.8E-02 | 6.0E-01 | 5.5E-01 | 1.7E-02 | 3.2E-02 | 4.9E-02 | 0.27% |
| C19-C36 Aliphatics | 22700 | 1.2E-01 | 0.17 | 2.2E-01 | 6.0E+00 | 5.5E+00 | 2.1E-02 | 3.9E-02 | 6.0E-02 | 0.33% |
| C11-C22 Aromatics | 7050 | 3.9E-02 | 0.17 | 6.7E-02 | 3.0E-02 | 2.7E-02 | 1.3E+00 | 2.5E+00 | 3.8E+00 | 20.52% |
| | | | | | SUMMARY HAZARD INDEX | | 10 | 9 | 18 | |

RES-SB2R
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 0.31 | m³/hour |
| BODY WEIGHT | BW | 15 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 6 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 6 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SB2R
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 21 | NA | | 1.6E-08 | 9.3E-11 | 1.5E+01 | 1.4E-09 | 0.32% |
| Chromium | 2410 | NA | | 1.8E-06 | 1.1E-08 | 4.1E+01 | 4.4E-07 | 99.66% |
| Lead | 5060 | NA | | 3.8E-06 | 2.2E-08 | ND | | |
| Dieldrin | 0.0113 | NA | | 8.6E-12 | 5.0E-14 | 1.6E+01 | 8.0E-13 | 0.0002% |
| Aroclor-1248 | 0.482 | NA | | 3.7E-10 | 2.1E-12 | 2.0E+00 | 4.3E-12 | 0.001% |
| Aroclor-1260 | 12 | NA | | 9.1E-09 | 5.3E-11 | 2.0E+00 | 1.1E-10 | 0.024% |
| | | | | | | SUMMARY CANCER RISK | 4E-07 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Aluminum | 6970 | NA | | 5.3E-06 | 3.6E-07 | 1.0E-03 | 3.6E-04 | 6.80% |
| Arsenic | 21 | NA | | 1.6E-08 | 1.1E-09 | ND | | |
| Chromium | 2410 | NA | | 1.8E-06 | 1.2E-07 | 2.9E-05 | 4.3E-03 | 81.07% |
| Iron | 6880 | NA | | 5.2E-06 | 3.5E-07 | ND | | |
| Lead | 5060 | NA | | 3.8E-06 | 2.6E-07 | ND | | |
| Manganese | 169 | NA | | 1.3E-07 | 8.7E-09 | 1.4E-05 | 6.2E-04 | 11.78% |
| Dieldrin | 0.0113 | NA | | 8.6E-12 | 5.8E-13 | ND | | |
| Aroclor-1248 | 0.482 | NA | | 3.7E-10 | 2.5E-11 | ND | | |
| Aroclor-1260 | 12 | NA | | 9.1E-09 | 6.2E-10 | ND | | |
| VPH | | NA | | | | | | |
| C9-C12 Aliphatics | 130 | NA | | 9.8E-08 | 6.7E-09 | 5.7E-01 | 1.2E-08 | |
| C9-C10 Aromatics | 93 | NA | | 7.0E-08 | 4.8E-09 | 1.7E-02 | 2.8E-07 | 0.005% |
| EPH | | NA | | | | | | |
| C9-C18 Aliphatics | 1860 | NA | | 1.4E-06 | 9.6E-08 | 5.7E-01 | 1.7E-07 | 0.003% |
| C19-C36 Aliphatics | 22,700 | NA | | 1.7E-05 | 1.2E-06 | ND | | |
| C11-C22 Aromatics | 7050 | NA | | 5.3E-06 | 3.6E-07 | 2.0E-02 | 1.8E-05 | 0.34% |
| | | | | | | SUMMARY HAZARD INDEX | 0.005 | |

RES-GW2I
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION WATER | CW | chemical-specific | ug/liter |
| INGESTION RATE | IR | 2 | liters/day |
| BODY WEIGHT | BW | 70 | kg |
| CONVERSION FACTOR | CF | 0.001 | mg/ug |
| EXPOSURE FREQUENCY | EF | 350 | days/year |
| EXPOSURE DURATION | ED | 30 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 30 | years |

Notes:
For noncarcinogenic effects: AT = ED

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOITIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

$$\text{INTAKE} = \frac{\text{CW x IR x EF x ED x CF}}{\text{BW x AT x 365 days/year}}$$

RES-GW2I
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 2 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | WATER CONCENTRATION | UNITS | INTAKE INGESTION (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)^-1 | CANCER RISK INGESTION |
|---|---|---|---|---|---|
| Arsenic | 54.4 | ug/Liter | 6.4E-04 | 1.5E+00 | 9.6E-04 |
| Aroclor-1260 | 0.22 | ug/Liter | 2.6E-06 | 2.0E+00 | 5.2E-06 |
| Bis(2-ethylhexyl)phthalate | 400 | ug/Liter | 4.7E-03 | 1.4E-02 | 6.6E-05 |
| Tetrachloroethylene | 16 | ug/Liter | 1.9E-04 | 5.2E-02 | 9.8E-06 |
| Trikchloroethylene | 1.9 | ug/Liter | 2.2E-05 | 1.1E-02 | 2.5E-07 |
| | | | TOTAL CANCER RISK | | 1E-03 |

NONCARCINOGENIC EFFECTS

| COMPOUND | WATER CONCENTRATION | UNITS | INTAKE INGESTION (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT INGESTION |
|---|---|---|---|---|---|
| Arsenic | 54.4 | ug/Liter | 1.5E-03 | 3.0E-04 | 5.0E+00 |
| Iron | 3610 | ug/Liter | 9.9E-02 | ND | |
| Manganese | 724 | ug/Liter | 2.0E-02 | 2.4E-02 | 8.3E-01 |
| Aroclor-1260 | 0.22 | ug/Liter | 6.0E-06 | 2.0E-05 | 3.0E-01 |
| Bis(2-ethylhexyl)phthalate | 400 | ug/Liter | 1.1E-02 | 2.0E-02 | 5.5E-01 |
| 1,2-Dichloroethylene | 13 | ug/Liter | 3.6E-04 | 9.0E-03 | 4.0E-02 |
| Tetrachloroethylene | 16 | ug/Liter | 4.4E-04 | 1.0E-02 | 4.4E-02 |
| Trichloroethylene | 1.9 | ug/Liter | 5.2E-05 | 6.0E-03 | 8.7E-03 |
| | | | TOTAL HAZARD INDEX | | 7 |

MAIN-SS3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
FUTURE/CURRENT MAINTENANCE WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 100 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.024 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 11,600 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 52 | days/year |
| EXPOSURE DURATION | ED | 25 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 25 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
The exposure frequency is assumed to be 1 day a week from May 1st to October 31st.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

MAIN-SS3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
FUTURE/CURRENT MAINTENANCE WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | 3.0E-06 | 0.03 | 2.5E-07 | 1.5E+00 | 1.6E+00 | 4.5E-06 | 4.0E-07 | 4.9E-06 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 4E-06 | 4E-07 | 5E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | 8.3E-06 | 0.03 | 7.0E-07 | 3.0E-04 | 2.9E-04 | 2.8E-02 | 2.4E-03 | 3.0E-02 | 94.57% |
| Iron | 8040 | 1.6E-03 | ND | | ND | ND | | | | |
| Manganese | 548 | 1.1E-04 | ND | | 7.1E-02 | ND | 1.6E-03 | | 1.6E-03 | 4.92% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 16 | 3.3E-06 | 0.17 | 1.5E-06 | 6.0E-01 | 5.5E-01 | 5.4E-06 | 2.8E-06 | 8.2E-06 | 0.03% |
| C9-C10 Aromatics | 4.85 | 9.9E-07 | 0.17 | 4.7E-07 | 3.0E-02 | 2.7E-02 | 3.3E-05 | 1.7E-05 | 5.0E-05 | 0.16% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 3.63 | 7.4E-07 | 0.17 | 3.5E-07 | 6.0E-01 | 5.5E-01 | 1.2E-06 | 6.4E-07 | 1.9E-06 | 0.006% |
| C19-C36 Aliphatics | 38 | 7.7E-06 | 0.17 | 3.7E-06 | 6.0E+00 | 5.5E+00 | 1.3E-06 | 6.7E-07 | 2.0E-06 | 0.006% |
| C11-C22 Aromatics | 10 | 2.0E-06 | 0.17 | 9.4E-07 | 3.0E-02 | 2.7E-02 | 6.6E-05 | 3.5E-05 | 1.0E-04 | 0.32% |
| | | | | | | SUMMARY HAZARD INDEX | 0.03 | 0.002 | 0.03 | |

MAIN-SS3I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE/CURRENT MAINTENANCE WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 1.6 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 52 | days/year |
| EXPOSURE DURATION | ED | 25 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 25 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

MAIN-SS3I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE/CURRENT MAINTENANCE WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF ($m^3$/kg) | AIR CONCENTRATION VOLATILES (mg/$m^3$) | AIR CONCENTRATION PARTICULATES (mg/$m^3$) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | NA | | 3.1E-08 | 2.9E-10 | 1.5E+01 | 4.3E-09 | 100.00% |
| | | | | | | SUMMARY CANCER RISK: | 4E-09 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF ($m^3$/kg) | AIR CONCENTRATION VOLATILES (mg/$m^3$) | AIR CONCENTRATION PARTICULATES (mg/$m^3$) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | NA | | 3.1E-08 | 8.1E-10 | ND | | |
| Iron | 8040 | NA | | 6.1E-06 | 1.6E-07 | ND | | |
| Manganese | 548 | NA | | 4.2E-07 | 1.1E-08 | 1.4E-05 | 7.7E-04 | 100.00% |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 16 | NA | | 1.2E-08 | 3.2E-10 | 5.7E-01 | 5.5E-10 | 0.00000072 |
| C9-C10 Aromatics | 4.85 | NA | | 3.7E-09 | 9.6E-11 | 1.7E-02 | 5.6E-09 | 0.0000073 |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 3.6 | NA | | 2.8E-09 | 7.2E-11 | 5.7E-01 | 1.3E-10 | 0.00000016 |
| C19-C36 Aliphatics | 38 | NA | | 2.9E-08 | 7.5E-10 | ND | | |
| C11-C22 Aromatics | 10 | NA | | 7.4E-09 | 1.9E-10 | 2.0E-02 | 9.6E-09 | 0.000012 |
| | | | | | | SUMMARY HAZARD INDEX: | 0.0008 | |

MAIN-SS3I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
FUTURE/CURRENT MAINTENANCE WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

August 1992

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 50 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.024 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 11,600 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 26 | days/year |
| EXPOSURE DURATION | ED | 6.6 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 6.6 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
The exposure frequency is assumed to be 1 day a week from May 1st to October 31st.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

MAIN-SS3I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
FUTURE/CURRENT MAINTENANCE WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | 2.0E-07 | 0.03 | 3.3E-08 | 1.5E+00 | 1.6E+00 | 3.0E-07 | 5.3E-08 | 3.5E-07 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 3E-07 | 5E-08 | 3E-07 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | 2.1E-06 | 0.03 | 3.5E-07 | 3.0E-04 | 2.9E-04 | 7.0E-03 | 1.2E-03 | 8.2E-03 | 94.80% |
| Iron | 8040 | 4.1E-04 | ND | | ND | ND | | | | |
| Manganese | 548 | 2.8E-05 | ND | | 7.1E-02 | ND | 3.9E-04 | | 3.9E-04 | 4.56% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 16 | 8.1E-07 | 0.17 | 7.7E-07 | 6.0E-01 | 5.5E-01 | 1.4E-06 | 1.4E-06 | 2.8E-06 | 0.03% |
| C9-C10 Aromatics | 4.85 | 2.5E-07 | 0.17 | 2.3E-07 | 3.0E-02 | 2.7E-02 | 8.2E-06 | 8.7E-06 | 1.7E-05 | 0.20% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 3.63 | 1.8E-07 | 0.17 | 1.7E-07 | 6.0E-01 | 5.5E-01 | 3.1E-07 | 3.2E-07 | 6.3E-07 | 0.007% |
| C19-C36 Aliphatics | 38 | 1.9E-06 | 0.17 | 1.8E-06 | 6.0E+00 | 5.5E+00 | 3.2E-07 | 3.3E-07 | 6.5E-07 | 0.008% |
| C11-C22 Aromatics | 10 | 5.0E-07 | 0.17 | 4.7E-07 | 3.0E-02 | 2.7E-02 | 1.7E-05 | 1.7E-05 | 3.4E-05 | 0.39% |
| | | | | | | SUMMARY HAZARD INDEX | 0.007 | 0.0012 | 0.009 | |

MAIN-SS3I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE/CURRENT MAINTENANCE WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 1.6 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 26 | days/year |
| EXPOSURE DURATION | ED | 6.6 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 6.6 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

MAIN-SS3I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE/CURRENT MAINTENANCE WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | NA | | 3.1E-08 | 3.8E-11 | 1.5E+01 | 5.7E-10 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 6E-10 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | NA | | 3.1E-08 | 4.0E-10 | ND | | |
| Iron | 8040 | NA | | 6.1E-06 | 7.9E-08 | ND | | |
| Manganese | 548 | NA | | 4.2E-07 | 5.4E-09 | 1.4E-05 | 3.9E-04 | 100.00% |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 16 | NA | | 1.2E-08 | 1.6E-10 | 5.7E-01 | 2.8E-10 | 0.00000072 |
| C9-C10 Aromatics | 4.85 | NA | | 3.7E-09 | 4.8E-11 | 1.7E-02 | 2.8E-09 | 0.0000073 |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 3.6 | NA | | 2.8E-09 | 3.6E-11 | 5.7E-01 | 6.3E-11 | 0.00000016 |
| C19-C36 Aliphatics | 38 | NA | | 2.9E-08 | 3.7E-10 | ND | | |
| C11-C22 Aromatics | 10 | NA | | 7.4E-09 | 9.6E-11 | 2.0E-02 | 4.8E-09 | 0.000012 |
| | | | | | | SUMMARY HAZARD INDEX | 0.0004 | |

CWIW-SS3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

August 1992

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 100 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.016 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 12,731 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 25 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 25 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

CWIW-SS3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | 8.6E-06 | 0.03 | 5.3E-07 | 1.5E+00 | 1.6E+00 | 1.3E-05 | 8.4E-07 | 1.4E-05 | 100.00% |
| SUMMARY CANCER RISK | | | | | | | 1E-05 | 8E-07 | 1E-05 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | 2.4E-05 | 0.03 | 1.5E-06 | 3.0E-04 | 2.9E-04 | 8.0E-02 | 5.1E-03 | 8.5E-02 | 94.51% |
| Iron | 8040 | 4.7E-03 | ND | | ND | ND | | | | |
| Manganese | 548 | 3.2E-04 | ND | | 7.1E-02 | ND | 4.5E-03 | | 4.5E-03 | 5.02% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 16 | 9.4E-06 | 0.17 | 3.3E-06 | 6.0E-01 | 5.5E-01 | 1.6E-05 | 5.9E-06 | 2.2E-05 | 0.02% |
| C9-C10 Aromatics | 4.85 | 2.8E-06 | 0.17 | 9.9E-07 | 3.0E-02 | 2.7E-02 | 9.5E-05 | 3.7E-05 | 1.3E-04 | 0.15% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 3.63 | 2.1E-06 | 0.17 | 7.4E-07 | 6.0E-01 | 5.5E-01 | 3.6E-06 | 1.3E-06 | 4.9E-06 | 0.01% |
| C19-C36 Aliphatics | 38 | 2.2E-05 | 0.17 | 7.7E-06 | 6.0E+00 | 5.5E+00 | 3.7E-06 | 1.4E-06 | 5.1E-06 | 0.01% |
| C11-C22 Aromatics | 10 | 5.7E-06 | 0.17 | 2.0E-06 | 3.0E-02 | 2.7E-02 | 1.9E-04 | 7.3E-05 | 2.6E-04 | 0.29% |
| SUMMARY HAZARD INDEX | | | | | | | 0.09 | 0.005 | 0.09 | |

CWIW-SS3I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 1.6 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 25 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 25 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CWIW-SS3I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | NA | | 3.1E-08 | 8.3E-10 | 1.5E+01 | 1.3E-08 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 1E-08 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | NA | | 3.1E-08 | 2.3E-09 | ND | | |
| Iron | 8040 | NA | | 6.1E-06 | 4.6E-07 | ND | | |
| Manganese | 548 | NA | | 4.2E-07 | 3.1E-08 | 1.4E-05 | 2.2E-03 | 100.00% |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 16 | NA | | 1.2E-08 | 9.1E-10 | 5.7E-01 | 1.6E-09 | 0.00000072 |
| C9-C10 Aromatics | 4.85 | NA | | 3.7E-09 | 2.8E-10 | 1.7E-02 | 1.6E-08 | 0.0000073 |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 3.6 | NA | | 2.8E-09 | 2.1E-10 | 5.7E-01 | 3.6E-10 | 0.00000016 |
| C19-C36 Aliphatics | 38 | NA | | 2.9E-08 | 2.2E-09 | ND | | |
| C11-C22 Aromatics | 10 | NA | | 7.4E-09 | 5.6E-10 | 2.0E-02 | 2.8E-08 | 0.000012 |
| | | | | | | SUMMARY HAZARD INDEX | 0.002 | |

CWIW-SS3I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 50 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.016 | $mg/cm^2$ |
| SURFACE AREA EXPOSED | SA | 12,731 | $cm^2$ |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 6.6 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 6.6 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

CWIW-SS3I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | 1.1E-06 | 0.03 | 1.4E-07 | 1.5E+00 | 1.6E+00 | 1.7E-06 | 2.2E-07 | 1.9E-06 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 2E-06 | 2E-07 | 2E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | 1.2E-05 | 0.03 | 1.5E-06 | 3.0E-04 | 2.9E-04 | 4.0E-02 | 5.1E-03 | 4.5E-02 | 94.68% |
| Iron | 8040 | 2.4E-03 | ND | | ND | ND | | | | |
| Manganese | 548 | 1.6E-04 | ND | | 7.1E-02 | ND | 2.3E-03 | | 2.3E-03 | 4.75% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 16 | 4.7E-06 | 0.17 | 3.3E-06 | 6.0E-01 | 5.5E-01 | 7.8E-06 | 5.9E-06 | 1.4E-05 | 0.03% |
| C9-C10 Aromatics | 4.85 | 1.4E-06 | 0.17 | 9.9E-07 | 3.0E-02 | 2.7E-02 | 4.7E-05 | 3.7E-05 | 8.4E-05 | 0.18% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 3.63 | 1.1E-06 | 0.17 | 7.4E-07 | 6.0E-01 | 5.5E-01 | 1.8E-06 | 1.3E-06 | 3.1E-06 | 0.01% |
| C19-C36 Aliphatics | 38 | 1.1E-05 | 0.17 | 7.7E-06 | 6.0E+00 | 5.5E+00 | 1.9E-06 | 1.4E-06 | 3.3E-06 | 0.01% |
| C11-C22 Aromatics | 10 | 2.9E-06 | 0.17 | 2.0E-06 | 3.0E-02 | 2.7E-02 | 9.5E-05 | 7.3E-05 | 1.7E-04 | 0.35% |
| | | | | | | SUMMARY HAZARD INDEX | 0.04 | 0.005 | 0.05 | |

CWIW-SS3I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 1.6 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 6.6 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 6.6 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CWIW-SS3I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | NA | | 3.1E-08 | 2.2E-10 | 1.5E+01 | 3.3E-09 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 3E-09 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | NA | | 3.1E-08 | 2.3E-09 | ND | | |
| Iron | 8040 | NA | | 6.1E-06 | 4.6E-07 | ND | | |
| Manganese | 548 | NA | | 4.2E-07 | 3.1E-08 | 1.4E-05 | 2.2E-03 | 100.00% |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 16 | NA | | 1.2E-08 | 9.1E-10 | 5.7E-01 | 1.6E-09 | 0.00000072 |
| C9-C10 Aromatics | 4.85 | NA | | 3.7E-09 | 2.8E-10 | 1.7E-02 | 1.6E-08 | 0.0000073 |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 3.6 | NA | | 2.8E-09 | 2.1E-10 | 5.7E-01 | 3.6E-10 | 0.00000016 |
| C19-C36 Aliphatics | 38 | NA | | 2.9E-08 | 2.2E-09 | ND | | |
| C11-C22 Aromatics | 10 | NA | | 7.4E-09 | 5.6E-10 | 2.0E-02 | 2.8E-08 | 0.000012 |
| | | | | | | SUMMARY HAZARD INDEX | 0.002 | |

CWIW-GW2I
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - RME
CURRENT/FUTURE LAND USE - COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION WATER | CW | chemical-specific | ug/liter |
| INGESTION RATE | IR | 1 | liters/day |
| BODY WEIGHT | BW | 70 | kg |
| CONVERSION FACTOR | CF | 0.001 | mg/ug |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 25 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 25 | years |

Notes:
For noncarcinogenic effects: AT = ED

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOITIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

$$\text{INTAKE} = \frac{\text{CW x IR x EF x ED x CF}}{\text{BW x AT x 365 days/year}}$$

CWIW-GW21
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - RME
CURRENT/FUTURE LAND USE - COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | WATER CONCENTRATION | UNITS | INTAKE INGESTION (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)^-1 | CANCER RISK INGESTION |
|---|---|---|---|---|---|
| Arsenic | 33.2 | ug/Liter | 1.2E-04 | 1.5E+00 | 1.7E-04 |
| Cadmium | 8.67 | ug/Liter | 3.0E-05 | ND | |
| 1,4-Dichlorobenzene | 5.6 | ug/Liter | 2.0E-05 | 2.4E-02 | 4.7E-07 |
| Naphthalene | 20 | ug/Liter | 7.0E-05 | ND | |
| Carbon Tetrachloride | 4.5 | ug/Liter | 1.6E-05 | 1.3E-01 | 2.0E-06 |
| Chloroform | 10 | ug/Liter | 3.5E-05 | 6.1E-03 | 2.1E-07 |
| Tetrachloroethene | 2.6 | ug/Liter | 9.1E-06 | 5.2E-02 | 4.7E-07 |
| | | | TOTAL CANCER RISK | | 2E-04 |

NONCARCINOGENIC EFFECTS

| COMPOUND | WATER CONCENTRATION | UNITS | INTAKE INGESTION (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT INGESTION |
|---|---|---|---|---|---|
| Aluminum | 190 | ug/Liter | 1.9E-03 | 1.0E+00 | 1.9E-03 |
| Arsenic | 33.2 | ug/Liter | 3.2E-04 | 3.0E-04 | 1.1E+00 |
| Cadmium | 8.67 | ug/Liter | 8.5E-05 | 5.0E-04 | 1.7E-01 |
| Iron | 12400 | ug/Liter | 1.2E-01 | ND | |
| Manganese | 466 | ug/Liter | 4.6E-03 | 2.4E-02 | 1.9E-01 |
| 1,2-Dichlorobenzene | 9.8 | ug/Liter | 9.6E-05 | 9.0E-02 | 1.1E-03 |
| 1,4-Dichlorobenzene | 5.6 | ug/Liter | 5.5E-05 | 3.0E-02 | 1.8E-03 |
| Naphthalene | 20 | ug/Liter | 2.0E-04 | 2.0E-02 | 9.8E-03 |
| Carbon Tetrachloride | 4.5 | ug/Liter | 4.4E-05 | 7.0E-04 | 6.3E-02 |
| Chloroform | 10 | ug/Liter | 9.8E-05 | 1.0E-02 | 9.8E-03 |
| Tetrachloroethene | 2.6 | ug/Liter | 2.5E-05 | 1.0E-02 | 2.5E-03 |
| C9-C10 Aromatics | 310 | ug/Liter | 3.0E-03 | 3.0E-02 | 1.0E-01 |
| | | | TOTAL HAZARD INDEX | | 2 |

CWIW-GW2I(CT)
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - CENTRAL TENDENCY
CURRENT/FUTURE LAND USE - COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION WATER | CW | chemical-specific | ug/liter |
| INGESTION RATE | IR | 1 | liters/day |
| BODY WEIGHT | BW | 70 | kg |
| CONVERSION FACTOR | CF | 0.001 | mg/ug |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 6.6 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 6.6 | years |

Notes:
For noncarcinogenic effects: AT = ED

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOITIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

$$\text{INTAKE} = \frac{\text{CW x IR x EF x ED x CF}}{\text{BW x AT x 365 days/year}}$$

CWIW-GW2I(CT)
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - CENTRAL TENDENCY
CURRENT/FUTURE LAND USE - COMMERCIAL/INDUSTRIAL WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | WATER CONCENTRATION | UNITS | INTAKE INGESTION (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)^-1 | CANCER RISK INGESTION |
|---|---|---|---|---|---|
| Arsenic | 33.2 | ug/Liter | 3.1E-05 | 1.5E+00 | 4.6E-05 |
| Cadmium | 8.67 | ug/Liter | 8.0E-06 | ND | |
| 1,4-Dichlorobenzene | 5.6 | ug/Liter | 5.2E-06 | 2.4E-02 | 1.2E-07 |
| Naphthalene | 20 | ug/Liter | 1.8E-05 | ND | |
| Carbon Tetrachloride | 4.5 | ug/Liter | 4.2E-06 | 1.3E-01 | 5.4E-07 |
| Chlorofoem | 10 | ug/Liter | 9.2E-06 | 6.1E-03 | 5.6E-08 |
| Tetrachloroethene | 2.6 | ug/Liter | 2.4E-06 | 5.2E-02 | 1.2E-07 |
| TOTAL CANCER RISK | | | | | 5E-05 |

NONCARCINOGENIC EFFECTS

| COMPOUND | WATER CONCENTRATION | UNITS | INTAKE INGESTION (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT INGESTION |
|---|---|---|---|---|---|
| Aluminum | 190 | ug/Liter | 1.9E-03 | 1.0E+00 | 1.9E-03 |
| Arsenic | 33.2 | ug/Liter | 3.2E-04 | 3.0E-04 | 1.1E+00 |
| Cadmium | 8.67 | ug/Liter | 8.5E-05 | 5.0E-04 | 1.7E-01 |
| Iron | 12400 | ug/Liter | 1.2E-01 | ND | |
| Manganese | 466 | ug/Liter | 4.6E-03 | 2.4E-02 | 1.9E-01 |
| 1,2-Dichlorobenzene | 9.8 | ug/Liter | 9.6E-05 | 9.0E-02 | 1.1E-03 |
| 1,4-Dichlorobenzene | 5.6 | ug/Liter | 5.5E-05 | 3.0E-02 | 1.8E-03 |
| Naphthalene | 20 | ug/Liter | 2.0E-04 | 2.0E-02 | 9.8E-03 |
| Carbon Tetrachloride | 4.5 | ug/Liter | 4.4E-05 | 7.0E-04 | 6.3E-02 |
| Chloroform | 10 | ug/Liter | 9.8E-05 | 1.0E-02 | 9.8E-03 |
| Tetrachloroethene | 2.6 | ug/Liter | 2.5E-05 | 1.0E-02 | 2.5E-03 |
| C9-C10 Aromatics | 310 | ug/Liter | 3.0E-03 | 3.0E-02 | 1.0E-01 |
| TOTAL HAZARD INDEX | | | | | 2 |

CON-SS3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

03-Feb-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 480 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.28 | mg/cm² |
| SURFACE AREA | SA | 5200 | cm2 |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.5 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.5 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

CON-SS3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | 1.4E-06 | 0.03 | 1.3E-07 | 1.5E+00 | 1.60E+00 | 2.1E-06 | 2.0E-07 | 2.3E-06 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 2E-06 | 2E-07 | 2E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | 1.9E-04 | 0.03 | 1.8E-05 | 3.0E-04 | 2.9E-04 | 6.4E-01 | 6.0E-02 | 7.0E-01 | 95.04% |
| Iron | 8040 | 3.8E-02 | ND | 0.0E+00 | ND | ND | | | | |
| Manganese | 548 | 2.6E-03 | ND | 0.0E+00 | 7.1E-02 | 4.30E-03 | 3.6E-02 | 0.0E+00 | 3.6E-02 | 4.91% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 16 | 7.5E-05 | 0.17 | 3.9E-05 | 6.0E+00 | 5.5E+00 | 1.3E-05 | 7.0E-06 | 2.0E-05 | 0.003% |
| C9-C10 Aromatics | 4.85 | 2.3E-05 | 0.17 | 1.2E-05 | 3.0E-01 | 2.7E-01 | 7.6E-05 | 4.4E-05 | 1.2E-04 | 0.02% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 3.6 | 1.7E-05 | 0.17 | 8.8E-06 | 6.0E+00 | 5.5E+00 | 2.8E-06 | 1.6E-06 | 4.4E-06 | 0.001% |
| C19-C36 Aliphatics | 38 | 1.8E-04 | 0.17 | 9.2E-05 | 6.0E+01 | 5.5E+01 | 3.0E-06 | 1.7E-06 | 4.6E-06 | 0.001% |
| C11-C22 Aromatics | 10 | 4.6E-05 | 0.17 | 2.4E-05 | 3.0E-01 | 2.7E-01 | 1.5E-04 | 8.7E-05 | 2.4E-04 | 0.03% |
| | | | | | | SUMMARY HAZARD INDEX | 0.7 | 0.06 | 0.7 | |

CON-SS3i
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 3.3 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.5 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.50 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SS3I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | NA | | 3.1E-08 | 5.7E-11 | 1.5E+01 | 8.6E-10 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 9E-10 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | NA | | 3.1E-08 | 8.0E-09 | ND | | |
| Iron | 8040 | NA | | 6.1E-06 | 1.6E-06 | ND | | |
| Manganese | 548 | NA | | 4.2E-07 | 1.1E-07 | 1.4E-05 | 7.7E-03 | 100.00% |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 16 | NA | | 1.2E-08 | 3.1E-09 | 5.7E+00 | 5.5E-10 | 0.000000072 |
| C9-C10 Aromatics | 4.85 | NA | | 3.7E-09 | 9.5E-10 | 1.7E-01 | 5.6E-09 | 0.00000073 |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 3.6 | NA | | 2.8E-09 | 7.1E-10 | 5.7E+00 | 1.2E-10 | 0.000000016 |
| C19-C36 Aliphatics | 38 | NA | | 2.9E-08 | 7.4E-09 | ND | | |
| C11-C22 Aromatics | 10 | NA | | 7.4E-09 | 1.9E-09 | 2.0E-01 | 9.5E-09 | 0.0000012 |
| | | | | | | SUMMARY HAZARD INDEX | 0.008 | |

CON-SB3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 480 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.28 | mg/cm² |
| SURFACE AREA | SA | 5200 | $cm^2$ |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.5 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.5 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

CON-SB3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.67 | 3.2E-07 | 0.03 | 3.0E-08 | 1.5E+00 | 1.60E+00 | 4.9E-07 | 4.7E-08 | 5.3E-07 | 100.00% |
| | | | | | SUMMARY CANCER RISK | | 5E-07 | 5E-08 | 5E-07 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.67 | 4.5E-05 | 0.03 | 4.1E-06 | 3.0E-04 | 2.9E-04 | 1.5E-01 | 1.4E-02 | 1.7E-01 | 98.26% |
| Iron | 6410 | 3.0E-02 | ND | 0.0E+00 | ND | ND | | | | |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 0.84 | 3.9E-06 | 0.17 | 2.0E-06 | 6.0E+00 | 5.5E+00 | 6.6E-07 | 3.7E-07 | 1.0E-06 | 0.001% |
| C9-C10 Aromatics | 0.35 | 1.6E-06 | 0.17 | 8.5E-07 | 3.0E-01 | 2.7E-01 | 5.5E-06 | 3.1E-06 | 8.6E-06 | 0.01% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 78 | 3.7E-04 | 0.17 | 1.9E-04 | 6.0E+00 | 5.5E+00 | 6.1E-05 | 3.4E-05 | 9.5E-05 | 0.06% |
| C19-C36 Aliphatics | 990 | 4.6E-03 | 0.17 | 2.4E-03 | 6.0E+01 | 5.5E+01 | 7.7E-05 | 4.4E-05 | 1.2E-04 | 0.07% |
| C11-C22 Aromatics | 110 | 5.2E-04 | 0.17 | 2.7E-04 | 3.0E-01 | 2.7E-01 | 1.7E-03 | 9.9E-04 | 2.7E-03 | 1.61% |
| | | | | | SUMMARY HAZARD INDEX | | 0.2 | 0.02 | 0.2 | |

CON-SB3I
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 3.3 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.5 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.50 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SB3I
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.67 | NA | | 7.3E-09 | 1.4E-11 | 1.5E+01 | 2.0E-10 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 2E-10 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.67 | NA | | 7.3E-09 | 1.9E-09 | ND | | |
| Iron | 6410 | NA | | 4.9E-06 | 1.3E-06 | ND | | |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 0.84 | NA | | 6.4E-10 | 1.6E-10 | 5.7E+00 | 2.9E-11 | 0.026% |
| C9-C10 Aromatics | 0.35 | NA | | 2.7E-10 | 6.8E-11 | 1.7E-01 | 4.0E-10 | 0.36% |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 78 | NA | | 5.9E-08 | 1.5E-08 | 5.7E+00 | 2.7E-09 | 2.42% |
| C19-C36 Aliphatics | 990 | NA | | 7.5E-07 | 1.9E-07 | ND | | |
| C11-C22 Aromatics | 110 | NA | | 8.3E-08 | 2.2E-08 | 2.0E-01 | 1.1E-07 | 97.19% |
| | | | | | | SUMMARY HAZARD INDEX | 0.0000001 | |

CON-SS3I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

03-Feb-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 480 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.28 | mg/cm² |
| SURFACE AREA | SA | 5200 | cm2 |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.25 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.25 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

CON-SS3I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | 6.9E-07 | 0.03 | 6.3E-08 | 1.5E+00 | 1.60E+00 | 1.0E-06 | 1.0E-07 | 1.1E-06 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 1E-06 | 1E-07 | 1E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | 1.9E-04 | 0.03 | 1.8E-05 | 3.0E-04 | 2.9E-04 | 6.4E-01 | 6.0E-02 | 7.0E-01 | 95.04% |
| Iron | 8040 | 3.8E-02 | ND | 0.0E+00 | ND | ND | | | | |
| Manganese | 548 | 2.6E-03 | ND | 0.0E+00 | 7.1E-02 | 4.30E-03 | 3.6E-02 | 0.0E+00 | 3.6E-02 | 4.91% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 16 | 7.5E-05 | 0.17 | 3.9E-05 | 6.0E+00 | 5.5E+00 | 1.3E-05 | 7.0E-06 | 2.0E-05 | 0.003% |
| C9-C10 Aromatics | 4.85 | 2.3E-05 | 0.17 | 1.2E-05 | 3.0E-01 | 2.7E-01 | 7.6E-05 | 4.4E-05 | 1.2E-04 | 0.02% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 3.6 | 1.7E-05 | 0.17 | 8.8E-06 | 6.0E+00 | 5.5E+00 | 2.8E-06 | 1.6E-06 | 4.4E-06 | 0.001% |
| C19-C36 Aliphatics | 38 | 1.8E-04 | 0.17 | 9.2E-05 | 6.0E+01 | 5.5E+01 | 3.0E-06 | 1.7E-06 | 4.6E-06 | 0.001% |
| C11-C22 Aromatics | 10 | 4.6E-05 | 0.17 | 2.4E-05 | 3.0E-01 | 2.7E-01 | 1.5E-04 | 8.7E-05 | 2.4E-04 | 0.03% |
| | | | | | | SUMMARY HAZARD INDEX | 0.7 | 0.06 | 0.7 | |

CON-SS3I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 3.3 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.25 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.25 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SS3I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | NA | | 3.1E-08 | 2.9E-11 | 1.5E+01 | 4.3E-10 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 4E-10 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | NA | | 3.1E-08 | 8.0E-09 | ND | | |
| Iron | 8040 | NA | | 6.1E-06 | 1.6E-06 | ND | | |
| Manganese | 548 | NA | | 4.2E-07 | 1.1E-07 | 1.4E-05 | 7.7E-03 | 100.00% |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 16 | NA | | 1.2E-08 | 3.1E-09 | 5.7E+00 | 5.5E-10 | 0.000000072 |
| C9-C10 Aromatics | 4.85 | NA | | 3.7E-09 | 9.5E-10 | 1.7E-01 | 5.6E-09 | 0.00000073 |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 3.6 | NA | | 2.8E-09 | 7.1E-10 | 5.7E+00 | 1.2E-10 | 0.000000016 |
| C19-C36 Aliphatics | 38 | NA | | 2.9E-08 | 7.4E-09 | ND | | |
| C11-C22 Aromatics | 10 | NA | | 7.4E-09 | 1.9E-09 | 2.0E-01 | 9.5E-09 | 0.0000012 |
| | | | | | | SUMMARY HAZARD INDEX | 0.008 | |

CON-SB3I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 480 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.28 | mg/cm² |
| SURFACE AREA | SA | 5200 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.25 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.25 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

CON-SB3I(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.67 | 1.6E-07 | 0.03 | 1.5E-08 | 1.5E+00 | 1.60E+00 | 2.4E-07 | 2.4E-08 | 2.7E-07 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 2E-07 | 2E-08 | 3E-07 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.67 | 4.5E-05 | 0.03 | 4.1E-06 | 3.0E-04 | 2.9E-04 | 1.5E-01 | 1.4E-02 | 1.7E-01 | 98.26% |
| Iron | 6410 | 3.0E-02 | ND | 0.0E+00 | ND | ND | | | | |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 0.84 | 3.9E-06 | 0.17 | 2.0E-06 | 6.0E+00 | 5.5E+00 | 6.6E-07 | 3.7E-07 | 1.0E-06 | 0.001% |
| C9-C10 Aromatics | 0.35 | 1.6E-06 | 0.17 | 8.5E-07 | 3.0E-01 | 2.7E-01 | 5.5E-06 | 3.1E-06 | 8.6E-06 | 0.01% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 78 | 3.7E-04 | 0.17 | 1.9E-04 | 6.0E+00 | 5.5E+00 | 6.1E-05 | 3.4E-05 | 9.5E-05 | 0.06% |
| C19-C36 Aliphatics | 990 | 4.6E-03 | 0.17 | 2.4E-03 | 6.0E+01 | 5.5E+01 | 7.7E-05 | 4.4E-05 | 1.2E-04 | 0.07% |
| C11-C22 Aromatics | 110 | 5.2E-04 | 0.17 | 2.7E-04 | 3.0E-01 | 2.7E-01 | 1.7E-03 | 9.9E-04 | 2.7E-03 | 1.61% |
| | | | | | | SUMMARY HAZARD INDEX | 0.2 | 0.02 | 0.2 | |

CON-SB3i(CT)
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 3.3 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.25 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.25 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SB3I(CT)
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.67 | NA | | 7.3E-09 | 6.8E-12 | 1.5E+01 | 1.0E-10 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 1E-10 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.67 | NA | | 7.3E-09 | 1.9E-09 | ND | | |
| Iron | 6410 | NA | | 4.9E-06 | 1.3E-06 | ND | | |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 0.84 | NA | | 6.4E-10 | 1.6E-10 | 5.7E+00 | 2.9E-11 | 0.026% |
| C9-C10 Aromatics | 0.35 | NA | | 2.7E-10 | 6.8E-11 | 1.7E-01 | 4.0E-10 | 0.36% |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 78 | NA | | 5.9E-08 | 1.5E-08 | 5.7E+00 | 2.7E-09 | 2.42% |
| C19-C36 Aliphatics | 990 | NA | | 7.5E-07 | 1.9E-07 | ND | | |
| C11-C22 Aromatics | 110 | NA | | 8.3E-08 | 2.2E-08 | 2.0E-01 | 1.1E-07 | 97.19% |
| | | | | | | SUMMARY HAZARD INDEX | 0.0000001 | |

RES-SS3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 100 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.08 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 5,800 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 24 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 24 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RES-SS3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | 8.3E-06 | 0.03 | 1.1E-06 | 1.5E+00 | 1.60E+00 | 1.2E-05 | 1.8E-06 | 1.4E-05 | 100.00% |
| | | | | | SUMMARY CANCER RISK | | 1E-05 | 2E-06 | 1E-05 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | 2.4E-05 | 0.03 | 3.4E-06 | 3.0E-04 | 2.9E-04 | 8.0E-02 | 1.2E-02 | 9.2E-02 | 94.73% |
| Iron | 8040 | 4.7E-03 | ND | | ND | ND | | | | |
| Manganese | 548 | 3.2E-04 | ND | | 7.1E-02 | ND | 4.5E-03 | | 4.5E-03 | 4.68% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 16 | 9.4E-06 | 0.17 | 7.4E-06 | 6.0E-01 | 5.5E-01 | 1.6E-05 | 1.3E-05 | 2.9E-05 | 0.03% |
| C9-C10 Aromatics | 4.85 | 2.8E-06 | 0.17 | 2.2E-06 | 3.0E-02 | 2.7E-02 | 9.5E-05 | 8.3E-05 | 1.8E-04 | 0.18% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 3.63 | 2.1E-06 | 0.17 | 1.7E-06 | 6.0E-01 | 5.5E-01 | 3.6E-06 | 3.1E-06 | 6.6E-06 | 0.01% |
| C19-C36 Aliphatics | 38 | 2.2E-05 | 0.17 | 1.8E-05 | 6.0E+00 | 5.5E+00 | 3.7E-06 | 3.2E-06 | 6.9E-06 | 0.01% |
| C11-C22 Aromatics | 10 | 5.7E-06 | 0.17 | 4.5E-06 | 3.0E-02 | 2.7E-02 | 1.9E-04 | 1.7E-04 | 3.6E-04 | 0.37% |
| | | | | | SUMMARY HAZARD INDEX | | 0.09 | 0.01 | 0.1 | |

RES-SS3I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 0.63 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 24 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 24 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SS3I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | NA | | 3.1E-08 | 3.2E-10 | 1.5E+01 | 4.7E-09 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 5E-09 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | NA | | 3.1E-08 | 9.2E-10 | ND | | |
| Iron | 8040 | NA | | 6.1E-06 | 1.8E-07 | ND | | |
| Manganese | 548 | NA | | 4.2E-07 | 1.2E-08 | 1.4E-05 | 8.8E-04 | 100.00% |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 16 | NA | | 1.2E-08 | 3.6E-10 | 5.7E-01 | 6.3E-10 | 0.00000072 |
| C9-C10 Aromatics | 4.85 | NA | | 3.7E-09 | 1.1E-10 | 1.7E-02 | 6.4E-09 | 0.0000073 |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 3.6 | NA | | 2.8E-09 | 8.1E-11 | 5.7E-01 | 1.4E-10 | 0.00000016 |
| C19-C36 Aliphatics | 38 | NA | | 2.9E-08 | 8.5E-10 | ND | | |
| C11-C22 Aromatics | 10 | NA | | 7.4E-09 | 2.2E-10 | 2.0E-02 | 1.1E-08 | 0.000012 |
| | | | | | | SUMMARY HAZARD INDEX | 0.001 | |

RES-SS3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 200 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 1 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 2,045 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 15 | kg |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 6 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 6 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RES-SS3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | 1.9E-05 | 0.03 | 5.9E-06 | 1.5E+00 | 1.60E+00 | 2.9E-05 | 9.5E-06 | 3.8E-05 | 100.00% |
| SUMMARY CANCER RISK | | | | | | | 3E-05 | 9E-06 | 4E-05 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | 2.2E-04 | 0.03 | 6.9E-05 | 3.0E-04 | 2.9E-04 | 7.5E-01 | 2.4E-01 | 9.9E-01 | 95.11% |
| Iron | 8040 | 4.4E-02 | ND | | ND | ND | | | | |
| Manganese | 548 | 3.0E-03 | ND | | 7.1E-02 | ND | 4.2E-02 | | 4.2E-02 | 4.08% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 16 | 8.8E-05 | 0.17 | 1.5E-04 | 6.0E-01 | 5.5E-01 | 1.5E-04 | 2.8E-04 | 4.2E-04 | 0.04% |
| C9-C10 Aromatics | 4.85 | 2.7E-05 | 0.17 | 4.6E-05 | 3.0E-02 | 2.7E-02 | 8.9E-04 | 1.7E-03 | 2.6E-03 | 0.25% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 3.63 | 2.0E-05 | 0.17 | 3.5E-05 | 6.0E-01 | 5.5E-01 | 3.3E-05 | 6.3E-05 | 9.6E-05 | 0.01% |
| C19-C36 Aliphatics | 38 | 2.1E-04 | 0.17 | 3.6E-04 | 6.0E+00 | 5.5E+00 | 3.5E-05 | 6.6E-05 | 1.0E-04 | 0.01% |
| C11-C22 Aromatics | 10 | 5.3E-05 | 0.17 | 9.3E-05 | 3.0E-02 | 2.7E-02 | 1.8E-03 | 3.4E-03 | 5.2E-03 | 0.50% |
| SUMMARY HAZARD INDEX | | | | | | | 0.8 | 0.2 | 1.0 | |

RES-SS3I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 0.31 | m³/hour |
| BODY WEIGHT | BW | 15 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 6 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 6 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SS3I
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | NA | | 3.1E-08 | 1.8E-10 | 1.5E+01 | 2.7E-09 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 3E-09 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 41 | NA | | 3.1E-08 | 2.1E-09 | ND | | |
| Iron | 8040 | NA | | 6.1E-06 | 4.1E-07 | ND | | |
| Manganese | 548 | NA | | 4.2E-07 | 2.8E-08 | 1.4E-05 | 2.0E-03 | 100.00% |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 16 | NA | | 1.2E-08 | 8.2E-10 | 5.7E-01 | 1.4E-09 | 0.00000072 |
| C9-C10 Aromatics | 4.85 | NA | | 3.7E-09 | 2.5E-10 | 1.7E-02 | 1.5E-08 | 0.0000073 |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 3.6 | NA | | 2.8E-09 | 1.9E-10 | 5.7E-01 | 3.3E-10 | 0.00000016 |
| C19-C36 Aliphatics | 38 | NA | | 2.9E-08 | 2.0E-09 | ND | | |
| C11-C22 Aromatics | 10 | NA | | 7.4E-09 | 5.0E-10 | 2.0E-02 | 2.5E-08 | 0.000012 |
| | | | | | | SUMMARY HAZARD INDEX | 0.002 | |

RES-SB3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

03-Feb-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 100 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.08 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 5,800 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 24 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 24 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RES-SB3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.67 | 1.9E-06 | 0.03 | 2.7E-07 | 1.5E+00 | 1.60E+00 | 2.9E-06 | 4.3E-07 | 3.4E-06 | 100.00% |
| SUMMARY CANCER RISK | | | | | | | 3E-06 | 4E-07 | 3E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.67 | 5.7E-06 | 0.03 | 7.9E-07 | 3.0E-04 | 2.9E-04 | 1.9E-02 | 2.7E-03 | 2.2E-02 | 83.19% |
| Iron | 6410 | 3.8E-03 | ND | | ND | ND | | | | |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 0.84 | 4.9E-07 | 0.17 | 3.9E-07 | 6.0E-01 | 5.5E-01 | 8.2E-07 | 7.1E-07 | 1.5E-06 | 0.006% |
| C9-C10 Aromatics | 0.35 | 2.1E-07 | 0.17 | 1.6E-07 | 3.0E-02 | 2.7E-02 | 6.8E-06 | 6.0E-06 | 1.3E-05 | 0.05% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 78 | 4.6E-05 | 0.17 | 3.6E-05 | 6.0E-01 | 5.5E-01 | 7.6E-05 | 6.6E-05 | 1.4E-04 | 0.55% |
| C19-C36 Aliphatics | 990 | 5.8E-04 | 0.17 | 4.6E-04 | 6.0E+00 | 5.5E+00 | 9.7E-05 | 8.3E-05 | 1.8E-04 | 0.69% |
| C11-C22 Aromatics | 110 | 6.5E-05 | 0.17 | 5.1E-05 | 3.0E-02 | 2.7E-02 | 2.2E-03 | 1.9E-03 | 4.0E-03 | 15.52% |
| SUMMARY HAZARD INDEX | | | | | | | 0.02 | 0.005 | 0.03 | |

RES-SB3i
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 0.63 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 24 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 24 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SB3I
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.67 | NA | | 7.3E-09 | 7.4E-11 | 1.5E+01 | 1.1E-09 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 1E-09 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.67 | NA | | 7.3E-09 | 2.2E-10 | ND | | |
| Iron | 6410 | NA | | 4.9E-06 | 1.4E-07 | ND | | |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 0.84 | NA | | 6.4E-10 | 1.9E-11 | 5.7E-01 | 3.3E-11 | 0.03% |
| C9-C10 Aromatics | 0.35 | NA | | 2.7E-10 | 7.8E-12 | 1.7E-02 | 4.6E-10 | 0.36% |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 78 | NA | | 5.9E-08 | 1.7E-09 | 5.7E-01 | 3.1E-09 | 2.42% |
| C19-C36 Aliphatics | 990 | NA | | 7.5E-07 | 2.2E-08 | ND | | |
| C11-C22 Aromatics | 110 | NA | | 8.3E-08 | 2.5E-09 | 2.0E-02 | 1.2E-07 | 97.19% |
| | | | | | | SUMMARY HAZARD INDEX | 0.0000001 | |

RES-SB3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

03-Feb-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 200 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 1 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 2,045 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 15 | kg |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 6 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 6 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RES-SB3I
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.67 | 4.5E-06 | 0.03 | 1.4E-06 | 1.5E+00 | 1.60E+00 | 6.8E-06 | 2.2E-06 | 9.0E-06 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 7E-06 | 2E-06 | 9E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.67 | 5.3E-05 | 0.03 | 1.6E-05 | 3.0E-04 | 2.9E-04 | 1.8E-01 | 5.6E-02 | 2.3E-01 | 78.48% |
| Iron | 6410 | 3.5E-02 | ND | | ND | ND | | | | |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 0.84 | 4.6E-06 | 0.17 | 8.0E-06 | 6.0E-01 | 5.5E-01 | 7.7E-06 | 1.5E-05 | 2.2E-05 | 0.007% |
| C9-C10 Aromatics | 0.35 | 1.9E-06 | 0.17 | 3.3E-06 | 3.0E-02 | 2.7E-02 | 6.4E-05 | 1.2E-04 | 1.9E-04 | 0.06% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 78 | 4.3E-04 | 0.17 | 7.4E-04 | 6.0E-01 | 5.5E-01 | 7.1E-04 | 1.4E-03 | 2.1E-03 | 0.70% |
| C19-C36 Aliphatics | 990 | 5.4E-03 | 0.17 | 9.4E-03 | 6.0E+00 | 5.5E+00 | 9.0E-04 | 1.7E-03 | 2.6E-03 | 0.88% |
| C11-C22 Aromatics | 110 | 6.0E-04 | 0.17 | 1.0E-03 | 3.0E-02 | 2.7E-02 | 2.0E-02 | 3.9E-02 | 5.9E-02 | 19.87% |
| | | | | | | SUMMARY HAZARD INDEX | 0.2 | 0.1 | 0.3 | |

RES-SB3I
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 0.31 | m³/hour |
| BODY WEIGHT | BW | 15 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 6 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 6 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SB3I
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.67 | NA | | 7.3E-09 | 4.3E-11 | 1.5E+01 | 6.4E-10 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 6E-10 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 9.67 | NA | | 7.3E-09 | 5.0E-10 | ND | | |
| Iron | 6410 | NA | | 4.9E-06 | 3.3E-07 | ND | | |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 0.84 | NA | | 6.4E-10 | 4.3E-11 | 5.7E-01 | 7.6E-11 | 0.03% |
| C9-C10 Aromatics | 0.35 | NA | | 2.7E-10 | 1.8E-11 | 1.7E-02 | 1.1E-09 | 0.36% |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 78 | NA | | 5.9E-08 | 4.0E-09 | 5.7E-01 | 7.0E-09 | 2.42% |
| C19-C36 Aliphatics | 990 | NA | | 7.5E-07 | 5.1E-08 | ND | | |
| C11-C22 Aromatics | 110 | NA | | 8.3E-08 | 5.7E-09 | 2.0E-02 | 2.8E-07 | 97.19% |
| | | | | | | SUMMARY HAZARD INDEX | 0.0000003 | |

RES-GW2I
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION WATER | CW | chemical-specific | ug/liter |
| INGESTION RATE | IR | 2 | liters/day |
| BODY WEIGHT | BW | 70 | kg |
| CONVERSION FACTOR | CF | 0.001 | mg/ug |
| EXPOSURE FREQUENCY | EF | 350 | days/year |
| EXPOSURE DURATION | ED | 30 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 30 | years |

Notes:
For noncarcinogenic effects: AT = ED

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOITIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

$$\text{INTAKE} = \frac{\text{CW x IR x EF x ED x CF}}{\text{BW x AT x 365 days/year}}$$

RES-GW21
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 INDUSTRIAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | WATER CONCENTRATION | UNITS | INTAKE INGESTION (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)^-1 | CANCER RISK INGESTION |
|---|---|---|---|---|---|
| Arsenic | 33.2 | ug/Liter | 3.9E-04 | 1.5E+00 | 5.8E-04 |
| Cadmium | 8.67 | ug/Liter | 1.0E-04 | ND | |
| 1,4-Dichlorobenzene | 5.6 | ug/Liter | 6.6E-05 | 2.4E-02 | 1.6E-06 |
| Naphthalene | 20 | ug/Liter | 2.3E-04 | ND | |
| Carbon Tetrachloride | 4.5 | ug/Liter | 5.3E-05 | 1.3E-01 | 6.9E-06 |
| Chloroform | 10 | ug/Liter | 1.2E-04 | 6.1E-03 | 7.2E-07 |
| Tetrachloroethene | 2.6 | ug/Liter | 3.1E-05 | 5.2E-02 | 1.6E-06 |
| TOTAL CANCER RISK | | | | | 6E-04 |

NONCARCINOGENIC EFFECTS

| COMPOUND | WATER CONCENTRATION | UNITS | INTAKE INGESTION (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT INGESTION |
|---|---|---|---|---|---|
| Aluminum | 190 | ug/Liter | 5.2E-03 | 1.0E+00 | 5.2E-03 |
| Arsenic | 33.2 | ug/Liter | 9.1E-04 | 3.0E-04 | 3.0E+00 |
| Cadmium | 8.67 | ug/Liter | 2.4E-04 | 5.0E-04 | 4.8E-01 |
| Iron | 12400 | ug/Liter | 3.4E-01 | ND | |
| Manganese | 466 | ug/Liter | 1.3E-02 | 2.4E-02 | 5.3E-01 |
| 1,2-Dichlorobenzene | 9.8 | ug/Liter | 2.7E-04 | 9.0E-02 | 3.0E-03 |
| 1,4-Dichlorobenzene | 5.6 | ug/Liter | 1.5E-04 | 3.0E-02 | 5.1E-03 |
| Naphthalene | 20 | ug/Liter | 5.5E-04 | 2.0E-02 | 2.7E-02 |
| Carbon Tetrachloride | 4.5 | ug/Liter | 1.2E-04 | 7.0E-04 | 1.8E-01 |
| Chloroform | 10 | ug/Liter | 2.7E-04 | 1.0E-02 | 2.7E-02 |
| Tetrachloroethene | 2.6 | ug/Liter | 7.1E-05 | 1.0E-02 | 7.1E-03 |
| C9-C10 Aromatics | 310 | ug/Liter | 8.5E-03 | 3.0E-02 | 2.8E-01 |
| TOTAL HAZARD INDEX | | | | | 5 |

RECCH-SS3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
CURRENT/FUTURE RECREATIONAL CHILD (6 TO 16 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 100 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 1 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 3,850 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 38 | kg |
| EXPOSURE FREQUENCY | EF | 52 | days/year |
| EXPOSURE DURATION | ED | 11 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 11 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RECCH-SS3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
CURRENT/FUTURE RECREATIONAL CHILD (6 TO 16 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 28 | 1.6E-06 | 0.03 | 1.9E-06 | 1.5E+00 | 1.6E+00 | 2.5E-06 | 3.0E-06 | 5.5E-06 | 97.67% |
| Dieldrin | 0.14 | 8.2E-09 | ND | 0.0E+00 | 1.6E+01 | ND | 1.3E-07 | | 1.3E-07 | 2.33% |
| | | | | | | SUMMARY CANCER RISK | 2E-06 | 3E-06 | 6E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 28 | 1.0E-05 | 0.03 | 1.2E-05 | 3.0E-04 | 2.9E-04 | 3.5E-02 | 4.2E-02 | 7.7E-02 | 15.81% |
| Manganese | 170 | 6.4E-05 | ND | | 7.1E-02 | ND | 9.0E-04 | | 9.0E-04 | 0.18% |
| Dieldrin | 0.14 | 5.2E-08 | ND | | 5.0E-05 | ND | 1.0E-03 | | 1.0E-03 | 0.22% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 1500 | 5.6E-04 | 0.17 | 3.7E-03 | 6.0E-01 | 5.5E-01 | 9.4E-04 | 6.7E-03 | 7.6E-03 | 1.57% |
| C9-C10 Aromatics | 600 | 2.2E-04 | 0.17 | 1.5E-03 | 3.0E-02 | 2.7E-02 | 7.5E-03 | 5.5E-02 | 6.2E-02 | 12.77% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 1300 | 4.9E-04 | 0.17 | 3.2E-03 | 6.0E-01 | 5.5E-01 | 8.1E-04 | 5.8E-03 | 6.6E-03 | 1.36% |
| C19-C36 Aliphatics | 20,000 | 7.5E-03 | 0.17 | 4.9E-02 | 6.0E+00 | 5.5E+00 | 1.2E-03 | 8.9E-03 | 1.0E-02 | 2.09% |
| C11-C22 Aromatics | 3100 | 1.2E-03 | 0.17 | 7.6E-03 | 3.0E-02 | 2.7E-02 | 3.9E-02 | 2.8E-01 | 3.2E-01 | 65.99% |
| | | | | | | SUMMARY HAZARD INDEX | 0.09 | 0.4 | 0.5 | |

RECCH-SD3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SEDIMENT - RME
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SEDIMENT | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 25 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 1 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 3,850 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 38 | kg |
| EXPOSURE FREQUENCY | EF | 52 | days/year |
| EXPOSURE DURATION | ED | 11 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 11 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RECCH-SD3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SEDIMENT - RME
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SEDIMENT CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 37 | 5.4E-07 | 0.03 | 2.5E-06 | 1.5E+00 | 1.6E+00 | 8.2E-07 | 4.0E-06 | 4.8E-06 | 87.51% |
| Aroclor-1260 | 0.84 | 1.2E-08 | 0.14 | 2.7E-07 | 2.0E+00 | 2.5E+00 | 2.5E-08 | 6.7E-07 | 6.9E-07 | 12.49% |
| SUMMARY CANCER RISK | | | | | | | 8E-07 | 5E-06 | 6E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SEDIMENT CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 37 | 3.5E-06 | 0.03 | 1.6E-05 | 3.0E-04 | 2.9E-04 | 1.2E-02 | 5.5E-02 | 6.7E-02 | 48.47% |
| Manganese | 459 | 4.3E-05 | ND | | 7.1E-02 | 4.3E-03 | 6.1E-04 | 0.0E+00 | 6.1E-04 | 0.44% |
| Aroclor-1260 | 0.84 | 7.9E-08 | 0.14 | 1.7E-06 | 2.0E-05 | 1.6E-05 | 3.9E-03 | 1.1E-01 | 1.1E-01 | 79.83% |
| EPH Fractions | | | | | | | | | | |
| C11-C22 Aromatics | 280 | 2.6E-05 | 0.17 | 6.9E-04 | 3.0E-02 | 2.7E-02 | 8.7E-04 | 2.5E-02 | 2.6E-02 | 19.10% |
| C19-C36 Aliphatics | 630 | 5.9E-05 | 0.17 | 1.5E-03 | 6.0E+00 | 5.5E+00 | 9.8E-06 | 2.8E-04 | 2.9E-04 | 0.211% |
| VPH Fractions | | | | | | | | | | |
| C5-C8 Aliphatics | 3.3 | 3.1E-07 | 0.17 | 8.1E-06 | 6.0E-02 | 5.5E-02 | 5.2E-06 | 1.5E-04 | 1.5E-04 | 0.111% |
| C9-C10 Aromatics | 4.3 | 4.0E-07 | 0.17 | 1.1E-05 | 3.0E-02 | 2.7E-02 | 1.3E-05 | 3.9E-04 | 4.0E-04 | 0.293% |
| C9-C12 Aliphatics | 5.6 | 5.2E-07 | 0.17 | 1.4E-05 | 6.0E-01 | 5.5E-01 | 8.7E-07 | 2.5E-05 | 2.6E-05 | 0.0188% |
| SUMMARY HAZARD INDEX | | | | | | | 0.01 | 0.1 | 0.1 | |

RECCH-SW3R

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE WATER - RME
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA
EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION WATER | CW | average | mg/liter |
| INGESTION RATE | IR | 0.013 | liters/hour |
| SURFACE AREA EXPOSED | SA | 2,518 | $cm^2$/day |
| CONVERSION FACTOR | CF | 0.001 | liter/$cm^3$ |
| BODY WEIGHT | BW | 38 | kg |
| EXPOSURE TIME | ET | 2 | hours/day |
| EXPOSURE FREQUENCY | EF | 52 | days/year |
| EXPOSURE DURATION | ED | 11 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 11 | years |
| PERMEABILITY COEFFICIENT | Kpevent | Chemical-specific | cm/day |

Notes:
For noncarcinogenic effects: AT = ED
ND - Value not determined
TPHC - Total Petroleum Hydrocarbons

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR $(mg/kg\text{-}day)^{-1}$

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CW \times IR \times ET \times EF \times ED}{BW \times AT \times 365\ days/yr}$$

$$\text{INTAKE-DERMAL} = \frac{CW \times Kpevent \times ET \times SA \times CF \times EF \times ED}{BW \times AT \times 365\ days/yr}$$

RECCH-SW3R

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE WATER - RME
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA
CARCINOGENIC EFFECTS

| COMPOUND | WATER CONCENTRATION (mg/L) | INTAKE INGESTION (mg/kg-day) | PERMEABILITY COEFFICIENT (cm/hour) | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)$^{-1}$ | CANCER SLOPE FACTOR DERMAL (mg/kg-day)$^{-1}$ | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 0.153 | 2.3E-06 | 1.0E-03 | 4.5E-07 | 1.5E+00 | 1.6E+00 | 3.5E-06 | 7.3E-07 | 4.2E-06 | 93.90% |
| Benzo(k)fluoranthene | 0.00094 | 1.4E-08 | 1.2E+00 | 3.3E-06 | 7.3E-02 | 8.2E-02 | 1.1E-09 | 2.7E-07 | 2.8E-07 | 6.10% |
| SUMMARY CANCER RISK | | | | | | | 4E-06 | 1E-06 | 5E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | WATER CONCENTRATION (mg/L) | INTAKE INGESTION (mg/kg-day) | PERMEABILITY COEFFICIENT (cm/hour) | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Antimony | 0.0056 | 5.5E-07 | 1.0E-03 | 1.1E-07 | 4.0E-04 | 6.0E-05 | 1.36E-03 | 1.76E-03 | 3.1E-03 | 4.59% |
| Arsenic | 0.153 | 1.5E-05 | 1.0E-03 | 2.9E-06 | 3.0E-04 | 2.9E-04 | 4.97E-02 | 9.96E-03 | 6.0E-02 | 87.62% |
| Barium | 0.278 | 2.7E-05 | 1.0E-03 | 5.2E-06 | 7.0E-02 | 4.9E-03 | 3.87E-04 | 1.07E-03 | 1.5E-03 | 2.14% |
| Manganese | 0.093 | 9.1E-06 | 1.0E-03 | 1.8E-06 | 2.4E-02 | 1.4E-03 | 3.78E-04 | 1.25E-03 | 1.6E-03 | 2.40% |
| Benzo(k)fluoranthene | 0.00094 | 9.2E-08 | 1.2E+00 | | ND | ND | | | | |
| EPH Fractions | | | | | | | | | | |
| C10-C22 Aromatics | 0.65 | 6.3E-05 | NA | | 3.0E-02 | 2.7E-02 | 2.11E-03 | | 2.1E-03 | 3.10% |
| C19-C36 Aliphatics | 1.1 | 1.1E-04 | NA | | 6.0E+00 | 5.5E+00 | 1.79E-05 | | 1.8E-05 | 0.026% |
| VPH Fractions | | | | | | | | | | |
| C9-C10 Aromatics | 0.025 | 2.4E-06 | NA | | 3.0E-02 | 2.7E-02 | 8.12E-05 | | 8.1E-05 | 0.12% |
| SUMMARY HAZARD INDEX | | | | | | | 0.1 | 0.01 | 0.1 | |

RECCH-SS3R(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
CURRENT/FUTURE RECREATIONAL CHILD (6 TO 16 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 50 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 1 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 3,850 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 38 | kg |
| EXPOSURE FREQUENCY | EF | 26 | days/year |
| EXPOSURE DURATION | ED | 11 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 11 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RECCH-SS3R(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
CURRENT/FUTURE RECREATIONAL CHILD (6 TO 16 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 28 | 4.1E-07 | 0.03 | 9.5E-07 | 1.5E+00 | 1.6E+00 | 6.2E-07 | 1.5E-06 | 2.1E-06 | 100.00% |
| Dieldrin | 0.14 | 2.1E-09 | ND | 0.0E+00 | ND | ND | | | | |
| SUMMARY CANCER RISK | | | | | | | 6E-07 | 2E-06 | 2E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 28 | 2.6E-06 | 0.03 | 6.1E-06 | 3.0E-04 | 2.9E-04 | 8.7E-03 | 2.1E-02 | 3.0E-02 | 13.40% |
| Manganese | 170 | 1.6E-05 | ND | | 7.1E-02 | ND | 2.2E-04 | | 2.2E-04 | 0.10% |
| Dieldrin | 0.14 | 1.3E-08 | ND | | 5.0E-05 | ND | 2.6E-04 | | 2.6E-04 | 0.12% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 1500 | 1.4E-04 | 0.17 | 1.8E-03 | 6.0E-01 | 5.5E-01 | 2.3E-04 | 3.3E-03 | 3.6E-03 | 1.62% |
| C9-C10 Aromatics | 600 | 5.6E-05 | 0.17 | 7.4E-04 | 3.0E-02 | 2.7E-02 | 1.9E-03 | 2.7E-02 | 2.9E-02 | 13.17% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 1300 | 1.2E-04 | 0.17 | 1.6E-03 | 6.0E-01 | 5.5E-01 | 2.0E-04 | 2.9E-03 | 3.1E-03 | 1.40% |
| C19-C36 Aliphatics | 20,000 | 1.9E-03 | 0.17 | 2.5E-02 | 6.0E+00 | 5.5E+00 | 3.1E-04 | 4.5E-03 | 4.8E-03 | 2.16% |
| C11-C22 Aromatics | 3100 | 2.9E-04 | 0.17 | 3.8E-03 | 3.0E-02 | 2.7E-02 | 9.7E-03 | 1.4E-01 | 1.5E-01 | 68.03% |
| SUMMARY HAZARD INDEX | | | | | | | 0.02 | 0.2 | 0.2 | |

RECCH-SD3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SEDIMENT - CENTRAL TENDENCY
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SEDIMENT | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 25 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 1 | $mg/cm^2$ |
| SURFACE AREA EXPOSED | SA | 3,850 | $cm^2$ |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 38 | kg |
| EXPOSURE FREQUENCY | EF | 26 | days/year |
| EXPOSURE DURATION | ED | 11 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 11 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RECCH-SD3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SEDIMENT - CENTRAL TENDENCY
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SEDIMENT CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 37 | 2.7E-07 | 0.03 | 1.3E-06 | 1.5E+00 | 1.6E+00 | 4.1E-07 | 2.0E-06 | 2.4E-06 | 87.51% |
| Aroclor-1260 | 0.84 | 6.2E-09 | 0.14 | 1.3E-07 | 2.0E+00 | 2.5E+00 | 1.2E-08 | 3.3E-07 | 3.5E-07 | 12.49% |
| | | | | | | SUMMARY CANCER RISK | 4E-07 | 2E-06 | 3E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SEDIMENT CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 37 | 1.7E-06 | 0.03 | 8.0E-06 | 3.0E-04 | 2.9E-04 | 5.8E-03 | 2.8E-02 | 3.3E-02 | 48.47% |
| Manganese | 459 | 2.2E-05 | ND | | 7.1E-02 | 4.3E-03 | 3.0E-04 | 0.0E+00 | 3.0E-04 | 0.44% |
| Aroclor-1260 | 0.84 | 3.9E-08 | 0.14 | 8.5E-07 | 2.0E-05 | 1.6E-05 | 2.0E-03 | 5.3E-02 | 5.5E-02 | 79.83% |
| EPH Fractions | | | | | | | | | | |
| C11-C22 Aromatics | 280 | 1.3E-05 | 0.17 | 3.4E-04 | 3.0E-02 | 2.7E-02 | 4.4E-04 | 1.3E-02 | 1.3E-02 | 19.10% |
| C19-C36 Aliphatics | 630 | 3.0E-05 | 0.17 | 7.7E-04 | 6.0E+00 | 5.5E+00 | 4.9E-06 | 1.4E-04 | 1.5E-04 | 0.211% |
| VPH Fractions | | | | | | | | | | |
| C5-C8 Aliphatics | 3.3 | 1.5E-07 | 0.17 | 4.0E-06 | 6.0E-02 | 5.5E-02 | 2.6E-06 | 7.4E-05 | 7.6E-05 | 0.111% |
| C9-C10 Aromatics | 4.3 | 2.0E-07 | 0.17 | 5.3E-06 | 3.0E-02 | 2.7E-02 | 6.7E-06 | 2.0E-04 | 2.0E-04 | 0.293% |
| C9-C12 Aliphatics | 5.6 | 2.6E-07 | 0.17 | 6.9E-06 | 6.0E-01 | 5.5E-01 | 4.4E-07 | 1.2E-05 | 1.3E-05 | 0.0188% |
| | | | | | | SUMMARY HAZARD INDEX | 0.003 | 0.07 | 0.07 | |

RECCH-SW3R

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE WATER - CENTRAL TENDENCY
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION WATER | CW | average | mg/liter |
| INGESTION RATE | IR | 0.013 | liters/hour |
| SURFACE AREA EXPOSED | SA | 2,518 | $cm^2$/day |
| CONVERSION FACTOR | CF | 0.001 | liter/$cm^3$ |
| BODY WEIGHT | BW | 38 | kg |
| EXPOSURE TIME | ET | 2 | hours/day |
| EXPOSURE FREQUENCY | EF | 26 | days/year |
| EXPOSURE DURATION | ED | 11 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 11 | years |
| PERMEABILITY COEFFICIENT | Kpevent | Chemical-specific | cm/day |

Notes:
For noncarcinogenic effects: AT = ED
ND - Value not determined
TPHC - Total Petroleum Hydrocarbons

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR $(mg/kg\text{-}day)^{-1}$

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CW \times IR \times ET \times EF \times ED}{BW \times AT \times 365\ days/yr}$$

$$\text{INTAKE-DERMAL} = \frac{CW \times Kpevent \times ET \times SA \times CF \times EF \times ED}{BW \times AT \times 365\ days/yr}$$

RECCH-SW3R

INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE WATER - CENTRAL TENDENCY
CURRENT/FUTURE RECREATIONAL CHILD (6-16 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA
CARCINOGENIC EFFECTS

| COMPOUND | WATER CONCENTRATION (mg/L) | INTAKE INGESTION (mg/kg-day) | PERMEABILITY COEFFICIENT (cm/hour) | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)$^{-1}$ | CANCER SLOPE FACTOR DERMAL (mg/kg-day)$^{-1}$ | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 0.153 | 1.2E-06 | 1.0E-03 | 2.3E-07 | 1.5E+00 | 1.6E+00 | 1.8E-06 | 3.6E-07 | 2.1E-06 | 93.90% |
| Benzo(k)fluoranthene | 0.00094 | 7.2E-09 | 1.2E+00 | 1.7E-06 | 7.3E-02 | 8.2E-02 | 5.3E-10 | 1.4E-07 | 1.4E-07 | 6.10% |
| SUMMARY CANCER RISK | | | | | | | 2E-06 | 5E-07 | 2E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | WATER CONCENTRATION (mg/L) | INTAKE INGESTION (mg/kg-day) | PERMEABILITY COEFFICIENT (cm/hour) | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Antimony | 0.0056 | 2.7E-07 | 1.0E-03 | 5.3E-08 | 4.0E-04 | 6.0E-05 | 6.82E-04 | 8.81E-04 | 1.6E-03 | 4.59% |
| Arsenic | 0.153 | 7.5E-06 | 1.0E-03 | 1.4E-06 | 3.0E-04 | 2.9E-04 | 2.49E-02 | 4.98E-03 | 3.0E-02 | 87.62% |
| Barium | 0.278 | 1.4E-05 | 1.0E-03 | 2.6E-06 | 7.0E-02 | 4.9E-03 | 1.94E-04 | 5.36E-04 | 7.3E-04 | 2.14% |
| Manganese | 0.093 | 4.5E-06 | 1.0E-03 | 8.8E-07 | 2.4E-02 | 1.4E-03 | 1.89E-04 | 6.27E-04 | 8.2E-04 | 2.40% |
| Benzo(k)fluoranthene | 0.00094 | 4.6E-08 | 1.2E+00 | | ND | ND | | | | |
| EPH Fractions | | | | | | | | | | |
| C10-C22 Aromatics | 0.65 | 3.2E-05 | NA | | 3.0E-02 | 2.7E-02 | 1.06E-03 | | 1.1E-03 | 3.10% |
| C19-C36 Aliphatics | 1.1 | 5.4E-05 | NA | | 6.0E+00 | 5.5E+00 | 8.94E-06 | | 8.9E-06 | 0.026% |
| VPH Fractions | | | | | | | | | | |
| C9-C10 Aromatics | 0.025 | 1.2E-06 | NA | | 3.0E-02 | 2.7E-02 | 4.06E-05 | | 4.1E-05 | 0.12% |
| SUMMARY HAZARD INDEX | | | | | | | 0.03 | 0.01 | 0.03 | |

CONS-SS3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

16-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 480 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.28 | mg/cm² |
| SURFACE AREA | SA | 5200 | cm2 |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.5 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.5 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

CON-SS3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 28 | 9.4E-07 | 0.03 | 8.5E-08 | 1.5E+00 | 1.60E+00 | 1.4E-06 | 1.4E-07 | 1.5E-06 | 95.36% |
| Dieldrin | 0.14 | 4.7E-09 | ND | 0.0E+00 | 1.6E+01 | ND | 7.5E-08 | | 7.5E-08 | 4.64% |
| SUMMARY CANCER RISK | | | | | | | 1E-06 | 1E-07 | 2E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 28 | 1.3E-04 | 0.03 | 1.2E-05 | 3.0E-04 | 2.9E-04 | 4.4E-01 | 4.1E-02 | 4.8E-01 | 79.80% |
| Manganese | 170 | 8.0E-04 | ND | 0.0E+00 | 7.1E-02 | 4.30E-03 | 1.1E-02 | 0.0E+00 | 1.1E-02 | 1.87% |
| Dieldrin | 0.14 | 6.6E-07 | ND | 0.0E+00 | 5.0E-05 | ND | 1.3E-02 | | 1.3E-02 | 2.19% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 1500 | 7.0E-03 | 0.17 | 3.6E-03 | 6.0E+00 | 5.5E+00 | 1.2E-03 | 6.6E-04 | 1.8E-03 | 0.31% |
| C9-C10 Aromatics | 600 | 2.8E-03 | 0.17 | 1.5E-03 | 3.0E-01 | 2.7E-01 | 9.4E-03 | 5.4E-03 | 1.5E-02 | 2.46% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 1,300.0 | 6.1E-03 | 0.17 | 3.1E-03 | 6.0E+00 | 5.5E+00 | 1.0E-03 | 5.7E-04 | 1.6E-03 | 0.26% |
| C19-C36 Aliphatics | 20,000 | 9.4E-02 | 0.17 | 4.8E-02 | 6.0E+01 | 5.5E+01 | 1.6E-03 | 8.8E-04 | 2.4E-03 | 0.41% |
| C11-C22 Aromatics | 3,100 | 1.5E-02 | 0.17 | 7.5E-03 | 3.0E-01 | 2.7E-01 | 4.9E-02 | 2.8E-02 | 7.6E-02 | 12.70% |
| SUMMARY HAZARD INDEX | | | | | | | 0.5 | 0.08 | 0.6 | |

CON-SS3R
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 3.3 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.5 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.50 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SS3R
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 28 | NA | | 2.1E-08 | 3.9E-11 | 1.5E+01 | 5.9E-10 | 99.47% |
| Dieldrin | 0.14 | NA | | 1.1E-10 | 2.0E-13 | 1.6E+01 | 3.1E-12 | 0.53% |
| | | | | | | SUMMARY CANCER RISK | 6E-10 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 28 | NA | | 2.1E-08 | 5.5E-09 | ND | | |
| Manganese | 170 | NA | | 1.3E-07 | 3.3E-08 | 1.4E-05 | 2.4E-03 | 99.84% |
| Dieldrin | 0.14 | | | 1.1E-10 | 2.7E-11 | ND | | |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 1500 | NA | | 1.1E-06 | 2.9E-07 | 5.7E+00 | 5.1E-08 | 0.0022% |
| C9-C10 Aromatics | 600 | NA | | 4.5E-07 | 1.2E-07 | 1.7E-01 | 6.9E-07 | 0.029% |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 1,300.0 | NA | | 9.8E-07 | 2.5E-07 | 5.7E+00 | 4.5E-08 | 0.0019% |
| C19-C36 Aliphatics | 20,000 | NA | | 1.5E-05 | 3.9E-06 | ND | | |
| C11-C22 Aromatics | 3,100 | NA | | 2.3E-06 | 6.1E-07 | 2.0E-01 | 3.0E-06 | 0.13% |
| | | | | | | SUMMARY HAZARD INDEX | 0.002 | |

CON-SB3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 480 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.28 | mg/cm² |
| SURFACE AREA | SA | 5200 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.5 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.5 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

CON-SB3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 28.2 | 9.5E-07 | 0.03 | 8.6E-08 | 1.5E+00 | 1.60E+00 | 1.4E-06 | 1.4E-07 | 1.6E-06 | 100.00% |
| SUMMARY CANCER RISK | | | | | | | 1E-06 | 1E-07 | 2E-06 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 28.2 | 1.3E-04 | 0.03 | 1.2E-05 | 3.0E-04 | 2.9E-04 | 4.4E-01 | 4.2E-02 | 4.8E-01 | 100.00% |
| SUMMARY HAZARD INDEX | | | | | | | 0.4 | 0.04 | 0.5 | |

CON-SB3R
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 3.3 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.5 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.50 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SB3R
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 28.2 | NA | | 2.1E-08 | 3.9E-11 | 1.5E+01 | 5.9E-10 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 6E-10 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 28.2 | NA | | 2.1E-08 | 5.5E-09 | ND | | |
| | | | | | | SUMMARY HAZARD INDEX | 0.0 | |

CON-SS3R(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

16-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 480 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.28 | mg/cm² |
| SURFACE AREA | SA | 5200 | cm2 |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.25 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.25 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

CON-SS3R(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 28 | 4.7E-07 | 0.03 | 4.3E-08 | 1.5E+00 | 1.60E+00 | 7.0E-07 | 6.8E-08 | 7.7E-07 | 95.36% |
| Dieldrin | 0.14 | 2.3E-09 | ND | 0.0E+00 | 1.6E+01 | ND | 3.8E-08 | | 3.8E-08 | 4.64% |
| | | | | | | SUMMARY CANCER RISK | 7E-07 | 7E-08 | 8E-07 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 28 | 1.3E-04 | 0.03 | 1.2E-05 | 3.0E-04 | 2.9E-04 | 4.4E-01 | 4.1E-02 | 4.8E-01 | 79.80% |
| Manganese | 170 | 8.0E-04 | ND | 0.0E+00 | 7.1E-02 | 4.30E-03 | 1.1E-02 | 0.0E+00 | 1.1E-02 | 1.87% |
| Dieldrin | 0.14 | 6.6E-07 | ND | 0.0E+00 | 5.0E-05 | ND | 1.3E-02 | | 1.3E-02 | 2.19% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 1500 | 7.0E-03 | 0.17 | 3.6E-03 | 6.0E+00 | 5.5E+00 | 1.2E-03 | 6.6E-04 | 1.8E-03 | 0.31% |
| C9-C10 Aromatics | 600 | 2.8E-03 | 0.17 | 1.5E-03 | 3.0E-01 | 2.7E-01 | 9.4E-03 | 5.4E-03 | 1.5E-02 | 2.46% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 1,300.0 | 6.1E-03 | 0.17 | 3.1E-03 | 6.0E+00 | 5.5E+00 | 1.0E-03 | 5.7E-04 | 1.6E-03 | 0.26% |
| C19-C36 Aliphatics | 20,000 | 9.4E-02 | 0.17 | 4.8E-02 | 6.0E+01 | 5.5E+01 | 1.6E-03 | 8.8E-04 | 2.4E-03 | 0.41% |
| C11-C22 Aromatics | 3,100 | 1.5E-02 | 0.17 | 7.5E-03 | 3.0E-01 | 2.7E-01 | 4.9E-02 | 2.8E-02 | 7.6E-02 | 12.70% |
| | | | | | | SUMMARY HAZARD INDEX | 0.5 | 0.08 | 0.6 | |

CON-SS3R(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 3.3 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.25 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.25 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365 \text{ days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SS3R(CT)
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 28 | NA | | 2.1E-08 | 2.0E-11 | 1.5E+01 | 2.9E-10 | 99.47% |
| Dieldrin | 0.14 | NA | | 1.1E-10 | 9.8E-14 | 1.6E+01 | 1.6E-12 | 0.53% |
| | | | | | | SUMMARY CANCER RISK | 3E-10 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 28 | NA | | 2.1E-08 | 5.5E-09 | ND | | |
| Manganese | 170 | NA | | 1.3E-07 | 3.3E-08 | 1.4E-05 | 2.4E-03 | 99.84% |
| Dieldrin | 0.14 | | | 1.1E-10 | 2.7E-11 | ND | | |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 1500 | NA | | 1.1E-06 | 2.9E-07 | 5.7E+00 | 5.1E-08 | 0.0022% |
| C9-C10 Aromatics | 600 | NA | | 4.5E-07 | 1.2E-07 | 1.7E-01 | 6.9E-07 | 0.029% |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 1,300.0 | NA | | 9.8E-07 | 2.5E-07 | 5.7E+00 | 4.5E-08 | 0.0019% |
| C19-C36 Aliphatics | 20,000 | NA | | 1.5E-05 | 3.9E-06 | ND | | |
| C11-C22 Aromatics | 3,100 | NA | | 2.3E-06 | 6.1E-07 | 2.0E-01 | 3.0E-06 | 0.13% |
| | | | | | | SUMMARY HAZARD INDEX | 0.002 | |

CON-SB3R(CT)
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 3.3 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.25 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.25 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

CON-SB3R(CT)
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 28.2 | NA | | 2.1E-08 | 2.0E-11 | 1.5E+01 | 3.0E-10 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 3E-10 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 28.2 | NA | | 2.1E-08 | 5.5E-09 | ND | | |
| | | | | | | SUMMARY HAZARD INDEX | 0 | |

CON-SB3R(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 480 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.28 | $mg/cm^2$ |
| SURFACE AREA | SA | 5200 | $cm^2$ |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 250 | days/year |
| EXPOSURE DURATION | ED | 0.25 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 0.25 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

CON-SB3R(CT)
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - CENTRAL TENDENCY
FUTURE CONSTRUCTION WORKER
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 28.2 | 4.7E-07 | 0.03 | 4.3E-08 | 1.5E+00 | 1.60E+00 | 7.1E-07 | 6.9E-08 | 7.8E-07 | 100.00% |
| SUMMARY CANCER RISK | | | | | | | 7E-07 | 7E-08 | 8E-07 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 28.2 | 1.3E-04 | 0.03 | 1.2E-05 | 3.0E-04 | 2.9E-04 | 4.4E-01 | 4.2E-02 | 4.8E-01 | 100.00% |
| SUMMARY HAZARD INDEX | | | | | | | 0.4 | 0.04 | 0.5 | |

RES-SS3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 100 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.08 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 5,800 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 24 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 24 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RES-SS3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 28 | 5.6E-06 | 0.03 | 7.8E-07 | 1.5E+00 | 1.6E+00 | 8.5E-06 | 1.3E-06 | 9.7E-06 | 95.56% |
| Dieldrin | 0.14 | 2.8E-08 | ND | 0.0E+00 | 1.6E+01 | ND | 4.5E-07 | | 4.5E-07 | 4.44% |
| SUMMARY CANCER RISK | | | | | | | 9E-06 | 1E-06 | 1E-05 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 28 | 1.6E-05 | 0.03 | 2.3E-06 | 3.0E-04 | 2.9E-04 | 5.5E-02 | 7.9E-03 | 6.3E-02 | 29.80% |
| Manganese | 170 | 1.0E-04 | ND | | 7.1E-02 | ND | 1.4E-03 | | 1.4E-03 | 0.67% |
| Dieldrin | 0.14 | 8.2E-08 | ND | | 5.0E-05 | ND | 1.6E-03 | | 1.6E-03 | 0.78% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 1500 | 8.8E-04 | 0.17 | 6.9E-04 | 6.0E-01 | 5.5E-01 | 1.5E-03 | 1.3E-03 | 2.7E-03 | 1.30% |
| C9-C10 Aromatics | 600 | 3.5E-04 | 0.17 | 2.8E-04 | 3.0E-02 | 2.7E-02 | 1.2E-02 | 1.0E-02 | 2.2E-02 | 10.47% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 1300 | 7.6E-04 | 0.17 | 6.0E-04 | 6.0E-01 | 5.5E-01 | 1.3E-03 | 1.1E-03 | 2.4E-03 | 1.13% |
| C19-C36 Aliphatics | 20,000 | 1.2E-02 | 0.17 | 9.3E-03 | 6.0E+00 | 5.5E+00 | 2.0E-03 | 1.7E-03 | 3.6E-03 | 1.73% |
| C11-C22 Aromatics | 3,100 | 1.8E-03 | 0.17 | 1.4E-03 | 3.0E-02 | 2.7E-02 | 6.1E-02 | 5.3E-02 | 1.1E-01 | 54.12% |
| SUMMARY HAZARD INDEX | | | | | | | 0.1 | 0.08 | 0.2 | |

RES-SS3R
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 0.63 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 24 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 24 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SS3R
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 28 | NA | | 2.1E-08 | 2.2E-10 | 1.5E+01 | 3.2E-09 | 99.47% |
| Dieldrin | 0.14 | NA | | 1.1E-10 | 1.1E-12 | 1.6E+01 | 1.7E-11 | 0.53% |
| | | | | | | SUMMARY CANCER RISK | 3E-09 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 28 | NA | | 2.1E-08 | 6.3E-10 | ND | | |
| Manganese | 170 | NA | | 1.3E-07 | 3.8E-09 | 1.4E-05 | 2.7E-04 | 98.42% |
| Dieldrin | 0.14 | NA | | 1.1E-10 | 3.1E-12 | ND | | |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 1500 | NA | | 1.1E-06 | 3.4E-08 | 5.7E-01 | 5.9E-08 | 0.021% |
| C9-C10 Aromatics | 600 | NA | | 4.5E-07 | 1.3E-08 | 1.7E-02 | 7.9E-07 | 0.29% |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 1300 | NA | | 9.8E-07 | 2.9E-08 | 5.7E-01 | 5.1E-08 | 0.018% |
| C19-C36 Aliphatics | 20,000 | NA | | 1.5E-05 | 4.5E-07 | ND | | |
| C11-C22 Aromatics | 3,100 | NA | | 2.3E-06 | 6.9E-08 | 2.0E-02 | 3.5E-06 | 1.26% |
| | | | | | | SUMMARY HAZARD INDEX | 0.0003 | |

RES-SS3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

14-Mar-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 200 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 1 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 2,045 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 15 | kg |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 6 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 6 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RES-SS3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 28 | 1.3E-05 | 0.03 | 4.0E-06 | 1.5E+00 | 1.60E+00 | 2.0E-05 | 6.5E-06 | 2.6E-05 | 96.14% |
| Dieldrin | 0.14 | 6.6E-08 | ND | 0.0E+00 | 1.6E+01 | ND | 1.1E-06 | | 1.1E-06 | 3.86% |
| | | | | | | SUMMARY CANCER RISK | 2E-05 | 6E-06 | 3E-05 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 28 | 1.5E-04 | 0.03 | 4.7E-05 | 3.0E-04 | 2.9E-04 | 5.1E-01 | 1.6E-01 | 6.7E-01 | 23.97% |
| Manganese | 170 | 9.3E-04 | ND | | 7.1E-02 | ND | 1.3E-02 | | 1.3E-02 | 0.47% |
| Dieldrin | 0.14 | 7.7E-07 | ND | | 5.0E-05 | ND | 1.5E-02 | | 1.5E-02 | 0.55% |
| VPH | | | | | | | | | | |
| C9-C12 Aliphatics | 1500 | 8.2E-03 | 0.17 | 1.4E-02 | 6.0E-01 | 5.5E-01 | 1.4E-02 | 2.6E-02 | 4.0E-02 | 1.41% |
| C9-C10 Aromatics | 600 | 3.3E-03 | 0.17 | 5.7E-03 | 3.0E-02 | 2.7E-02 | 1.1E-01 | 2.1E-01 | 3.2E-01 | 11.43% |
| EPH | | | | | | | | | | |
| C9-C18 Aliphatics | 1300 | 7.1E-03 | 0.17 | 1.2E-02 | 6.0E-01 | 5.5E-01 | 1.2E-02 | 2.3E-02 | 3.4E-02 | 1.22% |
| C19-C36 Aliphatics | 20,000 | 1.1E-01 | 0.17 | 1.9E-01 | 6.0E+00 | 5.5E+00 | 1.8E-02 | 3.5E-02 | 5.3E-02 | 1.88% |
| C11-C22 Aromatics | 3,100 | 1.7E-02 | 0.17 | 3.0E-02 | 3.0E-02 | 2.7E-02 | 5.7E-01 | 1.1E+00 | 1.7E+00 | 59.06% |
| | | | | | | SUMMARY HAZARD INDEX | 1 | 2 | 3 | |

RES-SS3R
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 0.31 | m³/hour |
| BODY WEIGHT | BW | 15 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 6 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 6 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SS3R
INHALATION EXPOSURE TO PARTICULATES IN SURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 28 | NA | | 2.1E-08 | 1.2E-10 | 1.5E+01 | 1.9E-09 | 99.47% |
| Dieldrin | 0.14 | NA | | 1.1E-10 | 6.2E-13 | 1.6E+01 | 9.9E-12 | 0.53% |
| | | | | | | SUMMARY CANCER RISK | 2E-09 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF (m³/kg) | AIR CONCENTRATION VOLATILES (mg/m³) | AIR CONCENTRATION PARTICULATES (mg/m³) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 28 | NA | | 2.1E-08 | 1.4E-09 | ND | | |
| Manganese | 170 | NA | | 1.3E-07 | 8.8E-09 | 1.4E-05 | 6.3E-04 | 98.42% |
| Dieldrin | 0.14 | NA | | 1.1E-10 | 7.2E-12 | ND | | |
| VPH | | | | | | | | |
| C9-C12 Aliphatics | 1500 | NA | | 1.1E-06 | 7.7E-08 | 5.7E-01 | 1.4E-07 | 0.021% |
| C9-C10 Aromatics | 600 | NA | | 4.5E-07 | 3.1E-08 | 1.7E-02 | 1.8E-06 | 0.29% |
| EPH | | | | | | | | |
| C9-C18 Aliphatics | 1300 | NA | | 9.8E-07 | 6.7E-08 | 5.7E-01 | 1.2E-07 | 0.018% |
| C19-C36 Aliphatics | 20,000 | NA | | 1.5E-05 | 1.0E-06 | ND | | |
| C11-C22 Aromatics | 3,100 | NA | | 2.3E-06 | 1.6E-07 | 2.0E-02 | 8.0E-06 | 1.26% |
| | | | | | | SUMMARY HAZARD INDEX | 0.0006 | |

RES-SB3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

02-Feb-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 100 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 0.08 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 5,800 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 24 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 24 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RES-SB3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 28.2 | 5.7E-06 | 0.03 | 7.9E-07 | 1.5E+00 | 1.6E+00 | 8.5E-06 | 1.3E-06 | 9.8E-06 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 9E-06 | 1E-06 | 1E-05 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 28.2 | 1.7E-05 | 0.03 | 2.3E-06 | 3.0E-04 | 2.9E-04 | 5.5E-02 | 7.9E-03 | 6.3E-02 | 100.00% |
| | | | | | | SUMMARY HAZARD INDEX | 0.1 | 0.01 | 0.1 | |

RES-SB3R
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 0.63 | m³/hour |
| BODY WEIGHT | BW | 70 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 24 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 24 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SB3R
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF ($m^3$/kg) | AIR CONCENTRATION VOLATILES (mg/$m^3$) | AIR CONCENTRATION PARTICULATES (mg/$m^3$) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 28.2 | NA | | 2.1E-08 | 2.2E-10 | 1.5E+01 | 3.3E-09 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 3E-09 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF ($m^3$/kg) | AIR CONCENTRATION VOLATILES (mg/$m^3$) | AIR CONCENTRATION PARTICULATES (mg/$m^3$) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 28.2 | NA | | 2.1E-08 | 6.3E-10 | ND | | |
| | | | | | | SUMMARY HAZARD INDEX | 0 | |

RES-SB3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

02-Feb-00

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL | CS | See Below* | mg/kg |
| INGESTION RATE | IR | 200 | mg/day |
| FRACTION INGESTED | FI | 100% | |
| SOIL ADHERENCE FACTOR | SAF | 1 | mg/cm² |
| SURFACE AREA EXPOSED | SA | 2,045 | cm² |
| CONVERSION FACTOR | CF | 0.000001 | kg/mg |
| BODY WEIGHT | BW | 15 | kg |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 6 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 6 | years |
| DERMAL ABSORPTION EFFICIENCY | AE | Chemical-specific | unitless |

Notes:
For noncarcinogenic effects: AT = ED
The dermal absorption efficiency is from the Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance Dermal Risk Assessment, 1998.
*The lesser of the 95 % upper confidence limit (UCL) & maximum concentration.
ND = Value not determined NE = Route not evaluated

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times AE \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

RES-SB3R
INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | CANCER SLOPE FACTOR ORAL (mg/kg-day)-1 | CANCER SLOPE FACTOR DERMAL (mg/kg-day)-1 | CANCER RISK INGESTION | CANCER RISK DERMAL | TOTAL CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 28.2 | 1.3E-05 | 0.03 | 4.1E-06 | 1.5E+00 | 1.60E+00 | 2.0E-05 | 6.5E-06 | 2.6E-05 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 2E-05 | 7E-06 | 3E-05 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | INTAKE INGESTION (mg/kg-day) | DERMAL ABSORPTION EFFICIENCY | INTAKE DERMAL (mg/kg-day) | REFERENCE DOSE ORAL (mg/kg-day) | REFERENCE DOSE DERMAL (mg/kg-day) | HAZARD QUOTIENT INGESTION | HAZARD QUOTIENT DERMAL | TOTAL HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 28.2 | 1.5E-04 | 0.03 | 4.7E-05 | 3.0E-04 | 2.9E-04 | 5.2E-01 | 1.6E-01 | 6.8E-01 | 100.00% |
| | | | | | | SUMMARY HAZARD INDEX | 0.5 | 0.2 | 0.7 | |

RES-SB3R
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION SOIL* | CS | See below | mg/kg |
| CONCENTRATION AIR PARTICULATES | CAp | Calculated | mg/m³ |
| CONCENTRATION AIR VOLATILES | CAv | Calculated | mg/m³ |
| VOLATILIZATION FACTOR** | VF | Calculated | m³/kg |
| PARTICULATE EMISSIONS FACTOR | PEF | 1.32E+09 | ug/m³ |
| INHALATION RATE | IhR | 0.31 | m³/hour |
| BODY WEIGHT | BW | 15 | kg |
| EXPOSURE TIME | ET | 8 | hours/day |
| EXPOSURE FREQUENCY | EF | 150 | days/year |
| EXPOSURE DURATION | ED | 6 | years |
| RELATIVE ABSORPTION FACTOR | RAF | 100% | |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 6 | years |

Notes: * Soil concentration used is the lesser of the 95 % upper confidence limit (UCL) & maximum concentration
**Volatilization factor used only for volatile chemicals of potential concern.
For noncarcinogenic effects: AT = ED
ND = Value not determined

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE CONCENTRATION (mg/kg-day)

$$\text{INTAKE - INHALATION} = \frac{(CAp + Cav) \times RAF \times IhR \times ET \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

AIR CONCENTRATION PARTICULATES = CS x 1/PEF

AIR CONCENTRATION VOLATILES = CS x 1/VF
(VF not calculated because there are no VOCs selected as CPCs).

RES-SB3R
INHALATION EXPOSURE TO PARTICULATES IN SUBSURFACE SOIL - RME
UNRESTRICTED LAND USE - CHILD RESIDENT (1 TO 6 YEARS)
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF ($m^3$/kg) | AIR CONCENTRATION VOLATILES (mg/$m^3$) | AIR CONCENTRATION PARTICULATES (mg/$m^3$) | INTAKE (mg/kg-day) | CANCER SLOPE FACTOR (mg/kg-day)-1 | CANCER RISK | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 28.2 | NA | | 2.1E-08 | 1.2E-10 | 1.5E+01 | 1.9E-09 | 100.00% |
| | | | | | | SUMMARY CANCER RISK | 2E-09 | |

NONCARCINOGENIC EFFECTS

| COMPOUND | SOIL CONCENTRATION (mg/kg) | VF ($m^3$/kg) | AIR CONCENTRATION VOLATILES (mg/$m^3$) | AIR CONCENTRATION PARTICULATES (mg/$m^3$) | INTAKE (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT | PERCENT TOTAL RISK |
|---|---|---|---|---|---|---|---|---|
| Arsenic | 28.2 | NA | | 2.1E-08 | 1.5E-09 | ND | | |
| | | | | | | SUMMARY HAZARD INDEX | 0 | |

RES-GW2I
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

EXPOSURE PARAMETERS

| PARAMETER | SYMBOL | VALUE | UNITS |
|---|---|---|---|
| CONCENTRATION WATER | CW | chemical-specific | ug/liter |
| INGESTION RATE | IR | 2 | liters/day |
| BODY WEIGHT | BW | 70 | kg |
| CONVERSION FACTOR | CF | 0.001 | mg/ug |
| EXPOSURE FREQUENCY | EF | 350 | days/year |
| EXPOSURE DURATION | ED | 30 | years |
| AVERAGING TIME | | | |
| CANCER | AT | 70 | years |
| NONCANCER | AT | 30 | years |

Notes:
For noncarcinogenic effects: AT = ED

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)-1

HAZARD QUOITIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

$$\text{INTAKE} = \frac{\text{CW x IR x EF x ED x CF}}{\text{BW x AT x 365 days/year}}$$

RES-GW2I
INGESTION OF GROUNDWATER AS DRINKING WATER (UNFILTERED SAMPLES) - RME
UNRESTRICTED LAND USE - ADULT RESIDENT
AOC 57 AREA 3 RECREATIONAL
FORT DEVENS, MA

CARCINOGENIC EFFECTS

| COMPOUND | WATER CONCENTRATION | UNITS | INTAKE INGESTION (mg/kg-day) | CANCER SLOPE FACTOR ((mg/kg-day)^-1 | CANCER RISK INGESTION |
|---|---|---|---|---|---|
| Arsenic | 84.4 | ug/Liter | 9.9E-04 | 1.5E+00 | 1.5E-03 |
| 1,4-Dichlorobenzene | 2.7 | ug/Liter | 3.2E-05 | 2.4E-02 | 7.6E-07 |
| Bis(2-ethylhexyl)phthalate | 52 | ug/Liter | 6.1E-04 | 1.4E-02 | 8.5E-06 |
| Naphthalene | 13 | ug/Liter | 1.5E-04 | ND | |
| Tetrachloroethene | 5.5 | ug/Liter | 6.5E-05 | 5.2E-02 | 3.4E-06 |
| Trichloroethene | 3.8 | ug/Liter | 4.5E-05 | 1.1E-02 | 4.9E-07 |
| TOTAL CANCER RISK | | | | | 1E-03 |

NONCARCINOGENIC EFFECTS

| COMPOUND | WATER CONCENTRATION | UNITS | INTAKE INGESTION (mg/kg-day) | REFERENCE DOSE (mg/kg-day) | HAZARD QUOTIENT INGESTION |
|---|---|---|---|---|---|
| Aluminum | 2450 | ug/Liter | 6.7E-02 | 1.0E+00 | 6.7E-02 |
| Arsenic | 84.4 | ug/Liter | 2.3E-03 | 3.0E-04 | 7.7E+00 |
| Iron | 1910 | ug/Liter | 5.2E-02 | ND | |
| Manganese | 346 | ug/Liter | 9.5E-03 | 2.4E-02 | 3.9E-01 |
| 1,4-Dichlorobenzene | 2.7 | ug/Liter | 7.4E-05 | 3.0E-02 | 2.5E-03 |
| Bis(2-ethylhexyl)phthalate | 52 | ug/Liter | 1.4E-03 | 2.0E-02 | 7.1E-02 |
| Naphthalene | 13 | ug/Liter | 3.6E-04 | 2.0E-02 | 1.8E-02 |
| Tetrachloroethene | 5.5 | ug/Liter | 1.5E-04 | 1.0E-02 | 1.5E-02 |
| Trichloroethene | 3.8 | ug/Liter | 1.0E-04 | 6.0E-03 | 1.7E-02 |
| C5-C8 Aliphatics | 89.5 | ug/Liter | 2.5E-03 | 6.0E-02 | 4.1E-02 |
| C9-C12 Aliphatics | 42.5 | ug/Liter | 1.2E-03 | 6.0E-01 | 1.9E-03 |
| C9-C10 Aromatics | 172 | ug/Liter | 4.7E-03 | 3.0E-02 | 1.6E-01 |
| TOTAL HAZARD INDEX | | | | | 8 |

# N-6 RISK SUMMARY TABLES

TABLE 1
RISK ASSESSMENT SUMMARY
AREA 2 - INDUSTRIAL - MAINTENANCE WORKER
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Current/Future
Receptor Population: Maintenance worker
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Soil | Surface Soil | Area 2 - Industrial | Arsenic | 2E-06 | 2E-09 | 2E-07 | 2E-06 | Arsenic | Skin | 0.014 | -- | 0.0012 | 0.02 |
| | | | Chromium | NA | 5E-09 | NA | 5E-09 | Chromium | NOAEL (GI)[2] | 0.0018 | 0.000018 | -- | 0.002 |
| | | | | | | | | Iron | -- | -- | -- | -- | -- |
| | | | | | | | | Manganese | NOAEL (Nervous system)[1] | 0.0014 | 0.00068 | -- | 0.002 |
| | | | | | | | | C9-C12 Aliphatics | Nervous system | 0.000011 | 0.0000000011 | 0.0000056 | 0.00002 |
| | | | | | | | | C9-C10 Aromatics | Kidney | 0.00016 | 0.000000027 | 0.000082 | 0.0002 |
| | | | | | | | | C9-C18 Aliphatics | Nervous system | 0.00016 | 0.000000016 | 0.000081 | 0.0002 |
| | | | | | | | | C19-C36 Aliphatics | Liver | 0.00019 | -- | 0.000099 | 0.0003 |
| | | | | | | | | C11-C22 Aromatics | Kidney | 0.012 | 0.0000017 | 0.0063 | 0.02 |
| | | | (Total) | 2E-06 | 7E-09 | 2E-07 | 2E-06 | (Total) | | 0.03 | 0.0007 | 0.008 | 0.04 |
| | | | Total Risk Across All Media and All Exposure Routes | | | | 2E-06 | | Total Hazard Index Across All Media and All Exposure Routes | | | | 0.04 |

| | |
|---|---|
| Total [Skin] HI = | 0.02 |
| Total [GI] HI = | 0.002 |
| Total [Nervous system] HI = | 0.002 |
| Total [Liver] HI = | 0.0003 |
| Total [Kidney] HI = | 0.02 |
| Total [NOAEL] HI = | 0.004 |

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specific hazard index that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

# TABLE 2
# RISK ASSESSMENT SUMMARY
# AREA 2 - INDUSTRIAL - COMMERCIAL/INDUSTRIAL WORKER
# AOC 57

## REMEDIAL INVESTIGATION REPORT
## DEVENS, MASSACHUSETTS

Scenario Timeframe: Future
Receptor Population: Commercial/industrial worker
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Soil | Surface Soil | Area 2 - Industrial | Arsenic | 7E-06 | 6E-09 | 4E-07 | 7E-06 | Arsenic | Skin | 0.041 | -- | 0.0026 | 0.04 |
| | | | Chromium | NA | 2E-08 | NA | 2E-08 | Chromium | NOAEL (GI)[2] | 0.00079 | 0.000053 | -- | 0.0008 |
| | | | | | | | | Iron | | -- | -- | -- | -- |
| | | | | | | | | Manganese | NOAEL (Nervous system)[1] | 0.004 | 0.002 | -- | 0.006 |
| | | | | | | | | C9-C12 Aliphatics | Nervous system | 0.000031 | 0.0000000032 | 0.000012 | 0.00004 |
| | | | | | | | | C9-C10 Aromatics | Kidney | 0.00045 | 0.000000077 | 0.00017 | 0.0006 |
| | | | | | | | | C9-C18 Aliphatics | Nervous system | 0.00045 | 0.000000046 | 0.00017 | 0.0006 |
| | | | | | | | | C19-C36 Aliphatics | Liver | 0.00056 | -- | 0.00021 | 0.0008 |
| | | | | | | | | C11-C22 Aromatics | Kidney | 0.035 | 0.000005 | 0.013 | 0.05 |
| | | | (Total) | 7E-06 | 3E-08 | 4E-07 | 7E-06 | (Total) | | 0.08 | 0.002 | 0.02 | 0.1 |
| Groundwater | Groundwater | Area 2 - Industrial | NA | | | | | Aluminum | NOAEL | 0.002 | NA | NA | 0.0 |
| | | | | | | | | Manganese | NOAEL (Nervous system)[1] | 0.072 | NA | NA | 0.07 |
| | | | (Total) | 0E+00 | 0E+00 | 0E+00 | 0E+00 | (Total) | | 0.07 | 0.0 | 0.0 | 0.07 |
| | | | Total Risk Across All Media and All Exposure Routes | | | | 7E-06 | Total Hazard Index Across All Media and All Exposure Routes | | | | | 0.2 |
| | | | | | | | | | | | | Total [Skin] HI = | 0.04 |
| | | | | | | | | | | | | Total [GI] HI = | 0.0008 |
| | | | | | | | | | | | | Total [Nervous system] HI = | 0.08 |
| | | | | | | | | | | | | Total [Liver] HI = | 0.0008 |
| | | | | | | | | | | | | Total [Kidney] HI = | 0.05 |
| | | | | | | | | | | | | Total [NOAEL] HI = | 0.08 |

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specifc hazard index that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

TABLE 3
RISK ASSESSMENT SUMMARY
AREA 2 - INDUSTRIAL - CONSTRUCTION WORKER
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Future
Receptor Population: Construction worker
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | |
|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Soil | Surface Soil | Area 2 - Industrial | Arsenic | 2E-06 | 4E-10 | 2E-07 | 2E-06 |
| | | | Chromium | NA | 2E-09 | NA | 2E-09 |
| | | | (Total) | 2E-06 | 2E-09 | 2E-07 | 2E-06 |
| | Subsurface Soil | Area 2 - Industrial | Arsenic | 5E-07 | 2E-10 | 5E-08 | 6E-07 |
| | | | (Total) | 5E-07 | 2E-10 | 5E-08 | 6E-07 |
| Total Risk Across All Media and All Exposure Routes | | | | | | | 3E-06 |

| Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|
| | Primary Target Organ | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Arsenic | Skin | 0.33 | -- | 0.031 | 0.4 |
| Chromium | NOAEL (GI)[2] | 0.0063 | 0.00018 | -- | 0.006 |
| Iron | | -- | -- | -- | -- |
| Manganese | NOAEL (Nervous system)[1] | 0.032 | 0.0067 | -- | 0.04 |
| C9-C12 Aliphatics | Nervous system | 0.000025 | 0.0000000011 | 0.000014 | 0.00004 |
| C9-C10 Aromatics | Kidney | 0.00036 | 0.000000026 | 0.00021 | 0.0006 |
| C9-C18 Aliphatics | Nervous system | 0.00036 | 0.000000016 | 0.0002 | 0.0006 |
| C19-C36 Aliphatics | Liver | 0.00044 | -- | 0.00025 | 0.0007 |
| C11-C22 Aromatics | Kidney | 0.028 | 0.0000017 | 0.016 | 0.04 |
| (Total) | | 0.4 | 0.007 | 0.05 | 0.5 |
| Arsenic | Skin | 0.15 | -- | 0.015 | 0.2 |
| Iron | | -- | -- | -- | -- |
| Manganese | NOAEL (Nervous system)[1] | 0.015 | 0.0032 | -- | 0.02 |
| C9-C12 Aliphatics | Nervous system | 0.00000045 | 0.000000002 | 0.0000003 | 0.0000007 |
| C9-C10 Aromatics | Kidney | 0.0000064 | 0.000000005 | 0.0000037 | 0.00001 |
| C9-C18 Aliphatics | Nervous system | 0.0000064 | 0.000000003 | 0.0000036 | 0.00001 |
| C19-C36 Aliphatics | Liver | 0.0000079 | -- | 0.0000044 | 0.00001 |
| C11-C22 Aromatics | Kidney | 0.00049 | 0.00000003 | 0.00025 | 0.0007 |
| (Total) | | 0.2 | 0.003 | 0.02 | 0.2 |
| Total Hazard Index Across All Media and All Exposure Routes | | | | | 0.6 |
| Total [Skin] HI = | | | | | 0.5 |
| Total [GI] HI = | | | | | 0.006 |
| Total [Nervous system] HI = | | | | | 0.06 |
| Total [Liver] HI = | | | | | 0.0007 |
| Total [Kidney] HI = | | | | | 0.05 |
| Total [NOAEL] HI = | | | | | 0.06 |

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specific hazard index that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

TABLE 4
RISK ASSESSMENT SUMMARY
AREA 2 - INDUSTRIAL - ADULT RESIDENT
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Future Unrestricted
Receptor Population: Resident
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Soil | Surface Soil | Area 2 - Industrial | Arsenic | 6E-06 | 2E-09 | 9E-07 | 7E-06 | Arsenic | Skin | 0.041 | -- | 0.0059 | 0.05 |
| | | | Chromium | NA | 8E-09 | NA | 8E-09 | Chromium | NOAEL (GI)[2] | 0.0053 | 0.000021 | -- | 0.0053 |
| | | | | | | | | Iron | | -- | -- | -- | -- |
| | | | | | | | | Manganese | NOAEL (Nervous system)[1] | 0.004 | 0.00077 | -- | 0.005 |
| | | | | | | | | C9-C12 Aliphatics | Nervous system | 0.000031 | 0.0000000013 | 0.000027 | 0.00006 |
| | | | | | | | | C9-C10 Aromatics | Kidney | 0.00045 | 0.00000003 | 0.00039 | 0.0008 |
| | | | | | | | | C9-C18 Aliphatics | Nervous system | 0.00045 | 0.000000018 | 0.00039 | 0.0008 |
| | | | | | | | | C19-C36 Aliphatics | Liver | 0.00056 | -- | 0.00048 | 0.0010 |
| | | | | | | | | C11-C22 Aromatics | Kidney | 0.035 | 0.000002 | 0.03 | 0.07 |
| | | | (Total) | 6E-06 | 1E-08 | 9E-07 | 7E-06 | (Total) | | 0.09 | 0.0008 | 0.04 | 0.1 |
| | Subsurface Soil | Area 2 - Industrial | Arsenic | 3E-06 | 1E-09 | 4E-07 | 3E-06 | Arsenic | Skin | 0.019 | -- | 0.0028 | 0.02 |
| | | | | | | | | Iron | | -- | -- | -- | -- |
| | | | | | | | | Manganese | NOAEL (Nervous system)[1] | 0.0019 | 0.00037 | -- | 0.002 |
| | | | | | | | | C9-C12 Aliphatics | Nervous system | 0.00000056 | 0.00000000002 | 0.0000005 | 0.000001 |
| | | | | | | | | C9-C10 Aromatics | Kidney | 0.000008 | 0.0000000005 | 0.000007 | 0.00002 |
| | | | | | | | | C9-C18 Aliphatics | Nervous system | 0.000008 | 0.0000000003 | 0.0000069 | 0.00001 |
| | | | | | | | | C19-C36 Aliphatics | Liver | 0.0000099 | -- | 0.0000085 | 0.00002 |
| | | | | | | | | C11-C22 Aromatics | Kidney | 0.00061 | 0.000000035 | 0.00053 | 0.001 |
| | | | (Total) | 3E-06 | 1E-09 | 4E-07 | 3E-06 | (Total) | | 0.02 | 0.0004 | 0.003 | 0.03 |
| Groundwater | Groundwater | Area 2 - Industrial | NA | | | | | Aluminum | NOAEL | 0.0056 | NA | NA | 0.0 |
| | | | | | | | | Manganese | NOAEL (Nervous system)[1] | 0.2 | NA | NA | 0.2 |
| | | | (Total) | 0E+00 | 0E+00 | 0E+00 | 0E+00 | (Total) | | 0.2 | 0.0 | 0.0 | 0.2 |
| | | | Total Risk Across All Media and All Exposure Routes | | | | 1E-05 | Total Hazard Index Across All Media and All Exposure Routes | | | | | 0.4 |
| | | | | | | | | | | | | Total [Skin] HI = | 0.07 |
| | | | | | | | | | | | | Total [GI] HI = | 0.005 |
| | | | | | | | | | | | | Total [Nervous system] HI = | 0.2 |
| | | | | | | | | | | | | Total [Liver] HI = | 0.001 |
| | | | | | | | | | | | | Total [Kidney] HI = | 0.07 |
| | | | | | | | | | | | | Total [NOAEL] HI = | 0.2 |

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specific hazard index that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

TABLE 5
RISK ASSESSMENT SUMMARY
AREA 2 - INDUSTRIAL - CHILD RESIDENT
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Future Unrestricted
Receptor Population: Resident
Receptor Age: Child

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Soil | Surface Soil | Area 2 - Industrial | Arsenic | 1E-05 | 1E-09 | 5E-06 | 2E-05 | Arsenic | Skin | 0.38 | -- | 0.12 | 0.5 |
| | | | Chromium | NA | 5E-09 | NA | 5E-09 | Chromium | NOAEL (GI)[2] | 0.049 | 0.000048 | -- | 0.05 |
| | | | | | | | | Iron | | -- | -- | -- | -- |
| | | | | | | | | Manganese | NOAEL (Nervous system)[1] | 0.037 | 0.0018 | -- | 0.04 |
| | | | | | | | | C9-C12 Aliphatics | Nervous system | 0.00029 | 0.0000000029 | 0.00055 | 0.0008 |
| | | | | | | | | C9-C10 Aromatics | Kidney | 0.0042 | 0.00000007 | 0.0081 | 0.01 |
| | | | | | | | | C9-C18 Aliphatics | Nervous system | 0.0042 | 0.000000042 | 0.0081 | 0.01 |
| | | | | | | | | C19-C36 Aliphatics | Liver | 0.0052 | -- | 0.0098 | 0.02 |
| | | | | | | | | C11-C22 Aromatics | Kidney | 0.32 | 0.0000046 | 0.62 | 0.9 |
| | | | (Total) | 1E-05 | 6E-09 | 5E-06 | 2E-05 | (Total) | | 0.8 | 0.002 | 0.8 | 2 |
| | Subsurface Soil | Area 2 - Industrial | Arsenic | 7E-06 | 6E-10 | 2E-06 | 9E-06 | Arsenic | Skin | 0.18 | -- | 0.057 | 0.2 |
| | | | | | | | | Iron | | -- | -- | -- | -- |
| | | | | | | | | Manganese | NOAEL (Nervous system)[1] | 0.018 | 0.00085 | -- | 0.02 |
| | | | | | | | | C9-C12 Aliphatics | Nervous system | 0.0000052 | 0.00000000005 | 0.0000099 | 0.00002 |
| | | | | | | | | C9-C10 Aromatics | Kidney | 0.000075 | 0.0000000012 | 0.00014 | 0.0002 |
| | | | | | | | | C9-C18 Aliphatics | Nervous system | 0.000075 | 0.0000000007 | 0.00014 | 0.0002 |
| | | | | | | | | C19-C36 Aliphatics | Liver | 0.000092 | -- | 0.00017 | 0.0003 |
| | | | | | | | | C11-C22 Aromatics | Kidney | 0.0057 | 0.00000008 | 0.011 | 0.02 |
| | | | (Total) | 7E-06 | 6E-10 | 2E-06 | 9E-06 | (Total) | | 0.2 | 0.0009 | 0.07 | 0.3 |
| | | | Total Risk Across All Media and All Exposure Routes | | | | 2E-05 | Total Hazard Index Across All Media and All Exposure Routes | | | | | 2 |

| | |
|---|---|
| Total [Skin] HI = | 0.7 |
| Total [GI] HI = | 0.05 |
| Total [Nervous system] HI = | 0.07 |
| Total [Liver] HI = | 0.02 |
| Total [Kidney] HI = | 1 |
| Total [NOAEL] HI = | 0.1 |

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specifc hazard index that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

TABLE 6
RISK ASSESSMENT SUMMARY
AREA 2 - RECREATIONAL - RECREATIONAL VISITOR
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Current/Future
Receptor Population: Recreational visitor
Receptor Age: Child (ages 6 through 16)

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Soil | Surface Soil | Area 2 - Recreational | Arsenic | 4E-06 | NA | 5E-06 | 9E-06 | Arsenic | Skin | 0.06 | NA | 0.072 | 0.1 |
| | | | Aroclor-1260 | 4E-07 | NA | 3E-06 | 3E-06 | Aroclor-1260 | Immune system | 0.067 | NA | 0.45 | 0.5 |
| | | | | | | | | Iron | | – | NA | – | – |
| | | | | | | | | Manganese | NOAEL (Nervous system)[1] | 0.0014 | NA | – | 0.001 |
| | | | | | | | | C9-C12 Aliphatics | Nervous system | 0.000013 | NA | 0.000094 | 0.0001 |
| | | | | | | | | C9-C10 Aromatics | Kidney | 0.00021 | NA | 0.0015 | 0.002 |
| | | | | | | | | C9-C18 Aliphatics | Nervous system | 0.00019 | NA | 0.0013 | 0.001 |
| | | | | | | | | C19-C36 Aliphatics | Liver | 0.00023 | NA | 0.0016 | 0.002 |
| | | | | | | | | C11-C22 Aromatics | Kidney | 0.014 | NA | 0.1 | 0.1 |
| | | | (Total) | 4E-06 | 0E+00 | 8E-06 | 1E-05 | (Total) | | 0.1 | 0.0 | 0.6 | 0.8 |
| Sediment | Sediment | Area 2 - Recreational | Arsenic | 5E-06 | NA | 2E-05 | 3E-05 | Aluminum | NOAEL | 0.0015 | NA | – | 0.002 |
| | | | Lead | – | NA | – | 0E+00 | Arsenic | Skin | 0.069 | NA | 0.33 | 0.4 |
| | | | Dieldrin | 1E-08 | NA | – | 1E-08 | Chromium | NOAEL (GI)[2] | 0.0015 | NA | – | 0.002 |
| | | | | | | | | Iron | | – | NA | – | 0.000 |
| | | | | | | | | Lead | | – | NA | – | 0.000 |
| | | | | | | | | Manganese | NOAEL (Nervous system)[1] | 0.052 | NA | – | 0.05 |
| | | | | | | | | Dieldrin | Liver | 0.000086 | NA | – | 0.00009 |
| | | | | | | | | TPH | Kidney | 0.01 | NA | 0.29 | 0.3 |
| | | | (Total) | 5E-06 | 0E+00 | 2E-05 | 3E-05 | (Total) | | 0.07 | 0.0 | 0.6 | 0.4 |
| Surface water | Surface water | Area 2 - Recreational | Arsenic | 4E-06 | NA | 9E-07 | 5E-06 | Aluminum | NOAEL | 0.0015 | NA | – | 0.002 |
| | | | Lead | – | NA | – | 0E+00 | Arsenic | Skin | 0.064 | NA | 0.013 | 0.08 |
| | | | BEHP | 5E-09 | NA | – | 5E-09 | Barium | Cardiovascular | 0.00077 | NA | 0.0021 | 0.003 |
| | | | Chloroform | 7E-11 | NA | – | 7E-11 | Cadmium | Kidney | 0.0049 | NA | 0.019 | 0.02 |
| | | | PCE | 2E-09 | NA | – | 2E-09 | Chromium | NOAEL (GI)[2] | 0.0012 | NA | 0.0091 | 0.01 |
| | | | TCE | 6E-10 | NA | – | 6E-10 | Copper | | – | NA | – | 0.0 |
| | | | | | | | | Iron | | – | NA | – | 0.0 |
| | | | | | | | | Lead | | – | NA | – | 0.0 |
| | | | | | | | | Manganese | NOAEL (Nervous system)[1] | 0.0018 | NA | 0.0058 | 0.008 |
| | | | | | | | | Vanadium | NOAEL | 0.001 | NA | 0.0075 | 0.009 |
| | | | | | | | | BEHP | Liver | 0.00012 | NA | – | 0.0001 |
| | | | | | | | | 1,2-DCE | Liver | 0.00028 | NA | – | 0.0003 |
| | | | | | | | | Chloroform | Liver | 0.0000076 | NA | – | 0.000008 |
| | | | | | | | | PCE | Liver | 0.000025 | NA | – | 0.00003 |
| | | | | | | | | TCE | Liver | 0.000057 | NA | – | 0.00006 |
| | | | | | | | | C10-C22 Aromatics | Kidney | 0.0045 | NA | – | 0.005 |
| | | | | | | | | C19-C36 Aliphatics | Liver | 0.000028 | NA | – | 0.00003 |
| | | | (Total) | 4E-06 | 0E+00 | 9E-07 | 5E-06 | (Total) | | 0.07 | 0.0 | 0.06 | 0.1 |
| | | | Total Risk Across All Media and All Exposure Routes | | | | 2E-05 | Total Hazard Index Across All Media and All Exposure Routes | | | | | 1 |

| | |
|---|---|
| Total [Skin] HI = | 0.6 |
| Total [GI] HI = | 0.01 |
| Total [Nervous system] HI = | 0.06 |
| Total [Liver] HI = | 0.002 |
| Total [Kidney] HI = | 0.4 |
| Total [Cardiovascular] HI = | 0.003 |
| Total [immune system] HI = | 0.5 |
| Total [NOAEL] HI = | 0.08 |

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system.
Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system.
Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specific hazard index that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased likelihood of adverse effects to this target organ/system.
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
– = No toxicity data
BEHP - bis(2-ethylhexyl)phthalate
1,2-DCE - 1,2-Dichloroethene
TCE - Trichloroethene
PCE - Tetrachloroethene
TPH - Total petroleum hydrocarbons

TABLE 7
RISK ASSESSMENT SUMMARY
AREA 2 - RECREATIONAL - CONSTRUCTION WORKER
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Future
Receptor Population: Construction worker
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Soil | Surface Soil | Area 2 - Recreational | Arsenic | 2E-06 | 1E-09 | 2E-07 | 2E-06 | Arsenic | Skin | 0.75 | -- | 0.071 | 0.8 |
| | | | Aroclor-1260 | 2E-07 | 1E-11 | 1E-07 | 3E-07 | Aroclor-1260 | Immune system | 0.34 | -- | 0.18 | 0.5 |
| | | | | | | | | Iron | | -- | -- | -- | -- |
| | | | | | | | | Manganese | NOAEL (Nervous system)[1] | 0.018 | 0.0038 | -- | 0.02 |
| | | | | | | | | C9-C12 Aliphatics | Nervous system | 0.000016 | 0.0000000007 | 0.0000092 | 0.00003 |
| | | | | | | | | C9-C10 Aromatics | Kidney | 0.00027 | 0.00000002 | 0.00015 | 0.0004 |
| | | | | | | | | C9-C18 Aliphatics | Nervous system | 0.00023 | 0.00000001 | 0.00013 | 0.0004 |
| | | | | | | | | C19-C36 Aliphatics | Liver | 0.00028 | -- | 0.00016 | 0.0004 |
| | | | | | | | | C11-C22 Aromatics | Kidney | 0.018 | 0.0000011 | 0.01 | 0.03 |
| | | | (Total) | 2E-06 | 1E-09 | 3E-07 | 3E-06 | (Total) | | 1 | 0.004 | 0.3 | 1 |
| | Subsurface Soil | Area 2 - Recreational | Arsenic | 1E-06 | 4E-10 | 1E-07 | 1E-06 | Arsenic | Skin | 0.33 | -- | 0.031 | 0.4 |
| | | | Lead | -- | -- | -- | 0E+00 | Iron | | -- | -- | -- | -- |
| | | | Dieldrin | 6E-09 | 2E-13 | -- | 6E-09 | Manganese | NOAEL (Nervous system)[1] | 0.011 | 0.0024 | -- | 0.01 |
| | | | Aroclor-1260 | 8E-07 | 3E-11 | 4E-07 | 1E-06 | Aluminum | NOAEL | 0.033 | -- | -- | 0.03 |
| | | | Aroclor-1248 | 3E-08 | 1E-12 | 2E-08 | 5E-08 | Chromium | NOAEL (GI)[2] | 0.57 | 0.016 | -- | 0.6 |
| | | | Chromium | NA | 1E-07 | NA | 1E-07 | Lead | | -- | -- | -- | 0.0 |
| | | | | | | | | Dieldrin | Liver | 0.0011 | -- | -- | 0.001 |
| | | | | | | | | Aroclor-1260 | Immune system | 1.1 | -- | 0.6 | 2 |
| | | | | | | | | Aroclor-1248 | Immune system | 0.045 | -- | 0.024 | 0.07 |
| | | | | | | | | C9-C12 Aliphatics | Nervous system | 0.0001 | 0.000000004 | 0.0000570 | 0.0002 |
| | | | | | | | | C9-C10 Aromatics | Kidney | 0.0015 | 0.0000001 | 0.00083 | 0.002 |
| | | | | | | | | C9-C18 Aliphatics | Nervous system | 0.0015 | 0.00000006 | 0.00082 | 0.002 |
| | | | | | | | | C19-C36 Aliphatics | Liver | 0.0018 | -- | 0.001 | 0.003 |
| | | | | | | | | C11-C22 Aromatics | Kidney | 0.11 | 0.000007 | 0.063 | 0.2 |
| | | | (Total) | 2E-06 | 1E-07 | 5E-07 | 2E-06 | (Total) | | 2 | 0.02 | 0.7 | 2.9 |
| | | | Total Risk Across All Media and All Exposure Routes | | | | 5E-06 | Total Hazard Index Across All Media and All Exposure Routes | | | | | 4 |

| | |
|---|---|
| Total [Skin] HI = | 1 |
| Total [GI] HI = | 0.6 |
| Total [Nervous system] HI = | 0.04 |
| Total [Liver] HI = | 0.004 |
| Total [Kidney] HI = | 0.2 |
| Total [Immune system] HI = | 2 |
| Total [NOAEL] HI = | 0.7 |

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specific hazard index that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

TABLE 8
RISK ASSESSMENT SUMMARY
AREA 2 - RECREATIONAL - ADULT RESIDENT
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Future Unrestricted
Receptor Population: Resident
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Soil | Surface Soil | Area 2 - Recreational | Arsenic | 1E-05 | 5E-09 | 2E-06 | 1E-05 | Arsenic | Skin | 0.094 | -- | 0.013 | 0.1 |
| | | | Aroclor-1260 | 1E-06 | 5E-11 | 1E-06 | 2E-06 | Aroclor-1260 | Immune system | 0.11 | -- | 0.086 | 0.2 |
| | | | | | | | | Iron | -- | -- | -- | -- | -- |
| | | | | | | | | Manganese | NOAEL (Nervous system)[1] | 0.0023 | 0.00044 | -- | 0.003 |
| | | | | | | | | C9-C12 Aliphatics | Nervous system | 0.000021 | 0.0000000008 | 0.000018 | 0.00004 |
| | | | | | | | | C9-C10 Aromatics | Kidney | 0.00033 | 0.000000022 | 0.00029 | 0.0006 |
| | | | | | | | | C9-C18 Aliphatics | Nervous system | 0.00029 | 0.000000012 | 0.00025 | 0.0005 |
| | | | | | | | | C19-C36 Aliphatics | Liver | 0.00036 | -- | 0.00031 | 0.0007 |
| | | | | | | | | C11-C22 Aromatics | Kidney | 0.022 | 0.0000013 | 0.019 | 0.04 |
| | | | (Total) | 1E-05 | 5E-09 | 3E-06 | 1E-05 | (Total) | | 0.2 | 0.0004 | 0.1 | 0.3 |
| | Subsurface Soil | Area 2 - Recreational | Arsenic | 6E-06 | 2E-09 | 9E-07 | 7E-06 | Arsenic | Skin | 0.041 | -- | 0.0039 | 0.05 |
| | | | Lead | -- | -- | -- | 0E+00 | Iron | -- | -- | -- | -- | -- |
| | | | Dieldrin | 4E-08 | 1E-12 | -- | 4E-08 | Manganese | NOAEL (Nervous system)[1] | 0.0014 | 0.00027 | -- | 0.002 |
| | | | Aroclor-1260 | 5E-06 | 2E-10 | 4E-06 | 9E-06 | Aluminum | NOAEL | 0.004 | -- | -- | 0.004 |
| | | | Aroclor-1248 | 2E-07 | 7E-12 | 2E-07 | 4E-07 | Chromium | NOAEL (GI)[2] | 0.47 | 0.0019 | -- | 0.5 |
| | | | Chromium | NA | 8E-07 | NA | 8E-07 | Lead | -- | -- | -- | -- | 0.0 |
| | | | | | | | | Dieldrin | Liver | 0.0013 | -- | -- | 0.001 |
| | | | | | | | | Aroclor-1260 | Immune system | 0.35 | -- | 0.29 | 1 |
| | | | | | | | | Aroclor-1248 | Immune system | 0.014 | -- | 0.011 | 0.03 |
| | | | | | | | | C9-C12 Aliphatics | Nervous system | 0.00013 | 0.000000005 | 0.00011 | 0.0002 |
| | | | | | | | | C9-C10 Aromatics | Kidney | 0.0018 | 0.0000001 | 0.0016 | 0.003 |
| | | | | | | | | C9-C18 Aliphatics | Nervous system | 0.0018 | 0.00000007 | 0.0016 | 0.003 |
| | | | | | | | | C19-C36 Aliphatics | Liver | 0.0022 | -- | 0.0019 | 0.004 |
| | | | | | | | | C11-C22 Aromatics | Kidney | 0.14 | 0.000008 | 0.12 | 0.3 |
| | | | (Total) | 1E-05 | 8E-07 | 5E-06 | 2E-05 | (Total) | | 1 | 0.002 | 0.4 | 1 |
| Groundwater | Groundwater | Area 2 - Recreational | Arsenic | 9E-04 | NA | NA | 9E-04 | Arsenic | Skin | 5 | NA | NA | 5 |
| | | | Aroclor-1260 | 5E-06 | NA | NA | 5E-06 | Aroclor-1260 | Immune system | 0.3 | NA | NA | 0.3 |
| | | | BEHP | 7E-05 | NA | NA | 7E-05 | BEHP | Liver | 0.55 | NA | NA | 0.6 |
| | | | PCE | 1E-05 | NA | NA | 1E-05 | PCE | Liver | 0.04 | NA | NA | 0.04 |
| | | | TCE | 2E-07 | NA | NA | 2E-07 | TCE | Liver | 0.0087 | NA | NA | 0.009 |
| | | | | | | | | 1,2-DCE | Liver | 0.04 | NA | NA | 0.04 |
| | | | | | | | | Manganese | NOAEL (Nervous system)[1] | 0.83 | NA | NA | 0.8 |
| | | | (Total) | 1E-03 | 0E+00 | 0E+00 | 1E-03 | (Total) | | 7 | 0.0 | 0.0 | 7 |
| | | | | | | Total Risk Across All Media and All Exposure Routes | 1E-03 | | | | | Total Hazard Index Across All Media and All Exposure Routes | 8 |

| | |
|---|---|
| Total [Skin] HI = | 5 |
| Total [GI] HI = | 0.5 |
| Total [Nervous system] HI = | 0.8 |
| Total [Liver] HI = | 0.6 |
| Total [Kidney] HI = | 0.3 |
| Total [Immune system] HI = | 1 |
| Total [NOAEL] HI = | 1 |

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system.
Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system.
Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specific hazard index or chemical-specific hazard quotient that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
Shaded value indicates an excess lifetime cancer risk that exceeds the upper-bound of the USEPA cancer risk range ($1x10^{-4}$ to $1x10^{-6}$)
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data
BEHP - bis(2-ethylhexyl)phthalate
1,2-DCE - 1,2-Dichloroethene
TCE - Trichloroethene
PCE - Tetrachloroethene

TABLE 9
RISK ASSESSMENT SUMMARY
AREA 2 - RECREATIONAL - CHILD RESIDENT
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Future Unrestricted
Receptor Population: Resident
Receptor Age: Child

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Soil | Surface Soil | Area 2 - Recreational | Arsenic | 3E-05 | 3E-09 | 1E-05 | 4E-05 | Arsenic | Skin | 0.87 | -- | 0.28 | 1 |
| | | | Aroclor-1260 | 3E-06 | 3E-11 | 6E-06 | 9E-06 | Aroclor-1260 | Immune system | 0.99 | -- | 1.8 | 3 |
| | | | | | | | | Iron | | -- | -- | -- | -- |
| | | | | | | | | Manganese | NOAEL (Nervous system)[1] | 0.021 | 0.001 | -- | 0.02 |
| | | | | | | | | C9-C12 Aliphatics | Nervous system | 0.00019 | 0.000000002 | 0.00036 | 0.0006 |
| | | | | | | | | C9-C10 Aromatics | Kidney | 0.0031 | 0.000000051 | 0.006 | 0.009 |
| | | | | | | | | C9-C18 Aliphatics | Nervous system | 0.0027 | 0.000000027 | 0.0052 | 0.008 |
| | | | | | | | | C19-C36 Aliphatics | Liver | 0.0033 | -- | 0.0063 | 0.01 |
| | | | | | | | | C11-C22 Aromatics | Kidney | 0.21 | 0.0000029 | 0.4 | 0.6 |
| | | | (Total) | 3E-05 | 3E-09 | 2E-05 | 5E-05 | (Total) | | 2 | 0.001 | 2 | 5 |
| | Subsurface Soil | Area 2 - Recreational | Arsenic | 1E-05 | 1E-09 | 5E-06 | 2E-05 | Arsenic | Skin | 0.38 | -- | 0.12 | 0.5 |
| | | | Lead | -- | -- | -- | 0E+00 | Iron | | -- | -- | -- | -- |
| | | | Dieldrin | 8E-08 | 8E-13 | -- | 8E-08 | Manganese | NOAEL (Nervous system)[1] | 0.013 | 0.00062 | -- | 0.01 |
| | | | Aroclor-1260 | 1E-05 | 1E-10 | 2E-05 | 3E-05 | Aluminum | NOAEL | 0.026 | -- | -- | 0.03 |
| | | | Aroclor-1248 | 4E-07 | 4E-12 | 8E-07 | 1E-06 | Chromium | NOAEL (GI)[2] | 4.4 | 0.0043 | -- | 4 |
| | | | Chromium | NA | 4E-07 | NA | 4E-07 | Lead | | -- | -- | -- | 0.0 |
| | | | | | | | | Dieldrin | Liver | 0.0012 | -- | -- | 0.001 |
| | | | | | | | | Aroclor-1260 | Immune system | 3.3 | -- | 5.9 | 9 |
| | | | | | | | | Aroclor-1248 | Immune system | 0.13 | -- | 0.24 | 0.4 |
| | | | | | | | | C9-C12 Aliphatics | Nervous system | 0.0012 | 0.000000012 | 0.00230 | 0.004 |
| | | | | | | | | C9-C10 Aromatics | Kidney | 0.017 | 0.0000003 | 0.033 | 0.05 |
| | | | | | | | | C9-C18 Aliphatics | Nervous system | 0.017 | 0.00000017 | 0.032 | 0.05 |
| | | | | | | | | C19-C36 Aliphatics | Liver | 0.021 | -- | 0.039 | 0.06 |
| | | | | | | | | C11-C22 Aromatics | Kidney | 1.3 | 0.000018 | 2.5 | 4 |
| | | | (Total) | 2E-05 | 4E-07 | 3E-05 | 5E-05 | (Total) | | 10 | 0.005 | 9 | 18 |

Total Risk Across All Media and All Exposure Routes: 1E-04

Total Hazard Index Across All Media and All Exposure Routes: 23

| | |
|---|---|
| Total [Skin] HI = | 2 |
| Total [GI] HI = | 4 |
| Total [Nervous system] HI = | 0.1 |
| Total [Liver] HI = | 0.1 |
| Total [Kidney] HI = | 4 |
| Total [Immune system] HI = | 12 |
| Total [NOAEL] HI = | 4 |

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system.
Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system.
Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specific hazard index or chemical-specific hazard quotient that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
Shaded value indicates an excess lifetime cancer risk that exceeds the upper-bound of the USEPA cancer risk range ($1x10^{-6}$ to $1x10^{-4}$)
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

TABLE 10
RISK ASSESSMENT SUMMARY
AREA 3 - INDUSTRIAL - MAINTENANCE WORKER
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Current/Future
Receptor Population: Maintenance worker
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | |
|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Soil | Surface Soil | Area 3 - Industrial | Arsenic | 5E-06 | 4E-09 | 4E-07 | 5E-06 |
| | | | (Total) | 5E-06 | 4E-09 | 4E-07 | 5E-06 |
| | | | Total Risk Across All Media and All Exposure Routes | | | | 5E-06 |

| Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|
| | Primary Target Organ | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Arsenic | Skin | 0.028 | -- | 0.0024 | 0.03 |
| Iron | | -- | -- | -- | -- |
| Manganese | NOAEL (Nervous system)[1] | 0.0016 | 0.00077 | -- | 0.002 |
| C9-C12 Aliphatics | Nervous system | 0.0000054 | 0.0000000006 | 0.0000028 | 0.00001 |
| C9-C10 Aromatics | Kidney | 0.000033 | 0.0000000056 | 0.000017 | 0.0001 |
| C9-C18 Aliphatics | Nervous system | 0.0000012 | 0.0000000001 | 0.00000064 | 0.0000 |
| C19-C36 Aliphatics | Liver | 0.0000013 | -- | 0.00000067 | 0.0000 |
| C11-C22 Aromatics | Kidney | 0.000066 | 0.0000000096 | 0.000035 | 0.00 |
| (Total) | | 0.03 | 0.0008 | 0.002 | 0.03 |
| Total Hazard Index Across All Media and All Exposure Routes | | | | | 0.03 |
| Total [Skin] HI = | | | | | 0.03 |
| Total [Nervous system] HI = | | | | | 0.002 |
| Total [Liver] HI = | | | | | 0.000002 |
| Total [Kidney] HI = | | | | | 0.0002 |
| Total [NOAEL] HI = | | | | | 0.002 |

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specifc hazard index that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

TABLE 11
RISK ASSESSMENT SUMMARY
AREA 3 - INDUSTRIAL - COMMERCIAL/INDUSTRIAL WORKER
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Future
Receptor Population: Commercial/industrial worker
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Soil | Surface Soil | Area 3 - Industrial | Arsenic | 1E-05 | 1E-08 | 8E-07 | 1E-05 | Arsenic | Skin | 0.08 | -- | 0.0051 | 0.09 |
| | | | | | | | | Iron | | -- | -- | -- | -- |
| | | | | | | | | Manganese | NOAEL (Nervous system)[1] | 0.0045 | 0.0022 | -- | 0.007 |
| | | | | | | | | C9-C12 Aliphatics | Nervous system | 0.000016 | 0.0000000016 | 0.0000059 | 0.00002 |
| | | | | | | | | C9-C10 Aromatics | Kidney | 0.000095 | 0.000000016 | 0.000037 | 0.0001 |
| | | | | | | | | C9-C18 Aliphatics | Nervous system | 0.0000036 | 0.0000000004 | 0.0000013 | 0.000005 |
| | | | | | | | | C19-C36 Aliphatics | Liver | 0.0000037 | -- | 0.0000014 | 0.000005 |
| | | | | | | | | C11-C22 Aromatics | Kidney | 0.00019 | 0.000000027 | 0.000073 | 0.0003 |
| | | | (Total) | 1E-05 | 1E-08 | 8E-07 | 1E-05 | (Total) | | 0.08 | 0.002 | 0.01 | 0.09 |
| Groundwater | Groundwater | Area 3 - Industrial | Arsenic | 2E-04 | NA | NA | 2E-04 | Aluminum | NOAEL | 0.0019 | NA | NA | 0.002 |
| | | | 1,4-Dichlorobenzene | 5E-07 | NA | NA | 5E-07 | Arsenic | Skin | 1.1 | NA | NA | 1 |
| | | | Naphthalene | -- | NA | NA | 0E+00 | Cadmium | Kidney | 0.17 | NA | NA | 0.2 |
| | | | Carbon Tetrachloride | 2E-06 | NA | NA | 2E-06 | Iron | | -- | NA | NA | 0 |
| | | | Chloroform | 2E-07 | NA | NA | 2E-07 | Manganese | NOAEL (Nervous system)[1] | 0.19 | NA | NA | 0.2 |
| | | | Tetrachloroethene | 5E-07 | NA | NA | 5E-07 | 1,2-Dichlorobenzene | NOAEL | 0.0011 | NA | NA | 0.001 |
| | | | | | | | | 1,4-Dichlorobenzene | NOAEL | 0.0018 | NA | NA | 0.002 |
| | | | | | | | | Naphthalene | Liver | 0.0098 | NA | NA | 0.01 |
| | | | | | | | | Carbon Tetrachloride | Liver | 0.063 | NA | NA | 0.06 |
| | | | | | | | | Chloroform | Liver | 0.0098 | NA | NA | 0.01 |
| | | | | | | | | Tetrachloroethene | Liver | 0.0025 | NA | NA | 0.003 |
| | | | | | | | | C9-C10 Aromatics | Kidney | 0.1 | NA | NA | 0.1 |
| | | | (Total) | 2E-04 | 0E+00 | 0E+00 | 2E-04 | (Total) | | 2 | 0.0 | 0.0 | 2 |
| | | | Total Risk Across All Media and All Exposure Routes | | | | 2E-04 | Total Hazard Index Across All Media and All Exposure Routes | | | | | 2 |
| | | | | | | | | Total [Skin] HI = | | | | | 1 |
| | | | | | | | | Total [Nervous system] HI = | | | | | 0.2 |
| | | | | | | | | Total [Liver] HI = | | | | | 0.09 |
| | | | | | | | | Total [Kidney] HI = | | | | | 0.3 |
| | | | | | | | | Total [NOAEL] HI = | | | | | 0.01 |

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system.
Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system.
Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specific hazard index or chemical-specific hazard quotient that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
Shaded value indicates an excess lifetime cancer risk that exceeds the upper-bound of the USEPA cancer risk range ($1x10^{-6}$ to $1x10^{-4}$)
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

TABLE 12
RISK ASSESSMENT SUMMARY
AREA 3 - INDUSTRIAL - CONSTRUCTION WORKER
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Future
Receptor Population: Construction worker
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | |
|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Soil | Surface Soil | Area 3 - Industrial | Arsenic | 2E-06 | 9E-10 | 2E-07 | 2E-06 |
| | | | (Total) | 2E-06 | 9E-10 | 2E-07 | 2E-06 |
| | Subsurface Soil | Area 3 - Industrial | Arsenic | 5E-07 | 2E-10 | 5E-08 | 5E-07 |
| | | | (Total) | 5E-07 | 2E-10 | 5E-08 | 5E-07 |
| | | | Total Risk Across All Media and All Exposure Routes | | | | 3E-06 |

| Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|
| | Primary Target Organ | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Arsenic | Skin | 0.64 | -- | 0.06 | 0.7 |
| Iron | | -- | -- | -- | -- |
| Manganese | NOAEL (Nervous system)[1] | 0.036 | 0.0077 | -- | 0.04 |
| C9-C12 Aliphatics | Nervous system | 0.000013 | 0.0000000006 | 0.000007 | 0.00002 |
| C9-C10 Aromatics | Kidney | 0.000076 | 0.0000000056 | 0.000044 | 0.0001 |
| C9-C18 Aliphatics | Nervous system | 0.0000028 | 0.0000000001 | 0.0000016 | 0.000004 |
| C19-C36 Aliphatics | Liver | 0.000003 | -- | 0.0000017 | 0.000005 |
| C11-C22 Aromatics | Kidney | 0.00015 | 0.0000000095 | 0.000087 | 0.0002 |
| (Total) | | 0.7 | 0.008 | 0.06 | 0.7 |
| Arsenic | Skin | 0.15 | -- | 0.014 | 0.2 |
| Iron | | -- | -- | -- | -- |
| C9-C12 Aliphatics | Nervous system | 0.00000066 | 0.00000000003 | 0.0000004 | 0.000001 |
| C9-C10 Aromatics | Kidney | 0.0000055 | 0.0000000004 | 0.0000031 | 0.000009 |
| C9-C18 Aliphatics | Nervous system | 0.000061 | 0.000000003 | 0.000034 | 0.0001 |
| C19-C36 Aliphatics | Liver | 0.000077 | 0.00000011 | 0.000044 | 0.0001 |
| C11-C22 Aromatics | Kidney | 0.0017 | 0.00000003 | 0.00099 | 0.003 |
| (Total) | | 0.2 | 0.0000001 | 0.02 | 0.2 |
| Total Hazard Index Across All Media and All Exposure Routes | | | | | 0.9 |

| | |
|---|---|
| Total [Skin] HI = | 0.9 |
| Total [Nervous system] HI = | 0.04 |
| Total [Liver] HI = | 0.0001 |
| Total [Kidney] HI = | 0.003 |
| Total [NOAEL] HI = | 0.04 |

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specifc hazard index that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

TABLE 13
RISK ASSESSMENT SUMMARY
AREA 3 - INDUSTRIAL - ADULT RESIDENT
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Future Unrestricted
Receptor Population: Resident
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Soil | Surface Soil | Area 3 - Industrial | Arsenic | 1E-05 | 5E-09 | 2E-06 | 1E-05 | Arsenic | Skin | 0.08 | -- | 0.012 | 0.09 |
| | | | | | | | | Iron | | -- | -- | -- | -- |
| | | | | | | | | Manganese | NOAEL (Nervous system)[1] | 0.0045 | 0.00088 | -- | 0.005 |
| | | | | | | | | C9-C12 Aliphatics | Nervous system | 0.000016 | 0.0000000006 | 0.000013 | 0.00003 |
| | | | | | | | | C9-C10 Aromatics | Kidney | 0.000095 | 0.0000000064 | 0.000083 | 0.0002 |
| | | | | | | | | C9-C18 Aliphatics | Nervous system | 0.0000036 | 0.0000000001 | 0.0000031 | 0.00001 |
| | | | | | | | | C19-C36 Aliphatics | Liver | 0.0000037 | -- | 0.0000032 | 0.00001 |
| | | | | | | | | C11-C22 Aromatics | Kidney | 0.00019 | 0.000000011 | 0.00017 | 0.000 |
| | | | (Total) | 1E-05 | 5E-09 | 2E-06 | 1E-05 | (Total) | | 0.08 | 0.0009 | 0.01 | 0.1 |
| | Subsurface Soil | Area 3 - Industrial | Arsenic | 3E-06 | 1E-09 | 4E-07 | 3E-06 | Arsenic | Skin | 0.019 | -- | 0.0027 | 0.02 |
| | | | | | | | | Iron | | -- | -- | -- | 0.0 |
| | | | | | | | | C9-C12 Aliphatics | Nervous system | 0.00000082 | 0.00000000003 | 0.0000007 | 0.000002 |
| | | | | | | | | C9-C10 Aromatics | Kidney | 0.0000068 | 0.0000000005 | 0.000006 | 0.00001 |
| | | | | | | | | C9-C18 Aliphatics | Nervous system | 0.000076 | 0.0000000031 | 0.000066 | 0.0001 |
| | | | | | | | | C19-C36 Aliphatics | Liver | 0.000097 | -- | 0.000083 | 0.0002 |
| | | | | | | | | C11-C22 Aromatics | Kidney | 0.0022 | 0.0000001200 | 0.0019 | 0.004 |
| | | | (Total) | 3E-06 | 1E-09 | 4E-07 | 3E-06 | (Total) | | 0.02 | 0.0000001 | 0.005 | 0.03 |
| Groundwater | Groundwater | Area 3 - Industrial | Arsenic | 6E-04 | | | 6E-04 | Aluminum | NOAEL | 0.0052 | NA | NA | 0.005 |
| | | | 1,4-Dichlorobenzene | 2E-06 | | | 2E-06 | Arsenic | Skin | 3 | NA | NA | 3 |
| | | | Naphthalene | -- | | | 0E+00 | Cadmium | Kidney | 0.48 | NA | NA | 0.5 |
| | | | Carbon Tetrachloride | 7E-06 | | | 7E-06 | Iron | | -- | NA | NA | -- |
| | | | Chloroform | 7E-07 | | | 7E-07 | Manganese | NOAEL (Nervous system)[1] | 0.53 | NA | NA | 0.5 |
| | | | Tetrachloride | 2E-06 | | | 2E-06 | 1,2-Dichlorobenzene | NOAEL | 0.003 | NA | NA | 0.003 |
| | | | | | | | | 1,4-Dichlorobenzene | NOAEL | 0.0051 | NA | NA | 0.005 |
| | | | | | | | | Naphthalene | Liver | 0.027 | NA | NA | 0.03 |
| | | | | | | | | Carbon Tetrachloride | Liver | 0.18 | NA | NA | 0.2 |
| | | | | | | | | Chloroform | Liver | 0.027 | NA | NA | 0.03 |
| | | | | | | | | Tetrachloroethane | Liver | 0.0071 | NA | NA | 0.007 |
| | | | | | | | | C9-C10 Aromatics | Kidney | 0.28 | NA | NA | 0.28 |
| | | | (Total) | 6E-04 | 0E+00 | 0E+00 | 6E-04 | (Total) | | 5 | 0.0 | 0.0 | 5 |
| | | | Total Risk Across All Media and All Exposure Routes | | | | 6E-04 | Total Hazard Index Across All Media and All Exposure Routes | | | | | 5 |
| | | | | | | | | Total [Skin] HI = | | | | | 3 |
| | | | | | | | | Total [Nervous system] HI = | | | | | 0.5 |
| | | | | | | | | Total [Liver] HI = | | | | | 0.2 |
| | | | | | | | | Total [Kidney] HI = | | | | | 0.8 |
| | | | | | | | | Total [NOAEL] HI = | | | | | 0.5 |

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system
Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system
Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specific hazard index or chemical-specific hazard quotient that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
Shaded value indicates an excess lifetime cancer risk that exceeds the upper-bound of the USEPA cancer risk range ($1x10^{-6}$ to $1x10^{-4}$)
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

TABLE 14
RISK ASSESSMENT SUMMARY
AREA 3 - INDUSTRIAL - CHILD RESIDENT
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Future Unrestricted
Receptor Population: Resident
Receptor Age: Child

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Soil | Surface Soil | Area 3 - Industrial | Arsenic | 3E-05 | 3E-09 | 1E-05 | 4E-05 | Arsenic | Skin | 0.75 | -- | 0.24 | 1 |
| | | | | | | | | Iron | | -- | -- | -- | -- |
| | | | | | | | | Manganese | NOAEL (Nervous system)[1] | 0.042 | 0.002 | -- | 0.04 |
| | | | | | | | | C9-C12 Aliphatics | Nervous system | 0.00015 | 0.0000000014 | 0.00028 | 0.0004 |
| | | | | | | | | C9-C10 Aromatics | Kidney | 0.00089 | 0.0000000015 | 0.0017 | 0.003 |
| | | | | | | | | C9-C18 Aliphatics | Nervous system | 0.000033 | 0.0000000003 | 0.000063 | 0.0001 |
| | | | | | | | | C19-C36 Aliphatics | Liver | 0.000035 | -- | 0.000066 | 0.0001 |
| | | | | | | | | C11-C22 Aromatics | Kidney | 0.0018 | 0.000000025 | 0.0034 | 0.005 |
| | | | (Total) | 3E-05 | 3E-09 | 1E-05 | 4E-05 | (Total) | | 0.8 | 0.002 | 0.2 | 1 |
| | Subsurface Soil | Area 3 - Industrial | Arsenic | 7E-06 | 6E-10 | 2E-06 | 9E-06 | Arsenic | Skin | 0.18 | -- | 0.056 | 0.2 |
| | | | | | | | | Iron | | -- | -- | -- | -- |
| | | | | | | | | C9-C12 Aliphatics | Nervous system | 0.0000077 | 0.00000000008 | 0.0000150 | 0.00002 |
| | | | | | | | | C9-C10 Aromatics | Kidney | 0.000064 | 0.0000000001 | 0.00012 | 0.0002 |
| | | | | | | | | C9-C18 Aliphatics | Nervous system | 0.00071 | 0.0000000070 | 0.0014 | 0.0021 |
| | | | | | | | | C19-C36 Aliphatics | Liver | 0.0009 | -- | 0.0017 | 0.0026 |
| | | | | | | | | C11-C22 Aromatics | Kidney | 0.02 | 0.00000028 | 0.039 | 0.06 |
| | | | (Total) | 7E-06 | 6E-10 | 2E-06 | 9E-06 | (Total) | | 0.2 | 0.0000003 | 0.1 | 0.3 |
| | | | Total Risk Across All Media and All Exposure Routes | | | | 5E-05 | Total Hazard Index Across All Media and All Exposure Routes | | | | | 1 |

| | |
|---|---|
| Total [Skin] HI = | 1 |
| Total [Nervous system] HI = | 0.05 |
| Total [Liver] HI = | 0.003 |
| Total [Kidney] HI = | 0.1 |
| Total [NOAEL] HI = | 0.04 |

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specifc hazard index that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

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TABLE 15
RISK ASSESSMENT SUMMARY
AREA 3 - RECREATIONAL - RECREATIONAL VISITOR
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Current/Future
Receptor Population: Recreational visitor
Receptor Age: Child (ages 6 through 16)

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Soil | Surface Soil | Area 3 - Recreational | Arsenic | 2E-06 | NA | 3E-06 | 5E-06 | Arsenic | Skin | 0.035 | NA | 0.042 | 0.1 |
| | | | Dieldrin | 1E-07 | NA | -- | 1E-07 | Dieldrin | Liver | 0.001 | NA | -- | 0.001 |
| | | | | | | | | Manganese | NOAEL (Nervous system)[1] | 0.0009 | NA | -- | 0.0009 |
| | | | | | | | | C9-C12 Aliphatics | Nervous system | 0.00094 | NA | 0.0067 | 0.008 |
| | | | | | | | | C9-C10 Aromatics | Kidney | 0.0075 | NA | 0.055 | 0.06 |
| | | | | | | | | C9-C18 Aliphatics | Nervous system | 0.00081 | NA | 0.0058 | 0.007 |
| | | | | | | | | C19-C36 Aliphatics | Liver | 0.0012 | NA | 0.0089 | 0.01 |
| | | | | | | | | C11-C22 Aromatics | Kidney | 0.039 | NA | 0.28 | 0.3 |
| | | | (Total) | 2E-06 | 0E+00 | 3E-06 | 5E-06 | (Total) | | 0.1 | 0.0 | 0.4 | 0.5 |
| Sediment | Sediment | Area 3 - Recreational | Arsenic | 8E-07 | NA | 4E-06 | 5E-06 | Arsenic | Skin | 0.012 | NA | 0.055 | 0.07 |
| | | | Aroclor-1260 | 2E-08 | NA | 7E-07 | 7E-07 | Aroclor-1260 | Immune system | 0.0039 | NA | 0.11 | 0.1 |
| | | | | | | | | Manganese | NOAEL (Nervous system)[1] | 0.00061 | NA | -- | 0.0006 |
| | | | | | | | | C9-C12 Aliphatics | Nervous system | 0.00000087 | NA | 0.000025 | 0.00003 |
| | | | | | | | | C9-C10 Aromatics | Kidney | 0.000013 | NA | 0.00039 | 0.0004 |
| | | | | | | | | C5-C8 Aliphatics | Nervous system | 0.0000052 | NA | 0.00015 | 0.0002 |
| | | | | | | | | C19-C36 Aliphatics | Liver | 0.0000098 | NA | 0.00028 | 0.0003 |
| | | | | | | | | C11-C22 Aromatics | Kidney | 0.00087 | NA | 0.025 | 0.03 |
| | | | (Total) | 8E-07 | 0E+00 | 5E-06 | 6E-06 | (Total) | | 0.02 | 0.0 | 0.2 | 0.2 |
| Surface water | Surface water | Area 3 - Recreational | Arsenic | 3E-06 | NA | 7E-07 | 4E-06 | Antimony | NOAEL | 0.0014 | NA | 0.0018 | 0.003 |
| | | | Benzo(k)fluoranthene | 1E-09 | NA | 3E-07 | 3E-07 | Arsenic | Skin | 0.05 | NA | 0.01 | 0.06 |
| | | | | | | | | Barium | Cardiovascular | 0.00039 | NA | 0.0011 | 0.001 |
| | | | | | | | | Manganese | NOAEL (Nervous system)[1] | 0.00038 | NA | 0.0012 | 0.002 |
| | | | | | | | | Benzo(k)fluoranthene | NOAEL | -- | NA | -- | 0 |
| | | | | | | | | C11-C22 Aromatics | Kidney | 0.0021 | NA | -- | 0.002 |
| | | | | | | | | C19-C36 Aliphatics | Liver | 0.000018 | NA | -- | 0.00002 |
| | | | | | | | | C9-C10 Aromatics | Kidney | 0.000081 | NA | -- | 0.00008 |
| | | | (Total) | 3E-06 | 0E+00 | 1E-06 | 4E-06 | (Total) | | 0.05 | 0.0 | 0.01 | 0.1 |
| | | | Total Risk Across All Media and All Exposure Routes | | | | 1E-05 | | Total Hazard Index Across All Media and All Exposure Routes | | | | 0.7 |

| | |
|---|---|
| Total [Skin] HI = | 0.3 |
| Total [Nervous system] HI = | 0.02 |
| Total [Liver] HI = | 0.01 |
| Total [Kidney] HI = | 0.4 |
| Total [Cardiovascular] HI = | 0.001 |
| Total [Immune system] HI = | 0.1 |
| Total [NOAEL] HI = | 0.01 |

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specific hazard index that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

TABLE 16
RISK ASSESSMENT SUMMARY
AREA 3 - RECREATIONAL - CONSTRUCTION WORKER
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Future
Receptor Population: Construction worker
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | |
|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Soil | Surface Soil | Area 3 - Recreational | Arsenic | 1E-06 | 6E-10 | 1E-07 | 1E-06 |
| | | | Dieldrin | 7E-07 | 3E-12 | -- | 7E-07 |
| | | | (Total) | 2E-06 | 6E-10 | 1E-07 | 2E-06 |
| | Subsurface Soil | Area 3 - Recreational | Arsenic | 1E-06 | 6E-10 | 1E-07 | 1E-06 |
| | | | (Total) | 1E-06 | 6E-10 | 1E-07 | 1E-06 |
| Total Risk Across All Media and All Exposure Routes | | | | | | | 3E-06 |

| Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|
| | Primary Target Organ | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Arsenic | Skin | 0.44 | -- | 0.041 | 0.5 |
| Dieldrin | Liver | 0.013 | -- | -- | 0.0 |
| Manganese | NOAEL (Nervous system)[1] | 0.011 | 0.0024 | -- | 0.01 |
| C9-C12 Aliphatics | Nervous system | 0.0012 | 0.000000051 | 0.00066 | 0.00186 |
| C9-C10 Aromatics | Kidney | 0.0094 | 0.00000069 | 0.0054 | 0.0148 |
| C9-C18 Aliphatics | Nervous system | 0.001 | 0.000000045 | 0.00057 | 0.0016 |
| C19-C36 Aliphatics | Liver | 0.0016 | -- | 0.00088 | 0.0025 |
| C11-C22 Aromatics | Kidney | 0.049 | 0.000003 | 0.028 | 0.08 |
| (Total) | | 1 | 0.002 | 0.1 | 0.6 |
| Arsenic | Skin | 0.44 | -- | 0.042 | 0.5 |
| (Total) | | 0.4 | 0 | 0.04 | 0.5 |
| Total Hazard Index Across All Media and All Exposure Routes | | | | | 1 |

| | |
|---|---|
| Total [Skin] HI = | 1 |
| Total [Nervous system] HI = | 0.02 |
| Total [Liver] HI = | 0.02 |
| Total [Kidney] HI = | 0.1 |
| Total [NOAEL] HI = | 0.01 |

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system. Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specifc hazard index that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

TABLE 17
RISK ASSESSMENT SUMMARY
AREA 3 - RECREATIONAL - ADULT RESIDENT
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Future Unrestricted
Receptor Population: Resident
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Soil | Surface Soil | Area 3 - Recreational | Arsenic | 8E-06 | 3E-09 | 1E-06 | 9E-06 | Arsenic | Skin | 0.055 | -- | 0.0079 | 0.1 |
| | | | Dieldrin | 4E-07 | 2E-11 | -- | 4E-07 | Dieldrin | Liver | 0.0016 | -- | -- | 0.002 |
| | | | | | | | | Manganese | NOAEL (Nervous system)[1] | 0.0014 | 0.00027 | -- | 0.002 |
| | | | | | | | | C9-C12 Aliphatics | Nervous system | 0.0015 | 0.000000059 | 0.0013 | 0.003 |
| | | | | | | | | C9-C10 Aromatics | Kidney | 0.012 | 0.00000079 | 0.01 | 0.02 |
| | | | | | | | | C9-C18 Aliphatics | Nervous system | 0.0013 | 0.000000051 | 0.0011 | 0.002 |
| | | | | | | | | C19-C36 Aliphatics | Liver | 0.002 | -- | 0.0017 | 0.004 |
| | | | | | | | | C11-C22 Aromatics | Kidney | 0.061 | 0.0000035 | 0.053 | 0.1 |
| | | | (Total) | 8E-06 | 3E-09 | 1E-06 | 9E-06 | (Total) | | 0.1 | 0.0003 | 0.08 | 0.2 |
| | Subsurface Soil | Area 3 - Recreational | Arsenic | 8E-06 | 3E-09 | 1E-06 | 9E-06 | Arsenic | Skin | 0.055 | -- | 0.0079 | 0.06 |
| | | | (Total) | 8E-06 | 3E-09 | 1E-06 | 9E-06 | (Total) | | 0.06 | 0 | 0.008 | 0.06 |
| Groundwater | Groundwater | Area 3 - Recreational | Arsenic | 1E-03 | NA | NA | 1E-03 | Arsenic | Skin | 7.7 | NA | NA | 8 |
| | | | 1,4-Dichlorobenzene | 8E-07 | NA | NA | 8E-07 | Aluminum | NOAEL | 0.067 | NA | NA | 0.07 |
| | | | BEHP | 8E-06 | NA | NA | 8E-06 | Iron | | -- | NA | NA | 0 |
| | | | Naphthalene | -- | NA | NA | 0E+00 | 1,4-Dichlorobenzene | NOAEL | 0.0025 | NA | NA | 0.003 |
| | | | PCE | 3E-06 | NA | NA | 3E-06 | Naphthalene | Liver | 0.018 | NA | NA | 0.02 |
| | | | TCE | 5E-07 | NA | NA | 5E-07 | BEHP | Liver | 0.071 | NA | NA | 0.07 |
| | | | | | | | | PCE | Liver | 0.015 | NA | NA | 0.02 |
| | | | | | | | | TCE | Liver | 0.017 | NA | NA | 0.02 |
| | | | | | | | | Manganese | NOAEL (Nervous system)[1] | 0.39 | NA | NA | 0.4 |
| | | | | | | | | C5-C8 Aliphatics | Nervous system | 0.041 | NA | NA | 0.04 |
| | | | | | | | | C9-C12 Aliphatics | Nervous system | 0.0019 | NA | NA | 0.002 |
| | | | | | | | | C9-C10 Aromatics | Kidney | 0.16 | NA | NA | 0.2 |
| | | | (Total) | 1E-03 | 0E+00 | 0E+00 | 1E-03 | (Total) | | 8 | 0 | 0 | 8 |
| | | | Total Risk Across All Media and All Exposure Routes | | | | 1E-03 | Total Hazard Index Across All Media and All Exposure Routes | | | | | 9 |

| | |
|---|---|
| Total [Skin] HI = | 8 |
| Total [Nervous system] HI = | 0.4 |
| Total [Liver] HI = | 0.2 |
| Total [Kidney] HI = | 0.3 |
| Total [NOAEL] HI = | 0.5 |

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system.
Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system.
Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specific hazard index or chemical-specific hazard quotient that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
Shaded value indicates an excess lifetime cancer risk that exceeds the upper-bound of the USEPA cancer risk range ($1x10^{-6}$ to $1x10^{-4}$)
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data
BEHP - bis(2-ethylhexyl)phthalate
TCE - Trichloroethene
PCE - Tetrachloroethene

TABLE 18
RISK ASSESSMENT SUMMARY
AREA 3 - RECREATIONAL - CHILD RESIDENT
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

Scenario Timeframe: Future Unrestricted
Receptor Population: Resident
Receptor Age: Child

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | |
|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Soil | Surface Soil | Area 3 - Recreational | Arsenic | 2E-05 | 2E-09 | 6E-06 | 3E-05 |
| | | | Dieldrin | 1E-06 | 1E-11 | -- | 1E-06 |
| | | | (Total) | 2E-05 | 2E-09 | 6E-06 | 3E-05 |
| | Subsurface Soil | Area 3 - Recreational | Arsenic | 2E-05 | 2E-09 | 6E-06 | 3E-05 |
| | | | (Total) | 2E-05 | 2E-09 | 6E-06 | 3E-05 |
| Total Risk Across All Media and All Exposure Routes | | | | | | | 5E-05 |

| Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|
| | Primary Target Organ | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Arsenic | Skin | 0.51 | -- | 0.16 | 0.7 |
| Dieldrin | Liver | 0.015 | -- | -- | 0.02 |
| Manganese | NOAEL (Nervous system)[1] | 0.013 | 0.00063 | -- | 0.01 |
| C9-C12 Aliphatics | Nervous system | 0.014 | 0.00000014 | 0.026 | 0.04 |
| C9-C10 Aromatics | Kidney | 0.11 | 0.0000018 | 0.21 | 0.3 |
| C9-C18 Aliphatics | Nervous system | 0.012 | 0.00000012 | 0.023 | 0.04 |
| C19-C36 Aliphatics | Liver | 0.018 | -- | 0.035 | 0.05 |
| C11-C22 Aromatics | Kidney | 0.57 | 0.000008 | 1.1 | 2 |
| (Total) | | 1 | 0.0006 | 2 | 3 |
| Arsenic | Skin | 0.52 | -- | 0.16 | 0.68 |
| (Total) | | 0.5 | 0.0 | 0.2 | 0.7 |
| Total Hazard Index Across All Media and All Exposure Routes | | | | | 3 |
| Total [Skin] HI = | | | | | 1 |
| Total [Nervous system] HI = | | | | | 0.1 |
| Total [Liver] HI = | | | | | 0.1 |
| Total [Kidney] HI = | | | | | 2 |
| Total [NOAEL] HI = | | | | | 0.01 |

Notes:
1 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the nervous system.
Therefore, the HQ for this chemical was included in the segregated HI for effects to the nervous system to provide a conservative estimate of the HI.
2 - RfD is based on NOAEL dose level. However, higher doses in study used to develop RfD were associated with effects on the GI system.
Therefore, the HQ for this chemical was included in the segregated HI for effects to the GI system to provide a conservative estimate of the HI.
Shaded value indicates a target organ-specifc hazard index or chemical-specific hazard quotient that exceeds the USEPA threshold hazard index value of 1, indicating that there is an increased liklihood of adverse effects to this target organ/system.
Shaded value indicates an excess lifetime cancer risk that exceeds the upper-bound of the USEPA cancer risk range ($1x10^{-6}$ to $1x10^{-4}$)
NA - No toxicity data
NOAEL - No observable adverse effect level
HQ - Hazard quotient
HI - Hazard index
-- = No toxicity data

ECOLOGICAL RISK ASSESSMENT

O-1 EXPOSURE AND EFFECTS ASSUMPTIONS CPCs

O-2 ECOLOGICAL RISK CALCULATIONS

O-3 ECOLOGICAL RISK CALCULATIONS FOR CPCs SUPPORTING INFORMATION

O-4 ECOLOGICAL RISK CALCULATIONS FOR NON-CPCs SUPPORTING INFORMATION

O-5 STATISTICAL ANALYSIS OF TOXICITY TESTING (MIDGE GROWTH)

# O-1 EXPOSURE AND EFFECTS ASSUMPTIONS FOR CPCs

## Table O-1.1
## Exposure Parameters for Representative Wildlife Species
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Representative Wildlife Species | Body Weight (kg) | Reported Diet | Assumed Diet for Exposure Assessment (% of diet) | Food Ingestion Rate (kg/day) | Water Intake Rate (ℓ /day) | Exposure Duration | Home Range (acres) |
|---|---|---|---|---|---|---|---|
| White-footed mouse (*Peromyscus leucopus*) | 0.040 [a] | Seeds and some insects [a] | 88% Plants<br>10% Invertebrates<br>2% Soil [a] | 0.0049 [b] | 0.0055 [c] | 1 | 0.147 [d] |
| Short-tailed shrew (*Blarina brevicauda*) | 0.017 [a] | Earthworms, slugs, snails, fungi, insects, and vegetation [b] | 78% Invertebrates<br>12% Plants<br>10% Soil [g] | 0.0024 [b] | 0.0025 [c] | 1 | 0.96 ± 0.09 [a] |
| Muskrat (*Ondatra zibethicus*) | 1.27 [e] | Cattails, reeds, pondweeds, bulrushes, water lillies, fresh-water clams, and other small aquatic animals [f] | 80% Plants<br>10% Invertebrates<br>10% Sediment [g] | 0.084 [b] | 0.12 [c] | 1 | 0.20 [h] |
| American robin (*Turdus migratorius*) | 0.077 [i] | Fruits and invertebrates [j]. | 57% Plants<br>33% Invertebrates<br>10% Soil [k] | 0.011 [l] | 0.011 [m] | 0.75 [v] | 0.48 [n] |
| Mallard (*Anas platyrhynchos*) | 1.134 [o] | Primarily aquatic plants in winter. Breeding females eat grasses, rice, insects, gastropods, insects, crustaceans, and annelids [a] | 97% Plants<br>1% Invertebrates<br>2% Sediment [k] | 0.063 [l] | 0.064 [m] | 1 | 235 [p] |
| Red fox (*Vulpes vulpes*) | 4.69 [q] | Small mammals, birds, and invertebrates, as well as berries and other fruits. [a] | 57% Small mammals<br>20% Invertebrates<br>10% Small birds<br>10% Plants<br>3% Soil [a] | 0.24 [b] | 0.40 [c] | 1 | 1,727 ± 339 [a] |

See notes at end of table

**Table O-1.1**
**Exposure Parameters for Representative Wildlife Species**
**AOC 57**

Remedial Investigation Report
Devens, Massachusetts

| Representative Wildlife Species | Body Weight (kg) | Reported Diet | Assumed Diet for Exposure Assessment (% of diet) | Food Ingestion Rate (kg/day) | Water Intake Rate (ℓ /day) | Exposure Duration | Home Range (acres) |
|---|---|---|---|---|---|---|---|
| Raccoon (*Procyon lotor*) | 3.99 [r] | Mostly fleshy fruits, nuts acorns, corn; also frogs, crayfish, and insects [a] | Sediment Exposures:<br>91% Crayfish and other aquatic invertebrates<br>9% Sediment [k]<br>Floodplain Exposures:<br>56% Plants<br>14% Invertebrates<br>19% Mammals<br>2% Birds<br>9% Soil [k] | 0.214 [b] | 0.344 [c] | 1 | 385 [s] |
| Barred owl (*Strix varia*) | 0.72 [t] | Mice (staple) and other small mammals, frogs, birds, insects, crayfish, [f] | 80% Small mammals<br>12% Small birds<br>3% Invertebrates<br>5% Soil [g] | 0.047 [l] | 0.047 [m] | 1 | 565 [f] |
| Great blue heron (*Ardea herodias*) | 2.23 ± 0.76 [a] | Mostly fish; some amphibians, crustaceans, and birds [a] | 98% Fish and aquatic invertebrates<br>2% Sediment [g] | 0.401 [l] | 0.101 [m] | 0.5 [v] | 1.5 [u] |

See notes at end of table

## Table O-1.1
## Exposure Parameters for Representative Wildlife Species
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Representative Wildlife Species | Body Weight (kg) | Reported Diet | Assumed Diet for Exposure Assessment (% of diet) | Food Ingestion Rate (kg/day) | Water Intake Rate (ℓ /day) | Exposure Duration | Home Range (acres) |
|---|---|---|---|---|---|---|---|

References:
[a] Wildlife Exposure Factors Handbook (USEPA, 1993a). Values for the cotton mouse and deer mouse are used for the white-footed mouse when not available. Mean of means reported for male and female shrews in summer and fall.
[b] Calculated using the mammal equation based on body weight (Wt.) in kg. Food ingestion (kg/day) = $0.0687 \times Wt^{0.822}$ (kg) (USEPA, 1993a).
[c] Calculated using the mammal equation based on body weight (Wt.) in kg. Water ingestion (l/day) = $0.099 \times Wt^{0.90}$ (kg) (USEPA, 1993a).
[d] Average for male and female deer mice, Virginia/mixed deciduous forest (USEPA, 1993a).
[e] Average of male and female muskrat body weights during winter in Tennessee (USEPA, 1993a).
[f] DeGraaf & Rudis (1986).
[g] Estimated soil ingestion.
[h] Average of mean home range values for muskrats in early and late summer in Ontario Bay (USEPA, 1993a).
[i] Mean year-round value for male and female robins in Pennsylvania (USEPA, 1993a).
[j] Average year-round values for robins in the eastern United States (USEPA, 1993a).
[k] The sediment ingestion for raccoons and mallards were estimated to be the same as their estimated soil ingestion. The soil ingestion rate for the robin was assumed to be the same as for American woodcocks, which ingest higher percentages of soil because of their relatively high dietary composition of earthworms (USEPA 1993a).
[l] Calculated using the bird equation based on body weight (Wt.) in kg. Food ingestion (kg/day) = $0.0582 \times Wt^{0.651}$ (kg) (USEPA, 1993a).
[m] Calculated using the bird equation based on body weight (Wt.) in kg. Water ingestion (l/day) = $0.059 \times Wt^{0.67}$ (kg) (USEPA, 1993a).
[n] Average of mean home range values provided for robins feeding nestlings and fledglings (USEPA, 1993a).
[o] Average of mean body weights for male and female mallards throughout North America (USEPA, 1993a).
[p] Average of male and female mallard home ranges in Minnesota wetlands and rivers (USEPA, 1993a).
[q] Average of adult male and female foxes in spring (USEPA, 1993a).
[r] Median of mean weights for male and female raccoons in Alabama (USEPA, 1993a).
[s] Average of adult male and female raccoons from May to December (USEPA, 1993a).
[t] Midpoint of average for male and female owls (Terres, 1987).
[u] Size of heron feeding territory in summer (USEPA, 1993a).
[v] The exposure durations for the robin and heron are less than 1 due to decreased foraging capabilities (i.e., robins increase their berry consumption and decrease their earthworm consumption in the winter) and/or migration during winter (i.e., inability of heron to forage in stream during frozen wintertime conditions).

Notes:
g = grams
kg = kilograms
kg/day = kilograms per day
ℓ /day = liters per day
% = percent
NA = not applicable

**Table O-1.2**
**Summary of Bioaccumulation and Bioconcentration Data**
**AOC 57**

**Remedial Investigation Report**
**Devens, Massachusetts**

| Analyte | log $K_{ow}$ [b] | | Bioaccumulation Factor [a] | | | | | | Bioconcentration Factor [a] |
|---|---|---|---|---|---|---|---|---|---|
| | | | Terrestrial Invertebrate [c] | Terrestrial Plant [d] | Mammal [e] | Bird [f] | Aquatic [g] Invertebrate | Aquatic Plant | Fish |
| INORGANICS | | | | | | | | | |
| Aluminum | NA | | 7.5E-02 [h] | 8.0E-04 [i] | 7.5E-02 [j] | 7.5E-02 | 7.5E-02 | 6.0E-03 [k] | 9.5E+01 [l] |
| Antimony | NA | | 5.0E-02 [h] | 4.0E-02 [i] | 5.0E-02 [j] | 5.0E-02 | [m] | [m] | [m] |
| Arsenic | NA | | 6.6E-03 [n] | 3.0E-01 [o] | 1.0E-01 [j] | 6.0E-03 | 6.6E-03 | 3.0E-01 [o] | 2.8E+02 [p] |
| Beryllium | NA | | 5.0E-02 [h] | 2.0E-03 [i] | 5.0E-02 [j] | 5.0E-02 | [m] | [m] | [m] |
| Barium | NA | | 7.5E-03 [h] | 3.0E-02 [i] | 7.5E-03 [j] | 7.5E-03 | 7.5E-03 | 2.5E-02 [k] | 4.0E+00 [p] |
| Cadmium | NA | | 1.4E+00 [q] | 3.3E+01 [r] | 2.1E+00 [j] | 3.8E-01 [s] | 1.4E+00 | 4.1E-01 [k] | 3.2E+02 [l] |
| Chromium | NA | | 1.6E-01 [p] | 1.5E-03 [i] | 2.8E-01 [j] | 2.8E-01 | 1.6E-01 | 6.3E-03 [k] | 2.0E+02 |
| Cobalt | NA | | 1.0E+00 [h] | 4.0E-03 [i] | 1.0E+00 [j] | 1.0E+00 | 1.0E+00 | 9.3E-03 [k] | [m] |
| Copper | NA | | 1.6E-01 [t] | 7.8E-01 [u] | 6.0E-01 [r] | 6.0E-01 | 1.6E-01 | 6.0E-02 [k] | 3.4E+02 [l] |
| Lead | NA | | 7.8E-02 [v] | 9.0E-03 [i] | 1.5E-02 [j] | 1.5E-02 | 7.8E-02 | 5.6E-02 [w] | 1.5E+02 [l] |
| Manganese | NA | | 2.0E-02 [h] | 5.0E-02 [i] | 2.0E-02 [j] | 2.0E-02 | 2.0E-02 | 1.3E-01 [k] | 1.7E+03 [l] |
| Mercury | NA | | 6.8E-02 [x] | 1.8E-01 [i] | 1.0E-02 [y] | 2.3E+00 | 1.7E+01 [z] | 2.4E-01 [k] | 6.3E+04 [p] |
| Nickel | NA | | 2.3E-01 [aa] | 1.2E-02 [i] | 3.0E-01 [j] | 3.0E-01 | 2.3E-01 | 1.4E-02 [w] | [m] |
| Selenium | NA | | 7.6E-01 [n] | 9.0E-03 [ab] | 7.5E-01 [j] | 5.1E-01 [ac] | 7.6E-01 | 1.6E-01 [k] | 8.3E+00 [p] |
| Vanadium | NA | | 1.3E-01 [h] | 1.1E-03 [i] | 1.2E-01 [j] | 1.2E-01 | 1.3E-01 | 1.1E-03 [i] | 1.0E-02 [p] |
| Zinc | NA | | 1.8E+00 [t] | 6.1E-01 [r] | 2.1E+00 [j] | 2.1E+00 | 1.8E+00 | 9.2E-01 [k] | 2.3E+02 [l] |
| PESTICIDES/PCBs | | | | | | | | | |
| 4,4'-DDD | 6 | | 3.3E+00 [ad] | 1.0E-02 [ae] | 1.2E+00 [af] | 2.9E+00 [ag] | 2.1E+01 [ah] | 1.0E-02 [ae] | [m] |
| 4,4'-DDE | 5.7 | | 1.7E+00 [ad] | 1.0E-02 [ae] | 1.2E+00 [af] | 2.9E+00 [ag] | 2.1E+00 [ah] | 1.0E-02 [ae] | [m] |
| 4,4'-DDT | 6.4 | | 5.7E-01 [ad] | 1.0E-02 [ae] | 1.2E+00 [af] | 2.9E+00 [ag] | 2.1E+00 [ah] | 1.0E-02 [ae] | [m] |
| Aroclor-1242 | 4.1 [ai] | | 5.8E+00 [t] | 1.2E-01 [aj] | 3.8E+00 [ak] | 3.2E-01 [al] | 5.8E+00 [t] | 1.2E-01 [aj] | [m] |
| Aroclor-1260 | 7.1 [ai] | | 5.8E+00 [t] | 1.2E-01 [aj] | 3.8E+00 [ak] | 3.2E-01 [al] | 5.8E+00 [t] | 1.2E-01 [aj] | [m] |
| alpha-Chlordane | 5.5 | | 1.6E+00 [ar] | 5.1E-03 | 5.5E-01 [as] | 1.8E+00 [at] | [m] | [m] | [m] |
| gamma-Chlordane | 5.5 | | 1.6E+00 [au] | 5.1E-03 | 5.5E-01 [as] | 1.8E+00 [at] | [m] | [m] | [m] |
| Dieldrin | 4.6 | | 5.5E+00 [am] | 1.7E-02 | 1.5E+00 [an] | 4.4E-01 [ao] | 5.5E+00 [am] | 1.7E-02 | [m] |
| SEMIVOLATILES | | | | | | | | | |
| 1,2-Dichlorobenzene | 3.4 | 3.5 | 5.0E-02 | 7.3E-02 | 1.5E-01 | 1.5E-01 | 5.0E-02 | 7.3E-02 | [m] |
| 1,4-Dichlorobenzene | 3.5 | 3.5 | 5.0E-02 | 7.3E-02 | 1.5E-01 | 1.5E-01 | 5.0E-02 | 7.3E-02 | [m] |
| 2-Methylnaphthalene | -1.9 | 4.3 | 5.0E-02 | 2.5E-02 | 1.5E-01 | 1.5E-01 | 5.0E-02 | 2.5E-02 | [m] |
| Acenaphthylene | 4.1 | 4.3 | 5.0E-02 | 2.5E-02 | 1.5E-01 | 1.5E-01 | [m] | [m] | [m] |
| Benzo(b)fluoranthene | 6.1 | 4.3 | [m] | [m] | [m] | [m] | 5.0E-02 | 2.5E-02 | [m] |
| Benzo(k)fluoranthene | 6.1 | 4.3 | 5.0E-02 | 2.5E-02 | 1.5E-01 | 1.5E-01 | 5.0E-02 | 2.5E-02 | [m] |
| Bis(2-ethylhexyl)phthalate | 5.1 | 5.2 | 5.0E-02 | 7.6E-03 | 2.4E-01 | 2.4E-01 | 5.0E-02 | 7.6E-03 | 3.1E+02 [p] |
| Chrysene | 5.7 | 4.3 | 5.0E-02 | 2.5E-02 | 1.5E-01 | 1.5E-01 | 5.0E-02 | 2.5E-02 | [m] |
| Dibenzofuran | 4.1 | 4.1 | 5.0E-02 | 3.3E-02 | 1.5E-01 | 1.5E-01 | 5.0E-02 | 3.3E-02 | [m] |
| Di-n-butylphthalate | 5.2 | 5.2 | 5.0E-02 | 7.6E-03 | 2.4E-01 | 2.4E-01 | 5.0E-02 | 7.6E-03 | [m] |
| Fluoranthene | 4.95 [ap] | 4.3 | 5.0E-02 | 2.5E-02 | 1.5E-01 | 1.5E-01 | 5.0E-02 | 2.5E-02 | [m] |
| Naphthalene | 3.6 | 4.3 | 5.0E-02 | 2.5E-02 | 1.5E-01 | 1.5E-01 | 5.0E-02 | 2.5E-02 | [m] |
| Phenanthrene | 4.5 | 4.3 | 5.0E-02 | 2.5E-02 | 1.5E-01 | 1.5E-01 | 5.0E-02 | 2.5E-02 | 3.2E+02 [aq] |
| Pyrene | 5.3 | 4.3 | 5.0E-02 | 2.5E-02 | 1.5E-01 | 1.5E-01 | 5.0E-02 | 2.5E-02 | [m] |
| VOLATILES | | | | | | | | | |
| 1,2-Dichloroethylenes | 2.0 | | NA | NA | NA | NA | NA | NA | NA |
| 1,1,1-Trichloroethane | 2.5 | | NA | NA | NA | NA | [m] | [m] | [m] |
| Acetone | -0.24 | | NA | NA | NA | NA | NA | NA | NA |
| Benzene | 2.1 | | [m] | [m] | [m] | [m] | NA | NA | [m] |
| Carbon disulfide | 2.2 | | [m] | [m] | [m] | [m] | [m] | [m] | NA |
| Chlorobenzene | 2.8 | | NA | NA | NA | NA | NA | NA | NA |
| Chloroform | 2.0 | | NA | NA | NA | NA | NA | NA | NA |
| Ethylbenzene | 3.2 | | NA | NA | NA | NA | NA | NA | NA |
| Methylene chloride | 1.3 | | NA | NA | NA | NA | NA | NA | NA |
| Tetrachloroethylene | 3.4 | | NA | NA | NA | NA | NA | NA | NA |
| Toluene | 2.79 | | NA | NA | NA | NA | NA | NA | NA |
| Trichloroethylene | 2.4 | | NA | NA | NA | NA | NA | NA | NA |
| Trichlorofluoromethane | 2.5 | | NA | NA | NA | NA | NA | NA | NA |
| Xylenes | 3.2 | | NA | NA | NA | NA | NA | NA | NA |

NOTES:
[a] Units for bioaccumulation factors (BAFs) are mg/kg fresh wt tissue over mg/kg dry wt soil for terrestrial invertebrates and plants, mg/kg fresh wt. tissue

**Table O-1.2**
**Summary of Bioaccumulation and Bioconcentration Data**
**AOC 57**

**Remedial Investigation Report**
**Devens, Massachusetts**

| Analyte | log $K_{ow}$ [b] | Bioaccumulation Factor [a] | | | | | | Bioconcentration Factor [a] |
|---|---|---|---|---|---|---|---|---|
| | | Terrestrial Invertebrate [c] | Terrestrial Plant [d] | Mammal [e] | Bird [f] | Aquatic [g] Invertebrate | Aquatic Plant | Fish |

over mg/kg fresh wt. food for small mammals and small birds, and mg/kg fresh wt. tissue over mg/kg fresh wt. sediment for aquatic plants and organisms. No BAFs were calculated for VOAs since available evidence suggests that these analytes do not bioaccumulate. Units for bioconcentration factors (BCFs) are $\mu$g/kg fresh wt. tissue over $\mu$g/L water. BCFs are presented for only those analytes that are selected as surface water CPCs.

[b] From Superfund Chemical Data Matrix (USEPA, 1993) unless otherwise noted. Log $K_{ow}$s for classes of semivolatile compounds were averaged to provide an average BAF value. Compounds were grouped accordingly: PAHs (4.3), phthalates (5.2), dibenzofuran (4.1), and dichlorobenzenes (3.5).

[c] Average of earthworm BAFs for SVOCs (Beyer, 1990) converted from dry weight to wet weight assuming earthworm is 80% water, unless otherwise noted. When no earthworm data were available, the BAF for small mammals was used as a surrogate.

[d] Plant BAF calclulated using the following equation presented by Travis and Arms (1988) unless otherwise noted: log (Plant Uptake Factor)=1.588−0.578 (log Kow). Converted from dry weight to wet weight plant concentration assuming 80% water content.

[e] Calculated using the following equation in Travis and Arms (1988) for semivolatile organic analytes with log $K_{ow}$s >5: log BTF (biotransfer factor) = log $K_{ow}$ − 7.6; result multiplied by average ingestion rates for non−lactating and lactating test animals to convert from BTFs to BAFs, and divided by a factor of 0.2 to convert from dry feed to fresh feed. There is an uncertainty involved in using this equation for PAHs because this study did not use any PAHs in the regression analysis. BAFs for analytes with log $K_{ow}$s <5 are assumed to be 0.15 because they are unlikely to bioaccumulate in animal tissue (Maughan, 1993).

[f] Bioaccumulation data are generally lacking for avians. When no bird data were available, the BAF for small mammals was used as a surrogate.

[g] Used to represent bioaccumulation from sediment to fish and aquatic invertebrates. Sediment BAFs are presented for only those analytes that were selected as sediment CPCs. When no aquatic BAF data were available, the BAF for terrestrial inverebrates was used as a surrogate.

[h] Prey−specific value not available; value shown is small mammal BAF for this chemical.

[i] Value from Baes et al. (1984) for leafy portions of plants multiplied by 0.2 to represent 80% water composition of plants.

[j] Value derived from biotransfer factors (BTFs), presented in Baes et al. (1984) for uptake into cattle. BTF converted to BAF by multiplying by food ingestion rate of 50 kg/day wet weight.

[k] Aquatic plant BAFs derived from an uptake study (Cherry & Guthrie, 1979) with two sedge species, *Andropogon virginicus* and *Cyperus retrofractus*, that were exposed to contaminated sediment. Values were converted from dry weight plant tissue to wet weight by applying a factor of 0.2 (assuming plants are 80% water).

[l] Geometric mean of BCFs obtained from AQUIRE (1994) and AWQC documents (calculated in Appendix O, Table O−1.4).

[m] This receptor group is not likely to be exposed to this CPC. Receptor exposures to analytes detected in surface soil include terrestrial invertebrates, terrestrial plants, mammals, and birds. Receptor exposures to analytes detected in surface water and sediment include aquatic organisms, aquatic plants, small fish, semi−aquatic mammals, and semi−aquatic birds.

[n] Average of values for industrial soils from Beyer and Cromatie (1987) multiplied by 0.2 to represent 80% water composition in earthworms.

[o] Average of BAF values reported from Wang et al. (1984), Sheppard et al. (1985), and Merry et al. (1986).

[p] From Barnthouse *et al.* (1988).

[q] Mean of values reported for soil invertebrates in MacFadyen (1980) converted from dry weight to wet weight.

[r] Mammal value for copper and plant value for cadmium from Levine et al., 1989.

[s] Based on accumulation of cadmium in kidneys of European quail in Pimentel et al. (1984).

[t] BCF for earthworms from Diercxsens et al. (1985).

[u] Median of values reported from Levine et al. (1989).

[v] Geometric mean of BAF values (fresh wt./dry wts) for worms and woodlice (USEPA, 1985). Fresh weight tissue concentrations calculated assuming 80% body water content.

[w] Values for lead and nickel from Mudroch & Capobianco (1979) represent an average of BAFs from sediment in several lakes, rivers, and bays into water lilies. Values converted from dry weight plant tissue to wet weight by applying a factor of 0.2 (assuming plants are 80% water).

[x] Uptake value (fresh wt./dry wt.) for earthworms from USEPA (1985) sludge document. Fresh weight tissue concentrations calculated assuming 80% body water

[y] USEPA, 1985.

[z] Based on the ranges of mercury concentrations in sediment and macroinvertebrates in an eight lake ecosystem in Sweden. Sediment concentrations ranged from 0.05 to 0.3 $\mu$g/g dry weight (mid point = 0.18 $\mu$g/g) and macroinvertebrate concentrations ranged from 0.02 to 6 $\mu$g/g dry weight (mid point = 3.01 $\mu$g/g). Based on these midpoints, a bioaccumulation factor of 16.7 was obtained.

[aa] Value from nickel sludge document (USEPA, 1985) multiplied by 0.2 to represent 80% water composition of earthworms.

[ab] Based on reported ratio of selenium in plant tissue and iron fly ash amended soil (Stoewsand et. al., 1978).

[ac] Based on average of reported ratio of selenium in diet to liver, kidney, and breast tissue of chickens (Eisler, 1985).

[ad] Geometric means of 4,4'−DDT [Davis (1968), Davis & Harrison (1966), Wheatley & Hardman (1968), Bailey et al. (1970), Cramp & Olney (1967), and Beyer & Gish (1980)], 4,4'−DDE [Davis (1968), Davis & Harrison (1966), Cramp & Olney (1967), Collett & Harrison (1968), Hunt & Sacho (1969), and Gish (1970)], and 4,4−DDD [Barker (1958), Davis (1968), Davis & Harrison (1966), Cramp & Olney (1967), Collett & Harrison (1968), Wheatley & Hardman (1968), Hunt & Sacho (1969), Bailey et al. (1970), Dimond et al. (1970), Gish (1970), and Beyer & Gish (1980)] reported for earthworms. Dry soil concentrations calculated assuming 10% moisture content in sandy−loam soils (Donahue et al., 1977).

[ae] Geometric mean of 4,4'−DDT, 4,4'−DDD, and 4,4'−DDE BAFs (fresh wt/dry wt) reported for roots (carrot, potato, sugar beet), grains (corn, oats), and legumes (alfalfa) derived from USEPA (1985b) converted from dry weight to wet−weight per values provided by Suter (1993).

[af] BAF for shrews and voles calculated using measured concentrations of $DDT_R$ in stomach content and in whole body (Forsyth & Petrle, 1984).

[ag] Whole−body pheasant BAF for 4,4'−DDT presented in USEPA (1985b); derived from Kenaga (1973).

[ah] Amphipod to sediment mean biomagnification factor for total DDT in Lake Michigan and Lake Ontario (Evans *et al.*, 1991).

Table O-1.2
Summary of Bioaccumulation and Bioconcentration Data
AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Analyte | log $K_{ow}$ [b] | Bioaccumulation Factor [a] | | | | | | Bioconcentration Factor [a] |
|---|---|---|---|---|---|---|---|---|
| | | Terrestrial Invertebrate [c] | Terrestrial Plant [d] | Mammal [e] | Bird [f] | Aquatic [g] Invertebrate | Aquatic Plant | Fish |

[ai] USEPA (1990a) Basics of Pump-and-Treat Ground-Water Remediation Technology
[aj] Arthmetic mean BAF for corn, leaves, carrots, beets, sugarbeets, radishes, and soybeans (tops, roots, and whole plants) from USEPA (1985a) and Webber etal.
[ak] BAF calculated from discussion in Eisler (1986) stating that Aroclor 1254 residues in subcutaneous fat of adult minks were up to 38 times dietary levels. Converted to whole body concentrations assuming 10% lipid content.
[al] BAF calculated from data presented in Eisler, 1986. Kestrels fed 33 mg PCB/kg diet for 62-69 days accumulated 107 mg PCB/kg lipid weight in muscle Assuming muscle is 10%lipid content, the muscle concentration is about 10.7 mg/kg.
[am] Geometric mean of reported BAFs for earthworms (Edwards & Thompson, 1973). Values provided by Gish (1970) were converted from dry weight to wet weight by multiplying by a conversion factor of 0.2 assuming 80% water content.
[an] BAF calculated from data presented by Potter et al (1974). Based on an average dieldrin concentration in cow muscle and fat of 0.17 mg/kg (dry weight) and a dieldrin concentration of 0.11 mg/kg in the diet (dry weight).
[ao] Jeffries and Davis (1968).
[ap] USEPA (1992), Dermal Exposure Guidance.
[aq] BCFs for PAHs obtained from Eisler (1987).
[ar] Value for gamma-chlordane used as a surrogate.
[as] BAF calculated from data presented in Eisler, 1990. Rats fed 20 mg/kg diet technical chlordane (equivalent to 3.6 mg/kg diet cis- and trans-chlordane) for 350 days accumulated 20 mg/kg in lipids. Assuming 10% lipid content, the whole body concentration is about 2 mg/kg.
[at] BAF calculated from data presented in Eisler, 1990. Red-winged blackbirds fed 10 mg/kg diet technical chlordane (equivalent to 1.8 mg/kg diet cis- and trans- chlordane) for 84 days accumulated 1.8 mg/kg wet weight whole body residue.
[au] Geometric mean of reported BAFs for earthworms (Gish, 1970) converted from dry weight to wet weight assuming 80% water composition of earthworms.
NA = Not available

## Table O-1.3
## Summary of Oligochaete Bioaccumulation Factors and Summary of Crayfish and Fish Tissue Concentrations
## AOC 57

**Remedial Investigation Report**
**Devens, Massachusetts**

| Site ID | Analyte [1] | Sediment Data (µg/g dry weight) | Oligochaete Data (µg/g wet weight) | Oligochaete Bioaccumulation Factors [2] |
|---|---|---|---|---|
| Control | 4,4'-DDD | NA | ND | 0.00E+00 |
| | 4,4'-DDE | NA | ND | 0.00E+00 |
| | 4,4'-DDT | NA | ND | 0.00E+00 |
| | Aldrin[3] | NA | 0.0397 | NA |
| | Aroclor-1260 | NA | ND | 0.00E+00 |
| | Dieldrin | NA | ND | 0.00E+00 |
| | % Lipids | NA | 2.0 | NA |
| 57D-95-05X | 4,4'-DDD | 0.0258 | ND | 0.00E+00 |
| | 4,4'-DDE | ND | ND | 0.00E+00 |
| | 4,4'-DDT | 0.0363 | ND | 0.00E+00 |
| | Aldrin[3] | ND | ND | NA |
| | Aroclor-1260 | 0.301 | ND | 0.00E+00 |
| | Dieldrin | 0.0183 | ND | 0.00E+00 |
| | % Lipids | NA | 1.5 | NA |
| 57D-95-06X | 4,4'-DDD | 0.44 | ND | 0.00E+00 |
| | 4,4'-DDE | 0.162 | ND | 0.00E+00 |
| | 4,4'-DDT | 0.0759 | ND | 0.00E+00 |
| | Aldrin[3] | ND | 0.0166 | NA |
| | Aroclor-1260 | ND | ND | 0.00E+00 |
| | Dieldrin | ND | ND | 0.00E+00 |
| | % Lipids | NA | 1.3 | NA |
| 57D-95-08X | 4,4'-DDD | 0.49 | ND | 0.00E+00 |
| | 4,4'-DDE | 0.18 | ND | 0.00E+00 |
| | 4,4'-DDT | 0.12 | ND | 0.00E+00 |
| | Aldrin[3] | ND | 0.0216 | NA |
| | Aroclor-1260 | ND | ND | 0.00E+00 |
| | Dieldrin | ND | ND | 0.00E+00 |
| | % Lipids | NA | 0.5 | NA |

| Analyte [4] | Station 1 Crayfish (µg/g wet weight) | Station 2 Crayfish (µg/g wet weight) | Station 4 Crayfish (µg/g wet weight) | Station 6 Crayfish (µg/g wet weight) | Station 2 Suckers (µg/g wet weight) | Station 1 Pickerels (µg/g wet weight) |
|---|---|---|---|---|---|---|
| % Lipids | 1.0 | 1.1 | 0.6 | 1.4 | 1.8 | 1.8 |
| 4,4'-DDD | <0.001 | <0.001 | <0.001 | <0.001 | 0.0809 | 0.0295 |
| 4,4'-DDE | <0.001 | <0.001 | 0.00291 | 0.0126 | 0.0754 | 0.0313 |
| Aroclor-1260 | 0.263 | <0.02 | <0.02 | <0.02 | 0.0472 | 0.26 |
| alpha-Chlordane | <0.001 | <0.001 | <0.001 | <0.001 | 0.00523 | <0.001 |
| gamma-Chlordane | <0.001 | <0.001 | <0.001 | <0.001 | 0.00232 | <0.001 |
| Dieldrin | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.00383 |
| Heptachlor | <0.001 | <0.001 | 0.00116 | <0.001 | <0.001 | 0.00224 |

| Analyte [5] | Average Crayfish Tissue Concentration (µg/g) for Muskrat, Mallard, and Raccoon Exposures [6] | Average Fish Tissue Concentration (µg/g) for Great blue heron Exposures [6] |
|---|---|---|
| 4,4'-DDD | 0 | 0.0552 |
| 4,4'-DDE | 0.00413 | 0.0534 |
| Aroclor-1260 | 0.0733 | 0.154 |
| Dieldrin | 0 | 0.00217 |

NOTES:
[1] Only those analytes that were detected in oligochaete tissue are presented.
[2] Units for BAFs are equal to mg/kg wet weight tissue over mg/kg dry weight sediment. All BAFs are assumed to be zero because none of the CPCs were detected in oligochaete tissue.
[3] The tissue results for aldrin are listed; however, aldrin was not detected in any AOC 57 sediments and was not evaluated in the AOC 57 ERA. Tissue concentrations of aldrin may be attributable to spike contamination in the analytical equipment at the laboratory.
[4] Only those analytes that were detected in crayfish or fish tissue are presented.
[5] Only those analytes that were detected in sediments and retained as CPCs are presented.
[6] Average tissue concentrations use 1/2 the detection limit for non-detects, unless an analyte was not detected at all in which case a tissue concentration of zero was used.
NA = Not available, not applicable
ND = Not detected

# Table O–1.4
# Bioconcentration Data
# AOC 57

**Remedial Investigation Report**
**Devens, Massachusetts**

| Chemical Name | Species | Age | Exposure | Concentration (µg/L) | BCF | ln (BCF) | Reference | Year of Publ. |
|---|---|---|---|---|---|---|---|---|
| **Inorganics** | | | | | | | | |
| Aluminum | Salvelinus fontinalis; Brook trout | 0.2 grams, 30 days | 56 days | 268 | 36 | 3.583518938 | AQUIRE, 1994 | 91 |
| Aluminum chloride | Unio pictorum; Mussel; | 9.4 (7.7–10.18) cm | 3 weeks | 166.8 to 414.3 | 250 | 5.521460917 | AQUIRE, 1994 | 90 |
| | | | | | | | **95 = Geometric Mean BCF for Aluminum** | |
| Cadmium | Spirulina platensis; Blue–green algae | NR | 12 hours | 100 | 14.61 | 2.681706225 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 24 hours | 100 | 18.3 | 2.906901059 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 36 hours | 100 | 18 | 2.890371757 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 48 hours | 100 | 16.1 | 2.778819272 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 12 hours | 500 | 7.81 | 2.055404963 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 24 hours | 500 | 8.77 | 2.171336806 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 36 hours | 500 | 8.56 | 2.147100190 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 48 hours | 500 | 7.42 | 2.004179057 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 12 hours | 1000 | 6.22 | 1.827769906 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 24 hours | 1000 | 7.04 | 1.951608170 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 36 hours | 1000 | 7.14 | 1.965712776 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 48 hours | 1000 | 6.77 | 1.912501086 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 12 hours | 5000 | 3.06 | 1.118414916 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 24 hours | 5000 | 2.79 | 1.026041595 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 36 hours | 5000 | 2.63 | 0.966983846 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 48 hours | 5000 | 2.1 | 0.741937344 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 12 hours | 10000 | 2.42 | 0.883767540 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 24 hours | 10000 | 1.85 | 0.615185639 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 36 hours | 10000 | 1.69 | 0.524728528 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 48 hours | 10000 | 1.55 | 0.438254930 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 12 hours | 100 | 16.76 | 2.818995095 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 24 hours | 100 | 14.02 | 2.640484881 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 36 hours | 100 | 13.04 | 2.568021556 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 48 hours | 100 | 13.41 | 2.596000697 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 12 hours | 500 | 8.56 | 2.147100190 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 24 hours | 500 | 7.64 | 2.033397603 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 36 hours | 500 | 7.36 | 1.996059932 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 48 hours | 500 | 6.5 | 1.871802176 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 12 hours | 1000 | 6.13 | 1.813194749 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 24 hours | 1000 | 6 | 1.791759469 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 36 hours | 1000 | 6.16 | 1.818076777 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 48 hours | 1000 | 4.13 | 1.418277407 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 12 hours | 5000 | 3.38 | 1.217875709 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 24 hours | 5000 | 3.08 | 1.124929597 | AQUIRE, 1994 | 86 |

# Table O–1.4
# Bioconcentration Data
# AOC 57

**Remedial Investigation Report**
**Devens, Massachusetts**

| Chemical Name | Species | Age | Exposure | Concentration (µg/L) | BCF | ln (BCF) | Reference | Year of Publ. |
|---|---|---|---|---|---|---|---|---|
| Cadmium (cont.) | Spirulina platensis; Blue–green algae | NR | 36 hours | 5000 | 3.03 | 1.108562619 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 48 hours | 5000 | 2.63 | 0.966983846 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 12 hours | 10000 | 2.63 | 0.966983846 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 24 hours | 10000 | 2.31 | 0.837247524 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 36 hours | 10000 | 2.21 | 0.792992515 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 48 hours | 10000 | 2.2 | 0.788457360 | AQUIRE, 1994 | 86 |
| | | | | **Average ln(BCF) for Blue–green algae =** | | **1.67** | | |
| | Oncorhynchus mykiss; Rainbow trout | 46.21 grams | 72 days | 0.00127 | 55 | 4.007333185 | AQUIRE, 1994 | 89 |
| | Coregonus clupeaformis; Lake whitefish | 26.63 grams | 72 days | 0.00125 | 42.1 | 3.740047740 | AQUIRE, 1994 | 89 |
| | Cladoceran | | | | 320 | 5.768320995 | USEPA, 1980 | |
| | Crayfish | | | | 184 | 5.214935757 | USEPA, 1980 | |
| | Stonefly | | | | 373 | 5.921578419 | USEPA, 1980 | |
| | Mayfly | | | | 1,630 | 7.396335293 | USEPA, 1980 | |
| | Mayfly | | | | 3,520 | 8.166216268 | USEPA, 1980 | |
| | | | | **Average ln(BCF) for Mayfly =** | | **7.78** | | |
| | Dragonfly | | | | 736 | 6.601230118 | USEPA, 1980 | |
| | Dragonfly | | | | 680 | 6.522092798 | USEPA, 1980 | |
| | Dragonfly | | | | 1,300 | 7.170119543 | USEPA, 1980 | |
| | Dragonfly | | | | 928 | 6.833031732 | USEPA, 1980 | |
| | | | | **Average ln(BCF) for Dragonfly =** | | **6.78** | | |
| | Caddisfly | | | | 4,190 | 8.340456012 | USEPA, 1980 | |
| | Beetle | | | | 164 | 5.099866427 | USEPA, 1980 | |
| | Beetle | | | | 260 | 5.560681631 | USEPA, 1980 | |
| | | | | **Average ln(BCF) for Bettle =** | | **5.33** | | |
| | Midge | | | | 2,220 | 7.705262474 | USEPA, 1980 | |
| | Midge | | | | 1,830 | 7.512071245 | USEPA, 1980 | |
| | Biting midge | | | | 936 | 6.841615476 | USEPA, 1980 | |
| | Biting midge | | | | 662 | 6.495265555 | USEPA, 1980 | |
| | | | | **Average ln(BCF) for Midge =** | | **7.14** | | |
| | Snail | | | | 1,750 | 7.467371066 | USEPA, 1980 | |
| | | | | | | **319** | **= Geometric Mean BCF for Cadmium** | |
| Copper | Spirulina platensis; Blue–green algae; | NR | 12 hours | 100 | 36.65 | 3.601413428 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 24 hours | 100 | 39.51 | 3.676553804 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 36 hours | 100 | 31.2 | 3.440418094 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 48 hours | 100 | 25.38 | 3.233961462 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 12 hours | 500 | 12.5 | 2.525728644 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 24 hours | 500 | 17 | 2.833213344 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 36 hours | 500 | 12.7 | 2.541601993 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 48 hours | 500 | 11.4 | 2.433613355 | AQUIRE, 1994 | 86 |

# Table O–1.4
# Bioconcentration Data
# AOC 57

**Remedial Investigation Report**
**Devens, Massachusetts**

| Chemical Name | Species | Age | Exposure | Concentration (µg/L) | BCF | ln (BCF) | Reference | Year of Publ. |
|---|---|---|---|---|---|---|---|---|
| Copper (cont.) | Spirulina platensis; Blue–green algae; | NR | 12 hours | 1000 | 8.13 | 2.095560923 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 24 hours | 1000 | 12.2 | 2.501435951 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 36 hours | 1000 | 9.53 | 2.254444717 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 48 hours | 1000 | 8.13 | 2.095560923 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 12 hours | 5000 | 2.6 | 0.955511445 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 24 hours | 5000 | 4.99 | 1.607435909 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 36 hours | 5000 | 4.27 | 1.451613827 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 48 hours | 5000 | 3.68 | 1.302912752 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 12 hours | 10000 | 1.46 | 0.378436435 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 24 hours | 10000 | 3.4 | 1.223775431 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 36 hours | 10000 | 3.07 | 1.121677561 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 48 hours | 10000 | 2.68 | 0.985816794 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 12 hours | 100 | 28.31 | 3.343215099 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 24 hours | 100 | 36.01 | 3.583796677 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 36 hours | 100 | 35.39 | 3.566429294 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 48 hours | 100 | 31.18 | 3.439776863 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 12 hours | 500 | 9.37 | 2.237513096 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 24 hours | 500 | 11.02 | 2.399711803 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 36 hours | 500 | 12 | 2.484906649 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 48 hours | 500 | 11.47 | 2.439734931 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 12 hours | 1000 | 5.76 | 1.750937474 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 24 hours | 1000 | 6.22 | 1.827769906 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 36 hours | 1000 | 7.81 | 2.055404963 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 48 hours | 1000 | 8.58 | 2.149433913 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 12 hours | 5000 | 1.93 | 0.657520002 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 24 hours | 5000 | 2.12 | 0.751416088 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 36 hours | 5000 | 2.45 | 0.896088024 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 48 hours | 5000 | 2.41 | 0.879626747 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 12 hours | 10000 | 1.2 | 0.182321556 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 24 hours | 10000 | 1.35 | 0.300104592 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 36 hours | 10000 | 1.49 | 0.39877612 | AQUIRE, 1994 | 86 |
| | Spirulina platensis; Blue–green algae; | NR | 48 hours | 10000 | 1.38 | 0.322083499 | AQUIRE, 1994 | 86 |
| | | | | **Average ln(BCF) for Blue–green algae =** | | **1.95** | | |
| | Asiatic clam | | | | 19,800 | 9.893437216 | USEPA, 1985a | |
| | Cladoceran | | | | 471 | 6.154858094 | USEPA, 1985a | |
| | Stonefly | | | | 203 | 5.313205979 | USEPA, 1985a | |
| | | | | | | | **339 = Geometric Mean BCF for Copper** | |
| Lead | Salvelinus fontinalis; Brook trout | FINGERLING, 7.3–10 c | 3 weeks | 4.1 to 88 | 1,400 | 7.244227515 | AQUIRE, 1994 | 75 |
| | Salvelinus fontinalis; Brook trout | FINGERLING, 7.3–10 c | 3 weeks | 135 | 41.9 | 3.735285826 | AQUIRE, 1994 | 75 |

# Table O–1.4
# Bioconcentration Data
# AOC 57

**Remedial Investigation Report**
**Devens, Massachusetts**

| Chemical Name | Species | Age | Exposure | Concentration (µg/L) | BCF | ln (BCF) | Reference | Year of Publ. |
|---|---|---|---|---|---|---|---|---|
| Lead (cont.) | Salvelinus fontinalis; Brook trout | FINGERLING, 7.3–10 c | 3 weeks | 135 | 7.78 | 2.051556338 | AQUIRE, 1994 | 75 |
| | Salvelinus fontinalis; Brook trout | FINGERLING, 7–10 cm | 3 weeks | 4.3 | 160 | 5.075173815 | AQUIRE, 1994 | 75 |
| | Salvelinus fontinalis; Brook trout | FINGERLING, 7–10 cm | 3 weeks | 5.7 | 140 | 4.941642422 | AQUIRE, 1994 | 75 |
| | Salvelinus fontinalis; Brook trout | FINGERLING, 7–10 cm | 3 weeks | 12.5 | 73 | 4.290459441 | AQUIRE, 1994 | 75 |
| | Salvelinus fontinalis; Brook trout | FINGERLING, 7–10 cm | 3 weeks | 12.5 | 32 | 3.465735902 | AQUIRE, 1994 | 75 |
| | Salvelinus fontinalis; Brook trout | FINGERLING, 7–10 cm | 3 weeks | 12.5 | 24 | 3.178053830 | AQUIRE, 1994 | 75 |
| | Salvelinus fontinalis; Brook trout | FINGERLING, 7–10 cm | 3 weeks | 12.5 | 48 | 3.871201010 | AQUIRE, 1994 | 75 |
| | Salvelinus fontinalis; Brook trout | FINGERLING, 7–10 cm | 3 weeks | 12.5 | 160 | 5.075173815 | AQUIRE, 1994 | 75 |
| | Salvelinus fontinalis; Brook trout | FINGERLING, 7–10 cm | 3 weeks | 12.5 | 16 | 2.772588722 | AQUIRE, 1994 | 75 |
| | | | **Average ln(BCF) for Brook trout =** | | | **4.15** | | |
| | Colisa fasciata; Giant gourami | NR | 8 hours | 902 | 2.9 | 1.064710737 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 8 hours | 902 | 0.8 | −0.22314355 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 16 hours | 0.860 | 3.4 | 1.223775431 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 16 hours | 0.860 | 0.4 | −0.91629073 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 16 hours | 0.860 | 1 | 0 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 24 hours | 801 | 3.4 | 1.223775431 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 24 hours | 801 | 0.3 | −1.20397280 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 24 hours | 801 | 1.1 | 0.095310179 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 5 days | 1000 | 5 | 1.609437912 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 5 days | 1000 | 0.5 | −0.69314718 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 5 days | 1000 | 3.9 | 1.360976553 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 10 days | 701 | 6.9 | 1.931521411 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 10 days | 701 | 0.7 | −0.35667494 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 10 days | 701 | 6.1 | 1.808288771 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 15 days | 586 | 5.3 | 1.667706820 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 15 days | 586 | 0.8 | −0.22314355 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 15 days | 586 | 5.7 | 1.740466174 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 20 days | 621 | 7.2 | 1.974081026 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 20 days | 621 | 0.7 | −0.35667494 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 20 days | 621 | 6.5 | 1.871802176 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 25 days | 601 | 8 | 2.079441541 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 25 days | 601 | 0.9 | −0.10536051 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 25 days | 601 | 7.1 | 1.960094784 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 8 hours | 1799 | 0.9 | −0.10536051 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 8 hours | 1799 | 0.6 | −0.51082562 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 8 hours | 1799 | 0.8 | −0.22314355 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 16 hours | 1602 | 1.8 | 0.587786664 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 16 hours | 1602 | 0.8 | −0.22314355 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 16 hours | 1602 | 1.8 | 0.587786664 | AQUIRE, 1994 | 91 |

# Table O–1.4
# Bioconcentration Data
# AOC 57

**Remedial Investigation Report**
**Devens, Massachusetts**

| Chemical Name | Species | Age | Exposure | Concentration (µg/L) | BCF | ln (BCF) | Reference | Year of Publ. |
|---|---|---|---|---|---|---|---|---|
| Lead (cont.) | Colisa fasciata; Giant gourami | NR | 24 hours | 1523 | 1.7 | 0.530628251 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 24 hours | 1523 | 0.8 | −0.22314355 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 24 hours | 1523 | 2.1 | 0.741937344 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 5 days | 1544 | 3.1 | 1.131402111 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 5 days | 1544 | 1.2 | 0.182321556 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 5 days | 1544 | 3.2 | 1.163150809 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 10 days | 1368 | 2.8 | 1.029619417 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 10 days | 1368 | 2.1 | 0.741937344 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 10 days | 1368 | 4.2 | 1.435084525 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 15 days | 1402 | 4.5 | 1.504077396 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 15 days | 1402 | 1.5 | 0.405465108 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 15 days | 1402 | 3.7 | 1.308332819 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 20 days | 1301 | 6.8 | 1.916922612 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 20 days | 1301 | 1.9 | 0.641853886 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 20 days | 1301 | 4.9 | 1.589235205 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 25 days | 1300 | 4.9 | 1.589235205 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 25 days | 1300 | 1.8 | 0.587786664 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 25 days | 1300 | 5 | 1.609437912 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 8 hours | 4324 | 0.8 | −0.22314355 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 8 hours | 4324 | 0.4 | −0.91629073 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 8 hours | 4324 | 1 | 0 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 16 hours | 4300 | 1.7 | 0.530628251 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 16 hours | 4300 | 0.6 | −0.51082562 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 16 hours | 4300 | 1 | 0 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 24 hours | 4285 | 1.4 | 0.336472236 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 24 hours | 4285 | 0.5 | −0.69314718 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 24 hours | 4285 | 1.6 | 0.470003629 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 5 days | 4188 | 4.2 | 1.435084525 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 5 days | 4188 | 0.9 | −0.10536051 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 5 days | 4188 | 2.2 | 0.788457360 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 10 days | 4180 | 4.2 | 1.435084525 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 10 days | 4180 | 1 | 0 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 10 days | 4180 | 3.8 | 1.335001066 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 15 days | 4060 | 4.5 | 1.504077396 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 15 days | 4060 | 1.1 | 0.095310179 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 15 days | 4060 | 3.9 | 1.360976553 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 20 days | 4000 | 4.9 | 1.589235205 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 20 days | 4000 | 1.4 | 0.336472236 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 20 days | 4000 | 4.4 | 1.481604540 | AQUIRE, 1994 | 91 |

# Table O–1.4
# Bioconcentration Data
# AOC 57

**Remedial Investigation Report**
**Devens, Massachusetts**

| Chemical Name | Species | Age | Exposure | Concentration (µg/L) | BCF | ln (BCF) | Reference | Year of Publ. |
|---|---|---|---|---|---|---|---|---|
| Lead (cont.) | Colisa fasciata; Giant gourami | NR | 25 days | 4000 | 4.5 | 1.504077396 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 25 days | 4000 | 1.4 | 0.336472236 | AQUIRE, 1994 | 91 |
| | Colisa fasciata; Giant gourami | NR | 25 days | 4000 | 4.3 | 1.458615022 | AQUIRE, 1994 | 91 |
| | | | | **Average ln(BCF) for Giant gourami =** | | **0.69** | | |
| | Snail | | | | 1,700 | 7.43838353 | USEPA, 1985b | |
| | Snail | | | | 738 | 6.603943824 | USEPA, 1985b | |
| | | | | **Average ln(BCF) for Snail =** | | **7.02** | | |
| | Stonefly | | | | 1,120 | 7.021083964 | USEPA, 1985b | |
| | Caddisfly | | | | 499 | 6.212606095 | USEPA, 1985b | |
| | | | | | | **151** | **= Geometric Mean BCF for Lead** | |
| Manganese | Physa sp; Pouch snail; | NR | NR | 165.1 | 1,300 | 7.170119543 | AQUIRE, 1994 | 77 |
| | Physa sp; Pouch snail; | NR | NR | 142.9 | 800 | 6.684611727 | AQUIRE, 1994 | 77 |
| | | | | **Average ln(BCF) for Snail =** | | **6.93** | | |
| | Corbicula fluminea; Asiatic clam | NR | NR | 60 | 470 | 6.152732694 | AQUIRE, 1994 | 80 |
| | Corbicula fluminea; Asiatic clam | NR | NR | 60 | 1,800 | 7.495541943 | AQUIRE, 1994 | 80 |
| | Corbicula fluminea; Asiatic clam | NR | NR | 70 | 470 | 6.152732694 | AQUIRE, 1994 | 80 |
| | Corbicula fluminea; Asiatic clam | NR | NR | 70 | 2,100 | 7.649692623 | AQUIRE, 1994 | 80 |
| | | | | **Average ln(BCF) for Asiatic clam =** | | **6.86** | | |
| | Plankton; Plankton; | NR | NR | 32 | 690 | 6.536691597 | AQUIRE, 1994 | 78 |
| | Oligochaeta; Annelid worm class | NR | NR | 32 | 88 | 4.477336814 | AQUIRE, 1994 | 78 |
| | Insecta; Insect class; | NR | NR | 32 | 28 | 3.332204510 | AQUIRE, 1994 | 78 |
| | Osteichthyes; Class – bony fishes | 661–824 grams | NR | 32 | 84 | 4.430816798 | AQUIRE, 1994 | 78 |
| | Lemna minor; Duckweed; | NR | NR | 148.5 | 10,900 | 9.296518068 | AQUIRE, 1994 | 75 |
| | Lemna sp; Duckweed; | NR | NR | 16.66 to 23.23 | 46,647 | 10.75036389 | AQUIRE, 1994 | 80 |
| | | | | **Average ln(BCF) for Duckweed =** | | **10.02** | | |
| | Chironomidae; Midge family; | LARVAE | NR | < 30 | 3,900 | 8.268731832 | AQUIRE, 1994 | 82 |
| | Crustacea; Crustacean class; | NR | NR | < 30 | 1,100 | 7.003065458 | AQUIRE, 1994 | 82 |
| | Unio pictorum; Mussel; | 12.5 grams | NR | < 30 | 160,000 | 11.98292909 | AQUIRE, 1994 | 82 |
| | Anodonta cygnea; Swan mussel; | 28.5 grams | NR | < 30 | 350,000 | 12.76568843 | AQUIRE, 1994 | 82 |
| | | | | **Average ln(BCF) for Mussel =** | | **12.37** | | |
| | Abramis brama; Bream; | 350 grams | NR | < 30 | 600 | 6.396929655 | AQUIRE, 1994 | 82 |
| | Abramis brama; Bream; | 350 grams | NR | < 30 | 240 | 5.480638923 | AQUIRE, 1994 | 82 |
| | Abramis brama; Bream; | 350 grams | NR | < 30 | 170 | 5.135798437 | AQUIRE, 1994 | 82 |
| | | | | **Average ln(BCF) for Bream =** | | **5.67** | | |
| | Stizostedion lucioperca; Pikeperch | 500 grams | NR | < 30 | 260 | 5.560681631 | AQUIRE, 1994 | 82 |
| | Stizostedion lucioperca; Pikeperch | 500 grams | NR | < 30 | 210 | 5.347107530 | AQUIRE, 1994 | 82 |
| | Stizostedion lucioperca; Pikeperch | 500 grams | NR | < 30 | 70 | 4.248495242 | AQUIRE, 1994 | 82 |
| | | | | **Average ln(BCF) for Pikeperch =** | | **5.05** | | |
| | Melosira varians; Diatom; | NR | NR | 16.66 to 23.23 | 59,052 | 10.98617369 | AQUIRE, 1994 | 80 |

# Table O–1.4
# Bioconcentration Data
# AOC 57

**Remedial Investigation Report**
**Devens, Massachusetts**

| Chemical Name | Species | Age | Exposure | Concentration (µg/L) | BCF | ln (BCF) | Reference | Year of Publ. |
|---|---|---|---|---|---|---|---|---|
| Manganese (cont.) | Elodea sp; Waterweed; | NR | NR | 16.66 to 23.23 | 12,465 | 9.430679996 | AQUIRE, 1994 | 80 |
| | Planaria sp; Planarian, flatworm | NR | NR | 16.66 to 23.23 | 2,255 | 7.720905251 | AQUIRE, 1994 | 80 |
| | Tubifex sp; Tubificid worm; | NR | NR | 16.66 to 23.23 | 14,583 | 9.587611745 | AQUIRE, 1994 | 80 |
| | | | | | | **1,665** | **= Geometric Mean BCF for Manganese** | |
| Zinc | Asiatic clam | | | | 126.2 | 4.837867950 | USEPA, 1987 | |
| | Asiatic clam | | | | 71.6 | 4.271095074 | USEPA, 1987 | |
| | Asiatic clam | | | | 102.2 | 4.626931677 | USEPA, 1987 | |
| | | | | **Average ln(BCF) for Asiatic clams =** | | **4.58** | | |
| | Mayfly | | | | 1,130 | 7.029972911 | USEPA, 1987 | |
| | Stonefly | | | | 106 | 4.663439094 | USEPA, 1987 | |
| | | | | | | **227** | **= Geometric Mean BCF for Zinc** | |

NOTES:

NR = Not Reported
cm = centimeters

# Table O–1.5
## Ingestion Toxicity Information for Wildlife
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical | Test Species | Test Type | Duration | Effect | Lethal RTV mg/kgBW–day Oral $LD_{50}$ | Lethal RTV mg/kgBW–day LOAEL | Sublethal RTV mg/kgBW–day LOAEL | Sublethal RTV mg/kgBW–day NOAEL | Reference |
|---|---|---|---|---|---|---|---|---|---|
| **INORGANIC ANALYTES** | | | | | | | | | |
| Aluminum | Mouse | Oral (chronic) | 2–3 generations | Reduced body weight gain of newborns | | | 425 | | NIOSH, 1985 |
| | Rat | Oral (subchronic) | 15 days | Reduced growth | | | 100 | | Bernuzzi, et al., 1989 |
| | Rat | Oral $LD_{50}$ | NR | Mortality | 3,700 | | | | Sax, 1984 |
| Antimony | Rat | Oral (acute) | Single oral dose | NOAEL for death | | 16,714 | | | ATSDR, 1991a |
| | Rat | Oral (chronic) | NS | Longevity; blood glucose; cholesterol | | | 0.35 (water) | | IRIS, 1993 |
| | Rat | Oral (subchronic) | 24 weeks | Decreased RBC, swelling of hepatic cords | | | 41.8 | | ATSDR, 1991a |
| Arsenic | Rat | Oral | NR | Reproductive effects | | | 0.61 | | RTECS, 1993 |
| | Rat | Oral | NR | Reproductive effects | | | 0.58 | | RTECS, 1993 |
| | Rat | Oral $LD_{50}$ | NR | Mortality | 763 | | | | RTECS, 1993 |
| | Mouse | Oral $LD_{50}$ | NR | Mortality | 145 | | | | RTECS, 1993 |
| | Mallard | Oral $LD_{50}$ | NR | Mortality | 323 | | | | Eisler, 1988 |
| | Cowbird | Oral $LD_{50}$ | 11 days | Mortality | 18.1 [a] | | | | Eisler, 1988 |
| | Young chicken | Oral | 56 days | Egg production | | | | 1 | Hermeyer et. al., 1977 |
| | Dog | Oral (chronic) | 2 years | Mortality | | 3.1 | | | ATSDR, 1991b |
| Barium | Rat | Oral (chronic) | 68 weeks | Renal ultrastructure changes | | | 142 | | IRIS, 1993 |
| | Rat | Oral (subchronic) | 13 weeks | Renal effects | | | 91 | | Dietz et al., 1992 |
| | Rat | Oral (acute) | 10 days | Decreased ovarian weight | | | 198 | | ATSDR, 1991b |
| | Rat | Oral (subchronic) | 13 weeks | 20% population mortality | | 430 | | | Dietz et al., 1992 |
| Beryllium | Rat | Oral $LD_{50}$ | NR | Mortality | 10 | | | | USEPA, 1985g |
| | Rat | Oral (chronic) | NR | Increase in lung sarcomas | | | 0.22 | | USEPA, 1985g |
| | Rat | Oral (chronic) | 3.2 years | Respiratory, cardiopulmonary, hematological, and hepatic effects | | | 0.85 | | ATSDR, 1991d |
| Cadmium | Rat | Oral | NR | Reproductive effects | | | 155 | | RTECS, 1993 |
| | Rat | Oral | NR | Reproductive effects | | | 220 | | RTECS, 1993 |
| | Rat | Oral | NR | Reproductive effects | | | 21.5 | | RTECS, 1993 |
| | Rat | Oral | NR | Reproductive effects | | | 23 | | RTECS, 1993 |
| | Rat | Oral $LD_{50}$ | | Mortality | 250 | | | | Eisler, 1985 |
| | Rat | Oral $LD_{50}$ | NR | Mortality | 225 | | | | RTECS, 1993 |
| | Mouse | Oral $LD_{50}$ | NR | Mortality | 890 | | | | RTECS, 1993 |
| | Mouse | Oral | NR | Reproductive effects | | | 448 | | RTECS, 1993 |
| | Mouse | Oral | NR | Reproductive effects | | | 1,700 | | RTECS, 1993 |
| | Guinea pig | Oral $LD_{50}$ | NR | Mortality | 150 | | | | Eisler, 1985 |
| | Mallard | Oral (subchronic) | 90 days | Egg production suppressed | | | 10 | | Eisler, 1985 |
| Chromium | Japanese quail | Oral $LD_{50}$ | 5 days | Mortality | 126 | | | | Hill and Camardese, 1986 |
| | Rat | Oral (subchronic) | 90 days | Histopathologic and reproductive effects | | | | 1,400 | Ivankovic and Preussman, 1975 |
| | Mouse | Oral (chronic) | 7 weeks | Decreased spermatogenesis | | | 3.5 | | ATSDR, 1993a |
| | Black Duck | Oral (subchronic) | 5 months | Reproductive effects | | | | 200 | Outridge and Scheuhammer, 1993 |
| | Rat | Oral $LD_{50}$ | | Mortality | 200 | | | | ATSDR, 1991c |
| Cobalt | Rat | Oral $LD_{50}$ | | Mortality | 91 | | | | ATSDR, 1991d |
| | Rat | Single oral dose | | Hepatic/renal hyperemia | | | | | ATSDR, 1991d |
| | Rat | Oral (subchronic) | 8 weeks | Decreased body weight gain | | | 4.2 | | ATSDR, 1991d |
| | Rat | Oral (chronic) | 98 days | Testicular degeneration | | | 13 | | ATSDR, 1991d |
| | Rat | Oral (chronic) | 69 days | Testicular atrophy | | | 20 | | ATSDR, 1991d |
| | Dog | Oral (subchronic) | 4 weeks | Increased red blood cell count | | | 5 | | ATSDR, 1991d |
| Copper | Rat | Single oral dose | | Reproductive effects | | | 152 | | NIOSH, 1985 and RTECS, 1993 |
| | Rat | Oral $LD_{50}$ | NR | Mortality | 940 | | | | Sax, 1984 |
| | Mouse | Oral (chronic) | 30 days | Decreased litter sizes with teratogenic effects | | | 100 | | Lecyk, 1980 |
| Lead | Rat | Oral | NR | Reproductive effects | | | 790 | | RTECS, 1993 |
| | Rat | Oral | NR | Reproductive effects | | | 1,140 | | RTECS, 1993 |
| | Rat | Oral | NR | Reproductive effects | | | 520 | | RTECS, 1993 |
| | Rat | Oral | NR | Reproductive effects | | | 1,100 | | RTECS, 1993 |
| | Calf | Oral $LD_{50}$ | NR | Mortality | 220 | | | | Eisler, 1988 |
| | Rat | Oral (subchronic) | 12–14 days | Decreased fetal body weight | | | 2.5 | | McClain and Becker, 1972 |
| | Mouse | Oral | NR | Reproductive effects | | | 1,120 | | RTECS, 1993 |
| | Mouse | Oral | NR | Reproductive effects | | | 6,300 | | RTECS, 1993 |
| | Mouse | Oral | NR | Reproductive effects | | | 300 | | RTECS, 1993 |
| | Mouse | Oral | NR | Reproductive effects | | | 4,800 | | RTECS, 1993 |
| | Domestic animal | Oral | NR | Reproductive effects | | | 662 | | RTECS, 1993 |
| | Mammal | Oral | NR | Reproductive effects | | | 2,118 | | RTECS, 1993 |
| | Kestrel | Diet | NR | Decreased egg laying fertility; decreased egg shell thickness | | | | 4.61 [a] | Eisler, 1988 |

## Table O–1.5
## Ingestion Toxicity Information for Wildlife
## AOC 57

**Remedial Investigation Report**
**Devens, Massachusetts**

| Chemical | Test Species | Test Type | Duration | Effect | Lethal RTV mg/kgBW–day Oral $LD_{50}$ | Lethal RTV mg/kgBW–day LOAEL | Sublethal RTV mg/kgBW–day LOAEL | Sublethal RTV mg/kgBW–day NOAEL | Reference |
|---|---|---|---|---|---|---|---|---|---|
| Lead (cont.) | Kestrel nestlings | Oral | 10 days | Reduced growth and brain weight; abnormal development | | | 125 | | Eisler, 1988 |
| | Japanese quail | Oral $LD_{50}$ | 5 days | Mortality | 24,752 | | | | Hill and Camardese, 1986 |
| | Rat | Oral (chronic) | 2 generations | Developmental effects | | | | 7 | Kimmel et al., 1980 and Grant et al., 1980 |
| | Guinea pig | Oral $LD_{50}$ | | Mortality | 300 | | | | Sax, 1984 |
| | Rock dove | Oral (chronic) | NS | Kidney pathology; learning deficiences | | | 6.25 | | Anders et al., 1982 and Dietz et al., 1979 |
| | Rock dove | Oral $LD_{50}$ | | Mortality | 375 | | | | Kendall and Scanlon, 1985 |
| Manganese | Mouse | Oral (subchronic) | 90 days | Delayed growth of testes | | | 140 | | ATSDR, 1990b |
| | Mouse | Oral (chronic) | 103 weeks | Mortality | | | 4,050 | | ATSDR, 1990b |
| | Rat | Oral $LD_{50}$ | NR | Mortality | 410 | | | | ATSDR, 1990b |
| | Rat | Oral $LD_{50}$ | 20 days | Mortality | 225 | | | | ATSDR, 1990b |
| | Rat | Oral (subchronic) | 20 days | Decreased litter weight during gestation | | | | 620 | ATSDR, 1990b |
| | Rat | Oral (chronic) | 103 weeks | Mortality | | | 930 | | ATSDR, 1990b |
| | Guinea pig | Oral $LD_{50}$ | NR | Mortality | 400 | | | | USEPA, 1984a |
| | Monkey | Oral (chronic) | 18 months | Weakness, rigidity | | | 25 | | ATSDR, 1990b |
| | Rodents/livestock | Oral (subchronic) | 10 days – 2 months | Decreased growth rate | | | 100 | | Cunningham et al., 1966 |
| | Mouse | Oral (subchronic) | 180 days | NOAEL for mortality | | 2,300 | | | Gianutsos and Murray, 1982 |
| Mercury | Mouse | Oral $LD_{50}$ | | Mortality | 22 | | | | NIOSH, 1985 |
| | Mouse | Oral (subchronic) | Day 6–17 (gest) | Stillbirths and neonatal death | | | 4 | | Suzuki, 1979 |
| | Rat | Oral (subchronic) | Day 6–14 (gest) | Retarded fetus growth | | | 4 | | Suzuki, 1979 |
| organomercury | Rat | Oral (chronic) | NR | Reduced fertility | | | 0.5 | | Eisler, 1987a |
| | Rat | Oral $LD_{50}$ | | Mortality | 18 | | | | NIOSH, 1985 |
| organomercury | Pig | Oral (subchronic) | Pregnancy | High incidence of stillbirths | | | 0.5 | | Eisler, 1987a |
| organomercury | Mule deer | Oral $LD_{50}$ | | Mortality | 17.9 | | | | Eisler, 1987a |
| organomercury | River otter | Oral $LD_{50}$ | | Mortality | 2 | | | | Eisler, 1987a |
| organomercury | Mink | Oral $LD_{50}$ | | Mortality | 1 | | | | Eisler, 1987a |
| organomercury | Dog | Oral (subchronic) | Pregnancy | High incidence of stillbirths | | | 0.1 | | Eisler, 1987a |
| methylmercury | House sparrow | Oral $LD_{50}$ | | Mortality | 12.6 | | | | Eisler, 1987a |
| ethylmercury | Rock dove | Oral $LD_{50}$ | | Mortality | 22.8 | | | | Eisler, 1987a |
| | Chicken | Oral $LD_{50}$ | | Mortality | 20 | | | | Finreite, 1979 |
| | Bantam chicken | Oral $LD_{50}$ | | Mortality | 190 | | | | Finreite, 1979 |
| ethylmercury | Prairie chicken | Oral $LD_{50}$ | | Mortality | 11.5 | | | | Eisler, 1987a |
| ethylmercury | Chukar | Oral $LD_{50}$ | | Mortality | 26.9 | | | | Eisler, 1987a |
| methylmercury | Corturnix | Oral $LD_{50}$ | | Mortality | 11 | | | | Eisler, 1987a |
| methylmercury | Mallard | Oral | 3 generation | Reproduction, behavior | | | 0.064 | | USEPA, 1993 |
| methylmercury | Black duck | Oral (subchronic) | 28 weeks | Reproduction inhibited | | | 0.22 [a] | | Eisler, 1987a |
| methylmercury | Fulvous whistling duck | Oral $LD_{50}$ | | Mortality | 37.8 | | | | Eisler, 1987a |
| methylmercury | Northern bobwhite | Oral $LD_{50}$ | | Mortality | 23.8 | | | | Eisler, 1987a |
| methylmercury | Bobwhite quail | Oral $LD_{50}$ | 5 days | Mortality | 523 | | | | Hill et al., 1975 |
| | Japanese quail | Oral $LD_{50}$ | | Mortality | 14.4 | | | | Eisler, 1987a |
| ethylmercury | Gray partridge | Oral $LD_{50}$ | | Mortality | 17.6 | | | | Eisler, 1987a |
| organomercury | Gray pheasant | Oral (subchronic) | 30 days | Reduced reproductive ability | | | 0.64 | | Eisler, 1987a |
| methylmercury | Ring–necked pheasant | Oral $LD_{50}$ | | Mortality | 11.5 | | | | Eisler, 1987a |
| | Mouse | Oral (subchronic) | 50 days | Embryotoxicity and teratogenicity | | | 0.9 | | Suzuki, 1979 |
| Nickel | Rat | Oral | NR | Reproductive effects | | | 158 | | RTECS, 1994 |
| | Rat | Oral $LD_{50}$ | NR | Mortality | 67 | | | | USEPA, 1985h |
| | Rat | Oral (chronic) | 2 years | Decreased body weight gain | | | 50 | | USEPA, 1985h |
| | Rat | Oral $LD_{50}$ | NR | Mortality | 350 | | | | Sax, 1984 |
| | Japanese quail | Oral (acute) | 5 days | Mortality | 504 | | | | Hill and Camardese, 1986 |
| | Dog | Oral (chronic) | 2 years | Histological lesions in bone marrow | | | 62.5 | | USEPA, 1987 |
| Selenium | Rat | Oral $LD_{50}$ | NR | Mortality | 6,700 | | | | RTECS, 1993 |
| | Rat | Oral $LD_{50}$ | NR | Mortality | 138 | | | | Sax, 1984 |
| | Mouse | Oral | NR | Reproductive effects | | | 134 | | RTECS, 1993 |
| | Mallard | Oral (subchronic) | 3 months | Reduced hatchability | | | 1.75 | | Eisler, 1985 |
| | Rat | Oral (chronic) | 2 years | Decrease in breeding | | | 0.2 | | ATSDR, 1988 |
| | Rat | Oral (chronic) | NS | Histological changes in heart and kidney | | | 0.045 | | Eisler, 1985 |
| | Japanese quail | Oral (chronic) | NS | Reduced egg hatching | | | 0.6 | | Eisler, 1985 |
| | Mallard | Oral (subchronic) | 3 months | NOAEL for taratogenic effects | | | 0.72 | 0.36 | Eisler, 1985 |
| | Horse | Oral $LD_{50}$ | | MLD | 3.3 | | | | Eisler, 1985 |
| | Mallard | Oral | 6 weeks | Increased mortality | | 2.7 [a] | | | Heinz et al., 1988 |

## Table O–1.5
## Ingestion Toxicity Information for Wildlife
## AOC 57

**Remedial Investigation Report**
**Devens, Massachusetts**

| Chemical | Test Species | Test Type | Duration | Effect | Lethal RTV mg/kgBW–day Oral $LD_{50}$ | Lethal RTV mg/kgBW–day LOAEL | Sublethal RTV mg/kgBW–day LOAEL | Sublethal RTV mg/kgBW–day NOAEL | Reference |
|---|---|---|---|---|---|---|---|---|---|
| Selenium (cont.) | Black–crowned night heron | Oral | NR | NOAEL for egg hatchability | | | | 0.61 [a] | Smith et al., 1988 |
| Vanadium | Japanese quail | Oral $LD_{50}$ | 5 days | Mortality | 96 | | | | Hill and Camardese, 1986 |
| | Mouse | Gavage $LD_{50}$ | One time | Mortality | 31 | | | | ATSDR, 1990c |
| | Rat | Oral (subchronic) | 2 months | Hypertension | | | 15 | | Susic and Kentera, 1986 |
| | Rat | Oral (subchronic) | 35 days | Developmented effects | | | | 8.4 | Domingo, et al., 1986 |
| | Chicken | Oral (subchronic) | 6 weeks | Decrease in egg–laying | | | 11 [b] | | Berg et al., 1963 |
| Zinc | Rat | Oral $LD_{50}$ | | Mortality | 2,510 | | | | RTECS, 1993 |
| | Rat | Oral | Gestation | Fetal resorptions in 4 to 20% of population | | | 200 | | Shlicker and Cox, 1968 |
| | Ferret | Oral | 3–13 days | Mortality and gastrointestinal effects | | 390 | | | Straube et al., 1980 |
| | Rat | Oral (subchronic) | NR | Kidney toxicity | | | 160 | | Llobet, et al., 1988 |
| **PESTICIDES/PCBs** | | | | | | | | | |
| 4,4'–DDE | Rat | Oral $LD_{50}$ | NR | Mortality | 800 | | | | RTECS, 1993 |
| | Mouse | Oral $LD_{50}$ | NR | Mortality | 700 | | | | RTECS, 1993 |
| | Hamster | Oral $LD_{50}$ | NR | Mortality | >5,000 | | | | RTECS, 1993 |
| | Mallard | Oral | NR | Eggshell thinning | | | 2.91 | | USEPA, 1993c |
| | Mallard | Oral | 2 years | Reproductive: embryo mortality, cracked eggs | | | 0.58 | | USEPA, 1993c |
| | Kestrel | Oral | NR | Eggshell thinning | | | 0.39 | | USEPA, 1993c |
| 4,4'–DDT (surrogate for 4,4'–DDD and 4,4'–DDE) | Rat | Oral $LD_{50}$ | NR | Mortality | 87 | | | | RTECS, 1993 |
| | Rat | Oral $LD_{50}$ | | Mortality | 100 | | | | USEPA, 1985d |
| | Rat | Oral | NR | Reproductive | | | 112 | | RTECS, 1993 |
| | Rat | Oral | NR | Reproductive | | | 100 | | RTECS, 1993 |
| | Rat | Oral | NR | Reproductive | | | 430 | | RTECS, 1993 |
| | Rat | Oral | NR | Reproductive | | | 1,890 | | RTECS, 1993 |
| | Rat | Oral | NR | Reproductive | | | 250 | | RTECS, 1993 |
| | Rat | Oral | NR | Reproductive | | | 50 | | RTECS, 1993 |
| | Rat | Oral (chronic) | 3 generations | Reproductive | | | 0.2 | | IRIS, 1991 |
| | Rat | Oral | 2 years | Reproductive | | | 2.5 | | USEPA, 1993c |
| | Mouse | Oral $LD_{50}$ | NR | Mortality | 135 | | | | RTECS, 1993 |
| | Mouse | Oral $LD_{50}$ | | Mortality | 200 | | | | USEPA, 1985d |
| | Mouse | Oral | NR | Reproductive | | | 504 | | RTECS, 1993 |
| | Mouse | Oral | NR | Reproductive | | | 81 | | RTECS, 1993 |
| | Mouse | Oral | NR | Reproductive | | | 124 | | RTECS, 1993 |
| | Mouse | Oral | NR | Reproductive | | | 148 | | RTECS, 1993 |
| | Rabbit | Oral $LD_{50}$ | NR | Mortality | 250 | | | | RTECS, 1993 |
| | Rabbit | Oral | NR | Reproductive | | | 150 | | RTECS, 1993 |
| | Guinea pig | Oral $LD_{50}$ | NR | Mortality | 150 | | | | RTECS, 1993 |
| | Hamster | Oral $LD_{50}$ | NR | Mortality | >5,000 | | | | RTECS, 1993 |
| | Dog | Oral $LD_{50}$ | NR | Mortality | 150 | | | | RTECS, 1993 |
| | Dog | Oral $LD_{50}$ | | Mortality | 60 | | | | USEPA, 1985d |
| | Dog | Oral | NR | Reproductive | | | 3,540 | | RTECS, 1993 |
| | Dog | Oral (chronic) | 14 months | Stillbirths, delayed estrus, reduced libido, lack of mammary gland development, and increased deat | | | 12 | | ATSDR, 1992b |
| | Monkey | Oral $LD_{50}$ | NR | Mortality | 200 | | | | RTECS, 1993 |
| | Chicken | Oral (subchronic) | 10 weeks | Decreased reproductive success; toxic symptoms | | | 91.4 [a] | | USEPA, 1985d |
| | Rock dove | Oral $LD_{50}$ | | Mortality | 4,000 | | | | USFWS, 1984 |
| | Black duck | Oral (chronic) | 2 years | Reduced eggshell thickness | | | 0.14 [a] | | Longcore and Stendell, 1977 |
| | Mallard | Oral $LD_{50}$ | | Mortality | 2,240 | | | | USFWS, 1984 |
| | Mallard | Oral (subchronic) | 96 days | Reduced eggshell thickness | | | 2.8 | | Longcore and Stendell, 1977 |
| | Mallard | Oral | NR | Eggshell thinning | | | 1.16 | | USEPA, 1993c |
| | Mallard | Oral | NR | Eggshell thinning | | | 2.91 | | USEPA, 1993c |
| | Mallard | Oral | 2 years | Reproductive | | | 1.45 | | USEPA, 1993c |
| | California quail | Oral $LD_{50}$ | | Mortality | 595 | | | | USFWS, 1984 |
| | Japanese quail | Oral $LD_{50}$ | | Mortality | 841 | | | | USFWS, 1984 |
| | Pheasant | Oral $LD_{50}$ | | Mortality | 1,334 | | | | USFWS, 1984 |
| | Sandhill crane | Oral $LD_{50}$ | | Mortality | 1,200 | | | | USFWS, 1984 |
| | Kestrel | Oral (chronic) | 7 wk – 1 yr | Reduced eggshell thickness | | | 0.56a | | USEPA, 1985d |
| | Kestrel | Oral (chronic) | 1 year | Reduced eggshell thickness | | | 0.16a | | Wiemeyer, et al., 1986 |
| | Barn owl | Oral (chronic) | 2 years | Reduced eggshell thickness | | | 0.14 [a] | | Longcore and Stendell, 1977 |
| Aroclor 1254 (surrogate for Aroclor 1242 and 1260) | Mouse | Oral | NR | Reproductive | | | 1.53 | | USEPA, 1993c |
| | Chicken | Oral (chronic) | NR | Embryonic mortality | | | 0.9 | | USEPA, 1976 |
| | Rock dove | Oral (chronic) | NR | Parental incubation behavior | | | 0.9 | | Peakall and Peakall, 1973 |

## Table O–1.5
## Ingestion Toxicity Information for Wildlife
## AOC 57

**Remedial Investigation Report**
**Devens, Massachusetts**

| Chemical | Test Species | Test Type | Duration | Effect | Lethal RTV mg/kgBW–day Oral $LD_{50}$ | Lethal RTV mg/kgBW–day LOAEL | Sublethal RTV mg/kgBW–day LOAEL | Sublethal RTV mg/kgBW–day NOAEL | Reference |
|---|---|---|---|---|---|---|---|---|---|
| Aroclor 1254 (cont.) | American kestrel | Oral (chronic) | 69 days | Reduced sperm concentration | | | 9 | | Eisler, 1986 |
| | Mink | Oral dose | 160 days | Reproductive | | | 0.096 | | USEPA, 1993c |
| | Mink | Oral | NR | Kit growth | | | 0.15 | | USEPA, 1993c |
| | Mink | Oral | 12.5 days | Reproductive | | | 0.375 | | USEPA, 1993c |
| | Chicken | Oral | 39 weeks | Egg production and fertility | | | 2.44 | | USEPA, 1993c |
| | Chicken | Oral | NR | Egg production and hatchability | | | 9.8 | | USEPA, 1993c |
| | Chicken | Maternal diet | NR | Chick growth | | | 0.98 | | USEPA, 1993c |
| | Pheasant | Oral | 16 weeks | Egg hatchability | | | 1.8 | | USEPA, 1993c |
| Aroclor 1260 | Rat | Oral $LD_{50}$ | NR | Mortality | 1,315 | | | | RTECS, 1993 |
| | Rat | Oral $LD_{50}$ | NR | Mortality | 500 | | | | Eisler, 1986 |
| | Rat | Oral $LD_{50}$ | NR | Mortality | 1,300 | | | | Eisler, 1986 |
| | Rat | Oral | NR | Reproductive effects | | | 1,674 | | RTECS, 1993 |
| | Rat | Oral (chronic) | 2 generations | Reduced litter size | | | 7.6 | | USEPA, 1985 |
| | Rat | Oral (subchronic) | 9 weeks | Fetal mortality; maternal toxicity | | | 6.4 | | ATSDR, 1987 |
| | Mouse | Oral | NR | Reproductive effects | | | 74 | | RTECS, 1993 |
| | Mink | Oral $LD_{50}$ | | Mortality | 4,000 | | | | Eisler, 1986 |
| | Mink | Oral $LD_{50}$ | | Mortality | 3,000 | | | | Eisler, 1986 |
| | Mink | Oral $LD_{50}$ | | Mortality | 750 | | | | Eisler, 1986 |
| | Mink | Oral (subchronic) | 4 months | Impaired reproduction | | | 0.0075 | | Newell et al., 1987 |
| | Bobwhite | Oral $LD_{50}$ | 8 days | Mortality | 80 [a] | | | | Eisler, 1986 |
| | Mallard | Oral $LD_{50}$ | 8 days | Mortality | 111 | | | | Eisler, 1986 |
| gamma–Chlordane (surrogate for alpha–chlordane) | Rat | Oral LD50 | NR | Mortality | 283 | | | | RTECS, 1993 |
| | Rat | Oral LD50 | | Mortality | 430 | | | | Allen et al., 1979 |
| | Rat | Oral LD50 | | Mortality | 335 | | | | Allen et al., 1979 |
| | Rabbit | Oral LD50 | | Mortality | 300 | | | | Allen et al., 1979 |
| | Rabbit | Oral LD50 | | Mortality | 100 | | | | Allen et al., 1979 |
| | Dog | Oral LD50 | | Mortality | 200 | | | | Allen et al., 1979 |
| | Goat | Oral LD50 | | Mortality | 180 | | | | Allen et al., 1979 |
| | Rat | Oral(subchronic) | Multi–generational | Decreased fertility | | | 16 | | ATSDR, 1992a |
| | Japanese quail | Oral LD50 | 5 days | Mortality | 35 | | | | Hill et al., 1975 |
| | Bobwhite | Oral LD50 | 5 days | Mortality | 29 | | | | Hill et al., 1975 |
| | Mallard | Oral LD50 | 5 days | Mortality | 62 | | | | Hill et al., 1975 |
| | Pheasant | Oral LD50 | | Mortality | 24 | | | | USFWS, 1984 |
| | Mouse | Oral (chronic) | 2 years | Hepatocellular hypertrophy and necrosis | | | 0.47 | | ATSDR, 1992a |
| | Mouse | Oral (chronic) | 30 months | Regional liver hypertrophy (females) | | | 0.273 | 0.055 | ATSDR, 1992a |
| | Dog | Oral (chronic) | 2 years | Histologic changes | | | 0.375 | | USEPA, 1988a |
| | Young chicken | Chronic | 4 week | Egg hatchability and growth | | | | 0.031 [b] | Eisler, 1990 |
| Dieldrin | Mouse | Oral $LD_{50}$ | NR | Mortality | 38 | | | | Allen et al., 1979 |
| | Mouse | Oral (chronic) | 80 weeks | Body tremors | | | 0.33 | | NCI, 1978 |
| | Mouse | Oral (chronic) | 2 year | Liver enlargement w/ histopathology | | | 0.1 | | IRIS, 1991 |
| | Mouse | Oral (chronic) | 2 year | Hepatic cancer | | | 1.3 | | ATSDR, 1991e |
| | Rat | Oral (chronic) | 2 year | Histologic changes | | | 2 | | ATSDR, 1987b |
| | Rat | Oral (chronic) | 2 year | Liver lesions | | | 0.05 | 0.005 | IRIS, 1991 |
| | Dog | Oral (chronic) | 2 year | Increased liver weight; liver/body weight | | | 0.05 | 0.005 | IRIS, 1991 |
| | Dog | Oral (chronic) | 25 months | Hepatocyte degeneration | | | 0.5 | | ATSDR, 1987b |
| | Monkey | Oral (chronic) | 120 days | Tremors and Convusions | | | 0.1 | | Smith et al., 1976 |
| | Mouse | Oral (subchronic) | 4 wks | Decreased pup survival | | | 0.65 | | Virgo & Bellward, 1975 |
| | Rat | Oral (subchronic) | 120 days | Operant behavior | | | | 0.025 | Smith et al., 1976 |
| | Rat | Oral $LD_{50}$ | NR | Mortality | 46 | | | | Allen et al., 1979 |
| | Guinea pig | Oral $LD_{50}$ | NR | Mortality | 25 | | | | Allen et al., 1979 |
| | Rabbit | Oral $LD_{50}$ | NR | Mortality | 45 | | | | Allen et al., 1979 |
| | House sparrow | Oral $LD_{50}$ | NR | Mortality | 48 | | | | USFWS, 1984 |
| | Chicken | Oral $LD_{50}$ | NR | Mortality | 20 | | | | Allen et al., 1979 |
| | Rock dove | Oral $LD_{50}$ | NR | Mortality | 27 | | | | USFWS, 1984 |
| | Gray partridge | Oral $LD_{50}$ | NR | Mortality | 9 | | | | USFWS, 1984 |
| | Chukar | Oral $LD_{50}$ | NR | Mortality | 25 | | | | USFWS, 1984 |
| | Japanese quail | Oral $LD_{50}$ | 5 days | Mortality | 6 [a] | | | | Hill et al., 1975 |
| | Japanese quail | Oral $LD_{50}$ | NR | Mortality | 70 | | | | USFWS, 1984 |
| | California quail | Oral $LD_{50}$ | NR | Mortality | 9 | | | | USFWS, 1984 |
| | Bobwhite | Oral $LD_{50}$ | 5 days | Mortality | 3 [a] | | | | Hill et al., 1975 |
| | Pheasant | Oral $LD_{50}$ | NR | Mortality | 79 | | | | USFWS, 1984 |

## Table O-1.5
## Ingestion Toxicity Information for Wildlife
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical | Test Species | Test Type | Duration | Effect | Lethal RTV mg/kgBW-day Oral $LD_{50}$ | Lethal RTV mg/kgBW-day LOAEL | Sublethal RTV mg/kgBW-day LOAEL | Sublethal RTV mg/kgBW-day NOAEL | Reference |
|---|---|---|---|---|---|---|---|---|---|
| Dieldrin (cont.) | Mallard | Oral $LD_{50}$ | 5 days | Mortality | 12 [a] | | | | Hill et al., 1975 |
| | Mallard | Oral $LD_{50}$ | 5 days | Mortality | 11 [a] | | | | Hill et al., 1975 |
| | Mallard | Oral $LD_{50}$ | NR | Mortality | 381 | | | | USFWS, 1984 |
| | Whistling duck | Oral $LD_{50}$ | NR | Mortality | 100 | | | | USFWS, 1984 |
| | Canada goose | Oral $LD_{50}$ | NR | Mortality | 141 | | | | USFWS, 1984 |
| | Goat | Oral $LD_{50}$ | NR | Mortality | 100 | | | | Allen et al., 1979 |
| | Sheep | Oral $LD_{50}$ | NR | Mortality | 50 | | | | Allen et al., 1979 |
| | Cattle | Oral $LD_{50}$ | NR | Mortality | 60 | | | | Allen et al., 1979 |
| | Mule deer | Oral $LD_{50}$ | NR | Mortality | 75 | | | | Allen et al., 1979 |
| | Cat | Oral $LD_{50}$ | NR | Mortality | 300 | | | | Allen et al., 1979 |
| | Dog | Oral $LD_{50}$ | NR | Mortality | 65 | | | | Allen et al., 1979 |
| **SEMIVOLATILE ORGANIC COMPOUNDS** | | | | | | | | | |
| 1,4-Dichlorobenzene | Rat | $LD_{50}$, gavage oil | 14 days | Mortality | 3,800 | | | | ATSDR, 1992 |
| (& 1,2-DCB) | Mouse | Oral | | Systemic, hepatocellular degeneration | | | 300 | | ATSDR, 1992 |
| 2-Methylnaphthalene | Rat | Oral $LD_{50}$ | | Mortality | 1,630 | | | | NIOSH, 1985 |
| Acenaphthylene | Rat | Oral (chronic) | 40 days | Physiological changes | | | 600 | | USEPA, 1984 |
| Benzo(a)pyrene (used as a | Rat | Oral (chronic) | Pregnancy | Sterility in offspring | | | 40 | | USEPA, 1984a |
| surrogate for PAHs). | Rat | Oral (chronic) | 3.5 months | Reproductive | | | 50 | | USEPA, 1984a |
| | Mouse | Oral | Multi-generational | Decreased fertility of F1 progeny; decreased F2 litter size. | | | 10 [c] | | MacKenzie and Angevine, 1981 |
| | Mouse | Oral (subchronic) | 6 months | Mortality | | 120 | | | ATSDR, 1993a |
| Benzo(b&k)fluoranthene | Rodents | Oral (chronic) | NS | Carcinogenicity | | | 40 | | Eisler, 1987 |
| Bis(2-ethylhexyl)phthalate | Rat | Oral $LD_{50}$ | NR | Mortality | 30,600 | | | | RTECS, 1993 |
| | Rat | Oral | NR | Reproductive effects | | | 7,140 | | RTECS, 1993 |
| | Rat | Oral | NR | Reproductive effects | | | 35 | | RTECS, 1993 |
| | Rat | Oral | NR | Reproductive effects | | | 6,000 | | RTECS, 1993 |
| | Rat | Oral | NR | Reproductive effects | | | 17,200 | | RTECS, 1993 |
| | Rat | Oral | NR | Reproductive effects | | | 10,000 | | RTECS, 1993 |
| | Rat | Oral | NR | Reproductive effects | | | 9,766 | | RTECS, 1993 |
| | Mouse | Oral $LD_{50}$ | NR | Mortality | 30,000 | | | | RTECS, 1993 |
| | Mouse | Oral | NR | Reproductive effects | | | 78,880 | | RTECS, 1993 |
| | Mouse | Oral | NR | Reproductive effects | | | 4,200 | | RTECS, 1993 |
| | Mouse | Oral | NR | Reproductive effects | | | 50 | | RTECS, 1993 |
| | Mouse | Oral | NR | Reproductive effects | | | 1,000 | | RTECS, 1993 |
| | Mouse | Oral | NR | Reproductive effects | | | 2,040 | | RTECS, 1993 |
| | Rabbit | Oral $LD_{50}$ | NR | Mortality | 34,000 | | | | RTECS, 1993 |
| | Guinea pig | Oral $LD_{50}$ | NR | Mortality | 26,000 | | | | RTECS, 1993 |
| | Guinea pig | Oral | NR | Reproductive effects | | | 20,000 | | RTECS, 1993 |
| | Mammal | Oral | NR | Reproductive effects | | | 20,000 | | RTECS, 1993 |
| | Mammal | Oral | NR | Reproductive effects | | | 509,000 | | RTECS, 1993 |
| | Mouse | Oral $LD_{50}$ | | Mortality | 800 | | | | RTECS, 1993 |
| | Mouse | Oral (subchronic) | 13 weeks | Renal effects | | | 125 | | RTECS, 1993 |
| Chrysene | Rodents | Oral (chronic) | NS | Carcinogenicity | | | 99 | | Eisler, 1987a |
| Dibenzofuran | Rodents | Single oral dose | | LC 20 | | 500 | | | ATSDR, 1991f |
| | Rodents | Oral (chronic) | 13 weeks | LC 10 | | 125 | | | ATSDR, 1991f |
| | Mouse | Oral (chronic) | 103 weeks | Multinuclear hepatocytes | | | | 60 | ATSDR, 1991f |
| Di-n-butylphthalate | Rat | Oral (subchronic) | 48 days | Reproductive effects | | | 125 | | USEPA, 1989a |
| | Rat | Oral (chronic) | 1 year | Mortality | | 600 | | | IRIS, 1991 |
| | Mouse | Oral $LD_{50}$ | | Mortality | 5,28 | | | | Sax, 1984 |
| | Rat | Oral $LD_{50}$ | | Mortality | 12,000 | | | | Sax, 1984 |
| Fluoranthene | Rat | Oral $LD_{50}$ | NR | Mortality | 2,000 | | | | RTECS, 1994 |
| | Mouse | Oral (subchronic) | 90 days | Nephropathy; clinical and pathological effects | | | 250 | 125 | IRIS, 1990 |
| Naphthalene | Rat | Oral (chronic) | 100 weeks | Ocular lesions | | | 41 | | USEPA, 1990a |
| | Rat | Oral (subchronic) | 13 weeks | Decreased body weight gain | | | 35.7 | | USEPA, 1990a |
| | Mouse | Oral $LD_{50}$ | | Mortality | 533 | | | | ATSDR, 1990a |
| Phenanthrene | Mouse | Oral $LD_{50}$ | NR | Mortality | 700 | | | | RTECS, 1994 |
| | Mouse | Oral (subchronic) | 6 months | Increased liver weight | | | 120 | | USEPA, 1989a |
| Pyrene | Rat | Oral $LD_{50}$ | NR | Mortality | 2,700 | | | | RTECS, 1993 and NIOSH, 1985 |
| | Mouse | Oral $LD_{50}$ | NR | Mortality | 800 | | | | RTECS, 1993 and NIOSH, 1985 |

## Table O–1.5
## Ingestion Toxicity Information for Wildlife
## AOC 57

**Remedial Investigation Report**
**Devens, Massachusetts**

| Chemical | Test Species | Test Type | Duration | Effect | Lethal RTV mg/kgBW–day Oral $LD_{50}$ | Lethal RTV mg/kgBW–day LOAEL | Sublethal RTV mg/kgBW–day LOAEL | Sublethal RTV mg/kgBW–day NOAEL | Reference |
|---|---|---|---|---|---|---|---|---|---|
| **VOLATILE ORGANIC COMPOUNDS** | | | | | | | | | |
| 1,1–Dichloroethylene (surrogate | Rat | Single oral dose | NR | Mortality | 200 | | | | IRIS, 1988 |
| for 1,2–Dichloroethylene) | Rat | Oral (chronic) | 2 years | Liver lesions | | | 9 | | IRIS, 1988 |
| | Rat | Oral (chronic) | 2 years | Reproductive effects from 1,1–DCE administered via drinking water | | | | 30 | ATSDR, 1992 |
| 1,1,1–Trichloroethane | Ginea Pig | Oral (subchronic) | 90 days | Hepatotoxicity | | | 90 | | IRIS, 1991 |
| | Rat | Single oral dose | | Mortality | 10,300 | | | | NIOSH, 1985 |
| | Rat | Oral (subchronic) | 78 weeks | Reproductive effects | | | | 1500 | USEPA, 1990 |
| Acetone | Rat | Oral | NR | Reproductive effects | | | 273,000 | | RTECS, 1993 |
| | Rat | Oral $LD_{50}$ | NR | Mortality | 5,800 | | | | RTECS, 1993 |
| | Rat | Oral $LD_{50}$ | | Mortality | 9,750 | | | | Sax, 1984 |
| | Mouse | Oral $LD_{50}$ | NR | Mortality | 3,000 | | | | RTECS, 1993 |
| | Rabbit | Oral $LD_{50}$ | NR | Mortality | 5,340 | | | | RTECS, 1993 |
| Benzene | Rat | Single oral dose | | Mortality | 3,800 | | | | TDB, 1984 |
| | Rat | Oral (chronic) | 187 days | Hematopoietic effects | | | 10 | | USEPA, 1984 |
| Carbon disulfide | Rabbit | Converted inhalation | 34 weeks | NOAEL for Fetotoxicity/malformations | | | | 11 | IRIS, 1991 |
| Chlorobenzene | Rat | Oral (subchronic) | 93 – 99 days | Increased liver and kidney weight | | | 100 | | USEPA, 1984b |
| | Dog | Oral (subchronic) | 13 weeks | Histopathological changes in liver | | | 136 | | IRIS, 1991 |
| | Mouse | Oral (subchronic) | 13 weeks | Increased liver weight, hepatic necrosis | | | 89 | | USEPA, 1984b |
| | Rat | Oral $LD_{50}$ | Single dose | Mortality | 1,000 | | | | ATSDR, 1989 |
| Chloroform | Rat | Oral | NR | Mortality | 908 | | | | RTECS, 1994 |
| | Rat | Oral | NR | Reproductive effects | | | 1,260 | | RTECS, 1994 |
| | Rat | Oral | NR | Reproductive effects | | | 4,000 | | RTECS, 1994 |
| | Mouse | Oral | NR | Reproductive effects | | | 2,177 | | RTECS, 1994 |
| | Mouse | Oral | NR | Reproductive effects | | | 2,115 | | RTECS, 1994 |
| | Guinea pig | Oral | NR | Mortality | 820 | | | | RTECS, 1994 |
| | Rabbit | Oral | NR | Reproductive effects | | | 260 | | RTECS, 1994 |
| Ethylbenzene | Rat | Oral (subchronic) | 182 days | Liver and kidney toxicity | | | 291 | 97.1 | IRIS, 1991 |
| | Rat | Oral $LD_{50}$ | | Mortality | 3,500 | | | | NIOSH, 1985 |
| | Rat | $LD_{50}$ (gavage) | 1 day | Mortality | 4,728 | | | | ATSDR, 1989 |
| Methylene chloride | Rat | Oral $LD_{50}$ | NR | Mortality | 1,600 | | | | RTECS, 1994 |
| | Dog | Oral $LD_{50}$ | NR | Mortality | 3,000 | | | | RTECS, 1994 |
| | Rabbit | Oral $LD_{50}$ | NR | Mortality | 1,900 | | | | RTECS, 1994 |
| | Rat | Oral (chronic) | 2 years | Liver toxicity | | | 52.6 | 5.9 | IRIS,1991 |
| Methylene chloride (cont.) | Rat | Oral (subchronic) | 3 months | Mortality, blood chemistry, histopathology | | | | 12.5 | USEPA, 1984b |
| Tetrachloroethylene | Rat | Single oral dose | | Mortality | 8,850 | | | | NIOSH, 1985 |
| | Mouse | Single oral dose | | Mortality | 8,100 | | | | TBD, 1984 |
| | Mouse | Oral (subchronic) | 6 weeks | Hepatotoxicity | | | 100 | | Buben and O'Flaherty, 1985 |
| Toluene | Rat | Oral (subchronic) | 13 weeks | Increased liver and kidney weight | | | 446 | | IRIS, 1991 |
| | Rat | Oral $LD_{50}$ | | Mortality | 5,000 | | | | NIOSH, 1985 |
| | Mouse | Oral (subchronic) | 76 days | Decreased open field activity | | | 76 | | ATSDR, 1992ac |
| Trichloroethene | Mouse | Single oral dose | | Mortality | 2,402 | | | | NIOSH, 1985 |
| | Rat | Single oral dose | | Mortality | 7,193 | | | | NIOSH, 1985 |
| | Mouse | Oral (multi–generational) | 12 weeks | Decreased dam and fetal weights | | | 750 | | ATSDR, 1991a |
| Trichlorofluoromethane | Mouse | $LD_{50}$ (inter–peritoneal injection) | | Mortality | 1,743 | | | | Sax, 1984 |
| Xylenes (total) | Rat | Oral $LD_{50}$ | | Mortality | 4,300 | | | | NIOSH, 1985 |
| | Rat | Oral (chronic) | 103 weeks | Hyperactivity, decreased BW, mortality | | | 500 | 250 | IRIS, 1991 |
| | Japanese quail | Oral (acute) | 5 days | Mortality | 20,000 | 2,014 | | | Hül and Camardese, 1986 |

NOTES:
$LD_{50}$ = Dose resulting in 50% mortality in test population
BW = Body weight
NR = Not reported
LOAEL = Lowest Observed Adverse Effect Level
NOAEL = No Observed Adverse Effect Level
[a] Converted to dose per kilogram body weight by multiplying by ingestion and dividing by body weight. Body weights for birds obtained from Dunning, 1984.
Ingestion rates were calculated using the following regression equation (for all birds) from USEPA, 1993a: Food Ingestion (kg/day) = 0.00582 * Body Weight $^{0.651}$ (kg). Ingestion rates for the chicken from NRC, 1984 (pg. 13).
[b] Converted from 30 ppm to 11 mg/kgBW–day using standard default parameters (USEPA, 1988).
[c] Value for benzo(a)pyrene chosen as a surrogate for all PAHs. Chemical–specific toxicity studies for ecologically significant endpoints are lacking for other PAHs.

**Table O-1.6**
**RTVs Selected for Ecological Risk Assessment (mg/kgBW/day) [a]**
**AOC 57**

**Remedial Investigation Report**
**Devens, Massachusetts**

| Compound | Small Mammal [b] | | | Small Bird [c] | | | Predatory Mammal [d] | | | Predatory Bird [e] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Lethal | Sublethal | Selected RTV | Lethal | Sublethal | Selected RTV | Lethal | Sublethal | Selected RTV | Lethal | Sublethal | Selected RTV |
| Inorganic Analytes | | | | | | | | | | | | |
| Aluminum | 740 | 425 | 425 | 740 | 425 | 425 | 740 | 425 | 425 | 740 | 425 | 425 |
| Antimony | 16,714 | 41.8 | 41.8 | 16,714 | 41.8 | 41.8 | 16,714 | 41.8 | 41.8 | 16,714 | 41.8 | 41.8 |
| Arsenic | 29 | 0.58 | 0.58 | 3.6 | 1 | 1 | 3.1 | 0.58 | 0.58 | 3.6 | 1 | 1 |
| Barium | 430 | 198 | 198 | 430 | 198 | 198 | 430 | 198 | 198 | 430 | 198 | 198 |
| Beryllium | 2 | 0.85 | 0.85 | 2 | 0.85 | 0.85 | 2 | 0.85 | 0.85 | 2 | 0.85 | 0.85 |
| Cadmium | 30 | 21.5 | 21.5 | 30 | 10 | 10 | 30 | 21.5 | 21.5 | 30 | 10 | 10 |
| Chromium | 40 | 3.5 | 3.5 | 25.2 | 200 | 25.2 | 40 | 3.5 | 3.5 | 25.2 | 200 | 25.2 |
| Cobalt | 18.2 | 4.2 | 4.2 | 18.2 | 4.2 | 4.2 | 18.2 | 4.2 | 4.2 | 18.2 | 4.2 | 4.2 |
| Copper | 188 | 100 | 100 | 188 | 100 | 100 | 188 | 100 | 100 | 188 | 100 | 100 |
| Lead | 60 | 2.5 | 2.5 | 75 | 125 | 75 | 60 | 2.5 | 2.5 | 75 | 125 | 75 |
| Manganese | 45 | 100 | 45 | 45 | 100 | 45 | 45 | 100 | 45 | 45 | 100 | 45 |
| Mercury | 3.6 | 0.9 | 0.9 | 2.9 | 0.064 | 0.064 | 0.2 | 0.1 | 0.1 | 2.9 | 0.064 | 0.064 |
| Nickel | 13 | 50 | 13 | 100 | 50 | 50 | 13 | 50 | 13 | 100 | 50 | 50 |
| Selenium | 28 | 0.2 | 0.2 | 2.7 | 0.6/1.75 [h] | 0.6/1.75 | 28 | 0.2 | 0.2 | 2.7 | 0.6 | 0.6 |
| Vanadium | 6 | 8.4 | 6 | 19.2 | 11 | 11 | 6 | 8.4 | 6 | 19.2 | 11 | 11 |
| Zinc | 390 | 200 | 200 | 390 | 200 | 200 | 390 | 200 | 200 | 390 | 200 | 200 |
| Pesticides/PCBs | | | | | | | | | | | | |
| 4,4'-DDD | 17.4 | 0.2 | 0.2 | 119/448 [h] | 0.14/1.16 [h] | 0.14/1.16 | 12 | 12 | 12 | 119 | 0.14 | 0.14 |
| 4,4'-DDE | 140 | 0.2 | 0.2 | 119/448 [h] | 0.39/0.58 [h] | 0.39/0.58 | 140 | 12 | 12 | 119 | 0.39 | 0.39 |
| 4,4'-DDT | 17.4 | 0.2 | 0.2 | 119/448 [h] | 0.14/1.16 [h] | 0.14/1.16 | 12 | 12 | 12 | 119 | 0.14 | 0.14 |
| Aroclor-1242 | 100 | 6.4 | 6.4 | 16/22.2 [h] | 0.9 | 0.9 | 150 | 0.0075 | 0.0075 | 16 | 9 | 9 |
| Aroclor-1260 | 100 | 6.4 | 6.4 | 16/22.2 [h] | 0.9 | 0.9 | 150 | 0.0075 | 0.0075 | 16 | 9 | 9 |
| alpha-Chlordane | 20 | 16 | 16 | 4.8 | 0.031 | 0.031 | 40 | 16 | 16 | 4.8 | 0.031 | 0.031 |
| gamma-Chlordane | 20 | 16 | 16 | 4.8 | 0.031 | 0.031 | 40 | 16 | 16 | 4.8 | 0.031 | 0.031 |
| Dieldrin | 8 | 0.65 | 0.65 | 0.6/2.2 [h] | 0.65 | 0.6/2.2 | 13 | 0.65 | 0.65 | 0.6 | 0.65 | 0.6 |
| Semivolatile Organic Compounds | | | | | | | | | | | | |
| 1,2-Dichlorobenzene | 760 | NA | 760 | 760 | NA | 760 | 760 | NA | 760 | 760 | NA | 760 |
| 1,4-Dichlorobenzene | 760 | NA | 760 | 760 | NA | 760 | 760 | NA | 760 | 760 | NA | 760 |
| 2-Methylnaphthylene | 326 | 10 [f] | 10 | 326 | 10 [f] | 10 | 326 | 10 [f] | 10 | 326 | 10 [f] | 10 |
| Acenaphthylene | 120 [f] | 10 [f] | 10 | 120 [f] | 10 [f] | 10 | 120 [f] | 10 [f] | 10 | 120 [f] | 10 [f] | 10 |
| Benzo(b)fluoranthene | 120 [f] | 10 [f] | 10 | 120 [f] | 10 [f] | 10 | 120 [f] | 10 [f] | 10 | 120 [f] | 10 [f] | 10 |
| Benzo(k)fluoranthene | 120 [f] | 10 [f] | 10 | 120 [f] | 10 [f] | 10 | 120 [f] | 10 [f] | 10 | 120 [f] | 10 [f] | 10 |
| Bis(2-ethylhexyl)phthalate | 160 | 35 | 35 | 160 | 35 | 35 | 160 | 35 | 35 | 160 | 35 | 35 |
| Chrysene | 120 [f] | 10 [f] | 10 | 120 [f] | 10 [f] | 10 | 120 [f] | 10 [f] | 10 | 120 [f] | 10 [f] | 10 |
| Dibenzofuran | 125 | 12.5 [g] | 12.5 | 125 | 12.5 [g] | 12.5 | 125 | 12.5 [g] | 12.5 | 125 | 12.5 [g] | 12.5 |
| Di-n-butylphthalate | 1.1 | 125 | 1.1 | 1.1 | 125 | 1.1 | 1.1 | 125 | 1.1 | 1.1 | 125 | 1.1 |
| Fluoranthene | 400 | 10 [f] | 10 | 400 | 10 [f] | 10 | 400 | 10 [f] | 10 | 400 | 10 [f] | 10 |
| Naphthalene | 107 | 35.7 | 35.7 | 107 | 35.7 | 35.7 | 107 | 35.7 | 35.7 | 107 | 35.7 | 35.7 |
| Phenanthrene | 140 | 10 [f] | 10 | 140 | 10 [f] | 10 | 140 | 10 [f] | 10 | 140 | 10 [f] | 10 |
| Pyrene | 160 | 10 [f] | 10 | 160 | 10 [f] | 10 | 160 | 10 [f] | 10 | 160 | 10 [f] | 10 |
| Volatile Organic Compounds | | | | | | | | | | | | |
| 1,2-Dichloroethylene | 40 | 30 | 30 | 40 | 30 | 30 | 40 | 30 | 30 | 40 | 30 | 30 |
| 1,1,1-Trichloroethane | 2,060 | 1,500 | 1,500 | 2,060 | 1,500 | 1,500 | 2,060 | 1,500 | 1,500 | 2,060 | 1,500 | 1,500 |
| Acetone | 600 | 273,000 | 600 | 600 | 273,000 | 600 | 600 | 273,000 | 600 | 600 | 273,000 | 600 |
| Benzene | 760 | NA | 760 | 760 | NA | 760 | 760 | NA | 760 | 760 | NA | 760 |
| Carbon disulfide | NA | 11 | 11 | NA | 11 | 11 | NA | 11 | 11 | NA | 11 | 11 |
| Chlorobenzene | 100 | 89 | 89 | 100 | 89 | 89 | 100 | 89 | 89 | 100 | 89 | 89 |

## Table O-1.6
## RTVs Selected for Ecological Risk Assessment (mg/kgBW/day) [a]
## AOC 57

### Remedial Investigation Report
### Devens, Massachusetts

| Compound | Small Mammal [b] | | | Small Bird [c] | | | Predatory Mammal [d] | | | Predatory Bird [e] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Lethal | Sublethal | Selected RTV | Lethal | Sublethal | Selected RTV | Lethal | Sublethal | Selected RTV | Lethal | Sublethal | Selected RTV |
| Chloroform | 164 | 260 | 164 | 164 | 260 | 164 | 164 | 260 | 164 | 164 | 260 | 164 |
| Ethylbenzene | 700 | 291 | 291 | 700 | 291 | 291 | 700 | 291 | 291 | 700 | 291 | 291 |
| Methylene chloride | 320 | 52.6 | 52.6 | 320 | 52.6 | 52.6 | 600 | 52.6 | 52.6 | 600 | 52.6 | 52.6 |
| Tetrachloroethylene | 1,620 | 100 | 100 | 1,620 | 100 | 100 | 1,620 | 100 | 100 | 1,620 | 100 | 100 |
| Toluene | 1,000 | 76 | 76 | 1,000 | 76 | 76 | 1,000 | 76 | 76 | 1,000 | 76 | 76 |
| Trichloroethylene | 480 | 750 | 480 | 480 | 750 | 480 | 480 | 750 | 480 | 480 | 750 | 480 |
| Trichlorofluoromethane | 350 | 35 [g] | 35 | 350 | 35 [g] | 35 | 350 | 35 [g] | 35 | 350 | 35 [g] | 35 |
| Xylenes | 860 | 500 | 500 | 2,014 | 500 | 500 | 860 | 500 | 500 | 2,014 | 500 | 500 |

Notes:

[a] Lethal RTVs correspond to the boxed lethal RTV (one-fifth of the oral $LD_{50}$ or the LOAEL) presented in Table __-5. When available, oral $LD_{50}$ data were preferentially chosen. Sublethal RTVs correspond to the boxed sublethal RTV (LOAEL or NOAEL) presented in Table __-5. When available, sublethal LOAEL data were preferentially chosen.

[b] These RTVs represent chemical concentrations that are not anticipated to result in adverse effects for the short-tailed shrew, white-footed mouse, and muskrat.

[c] These RTVs represent chemical concentrations that are not anticipated to result in adverse effects for the American robin or mallard. When no data were available, the small mammal value was used as a surrogate.

[d] These RTVs represent chemical concentrations that are not anticipated to result in adverse effects for the red fox or the raccoon. When no data were available, the small mammal value was used as a surrogate.

[e] These RTVs represent chemical concentrations that are not anticipated to result in adverse effects for the barred owl or great blue heron. When no data were available, the small bird or predatory mammal value was used as a surrogate.

[f] The value for benzo(a)pyrene was used as a surrogate.

[g] A sublethal RTV was derived by applying a factor of 0.1 to the lethal RTV, which is expected to be protective of 99% of the population (USEPA, 1986).

[h] When injestion toxicity data were available for mallards, these data were preferentially chosen for evaluating food chain effects to mallards; other (more conservative) effects data may have been selected for evaluatng food chain exposures to all other bird species.

$LD_{50}$ = Median lethal dose.
LOAEL = Lowest Observed Adverse Effect Level
NOAEL = No Observed Adverse Effect Level.
RTV = Reference toxicity value.
NA = Not available.

# TABLE O–1.7
# SUMMARY OF TOXICITY DATA FOR PLANT RECEPTORS
# AOC 57

## Remedial Investigation Report
## Devens, Massachusetts

| Chemical | Reference | RTV in soil [a] (µg/g) |
|---|---|---|
| **INORGANICS** | | |
| Aluminum | Will and Suter, 1994 | 50 |
| Antimony | Will and Suter, 1994 | 5 |
| Arsenic | Will and Suter, 1994 | 10 |
| Barium | Will and Suter, 1994 | 500 |
| Beryllium | Will and Suter, 1994 | 10 |
| Cadmium | Will and Suter, 1994 | 3 |
| Chromium | Will and Suter, 1994 | 1 |
| Cobalt | Will and Suter, 1994 | 20 |
| Copper | Will and Suter, 1994 | 100 |
| Lead | Will and Suter, 1994 | 50 |
| Manganese | Will and Suter, 1994 | 500 |
| Nickel | Will and Suter, 1994 | 30 |
| Selenium | Will and Suter, 1994 | 1 |
| Vanadium | Will and Suter, 1994 | 2 |
| Zinc | Will and Suter, 1994 | 50 |
| **PESTICIDES/PCBs** | | |
| 4,4'–DDE | | 12.5 [b] |
| 4,4'–DDT | Eno & Everett, 1958 | 12.5 |
| Aroclors | Will and Suter, 1994 | 40 |
| Dieldrin | | 12.5 [b] |
| **SEMI–VOLATILE ORGANICS** | | |
| 1,2–Dichlorobenzene | Hulzebos *et al.*, 1993 [d] | 248 |
| 1,4–Dichlorobenzene | Hulzebos *et al.*, 1993 [d] | 248 |
| 2–Methylnaphthalene | | 25 [c] |
| Bis(2–ethylhexyl)phthalate | Hulzebos *et al.*, 1993 [d] | >1,000 |
| Dibenzofuran | Hulzebos *et al.*, 1993 [d] | 617 [e] |
| Di–n–butylphthalate | Will and Suter, 1994 | 200 |
| Fluoranthene | | 25 [c] |
| Naphthalene | Hulzebos *et al.*, 1993 [d] | 100 |
| Phenanthrene | | 25 [c] |
| Pyrene | | 25 [c] |
| **VOLATILE ORGANICS** | | |
| 1,2–Dichloroethylene | | >1,000 [f] |
| Acetone | | NA |
| Chloroform | | >1,000 [f] |
| Ethylbenzene | | 200 [g] |
| Methylene chloride | | >1,000 [f] |
| Tetrachloroethylene | Hulzebos *et al.*, 1993 [d] | >1,000 |
| Toluene | Will and Suter, 1994 | 200 |
| Trichlorofluoromethane | | NA |
| Xylene (total) | Hulzebos *et al.*, 1993 [d] | >1,000 |

Notes:
[a] RTVs in soil are equal to chemical concentrations in soil that are not expected to result in adverse effects to plants.
[b] Value for 4,4'–DDT used as a surrogate.
[c] Value for acenaphthene used as a surrogate.
[d] Values represent 14–day growth $EC_{50}$s for *Lactuca sativa* in soil.
[e] Value for furan used as a surrogate.
[f] Value for tetrachloroethylene used as a surrogate.
[g] Value for toluene used as a surrogate
NA = Not available

TABLE O–1.8
SUMMARY OF TOXICITY DATA FOR TERRESTRIAL INVERTEBRATE RECEPTORS
AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical | Test Type | Test Duration | Test Species | Chemical Concentration (µg/g) | Effect | RTV (µg/g) | Reference |
|---|---|---|---|---|---|---|---|
| **INORGANICS** | | | | | | | |
| Aluminum | NA | NA | NA | NA | NA | NA | NA |
| Antimony | NA | NA | NA | NA | NA | NA | NA |
| Arsenic | Soil Test | 14 day | *E. foetida* | 100 | 0 % mortality | 100 | Bouche *et al.*, 1987 |
| Arsenic | Soil Test | 14 day | *E. foetida* | 200 | 100 % mortality | | Bouche *et al.*, 1987 |
| Barium | NA | NA | NA | NA | NA | NA | NA |
| Beryllium | NA | NA | NA | NA | NA | NA | NA |
| Cadmium | Soil Test | 14 day | *E. foetida* | 900 | 0 % mortality | | Bouche *et al.*, 1987 |
| Cadmium | Soil Test | 14 day | *E. foetida* | 2,700 | 100 % mortality | | Bouche *et al.*, 1987 |
| Cadmium | Soil Test | 14 day | *E. foetida* | 1,000 [a] | $LC_{50}$ | | van Gestel and van Dis, 1988 |
| Cadmium | Soil Test | 20 week | *E. foetida* | 50 [b] | Decrease in cocoon production | 50 [c] | Malecki *et al.*, 1982 |
| Cadmium | Soil Test | 2 week | *E. foetida* | 1,843 | $LC_{50}$ | | Neuhauser *et al.*, 1985 |
| Chromium (III) | Soil Test | 8 week | *E. foetida* | 250 | Reproduction 50% inhibited | 250 | Molnar *et al.*, 1989 |
| Cobalt | NA | NA | NA | NA | NA | NA | NA |
| Copper | Soil Test | 14 day | *E. foetida* | 10 | 0 % mortality | | Bouche *et al.*, 1987 |
| Copper | Soil Test | 14 day | *E. foetida* | 30 | 20 % mortality | 30 | Bouche *et al.*, 1987 |
| Copper | Soil Test | 20 week | *E. foetida* | 2,000 [b] | Decrease in cocoon production | | Malecki *et al.*, 1982 |
| Copper | Soil Test | 2 week | *E. foetida* | 643 | $LC_{50}$ | | Neuhauser *et al.*, 1985 |
| Lead | Soil Test | 20 week | *E. foetida* | 5,000 [b] | Decrease in cocoon production | | Malecki *et al.*, 1982 |
| Lead | Soil Test | 2 week | *E. foetida* | 5,941 | $LC_{50}$ | 1,190 [c] | Neuhauser *et al.*, 1985 |
| Manganese | NA | NA | NA | NA | NA | NA | NA |
| Nickel | Soil Test | 20 week | *E. foetida* | 400 [b] | Decrease in cocoon production | 400 | Malecki *et al.*, 1982 |
| Nickel | Soil Test | 2 week | *E. foetida* | 757 | $LC_{50}$ | | Neuhauser *et al.*, 1985 |
| Selenium | NA | NA | NA | NA | NA | NA | NA |
| Vanadium | NA | NA | NA | NA | NA | NA | NA |
| Zinc | Soil Test | 20 week | *E. foetida* | 5,000 [b] | Decrease in cocoon production | | Malecki *et al.*, 1982 |
| Zinc | Soil Test | 2 week | *E. foetida* | 662 | $LC_{50}$ | 130 [c] | Neuhauser *et al.*, 1985 |
| **PESTICIDES/PCBs** | | | | | | | |
| 4,4'–DDE | Soil Test | NS | NS | 60 | 58% mortality | 12 [c] | U.S. EPA, 1985 |
| 4,4'–DDT | Soil Test | NS | NS | 60 | 58% mortality | 12 [c] | U.S. EPA, 1985 |
| Aroclor–1242 | NA | NA | NA | NA | NA | NA | NA |
| Aroclor–1260 | NA | NA | NA | NA | NA | NA | NA |
| Dieldrin | Soil Test | 89 day | *E. foetida* | 10 | 6 % decrease in number of cocoons hatched | | Reinecke and Venter, 1985 |
| Dieldrin | Soil Test | 89 day | *E. foetida* | 30 | 26 % decrease in number of coc | 30 | Reinecke and Venter, 1985 |
| Dieldrin | Soil Test | 89 day | *E. foetida* | 100 | 36 % decrease in number of cocoons hatched; | | Reinecke and Venter, 1985 |
| Dieldrin | Soil Test | 89 day | *E. foetida* | 100 | 50 % decrease in number of cocoons produced | | Reinecke and Venter, 1985 |
| **SEMI–VOLATILE ORGANIC COMPOUNDS** | | | | | | | |
| 1,2–Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA |
| 1,4–Dichlorobenzene | NA | NA | NA | NA | NA | NA | NA |
| 2–Methylnaphthalene | Soil Test | 14 day | *E. foetida* | 173 | $LC_{50}$ | 34 [d] | Neuhauser *et al.*, 1985. |
| Dibenzofuran | NA | NA | NA | NA | NA | NA | NA |
| Bis(2–ethylhexyl)phthalate | Soil Test | 14 day | 4 test species | 2,390 | $LC_{50}$ | 478 [e] | Neuhauser *et al.*, 1986. |
| Di–n–butylphthalate | Soil Test | 14 day | 4 test species | 2,390 | $LC_{50}$ | 478 [e] | Neuhauser *et al.*, 1986. |

TABLE O–1.8
SUMMARY OF TOXICITY DATA FOR TERRESTRIAL INVERTEBRATE RECEPTORS
AOC 57

**Remedial Investigation Report**
**Devens, Massachusetts**

| Chemical | Test Type | Test Duration | Test Species | Chemical Concentration (µg/g) | Effect | RTV (µg/g) | Reference |
|---|---|---|---|---|---|---|---|
| Fluoranthene | Soil Test | 14 day | *E. foetida* | 173 | $LC_{50}$ | 34 [d] | Neuhauser *et al.*, 1985. |
| Naphthalene | Soil Test | 14 day | *E. foetida* | 173 | $LC_{50}$ | 34 [d] | Neuhauser *et al.*, 1985. |
| Phenanthrene | Soil Test | 14 day | *E. foetida* | 173 | $LC_{50}$ | 34 [d] | Neuhauser *et al.*, 1985. |
| Pyrene | Soil Test | 14 day | *E. foetida* | 173 | $LC_{50}$ | 34 [d] | Neuhauser *et al.*, 1985. |
| **VOLATILE ORGANIC COMPOUNDS** | | | | | | | |
| Chloroform | Soil Test | 14 day | *E. foetida* | 740 | $LC_{50}$ | 150 [d] | Neuhauser *et al.*, 1985. |
| Ethylbenzene | Soil Test | 14 day | *E. foetida* | 106 | $LC_{50}$ | 21 [d] | Neuhauser *et al.*, 1985. |
| Methylene chloride | Soil Test | 14 day | *E. foetida* | 740 | $LC_{50}$ | 150 [d] | Neuhauser *et al.*, 1985. |
| Tetrachloroethylene | Soil Test | 14 day | *E. foetida* | 740 | $LC_{50}$ | 150 [d] | Neuhauser *et al.*, 1985. |
| Toluene | Soil Test | 14 day | *E. foetida* | 106 | $LC_{50}$ | 21 [d] | Neuhauser *et al.*, 1985. |
| Trichlorofluoromethane | NA | NA | NA | NA | NA | NA | NA |
| Xylene (total) | Soil Test | 14 day | *E. foetida* | 106 | $LC_{50}$ | 21 [d] | Neuhauser *et al.*, 1985. |
| **TOTAL PETROLEUM HYDROCARBONS** | | | | | | | |
| Total Petroleum Hydrocarbons | NA | NA | NA | NA | NA | NA | NA |

NOTES:
[a] $LC_{50}$ value for soil at pH = 7.0; $LC_{50}$ = 320 ug/g – 560 ug/g for soil pH = 4.1
[b] Acetate salt
[c] Conservative factor of 0.2 applied to endpoint; resultant value should be protective of 99.9% of the exposued population from acute effects (USEPA, 1986).
[d] Equal to the lowest $LC_{50}$ in each chemical class, multiplied by a safety factor of 0.2, as described in text. Value for 2–chloroethyl vinyl ether used for all chlorinated volatiles. Value for carbaryl used for aromatic hydrocarbons. Value for fluorene used for PAHs. Value for carbaryl used for aromatic hydrocarbons.
[e] Mean of $LC_{50}$s for four test species (*A. teberculata, E. foetida, E. eugeniae*, and *P. excavatus*) from artificial soil tests; values used for a whole chemical class are multiplied by a factor of 0.2 (Neuhauser *et al.*, 1986). Value for dimethylphthalate used for phthalates.
NA = Not available
NS = Not stated

# Table O.1–9
# AQUIRE Freshwater Toxicity Information (μg/L)
# AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| **PAL Volatile Organics** | | | | | | | | |
| 1,1–Dichloroethylene | Daphnia magna, water flea | <24 H | 48 H | $LC_{50}$ | 79,000 | | | 80 |
| | Daphnia magna, water flea | FIRST INSTAR | 24 H | $LC_{50}$ | 11,600 | | | 80 |
| | Daphnia magna, water flea | <24 H | 48 H | lethality | 2,400 | | | 80 |
| | Daphnia magna, water flea | <24 H | 24 H | $LC_{50}$ | 98,000 | | | 80 |
| | Daphnia magna, water flea | FIRST INSTAR | 48 H | $LC_{50}$ | 11,600 | | | 80 |
| | Lepomis macrochirus, bluegill | 33–75 MM | 96 H | $LC_{50}$ | 220,000 | | | 77 |
| | Lepomis macrochirus, bluegill | JUVENILE, 0.32–1.2 G | 24 H | $LC_{50}$ | 74,000 | | | 81 |
| | Lepomis macrochirus, bluegill | JUVENILE, 0.32–1.2 G | 96 H | $LC_{50}$ | 74,000 | | | 81 |
| | Lepomis macrochirus, bluegill | JUVENILE, 0.32–1.2 G | 96 H | $LC_{50}$ | 140,000 | | | 81 |
| | Lepomis macrochirus, bluegill | JUVENILE, 0.32–1.2 G | 24 H | $LC_{50}$ | 165,000 | | | 81 |
| | Pimephales promelas, fathead minnow | 0.8 G, 35 MM, ADULT | 8 D | $LC_{50}$ | 29,000 | | | 80 |
| | Pimephales promelas, fathead minnow | ADULT, 0.8 G, 35 MM | 96 H | $LC_{50}$ | 169,000 | | | 80 |
| | Pimephales promelas, fathead minnow | 0.8 G, 35 MM, ADULT | 13 D | $LC_{50}$ | 29,000 | | | 80 |
| | Pimephales promelas, fathead minnow | ADULT, 0.8 G, 35 MM | 5 D | $LC_{50}$ | 97,000 | | | 80 |
| | Pimephales promelas, fathead minnow | ADULT, 0.8 G, 35 MM | 24 H | $LC_{50}$ | 116,000 | | | 80 |
| | Pimephales promelas, fathead minnow | ADULT, 0.8 G, 35 MM | 6 D | $LC_{50}$ | 74,000 | | | 80 |
| | Pimephales promelas, fathead minnow | 0.8 G, 35 MM, ADULT | 10 D | $LC_{50}$ | 29,000 | | | 80 |
| | Pimephales promelas, fathead minnow | ADULT, 0.8 G, 35 MM | 7 D * | $LC_{50}$ | 29,000 | | | 80 |
| | Pimephales promelas, fathead minnow | 0.8 G, 35 MM, ADULT | 12 D | $LC_{50}$ | 29,000 | | | 80 |
| | Pimephales promelas, fathead minnow | ADULT, 0.8 G, 35 MM | 48 H | $LC_{50}$ | 169,000 | | | 80 |
| | Pimephales promelas, fathead minnow | ADULT, 0.8 G, 35 MM | 48 H | $LC_{50}$ | 108,000 | | | 80 |
| | Pimephales promelas, fathead minnow | 0.8 G, 35 MM, ADULT | 96 H | $LC_{50}$ | 108,000 | | | 80 |
| | Pimephales promelas, fathead minnow | 0.8 G, 35 MM, ADULT | 9 D | $LC_{50}$ | 29,000 | | | 80 |
| | Pimephales promelas, fathead minnow | ADULT, 0.8 G, 35 MM | 24 H | $LC_{50}$ | 175,000 | | | 80 |
| | Pimephales promelas, fathead minnow | 0.8 G, 35 MM, ADULT | 11 D | $LC_{50}$ | 29,000 | | | 80 |
| | Scenedesmus abundans, green algae | 10E4 CELLS/ML | 96 H | GRO | | 410,000 | | 85 |
| Chlorobenzene | Brachydanio rerio; zebrafish; | FERTILIZED EGG | 14 D | REP * | 8,500 | 213279 | 90 | |
| | Brachydanio rerio; zebrafish; | FERTILIZED EGG | 21 D | REP * | 8,500 | 213279 | 90 | |
| | Brachydanio rerio; zebrafish; | FERTILIZED EGG | 28 D | $LC_{50}$ | 10,300 | 213279 | 90 | |
| | Brachydanio rerio; zebrafish; | FERTILIZED EGG | 28 D | REP * | 8,500 | 213279 | 90 | |
| | Brachydanio rerio; zebrafish; | FERTILIZED EGG | 7 D | REP * | 8,500 | 213279 | 90 | |
| | Brachydanio rerio; zebrafish; | NR | 48 H | $LC_{50}$ | 10,500 | 315526 | 83 | |
| | Carassius auratus; Goldfish; | 3.8–6.4 CM, 1–2 G | 24 H | $LC_{50}$ | 73,030 | 210728 | 66 | |
| | Carassius auratus; Goldfish; | 3.8–6.4 CM, 1–2 G | 48 H | $LC_{50}$ | 56,000 | 210728 | 66 | |
| | Carassius auratus; Goldfish; | 3.8–6.4 CM, 1–2 G | 96 H | $LC_{50}$ | 51,620 | 210728 | 66 | |
| | Carassius auratus; Goldfish; | EGG | 7.5 D | $LC_{50}$ | 1,040 | 210538 | 79 | |
| | Carassius auratus; Goldfish; | EGG | 7.5 D | $LC_{50}$ | 880 | 210538 | 79 | |
| | Carassius auratus; Goldfish; | EGG | 84 H | $LC_{50}$ | 4,080 | 210538 | 79 | |
| | Carassius auratus; Goldfish; | EGG | 84 H | $LC_{50}$ | 4,380 | 210538 | 79 | |
| | Carassius auratus; Goldfish; | EGGS–4 D POST HATCH | 8 D | $LC_{50}$ * | 1,040 | 210563 | 79 | |
| | Carassius auratus; Goldfish; | EGGS–4 D POST HATCH | 8 D | $LC_{50}$ * | 880 | 210563 | 79 | |
| | Carassius auratus; Goldfish; | EGGS–4 D POST HATCH | 96 H | $LC_{50}$ * | 2,370 | 210563 | 79 | |
| | Carassius auratus; Goldfish; | EGGS–4 D POST HATCH | 96 H | $LC_{50}$ * | 3,480 | 210563 | 79 | |
| | Ceriodaphnia dubia; Water flea | NEONATE | 48 H | $LC_{50}$ | 10,400 | 310810 | 85 | |
| | Ceriodaphnia dubia; Water flea | NEONATE | 48 H | $LC_{50}$ | 11,000 | 310810 | 85 | |
| | Ceriodaphnia dubia; Water flea | NEONATE | 48 H | $LC_{50}$ | 11,100 | 310810 | 85 | |
| | Ceriodaphnia dubia; Water flea | NEONATE | 48 H | $LC_{50}$ | 11,400 | 310810 | 85 | |
| | Ceriodaphnia dubia; Water flea | NEONATE | 48 H | $LC_{50}$ | 11,800 | 310810 | 85 | |
| | Ceriodaphnia dubia; Water flea | NEONATE | 48 H | $LC_{50}$ | 7,900 | 310810 | [illegible] | |

## Table O.1-9
## AQUIRE Freshwater Toxicity Information (μg/L)
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| | Ceriodaphnia dubia; Water flea | NEONATE | 48 H | $LC_{50}$ | 7,900 | | 310810 | 85 |
| | Ceriodaphnia dubia; Water flea | NEONATE | 48 H | $LC_{50}$ | 8,900 | | 310810 | 85 |
| | Ceriodaphnia dubia; Water flea | NEONATE, <12 H | 168 H | $LC_{50}$ | 24,000 | | 210212 | 91 |
| | Ceriodaphnia dubia; Water flea | NEONATE, <12 H | 48 H | $LC_{50}$ | 47,000 | | 210212 | 91 |
| | Ceriodaphnia dubia; Water flea | NEONATE, <12 H | to 10 D | $EC_{50}RE$ * | 14,000 | | 210212 | 91 |
| | Ceriodaphnia dubia; Water flea | NEONATE, <12 H | to 10 D | $EC_{50}RE$ * | 22,000 | | 210212 | 91 |
| | Ceriodaphnia dubia; Water flea | NEONATE, <12 H | to 10 D | $EC_{50}RE$ * | 26,000 | | 210212 | 91 |
| | Ceriodaphnia dubia; Water flea | NEONATE, <12 H | to 10 D | MOR * | 3,890 | | 210212 | 91 |
| | Ceriodaphnia dubia; Water flea | NEONATE, <12 H | to 10 D | REP * | 12,000 | | 210212 | 91 |
| | Ceriodaphnia dubia; Water flea | NEONATE, <12 H | to 10 D | REP * | 19,000 | | 210212 | 91 |
| | Ceriodaphnia dubia; Water flea | NEONATE, <12 H | to 10 D | REP * | 19,000 | | 210212 | 91 |
| | Culex quinquefasciatus; Mosquito | LARVAE, 4TH INSTAR | 24 H | BCF | 1.01 | | 212480 | 75 |
| | Cyclotella meneghiniana; Diatom | EXPO GRO PHASE | 48 H | $EC_{50}$ * | 235,740 | | 210088 | 91 |
| | Daphnia magna; Water flea; | 12 H | 14 D | $EC_{50}RE$ * | 2,500 | | 315526 | 83 |
| | Daphnia magna; Water flea; | 24 H | 24 H | $LC_{50}$ | 310,000 | | 215718 | 77 |
| | Daphnia magna; Water flea; | <24 H | 24 H | $LC_{50}$ | 140,000 | | 215184 | 80 |
| | Daphnia magna; Water flea; | <24 H | 48 H | $LC_{50}$ | 86,000 | | 215184 | 80 |
| | Daphnia magna; Water flea; | <24 H | 48 H | MOR * | 10,000 | | 215184 | 80 |
| | Daphnia magna; Water flea; | NEONATE | 48 H | $LC_{50}$ | 10,700 | | 310810 | 85 |
| | Daphnia magna; Water flea; | NEONATE | 48 H | $LC_{50}$ | 11,500 | | 310810 | 85 |
| | Daphnia magna; Water flea; | NEONATE | 48 H | $LC_{50}$ | 12,800 | | 310810 | 85 |
| | Daphnia magna; Water flea; | NEONATE | 48 H | $LC_{50}$ | 12,900 | | 310810 | 85 |
| | Daphnia magna; Water flea; | NEONATE | 48 H | $LC_{50}$ | 13,000 | | 310810 | 85 |
| | Daphnia magna; Water flea; | NEONATE | 48 H | $LC_{50}$ | 15,400 | | 310810 | 85 |
| | Daphnia magna; Water flea; | NEONATE | 48 H | $LC_{50}$ | 21,300 | | 310810 | 85 |
| | Daphnia magna; Water flea; | NEONATE | 48 H | $LC_{50}$ | 8,600 | | 310810 | 85 |
| | Daphnia magna; Water flea; | NEONATE, <12 H | 240 H | $LC_{50}$ | 16,000 | | 210212 | 91 |
| | Daphnia magna; Water flea; | NEONATE, <12 H | 48 H | $LC_{50}$ | 31,000 | | 210212 | 91 |
| | Daphnia magna; Water flea; | NEONATE, <12 H | to 11 D | $EC_{50}RE$ * | 15,000 | | 210212 | 91 |
| | Daphnia magna; Water flea; | NEONATE, <12 H | to 11 D | $EC_{50}RE$ * | 16,000 | | 210212 | 91 |
| | Daphnia magna; Water flea; | NEONATE, <12 H | to 11 D | $EC_{50}RE$ * | 19,000 | | 210212 | 91 |
| | Daphnia magna; Water flea; | NEONATE, <12 H | to 11 D | MOR * | <1,400 | | 210212 | 91 |
| | Daphnia magna; Water flea; | NEONATE, <12 H | to 11 D | REP * | 11,000 | | 210212 | 91 |
| | Daphnia magna; Water flea; | NEONATE, <12 H | to 11 D | REP * | 11,000 | | 210212 | 91 |
| | Daphnia magna; Water flea; | NEONATE, <12 H | to 11 D | REP * | 6,500 | | 210212 | 91 |
| | Daphnia magna; Water flea; | NR | 24 H | BCF | 1.01 | | 212480 | 75 |
| | Daphnia magna; Water flea; | NR | 24 H | $EC_0$ | 74 | | 210707 | 82 |
| | Daphnia magna; Water flea; | NR | 24 H | $EC_{100}$ | 286 | | 210707 | 82 |
| | Daphnia magna; Water flea; | NR | 24 H | $EC_{50}$ | 195 | | 210707 | 82 |
| | Daphnia magna; Water flea; | NR | 24 H | $EC_{50}IM$ | 4,300 | | 315526 | 83 |
| | Gambusia affinis; Mosquitofish | NR | 24 H | BCF | 1.01 | | 212480 | 75 |
| | Lepomis macrochirus; Bluegill; | 3.8-6.4 CM, 1-2 G | 24 H | $LC_{50}$ | 24,000 | | 210728 | 66 |
| | Lepomis macrochirus; Bluegill; | 3.8-6.4 CM, 1-2 G | 48 H | $LC_{50}$ | 24,000 | | 210728 | 66 |
| | Lepomis macrochirus; Bluegill; | 3.8-6.4 CM, 1-2 G | 96 H | $LC_{50}$ | 24,000 | | 210728 | 66 |
| | Lepomis macrochirus; Bluegill; | JUVENILE, 0.32-1.2 G | 24 H | $LC_{50}$ | 17,000 | | 215590 | 81 |
| | Lepomis macrochirus; Bluegill; | JUVENILE, 0.32-1.2 G | 96 H | $LC_{50}$ | 16,000 | | 215590 | 81 |
| | Lepomis macrochirus; Bluegill; | JUVENILE, 3.65 CM, 0.90 G | 1 H | $LC_{50}$ | 12,000 | | 217398 | 85 |
| | Lepomis macrochirus; Bluegill; | JUVENILE, 3.65 CM, 0.90 G | 16 H | $LC_{50}$ | 6,000 | | 217398 | 85 |
| | Lepomis macrochirus; Bluegill; | JUVENILE, 3.65 CM, 0.90 G | 2 H | $LC_{50}$ | 6,800 | | 217398 | 85 |
| | Lepomis macrochirus; Bluegill; | JUVENILE, 3.65 CM, 0.90 G | 24 H | $LC_{50}$ | 4,500 | | 217398 | 85 |
| | Lepomis macrochirus; Bluegill; | JUVENILE, 3.65 CM, 0.90 G | 24 H | $LC_{50}$ | 6,000 | | 217398 | 85 |

## Table O.1-9
## AQUIRE Freshwater Toxicity Information (μg/L)
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| | Lepomis macrochirus; Bluegill; | JUVENILE, 3.65 CM, 0.90 G | 24 H | $LC_{50}$ | 8,000 | | 217398 | 85 |
| | Lepomis macrochirus; Bluegill; | JUVENILE, 3.65 CM, 0.90 G | 4 H | $LC_{50}$ | 6,000 | | 217398 | 85 |
| | Lepomis macrochirus; Bluegill; | JUVENILE, 3.65 CM, 0.90 G | 48 H | $LC_{50}$ | 4,500 | | 217398 | 85 |
| | Lepomis macrochirus; Bluegill; | JUVENILE, 3.65 CM, 0.90 G | 48 H | $LC_{50}$ | 7,700 | | 217398 | 85 |
| | Lepomis macrochirus; Bluegill; | JUVENILE, 3.65 CM, 0.90 G | 72 H | $LC_{50}$ | 4,500 | | 217398 | 85 |
| | Lepomis macrochirus; Bluegill; | JUVENILE, 3.65 CM, 0.90 G | 72 H | $LC_{50}$ | 7,400 | | 217398 | 85 |
| | Lepomis macrochirus; Bluegill; | JUVENILE, 3.65 CM, 0.90 G | 8 H | $LC_{50}$ | 6,000 | | 217398 | 85 |
| | Lepomis macrochirus; Bluegill; | JUVENILE, 3.65 CM, 0.90 G | 96 H | $LC_{50}$ | 4,500 | | 217398 | 85 |
| | Lepomis macrochirus; Bluegill; | JUVENILE, 3.65 CM, 0.90 G | 96 H | $LC_{50}$ | 7,400 | | 217398 | 85 |
| | Micropterus salmoides; Largemouth bass | EGG | 6.5 D | $LC_{50}$ | 50 | | 210538 | 79 |
| | Micropterus salmoides; Largemouth bass | EGG | 6.5 D | $LC_{50}$ | 60 | | 210538 | 79 |
| | Micropterus salmoides; Largemouth bass | EGG | 60 H | $LC_{50}$ | 660 | | 210538 | 79 |
| | Micropterus salmoides; Largemouth bass | EGG | 60 H | $LC_{50}$ | 710 | | 210538 | 79 |
| | Micropterus salmoides; Largemouth bass | EGGS-4 D POST HATCH | 7.5 D | $LC_{50}$ * | 50 | | 210563 | 79 |
| | Micropterus salmoides; Largemouth bass | EGGS-4 D POST HATCH | 7.5 D | $LC_{50}$ * | 60 | | 210563 | 79 |
| | Micropterus salmoides; Largemouth bass | EGGS-4 D POST HATCH | 84 H | $LC_{50}$ * | 340 | | 210563 | 79 |
| | Micropterus salmoides; Largemouth bass | EGGS-4 D POST HATCH | 84 H | $LC_{50}$ * | 390 | | 210563 | 79 |
| | Oedogonium cardiacum; Green algae | NR | 48 H | BCF | 1.01 | | 212480 | 75 |
| | Oncorhynchus mykiss; Rainbow trout | 200-400 G | 30 D | ENZ * | 2,100 | | 315457 | 82 |
| | Oncorhynchus mykiss; Rainbow trout | 200-400 G | 30 D | ENZ * | 2,900 | | 315457 | 82 |
| | Oncorhynchus mykiss; Rainbow trout | 200-400 G | 30 D | GRO * | 2,100 | | 315457 | 82 |
| | Oncorhynchus mykiss; Rainbow trout | 200-400 G | 30 D | HEM * | 2,100 | | 315457 | 82 |
| | Oncorhynchus mykiss; Rainbow trout | 200-400 G | 30 D | MOR * | 2,900 | | 315457 | 82 |
| | Oncorhynchus mykiss; Rainbow trout | 75-200 G | 72 H | HEM * | 9.8 | | 315457 | 82 |
| | Oncorhynchus mykiss; Rainbow trout | 75-200 G | 96 H | GRO * | 9.8 | | 315457 | 82 |
| | Oncorhynchus mykiss; Rainbow trout | EGGS-4 D POST HATCH | 16 D | $LC_{50}$ | <90 | | 210563 | 79 |
| | Oncorhynchus mykiss; Rainbow trout | EGGS-4 D POST HATCH | 16 D | $LC_{50}$ | <90 | | 210563 | 79 |
| | Oncorhynchus mykiss; Rainbow trout | NR | 3 H | ENZ * | 1 | | 216433 | 80 |
| | Oncorhynchus mykiss; Rainbow trout | NR | 48 H | $LC_{50}$ | 4,100 | | 315526 | 83 |
| | Oncorhynchus mykiss; Rainbow trout | NR | 96 H | $LC_{50}$ | 4,700 | | 315457 | 82 |
| | Oncorhynchus mykiss; Rainbow trout | STD LENGTH, 1.2-3.8 G, 4.6-6.4 CM | 96 H | $LC_{50}$ (Calc) | 7,460 | | 310688 | 84 |
| | Physa sp; Pouch snail; | NR | 48 H | BCF | 1.01 | | 212480 | 75 |
| | Pimephales promelas; Fathead minnow | 3.8-6.4 CM, 1-2 G | 24 H | $LC_{50}$ | 29,120 | | 210728 | 66 |
| | Pimephales promelas; Fathead minnow | 3.8-6.4 CM, 1-2 G | 24 H | $LC_{50}$ | 33,930 | | 210728 | 66 |
| | Pimephales promelas; Fathead minnow | 3.8-6.4 CM, 1-2 G | 24 H | $LC_{50}$ | 39,190 | | 210728 | 66 |
| | Pimephales promelas; Fathead minnow | 3.8-6.4 CM, 1-2 G | 48 H | $LC_{50}$ | 29,120 | | 210728 | 66 |
| | Pimephales promelas; Fathead minnow | 3.8-6.4 CM, 1-2 G | 48 H | $LC_{50}$ | 33,930 | | 210728 | 66 |
| | Pimephales promelas; Fathead minnow | 3.8-6.4 CM, 1-2 G | 48 H | $LC_{50}$ | 34,980 | | 210728 | 66 |
| | Pimephales promelas; Fathead minnow | 3.8-6.4 CM, 1-2 G | 96 H | $LC_{50}$ | 29,120 | | 210728 | 66 |
| | Pimephales promelas; Fathead minnow | 3.8-6.4 CM, 1-2 G | 96 H | $LC_{50}$ | 33,930 | | 210728 | 66 |
| | Pimephales promelas; Fathead minnow | 3.8-6.4 CM, 1-2 G | 96 H | $LC_{50}$ | 33,930 | | 210728 | 66 |
| | Pimephales promelas; Fathead minnow | 31 D, 17.8 MM, 0.083 G | 96 H | $LC_{50}$ | 16,900 | | 213217 | 90 |
| | Pimephales promelas; Fathead minnow | FRY, 10-15 D, 11.6 MG, 9.5 MM | 96 H | $LC_{50}$ | 22,300 | | 310432 | 83 |
| | Pimephales promelas; Fathead minnow | JUVENILE, 30-35 D, 76.8 MG, 14.9 MM | 96 H | $LC_{50}$ | 35,400 | | 310432 | 83 |
| | Pimephales promelas; Fathead minnow | SUB-ADULT, 65-94 D, 391 MG, 28 MM | 96 H | $LC_{50}$ | 22,200 | | 310432 | 83 |
| | Poecilia reticulata; Guppy; | 2-3 MO | 14 D | $LC_{50}$ (Calc) | 19,100 | | 216354 | 81 |
| | Poecilia reticulata; Guppy; | 6 M, 1.9-2.5 CM, 0.1-0.2 G | 24 H | $LC_{50}$ | 45,530 | | 210728 | 66 |
| | Poecilia reticulata; Guppy; | 6 M, 1.9-2.5 CM, 0.1-0.2 G | 48 H | $LC_{50}$ | 45,530 | | 210728 | 66 |
| | Poecilia reticulata; Guppy; | 6 M, 1.9-2.5 CM, 0.1-0.2 G | 96 H | $LC_{50}$ | 45,530 | | 210728 | 66 |
| Methylene chloride | Carassius auratus; Goldfish; | NR | 24 H | $LC_{50}$ | 420,000 | | 215772 | 78 |

## Table O.1–9
## AQUIRE Freshwater Toxicity Information (μg/L)
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| | Daphnia magna; Water flea; | 24 H | 24 H | $LC_{50}$ | 2,270,000 | | 215718 | 77 |
| | Daphnia magna; Water flea; | 6–24 H | 24 H | $EC_{50}IM$ | | 1,959,000 | 210846 | 89 |
| | Daphnia magna; Water flea; | 6–24 H | 48 H | $EC_{50}IM$ | | 1,682,000 | 210846 | 89 |
| | Daphnia magna; Water flea; | <24 H | 24 H | $LC_{50}$ | 310,000 | | 215184 | 80 |
| | Daphnia magna; Water flea; | <24 H | 48 H | $LC_{50}$ | 220,000 | | 215184 | 80 |
| | Daphnia magna; Water flea; | <24 H | 48 H | MOR * | 68,000 | | 215184 | 80 |
| | Daphnia magna; Water flea; | NR | 24 H | $EC_0$ | | 1.707 | 210707 | 82 |
| | Daphnia magna; Water flea; | NR | 24 H | $EC_{100}$ | | 2.5 | 210707 | 82 |
| | Daphnia magna; Water flea; | NR | 24 H | $EC_{50}$ | | 2.1 | 210707 | 82 |
| | Lepomis macrochirus; Bluegill; | JUVENILE, 0.32–1.2 G | 24 H | $LC_{50}$ | 230,000 | | 215590 | 81 |
| | Lepomis macrochirus; Bluegill; | JUVENILE, 0.32–1.2 G | 96 H | $LC_{50}$ | 220,000 | | 215590 | 81 |
| | Oryzias latipes; Medaka, high–eyes | NR | 24 H | $LC_{50}$ | 1,100,000 | | 312497 | 86 |
| | Oryzias latipes; Medaka, high–eyes | NR | 24 H | $LC_{50}$ | 1,100,000 | | 312497 | 86 |
| | Oryzias latipes; Medaka, high–eyes | NR | 24 H | $LC_{50}$ | 840,000 | | 312497 | 86 |
| | Oryzias latipes; Medaka, high–eyes | NR | 48 H | $LC_{50}$ | 1,100,000 | | 312497 | 86 |
| | Oryzias latipes; Medaka, high–eyes | NR | 48 H | $LC_{50}$ | 1,100,000 | | 312497 | 86 |
| | Oryzias latipes; Medaka, high–eyes | NR | 48 H | $LC_{50}$ | 840,000 | | 312497 | 86 |
| | Pimephales promelas; Fathead minnow | 1.04 G, 49.0 MM | 24 H | $EC_{50}IM$ | | 112,800 | 210973 | 78 |
| | Pimephales promelas; Fathead minnow | 1.04 G, 49.0 MM | 24 H | $LC_{50}$ | 268,000 | | 210973 | 78 |
| | Pimephales promelas; Fathead minnow | 1.04 G, 49.0 MM | 48 H | $EC_{50}IM$ | | 99,000 | 210973 | 78 |
| | Pimephales promelas; Fathead minnow | 1.04 G, 49.0 MM | 48 H | $LC_{50}$ | 265,000 | | 210973 | 78 |
| | Pimephales promelas; Fathead minnow | 1.04 G, 49.0 MM | 72 H | $EC_{50}IM$ | | 99,000 | 210973 | 78 |
| Methylene chloride (cont.) | Pimephales promelas; Fathead minnow | 1.04 G, 49.0 MM | 72 H | $LC_{50}$ | 232,400 | | 210973 | 78 |
| | Pimephales promelas; Fathead minnow | 1.04 G, 49.0 MM | 96 H | $EC_{50}IM$ | | 99,000 | 210973 | 78 |
| | Pimephales promelas; Fathead minnow | 1.04 G, 49.0 MM | 96 H | $LC_{50}$ | 193,000 | | 210973 | 78 |
| | Pimephales promelas; Fathead minnow | 1.04 G, 49.0 MM | 96 H | $LC_{50}$ | 310,000 | | 210973 | 78 |
| | Pimephales promelas; Fathead minnow | 30 D, 17.6 MM, 0.066 G | 96 H | $LC_{50}$ | 330,000 | | 312858 | 86 |
| | Pimephales promelas; Fathead minnow | < 24 H, EMBRYO | 28 D | GRO * | | 142,000 | 312567 | 87 |
| | Pimephales promelas; Fathead minnow | < 24 H, EMBRYO | 28 D | GRO * | | 82,500 | 312567 | 87 |
| | Pimephales promelas; Fathead minnow | JUVENILE | 192 H | $LC_{50}$ | 471,000 | | 312567 | 87 |
| | Pimephales promelas; Fathead minnow | JUVENILE | 96 H | $LC_{50}$ | 502,000 | | 312567 | 87 |
| | Poecilia reticulata; Guppy | 2–3 MO | 14 D | $LC_{50}$ (Calc) | 294,000 | | 216354 | 81 |
| Tetrachloroethylene | Daphnia magna; Water flea | NR | 24 H | $EC_{50}$ | | 147,000 | | 82 |
| | Daphnia magna; Water flea | FIRST INSTAR, < 24 H | 48 H | $EC_{50}IMM$ | | 7,500 | | 83 |
| | Daphnia magna; Water flea | <24 H | 24 H | $LC_{50}$ | 18,000 | | | 80 |
| | Daphnia magna; Water flea | FIRST INSTAR, <= 24 H | 48 H | $EC_{50}IMM$ | | 7,490 | | 83 |
| | Daphnia magna; Water flea | FIRST INSTAR, <= 24 H | 48 H | $LC_{50}$ | 9,090 | | | 83 |
| | Daphnia magna; Water flea | NR | 24 H | $EC_0$ | | 65,000 | | 82 |
| | Daphnia magna; Water flea | FIRST INSTAR, <= 24 H | 48 H | $LC_{50}$ | 18,100 | | | 83 |
| | Daphnia magna; Water flea | NR | 24 H | $EC_{100}$ | | 250,000 | | 82 |
| | Daphnia magna; Water flea | FIRST INSTAR, <= 24 H | 48 H | $EC_{50}IMM$ | | 8,500 | | 83 |
| | Daphnia magna; Water flea | FIRST INSTAR, < 24 H | 28 D | GRO | | 1,100 | | 83 |
| | Daphnia magna; Water flea | <24 H | 48 H | $LC_{50}$ | 18,000 | | | 80 |
| | Daphnia magna; Water flea | FIRST INSTAR, < 24 H | 28 D | GRO | | 510 | | 83 |
| | Daphnia magna; Water flea | <24 H | 48 H | MOR | 10,000 | | | 80 |
| | Daphnia magna; Water flea | < 24 H | 28 D | GRO | | 1,110 | | 83 |
| | Daphnia magna; Water flea | FIRST INSTAR, < 24 H | 48 H | $LC_{50}$ | 18,000 | | | 83 |
| | Daphnia magna; Water flea | FIRST INSTAR, < 24 H | 28 D | REP | | 510 | | 83 |
| | Daphnia magna; Water flea | < 24 H | 28 D | REP | | 1,110 | | 83 |
| | Daphnia magna; Water flea | FIRST INSTAR, < 24 H | 48 H | $LC_{50}$ | 9,100 | | | 83 |

## Table O.1–9
## AQUIRE Freshwater Toxicity Information (μg/L)
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| | Daphnia magna; Water flea | FIRST INSTAR, < 24 H | 48 H | $EC_{50}$IMM | | 8,500 | | 83 |
| | Daphnia magna; Water flea | FIRST INSTAR, < 24 H | 28 D | REP | | 1,100 | | 83 |
| | Lepomis macrochirus; Bluegill | JUVENILE, 0.32–1.2 G | 24 H | $LC_{50}$ | 46,000 | | | 81 |
| | Lepomis macrochirus; Bluegill | JUVENILE, 0.32–1.2 G | 96 H | $LC_{50}$ | 13,000 | | | 81 |
| | Moina macrocopa; Water flea | 5 D | 3 H | $LC_{50}$ | 1,800 | | | 86 |
| | Oncorhynchus mykiss; Rainbow trout | 7.3 CM, 5.86 G, FINGERLING | 24 H | $LC_{50}$ | 6,310 | | | 83 |
| | Oncorhynchus mykiss; Rainbow trout | 6.1 CM, 3.2 G, FINGERLING | 72 H | $LC_{50}$ | 4,990 | | | 83 |
| | Oncorhynchus mykiss; Rainbow trout | 6.1 CM, 3.2 G, FINGERLING | 24 H | $LC_{50}$ | 4,990 | | | 83 |
| | Oncorhynchus mykiss; Rainbow trout | 6.1 CM, 3.2 G, FINGERLING | 48 H | $LC_{50}$ | 4,990 | | | 83 |
| | Oncorhynchus mykiss; Rainbow trout | 7.3 CM, 5.86 G, FINGERLING | 96 H | $LC_{50}$ | 5,840 | | | 83 |
| | Oncorhynchus mykiss; Rainbow trout | 7.3 CM, 5.86 G, FINGERLING | 72 H | $LC_{50}$ | 5,810 | | | 83 |
| | Oncorhynchus mykiss; Rainbow trout | 7.3 CM, 5.86 G, FINGERLING | 48 H | $LC_{50}$ | 5,950 | | | 83 |
| | Oncorhynchus mykiss; Rainbow trout | 6.1 CM, 3.2 G, FINGERLING | 96 H | $LC_{50}$ | 4,990 | | | 83 |
| | Oncorhynchus mykiss; Rainbow trout | 3.20 G | 96 H | $LC_{50}$ | 4,990 | | | 82 |
| | Oryzias latipes; Medaka | 3 CM, 0.3 G | 48 H | $LC_{50}$ | 1,600 | | | 86 |
| | Pimephales promelas; Fathead minnow | 1.04 G, 49.0 MM | 96 H | $LC_{50}$ | 21,400 | | | 78 |
| | Pimephales promelas; Fathead minnow | 30–35 D | 48 H | $LC_{50}$ | 15,900 | | | 83 |
| | Pimephales promelas; Fathead minnow | 1.04 G, 49.0 MM | 72 H | $LC_{50}$ | 18,900 | | | 78 |
| | Pimephales promelas; Fathead minnow | 0.12 G | 96 H | $LC_{50}$ | 13,500 | | | 83 |
| | Pimephales promelas; Fathead minnow | 1.04 G, 49.0 MM | 72 H | $EC_{50}$IMM | | 14,400 | | 78 |
| | Pimephales promelas; Fathead minnow | 1.04 G, 49.0 MM | 48 H | $LC_{50}$ | 19,600 | | | 78 |
| | Pimephales promelas; Fathead minnow | 1.04 G, 49.0 MM | 48 H | $EC_{50}$IMM | | 14,400 | | 78 |
| Tetrachloroethylene (cont.) | Pimephales promelas; Fathead minnow | 30 D | 96 H | $LC_{50}$ | 13,400 | | | 85 |
| | Pimephales promelas; Fathead minnow | 1.04 G, 49.0 MM | 24 H | $LC_{50}$ | 23,500 | | | 78 |
| | Pimephales promelas; Fathead minnow | 31 D, 20.3 MM, 0.120 G | 96 H | $LC_{50}$ | 20,300 | | | 85 |
| | Pimephales promelas; Fathead minnow | 30–35 D | 96 H | $LC_{50}$ | 13,400 | | | 83 |
| | Pimephales promelas; Fathead minnow | 1.04 G, 49.0 MM | 96 H | $EC_{50}$IMM | | 14,400 | | 78 |
| | Pimephales promelas; Fathead minnow | 30–35 D | 24 H | $LC_{50}$ | 17,900 | | | 83 |
| | Pimephales promelas; Fathead minnow | 1.04 G, 49.0 MM | 24 H | $EC_{50}$IMM | | 14,400 | | 78 |
| | Pimephales promelas; Fathead minnow | 30–35 D | 72 H | $LC_{50}$ | 14,900 | | | 83 |
| | Pimephales promelas; Fathead minnow | 1.04 G, 49.0 MM | 96 H | $LC_{50}$ | 18,400 | | | 78 |
| | Tanytarsus dissimilis; Midge | 3RD OR 4TH INSTAR, 2.0–3.5 MM | 48 H | $LC_{50}$ | 30,800 | | | 83 |
| | Tanytarsus dissimilis; Midge | 3RD OR 4TH INSTAR, 2.0–3.5 MM | 24 H | $LC_{50}$ | 54,600 | | | 83 |
| Toluene | Aedes aegypti; Mosquito; | 4TH INSTAR LARVAE | 24 H | $EC_{50}$IM | | 21,520 | 215700 | 77 |
| | Aedes aegypti; Mosquito; | 4TH INSTAR LARVAE | 24 H | MOR | 9,950 | | 215700 | 77 |
| | Brachionus calyciflorus; Rotifer; Rotifers; | NEONATE | 24 H | $LC_{50}$ | 113,000 | | 219385 | 91 |
| | Chlorella vulgaris; Green algae; Chlorophyta; | NR | 24 H | $EC_{50}$GR | | 245,000 | 212215 | 75 |
| | Daphnia magna; Water flea; | 1ST INSTAR | 48 H | $EC_{50}$IM | | 19,600 | 215087 | 79 |
| | Daphnia magna; Water flea; | 24 H | 24 H | $LC_{50}$ | 470,000 | | 215718 | 77 |
| | Daphnia magna; Water flea; | <24 H | 24 H | $LC_{50}$ | 310,000 | | 215184 | 80 |
| | Daphnia magna; Water flea; | <24 H | 48 H | $LC_{50}$ | 310,000 | | 215184 | 80 |
| | Daphnia magna; Water flea; | <24 H | 48 H | MOR | 28,000 | | 215184 | 80 |
| | Daphnia magna; Water flea; | <= 24 H | 21 D | REP | | 1,000 | 210847 | 89 |
| | Daphnia magna; Water flea; | <= 24 H | 24 H | $EC_{50}$IM | | 84,000 | 210847 | 89 |
| | Daphnia magna; Water flea; | NR | 24 H | $EC_0$ | | 53 | 216628 | 88 |
| | Daphnia magna; Water flea; | NR | 24 H | $EC_0$ | | 93 | 210707 | 82 |
| | Daphnia magna; Water flea; | NR | 24 H | $EC_{100}$ | | 500 | 210707 | 82 |
| | Daphnia magna; Water flea; | NR | 24 H | $EC_{50}$ | | 270 | 210707 | 82 |
| | Daphnia magna; Water flea; | NR | 24 H | $EC_{50}$ | | 84 | 216628 | 88 |
| | Daphnia magna; Water flea; | NR | 24 H | $EC_{50}$IM | | 7,000 | 313140 | 88 |

## Table O.1–9
## AQUIRE Freshwater Toxicity Information (μg/L)
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration Lethal | Effect Concentration Sublethal | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | Diaptomus forbesi; Calanoid copepod; Copepoda; | NR | 96 H | $LC_{50}$ | 447,000 | | 311282 | 83 |
| | Scenedesmus subspicatus; Green algae; Chlorophyta; | LOG GRO PHASE | 48 H | $EC_{50}$BM | | 160,000 | 212997 | 90 |
| | Scenedesmus subspicatus; Green algae; Chlorophyta; | LOG GRO PHASE | 48 H | $EC_{50}$GR | | 125,000 | 212997 | 90 |
| | Selenastrum capricornutum; Green algae; Chlorophyta; | EXPO GRO PHASE | 8 D | $EC_{50}$GR | | 9,400 | 213550 | 90 |
| | Selenastrum capricornutum; Green algae; Chlorophyta; | NR | 72 H | $EC_{50}$GR | | 12,500 | 313142 | 88 |
| 1,1,2–Trichloroethylene | Aedes aegypti, mosquito | 3RD INSTAR | 48 H | $LC_{50}$ | 48,000 | | | 83 |
| | Ambystoma mexicanum, salamander | 3–4 WK | 48 H | $LC_{50}$ | 48,000 | | | 80 |
| | Asellus aquaticus, sowbug | NR | 48 H | $LC_{50}$ | 30,000 | | | 83 |
| | Brachydanio rerio, zebrafish | NR | 48 H | $LC_{50}$ | 60,000 | | | 79 |
| | Chironomus thummi, midge | NR | 48 H | $LC_{50}$ | 64,000 | | | 83 |
| | Cloeon dipterum, mayfly | NR | 48 H | $LC_{50}$ | 42,000 | | | 83 |
| | Corixa punctata, water boatman | NR | 48 H | $LC_{50}$ | 110,000 | | | 83 |
| | Culex pipiens, mosquito | 3RD INSTAR | 48 H | $LC_{50}$ | 55,000 | | | 83 |
| | Daphnia magna, water flea | <=24 H | 48 H | $LC_{50}$ | 18,000 | | | 80 |
| | Daphnia magna, water flea | NR | 3 D | ABD | 25,000 | | | 84 |
| | Daphnia magna, water flea | 24 H | 24 H | $LC_{50}$ | 1,000,000 | | | 77 |
| | Daphnia magna, water flea | NR | 24 H | leth | 110,000 | | | 84 |
| | Daphnia magna, water flea | NR | 24 H | $EC_{50}$ | 1,313,000 | | | 82 |
| | Daphnia magna, water flea | <=24 H | 24 H | $LC_{50}$ | 22,000 | | | 80 |
| | Daphnia magna, water flea | <=24 H | 48 H | | 2,200 | | | 80 |
| | Dugesia lugubris, flatworm | NR | 48 H | $LC_{50}$ | 42,000 | | | 83 |
| | Erpobdella octoculata, leech | NR | 48 H | $LC_{50}$ | 75,000 | | | 83 |
| | Gammarus pulex, scud | NR | 48 H | $LC_{50}$ | 24,000 | | | 83 |
| | Hydra oligactis, hydra | BUDLESS | 48 H | $LC_{50}$ | 75,000 | | | 83 |
| | Hydra oligactis, hydra | NR | 48 H | $LC_{50}$ | 75,000 | | | 83 |
| | Ischnura elegans, dragonfly | NR | 48 H | $LC_{50}$ | 49,000 | | | 83 |
| | Lepomis macrochirus, bluegill | JUVENILE 75 D, 2.2 CM | 1 H | RES | 100 | | | 90 |
| | Lepomis macrochirus, bluegill | JUVENILE, 0.32–1.2 G | 96 H | $LC_{50}$ | 45,000 | | | 81 |
| | Lepomis macrochirus, bluegill | JUVENILE, 0.32–1.2 G | 24 H | $LC_{50}$ | 68,000 to 100,000 | | | 81 |
| | Lymnaea stagnalis, great pond snail | 3–4 WK | 48 H | $LC_{50}$ | 56,000 | | | 83 |
| | Lymnaea stagnalis, great pond snail | NR | 48 H | $LC_{50}$ | 56,000 | | | 83 |
| | Moina macrocopa, water flea | 5 D | 3 H | $LC_{50}$ | 2,300 | | | 86 |
| | Nemoura cinerea, stonefly | NR | 48 H | $LC_{50}$ | 70,000 | | | 83 |
| | Oncorhynchus mykiss, rainbow trout | NR | 24 H | RES | 5,000 | | | 79 |
| | Oncorhynchus mykiss, rainbow trout | 5–8 WK | 48 H | $LC_{50}$ | 42,000 | | | 83 |
| | Oryzias latipes, medaka | 3 CM, 0.3 G | 48 H | $LC_{50}$ | 1,900 | | | 86 |
| | Oryzias latipes, medaka | 4–5 WK | 48 H | $LC_{50}$ | 270,000 | | | 83 |
| | Pimephales promelas, fathead minnow | 1.04 G, 49.0 MM | 48 H | IMM | 22,700 | | | 78 |
| | Pimephales promelas, fathead minnow | 31 D | 96 H | $LC_{50}$ | 44,100 | | | 85 |
| | Pimephales promelas, fathead minnow | 30–35 D | 24 H | $LC_{50}$ | 58,800 | | | 83 |
| | Pimephales promelas, fathead minnow | 3–4 WK | 48 H | $LC_{50}$ | 47,000 | | | 83 |
| | Pimephales promelas, fathead minnow | 1.04 G, 49.0 MM | 96 H | IMM | 21,900 | | | 78 |
| | Pimephales promelas, fathead minnow | 30–35 D | 48 H | $LC_{50}$ | 57,900 | | | 83 |
| | Pimephales promelas, fathead minnow | 1.04 G, 49.0 MM | 72 H | IMM | 22,200 | | | 78 |
| 1,1,2–Trichloroethylene (cont.) | Pimephales promelas, fathead minnow | 1.04 G, 49.0 MM | 24 H | $LC_{50}$ | 52,400 | | | 78 |
| | Pimephales promelas, fathead minnow | 30–35 D | 96 H | $LC_{50}$ | 45,000 | | | 83 |
| | Pimephales promelas, fathead minnow | 1.04 G, 49.0 MM | 24 H | IMM | 23,000 | | | 78 |
| | Pimephales promelas, fathead minnow | 0.12 G | 96 H | $LC_{50}$ | 44,100 | | | 83 |
| | Pimephales promelas, fathead minnow | 30–35 D | 72 H | $LC_{50}$ | 55,400 | | | 83 |
| | Pimephales promelas, fathead minnow | 1.04 G; 49.0 MM | 96 H | $LC_{50}$ | 66,800 | | | 78 |

## Table O.1–9
## AQUIRE Freshwater Toxicity Information (μg/L)
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| | Pimephales promelas, fathead minnow | 1.04 G, 49.0 MM | 96 H | $LC_{50}$ | 40,700 | | | 78 |
| | Pimephales promelas, fathead minnow | 1.04 G, 49.0 MM | 72 H | $LC_{50}$ | 39,000 | | | 78 |
| | Pimephales promelas, fathead minnow | 1.04 G, 49.0 MM | 48 H | $LC_{50}$ | 53,300 | | | 78 |
| | Scenedesmus abundans, green algae | 10E4 CELLS/ML | 96 H | GRO | 450,000 | | | 85 |
| | Selenastrum capricornutum, green algae | LOG PHASE | 96 H | PGR | 175,000 | | | 83 |
| | Tubificidae, tubificidae | NR | 48 H | $LC_{50}$ | 132,000 | | | 83 |
| | Xenopus laevis, clawed toad | 3–4 WK | 48 H | $LC_{50}$ | 45,000 | | | 80 |
| **PAL Semivolatile Organics** | | | | | | | | |
| Bis(2–ethylhexyl)phthalate | Anacystis aeruginosa; Blue–green algae; | LOG–PHASE 500000 CELLS/ML | 96 H | $EC_{50}$GR | | >=320 | 215336 | 81 |
| | Anacystis aeruginosa; Blue–green algae; | LOG–PHASE 500000 CELLS/ML | 96 H | PGR * | | >=320 | 215336 | 81 |
| | Brachydanio rerio; Zebra danio, zebrafish; | 4–5 WK | 96 H | $LC_{50}$ | >320 | | 215390 | 84 |
| | Brachydanio rerio; Zebra danio, zebrafish; | 4–5 WK | 96 H | MOR * | >=320 | | 215390 | 84 |
| | Brachydanio rerio; Zebra danio, zebrafish; | <4 H, EGGS | 5 WK | DVP * | | >=1000 | 215390 | 84 |
| | Brachydanio rerio; Zebra danio, zebrafish; | 1–2 D | 96 H | MOR * | >=320 | | 215390 | 84 |
| | Brachydanio rerio; Zebra danio, zebrafish; | <4 H, EGGS | 5 WK | GRO * | | >=1000 | 215390 | 84 |
| | Brachydanio rerio; Zebra danio, zebrafish; | 1–2 D | 96 H | BEH * | | >=320 | 215390 | 84 |
| | Brachydanio rerio; Zebra danio, zebrafish; | 4–5 WK | 96 H | BEH * | | >=320 | 215390 | 84 |
| | Brachydanio rerio; Zebra danio, zebrafish; | 1–2 D | 96 H | $LC_{50}$ | >320 | | 215390 | 84 |
| | Brachydanio rerio; Zebra danio, zebrafish; | <4 H, EGGS | 5 WK | MOR * | >=1000 | | 215390 | 84 |
| | Bufo woodhousei fowleri; Fowler's toad; | EMBRYO TO LARVA | to 8 D * | $LC_{50}$ | 3,880 | | 216772 | 78 |
| | Bufo woodhousei fowleri; Fowler's toad; | LARVA | 96 H * | $LC_{50}$ | 3,880 | | 216772 | 78 |
| | Carassius auratus; Goldfish; | EMBRYO TO LARVA | 96 H * | $LC_{50}$ | 6,180 | | 216772 | 78 |
| | Carassius auratus; Goldfish; | EGGS, 4 D POSTHATCH | 96 H | $LC_{50}$ * | > 191000 | | 210563 | 79 |
| | Carassius auratus; Goldfish; | EGGS, 4 D POSTHATCH | 96 H | $LC_{50}$ * | > 186000 | | 210563 | 79 |
| | Carassius auratus; Goldfish; | EGGS, 4 D POSTHATCH | 8 D | $LC_{50}$ * | > 191000 | | 210563 | 79 |
| | Carassius auratus; Goldfish; | EGGS, 4 D POSTHATCH | 8 D | $LC_{50}$ * | > 186000 | | 210563 | 79 |
| | Chironomus plumosus; Midge; | EGG | 30 D | HAT * | | 560 | 217688 | 77 |
| | Chironomus plumosus; Midge; | LARVAE | 30 D | DVP * | | 560 | 217688 | 77 |
| | Chlorella pyrenoidosa; Green algae; | LOG–PHASE 10000 CELLS/ML | 96 H | $EC_{50}$GR | | >320 | 215336 | 81 |
| | Chlorella pyrenoidosa; Green algae; | LOG–PHASE 10000 CELLS/ML | 96 H | PGR * | | >=320 | 215336 | 81 |
| | Daphnia magna; Water flea; | <24 H | 24 H | $LC_{50}$ | >68000 | | 215184 | 80 |
| | Daphnia magna; Water flea; | NR | 21 D | REP * | | 10 | 210736 | 73 |
| | Daphnia magna; Water flea; | < 24 H | 21 D | MOR * | 10 | | 311061 | 82 |
| | Daphnia magna; Water flea; | NR | 21 D | REP * | | 2.5 | 210736 | 73 |
| | Daphnia magna; Water flea; | < 24 H | 21 D | MOR * | 3.2 | | 311061 | 82 |
| | Daphnia magna; Water flea; | NR | 21 D | REP * | | 3 | 210736 | 73 |
| | Daphnia magna; Water flea; | < 24 H | 48 H | LOC * | | 47 | 311061 | 82 |
| | Daphnia magna; Water flea; | NR | 21 D | REP * | | 30 | 210736 | 73 |
| | Daphnia magna; Water flea; | <1 D | 2 WK | MOR * | 32 | | 215336 | 81 |
| | Daphnia magna; Water flea; | FIRST INSTAR, < 24 H | 7 D | BIO * | | 811 | 312340 | 87 |
| | Daphnia magna; Water flea; | FIRST INSTAR, < 24 H | 7 D | MOR * | 158 | | 312340 | 87 |
| | Daphnia magna; Water flea; | <1 D | 3 WK | $LC_{50}$ | >320 | | 215336 | 81 |
| | Daphnia magna; Water flea; | FIRST INSTAR, < 24 H | 7 D | MOR * | 811 | | 312340 | 87 |
| | Daphnia magna; Water flea; | <24 H | 2 WK | REP * | | 320 | 215336 | 81 |
| Bis(2–ethylhexyl)phthalate (cont.) | Daphnia magna; Water flea; | NR | 14 D | REP * | | 10 | 210736 | 73 |
| | Daphnia magna; Water flea; | <24 H | 48 H | $LC_{50}$ | 11,000 | | 215184 | 80 |
| | Daphnia magna; Water flea; | NR | 14 D | REP * | | 3 | 210736 | 73 |
| | Daphnia magna; Water flea; | FIRST INSTAR, < 24 H | 21 D | MOR * | 158 | | 312340 | 87 |
| | Daphnia magna; Water flea; | NR | 14 D | REP * | | 30 | 210736 | 73 |
| | Daphnia magna; Water flea; | FIRST INSTAR, < 24 H | 7 D | BIO * | | 158 | 312340 | 87 |

## Table O.1–9
## AQUIRE Freshwater Toxicity Information (μg/L)
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| | Daphnia magna; Water flea; | < 24 H | 21 D | MOR * | 100 | | 311061 | 82 |
| | Daphnia magna; Water flea; | <1 D | 3 WK | MOR * | >=320 | | 215336 | 81 |
| | Daphnia magna; Water flea; | < 24 H | 21 D | MOR * | 32 | | 311061 | 82 |
| | Daphnia magna; Water flea; | <24 H | 48 H | MOR * | 1,100 | | 215184 | 80 |
| | Daphnia magna; Water flea; | <1 D | 2 WK | $LC_{50}$ | >320 | | 215336 | 81 |
| | Daphnia magna; Water flea; | <1 D | 24 H | $EC_{50}$IM | | >320 | 215336 | 81 |
| | Daphnia magna; Water flea; | FIRST INSTAR, < 24 H | 21 D | MOR * | 811 | | 312340 | 87 |
| | Daphnia magna; Water flea; | 1ST INSTAR, 24 H | 21 D | REP | | 3 | 210732 | 73 |
| | Daphnia magna; Water flea; | <1 D | 2 WK | MOR * | >=320 | | 215336 | 81 |
| | Daphnia pulex; Water flea; | NEONATE, < 24 H | 48 H | $EC_{50}$IM | | 133 | 312730 | 87 |
| | Euglena gracilis; Flagellate euglenoid; | LOG–PHASE 10000 CELLS/ML | 96 H | $EC_{50}$GR | | >320 | 215336 | 81 |
| | Euglena gracilis; Flagellate euglenoid; | LOG–PHASE 10000 CELLS/ML | 96 H | PGR * | | >=320 | 215336 | 81 |
| | Gammarus pseudolimnaeus; Scud; | NR | 96 H | $LC_{50}$ | >32000 | | 210732 | 73 |
| | Gammarus pseudolimnaeus; Scud; | JUVENILE | 96 H | $LC_{50}$ | > 32000 | | 210666 | 80 |
| | Gammarus pulex; Scud; | >12 MM | 10 D | LOC * | | 100 | 210079 | 91 |
| | Gammarus pulex; Scud; | >12 MM | 10 D | LOC * | | 500 | 210079 | 91 |
| | Gasterosteus aculeatus; Three spine stickleback; | 4–5 WK | 48 H | $LC_{50}$ | > 300 | | 210823 | 89 |
| | Gasterosteus aculeatus; Three spine stickleback; | 4–5 WK | 96 H | $LC_{50}$ | > 300 | | 210823 | 89 |
| | Gasterosteus aculeatus; Three spine stickleback; | 4–5 WK | 24 H | $LC_{50}$ | > 300 | | 210823 | 89 |
| | Gasterosteus aculeatus; Three spine stickleback; | EGGS, < 6 H | 35 D | $EC_{50}$ * | | > 320 | 210823 | 89 |
| | Gasterosteus aculeatus; Three spine stickleback; | 4–5 WK | 24 H | $EC_{50}$ * | | > 300 | 210823 | 89 |
| | Gasterosteus aculeatus; Three spine stickleback; | EGGS, < 6 H | 35 D | $LC_{50}$ | > 320 | | 210823 | 89 |
| | Gasterosteus aculeatus; Three spine stickleback; | 4–5 WK | 72 H | $LC_{50}$ | > 300 | | 210823 | 89 |
| | Gasterosteus aculeatus; Three spine stickleback; | 4–5 WK | 48 H | $EC_{50}$ * | | > 300 | 210823 | 89 |
| | Gasterosteus aculeatus; Three spine stickleback; | 4–5 WK | 72 H | $EC_{50}$ * | | > 300 | 210823 | 89 |
| | Gasterosteus aculeatus; Three spine stickleback; | 4–5 WK | 96 H | $EC_{50}$ * | | > 300 | 210823 | 89 |
| | Ictalurus punctatus; Channel catfish; | 1.5 G | 96 H | $LC_{50}$ | > 100000 | | 210666 | 80 |
| | Ictalurus punctatus; Channel catfish; | EMBRYO TO LARVA | 96 H * | $LC_{50}$ | 690 | | 216772 | 78 |
| | Jordanella floridae; Flagfish; | 28–35 D | 3 WK | MOR * | >=320 | | 215336 | 81 |
| | Jordanella floridae; Flagfish; | <36 H | 4 WK | MOR * | >=320 | | 215336 | 81 |
| | Jordanella floridae; Flagfish; | <36 H | 7 D | $LC_{50}$ | >320 | | 215336 | 81 |
| | Jordanella floridae; Flagfish; | 1–2 D | 96 H | $LC_{50}$ | >320 | | 215336 | 81 |
| | Jordanella floridae; Flagfish; | 4–5 WK | 96 H | BEH * | | >=320 | 215336 | 81 |
| | Jordanella floridae; Flagfish; | 4–5 WK | 96 H | $LC_{50}$ | >320 | | 215336 | 81 |
| | Jordanella floridae; Flagfish; | 1–2 D | 48 H | $LC_{50}$ | >320 | | 215336 | 81 |
| | Jordanella floridae; Flagfish; | <36 H | 4 WK | GRO * | | >=320 | 215336 | 81 |
| | Jordanella floridae; Flagfish; | 28–35 D | 4 WK | MOR * | >=320 | | 215336 | 81 |
| | Jordanella floridae; Flagfish; | <36 H | 4 WK | $LC_{50}$ | >320 | | 215336 | 81 |
| | Jordanella floridae; Flagfish; | 4–5 WK | 48 H | $LC_{50}$ | >320 | | 215336 | 81 |
| | Jordanella floridae; Flagfish; | 1–2 D | 96 H | BEH * | | >=320 | 215336 | 81 |
| | Jordanella floridae; Flagfish; | 28–35 D | 4 WK | GRO * | | >=320 | 215336 | 81 |
| | Jordanella floridae; Flagfish; | 28–35 D | 2 WK | MOR * | >=320 | | 215336 | 81 |
| | Jordanella floridae; Flagfish; | 28–35 D | 4 WK | REP * | | >=320 | 215336 | 81 |
| | Jordanella floridae; Flagfish; | 28–35 D | 1 WK | MOR * | >=320 | | 215336 | 81 |
| | Lepomis macrochirus; Bluegill; | 0.32–1.2 G, JUVENILE | 24 H | $LC_{50}$ | >770000 | | 215590 | 81 |
| Bis(2–ethylhexyl)phthalate (cont.) | Lepomis macrochirus; Bluegill; | 0.32–1.2 G, JUVENILE | 96 H | $LC_{50}$ | >770000 | | 215590 | 81 |
| | Lepomis macrochirus; Bluegill; | 0.6 G | 96 H | $LC_{50}$ | > 100000 | | 210666 | 80 |
| | Lepomis macrochirus; Bluegill; | JUVENILE, 35 – 60 MM | 0.7 H | AVO * | | 112,400 | 215272 | 80 |
| | Micropterus salmoides; Largemouth bass; | EGGS, 4 D POSTHATCH | 84 H | $LC_{50}$ * | 32,100 | | 210563 | 79 |
| | Micropterus salmoides; Largemouth bass; | EMBRYO TO LARVA | 96 H * | $LC_{50}$ | 32,900 | | 216772 | 78 |
| | Micropterus salmoides; Largemouth bass; | EMBRYO TO LARVA | 96 H * | $LC_{50}$ | 42,100 | | 216772 | 78 |

## Table O.1–9
## AQUIRE Freshwater Toxicity Information (μg/L)
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration Lethal | Effect Concentration Sublethal | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | Micropterus salmoides; Largemouth bass; | EGGS, 4 D POSTHATCH | 7.5 D | $LC_{50}$ * | 45,500 | | 210563 | 79 |
| | Micropterus salmoides; Largemouth bass; | EGGS, 4 D POSTHATCH | 7.5 D | $LC_{50}$ * | 55,700 | | 210563 | 79 |
| | Micropterus salmoides; Largemouth bass; | EGGS, 4 D POSTHATCH | 84 H | $LC_{50}$ * | 65,500 | | 210563 | 79 |
| | Oncorhynchus kisutch; Coho salmon, silver salmon; | 1.5 G | 96 H | $LC_{50}$ | > 100000 | | 210666 | 80 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | EYED EGGS | 12 D * | MOR * | 54 | | 217859 | 76 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | EYED EGGS | 100 D | HAT * | | 54 | 217859 | 76 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | EYED EGGS | 12 D * | MOR * | 14 | | 217859 | 76 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | EGGS, 4 D POSTHATCH | 23 D | $LC_{50}$ * | 154,000 | | 210563 | 79 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | EYED EGGS | 12 D * | MOR * | 5 | | 217859 | 76 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | EGGS, 4 D POSTHATCH | 27 D | $LC_{50}$ * | 149,200 | | 210563 | 79 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 1.5 G | 96 H | $LC_{50}$ | > 100000 | | 210666 | 80 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | EMBRYO TO LARVA | 96 H * | $LC_{50}$ | 149,200 | | 216772 | 78 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | EYED EGGS | 24 D * | MOR * | 14 | | 217859 | 76 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | EYED EGG | 90 D | VTE * | | 14 | 215109 | 77 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | EYED EGGS | 24 D * | MOR * | 5 | | 217859 | 76 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | EYED EGGS | 100 D | GRO * | | 62 | 217859 | 76 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | EYED EGGS | 24 D * | MOR * | 54 | | 217859 | 76 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | EGGS, 4 D POSTHATCH | 27 D | $LC_{50}$ * | 139,500 | | 210563 | 79 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | EYED EGGS | 5 D * | MOR * | 14 | | 217859 | 76 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | EYED EGG | 90 D | GRO * | | 54 | 215109 | 77 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | EYED EGGS | 5 D * | MOR * | 5 | | 217859 | 76 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | EGGS, 4 D POSTHATCH | 23 D | $LC_{50}$ * | 139,100 | | 210563 | 79 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | EYED EGG | 90 D | VTE * | | 5 | 215109 | 77 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | EMBRYO TO LARVA | 96 H * | $LC_{50}$ | 139,500 | | 216772 | 78 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | EYED EGGS | 5 D * | MOR * | 54 | | 217859 | 76 |
| | Oryzias latipes; Medaka, high–eyes; | 28–35 D | 4 WK | GRO * | | >=320 | 215336 | 81 |
| | Oryzias latipes; Medaka, high–eyes; | 28–35 D | 4 WK | REP * | | >=320 | 215336 | 81 |
| | Oryzias latipes; Medaka, high–eyes; | 1–2 D | 96 H | BEH * | | >=320 | 215336 | 81 |
| | Oryzias latipes; Medaka, high–eyes; | 4–5 WK | 48 H | $LC_{50}$ | >320 | | 215336 | 81 |
| | Oryzias latipes; Medaka, high–eyes; | 28–35 D | 1 WK | MOR * | >=320 | | 215336 | 81 |
| | Oryzias latipes; Medaka, high–eyes; | 4–5 WK | 96 H | BEH * | | >=320 | 215336 | 81 |
| | Oryzias latipes; Medaka, high–eyes; | 28–35 D | 3 WK | MOR * | >=320 | | 215336 | 81 |
| | Oryzias latipes; Medaka, high–eyes; | 4–5 WK | 96 H | $LC_{50}$ | >320 | | 215336 | 81 |
| | Oryzias latipes; Medaka, high–eyes; | 28–35 D | 4 WK | $LC_{50}$ | >320 | | 215336 | 81 |
| | Oryzias latipes; Medaka, high–eyes; | <36 H | 4 WK | $LC_{50}$ | >320 | | 215336 | 81 |
| | Oryzias latipes; Medaka, high–eyes; | 1–2 D | 96 H | $LC_{50}$ | >320 | | 215336 | 81 |
| | Oryzias latipes; Medaka, high–eyes; | <36 H | 4 WK | MOR * | >=320 | | 215336 | 81 |
| | Oryzias latipes; Medaka, high–eyes; | 1–2 D | 48 H | $LC_{50}$ | >320 | | 215336 | 81 |
| | Oryzias latipes; Medaka, high–eyes; | 28–35 D | 2 WK | MOR * | >=320 | | 215336 | 81 |
| | Oryzias latipes; Medaka, high–eyes; | 28–35 D | 4 WK | MOR * | >=320 | | 215336 | 81 |
| | Oryzias latipes; Medaka, high–eyes; | <36 H | 7 D | $LC_{50}$ | >320 | | 215336 | 81 |
| | Pimephales promelas; Fathead minnow; | 7.5 MO, 1.24 G | 56 D | MOR * | 62 | | 217859 | 76 |
| | Pimephales promelas; Fathead minnow; | 7.5 MO, 1.24 G | 56 D | GRO * | | 62 | 217859 | 76 |
| | Pimephales promelas; Fathead minnow; | FRY, 10 D | 127 D | GRO * | | 100 | 215109 | 77 |
| | Pimephales promelas; Fathead minnow; | FRY, 10 D | 127 D | VTE * | | 11 | 215109 | 77 |
| Bis(2–ethylhexyl)phthalate (cont.) | Poecilia reticulata; Guppy; | 21–28 D | 2 WK | $LC_{50}$ | >320 | | 215336 | 81 |
| | Poecilia reticulata; Guppy; | 21–28 D | 48 H | $LC_{50}$ | >320 | | 215336 | 81 |
| | Poecilia reticulata; Guppy; | 21–28 D | 4 WK | $LC_{50}$ | >320 | | 215336 | 81 |
| | Poecilia reticulata; Guppy; | 21–28 D | 1 WK | $LC_{50}$ | >320 | | 215336 | 81 |
| | Rana arvalis; Moorfrog; | EGGS | 3 WK | HAT | | 0.89 to 187.40 | 215904 | 87 |
| | Rana pipiens; Leopard frog; | EMBRYO TO LARVA | to 8 D * | $LC_{50}$ | 4,440 | | 216772 | 78 |

# Table O.1-9
# AQUIRE Freshwater Toxicity Information (µg/L)
# AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration Lethal | Effect Concentration Sublethal | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | Rana pipiens; Leopard frog; | LARVA | 96 H * | $LC_{50}$ | 4,440 | | 216772 | 78 |
| | Salvelinus fontinalis; Brook trout; | ADULT, 1.5 YR | 150 D | GRO * | | 52 | 215109 | 77 |
| | Salvelinus fontinalis; Brook trout; | ADULT, 1.5 YR | 150 D | VTE * | | 3.7 | 215109 | 77 |
| | Selenastrum capricornutum; Green algae; | LOG-PHASE 50000 CELLS/ML | 96 H | $EC_{50}$GR | | >320 | 215336 | 81 |
| | Selenastrum capricornutum; Green algae; | LOG-PHASE 50000 CELLS/ML | 96 H | PGR * | | >=320 | 215336 | 81 |
| | Stephanodiscus hantzschii; Diatom; | LOG-PHASE 10000 CELLS/ML | 96 H | $EC_{50}$GR | | >320 | 215336 | 81 |
| | Stephanodiscus hantzschii; Diatom; | LOG-PHASE 10000 CELLS/ML | 96 H | PGR * | | >=320 | 215336 | 81 |
| **PAL Metals** | | | | | | | | |
| Aluminum | Brachionus calyciflorus; Rotifer; | NEONATE | 24 H | $LC_{50}$ | > 3,000 | | 219385 | 91 |
| | Myriophyllum spicatum; Water-milfoil; | 4 CM APEX | 32 D | $EC_{50}$GR * | | 12,700 | 212262 | 74 |
| | Myriophyllum spicatum; Water-milfoil; | 4 CM APEX | 32 D | $EC_{50}$BM * | | 7,600 | 212262 | 74 |
| | Myriophyllum spicatum; Water-milfoil; | 4 CM APEX | 32 D | $EC_{50}$BM * | | 2,500 | 212262 | 74 |
| | Myriophyllum spicatum; Water-milfoil; | 4 CM APEX | 32 D | $EC_{50}$GR * | | 5,100 | 212262 | 74 |
| | Salmo trutta; Brown trout; | ALEVIN | 28 D | $LC_{50}$ | 19 | | 213472 | 90 |
| | Salmo trutta; Brown trout; | ALEVIN | 42 D | $LC_{50}$ | 72 | | 213472 | 90 |
| | Salmo trutta; Brown trout; | ALEVIN | 21 D | $LC_{50}$ | 84 to 105 | | 213472 | 90 |
| | Salmo trutta; Brown trout; | ALEVIN | 42 D | $LC_{50}$ | 15 | | 213472 | 90 |
| | Salmo trutta; Brown trout; | ALEVIN | 28 D | $LC_{50}$ | 79 | | 213472 | 90 |
| | Salmo trutta; Brown trout; | FERT EGG | <4 MO | HAT | | <677 | 213472 | 90 |
| | Salvelinus fontinalis; Brook trout; | FRY | 43.2 H | $LT_{50}$ | 1,000 | | 216632 | 80 |
| | Salvelinus fontinalis; Brook trout; | FRY | 7.3 D | $LT_{50}$ | 630 | | 216632 | 80 |
| | Salvelinus fontinalis; Brook trout; | FRY | 79.2 H | $LT_{50}$ | 500 | | 216632 | 80 |
| | Salvelinus fontinalis; Brook trout; | ADULT, 25-30 CM | 5 D | LET | 320 | | 216632 | 80 |
| | Salvelinus fontinalis; Brook trout; | FRY | 86.4 H | $LT_{50}$ | 1,000 | | 216632 | 80 |
| | Salvelinus fontinalis; Brook trout; | FRY | 11.5 D | $LT_{50}$ | 100 | | 216632 | 80 |
| | Salvelinus fontinalis; Brook trout; | FRY, 22-23 MM | 10.67 D | $LT_{50}$ | 480 | | 216188 | 80 |
| | Salvelinus fontinalis; Brook trout; | FRY | 4.7 D | $LT_{50}$ | 650 | | 216632 | 80 |
| | Salvelinus fontinalis; Brook trout; | FRY, 22-23 MM | 19.67 D | $LT_{50}$ | 470 | | 216188 | 80 |
| | Salvelinus fontinalis; Brook trout; | FRY | 5 D | $LT_{50}$ | 1,000 | | 216632 | 80 |
| | Salvelinus fontinalis; Brook trout; | FRY, 22-23 MM | 20.83 D | $LT_{50}$ | 20 | | 216188 | 80 |
| | Salvelinus fontinalis; Brook trout; | FRY | 50.4 H | $LT_{50}$ | 500 | | 216632 | 80 |
| | Salvelinus fontinalis; Brook trout; | FRY, 22-23 MM | 4.79 D | $LT_{50}$ | 42 | | 216188 | 80 |
| | Salvelinus fontinalis; Brook trout; | FRY | 67.2 H | $LT_{50}$ | 500 | | 216632 | 80 |
| | Salvelinus fontinalis; Brook trout; | FRY, 22-23 MM | 8.42 D | $LT_{50}$ | 500 | | 216188 | 80 |
| | Salvelinus fontinalis; Brook trout; | EYED EGGS | 5 D | MOR * | 320 | | 216632 | 80 |
| | Salvelinus fontinalis; Brook trout; | FRY, 22-23 MM | >20.83 D | $LT_{50}$ | 10 | | 216188 | 80 |
| | Salvelinus fontinalis; Brook trout; | 0.2 G, 30 D | 3 D | GRO * | | 268 | 213592 | 91 |
| | Salvelinus fontinalis; Brook trout; | FRY, 22-23 MM | >20.83 D | $LT_{50}$ | 500 | | 216188 | 80 |
| | Salvelinus fontinalis; Brook trout; | FRY | 55.2 H | $LT_{50}$ | 500 | | 216632 | 80 |
| | Salvelinus fontinalis; Brook trout; | FRY, 22-23 MM | >20.83 D | $LT_{50}$ | 500 | | 216188 | 80 |
| | Salvelinus fontinalis; Brook trout; | FRY | 38.4 H | $LT_{50}$ | 500 | | 216632 | 80 |
| | Salvelinus fontinalis; Brook trout; | 0.2 G, 30 D | 56 D | MOR * | 268 | | 213592 | 91 |
| | Salvelinus fontinalis; Brook trout; | FRY | 5.2 D | $LT_{50}$ | 100 | | 216632 | 80 |
| | Salvelinus fontinalis; Brook trout; | RECENTLY HATCHED FRY | 5 D | LET | 320 | | 216632 | 80 |
| Aluminum (cont.) | Salvelinus fontinalis; Brook trout; | YEARLINGS, 13-17 CM | 5 D | LET | 320 | | 216632 | 80 |
| Aluminum chloride | Ambystoma opacum; Marbled salamander; | EGGS | 8 D | $LC_{50}$ | 2,280 | | 216199 | 78 |
| | Brachydanio rerio; Zebra danio, zebrafish; | LARVAE, 7-8 D POST-SPAWN | 48 H | $LC_{50}$ | 106,000 | | 311199 | 85 |
| | Brachydanio rerio; Zebra danio, zebrafish; | LARVAE, 7-8 D POST-SPAWN | 48 H | $LC_{50}$ | 80,000 | | 311199 | 85 |
| | Carassius auratus; Goldfish; | EGGS | 7 D | $LC_{50}$ * | 150 | | 215305 | 78 |
| | Chilomonas paramecium; Cryptomonad; | NR | 0.17 H | LET | 2,400 | | 212863 | 73 |

# Table O.1–9
## AQUIRE Freshwater Toxicity Information (μg/L)
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| | Cyprinus carpio; Common, mirror, colored, carp; | 7.5–8.5 CM, 10.5–12.5 G | 24 H | MOR * | 8,000 | | 315166 | 81 |
| | Cyprinus carpio; Common, mirror, colored, carp; | 7.5–8.5 CM, 10.5–12.5 G | 48 H | MOR * | 2,000 | | 315166 | 81 |
| | Cyprinus carpio; Common, mirror, colored, carp; | 7.5–8.5 CM, 10.5–12.5 G | 24 H | MOR * | 4,000 | | 315166 | 81 |
| | Cyprinus carpio; Common, mirror, colored, carp; | 7.5–8.5 CM, 10.5–12.5 G | 48 H | MOR * | 2,000 | | 315166 | 81 |
| | Cyprinus carpio; Common, mirror, colored, carp; | 7.5–8.5 CM, 10.5–12.5 G | 24 H | MOR * | 8,000 | | 315166 | 81 |
| | Cyprinus carpio; Common, mirror, colored, carp; | 7.5–8.5 CM, 10.5–12.5 G | 48 H | MOR * | 8,000 | | 315166 | 81 |
| | Daphnia magna; Water flea; | 12 H | 21 D | $EC_{50}$IM ? | | 1,400 | 212022 | 72 |
| | Daphnia magna; Water flea; | 4 H | 64 H | $EC_{50}$IM (Calc) | | 1,400 | 212054 | 48 |
| | Daphnia magna; Water flea; | 12 H | 48 H | $EC_{50}$IM ? | | 3,900 | 212022 | 72 |
| | Daphnia magna; Water flea; | 12 H | 21 D | $EC_{50}$RE ? | | 680 | 212022 | 72 |
| | Euglena gracilis; Flagellate euglenoid; | NR | 3 H | MOR * | 1,000,000 | | 212863 | 73 |
| | Gambusia affinis; Mosquitofish; Poeciliidae; | ADULT, FEMALE | 48 H | $LC_{50}$ ? (Calc) | 27,500 | | 210508 | 57 |
| | Gambusia affinis; Mosquitofish; Poeciliidae; | ADULT, FEMALE | 24 H | $LC_{50}$ ? (Calc) | 29,600 | | 210508 | 57 |
| | Gambusia affinis; Mosquitofish; Poeciliidae; | ADULT, FEMALE | 96 H | $LC_{50}$ ? (Calc) | 27,100 | | 210508 | 57 |
| | Gambusia affinis; Mosquitofish; Poeciliidae; | ADULT, FEMALE | 96 H | MOR * (Calc) | 20,400 | | 210508 | 57 |
| | Microhyla carolinensis; Narrow mouthed frog; | EGGS | 7 D | $LC_{50}$ * | 50 | | 215305 | 78 |
| | Micropterus salmoides; Largemouth bass; | EGGS | 8 D | $LC_{50}$ | 170 | | 216199 | 78 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | EGGS | 28 D | $LC_{50}$ * | 560 | | 215305 | 78 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | FINGERLING, 6 WK | 9.25 D | PHY * | | 5,140; 1,570 | 218830 | 73 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | EGGS | 28 D | $LC_{50}$ | 560 | | 216199 | 78 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | FINGERLING, 6 MO | 45 D | PHY * | | 514; 514 | 218830 | 73 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | FINGERLING, 11 WK | 43.9 D | $LT_{50}$ | 513 | | 219328 | 71 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | FINGERLING, 6 WK | 4.7 D | PHY * | | 5,200; 5,050 | 218830 | 73 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | FINGERLING, 6 MO | 31.96 D | $LT_{50}$ | 5,230 | | 219328 | 71 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | FINGERLING, 6 WK | 7.46 D | $LT_{50}$ | 5,140 | | 219328 | 71 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | FINGERLING, 6 MO | 45 D | GRO * | | 51.6; 51.6 | 218830 | 73 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | FINGERLING, 6 WK | 71.52 H | $LT_{50}$ | 5,200 | | 219328 | 71 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | FINGERLING, 11 WK | 45 D | GRO * | | 513 | 219328 | 71 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | FINGERLING, 6 MO | 45 D | GRO * | | 514 | 219328 | 71 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | FINGERLING, 6 MO | 45 D | GRO * | | 51.6 | 219328 | 71 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | FINGERLING, 11 WK | 38.9 D | $LT_{50}$ | 5,140 | | 219328 | 71 |
| | Peranema trichophorum; Flagellate; | NR | 0.17 H | LET | >1,000,000 | | 212863 | 73 |
| | Pimephales promelas; Fathead minnow; | LARVAE, <24 H | 14 D | GRO * | | 66; 35 | 213070 | 89 |
| | Pimephales promelas; Fathead minnow; | EMBRYO | 4 D | HAT * | | 66; 35 | 213070 | 89 |
| | Pimephales promelas; Fathead minnow; | 30 D | to 109 D | HIS | | 30 to 60 | 213182 | 90 |
| | Pimephales promelas; Fathead minnow; | 12 D LARVAE | to 96 H | MOR | 50 to 400 | | 210836 | 89 |
| | Pimephales promelas; Fathead minnow; | JUVENILE | to 96 H | MOR | 50 to 400 | | 210836 | 89 |
| | Pimephales promelas; Fathead minnow; | 1 D LARVAE | to 96 H | MOR | 50 to 400 | | 210836 | 89 |
| | Pimephales promelas; Fathead minnow; | LARVAE, <24 H | 14 D | MOR * | 66; 35 | | 213070 | 89 |
| | Pimephales promelas; Fathead minnow; | ADULT | 2 MO | REP * | | 66; 35 | 213070 | 89 |
| | Tetrahymena pyriformis; Ciliate; | NR | 0.17 H | LET | 3,200 | | 212863 | 73 |
| | Tropistemus lateralis; Beetle; | ADULT | 14 D | PHY * (Calc) | | 27,000 | 212868 | 69 |
| Aluminum sulfate | Asellus aquaticus; Aquatic sowbug; | ADULT, 7 MM, 1.5 MG DRY WT | 48 H | $EC_{50}$IM ? | | 6,570 | 311972 | 86 |
| | Asellus aquaticus; Aquatic sowbug; | ADULT, 7 MM, 1.5 MG DRY WT | 72 H | $EC_{50}$IM ? | | 4,370 | 311972 | 86 |
| | Biomphalaria glabrata; Snail; | ADULT, 4–4.5 SUTURE WHORL | 24 H | STR * | | 100 | 212853 | 63 |
| Aluminum sulfate (cont.) | Biomphalaria glabrata; Snail; | ADULT, 4–4.5 SUTURE WHORL | 24 H | STR * | | 1,000 | 212853 | 63 |
| | Cladocera; Water flea order; | NR | 2 MO * | POP * | | 500 | 217183 | 78 |
| | Crangonyx pseudogracilis; Amphipod; | ADULT, 4 MM, 0.2 MG DRY WT | 48 H | $EC_{50}$IM ? | | 12,800 | 311972 | 86 |
| | Crangonyx pseudogracilis; Amphipod; | ADULT, 4 MM, 0.2 MG DRY WT | 96 H | $EC_{50}$IM ? | | 9,190 | 311972 | 86 |
| | Crustacea; Crustacean class; | NR | 2 MO * | ABD * | | 500 | 217183 | 78 |
| | Cyprinus carpio; Common, mirror, colored, carp; | 7.5–8.5 CM, 10.5–12.5 G | 24 H | MOR * | 8,000 | | 315166 | 81 |

## Table O.1–9
## AQUIRE Freshwater Toxicity Information (μg/L)
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| | Cyprinus carpio; Common, mirror, colored, carp; | 7.5–8.5 CM, 10.5–12.5 G | 24 H | MOR * | 8,000 | | 315166 | 81 |
| | Cyprinus carpio; Common, mirror, colored, carp; | 7.5–8.5 CM, 10.5–12.5 G | 48 H | MOR * | 2,000 | | 315166 | 81 |
| | Cyprinus carpio; Common, mirror, colored, carp; | 7.5–8.5 CM, 10.5–12.5 G | 48 H | MOR * | 4,000 | | 315166 | 81 |
| | Cyprinus carpio; Common, mirror, colored, carp; | 7.5–8.5 CM, 10.5–12.5 G | 48 H | MOR * | 4,000 | | 315166 | 81 |
| | Cyprinus carpio; Common, mirror, colored, carp; | 7.5–8.5 CM, 10.5–12.5 G | 48 H | MOR * | 8,000 | | 315166 | 81 |
| | Daphnia magna; Water flea; | 8 H, YOUNG | 0.25 H * | LOC * | | 136,000 | 212171 | 44 |
| | Fundulus heteroclitus; Mummichog; | NR | 36 H | $LC_{100}$ (Calc) | 2,200 | | 212865 | 15 |
| | Fundulus heteroclitus; Mummichog; | NR | 5 D | $LC_{100}$ (Calc) | 1,100 | | 212865 | 15 |
| | Gambusia affinis; Mosquitofish; | ADULT, FEMALE | 24 H | $LC_{50}$ ? (Calc) | 69,000 | | 210508 | 57 |
| | Gambusia affinis; Mosquitofish; | ADULT, FEMALE | 48 H | $LC_{50}$ ? (Calc) | 38,000 | | 210508 | 57 |
| | Gambusia affinis; Mosquitofish; | ADULT, FEMALE | 48 H | MOR * (Calc) | < 28,000 | | 210508 | 57 |
| | Gambusia affinis; Mosquitofish; | ADULT, FEMALE | 96 H | $LC_{50}$ ? (Calc) | 37,000 | | 210508 | 57 |
| | Micropterus dolomieui; Smallmouth bass; | 13.8(12–17) MM, 32.5(9–59) MG | 30 D | GRO * | | 251.6 | 312723 | 87 |
| | Micropterus dolomieui; Smallmouth bass; | LARVAE | 30 D | MOR * | 251.6 | | 312723 | 87 |
| | Micropterus dolomieui; Smallmouth bass; | LARVAE, 48 H POST–HATCH | 96 H | MOR * | 100 | | 312723 | 87 |
| | Micropterus dolomieui; Smallmouth bass; | LARVAE, 48 H POST–HATCH | 96 H | MOR * | 196 | | 312723 | 87 |
| | Micropterus dolomieui; Smallmouth bass; | LARVAE, 48 H POST–HATCH | 96 H | MOR * | 217 | | 312723 | 87 |
| | Micropterus dolomieui; Smallmouth bass; | LARVAE, 48 H POST–HATCH | 96 H | MOR * | 32 | | 312723 | 87 |
| | Micropterus dolomieui; Smallmouth bass; | LARVAE, 48 H POST–HATCH | 96 H | MOR * | 320 | | 312723 | 87 |
| | Micropterus dolomieui; Smallmouth bass; | LARVAE, 48 H POST–HATCH | 96 H | MOR * | 56 | | 312723 | 87 |
| | Micropterus dolomieui; Smallmouth bass; | LARVAE, 48 H POST–HATCH | 96 H | MOR * | 560 | | 312723 | 87 |
| | Notemigonus crysoleucas; Golden shiner; | NR | 45 D | MOR * | 100,000 | | 312756 | 86 |
| | Notemigonus crysoleucas; Golden shiner; | NR | 45 D | MOR * | 100,000 | | 312756 | 86 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 118–355 G, 22–31 CM FORK LENGTH | 24 H | MOR * | 910 | | 212508 | 88 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 118–355 G, 22–31 CM FORK LENGTH | 24 H | MOR * | 9,100 | | 212508 | 88 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 118–355 G, 22–31 CM FORK LENGTH | 48 H | LET | 9,100 | | 212508 | 88 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 118–355 G, 22–31 CM FORK LENGTH | 48 H | MOR * | 910 | | 212508 | 88 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 118–355 G, 22–31 CM FORK LENGTH | 72 H | MOR * | 910 | | 212508 | 88 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 118–355 G, 22–31 CM FORK LENGTH | 96 H | HEM * | | 90 | 212508 | 88 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 118–355 G, 22–31 CM FORK LENGTH | 96 H | HEM * | | 910 | 212508 | 88 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 118–355 G, 22–31 CM FORK LENGTH | 96 H | HEM * | | 910 | 212508 | 88 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 118–355 G, 22–31 CM FORK LENGTH | 96 H | MOR * | 90 | | 212508 | 88 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 118–355 G, 22–31 CM FORK LENGTH | 96 H | MOR * | 910 | | 212508 | 88 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 50–80 MM | 10 D | LC0 | 200,000 | | 216520 | 80 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 50–80 MM | 10 D | LC0 | 50,000 | | 216520 | 80 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 50–80 MM | 42 H | $LC_{100}$ | 50,000 | | 216520 | 80 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 50–80 MM | 42 H | $LC_{100}$ | 50,000 | | 216520 | 80 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 50–80 MM | 96 H | MOR * | 50,000 | | 216520 | 80 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | FINGERLING, 11 WK | 45 D | PHY * | | 513 | 218830 | 73 |
| | Salvelinus fontinalis; Brook trout; | 14 MO, 210 MM, 130 G | 24 H | $LC_{50}$ ? | 4,000 | | 216115 | 75 |
| | Salvelinus fontinalis; Brook trout; | 14 MO, 210 MM, 130 G | 24 H | $LC_{50}$ ? | 4,450 | | 216115 | 75 |
| | Salvelinus fontinalis; Brook trout; | 14 MO, 210 MM, 130 G | 24 H | MOR * | 5,000 | | 216115 | 75 |
| | Salvelinus fontinalis; Brook trout; | 14 MO, 210 MM, 130 G | 24 H | MOR * | 5,000 | | 216115 | 75 |
| | Salvelinus fontinalis; Brook trout; | 14 MONTHS, 210 MM, 130 G | 96 H | $LC_{50}$ ? | 3,600 | | 216115 | 75 |
| | Salvelinus fontinalis; Brook trout; | EYED EMBRYO – LARVAE | 45 D | GRO * | | 283 | 312720 | 87 |
| Aluminum sulfate (cont.) | Salvelinus fontinalis; Brook trout; | EYED EMBRYO – LARVAE | 60 D | BEH * | | 283 | 312720 | 87 |
| | Salvelinus fontinalis; Brook trout; | EYED EMBRYO – LARVAE | 60 D | MOR * | 283 | | 312720 | 87 |
| | Stizostedion lucioperca; Pikeperch; | 11.5–16 MM | 24 H | MOR * | 400 | | 212700 | 75 |
| Arsenic | Ceriodaphnia reticulata; Water flea; | < 4 H | 48 H | $LC_{50}$ | 1,800 | | 311181 | 84 |
| | Daphnia magna; Water flea; | < 24 H | 48 H | $LC_{50}$ | 3,800 | | 311181 | 84 |

# Table O.1-9
# AQUIRE Freshwater Toxicity Information (μg/L)
# AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| | Daphnia pulex; Water flea; | < 24 H | 48 H | $LC_{50}$ | 1,900 | | 311181 | 84 |
| | Ictalurus punctatus; Channel catfish; | 400 G | 0.1 to 7 WK | RSD | | 1,910 to 2,500 | 315333 | 77 |
| | Lepomis cyanellus; Green sunfish; | <4 YR, 5.5-90.7 G | 4 MO | HIS | | 1,000 to 20,000 | 311560 | 85 |
| | Lepomis macrochirus; Bluegill; | NR | 6 MO | MOR * | 5,000 | | 212143 | 73 |
| | Myriophyllum spicatum; Water-milfoil; | 4 CM APEX | 32 D | $EC_{50}$BM * | | 2,600 | 212262 | 74 |
| | Myriophyllum spicatum; Water-milfoil; | 4 CM APEX | 32 D | $EC_{50}$BM * | | 2,900 | 212262 | 74 |
| | Myriophyllum spicatum; Water-milfoil; | 4 CM APEX | 32 D | $EC_{50}$GR * | | 3,600 | 212262 | 74 |
| | Myriophyllum spicatum; Water-milfoil; | 4 CM APEX | 32 D | $EC_{50}$GR * | | 4,100 | 212262 | 74 |
| | Simocephalus vetulus; Water flea; | < 24 H | 48 H | $LC_{50}$ | 1,700 | | 311181 | 84 |
| Barium | Daphnia magna; Water flea; | <= 24 H | 24 H | $LC_{50}$ | > 530,000 | | 215184 | 80 |
| | Daphnia magna; Water flea; | <= 24 H | 48 H | $LC_{50}$ | 410,000 | | 215184 | 80 |
| | Daphnia magna; Water flea; | <= 24 H | 48 H | MOR * | 68,000 | | 215184 | 80 |
| | Lemna minor; Duckweed; | 20 COLONIES OR 40 FRONDS | 4 D | $EC_{50}$GR | | 26,000 | 311789 | 86 |
| | Myriophyllum spicatum; Water-milfoil; | 4 CM APEX | 32 D | $EC_{50}$BM * | | 103,000 | 212262 | 74 |
| | Myriophyllum spicatum; Water-milfoil; | 4 CM APEX | 32 D | $EC_{50}$BM * | | 41,200 | 212262 | 74 |
| | Myriophyllum spicatum; Water-milfoil; | 4 CM APEX | 32 D | $EC_{50}$GR * | | 113,000 | 212262 | 74 |
| | Myriophyllum spicatum; Water-milfoil; | 4 CM APEX | 32 D | $EC_{50}$GR * | | 83,800 | 212262 | 74 |
| Barium chloride | Lemna minor; Duckweed | FRONDS | 96 H | GRO | | 25000 | 283261 | 88 |
| | Daphnia magna; Water flea | 12 H | 48 H | IMM | | 14500 | 228732 | 72 |
| | Echinogammarus berilloni; Scud | NR | 24 H | $LC_{50}$ | 336,000 | | 307710 | 86 |
| | Gammarus pulex; Scud | NR | 24 H | $LC_{50}$ | 3,980,000 | | 307706 | 86 |
| | Salmo trutta; Brown trout | YEARLING | 48 H | $LC_{50}$ | 150,000 | | 240072 | 74 |
| | Austropotamobius pallipes pall; Crayfish | 19-32 MM | 96 H | $LC_{50}$ | 46,000 | | 228813 | 73 |
| | Gambusia affinis; Mosquitofish | ADULT, FEMALE | 24 H | $LC_{50}$ | 2,910,000 | | 215454 | 57 |
| | Orconectes limosus; Crayfish | 19-32 MM | 96 H | $LC_{50}$ | 78,000 | | 228816 | 73 |
| | Gambusia affinis; Mosquitofish | ADULT, FEMALE | 96 H | MOR | 66,200 | | 215457 | 57 |
| | Daphnia magna; Water flea | 12 H | 21 D | REP | | 8,900 | 228734 | 72 |
| Cadmium | Algae; Algae, phytoplankton, algal mat | NATURAL COMMUNITY | 2 to 244 H | PGR | | 3.4 to 84.0 | 311823 | 85 |
| | Algae; Algae, phytoplankton, algal mat | EXPO GRO PHASE | 24 H | PSE | | <=56200 | 213095 | 89 |
| | Algae; Algae, phytoplankton, algal mat | PHYTOPLANKTON | 14 D | BMS * | | 100 | 313109 | 88 |
| | Algae; Algae, phytoplankton, algal mat | NATURAL COMMUNITY | 382 H | PGR | | 2.9 to 4.2 | 311823 | 85 |
| | Anabolia nervosa; Quiver fly | LARVAE | 7 D | LET | 9,000,000 | | 210725 | 57 |
| | Anacystis nidulans; Blue-green algae | NR | 48 H | BCF | | 500 | 312317 | 86 |
| | Anacystis nidulans; Blue-green algae | NR | 36 H | BCF | | 1,000 | 312317 | 86 |
| | Anacystis nidulans; Blue-green algae | NR | 48 H | BCF | | 1,000 | 312317 | 86 |
| | Anacystis nidulans; Blue-green algae | NR | 36 H | BCF | | 10,000 | 312317 | 86 |
| | Anacystis nidulans; Blue-green algae | NR | 24 H | BCF | | 10,000 | 312317 | 86 |
| | Anacystis nidulans; Blue-green algae | NR | 48 H | BCF | | 10,000 | 312317 | 86 |
| | Anacystis nidulans; Blue-green algae | NR | 48 H | BCF | | 100 | 312317 | 86 |
| | Anacystis nidulans; Blue-green algae | NR | 12 H | BCF | | 5,000 | 312317 | 86 |
| | Anacystis nidulans; Blue-green algae | NR | 24 H | BCF | | 500 | 312317 | 86 |
| | Anacystis nidulans; Blue-green algae | NR | 24 H | BCF | | 5,000 | 312317 | 86 |
| | Anacystis nidulans; Blue-green algae | NR | 36 H | BCF | | 100 | 312317 | 86 |
| Cadmium (cont.) | Anacystis nidulans; Blue-green algae | NR | 36 H | BCF | | 5,000 | 312317 | 86 |
| | Anacystis nidulans; Blue-green algae | NR | 24 H | BCF | | 1,000 | 312317 | 86 |
| | Anacystis nidulans; Blue-green algae | NR | 24 H | BCF | | 100 | 312317 | 86 |
| | Anacystis nidulans; Blue-green algae | NR | 12 H | BCF | | 500 | 312317 | 86 |
| | Anacystis nidulans; Blue-green algae | NR | 48 H | BCF | | 5,000 | 312317 | 86 |
| | Anacystis nidulans; Blue-green algae | NR | 12 H | BCF | | 1,000 | 312317 | 86 |

## Table O.1-9
## AQUIRE Freshwater Toxicity Information (μg/L)
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| | Anacystis nidulans; Blue-green algae | NR | 36 H | BCF | | 500 | 312317 | 86 |
| | Anacystis nidulans; Blue-green algae | NR | 12 H | BCF | | 100 | 312317 | 86 |
| | Anacystis nidulans; Blue-green algae | NR | 12 H | BCF | | 10,000 | 312317 | 86 |
| | Anodonta anatina; Fresh-water mussel | 80-100 MM | 15 WK | RSD | | 0.5 to 1.0 | 213792 | 91 |
| | Anodonta cygnea; Swan mussel | NR | to 12 WK | PHY * | | 50 | 213466 | 90 |
| | Anodonta cygnea; Swan mussel | 10 (8.5-11.5) CM | to 12 WK | BIO * | | 50 | 213467 | 90 |
| | Asellus aquaticus; Aquatic sowbug | 8-10 MM | 96 H | $LC_{50}$* | 60 | | 312041 | 85 |
| | Asellus aquaticus; Aquatic sowbug | JUVENILE, 30 D, 1.35 MM | 96 H | $LC_{50}$ | 80 | | 311953 | 86 |
| | Asellus aquaticus; Aquatic sowbug | EMBRYO, STAGE D | 96 H | $LC_{50}$ | 240 | | 311953 | 86 |
| | Asellus aquaticus; Aquatic sowbug | 8-10 MM | 48 H | $LC_{50}$* | 3,600 | | 312041 | 85 |

## Table O.1-9
## AQUIRE Freshwater Toxicity Information (μg/L)
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| Cadmium (cont.) | Asellus aquaticus; Aquatic sowbug | JUVENILE, 1.60 MM | 96 H | $LC_{50}$ | 170 | | 311953 | 86 |
| | Asellus aquaticus; Aquatic sowbug | 8-10 MM | 48 H | $LC_{50}$* | 4,000 | | 312041 | 85 |
| | Asellus aquaticus; Aquatic sowbug | JUVENILE, 1.60 MM | 96 H | $LC_{50}$ | 150 | | 311953 | 86 |
| | Asellus aquaticus; Aquatic sowbug | ADULT, 9.87 MM | 96 H | $LC_{50}$ | 600 | | 311953 | 86 |
| | Asellus aquaticus; Aquatic sowbug | ADULT, 9.87 MM | 96 H | $LC_{50}$ | 1,000 | | 311953 | 86 |
| | Asellus aquaticus; Aquatic sowbug | 8-10 MM | 24 H | $LC_{50}$* | 13,000 | | 312041 | 85 |
| | Asellus aquaticus; Aquatic sowbug | EMBRYO, STAGE C | 96 H | $LC_{50}$ | 2,000 | | 311953 | 86 |
| | Asellus aquaticus; Aquatic sowbug | 8-10 MM | 24 H | $LC_{50}$* | 11,000 | | 312041 | 85 |
| | Asellus aquaticus; Aquatic sowbug | EMBRYO, STAGE D | 96 H | $LC_{50}$ | 300 | | 311953 | 86 |
| | Asellus aquaticus; Aquatic sowbug | JUVENILE, 5.92 MM | 96 H | $LC_{50}$ | 540 | | 311953 | 86 |
| | Asellus aquaticus; Aquatic sowbug | 8-10 MM | 96 H | $LC_{50}$* | 60 | | 312041 | 85 |
| | Asellus aquaticus; Aquatic sowbug | JUVENILE, 3.52 MM | 96 H | $LC_{50}$ | 230 | | 311953 | 86 |
| | Asellus aquaticus; Aquatic sowbug | JUVENILE, 5.92 MM | 96 H | $LC_{50}$ | 450 | | 311953 | 86 |
| | Asellus aquaticus; Aquatic sowbug | JUVENILE, 3.52 MM | 96 H | $LC_{50}$ | 320 | | 311953 | 86 |
| | Asellus aquaticus; Aquatic sowbug | JUVENILE, 30 D, 1.35 MM | 96 H | $LC_{50}$ | 53 | | 311953 | 86 |
| | Asellus aquaticus; Aquatic sowbug | EMBRYO, STAGE C | 96 H | $LC_{50}$ | 1,750 | | 311953 | 86 |
| | Asellus aquaticus; Aquatic sowbug | JUVENILE, 2.30 MM | 96 H | $LC_{50}$ | 175 | | 311953 | 86 |
| | Asellus aquaticus; Aquatic sowbug | JUVENILE, 2.30 MM | 96 H | $LC_{50}$ | 170 | | 311953 | 86 |
| | Astacus astacus; European crayfish | 8-10 CM | to 10 WK | HIS | | 2 | 210376 | 91 |
| | Astacus astacus; European crayfish | 8-10 CM | 2 WK | ENZ * | | 2 | 210376 | 91 |
| | Baetis rhodani; Mayfly | 8-10 MM | 48 H | $LC_{50}$* | 4,000 | | 312041 | 85 |
| | Baetis rhodani; Mayfly | 8-10 MM | 24 H | $LC_{50}$* | 95,000 | | 312041 | 85 |
| | Baetis rhodani; Mayfly | 8-10 MM | 48 H | $LC_{50}$* | 2,200 | | 312041 | 85 |
| | Baetis rhodani; Mayfly | 8-10 MM | 96 H | $LC_{50}$* | 50 | | 312041 | 85 |
| | Baetis rhodani; Mayfly | 8-10 MM | 96 H | $LC_{50}$* | 70 | | 312041 | 85 |
| | Baetis rhodani; Mayfly | 8-10 MM | 24 H | $LC_{50}$* | 90,000 | | 312041 | 85 |
| | Brachionus calyciflorus; Rotifer | NEONATE | 24 H | $LC_{50}$ | 1,300 | | 219385 | 91 |
| | Carassius auratus; Goldfish | 5.0-20.9 G | 14 D | HEM * | | 445 | 310472 | 84 |
| | Catostomus commersoni; White sucker | JUVENILE, 142 MM, 28.7 G | 1 WK | RSD | | 660 | 312412 | 87 |
| | Ceriodaphnia reticulata; Water flea | < 4 H | 48 H | $LC_{50}$ | 66 | | 311181 | 84 |
| | Channa punctatus; Snake-head catfish | FINGERLING | 48 H | $LC_{50}$ | 34,640 | | 313173 | 88 |
| | Channa punctatus; Snake-head catfish | FINGERLING | 96 H | $LC_{50}$ | 18,500 | | 313173 | 88 |
| | Channa punctatus; Snake-head catfish | FINGERLING | 13 D | GRO * | | 3,500 | 313173 | 88 |
| | Chironomidae; Midge family | LARVAE | 12 MO | POP | | 7.6 | 213176 | 88 |
| | Chironomus plumosus; Midge | LARVA-STATE L3 | 96 H | $LC_{50}$ | 32,000 | | 215356 | 89 |
| | Chironomus plumosus; Midge | LARVA-STATE L2 | 96 H | $LC_{50}$ | 32,000 | | 215356 | 89 |
| | Chironomus plumosus; Midge | LARVA-STATE L2 | 72 H | $LC_{50}$ | 32,000 | | 215356 | 89 |
| | Chironomus plumosus; Midge | LARVA-STATE L4 | 72 H | $LC_{50}$ | 32,000 | | 215356 | 89 |
| | Chironomus plumosus; Midge | LARVA-STATE L2 | 48 H | $LC_{50}$ | 32,000 | | 215356 | 89 |
| | Chironomus plumosus; Midge | LARVA-STATE L3 | 72 H | $LC_{50}$ | 32,000 | | 215356 | 89 |
| | Chironomus plumosus; Midge | LARVA-STATE L2 | 24 H | $LC_{50}$ | 32,000 | | 215356 | 89 |
| | Chironomus plumosus; Midge | LARVA-STATE L3 | 24 H | $LC_{50}$ | 32,000 | | 215356 | 89 |
| | Chironomus plumosus; Midge | LARVA-STATE L1 | 24 H | $LC_{50}$ | 21,530 | | 215356 | 89 |
| | Chironomus plumosus; Midge | LARVA-STATE L4 | 96 H | $LC_{50}$ | 32,000 | | 215356 | 89 |
| | Chironomus plumosus; Midge | LARVA-STATE L4 | 24 H | $LC_{50}$ | 32,000 | | 215356 | 89 |
| | Chironomus plumosus; Midge | LARVA-STATE L3 | 48 H | $LC_{50}$ | 32,000 | | 215356 | 89 |
| | Chironomus plumosus; Midge | LARVA-STATE L4 | 48 H | $LC_{50}$ | 32,000 | | 215356 | 89 |
| | Chironomus riparius; Midge | LARVA-STATE L1 | 24 H | $LC_{50}$ | 53,610 | | 215356 | 89 |
| | Chironomus riparius; Midge | LARVA-STATE L4 | 24 H | $LC_{50}$ | 10,000 | | 215356 | 89 |
| | Chironomus riparius; Midge | LARVA-STATE L2 | 48 H | $LC_{50}$ | 10,000 | | 215356 | 89 |
| | Chironomus riparius; Midge | 4TH INSTAR LARVAE | >10 D | RSD | | 50 to 100 | 212720 | 89 |

## Table O.1–9
## AQUIRE Freshwater Toxicity Information (μg/L)
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| Cadmium (cont.) | Chironomus riparius; Midge | LARVA–STATE L2 | 72 H | $LC_{50}$ | 7,690 | | 215356 | 89 |
| | Chironomus riparius; Midge | EGGS | 7 to 96 H | MOR * | 1,000 | | 215356 | 89 |
| | Chironomus riparius; Midge | LARVA–STATE L3 | 24 H | $LC_{50}$ | 32,000 | | 215356 | 89 |
| | Chironomus riparius; Midge | LARVA–STATE L3 | 96 H | $LC_{50}$ | 7,360 | | 215356 | 89 |
| | Chironomus riparius; Midge | EGGS | 7 to 96 H | MOR * | 1,000 | | 215356 | 89 |
| | Chironomus riparius; Midge | LARVA–STATE L3 | 72 H | $LC_{50}$ | 15,210 | | 215356 | 89 |
| | Chironomus riparius; Midge | 10–12 MM | 48 H | $LC_{50}$* | 200,000 | | 312041 | 85 |
| | Chironomus riparius; Midge | 10–12 MM | 96 H | $LC_{50}$* | 300,000 | | 312041 | 85 |
| | Chironomus riparius; Midge | LARVA–STATE L4 | 96 H | $LC_{50}$ | 6,680 | | 215356 | 89 |
| | Chironomus riparius; Midge | LARVA–STATE L2 | 24 H | $LC_{50}$ | 10,000 | | 215356 | 89 |
| | Chironomus riparius; Midge | LARVA–STATE L4 | 48 H | $LC_{50}$ | 10,000 | | 215356 | 89 |
| | Chironomus riparius; Midge | EGGS | <=24 H | MOR * | 3,200 | | 215356 | 89 |
| | Chironomus riparius; Midge | 10–12 MM | 24 H | $LC_{50}$* | 200,000 | | 312041 | 85 |
| | Chironomus riparius; Midge | LARVA–STATE L3 | 48 H | $LC_{50}$ | 32,000 | | 215356 | 89 |
| | Chironomus riparius; Midge | LARVA–STATE L4 | 72 H | $LC_{50}$ | 10,000 | | 215356 | 89 |
| | Chironomus riparius; Midge | 10–12 MM | 96 H | $LC_{50}$* | 200,000 | | 312041 | 85 |
| | Chironomus riparius; Midge | EGGS | <=24 H | MOR * | 10,000 | | 215356 | 89 |
| | Chironomus riparius; Midge | LARVA–STATE L2 | 96 H | $LC_{50}$ | 4,320 | | 215356 | 89 |
| | Chironomus tentans; Midge | LARVA–STATE L1 | 24 H | $LC_{50}$ | 9,990 | | 215356 | 89 |
| | Chironomus tentans; Midge | LARVA–STATE L3 | 72 H | $LC_{50}$ | 730 | | 215356 | 89 |
| | Chironomus tentans; Midge | LARVA–STATE L3 | 48 H | $LC_{50}$ | 2,370 | | 215356 | 89 |
| | Chironomus tentans; Midge | LARVA–STATE L4 | 96 H | $LC_{50}$ | 1,410 | | 215356 | 89 |
| | Chironomus tentans; Midge | LARVA–STATE L3 | 24 H | $LC_{50}$ | 10,000 | | 215356 | 89 |
| | Chironomus tentans; Midge | LARVA–STATE L4 | 48 H | $LC_{50}$ | 2,700 | | 215356 | 89 |
| | Chironomus tentans; Midge | LARVA–STATE L2 | 96 H | $LC_{50}$ | 80 | | 215356 | 89 |
| | Chironomus tentans; Midge | LARVA–STATE L3 | 96 H | $LC_{50}$ | 480 | | 215356 | 89 |
| | Chironomus tentans; Midge | LARVA–STATE L2 | 72 H | $LC_{50}$ | 130 | | 215356 | 89 |
| | Chironomus tentans; Midge | LARVA–STATE L4 | 72 H | $LC_{50}$ | 1,930 | | 215356 | 89 |
| | Chironomus tentans; Midge | LARVA–STATE L2 | 24 H | $LC_{50}$ | 440 | | 215356 | 89 |
| | Chironomus tentans; Midge | LARVA–STATE L4 | 24 H | $LC_{50}$ | 10,000 | | 215356 | 89 |
| | Chironomus tentans; Midge | LARVA–STATE L2 | 48 H | $LC_{50}$ | 210 | | 215356 | 89 |
| | Chironomus thummi; Midge | LARVAE | 7 D | LET | 150,000 | | 210725 | 57 |
| | Chironomus yoshimatsui; Midge | 3RD AND 4TH INSTAR | 2 D | RSD * | | 10,000 | 311481 | 84 |
| | Corbicula fluminea; Asiatic clam | ADULT 5 CM | 1 D | RSD | | 0.3 | 312002 | 86 |
| | Coregonus clupeaformis; Lake whitefish | 26.63 G | 72 D | BCF * | | 0.00125 | 210688 | 89 |
| | Cyprinidae; Minnow, carp family | 2 SUMMERS | 84 H | LET * | 25,000 | | 210725 | 57 |
| | Cyprinidae; Minnow, carp family | 1 SUMMER | 5.63 D | LET * | 20,000 | | 210725 | 57 |
| | Cyprinidae; Minnow, carp family | 1 SUMMER | 7 D | MOR * | 13,000 | | 210725 | 57 |
| | Cyprinidae; Minnow, carp family | 1 SUMMER | 33 H | LET * | 30,000 | | 210725 | 57 |
| | Cyprinidae; Minnow, carp family | 1 SUMMER | 5.63 D | LET * | 15,000 | | 210725 | 57 |
| | Cyprinidae; Minnow, carp family | 1 SUMMER | 14 H | LET * | 50,000 | | 210725 | 57 |
| | Cyprinidae; Minnow, carp family | 1 SUMMER | 96 H | LET * | 25,000 | | 210725 | 57 |
| | Cypris subglobosa; Ostracod | NR | 96 H | $LC_{50}$ | 687.4 | | 312365 | 88 |
| | Cypris subglobosa; Ostracod | NR | 24 H | $LC_{50}$ | 6,981 | | 312365 | 88 |
| | Cypris subglobosa; Ostracod | NR | 48 H | $LC_{50}$ | 3,020 | | 312365 | 88 |
| | Cypris subglobosa; Ostracod | NR | 12 H | $LC_{50}$ | 12,660 | | 312365 | 88 |
| | Daphnia lumholzi; Water flea | NR | 96 H | $LC_{50}$ | 83 | | 312365 | 88 |
| | Daphnia lumholzi; Water flea | NR | 48 H | $LC_{50}$ | 618.6 | | 312365 | 88 |
| | Daphnia lumholzi; Water flea | NR | 12 H | $LC_{50}$ | 2,325 | | 312365 | 88 |
| | Daphnia lumholzi; Water flea | NR | 24 H | $LC_{50}$ | 1,585 | | 312365 | 88 |
| | Daphnia magna; Water flea | <= 24 H | 48 H | $LC_{50}$ | 33 | | 310929 | 84 |

## Table O.1–9
## AQUIRE Freshwater Toxicity Information (μg/L)
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| Cadmium (cont.) | Daphnia magna; Water flea | < 24 H | 21 D | REP * | | 3.2 | 310589 | 85 |
| | Daphnia magna; Water flea | < 24 H | 14 D | $LC_{50}$ | 24 | | 310589 | 85 |
| | Daphnia magna; Water flea | NR | 3 WK | MOR * | 7.78 | | 210772 | 89 |
| | Daphnia magna; Water flea | NR | 3 WK | MOR * | 22.9 | | 210772 | 89 |
| | Daphnia magna; Water flea | <= 24 H | 48 H | $LC_{50}$ | 62 | | 310929 | 84 |
| | Daphnia magna; Water flea | < 24 H | 21 D | $LC_{50}$ | 14 | | 310589 | 85 |
| | Daphnia magna; Water flea | < 24 H | 48 H | $LC_{50}$ | 118 | | 311181 | 84 |
| | Daphnia magna; Water flea | < 24 H | 21 D | LET | 5.6 | | 310589 | 85 |
| | Daphnia magna; Water flea | < 24 H | 21 D | MOR * | 3.2 | | 310589 | 85 |
| | Daphnia magna; Water flea | NR | 3 WK | REP * | | 1.86 | 210772 | 89 |
| | Daphnia magna; Water flea | NR | 28 D | MOR * | 0.5 | | 312770 | 87 |
| | Daphnia magna; Water flea | <= 24 H | 48 H | $LC_{50}$ | 40 | | 310929 | 84 |
| | Daphnia magna; Water flea | <= 24 H | 48 H | $LC_{50}$ | 36 | | 310929 | 84 |
| | Daphnia magna; Water flea | <= 24 H | 48 H | $LC_{50}$ | 24 | | 310929 | 84 |
| | Daphnia magna; Water flea | <= 24 H | 48 H | $LC_{50}$ | 36 | | 310929 | 84 |
| | Daphnia magna; Water flea | < 24 H | 21 D | MOR * | 1.8 | | 310589 | 85 |
| | Daphnia magna; Water flea | NR | 28 D | MOR * | 1 | | 312770 | 87 |
| | Daphnia magna; Water flea | < 24 H | 14 D | REP * | | 32 | 310589 | 85 |
| | Daphnia magna; Water flea | < 24 H | 21 D | MOR * | 1 | | 310589 | 85 |
| | Daphnia magna; Water flea | < 24 H | 21 D | GRO * | | 0.32 | 310589 | 85 |
| | Daphnia magna; Water flea | NR | 28 D | LET | 5 | | 312770 | 87 |
| | Daphnia pulex; Water flea | < 24 H | 48 H | $LC_{50}$ | 68 | | 311181 | 84 |
| | Dugesia tigrina; Turbellarian, flatworm | NR | 96 H | $LC_{50}$ | 2,250 | | 218709 | 74 |
| | Elodea canadensis; Waterweed | SHOOTS | to 9 WK | RSD * | | 0.5 to 6.0 | 210652 | 77 |
| | Ephemerella ignita; Mayfly | 8–10 MM | 24 H | $LC_{50}$* | 54,000 | | 312041 | 85 |
| | Ephemerella ignita; Mayfly | 8–10 MM | 96 H | $LC_{50}$* | 13,000 | | 312041 | 85 |
| | Ephemerella ignita; Mayfly | 8–10 MM | 24 H | $LC_{50}$* | 61,000 | | 312041 | 85 |
| | Ephemerella ignita; Mayfly | 8–10 MM | 48 H | $LC_{50}$* | 19,000 | | 312041 | 85 |
| | Ephemerella ignita; Mayfly | 8–10 MM | 96 H | $LC_{50}$* | 12,000 | | 312041 | 85 |
| | Ephemerella ignita; Mayfly | 8–10 MM | 48 H | $LC_{50}$* | 18,000 | | 312041 | 85 |
| | Esox lucius; Northern pike | 50–160 G | to 11 WK | RSD | | 60 to 225 | 213460 | 90 |
| | Gambusia affinis; Mosquitofish | NR | 48 H | MOR * | 6,700 | | 313098 | 88 |
| | Gammarus fasciatus; Scud | 0–1 WK | 6 WK | GRO * | | 3.42 | 210772 | 89 |
| | Gammarus fasciatus; Scud | 0–1 WK | 6 WK | MOR * | 2.23 | | 210772 | 89 |
| | Gammarus fasciatus; Scud | 0–1 WK | 6 WK | GRO * | | 2.23 | 210772 | 89 |
| | Gammarus fasciatus; Scud | 0–1 WK | 6 WK | MOR * | 1.49 | | 210772 | 89 |
| | Gammarus lacustris; Scud | NR | 96 H | $LC_{50}$ | 40.1 | | 313058 | 88 |
| | Gammarus pulex; Scud | 8–12 MM | 24 H | $LC_{50}$* | 1,300 | | 312041 | 85 |
| | Gammarus pulex; Scud | 8–12 MM | 96 H | $LC_{50}$* | 20 | | 312041 | 85 |
| | Gammarus pulex; Scud | 8–12 MM | 96 H | $LC_{50}$* | 30 | | 312041 | 85 |
| | Gammarus pulex; Scud | 8–12 MM | 24 H | $LC_{50}$* | 1,600 | | 312041 | 85 |
| | Gammarus pulex; Scud | 8–12 MM | 48 H | $LC_{50}$* | 400 | | 312041 | 85 |
| | Gammarus pulex; Scud | 8–12 MM | 48 H | $LC_{50}$* | 400 | | 312041 | 85 |
| | Gammarus roeseli; Scud | NR | 7 D | LET | 400 | | 210725 | 57 |
| | Gasterosteus aculeatus; Three spine stickleback | 0.3–0.6 G | to 10 D | RSD | | 2,500 | 312680 | 87 |
| | Gastropoda; Snails, limpets class | NR | 210 D | RSD * | | 2 | 219245 | 73 |
| | Heteropneustes fossilis; Indian catfish | 70 G | 1 to 60 D | ENZ * | | 260 | 310049 | 82 |
| | Hexagenia rigida; Mayfly | YEARLING, NYMPHS, 24 MM | 96 H | $LC_{50}$ | 6,200 | | 212091 | 80 |
| | Hyalella azteca; Scud | 0–1 WK | 6 WK | MOR * | 0.57 | | 210772 | 89 |
| | Hyalella azteca; Scud | 0–1 WK | 6 WK | MOR * | 0.92 | | 210772 | 89 |
| | Hyalella azteca; Scud | 0–1 WK | 6 WK | GRO * | | 2.23 | 210772 | 89 |

# Table O.1–9
# AQUIRE Freshwater Toxicity Information (μg/L)
# AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| Cadmium (cont.) | Hydrodictyon reticulatum; Green algae | NR | 1 to 168 H | BMS | | 100 to 10000 | 213348 | 89 |
| | Hydropsyche angustipennis; Caddisfly | 10–15 MM | 96 H | $LC_{50}$* | 520,000 | | 312041 | 85 |
| | Hydropsyche angustipennis; Caddisfly | 10–15 MM | 24 H | $LC_{50}$* | 200,000 | | 312041 | 85 |
| | Hydropsyche angustipennis; Caddisfly | 10–15 MM | 48 H | $LC_{50}$* | 200,000 | | 312041 | 85 |
| | Hydropsyche angustipennis; Caddisfly | 10–15 MM | 96 H | $LC_{50}$* | 200,000 | | 312041 | 85 |
| | Ictalurus nebulosus; Brown bullhead | NR | 24 H | THL * | | 50 | 313113 | 87 |
| | Invertebrates; Invertebrates | ZOOPLANKTON | 14 D | BMS * | | 3 | 312800 | 87 |
| | Invertebrates; Invertebrates | CLADOCERA, COPEPODA, ROTIFERA | 2 WK | POP * | | 3 | 311256 | 83 |
| | Invertebrates; Invertebrates | ZOOPLANKTON | 14 D | BMS * | | 1 | 312800 | 87 |
| | Lamellidens marginalis; Mussel | 7 CM | 4.2 to 11.3 H | PHY * | | 500 to 2,000 | 213311 | 89 |
| | Lamellidens marginalis; Mussel | 5.0–6.0 CM | 1 to 30 D | GRO | | 500 to 2,000 | 213776 | 91 |
| | Lamellidens marginalis; Mussel | 5.0–6.0 CM | 1 to 30 D | OC | | 500 to 2,000 | 213776 | 91 |
| | Lamellidens marginalis; Mussel | 5.0–6.0 CM | 96 H | $LC_{50}$ | 10,000 | | 213776 | 91 |
| | Lamellidens marginalis; Mussel | NR | 96 H | $LC_{50}$ | 10,000 | | 213311 | 89 |
| | Lampsilis ventricosa; Lamp–mussel | NR | 2 WK | RSD | | < 2 to 4.5 | 312614 | 87 |
| | Lemna minor; Duckweed | 20 COLONIES OR 40 FRONDS | 4 D | $EC_{50}$GR | | 200 | 311789 | 86 |
| | Lepomis macrochirus; Bluegill | NR | 48 H | ENZ * | | 1 | 213021 | 88 |
| | Lepomis macrochirus; Bluegill | NR | 14 D | PHY | | 1 to 100 | 212707 | 88 |
| | Lepomis macrochirus; Bluegill | NR | 6 MO | LET | 5,000 | | 212143 | 73 |
| | Limnodrilus hoffmeisteri; Oligochaete | 30–40 MM | 24 H | $LC_{50}$* | 24,000 | | 312041 | 85 |
| | Limnodrilus hoffmeisteri; Oligochaete | 30–40 MM | 96 H | $LC_{50}$* | 2,900 | | 312041 | 85 |
| | Limnodrilus hoffmeisteri; Oligochaete | 30–40 MM | 24 H | $LC_{50}$* | 20,000 | | 312041 | 85 |
| | Limnodrilus hoffmeisteri; Oligochaete | 30–40 MM | 48 H | $LC_{50}$* | 6,400 | | 312041 | 85 |
| | Limnodrilus hoffmeisteri; Oligochaete | 30–40 MM | 48 H | $LC_{50}$* | 6,800 | | 312041 | 85 |
| | Limnodrilus hoffmeisteri; Oligochaete | 30–40 MM | 96 H | $LC_{50}$* | 2,400 | | 312041 | 85 |
| | Limnodrilus sp; Sludge worm | NR | 14 D | RSD | | 50 | 311865 | 83 |
| | Lophopodella carteri; Bryozoa | ANCENSTRULAE 2–3 DAYS | 96 H | $LC_{50}$ | 150 | | 216703 | 80 |
| | Macrobrachium hendersodayanus; Prawn | NR | 96 H | OC * | | 34 | 311545 | 84 |
| | Morone saxatilis; Striped bass | LARVAE, 6 WK | 290 H | $LC_{50}$ | 6 | | 310625 | 85 |
| | Morone saxatilis; Striped bass | LARVAE, 1 D | 1 to 52 H | MOR | 1 to 20 | | 310625 | 85 |
| | Morone saxatilis; Striped bass | LARVAE, 7 D | 2 to 120 H | MOR | 5 to 250 | | 310625 | 85 |
| | Myriophyllum spicatum; Water–milfoil | 4 CM APEX | 32 D | $EC_{50}$GR * | | 809,000 | 212262 | 74 |
| | Myriophyllum spicatum; Water–milfoil | 4 CM APEX | 32 D | $EC_{50}$BM * | | 7,400 | 212262 | 74 |
| | Myriophyllum spicatum; Water–milfoil | 4 CM APEX | 32 D | $EC_{50}$BM * | | 14,600 | 212262 | 74 |
| | Myriophyllum spicatum; Water–milfoil | 4 CM APEX | 32 D | $EC_{50}$GR * | | 20,800 | 212262 | 74 |
| | Noemacheilus barbatulus; Stone loach | 5–12 G | to 15 WK | RSD | | 1,250 | 311872 | 86 |
| | Noemacheilus barbatulus; Stone loach | 5–15 G | 2 to 77 D | RSD * | | 1,250 | 312707 | 87 |
| | Noemacheilus barbatulus; Stone loach | 2–21 G | to 119 D | RSD | | 3 to 1,250 | 213451 | 90 |
| | Noemacheilus barbatulus; Stone loach | 7–21 G | 25 WK | BIO | | 3 | 219243 | 90 |
| | Notemigonus crysoleucas; Golden shiner | NR | 48 H | ENZ * | | 100 | 213021 | 88 |
| | Notemigonus crysoleucas; Golden shiner | ADULT, 70–90 MM | 12 H | ENZ * | | 1,350 | 312205 | 87 |
| | Notemigonus crysoleucas; Golden shiner | ADULT, 70–90 MM | 6 H | HEM * | | 1,350 | 312205 | 87 |
| | Notemigonus crysoleucas; Golden shiner | NR | 96 H | PHY | | 1,350 to 2,400 | 212707 | 88 |
| | Notemigonus crysoleucas; Golden shiner | ADULT, 70–90 MM | 96 H | $LC_{50}$ | 3,150 | | 312205 | 87 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | 1 SUMMER | 30 H | LET * | 7,000 | | 210725 | 57 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | 150–220 G | to 1.5 H | RSD * | | 0.6 to 1.12 | 315315 | 81 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | JUVENILE, 10 G | 1 WK | RSD * | | 3,000 to 60,000 | 312729 | 87 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | 5.7 CM, 3.1 G | 48 H | $LC_{50}$? | 7 | | 219245 | 73 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | FRY, 3 CM | 48 H | $LC_{50}$ | 91 | | 210459 | 80 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | NR | 2 MO | MOR | 18 to 54 | | 312383 | 83 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | 5.0 CM, 2.1 G | 24 H | $LC_{50}$? | 4,200 | | 219245 | 73 |

## Table O.1–9
## AQUIRE Freshwater Toxicity Information (μg/L)
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| Cadmium (cont.) | Oncorhynchus mykiss; Rainbow trout, donaldson trout | 1 SUMMER | 7 D | MOR * | 3,000 | | 210725 | 57 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | NR | 3 MO | BIO | | 9 | 312383 | 83 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | 5.0 CM, 2.1 G | 96 H | $LC_{50}$? | 6 | | 219245 | 73 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | 9–200 G | 3 to 133 D | RSD | | 3 to 15 | 213451 | 90 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | 375 G | 3 D | PHY * | | 6.4 | 310404 | 84 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | 1 SUMMER | 77 H | LET * | 5,000 | | 210725 | 57 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | FRY, 3 CM | 48 H | $LC_{50}$ | 3,698 | | 210459 | 80 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | FRY, 3 CM | 48 H | $LC_{50}$ | 358 | | 210459 | 80 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | NR | 7 D | MOR * | 8 to 10 | | 310185 | 68 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | 36–102 G | 25 WK | BIO | | 3 | 219243 | 90 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | NR | 280 D | RSD | | 0.01 to 4.8 | 219245 | 73 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | 1 SUMMER | 21 H | LET * | 8,000 | | 210725 | 57 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | FRY, 3 CM | 48 H | $LC_{50}$ | 677 | | 210459 | 80 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | 2 SUMMERS | 5.92 D | LET * | 8,000 | | 210725 | 57 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | NR | 12 MO | BIO * | | 9 | 313110 | 88 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | 5.7 CM, 1.1 G | 96 H | $LC_{50}$? | 7 | | 219245 | 73 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | 5.0 CM, 2.1 G | 10 D | $LC_{50}$? | 5 | | 219245 | 73 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | 5.7 CM, 1.1 G | 10 D | $LC_{50}$? | 7 | | 219245 | 73 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | 46.21 G | 72 D | BCF * | | 0.00127 | 210688 | 89 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | 1 SUMMER | 6 D | LET * | 4,000 | | 210725 | 57 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | 375 G | 178 D | PHY * | | 3.6 | 310404 | 84 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | 5.0 CM, 2.1 G | 48 H | $LC_{50}$? | 9 | | 219245 | 73 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | EYED EGGS | 4 to 756 D | RSD | | 0.5 to 7.1 | 217341 | 78 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | 1 SUMMER | 18 H | LET * | 10,000 | | 210725 | 57 |
| | Oryzias latipes; Medaka, high–eyes | FERTILIZED EGGS | 1 WK | ABN * | | 10 | 310880 | 84 |
| | Oryzias latipes; Medaka, high–eyes | EGG | NR | HAT | | 30 to 10,000 | 213213 | 89 |
| | Oryzias latipes; Medaka, high–eyes | EGG | 48 H | RSD | | 300 to 4,500 | 213212 | 89 |
| | Pectinatella magnifica; Bryozoa | ANCENSTRULAE 2–3 DAYS | 96 H | $LC_{50}$ | 700 | | 216703 | 80 |
| | Physa fontinalis; Bladder snail | 10–12 MM | 96 H | $LC_{50}$* | 80 | | 312041 | 85 |
| | Physa fontinalis; Bladder snail | 10–12 MM | 48 H | $LC_{50}$* | 2,100 | | 312041 | 85 |
| | Physa fontinalis; Bladder snail | 10–12 MM | 24 H | $LC_{50}$* | 4,200 | | 312041 | 85 |
| | Physa fontinalis; Bladder snail | 10–12 MM | 48 H | $LC_{50}$* | 1,800 | | 312041 | 85 |
| | Physa fontinalis; Bladder snail | 10–12 MM | 24 H | $LC_{50}$* | 4,400 | | 312041 | 85 |
| | Physa fontinalis; Bladder snail | 10–12 MM | 96 H | $LC_{50}$* | 80 | | 312041 | 85 |
| | Physa gyrina; Pouch snail | ADULT | 48 H | $LC_{50}$? | 4,250 | | 212021 | 76 |
| | Physa gyrina; Pouch snail | JUVENILE | 48 H | $LC_{50}$? | 690 | | 212021 | 76 |
| | Physa gyrina; Pouch snail | ADULT | 228 H | $LC_{50}$? | 830 | | 212021 | 76 |
| | Physa gyrina; Pouch snail | ADULT | 4 to 60 H | REP | | 1,800 to 10,000 | 212021 | 76 |
| | Physa gyrina; Pouch snail | ADULT | 96 H | $LC_{50}$? | 1,370 | | 212021 | 76 |
| | Physa gyrina; Pouch snail | JUVENILE | 96 H | $LC_{50}$? | 410 | | 212021 | 76 |
| | Physa gyrina; Pouch snail | ADULT | 24 H | $LC_{50}$? | 7,600 | | 212021 | 76 |
| | Pimephales promelas; Fathead minnow | NR | 48 H | ENZ * | | 1 | 213021 | 88 |
| | Pimephales promelas; Fathead minnow | NR | 48 H | ENZ * | | 10 | 213021 | 88 |
| | Plumatella emarginata; Bryozoan | ANCENSTRULAE 2–3 DAYS | 96 H | $LC_{50}$ | 1,090 | | 216703 | 80 |
| | Polycelis tenuis; Turbellarian | 10–12 MM | 48 H | $LC_{50}$* | 125,000 | | 312041 | 85 |
| | Polycelis tenuis; Turbellarian | 10–12 MM | 96 H | $LC_{50}$* | 74,000 | | 312041 | 85 |
| | Polycelis tenuis; Turbellarian | 10–12 MM | 96 H | $LC_{50}$* | 80,000 | | 312041 | 85 |
| | Polycelis tenuis; Turbellarian | 10–12 MM | 24 H | $LC_{50}$* | 130,000 | | 312041 | 85 |
| | Polycelis tenuis; Turbellarian | 10–12 MM | 24 H | $LC_{50}$* | 270,000 | | 312041 | 85 |
| | Polycelis tenuis; Turbellarian | 10–12 MM | 48 H | $LC_{50}$* | 100,000 | | 312041 | 85 |
| | Potamogeton crispus; Curled pondweed | NR | NR | PSE * | | 1,000 | 217552 | 77 |

## Table O.1–9
## AQUIRE Freshwater Toxicity Information (μg/L)
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| Cadmium (cont.) | Procambarus clarkii; Red swamp crayfish | ADULT INTERMOLT | to 30 D | BIO | | 100 | 212572 | 89 |
| | Procambarus clarkii; Red swamp crayfish | ADULT, INTERMOLT | 96 H | ENZ * | | 100 | 312701 | 87 |
| | Procambarus clarkii; Red swamp crayfish | ADULT INTERMOLT, 19.5–30.2 G | 1 to 96 H | BIO * | | 10,000 | 215112 | 91 |
| | Rutilus rutilus; Roach | 100 G | to 25 WK | RSD | | 500 | 311872 | 86 |
| | Rutilus rutilus; Roach | 15–100 G | 1 to 70 D | RSD * | | 30 to 500 | 312707 | 87 |
| | Rutilus rutilus; Roach | NR | 65 D | RSD | | 450 | 213451 | 90 |
| | Salvelinus fontinalis; Brook trout | EMBRYO | NR | GRO * | | 0.02 to 2,000 | 218196 | 88 |
| | Salvelinus fontinalis; Brook trout | 1 SUMMER | 47 H | LET * | 10,000 | | 210725 | 57 |
| | Salvelinus fontinalis; Brook trout | 1 SUMMER | 26 H | LET * | 25,000 | | 210725 | 57 |
| | Salvelinus fontinalis; Brook trout | 1 SUMMER | 7 D | MOR * | 4,000 | | 210725 | 57 |
| | Salvelinus fontinalis; Brook trout | 2 SUMMERS | 5.83 D | LET * | 25,000 | | 210725 | 57 |
| | Salvelinus fontinalis; Brook trout | 1 SUMMER | 76 H | LET * | 6,000 | | 210725 | 57 |
| | Salvelinus fontinalis; Brook trout | 1 SUMMER | 4.42 D | LET * | 5,000 | | 210725 | 57 |
| | Salvelinus fontinalis; Brook trout | 1 SUMMER | 55 H | LET * | 8,000 | | 210725 | 57 |
| | Salvelinus fontinalis; Brook trout | EMBRYO | NR | HAT * | | 0.02 to 2,000 | 218196 | 88 |
| | Salvelinus fontinalis; Brook trout | ADULT | 30 D | STR * | | 3.6 to 60 | 312833 | 86 |
| | Scyliorhinus canicula; Dogfish | NR | to 10 D | BIO | | 25,000 to 50,000 | 212560 | 89 |
| | Selenastrum capricornutum; Green algae | 25 E3 CELLS/ML, LAG PHASE | 48 H | PGR * | | 30 | 213335 | 90 |
| | Selenastrum capricornutum; Green algae | 25 E3 CELLS/ML, LAG PHASE | 48 H | PHY * | | 30 | 213335 | 90 |
| | Simocephalus vetulus; Water flea | < 24 H | 48 H | $LC_{50}$ | 24 | | 311181 | 84 |
| | Spirodela polyrhiza; Large duckweed | THREE FROND COLONY | 14 D | PHY | | 100 to 10,000 | 213264 | 89 |
| | Spirodela polyrhiza; Large duckweed | THREE FROND COLONY | 14 D | PGR | | 100 to 10,000 | 213264 | 89 |
| | Spirulina platensis; Blue–green algae | NR | 12 H | BCF | | 5,000 | 312317 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 36 H | BCF | | 10,000 | 312317 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 24 H | BCF | | 10,000 | 312317 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 48 H | BCF | | 1,000 | 312317 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 12 H | BCF | | 1,000 | 312317 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 36 H | BCF | | 1,000 | 312317 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 48 H | BCF | | 5,000 | 312317 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 36 H | BCF | | 100 | 312317 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 48 H | BCF | | 500 | 312317 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 48 H | BCF | | 10,000 | 312317 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 12 H | BCF | | 10,000 | 312317 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 48 H | BCF | | 100 | 312317 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 36 H | BCF | | 5,000 | 312317 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 12 H | BCF | | 500 | 312317 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 24 H | BCF | | 500 | 312317 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 24 H | BCF | | 1,000 | 312317 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 24 H | BCF | | 5,000 | 312317 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 24 H | BCF | | 100 | 312317 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 12 H | BCF | | 100 | 312317 | 86 |
| | Spirulina platensis; Blue–green algae | NR | 36 H | BCF | | 500 | 312317 | 86 |
| | Tilapia mossambica; Mozambique tilapia | 103.59 G, 19.9 CM | to 45 D | HEM * | | 0.0783 to 6.4635 | 213331 | 90 |
| | Tilapia mossambica; Mozambique tilapia | NR | to 6 WK | HEM * | | 100,000 | 312792 | 87 |
| | Tinca tinca; Tench | 1 SUMMER | 21 H | LET * | 50,000 | | 210725 | 57 |
| | Tinca tinca; Tench | 1 SUMMER | 73 H | LET * | 25,000 | | 210725 | 57 |
| | Tinca tinca; Tench | 1 SUMMER | 5.08 D | LET * | 20,000 | | 210725 | 57 |
| | Tinca tinca; Tench | 2 SUMMERS | 53 H | LET * | 40,000 | | 210725 | 57 |
| | Tinca tinca; Tench | 1 SUMMER | 28 H | LET * | 40,000 | | 210725 | 57 |
| | Tinca tinca; Tench | 1 SUMMER | 7 D | MOR * | 19,000 | | 210725 | 57 |
| | Tribolodon hakonensis; Japanese barbel | 4.3 CM, 1.1 G | 48 H | $LC_{50}$? | 56 to 100 | | 219245 | 73 |

## Table O.1 – 9
## AQUIRE Freshwater Toxicity Information (μg/L)
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| Cadmium (cont.) | Tribolodon hakonensis; Japanese barbel | 4.3 CM, 1.1 G | 96 H | $LC_{50}$? | 56 to 100 | | 219245 | 73 |
| | Tubifex sp; Tubificid worm | NR | 14 D | RSD | | 50 | 311865 | 83 |
| | Tubifex tubifex; Tubificid worm | NR | 7 D | LET | 5,000 | | 210725 | 57 |
| Chromium | Aedes aegypti; Mosquito; | LARVAE | 48 H | $LC_{50}$ | 12,500 | | 313255 | 88 |
| | Ceriodaphnia reticulata; Water flea; | < 4 H | 48 H | $LC_{50}$ | 45 | | 311181 | 84 |
| | Colisa fasciata; Giant gourami; | 5.23 G, 5.41 CM, ADULT | 24 H | HBM * | | 48,000 | 312803 | 87 |
| | Colisa fasciata; Giant gourami; | NR | 2 to 96 H | BIO * | | 48,000 | 312719 | 87 |
| | Cyclops sp; Cyclopoid copepod; | ADULT | 48 H | $LC_{50}$ | 10,470 | | 313255 | 88 |
| | Daphnia ambigua; Water flea; | 12 H | 72 H | $EC_{50}$IM | | 1,700 | 218476 | 76 |
| | Daphnia ambigua; Water flea; | 12 H | 72 H | $EC_{50}$IM | | 7,700 | 218476 | 76 |
| | Daphnia galeata; Water flea; | 12 H | 72 H | $EC_{50}$IM | | 65,600 | 218476 | 76 |
| | Daphnia magna; Water flea; | 12 H | 72 H | $EC_{50}$IM | | 42,100 | 218476 | 76 |
| | Daphnia magna; Water flea; | 12 H | 72 H | $EC_{50}$IM | | 5,200 | 218476 | 76 |
| | Daphnia magna; Water flea; | 24–48 HR, NEONATE | 21 D | GRO * | | 5 | 213950 | 91 |
| | Daphnia magna; Water flea; | < 24 H | 48 H | $LC_{50}$ | 22 | | 311181 | 84 |
| | Daphnia magna; Water flea; | 24–48 HR, NEONATE | 21 D | MOR | 5 to 15 | | 213950 | 91 |
| | Daphnia magna; Water flea; | 24–48 HR, NEONATE | 21 D | REP * | | 5 | 213950 | 91 |
| | Daphnia pulex; Water flea; | < 24 H | 48 H | $LC_{50}$ | 48 | | 311181 | 84 |
| | Daphnia pulex; Water flea; | NR | 96 H | $LC_{50}$ | 90,400 | | 210394 | 89 |
| | Daphnia pulicaria; Water flea; | 12 H | 72 H | $EC_{50}$IM | | 110,800 | 218476 | 76 |
| | Dugesia dorotocephala; Turbellarian, flatworm; | 18–20 MM | 1 H | BEH * | | 50 to 500 | 310581 | 91 |
| | Dugesia tigrina; Turbellarian, flatworm; | NR | 96 H | $LC_{50}$ | 2,220 | | 218709 | 74 |
| | Hydrodictyon reticulatum; Green algae; | NR | 1 to 168 H | BMS | | 100 to 10000 | 213348 | 89 |
| | Lemna minor; Duckweed; | 20 COLONIES OR 40 FRONDS | 4 D | $EC_{50}$GR | | 35,000 | 311789 | 86 |
| | Lophopodella carteri; Bryozoa; | ANCENSTRULAE, 2–3 D | 96 H | $LC_{50}$ | 1,560 | | 216703 | 80 |
| | Myriophyllum spicatum; Water–milfoil; | 4 CM APEX | 32 D | $EC_{50}$BM * | | 14,600 | 212262 | 74 |
| | Myriophyllum spicatum; Water–milfoil; | 4 CM APEX | 32 D | $EC_{50}$BM * | | 9,900 | 212262 | 74 |
| | Myriophyllum spicatum; Water–milfoil; | 4 CM APEX | 32 D | $EC_{50}$GR * | | 24,400 | 212262 | 74 |
| | Myriophyllum spicatum; Water–milfoil; | 4 CM APEX | 32 D | $EC_{50}$GR * | | 26,000 | 212262 | 74 |
| | Mystus vittatus; Catfish; | 80–100 MM, 6–10 G | 96 H | $LC_{50}$ ? | 200,000 | | 315793 | 82 |
| | Pectinatella magnifica; Bryozoa; | ANCENSTRULAE, 2–3 D | 96 H | $LC_{50}$ | 1,440 | | 216703 | 80 |
| | Pimephales promelas; Fathead minnow; | 40–68 MM | 48 H | $LC_{50}$ | 58,000 | | 210837 | 75 |
| | Pimephales promelas; Fathead minnow; | 40–68 MM | 48 H | $LC_{50}$ | 61,000 | | 210837 | 75 |
| | Pimephales promelas; Fathead minnow; | 40–68 MM | 96 H | $LC_{50}$ | 37,000 | | 210837 | 75 |
| | Pimephales promelas; Fathead minnow; | 40–68 MM | 96 H | $LC_{50}$ | 52,000 | | 210837 | 75 |
| | Plumatella emarginata; Bryozoan; | ANCENSTRULAE, 2–3 D | 96 H | $LC_{50}$ | 650 | | 216703 | 80 |
| | Simocephalus vetulus; Water flea; | < 24 H | 48 H | $LC_{50}$ | 50 | | 311181 | 84 |
| Copper | Algae; Algae, phytoplankton, algal mat; | EXPO GRO PHASE | 24 H | PSB | | <=1270 | 213095 | 89 |
| | Algae; Algae, phytoplankton, algal mat; | PHYTOPLANKTON | 124 H | PGR | | 10 to 400 | 311876 | 83 |
| | Algae; Algae, phytoplankton, algal mat; | PHYTOPLANKTON | 14 D | BMS * | | 100 | 313109 | 88 |
| | Aquatic community; Aquatic community; | OLIGOTROPHIC STREAM | NR | POP * | | 2.5 to 15 | 218766 | 88 |
| | Brachionus calyciflorus; Rotifer; | NEONATE | 24 H | $LC_{50}$ | 26 | | 219385 | 91 |
| | Brachionus calyciflorus; Rotifer; | NEONATE | 24 H | $LC_{50}$ | 31 | | 219385 | 91 |
| | Callitriche platycarpa; Macrophyte; | NR | 28 D | LT50 (Calc) | 6,000 | | 218344 | 78 |
| | Carassius auratus; Goldfish; | NR | to 4 WK | PHY | | 100 to 4000 | 213419 | 89 |
| | Ceriodaphnia dubia; Water flea; | NEONATE, <12 H, FIRST INSTAR | 48 H | $LC_{50}$ | 26 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | ADULT | 48 H | $LC_{50}$ | 110 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | NEONATE, <12 H, FIRST INSTAR | 48 H | $LC_{50}$ | 27 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | ADULT | 48 H | $LC_{50}$ | 63 | | 213110 | 89 |

## Table O.1–9
## AQUIRE Freshwater Toxicity Information (μg/L)
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| Copper (cont.) | Ceriodaphnia dubia; Water flea; | NEONATE, <12 H, FIRST INSTAR | 48 H | $LC_{50}$ | 28 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | ADULT | 48 H | $LC_{50}$ | 71 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | NEONATE, <12 H, FIRST INSTAR | 48 H | $LC_{50}$ | 30 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | ADULT | 48 H | $LC_{50}$ | 79 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | NEONATE, <12 H, FIRST INSTAR | 48 H | $LC_{50}$ | 95 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | < 4 H | 48 H | $LC_{50}$ | 17 | | 311181 | 84 |
| | Ceriodaphnia dubia; Water flea; | NEONATE, <12 H, FIRST INSTAR | 48 H | $LC_{50}$ | 31 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | NEONATE, <12 H, FIRST INSTAR | 48 H | $LC_{50}$ | 17 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | NEONATE, <12 H, FIRST INSTAR | 48 H | $LC_{50}$ | 32 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | NEONATE, <12 H, FIRST INSTAR | 48 H | $LC_{50}$ | 20 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | NEONATE, <12 H, FIRST INSTAR | 48 H | $LC_{50}$ | 34 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | NEONATE, <12 H, FIRST INSTAR | 48 H | $LC_{50}$ | 23 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | NEONATE, <12 H, FIRST INSTAR | 48 H | $LC_{50}$ | 37 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | NEONATE, <12 H, FIRST INSTAR | 48 H | $LC_{50}$ | 25 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | NEONATE, <12 H, FIRST INSTAR | 48 H | $LC_{50}$ | 38 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | ADULT | 48 H | $LC_{50}$ | 66 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | NEONATE, <12 H, FIRST INSTAR | 48 H | $LC_{50}$ | 42 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | NEONATE, <12 H, FIRST INSTAR | 48 H | $LC_{50}$ | 104 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | NEONATE, <12 H, FIRST INSTAR | 48 H | $LC_{50}$ | 49 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | NEONATE, <12 H, FIRST INSTAR | 48 H | $LC_{50}$ | 21 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | NEONATE, <12 H, FIRST INSTAR | 48 H | $LC_{50}$ | 58 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | ADULT | 48 H | $LC_{50}$ | 127 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | NEONATE, <12 H, FIRST INSTAR | 48 H | $LC_{50}$ | 67 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | NEONATE, <12 H, FIRST INSTAR | 48 H | $LC_{50}$ | 19 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | NEONATE, <12 H, FIRST INSTAR | 48 H | $LC_{50}$ | 81 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | NEONATE, <12 H, FIRST INSTAR | 48 H | $LC_{50}$ | 24 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | NEONATE, <12 H, FIRST INSTAR | 48 H | $LC_{50}$ | 78 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | FIRST INSTAR NEONATES, 2–8 H | 7 D | MOR | 1.5 to 122.5 | | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | FIRST INSTAR NEONATES, 2–8 H | 7 D | REP * | | 1.5 | 213110 | 89 |
| | Ceriodaphnia dubia; Water flea; | FIRST INSTAR NEONATES, 2–8 H | 7 D | REP * | | 6.3 | 213110 | 89 |
| | Chironomidae; Midge family; | LARVAE | 12 MO | POP | | 67 | 213176 | 88 |
| | Chironomus plumosus; Midge; | LARVA–STATE L1 | 24 H | $LC_{50}$ | 3,160 | | 215356 | 89 |
| | Chironomus plumosus; Midge; | LARVA–STATE L2 | 24 H | $LC_{50}$ | 8,590 | | 215356 | 89 |
| | Chironomus plumosus; Midge; | LARVA–STATE L2 | 48 H | $LC_{50}$ | 3,760 | | 215356 | 89 |
| | Chironomus plumosus; Midge; | LARVA–STATE L2 | 72 H | $LC_{50}$ | 1,990 | | 215356 | 89 |
| | Chironomus plumosus; Midge; | LARVA–STATE L2 | 96 H | $LC_{50}$ | 1,580 | | 215356 | 89 |
| | Chironomus plumosus; Midge; | LARVA–STATE L3 | 24 H | $LC_{50}$ | >10000 | | 215356 | 89 |
| | Chironomus plumosus; Midge; | LARVA–STATE L3 | 48 H | $LC_{50}$ | 2,050 | | 215356 | 89 |
| | Chironomus plumosus; Midge; | LARVA–STATE L3 | 72 H | $LC_{50}$ | 980 | | 215356 | 89 |
| | Chironomus plumosus; Midge; | LARVA–STATE L3 | 96 H | $LC_{50}$ | 530 | | 215356 | 89 |
| | Chironomus plumosus; Midge; | LARVA–STATE L4 | 24 H | $LC_{50}$ | 23,600 | | 215356 | 89 |
| | Chironomus plumosus; Midge; | LARVA–STATE L4 | 48 H | $LC_{50}$ | 12,510 | | 215356 | 89 |
| | Chironomus plumosus; Midge; | LARVA–STATE L4 | 72 H | $LC_{50}$ | 6,260 | | 215356 | 89 |
| | Chironomus plumosus; Midge; | LARVA–STATE L4 | 96 H | $LC_{50}$ | 2,200 | | 215356 | 89 |
| | Chironomus riparius; Midge; | 2ND INSTAR LARVAE | 240 H | $LC_{50}$ | 200 | | 215023 | 91 |
| | Chironomus riparius; Midge; | 2ND INSTAR LARVAE | 48 H | $LC_{50}$ | 1,200 | | 215023 | 91 |
| | Chironomus riparius; Midge; | 2ND INSTAR LARVAE | 96 H | $LC_{50}$ | 700 | | 215023 | 91 |
| | Chironomus riparius; Midge; | LARVA–STATE L1 | 24 H | $LC_{50}$ | 3,400 | | 215356 | 89 |
| | Chironomus riparius; Midge; | LARVA–STATE L2 | 24 H | $LC_{50}$ | 9,070 | | 215356 | 89 |
| | Chironomus riparius; Midge; | LARVA–STATE L2 | 48 H | $LC_{50}$ | 3,910 | | 215356 | 89 |
| | Chironomus riparius; Midge; | LARVA–STATE L2 | 72 H | $LC_{50}$ | 1,860 | | 215356 | 89 |

## Table O.1–9
## AQUIRE Freshwater Toxicity Information (μg/L)
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| Copper (cont.) | Chironomus riparius; Midge; | LARVA–STATE L2 | 96 H | $LC_{50}$ | 1,270 | | 215356 | 89 |
| | Chironomus riparius; Midge; | LARVA–STATE L3 | 24 H | $LC_{50}$ | 13,430 | | 215356 | 89 |
| | Chironomus riparius; Midge; | LARVA–STATE L3 | 48 H | $LC_{50}$ | 4,220 | | 215356 | 89 |
| | Chironomus riparius; Midge; | LARVA–STATE L3 | 72 H | $LC_{50}$ | 1,630 | | 215356 | 89 |
| | Chironomus riparius; Midge; | LARVA–STATE L3 | 96 H | $LC_{50}$ | 1,260 | | 215356 | 89 |
| | Chironomus riparius; Midge; | LARVA–STATE L4 | 24 H | $LC_{50}$ | 8,990 | | 215356 | 89 |
| | Chironomus riparius; Midge; | LARVA–STATE L4 | 48 H | $LC_{50}$ | 2,940 | | 215356 | 89 |
| | Chironomus riparius; Midge; | LARVA–STATE L4 | 72 H | $LC_{50}$ | 1,120 | | 215356 | 89 |
| | Chironomus riparius; Midge; | LARVA–STATE L4 | 96 H | $LC_{50}$ | 640 | | 215356 | 89 |
| | Chironomus tentans; Midge; | LARVA–STATE L1 | 24 H | $LC_{50}$ | 2,700 | | 215356 | 89 |
| | Chironomus tentans; Midge; | LARVA–STATE L2 | 24 H | $LC_{50}$ | 7,100 | | 215356 | 89 |
| | Chironomus tentans; Midge; | LARVA–STATE L2 | 48 H | $LC_{50}$ | 2,400 | | 215356 | 89 |
| | Chironomus tentans; Midge; | LARVA–STATE L2 | 72 H | $LC_{50}$ | 1,350 | | 215356 | 89 |
| | Chironomus tentans; Midge; | LARVA–STATE L2 | 96 H | $LC_{50}$ | 540 | | 215356 | 89 |
| | Chironomus tentans; Midge; | LARVA–STATE L3 | 24 H | $LC_{50}$ | 10,100 | | 215356 | 89 |
| | Chironomus tentans; Midge; | LARVA–STATE L3 | 48 H | $LC_{50}$ | 3,100 | | 215356 | 89 |
| | Chironomus tentans; Midge; | LARVA–STATE L3 | 72 H | $LC_{50}$ | 850 | | 215356 | 89 |
| | Chironomus tentans; Midge; | LARVA–STATE L3 | 96 H | $LC_{50}$ | 550 | | 215356 | 89 |
| | Chironomus tentans; Midge; | LARVA–STATE L4 | 24 H | $LC_{50}$ | >10000 | | 215356 | 89 |
| | Chironomus tentans; Midge; | LARVA–STATE L4 | 48 H | $LC_{50}$ | 2,200 | | 215356 | 89 |
| | Chironomus tentans; Midge; | LARVA–STATE L4 | 72 H | $LC_{50}$ | 870 | | 215356 | 89 |
| | Chironomus tentans; Midge; | LARVA–STATE L4 | 96 H | $LC_{50}$ | 310 | | 215356 | 89 |
| | Chlorella vulgaris; Green algae; | NR | 8 D | PGR | | 10 to 400 | 311876 | 83 |
| | Cypris subglobosa; Ostracod; | NR | 12 H | $LC_{50}$ | 13,581 | | 312365 | 88 |
| | Cypris subglobosa; Ostracod; | NR | 24 H | $LC_{50}$ | 12,200 | | 312365 | 88 |
| | Cypris subglobosa; Ostracod; | NR | 48 H | $LC_{50}$ | 5,363 | | 312365 | 88 |
| | Cypris subglobosa; Ostracod; | NR | 96 H | $LC_{50}$ | 277.3 | | 312365 | 88 |
| | Daphnia lumholzi; Water flea; | NR | 12 H | $LC_{50}$ | 83 | | 312365 | 88 |
| | Daphnia lumholzi; Water flea; | NR | 24 H | $LC_{50}$ | 67.2 | | 312365 | 88 |
| | Daphnia lumholzi; Water flea; | NR | 48 H | $LC_{50}$ | 54.6 | | 312365 | 88 |
| | Daphnia lumholzi; Water flea; | NR | 96 H | $LC_{50}$ | 9.4 | | 312365 | 88 |
| | Daphnia magna; Water flea; | > 24 H | 48 H | $EC_{50}$IM (Calc) | | 266 | 310633 | 84 |
| | Daphnia magna; Water flea; | > 24 H | 48 H | $EC_{50}$IM (Calc) | | 341 | 310633 | 84 |
| | Daphnia magna; Water flea; | <= 24 H | 48 H | $EC_{50}$IM (Calc) | | 31.8 | 310529 | 83 |
| | Daphnia magna; Water flea; | > 24 H | 48 H | $EC_{50}$IM (Calc) | | 36 | 310633 | 84 |
| | Daphnia magna; Water flea; | > 24 H | 48 H | $EC_{50}$IM (Calc) | | 146 | 310633 | 84 |
| | Daphnia magna; Water flea; | > 24 H | 48 H | $EC_{50}$IM (Calc) | | 55 | 310633 | 84 |
| | Daphnia magna; Water flea; | > 24 H | 48 H | $EC_{50}$IM (Calc) | | 257 | 310633 | 84 |
| | Daphnia magna; Water flea; | > 24 H | 48 H | $EC_{50}$IM (Calc) | | 92.8 | 310633 | 84 |
| | Daphnia magna; Water flea; | > 24 H | 48 H | $EC_{50}$IM (Calc) | | 102 | 310633 | 84 |
| | Daphnia magna; Water flea; | > 24 H | 48 H | $EC_{50}$IM (Calc) | | 96.6 | 310633 | 84 |
| | Daphnia magna; Water flea; | > 24 H | 48 H | $EC_{50}$IM (Calc) | | 207 | 310633 | 84 |
| | Daphnia magna; Water flea; | < 24 H | 48 H | $LC_{50}$ | 54 | | 311181 | 84 |
| | Daphnia magna; Water flea; | NR | 24 H | MOR | 772 | | 312372 | 85 |
| | Daphnia pulex; Water flea; | < 24 H | 36 D | LET | 10.1 | | 310453 | 84 |
| | Daphnia pulex; Water flea; | < 24 H | 42 D | REP * | | 10.1 | 310453 | 84 |
| | Daphnia pulex; Water flea; | < 24 H | 48 H | $LC_{50}$ | 53 | | 311181 | 84 |
| | Daphnia pulicaria; Water flea; | NR | 48 H | $LC_{50}$ | 10.8 | | 215081 | 78 |
| | Daphnia pulicaria; Water flea; | NR | 48 H | $LC_{50}$ | 11.4 | | 215081 | 78 |
| | Daphnia pulicaria; Water flea; | NR | 48 H | $LC_{50}$ | 113 | | 215081 | 78 |
| | Daphnia pulicaria; Water flea; | NR | 48 H | $LC_{50}$ | 165 | | 215081 | 78 |

## Table O.1-9
## AQUIRE Freshwater Toxicity Information (μg/L)
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| Copper (cont.) | Daphnia pulicaria; Water flea; | NR | 48 H | $LC_{50}$ | 184 | | 215081 | 78 |
| | Daphnia pulicaria; Water flea; | NR | 48 H | $LC_{50}$ | 199 | | 215081 | 78 |
| | Daphnia pulicaria; Water flea; | NR | 48 H | $LC_{50}$ | 213 | | 215081 | 78 |
| | Daphnia pulicaria; Water flea; | NR | 48 H | $LC_{50}$ | 240 | | 215081 | 78 |
| | Daphnia pulicaria; Water flea; | NR | 48 H | $LC_{50}$ | 35.5 | | 215081 | 78 |

## Table O.1-9
## AQUIRE Freshwater Toxicity Information (μg/L)
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| Copper (cont.) | Daphnia pulicaria; Water flea; | NR | 48 H | $LC_{50}$ | 53.3 | | 215081 | 78 |
| | Daphnia pulicaria; Water flea; | NR | 48 H | $LC_{50}$ | 55.3 | | 215081 | 78 |
| | Daphnia pulicaria; Water flea; | NR | 48 H | $LC_{50}$ | 55.4 | | 215081 | 78 |
| | Daphnia pulicaria; Water flea; | NR | 48 H | $LC_{50}$ | 627 | | 215081 | 78 |
| | Daphnia pulicaria; Water flea; | NR | 48 H | $LC_{50}$ | 7.24 | | 215081 | 78 |
| | Daphnia pulicaria; Water flea; | NR | 48 H | $LC_{50}$ | 76.4 | | 215081 | 78 |
| | Daphnia pulicaria; Water flea; | NR | 48 H | $LC_{50}$ | 78.8 | | 215081 | 78 |
| | Daphnia pulicaria; Water flea; | NR | 48 H | $LC_{50}$ | 84.7 | | 215081 | 78 |
| | Daphnia pulicaria; Water flea; | NR | 48 H | $LC_{50}$ | 9.06 | | 215081 | 78 |
| | Daphnia pulicaria; Water flea; | NR | 48 H | $LC_{50}$ | 9.3 | | 215081 | 78 |
| | Daphnia pulicaria; Water flea; | NR | 48 H | $LC_{50}$ | 97.2 | | 215081 | 78 |
| | Dugesia dorotocephala; Turbellarian, flatworm; | 18-20 MM | 1 H | BEH * | | 20 to 200 | 310581 | 91 |
| | Dugesia tigrina; Turbellarian, flatworm; | NR | 96 H | $LC_{50}$ | 2,450 | | 218709 | 74 |
| | Elodea nuttallii; Waterweed, ditchmoss; | NR | 14 D | LT50 (Calc) | 6,000 | | 218344 | 78 |
| | Gambusia affinis; Mosquitofish; | NR | 12 H | $LC_{50}$ ? | 49 | | 315578 | 78 |
| | Gambusia affinis; Mosquitofish; | NR | 133 D | MOR * | 3.2 | | 315578 | 78 |
| | Gambusia affinis; Mosquitofish; | NR | 48 H | MOR * | 160 | | 313098 | 88 |
| | Gambusia affinis; Mosquitofish; | NR | 96 H | $LC_{50}$ ? | 56 | | 315578 | 78 |
| | Gammarus lacustris; Scud; | ADULT | 0.12 H | BEH | | 0.05 to 5000 | 311804 | 83 |
| | Gammarus lacustris; Scud; | NR | 96 H | $LC_{50}$ | 212 | | 313058 | 88 |
| | Gammarus pulex; Scud; | JUVENILE, 2-3 MOLT, 3-5 MM | 240 H | $LC_{50}$ | 33 | | 215023 | 91 |
| | Gammarus pulex; Scud; | JUVENILE, 2-3 MOLT, 3-5 MM | 48 H | $LC_{50}$ | 47 | | 215023 | 91 |
| | Gammarus pulex; Scud; | JUVENILE, 2-3 MOLT, 3-5 MM | 96 H | $LC_{50}$ | 37 | | 215023 | 91 |
| | Gnathonemus petersii; Electric fish; | JUVENILE, 5-20 G | 4 H | PHY * | | 500 | 310685 | 84 |
| | Invertebrates; Invertebrates; | MACRO-INVERTEBRATES | 14 D | BEH * | | 5.5 | 213398 | 89 |
| | Invertebrates; Invertebrates; | MACROINVERTEBRATES | 10 D | $LC_{50}$ | 15 | | 210388 | 89 |
| | Invertebrates; Invertebrates; | MACROINVERTEBRATES | 10 D | $LC_{50}$ | 6 | | 210388 | 89 |
| | Invertebrates; Invertebrates; | MACROINVERTEBRATES | 4 D | $LC_{50}$ | 14 | | 210388 | 89 |
| | Invertebrates; Invertebrates; | MACROINVERTEBRATES | 4 D | $LC_{50}$ | 26 | | 210388 | 89 |
| | Lamellidens marginalis; Mussel; | 5.0-6.0 CM | 1 to 30 D | GRO | | 250 to 1000 | 213776 | 91 |
| | Lamellidens marginalis; Mussel; | 5.0-6.0 CM | 1 to 30 D | OC | | 250 to 1000 | 213776 | 91 |
| | Lamellidens marginalis; Mussel; | 5.0-6.0 CM | 96 H | $LC_{50}$ | 5,000 | | 213776 | 91 |
| | Lamellidens marginalis; Mussel; | 7 CM | to 9.75 H | PHY * | | 250 to 1000 | 213311 | 89 |
| | Lamellidens marginalis; Mussel; | NR | 96 H | $LC_{50}$ | 5,000 | | 213311 | 89 |
| | Lamellidens marginalis; Mussel; | NR | 96 H | $LC_{50}$ | 5,000 | | 213875 | 91 |
| | Lemna minor; Duckweed; | 20 COLONIES OR 40 FRONDS | 4 D | $EC_{50}$GR | | 1,100 | 311789 | 86 |
| | Lemna minor; Duckweed; | NR | 21 D | LT50 (Calc) | 6,000 | | 218344 | 78 |
| | Lepomis macrochirus; Bluegill; | 5.3-7.2 CM, 3.5-3.9 G | 96 H | $LC_{50}$ | 1,250 | | 212406 | 68 |
| | Lepomis macrochirus; Bluegill; | NR | 4 D | BEH | | 36 to 130 | 212858 | 89 |
| | Lepomis macrochirus; Bluegill; | NR | NR | BEH | | 25 to 1800 | 212858 | 89 |
| | Lophopodella carteri; Bryozoa; | ANCENSTRULAE, 2-3 DAYS | 96 H | $LC_{50}$ | 510 | | 216703 | 80 |
| | Macrobrachium hendersodayanus; Prawn; | NR | 96 H | OC * | | 1,750 | 311545 | 84 |
| | Myriophyllum spicatum; Water-milfoil; | 4 CM APEX | 32 D | $EC_{50}$BM * | | 250 | 212262 | 74 |
| | Myriophyllum spicatum; Water-milfoil; | 4 CM APEX | 32 D | $EC_{50}$BM * | | 380 | 212262 | 74 |
| | Myriophyllum spicatum; Water-milfoil; | 4 CM APEX | 32 D | $EC_{50}$GR * | | 1,500 | 212262 | 74 |
| | Myriophyllum spicatum; Water-milfoil; | 4 CM APEX | 32 D | $EC_{50}$GR * | | 700 | 212262 | 74 |
| | Oncorhynchus kisutch; Coho salmon, silver salmon; | JUVENILE, 6 G | 96 H | $LC_{50}$ | 164 ; 17 | | 310541 | 83 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 11 CM, 13 G | 96 H | $LC_{50}$ ? | 250 | | 212122 | 72 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 32 MM, 0.36 G | 15 H * | MOR * | 200 | | 218499 | 74 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 32 MM, 0.36 G | 16.67 H * | MOR * | 200 | | 218499 | 74 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 32 MM, 0.36 G | 24 H | $LC_{50}$ | 130 | | 218499 | 74 |

# Table O.1-9
# AQUIRE Freshwater Toxicity Information (μg/L)
# AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| Copper (cont.) | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 32 MM, 0.36 G | 24 H | $LC_{50}$ | 140 | | 218499 | 74 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 32 MM, 0.36 G | 4.33 H * | MOR * | 2,000 | | 218499 | 74 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 32 MM, 0.36 G | 5.5 H * | MOR * | 2,000 | | 218499 | 74 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 55.5 G | 40 D | GRO * | | 225 | 218386 | 76 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 6--8 G | 48 H | HEM * | | 30 | 219917 | 80 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 75-100 G | 48 H | MOR * | 85 | | 315401 | 82 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 75-100 G | 8 H | PHY * | | 170 | 315401 | 82 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | FINGERLING, 0.2 G | 1 WK | MOR * | 4.0 | | 315625 | 79 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | FINGERLING, 0.2 G | 1 WK | MOR * | 5.8 | | 315625 | 79 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | FINGERLING, 0.2 G | 1 WK | MOR * | 9.6 | | 315625 | 79 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | FINGERLING, 0.2 G | 7 D | PHY * | | 4.0 | 315625 | 79 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | FINGERLING, 0.25 G | 1 WK | MOR * | 5.1 | | 315625 | 79 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | FINGERLING, 0.25 G | 1 WK | MOR * | 9.5 | | 315625 | 79 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | FINGERLING, 0.25 G | 7 D | PHY * | | 2.1 | 315625 | 79 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | FINGERLING, 0.25 G | 7 D | PHY * | | 3.9 | 315625 | 79 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | FINGERLING, 0.6 G | 7 D | PHY * | | 6 | 315625 | 79 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | NR | 13 MO | MOR * | 10 | | 212122 | 72 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | NR | 13 MO | MOR * | 19 | | 212122 | 72 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | NR | 48 H | $LC_{50}$ | 400 | | 218317 | 68 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | NR | 48 H | $LC_{50}$ | 500 | | 218317 | 68 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | SAC-FRY | 42 D | GRO * (Calc) | | 3 | 310527 | 83 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | SAC-FRY | 42 D | MOR * | 17 | | 310527 | 83 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | SAC-FRY | 42 D | MOR * | 31 | | 310527 | 83 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | SAC-FRY | 42 D | MOR * (Calc) | 10 | | 310527 | 83 |
| | Osteichthyes; Bony fish class; | ADULT GUPPY, 20-30 MM | 48 H | $LC_{50}$ | 21 | | 212882 | 88 |
| | Osteichthyes; Bony fish class; | ADULT GUPPY, 20-30 MM | 96 H | $LC_{50}$ | 16 | | 212882 | 88 |
| | Osteichthyes; Bony fish class; | JUVENILE GUPPY, 8--15 MM | 48 H | $LC_{50}$ | 14 | | 212882 | 88 |
| | Osteichthyes; Bony fish class; | JUVENILE GUPPY, 8--15 MM | 96 H | $LC_{50}$ | 8.7 | | 212882 | 88 |
| | Pectinatella magnifica; Bryozoa; | ANCENSTRULAE, 2-3 DAYS | 96 H | $LC_{50}$ | 140 | | 216703 | 80 |
| | Pimephales promelas; Fathead minnow; | EMBRYO, 1 D | 30 D | GRO * | | 221.8 | 215081 | 78 |
| | Pimephales promelas; Fathead minnow; | NEWLY HAT, < 24 H | 7 D | GRO * | | 9.89 | 311182 | 85 |
| | Pimephales promelas; Fathead minnow; | NEWLY HAT, < 24 H | 7 D | GRO * | | 25.8 | 311182 | 85 |
| | Pimephales promelas; Fathead minnow; | NEWLY HAT, < 24 H | 7 D | $LC_{50}$ | 70 | | 311182 | 85 |
| | Pimephales promelas; Fathead minnow; | NR | 96 H | $LC_{50}$ | 1,129 | | 215081 | 78 |
| | Pimephales promelas; Fathead minnow; | NR | 96 H | $LC_{50}$ | 114 | | 215081 | 78 |
| | Pimephales promelas; Fathead minnow; | NR | 96 H | $LC_{50}$ | 2,336 | | 215081 | 78 |
| | Pimephales promelas; Fathead minnow; | NR | 96 H | $LC_{50}$ | 121 | | 215081 | 78 |
| | Pimephales promelas; Fathead minnow; | NR | 96 H | $LC_{50}$ | 1,001 | | 215081 | 78 |
| | Pimephales promelas; Fathead minnow; | NR | 96 H | $LC_{50}$ | 550 | | 215081 | 78 |
| | Pimephales promelas; Fathead minnow; | NR | 96 H | $LC_{50}$ | 2,050 | | 215081 | 78 |
| | Pimephales promelas; Fathead minnow; | NR | 96 H | $LC_{50}$ | 436 | | 215081 | 78 |
| | Pimephales promelas; Fathead minnow; | NR | 96 H | $LC_{50}$ | 516 | | 215081 | 78 |
| | Pimephales promelas; Fathead minnow; | NR | 96 H | $LC_{50}$ | 88.5 | | 215081 | 78 |
| | Pimephales promelas; Fathead minnow; | NR | 96 H | $LC_{50}$ | 1,586 | | 215081 | 78 |
| | Pimephales promelas; Fathead minnow; | 20-69 MM | 96 H | $LC_{50}$ ? | 5,600 | | 218320 | 76 |
| | Pimephales promelas; Fathead minnow; | 20-69 MM | 96 H | $LC_{50}$ ? | 20,000 | | 218320 | 76 |
| | Pimephales promelas; Fathead minnow; | 20-69 MM | 96 H | $LC_{50}$ ? | 21,000 | | 218320 | 76 |
| | Pimephales promelas; Fathead minnow; | 20-69 MM | 96 H | $LC_{50}$ ? | 21,000 | | 218320 | 76 |
| | Pimephales promelas; Fathead minnow; | 20-69 MM | 96 H | $LC_{50}$ ? | > 16,000 | | 218320 | 76 |
| | Pimephales promelas; Fathead minnow; | 20-69 MM | 96 H | $LC_{50}$ ? | 20,000 | | 218320 | 76 |
| | Pimephales promelas; Fathead minnow; | 20-69 MM | 96 H | $LC_{50}$ ? | 21,000 | | 218320 | 76 |

## Table O.1–9
## AQUIRE Freshwater Toxicity Information (μg/L)
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| Copper (cont.) | Pimephales promelas; Fathead minnow; | EMBRYO, 1 D | 30 D | MOR * | 221.8 | | 215081 | 78 |
| | Plumatella emarginata; Bryozoan; | ANCENSTRULAE, 2–3 DAYS | 96 H | $LC_{50}$ | 140 | | 216703 | 80 |
| | Poecilia reticulata; Guppy; | JUVENILE | 96 H | $LC_{50}$ | 112 | | 212010 | 76 |
| | Poecilia reticulata; Guppy; | JUVENILE | 96 H | $LC_{50}$ | 138 | | 212010 | 76 |
| | Procambarus clarkii; Red swamp crayfish; | ADULT, 24.8 G, 9.3 CM | 1045 H | $LC_{50}$ | 890 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | ADULT, 24.8 G, 9.3 CM | 1227 H | $LC_{50}$ | 776 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | ADULT, 24.8 G, 9.3 CM | 1358 H | $LC_{50}$ | 657 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | ADULT, 24.8 G, 9.3 CM | 146 H | $LC_{50}$ | 3,024 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | ADULT, 24.8 G, 9.3 CM | 246 H | $LC_{50}$ | 2,330 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | ADULT, 24.8 G, 9.3 CM | 342 H | $LC_{50}$ | 1,780 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | ADULT, 24.8 G, 9.3 CM | 453 H | $LC_{50}$ | 1,520 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | ADULT, 24.8 G, 9.3 CM | 49 H | $LC_{50}$ | 11,000 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | ADULT, 24.8 G, 9.3 CM | 549 H | $LC_{50}$ | 1,380 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | ADULT, 24.8 G, 9.3 CM | 622 H | $LC_{50}$ | 1,190 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | ADULT, 24.8 G, 9.3 CM | 72 H | $LC_{50}$ | 8,100 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | ADULT, 24.8 G, 9.3 CM | 734 H | $LC_{50}$ | 1,150 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | ADULT, 24.8 G, 9.3 CM | 843 H | $LC_{50}$ | 1,090 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | ADULT, 24.8 G, 9.3 CM | 945 H | $LC_{50}$ | 1,000 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | EMBRYO | 1147 H | $LC_{50}$ | 206 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | EMBRYO | 1267 H | $LC_{50}$ | 184 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | EMBRYO | 436 H | $LC_{50}$ | 3,350 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | EMBRYO | 598 H | $LC_{50}$ | 1,700 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | EMBRYO | 855 H | $LC_{50}$ | 1,140 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | EMBRYO | 903 H | $LC_{50}$ | 716 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | EMBRYO | 927 H | $LC_{50}$ | 556 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | LARVAE | 12 H | $LC_{50}$ | 4,170 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | LARVAE | 140 H | $LC_{50}$ | 527 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | LARVAE | 24 H | $LC_{50}$ | 1,990 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | LARVAE | 247 H | $LC_{50}$ | 242 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | LARVAE | 344 H | $LC_{50}$ | 199 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | LARVAE | 456 H | $LC_{50}$ | 146 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | LARVAE | 48 H | $LC_{50}$ | 1,350 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | LARVAE | 504 H | $LC_{50}$ | 67 | | 311758 | 83 |
| | Procambarus clarkii; Red swamp crayfish; | LARVAE | 98 H | $LC_{50}$ | 720 | | 311758 | 83 |
| | Salmo salar; Atlantic salmon; | 2–3 YR | 96 H | $LC_{50}$ | 125 | | 212068 | 72 |
| | Salmo trutta; Brown trout; | 78 G, 3RD YR CLASS | 53 D | HIS * | | 15 | 310527 | 83 |
| | Salvelinus fontinalis; Brook trout; | YEARLING, 14–16 CM, 30–42 G * | 720 D | GRO * | | 9.4 | 218397 | 74 |
| | Salvelinus fontinalis; Brook trout; | YEARLING, 14–16 CM, 30–42 G * | 720 D | HAT * | | 9.4 | 218397 | 74 |
| | Salvelinus fontinalis; Brook trout; | YEARLING, 14–16 CM, 30–42 G * | 720 D | MOR * | 9.4 | | 218397 | 74 |
| | Salvelinus fontinalis; Brook trout; | YEARLING, 14–16 CM, 30–42 G * | 720 D | REP * | | 9.4 | 218397 | 74 |
| | Simocephalus vetulus; Water flea; | < 24 H | 48 H | $LC_{50}$ | 57 | | 311181 | 84 |
| Iron | Dugesia dorotocephala; Turbellarian, flatworm; | 18–20 MM | 1 H | BEH * | | 1,000 to 50,000 | 310581 | 91 |
| | Lemna minor; Duckweed; | 20 COLONIES OR 40 FRONDS | 4 D | $EC_{50}$GR | | 3,700 | 311789 | 86 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | EGGS AND LARVA | NR | DVP * | | 5,700 | 315523 | 82 |
| | Salmo trutta; Brown trout; | ALEVIN | NR | MOR * | 5,170 | | 311637 | 83 |
| | Salmo trutta; Brown trout; | EGG | NR | HAT * | | 460 | 311637 | 83 |
| | Salmo trutta; Brown trout; | EYED EGGS | NR | MOR * | 5,170 | | 311637 | 83 |
| | Salmo trutta; Brown trout; | NEWLY HAT ALEVIN | NR | MOR * | 3,020 | | 311637 | 83 |
| | Tilapia sparrmanii; Banded bream; | 10.24–99.43 G | 2 to 72 H | OC * | | 88,000 | 213066 | 89 |

## Table O.1-9
## AQUIRE Freshwater Toxicity Information (μg/L)
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| Lead | Astacus astacus; European crayfish; | 8-10 CM | 2 WK | ENZ * | | 20 | 210376 | 91 |
| | Astacus astacus; European crayfish; | 8-10 CM | to 10 WK | HIS | | 20 | 210376 | 91 |
| | Barbus arulius; Barb; | 1.24 G | 4 D | HIS | | 200,000 to 400,0C | 219972 | 87 |
| | Brachionus calyciflorus; Rotifer; | NEONATE | 24 H | $LC_{50}$ | > 4,000 | | 219385 | 91 |
| | Brachydanio rerio; Zebra danio, zebrafish; | DECHLORIONATED EGG | 24 H | | | 72 | 219870 | 80 |
| | Brachydanio rerio; Zebra danio, zebrafish; | EGG | 48 H | | | 72 | 219870 | 80 |
| | Bufo arenarum; Toad; | EMBRYO | 24 H | DVP * | | 1,000 | 213162 | 90 |
| | Bufo arenarum; Toad; | EMBRYO | 24 H | MOR * | 1,000 | | 213162 | 90 |
| | Carassius auratus; Goldfish; | UNDERYEARLING | 1 WK * | ENZ * | | 470 | 315460 | 77 |
| | Ceriodaphnia reticulata; Water flea; | < 4 H | 48 H | $LC_{50}$ | 530 | | 311181 | 84 |
| | Daphnia magna; Water flea; | < 24 H | 48 H | $LC_{50}$ | 4,400 | | 311181 | 84 |
| | Daphnia pulex; Water flea; | < 24 H | 48 H | $LC_{50}$ | 5,100 | | 311181 | 84 |
| | Dugesia dorotocephala; Turbellarian, flatworm; | 18-20 MM | 1 H | BEH * | | 100 to 1,000 | 310581 | 91 |
| | Dugesia tigrina; Turbellarian, flatworm; | NR | 96 H | $LC_{50}$ | 160,000 | | 218709 | 74 |
| | Hyalella azteca; Scud; | NR | 5 D | $LC_{100}$ | 5,000 | | 219804 | 80 |
| | Lemna minor; Duckweed; | 20 COLONIES OR 40 FRONDS | 4 D | $EC_{50}GR$ | | 8,000 | 311789 | 86 |
| | Lepomis gibbosus; Pumpkinseed; | > 1.75 YR | <=2 WK * | ENZ * | | 90 | 315460 | 77 |
| | Micropterus dolomieui; Smallmouth bass; | EGG | 96 H | MOR * | <=15,900 | | 312153 | 86 |
| | Micropterus dolomieui; Smallmouth bass; | FINGERLING | 10 WK | LOC * | | 405 | 312153 | 86 |
| | Micropterus dolomieui; Smallmouth bass; | FINGERLING | 90 D | GRO * | | 405 | 312153 | 86 |
| | Micropterus dolomieui; Smallmouth bass; | FINGERLING | 90 D | HEM * | | 405 | 312153 | 86 |
| | Micropterus dolomieui; Smallmouth bass; | FINGERLING | 96 H | $LC_{50}$ | 29,000 | | 312153 | 86 |
| | Micropterus dolomieui; Smallmouth bass; | SAC FRY, 7 D POST-SPAWN | 96 H | MOR * | <=15,900 | | 312153 | 86 |
| | Micropterus dolomieui; Smallmouth bass; | SWIM-UP FRY, 17 D POST-SPAWN | 96 H | $LC_{50}$ | 2,800 | | 312153 | 86 |
| | Micropterus dolomieui; Smallmouth bass; | SWIM-UP, FRY 17 D POST-SPAWN | 96 H | $LC_{50}$ | 2,200 | | 312153 | 86 |
| | Micropterus salmoides; Largemouth bass; | NR | 24 H | BEH * | | 1,500 | 311127 | 78 |
| | Micropterus salmoides; Largemouth bass; | NR | 24 H | RES * | | 1,050 | 311127 | 78 |
| | Myriophyllum spicatum; Water-milfoil; | 4 CM APEX | 32 D | $EC_{50}BM$ * | | 363,000 | 212262 | 74 |
| | Myriophyllum spicatum; Water-milfoil; | 4 CM APEX | 32 D | $EC_{50}BM$ * | | 808,000 | 212262 | 74 |
| | Myriophyllum spicatum; Water-milfoil; | 4 CM APEX | 32 D | $EC_{50}GR$ * | | 725,000 | 212262 | 74 |
| | Myriophyllum spicatum; Water-milfoil; | 4 CM APEX | 32 D | $EC_{50}GR$ * | | 767,000 | 212262 | 74 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 10.5 G | 32 WK | HIS * | | | 310573 | 83 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 15 G | 24 H | HEM * | | 130 | 315719 | 78 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 4 MO, 15 G | 4 to 72 H | MOR * | 110 | | 315719 | 78 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 4 MO, 15 G | 4 to 72 H | MOR * | 120 | | 315719 | 78 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 4 MO, 15 G | 4 to 72 H | MOR * | 120 | | 315719 | 78 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 4 MO, 15 G | 4 to 72 H | MOR * | 210 | | 315719 | 78 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 4 MO, 15 G | 4 to 72 H | MOR * | 300 | | 315719 | 78 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 4 MO, 15 G | 4 to 72 H | MOR * | 470 | | 315719 | 78 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 4 MO, 15 G | 4 to 72 H | MOR * | 490 | | 315719 | 78 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 4 MO, 15 G | 4 to 72 H | MOR * | 500 | | 315719 | 78 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 4 MO, 15 G | 4 to 72 H | MOR * | 52 | | 315719 | 78 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 4 MO, 15 G | 4 to 72 H | MOR * | 53 | | 315719 | 78 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 4 MO, 15 G | 4 to 72 H | MOR * | 740 | | 315719 | 78 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 4 MO, 15 G | 4 to 72 H | MOR * | 80 | | 315719 | 78 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 4 MO, 15 G | 4 to 72 H | MOR * | 85 | | 315719 | 78 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 4 MO, 15 G | 4 to 72 H | MOR * | 900 | | 315719 | 78 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 4 MO, 15 G | 4 to 72 H | MOR * | 910 | | 315719 | 78 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 53 G | 1 WK | MOR * | 1,000 | | 315719 | 78 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 6-18 MO | <=2 WK * | ENZ * | | 10 | 315460 | 77 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 6.5 G | 30 WK | HIS * | | 120 | 310573 | 83 |

# Table O.1–9
# AQUIRE Freshwater Toxicity Information (μg/L)
# AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| Lead (cont.) | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | NEWLY HAT, SAC FRY | 189 D | ABN * | | 32 | 219830 | 80 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | NEWLY HAT, SAC FRY | 189 D | ENZ * | | 100 | 219830 | 80 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | NEWLY HAT, SAC FRY | 189 D | HEM * | | 100 | 219830 | 80 |
| | Pimephales promelas; Fathead minnow; | JUVENILE | 4 WK | PHY | | 500 to 1,000 | 210204 | 89 |
| | Potamogeton crispus; Curled pondweed; | NR | NR | PSE * | | 25,000 | 217552 | 77 |
| | Salvelinus fontinalis; Brook trout; | 6–18 MO | <=2 WK * | ENZ * | | 90 | 315460 | 77 |
| | Simocephalus vetulus; Water flea; | < 24 H | 48 H | $LC_{50}$ | 4,500 | | 311181 | 84 |
| Manganese | Algae; Algae, phytoplankton, algal mat; | NATURAL COLONY | 38 D | POP * | | 280 | 212862 | 69 |
| | Anabolia nervosa; Quiver fly; | LARVAE | 7 D | LET | 2,000,000 | | 210725 | 57 |
| | Chironomus thummi; Midge; | LARVAE | 7 D | LET | 1,000,000 | | 210725 | 57 |
| | Cyprinidae; Minnow, carp family; | 1 SUMMER | 2.25 H | LET * | 1,000,000 | | 210725 | 57 |
| | Cyprinidae; Minnow, carp family; | 1 SUMMER | 24 H | LET * | 2,000,000 | | 210725 | 57 |
| | Cyprinidae; Minnow, carp family; | 1 SUMMER | 25 H | LET * | 1,800,000 | | 210725 | 57 |
| | Cyprinidae; Minnow, carp family; | 1 SUMMER | 4.17 D | LET * | 800,000 | | 210725 | 57 |
| | Cyprinidae; Minnow, carp family; | 1 SUMMER | 5.13 D | LET * | 700,000 | | 210725 | 57 |
| | Cyprinidae; Minnow, carp family; | 1 SUMMER | 6.63 D | LET * | 650,000 | | 210725 | 57 |
| | Cyprinidae; Minnow, carp family; | 1 SUMMER | 7 D | MOR * | 600,000 | | 210725 | 57 |
| | Cyprinidae; Minnow, carp family; | 1 SUMMER | 78 H | LET * | 900,000 | | 210725 | 57 |
| | Cyprinidae; Minnow, carp family; | 2 SUMMERS | 48 H | LET * | 2,000,000 | | 210725 | 57 |
| | Gammarus roeseli; Scud; | NR | 7 D | LET | 70,000 | | 210725 | 57 |
| | Lemna minor; Duckweed; | 20 COLONIES OR 40 FRONDS | 4 D | $EC_{50}$GR | | 31,000 | 311789 | 86 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 1 SUMMER | 10 H | LET * | 700,000 | | 210725 | 57 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 1 SUMMER | 13 H | LET * | 600,000 | | 210725 | 57 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 1 SUMMER | 34 H | LET * | 300,000 | | 210725 | 57 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 1 SUMMER | 5 D | LET * | 100,000 | | 210725 | 57 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 1 SUMMER | 7 D | MOR * | 75,000 | | 210725 | 57 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 1 SUMMER | 77 H | LET * | 150,000 | | 210725 | 57 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 2 SUMMERS | 34 H | LET * | 600,000 | | 210725 | 57 |
| | Salvelinus fontinalis; Brook trout; | 1 SUMMER | 15 H | LET * | 700,000 | | 210725 | 57 |
| | Salvelinus fontinalis; Brook trout; | 1 SUMMER | 23 H | LET * | 600,000 | | 210725 | 57 |
| | Salvelinus fontinalis; Brook trout; | 1 SUMMER | 4.79 D | LET * | 150,000 | | 210725 | 57 |
| | Salvelinus fontinalis; Brook trout; | 1 SUMMER | 66 H | LET * | 300,000 | | 210725 | 57 |
| | Salvelinus fontinalis; Brook trout; | 1 SUMMER | 7 D | MOR * | 100,000 | | 210725 | 57 |
| | Salvelinus fontinalis; Brook trout; | 2 SUMMERS | 41 H | LET * | 600,000 | | 210725 | 57 |
| | Tinca tinca; Tench; | 1 SUMMER | 48 H | LET * | 2,000,000 | | 210725 | 57 |
| | Tinca tinca; Tench; | 1 SUMMER | 6.75 D | LET * | 1,500,000 | | 210725 | 57 |
| | Tinca tinca; Tench; | 1 SUMMER | 7 D | MOR * | 1,200,000 | | 210725 | 57 |
| | Tinca tinca; Tench; | 1 SUMMER | 7 D | MOR * | 1,300,000 | | 210725 | 57 |
| | Tinca tinca; Tench; | 1 SUMMER | 96 H | LET * | 1,800,000 | | 210725 | 57 |
| | Tinca tinca; Tench; | 2 SUMMERS | 7 D | LET * | 2,000,000 | | 210725 | 57 |
| | Tubifex tubifex; Tubificid worm; | NR | 7 D | LET | 700,000 | | 210725 | 57 |
| Mercury | Aedes aegypti; Mosquito | LARVAE | 48 H | $LC_{50}$ | 290 | | 313255 | 88 |
| | Algae; Algae, phytoplankton, algal mat | PHYTOPLANKTON | 14 D | BMS * | | 100 | 313109 | 88 |
| | Amoeba sp; Amoeba | NR | >1.66 H | $LT_{50}$ | 500 | | 218981 | 73 |
| | Anabolia nervosa; Quiver fly | LARVAE | 7 D | LET | 2,000 | | 210725 | 57 |
| | Brachionus calyciflorus; Rotifer | NEONATE | 24 H | $LC_{50}$ | 60 | | 219385 | 91 |
| | Carassius auratus; Goldfish | 20–25 G | to 15 D | BIO * | | 50 | 219207 | 72 |
| | Carassius auratus; Goldfish | NR | 8 D | RSD * | | 230 | 219568 | 71 |
| | Carassius auratus; Goldfish | 15–25 G | to 15 D | BIO * | | 50 | 219207 | 72 |

## Table O.1-9
## AQUIRE Freshwater Toxicity Information (µg/L)
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| Mercury (cont.) | Caridina rajadhari; Freshwater prawn | NR | 48 H | $LC_{50}$ | 6.918 | | 311025 | 85 |
| | Caridina rajadhari; Freshwater prawn | NR | 72 H | $LC_{50}$ | 5.784 | | 311025 | 85 |
| | Caridina rajadhari; Freshwater prawn | NR | 24 H | $LC_{50}$ | 9.12 | | 311025 | 85 |
| | Caridina rajadhari; Freshwater prawn | STAGE C, 2.5 CM | 30 D | HIS * (Calc) | | 0.51 | 311025 | 85 |
| | Caridina rajadhari; Freshwater prawn | NR | 96 H | $LC_{50}$ | 4.786 | | 311025 | 85 |
| | Catostomus commersoni; White sucker | JUVENILE, 142 MM, 28.7 G | 1 WK | RSD | | 190 | 312412 | 87 |
| | Chironomus plumosus; Midge | LARVA-STATE L3 | 24 H | $LC_{50}$ | 2,430 | | 215356 | 89 |
| | Chironomus plumosus; Midge | LARVA-STATE L3 | 72 H | $LC_{50}$ | 1,360 | | 215356 | 89 |
| | Chironomus plumosus; Midge | LARVA-STATE L3 | 48 H | $LC_{50}$ | 1,760 | | 215356 | 89 |
| | Chironomus plumosus; Midge | LARVA-STATE L4 | 48 H | $LC_{50}$ | 1,280 | | 215356 | 89 |
| | Chironomus plumosus; Midge | LARVA-STATE L4 | 96 H | $LC_{50}$ | 880 | | 215356 | 89 |
| | Chironomus plumosus; Midge | LARVA-STATE L3 | 96 H | $LC_{50}$ | 600 | | 215356 | 89 |
| | Chironomus plumosus; Midge | LARVA-STATE L4 | 24 H | $LC_{50}$ | 3,230 | | 215356 | 89 |
| | Chironomus plumosus; Midge | LARVA-STATE L4 | 72 H | $LC_{50}$ | 880 | | 215356 | 89 |
| | Chironomus plumosus; Midge | LARVA-STATE L1 | 24 H | $LC_{50}$ | 3,180 | | 215356 | 89 |
| | Chironomus riparius; Midge | LARVA-STATE L3 | 72 H | $LC_{50}$ | 230 | | 215356 | 89 |
| | Chironomus riparius; Midge | LARVA-STATE L2 | 72 H | $LC_{50}$ | 260 | | 215356 | 89 |
| | Chironomus riparius; Midge | LARVA-STATE L2 | 48 H | $LC_{50}$ | 820 | | 215356 | 89 |
| | Chironomus riparius; Midge | LARVA-STATE L4 | 48 H | $LC_{50}$ | 790 | | 215356 | 89 |
| | Chironomus riparius; Midge | LARVA-STATE L2 | 24 H | $LC_{50}$ | 1,960 | | 215356 | 89 |
| | Chironomus riparius; Midge | LARVA-STATE L3 | 96 H | $LC_{50}$ | 230 | | 215356 | 89 |
| | Chironomus riparius; Midge | LARVA-STATE L1 | 24 H | $LC_{50}$ | 1,690 | | 215356 | 89 |
| | Chironomus riparius; Midge | LARVA-STATE L3 | 48 H | $LC_{50}$ | 240 | | 215356 | 89 |
| | Chironomus riparius; Midge | EGGS | <=24 H | MOR * | 10,000 | | 215356 | 89 |
| | Chironomus riparius; Midge | LARVA-STATE L2 | 96 H | $LC_{50}$ | 220 | | 215356 | 89 |
| | Chironomus riparius; Midge | EGGS | 7 to 96 H | MOR * | 320 | | 215356 | 89 |
| | Chironomus riparius; Midge | LARVA-STATE L4 | 24 H | $LC_{50}$ | 4,800 | | 215356 | 89 |
| | Chironomus riparius; Midge | EGGS | <=24 H | MOR * | 3,200 | | 215356 | 89 |
| | Chironomus riparius; Midge | LARVA-STATE L3 | 24 H | $LC_{50}$ | 750 | | 215356 | 89 |
| | Chironomus riparius; Midge | LARVA-STATE L4 | 96 H | $LC_{50}$ | 480 | | 215356 | 89 |
| | Chironomus riparius; Midge | LARVA-STATE L4 | 72 H | $LC_{50}$ | 710 | | 215356 | 89 |
| | Chironomus riparius; Midge | EGGS | 7 to 96 H | MOR * | 320 | | 215356 | 89 |
| | Chironomus tentans; Midge | LARVA-STATE L1 | 24 H | $LC_{50}$ | 2,280 | | 215356 | 89 |
| | Chironomus tentans; Midge | LARVA-STATE L3 | 96 H | $LC_{50}$ | 280 | | 215356 | 89 |
| | Chironomus tentans; Midge | LARVA-STATE L3 | 48 H | $LC_{50}$ | 6,700 | | 215356 | 89 |
| | Chironomus tentans; Midge | LARVA-STATE L2 | 48 H | $LC_{50}$ | 8,040 | | 215356 | 89 |
| | Chironomus tentans; Midge | LARVA-STATE L2 | 24 H | $LC_{50}$ | 23,400 | | 215356 | 89 |
| | Chironomus tentans; Midge | LARVA-STATE L4 | 72 H | $LC_{50}$ | 3,040 | | 215356 | 89 |
| | Chironomus tentans; Midge | LARVA-STATE L3 | 24 H | $LC_{50}$ | 29,600 | | 215356 | 89 |
| | Chironomus tentans; Midge | LARVA-STATE L4 | 24 H | $LC_{50}$ | 32,300 | | 215356 | 89 |
| | Chironomus tentans; Midge | LARVA-STATE L2 | 96 H | $LC_{50}$ | 240 | | 215356 | 89 |
| | Chironomus tentans; Midge | LARVA-STATE L4 | 96 H | $LC_{50}$ | 570 | | 215356 | 89 |
| | Chironomus tentans; Midge | LARVA-STATE L3 | 72 H | $LC_{50}$ | 580 | | 215356 | 89 |
| | Chironomus tentans; Midge | LARVA-STATE L4 | 48 H | $LC_{50}$ | 6,860 | | 215356 | 89 |
| | Chironomus tentans; Midge | LARVA-STATE L2 | 72 H | $LC_{50}$ | 570 | | 215356 | 89 |
| | Chironomus thummi; Midge | LARVAE | 7 D | LET | 3,500 | | 210725 | 57 |
| | Cyclops sp; Cyclopoid copepod | ADULT | 48 H | $LC_{50}$ | 600 | | 313255 | 88 |
| | Cyprinidae; Minnow, carp family | 1 SUMMER | 7 D | MOR * | 300 | | 210725 | 57 |
| | Cyprinidae; Minnow, carp family | 1 SUMMER | 7 D | MOR * | 700 | | 210725 | 57 |
| | Cyprinidae; Minnow, carp family | 1 SUMMER | 60 H | LET * | 1,000 | | 210725 | 57 |
| | Cyprinidae; Minnow, carp family | 1 SUMMER | 8.5 H | LET * | 5,000 | | 210725 | 57 |

## Table O.1–9
## AQUIRE Freshwater Toxicity Information (μg/L)
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| Mercury (cont.) | Cyprinidae; Minnow, carp family | 1 SUMMER | 24.25 H | LET * | 1,500 | | 210725 | 57 |
| | Cyprinidae; Minnow, carp family | 1 SUMMER | 84 H | LET * | 800 | | 210725 | 57 |
| | Cyprinidae; Minnow, carp family | 1 SUMMER | 2.5 H | LET * | 75,000 | | 210725 | 57 |
| | Cyprinidae; Minnow, carp family | 1 SUMMER | 7 D | MOR * | 290 | | 210725 | 57 |
| | Cyprinidae; Minnow, carp family | 1 SUMMER | 4.5 H | LET * | 50,000 | | 210725 | 57 |
| | Cyprinidae; Minnow, carp family | 1 SUMMER | 7 D | MOR * | 500 | | 210725 | 57 |
| | Cyprinidae; Minnow, carp family | 2 SUMMERS | 58 H | LET * | 4,500 | | 210725 | 57 |
| | Cyprinidae; Minnow, carp family | 1 SUMMER | 1.25 H | LET * | 100,000 | | 210725 | 57 |
| | Dugesia tigrina; Turbellarian, flatworm | NR | 96 H | $LC_{50}$ | 270 | | 218709 | 74 |
| | Gambusia affinis; Mosquitofish | NR | <24 H | $LT_{50}$ | 50 to 500 | | 315524 | 79 |
| | Gambusia affinis; Mosquitofish | NR | 30 D | BCF * | | 1 | 315524 | 79 |
| | Gambusia affinis; Mosquitofish | NR | 30 D | BCF * | | 1 | 315524 | 79 |
| | Gambusia affinis; Mosquitofish | NR | 30 D | BCF * | | 1 | 315524 | 79 |
| | Gammarus roeseli; Scud | NR | 7 D | LET | 100 | | 210725 | 57 |
| | Gnathonemus petersii; Electric fish | JUVENILE, 5–20 G | 20 H | PHY * | | 100 | 310685 | 84 |
| | Lamellidens marginalis; Mussel | 5.0–6.0 CM | 1 to 30 D | OC | | 500 to 2,000 | 213776 | 91 |
| | Lamellidens marginalis; Mussel | 5.0–6.0 CM | 96 H | $LC_{50}$ | 5,000 | | 213776 | 91 |
| | Lamellidens marginalis; Mussel | NR | 96 H | $LC_{50}$ | 10,000 | | 213311 | 89 |
| | Lamellidens marginalis; Mussel | 5.0–6.0 CM | 1 to 30 D | GRO | | 500 to 2,000 | 213776 | 91 |
| | Lamellidens marginalis; Mussel | 7 CM | 3. to 6.5 H | PHY * | | 500 to 2,000 | 213311 | 89 |
| | Lamellidens marginalis; Mussel | 32 G | 48 H | OC * | | 5,910 | 311622 | 84 |
| | Myriophyllum spicatum; Water–milfoil | 4 CM APEX | 32 D | $EC_{50}$GR * | | 1,200 | 212262 | 74 |
| | Myriophyllum spicatum; Water–milfoil | 4 CM APEX | 32 D | $EC_{50}$BM * | | 3,400 | 212262 | 74 |
| | Myriophyllum spicatum; Water–milfoil | 4 CM APEX | 32 D | $EC_{50}$GR * | | 12,000 | 212262 | 74 |
| | Myriophyllum spicatum; Water–milfoil | 4 CM APEX | 32 D | $EC_{50}$BM * | | 4,400 | 212262 | 74 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | 1 SUMMER | 11 H | LET * | 500 | | 210725 | 57 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | 1 SUMMER | 7 D | MOR * | 150 | | 210725 | 57 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | 2 SUMMERS | 24 H | LET * | 500 | | 210725 | 57 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | 1 SUMMER | 5.33 D | LET * | 250 | | 210725 | 57 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | 5.8–15.6 CM, 1.7–52.5 G | 2 to 209 D | RSD | | 48,200 | 210503 | 71 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | 1 SUMMER | 13.67 H | LET * | 350 | | 210725 | 57 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout | 1 SUMMER | 8.17 H | LET * | 800 | | 210725 | 57 |
| | Planaria sp; Planarian, flatworm | NR | 6.6 H | $LT_{50}$ | 500 | | 218981 | 73 |
| | Potamogeton crispus; Curled pondweed | NR | NR | PSE * | | 5,000 | 217552 | 77 |
| | Salvelinus fontinalis; Brook trout | 1 SUMMER | 7 D | MOR * | 250 | | 210725 | 57 |
| | Salvelinus fontinalis; Brook trout | 2 SUMMERS | 88 H | LET * | 500 | | 210725 | 57 |
| | Salvelinus fontinalis; Brook trout | 1 SUMMER | 21 H | LET * | 350 | | 210725 | 57 |
| | Salvelinus fontinalis; Brook trout | 1 SUMMER | 18 H | LET * | 500 | | 210725 | 57 |
| | Salvelinus fontinalis; Brook trout | 1 SUMMER | 4.25 D | LET * | 300 | | 210725 | 57 |
| | Salvelinus fontinalis; Brook trout | 1 SUMMER | 16.33 H | LET * | 800 | | 210725 | 57 |
| | Tilapia mossambica; Mozambique tilapia | 7–10 CM, 6–10 G | 1 WK | HEM * | | 4,000 | 212931 | 87 |
| | Tilapia mossambica; Mozambique tilapia | 7.0–11.8 CM | 11 WK | BIO * | | 10 | 310166 | 84 |
| | Tinca tinca; Tench | 1 SUMMER | 72 H | LET * | 1,500 | | 210725 | 57 |
| | Tinca tinca; Tench | 1 SUMMER | 7 D | MOR * | 1,000 | | 210725 | 57 |
| | Tinca tinca; Tench | 1 SUMMER | 7.17 D | LET * | 1,100 | | 210725 | 57 |
| | Tinca tinca; Tench | 1 SUMMER | 12.58 H | LET * | 5,000 | | 210725 | 57 |
| | Tinca tinca; Tench | 1 SUMMER | 4.5 H | LET * | 50,000 | | 210725 | 57 |
| | Tinca tinca; Tench | 1 SUMMER | 4.25 D | LET * | 1,300 | | 210725 | 57 |
| | Tinca tinca; Tench | 2 SUMMERS | 4.3 D | LET * | 1,500 | | 210725 | 57 |
| | Tubifex tubifex; Tubificid worm | NR | 7 D | LET | 300 | | 210725 | 57 |

## Table O.1-9
## AQUIRE Freshwater Toxicity Information (μg/L)
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| Selenium | Brachionus calyciflorus; Rotifer | NEONATE | 24 H | $LC_{50}$ | 16,000 | | 219385 | 91 |
| | Chironomus riparius; Midge | <24 H | 30 D | DVP * | | 6 to 6,050 | 210956 | 90 |
| | Chironomus riparius; Midge | <24 H | 48 H | $EC_{50}$IM ? | | 1,790 | 210956 | 90 |
| | Chironomus riparius; Midge | <24 H | 48 H | $EC_{50}$IM ? | | 14,300 | 210956 | 90 |
| | Daphnia magna; Water flea | <24 H | 21 D | BCF * | | 711 | 210956 | 90 |
| | Daphnia magna; Water flea | <24 H | 21 D | BCF * | | 348 | 210956 | 90 |
| | Daphnia magna; Water flea | <=24 H OLD | 48 H | $LC_{50}$ | 430 | | 215184 | 80 |
| | Daphnia magna; Water flea | MIDDLE INSTAR | 48 H | $LC_{50}$ | 710 | | 210486 | 80 |
| | Daphnia magna; Water flea | <24 H | 21 D | MOR * | 711 | | 210956 | 90 |
| | Daphnia magna; Water flea | MIDDLE INSTAR | 96 H | $LC_{50}$ | 430 | | 210486 | 80 |
| | Daphnia magna; Water flea | <24 H | 21 D | REP * | | 156 | 210956 | 90 |
| | Daphnia magna; Water flea | MIDDLE INSTAR | 14 D | $LC_{50}$ | 430 | | 210486 | 80 |
| | Daphnia magna; Water flea | <= 24 H | 48 H | MOR * | 220 | | 215184 | 80 |
| | Daphnia magna; Water flea | 2 D | to 3 WK | REP * | | 280 | 210486 | 80 |
| | Daphnia magna; Water flea | <24 H | 21 D | BCF * | | 85 | 210956 | 90 |
| | Daphnia magna; Water flea | <24 H | 21 D | BCF * | | 156 | 210956 | 90 |
| | Daphnia magna; Water flea | <24 H | 48 H | $EC_{50}$IM ? | | 2,620 | 210956 | 90 |
| | Daphnia magna; Water flea | <24 H | 21 D | MOR * | 1,410 | | 210956 | 90 |
| | Daphnia magna; Water flea | 2 D | to 3 WK | MOR * | 280 | | 210486 | 80 |
| | Daphnia magna; Water flea | <24 H | 21 D | BCF * | | 5 | 210956 | 90 |
| | Daphnia magna; Water flea | <24 H | 21 D | REP * | | 348 | 210956 | 90 |
| | Daphnia magna; Water flea | <=24 H OLD | 24 H | $LC_{50}$ | 660 | | 215184 | 80 |
| | Daphnia magna; Water flea | <24 H | 48 H | $EC_{50}$IM ? | | 9,340 | 210956 | 90 |
| | Dugesia dorotocephala; Turbellarian, flatworm | 18-20 MM | 1 H | BEH * | | 1,000 to 10,000 | 310581 | 91 |
| | Hyalella azteca; Scud | ADULT | 96 H | $LC_{50}$ | 340 | | 210486 | 80 |
| | Hyalella azteca; Scud | ADULT | 48 H | $LC_{50}$ | 940 | | 210486 | 80 |
| | Hyalella azteca; Scud | ADULT | 14 D | $LC_{50}$ | 70 | | 210486 | 80 |
| | Lemna minor; Duckweed | 20 COLONIES OR 40 FRONDS | 4 D | $EC_{50}$GR | | 2,400 | 311789 | 86 |
| | Lepomis macrochirus; Bluegill | JUVENILE, 40-70 MM TOTAL LENGTH | 48 H | RES * | | 5 | 310565 | 83 |
| | Micropterus salmoides; Largemouth bass | JUVENILE, 40-70 MM TOTAL LENGTH | 48 H | RES * | | 5 | 310565 | 83 |
| | Oncorhynchus kisutch; Coho salmon, silver salmon | FRY, 0.7 G | 96 H | $LC_{50}$ | 16,900 | | 213174 | 90 |
| | Oncorhynchus kisutch; Coho salmon, silver salmon | FRY, 0.5 G | 96 H | $LC_{50}$ | 24,500 | | 213174 | 90 |
| | Oncorhynchus kisutch; Coho salmon, silver salmon | FRY, 0.5 G | 96 H | $LC_{50}$ | 25,800 | | 213174 | 90 |
| | Oncorhynchus kisutch; Coho salmon, silver salmon | FRY, 0.5 G | 96 H | $LC_{50}$ | 21,800 | | 213174 | 90 |
| | Oncorhynchus tshawytscha; Chinook salmon | FRY, 0.5 G | 96 H | $LC_{50}$ | 46,600 | | 213174 | 90 |
| | Oncorhynchus tshawytscha; Chinook salmon | FRY, 0.5 G | 96 H | $LC_{50}$ | 85,500 | | 213174 | 90 |
| | Oncorhynchus tshawytscha; Chinook salmon | FRY, 0.5 G | 96 H | $LC_{50}$ | 50,900 | | 213174 | 90 |
| | Oncorhynchus tshawytscha; Chinook salmon | FRY, 0.6 G | 96 H | $LC_{50}$ | 67,100 | | 213174 | 90 |
| | Pimephales promelas; Fathead minnow | 2 D, EGG | 62 H * | $LT_{50}$ | 1,000 | | 210486 | 80 |
| | Pimephales promelas; Fathead minnow | 2 D, EGG | 33 H * | $LT_{50}$ | 1,500 | | 210486 | 80 |
| | Pimephales promelas; Fathead minnow | 2 D, EGG | 17 D | DVP * | | 10,000 | 210486 | 80 |
| | Pimephales promelas; Fathead minnow | 2 D, EGG | 85 H * | $LT_{50}$ | 5 | | 210486 | 80 |
| | Pimephales promelas; Fathead minnow | 2 D, EGG | 17 D | HAT * | | 40,000 | 210486 | 80 |
| | Pimephales promelas; Fathead minnow | 59-61 D | 1 to 98 D | GRO | | 5,000 to 30,000 | 213930 | 89 |
| | Pimephales promelas; Fathead minnow | 2 D, EGG | 14 H * | $LT_{50}$ | 30,000 | | 210486 | 80 |
| | Pimephales promelas; Fathead minnow | 59-61 D | 98 D | | | 5,000 to 30,000 | 213930 | 89 |
| | Pimephales promelas; Fathead minnow | 2 D, EGG | 25 H * | $LT_{50}$ | 20,000 | | 210486 | 80 |
| | Pimephales promelas; Fathead minnow | 2 D, EGG | 120 H * | $LT_{50}$ | 1 | | 210486 | 80 |
| | Pimephales promelas; Fathead minnow | 2 D, EGG | 12 H * | $LT_{50}$ | 40 | | 210486 | 80 |
| | Pimephales promelas; Fathead minnow | 2 D, EGG | 17 D | DVP * | | 15,000 | 210486 | 80 |
| | Pimephales promelas; Fathead minnow | 2 D, EGG | 11 H * | $LT_{50}$ | 25,000 | | 210486 | 80 |

## Table O.1-9
## AQUIRE Freshwater Toxicity Information (μg/L)
## AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration Lethal | Effect Concentration Sublethal | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| Selenium (cont.) | Pimephales promelas; Fathead minnow | FRY, 0.03 G, 17 MM, 25-35 D | 14 D | $LC_{50}$ | 600 | | 210486 | 80 |
| | Pimephales promelas; Fathead minnow | FRY, 0.03 G, 17 MM, 25-35 D | 96 H | $LC_{50}$ | 1,000 | | 210486 | 80 |
| Vanadium oxide sulfate | Carassius auratus; Goldfish | 3-5 CM, 0.3-2.9 G | 6 D | $LC_{50}$ | 1,020 | | 228999 | 79 |
| | Lepomis macrochirus; Bluegill | NR | 96 H | $LC_{50}$ | 6,000 | | 287133 | 60 |
| | Pimephasles promelas; Fathead minnow | NR | 96 H | $LC_{50}$ | 4,800 | | 287131 | 60 |
| | Poecilia reticulata; Guppy | 1.5-2.5 CM, 0.1-0.5 G | 6 D | $LC_{50}$ | 128 | | 229000 | 79 |
| Zinc | Algae; Algae, phytoplankton, algal mat; | CLADOCERA, COPEPODA, ROTIFERA | 2 WK | CLR * | | 15 to 30 | 311256 | 83 |
| | Algae; Algae, phytoplankton, algal mat; | EXPO GRO PHASE | 24 H | PSE | | <=98100 | 213095 | 89 |
| | Asellus communis; Aquatic sowbug; | NR | 20 D | RSD * | | 0.11 to 0.12 | 312027 | 86 |
| | Brachionus calyciflorus; Rotifer; | NEONATE | 24 H | $LC_{50}$ | 1,300 | | 219385 | 91 |
| | Canthocamptus sp; Copepod; | LARVAE | 24 H | LET | 1,250 | | 311797 | 85 |
| | Carassius auratus; Goldfish; | 20-25 G | to 15 D | BIO * | | 500 | 219207 | 72 |
| | Catostomus commersoni; White sucker; | JUVENILE, 142 MM, 28.7 G | 1 WK | RSD | | 890 | 312412 | 87 |
| | Ceriodaphnia reticulata; Water flea; | < 4 H | 48 H | $LC_{50}$ | 76 | | 311181 | 84 |
| | Channa punctatus; Snake-head catfish; | 2.4 G, 58 MM | 24 H | ENZ * | | 56,000 | 315190 | 81 |
| | Chironomidae; Midge family; | LARVAE | 12 MO | POP | | 1,140 | 213176 | 88 |
| | Chironomus riparius; Midge; | 4TH INSTAR LARVAE | >10 D | RSD | | 50 to 100 | 212729 | 89 |
| | Clarias lazera; Catfish; | IMMATURE, 12-15 G | 2 to 96 H | BIO * | | 32,000 | 312716 | 87 |
| | Clarias lazera; Catfish; | JUVENILE, 230 MM, 130 G | 24 H | RSD * | | 15,000 | 312717 | 87 |
| | Cyclops sp; Cyclopoid copepod; | ADULT | 48 H | $LC_{50}$ | 3,310 | | 313255 | 88 |
| | Cypris subglobosa; Ostracod; | NR | 12 H | $LC_{50}$ | 47,780 | | 312365 | 88 |
| | Cypris subglobosa; Ostracod; | NR | 24 H | $LC_{50}$ | 50,620 | | 312365 | 88 |
| | Cypris subglobosa; Ostracod; | NR | 48 H | $LC_{50}$ | 34,990 | | 312365 | 88 |
| | Cypris subglobosa; Ostracod; | NR | 96 H | $LC_{50}$ | 8,352 | | 312365 | 88 |
| | Daphnia lumholzi; Water flea; | NR | 12 H | $LC_{50}$ | 10,740 | | 312365 | 88 |
| | Daphnia lumholzi; Water flea; | NR | 24 H | $LC_{50}$ | 6,704 | | 312365 | 88 |
| | Daphnia lumholzi; Water flea; | NR | 48 H | $LC_{50}$ | 2,290 | | 312365 | 88 |
| | Daphnia lumholzi; Water flea; | NR | 96 H | $LC_{50}$ | 437.5 | | 312365 | 88 |
| | Daphnia magna; Water flea; | 24-48 HR, NEONATE | 21 D | GRO * | | 150 | 213950 | 91 |
| | Daphnia magna; Water flea; | 24-48 HR, NEONATE | 21 D | MOR | 50 to 150 | | 213950 | 91 |
| | Daphnia magna; Water flea; | 24-48 HR, NEONATE | 21 D | REP * | | 150 | 213950 | 91 |
| | Daphnia magna; Water flea; | < 24 H | 48 H | $LC_{50}$ | 68 | | 311181 | 84 |
| | Daphnia pulex; Water flea; | < 24 H | 48 H | $LC_{50}$ | 107 | | 311181 | 84 |
| | Dugesia dorotocephala; Turbellarian, flatworm; | 18-20 MM | 1 H | BEH * | | 1,000 to 10,000 | 310581 | 91 |
| | Dugesia tigrina; Turbellarian, flatworm; | NR | 96 H | $LC_{50}$ | 7,400 | | 218709 | 74 |
| | Gambusia affinis; Mosquitofish; | MIXED SIZES | to 30 D | RSD | | 50 | 312897 | 88 |
| | Gambusia affinis; Mosquitofish; | NR | 48 H | $LC_{50}$ ? | 116 | | 315578 | 78 |
| | Gammarus lacustris; Scud; | NR | 96 H | $LC_{50}$ | 2,240 | | 313058 | 88 |
| | Gomphonema parvulum; Diatom; | MIXED SPECIES | to 28 D | ABD * | | 1,000 | 212397 | 84 |
| | Hyphessobrycon serpae; Serpa tetra; | JUVENILE & OLDER FISH | 14 D | RSD | | 66,000 | 212709 | 78 |
| | Invertebrates; Invertebrates; | CLADOCERA, COPEPODA, ROTIFERA | 2 WK | POP * | | 17.1 to 89.6 | 311256 | 83 |
| | Invertebrates; Invertebrates; | CLADOCERA, COPEPODA, ROTIFERA | 2 WK | POP * | | 30 to 90 | 311256 | 83 |
| | Lemna minor; Duckweed; | 20 COLONIES OR 40 FRONDS | 4 D | $EC_{50}$GR | | 10,000 | 311789 | 86 |
| | Lepomis gibbosus; Pumpkinseed; | 15-25 G | to 15 D | BIO * | | 500 | 219207 | 72 |
| | Lepomis macrochirus; Bluegill; | NR | 6 MO | MOR * | 5,000 | | 212143 | 73 |
| | Limnodrilus sp; Sludge worm; | NR | 14 D | RSD | | 1,000 | 311865 | 83 |
| | Lophopodella carteri; Bryozoa; | ANCENSTRULAE, 2-3 D | 96 H | $LC_{50}$ | 5,630 | | 216703 | 80 |
| | Macrobrachium hendersodayanus; Prawn; | NR | 96 H | OC * | | 7,870 | 311545 | 84 |
| | Myriophyllum spicatum; Water-milfoil; | 4 CM APEX | 32 D | $EC_{50}$BM * | | 21,600 | 212262 | 74 |

# Table O.1-9
# AQUIRE Freshwater Toxicity Information (μg/L)
# AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species | Age | Exposure | Effect | Effect Concentration | | AQUIRE Reference Number | Year of Publication |
|---|---|---|---|---|---|---|---|---|
| | | | | | Lethal | Sublethal | | |
| | Myriophyllum spicatum; Water-milfoil; | 4 CM APEX | 32 D | $EC_{50}$GR * | | 20,900 | 212262 | 74 |
| | Myriophyllum spicatum; Water-milfoil; | 4 CM APEX | 32 D | $EC_{50}$GR * | | 21,600 | 212262 | 74 |
| | Mystus vittatus; Catfish; | 80-100 MM, 6-10 G | 96 H | $LC_{50}$ ? | 209,000 | | 315793 | 82 |
| Zinc (cont.) | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | 20-50 G | 6 H | PHY * | | 2,000 | 311200 | 82 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | FINGERLING | 12 D | RSD * | | 910 to 2,320 | 311689 | 86 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | JUVENILE | to 4 WK | BIO | | 44 to 140 | 310107 | 84 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | NR | 48 H | $LC_{50}$ | 2,600 | | 310185 | 68 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | NR | 48 H | $LC_{50}$ | 2,800 | | 218317 | 68 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | NR | 48 H | $LC_{50}$ | 3,500 | | 218317 | 68 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | SAC-FRY | 42 D | GRO * | | 430 | 310527 | 83 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | SAC-FRY | 42 D | MOR * | 120 | | 310527 | 83 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | SAC-FRY | 42 D | MOR * | 430 | | 310527 | 83 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | SAC-FRY | 42 D | MOR * (Calc) | 220 | | 310527 | 83 |
| | Oncorhynchus mykiss; Rainbow trout, donaldson trout; | SAC-FRY | 42 D | MOR * (Calc) | 80 | | 310527 | 83 |
| | Osteichthyes; Bony fish class; | ADULT GUPPY, 20-30 MM | 48 H | $LC_{50}$ | 2,630 | | 212882 | 88 |
| | Osteichthyes; Bony fish class; | ADULT GUPPY, 20-30 MM | 96 H | $LC_{50}$ | 1,860 | | 212882 | 88 |
| | Osteichthyes; Bony fish class; | JUVENILE GUPPY, 8-15 MM | 48 H | $LC_{50}$ | 1,970 | | 212882 | 88 |
| | Osteichthyes; Bony fish class; | JUVENILE GUPPY, 8-15 MM | 96 H | $LC_{50}$ | 1,360 | | 212882 | 88 |
| | Pectinatella magnifica; Bryozoa; | ANCENSTRULAE, 2-3 D | 96 H | $LC_{50}$ | 4,310 | | 216703 | 80 |
| | Phaenopsectra sp; Chironomid; | MIXED SPECIES | to 28 D | ABD * | | 10,000 | 212397 | 84 |
| | Pimephales promelas; Fathead minnow; | NEWLY HAT, < 24 H | 7 D | GRO * | | 184 | 311182 | 85 |
| | Pimephales promelas; Fathead minnow; | NEWLY HAT, < 24 H | 7 D | GRO * | | 85 | 311182 | 85 |
| | Pimephales promelas; Fathead minnow; | NEWLY HAT, < 24 H | 7 D | $LC_{50}$ | 238 | | 311182 | 85 |
| | Pimephales promelas; Fathead minnow; | NEWLY HAT, < 24 H | 96 H | $LC_{50}$ | 238 | | 311182 | 85 |
| | Pimephales promelas; Fathead minnow; | SUBADULT, 8-12 WK, <=250 MG | 2 to 35 D | GRO * | | 600 | 210678 | 89 |
| | Pimephales promelas; Fathead minnow; | SUBADULT, 8-12 WK, <=250 MG | 96 H | $LC_{50}$ | 2,540 | | 210678 | 89 |
| | Plumatella emarginata; Bryozoan; | ANCENSTRULAE, 2-3 D | 96 H | $LC_{50}$ | 5,300 | | 216703 | 80 |
| | Salmo trutta; Brown trout; | NR | 2 to 40 D | RSD | | 366 to 832 | 311216 | 85 |
| | Tilapia sparrmanii; Banded bream; | 12.13-81.77 G | 2 to 72 H | OC * | | 98,000 | 213066 | 89 |
| | Tilapia zillii; Tilapia; | IMMATURE, 7-9 G | 2 to 96 H | BIO * | | 22,000 | 312716 | 87 |
| | Tubifex sp; Tubificid worm; | NR | 14 D | RSD | | 1,000 | 311865 | 83 |

**NOTES:**

ABD = Abundance
ABN = Abnormalities
BCF = Bioconcentration factor
BEH = Behavioral change
BIO = Biochemical effect
BM = Biomass
BMS = Biomass
C = Celcius
CLR = Chlorophyll content
CM = Centimeter
D = Days
$EC_{50}$ = Effect of concentration to 50% of the population
EMS = Emergance?
ENZ = Enzyme effect
F = Farenheit
G = Grams
GR = Growth
GRO = Growth
H = Hours
HAT = Hatchability
HEM = Hematological effect
HIS = Histological effect
IM = Immobilization
$LC_{50}$ = Lethal concentration to 50% of test organisms
LET = Lethality
LOC = Locomotor Behaviour
$LT_{50}$ = Lethal threshold to 50% of test organisms
MM = Millimeter
MOR = Mortality
NR = Not reported
OC = Oxygen consumption
PGR = Population growth
PHY = Physiological effects
POP = Population, species diversity
PSE = Photosynthesis effect
RE = Reproduction
REP = Adverse effect to reproduction
RES = Respiratory effects
RN = Renewel
RSD = Residue
ST = Static
STR = Stress
THL = Thermal effect
VTE = Vertebral effect
μg/L = Microgram per liter

[ ] = Lowest effect concentration (if a range is provided, the low end of the range is the lowest effect concentration).

TABLE O-1.10
SUMMARY OF TOXICITY DATA FOR AMPHIBIAN RECEPTORS [a]
AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species Identification (Organism) | Age/Life Stag | Exposure Regimen | Effects Concentration | Effect | Source |
|---|---|---|---|---|---|---|
| INORGANIC COMPOUNDS | | | | | | |
| Aluminum | Bufo americanus; American toad | Tadpole | 96 h | 0.627 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Bufo americanus; American toad | Tadpole | 96 h | 0.859 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Bufo americanus; American toad | Tadpole | 96 h | 1.379 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Bufo americanus; American toad | Tadpole | 96 h | 1.663 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Bufo americanus; American toad | Tadpole | 96 h | >1.762 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana pipiens; Northern leopard frog | Embryo | 96 h | 0.811 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana pipiens; Northern leopard frog | Embryo | 96 h | 0.403 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana pipiens; Northern leopard frog | Embryo | 96 h | >0.856 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana pipiens; Northern leopard frog | Embryo | 96 h | >1 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana pipiens; Northern leopard frog | Embryo | 96 h | >0.980 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana pipiens; Northern leopard frog | Embryo | 96 h | >1.018 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana pipiens; Northern leopard frog | Embryo | 96 h | 0.471 mg/L | $LC_{50}$ | ECOTOX |
| Aluminum chloride | Microhyla carolinensis; Narrow mouthed fro | Eggs | 7 d | 0.050 mg/L | $LC_{50}$ | AQUIRE; 215305 |
| | Ambystoma opacum; Marbled salamander | Eggs | 8 d | 2.28 mg/L | $LC_{50}$ | AQUIRE; 216199 |
| Beryllium Sulfate | Ambystoma maculatum; Spotted salamand | Larva | 24, 48, and | 31.5 mg/L Be | $TL_{50}$ | Devillers & Exbrayat, 1992 |
| | Ambystoma maculatum; Spotted salamand | Larva | 96 h | 3.15 mg/L Be | $TL_{50}$ | Devillers & Exbrayat, 1992 |
| | Ambystoma maculatum; Spotted salamand | Larva | 24, 48, and | 18.2 mg/L Be | $TL_{50}$ | Devillers & Exbrayat, 1992 |
| | Ambystoma maculatum; Spotted salamand | Larva | 96 h | 8.02 mg/L Be | $TL_{50}$ | Devillers & Exbrayat, 1992 |
| | Ambystoma maculatum; Spotted salamand | Larva | 48 and 96 | 18.2 mg/L Be | $TL_{50}$ | Devillers & Exbrayat, 1992 |
| | Ambystoma maculatum; Spotted salamand | Larva | 96 h | 8.32 mg/L Be | $TL_{50}$ | Devillers & Exbrayat, 1992 |
| | Ambystoma maculatum; Spotted salamand | Larva | 24 h | 6.83 mg/L Be | $TL_{50}$ | ECOTOX |
| | Ambystoma maculatum; Spotted salamand | Larva | 48 h | 4.21 mg/L BE | $LC_{50}$ | ECOTOX |
| | Ambystoma maculatum; Spotted salamand | Larva | 24 and 48 | >10 mg/L Be | $TL_{50}$ | ECOTOX |
| | Ambystoma maculatum; Spotted salamand | Larva | 24 h | 21.2 mg/L | $TL_{50}$ | ECOTOX |
| | Ambystoma opacum; Marbled salamander | Larva | 24, 48, and | 31.5 mg/L Be | $TL_{50}$ | Devillers & Exbrayat, 1992 |
| | Ambystoma opacum; Marbled salamander | Larva | 96 h | 3.15 mg/L Be | $TL_{50}$ | Devillers & Exbrayat, 1992 |
| | Ambystoma opacum; Marbled salamander | Larva | 24 h | 23.7 mg/L Be | $TL_{50}$ | ECOTOX |
| | Ambystoma opacum; Marbled salamander | Larva | 48 h | 4.21 mg/L Be | $TL_{50}$ | ECOTOX |
| Cadmium Acetate | Notophthalmus viridescens; Eastern newt | NA | 25 d | 3.5 mg/L | Mortality | AQUIRE |
| | Notophthalmus viridescens; Eastern newt | NA | 25 d | 4.0 mg/L | Mortality | AQUIRE |
| | Notophthalmus viridescens; Eastern newt | NA | 25 d | 4.5 mg/L | Mortality | AQUIRE |
| | Notophthalmus viridescens; Eastern newt | NA | 25 d | 2.0 mg/L | Mortality | AQUIRE |
| | Notophthalmus viridescens; Eastern newt | NA | 25 d | 2.5 mg/L | Mortality | AQUIRE |
| | Notophthalmus viridescens; Eastern newt | NA | 25 d | 3.0 mg/L | Mortality | AQUIRE |
| | Notophthalmus viridescens; Eastern newt | NA | 51 d | 2.25 mg/L | Mortality | AQUIRE |
| | Notophthalmus viridescens; Eastern newt | NA | 51 d | 4.5 mg/L | Mortality | AQUIRE |
| | Notophthalmus viridescens; Eastern newt | NA | 51 d | 6.75 mg/L | Mortality | AQUIRE |
| | Notophthalmus viridescens; Eastern newt | NA | 60 d | 2.0 mg/L | Regeneration capabilities | AQUIRE |
| | Notophthalmus viridescens; Eastern newt | NA | 76 d | 2.25 mg/L | Regeneration capabilities | AQUIRE |

TABLE O-1.10
SUMMARY OF TOXICITY DATA FOR AMPHIBIAN RECEPTORS [a]
AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species Identification (Organism) | Age/Life Stag | Exposure Regimen | Effects Concentration | Effect | Source |
|---|---|---|---|---|---|---|
| Cadimum Chloride | Xenopus laevis; Clawed toad | 3-4 weeks | 48 h | 3.2 mg/L $Cd^{2+}$ | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Xenopus laevis; Clawed toad | 2 days | 100 d | 1.5 mg/L $Cd^{2+}$ | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Ambystoma opacum; Marbled salamander | NA | 8 d | 0.15 mg/L | $LC_{50}$ | AQUIRE |
| | Bufo arenarum; Argentine toad | NA | 24 h | 3.41 mg/L | $LC_{50}$ | AQUIRE |
| | Bufo arenarum; Argentine toad | NA | 24 h | 4.05 mg/L | $LC_{50}$ | AQUIRE |
| | Bufo arenarum; Argentine toad | NA | 24 h | 4.76 mg/L | $LC_{50}$ | AQUIRE |
| | Bufo arenarum; Argentine toad | NA | 24 h | 9.92 mg/L | $LC_{50}$ | AQUIRE |
| | Bufo arenarum; Argentine toad | NA | 48 h | 2.55 mg/L | $LC_{50}$ | AQUIRE |
| | Bufo arenarum; Argentine toad | NA | 48 h | 3.15 mg/L | $LC_{50}$ | AQUIRE |
| | Bufo arenarum; Argentine toad | NA | 48 h | 3.4 mg/L | $LC_{50}$ | AQUIRE |
| | Bufo arenarum; Argentine toad | NA | 48 h | 8.6 mg/L | $LC_{50}$ | AQUIRE |
| | Bufo arenarum; Argentine toad | NA | 72 h | 2.32 mg/L | $LC_{50}$ | AQUIRE |
| | Bufo arenarum; Argentine toad | NA | 72 h | 2.87 mg/L | $LC_{50}$ | AQUIRE |
| | Bufo arenarum; Argentine toad | NA | 72 h | 3.11 mg/L | $LC_{50}$ | AQUIRE |
| | Bufo arenarum; Argentine toad | NA | 72 h | 7.84 mg/L | $LC_{50}$ | AQUIRE |
| | Bufo arenarum; Argentine toad | NA | 96 h | 2.19 mg/L | $LC_{50}$ | AQUIRE |
| | Bufo arenarum; Argentine toad | NA | 96 h | 2.65 mg/L | $LC_{50}$ | AQUIRE |
| | Bufo arenarum; Argentine toad | NA | 96 h | 3.06 mg/L | $LC_{50}$ | AQUIRE |
| | Bufo arenarum; Argentine toad | NA | 96 h | 6.77 mg/L | $LC_{50}$ | AQUIRE |
| | Rana pipiens; Northern leopard frog | NA | 1-2 d | 0.307 mg/L | Mortality | AQUIRE |
| | Rana pipiens; Northern leopard frog | NA | 1 d | 0.307 mg/L | Mortality | AQUIRE |
| | Rana pipiens; Northern leopard frog | NA | 1 d | 3.068 mg/L | Mortality | AQUIRE |
| | Rana pipiens; Northern leopard frog | NA | 1 d | 4.602 mg/L | Mortality | AQUIRE |
| | Rana pipiens; Northern leopard frog | NA | 1 d | 6.135 mg/L | Mortality | AQUIRE |
| Cadmium Nitrate | Ambystoma mexicanum; Axolotl | 3-4 weeks | 48 h | 1.3 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Ambystoma mexicanum; Axolotl | 3-4 weeks | 48 h | 1.10 mg/L | NOLC | Devillers & Exbrayat, 1992 |
| | Ambystoma mexicanum; Axolotl | NA | 48 h | 0.62 mg/L | $LC_{50}$ | AQUIRE |
| | Xenopus laevis; Clawed toad | 3-4 weeks | 48 h | 32 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Xenopus laevis; Clawed toad | 3-4 weeks | 48 h | 20.2 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Xenopus laevis; Clawed toad | 3-4 weeks | 48 h | 23 mg/L | NOLC | Devillers & Exbrayat, 1992 |
| Chromium | Gastrophryne carolinensis; Narrow-mouthed toad | Embryo | 96 h | 0.03 mg/L | $LC_{50}$ | Birge et al., 1979 |
| Cobalt | Gastrophryne carolinensis; Narrow-mouthed toad | Embryo | 96 h | 0.05 mg/L | $LC_{50}$ | Birge et al., 1979 |
| Copper | Gastrophryne carolinensis; Narrow-mouthed toad | Embryo | 96 h | 0.04 mg/L | $LC_{50}$ | Birge et al., 1979 |
| Copper Sulfate | Xenopus laevis; Clawed toad | 3-4 weeks | 48 h | 1.7 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |

TABLE O-1.10
SUMMARY OF TOXICITY DATA FOR AMPHIBIAN RECEPTORS [a]
AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species Identification (Organism) | Age/Life Stag | Exposure Regimen | Effects Concentration | Effect | Source |
|---|---|---|---|---|---|---|
| Lead | Bufo americanus; American toad | Tadpole | 6 d | 0.5 - 1.0 mg/L | Mortality | AQUIRE |
| | Bufo americanus; American toad | Embryo | 48 h | 0.47 - 0.90 mg/L $Pb^{2+}$ | $LC_{50}$ | ECOTOX |
| | Bufo arenarum; Argentine toad | NA | 24 h | 1.0 mg/L | Emergence | AQUIRE |
| | Bufo arenarum; Argentine toad | NA | 24 h | 1.0 mg/L | Mortality | AQUIRE |
| | Gastrophryne carolinensis; Narrow-mouthed toad | Embryo | 96 h | 0.04 mg/L | $LC_{50}$ | Birge et al., 1979 |
| Lead Chloride | Ambystoma opacum; Marbled salamander | NA | 8 d | 1.46 mg/L | $LC_{50}$ | AQUIRE |
| Lead Nitrate | Bufo arenarum; Argentine toad | Embryo | 48 h | 0.47-0.9 mg/L $Pb^{2+}$ | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana catesbeiana; Bullfrog | NA | 6 d | 0.5 - 1.0 mg/L | Locomotor behavior | AQUIRE |
| | Rana clamitans; Green frog | NA | 1-6 d | 0.75 mg/L | Behavior | AQUIRE |
| Magnesium [f] | | | | | | |
| Manganese | Gastrophryne carolinensis; Narrow-mouthed toad | Embryo | 96 h | 1.42 mg/L | $LC_{50}$ | Birge et al., 1979 |
| Mercury | Bufo fowleri; Fowler's toad | Embryo/Larva | 96 h [b] | 0.0659 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Bufo punctatus; Red spotted toad | Embryo/Larva | 96 h [b] | 0.0368 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Gastrophryne carolinensis; Narrow-mouthed toad | Embryo/Larva | 96 h [b] | 0.0013 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Hyla chrysoscelis; Gray treefrog | Embryo/Larva | 96 h [b] | 0.0024 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana grylio; Pig frog | Embryo/Larva | 96 h [b] | 0.0672 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana pipiens; Northern leopard frog | Embryo/Larva | 96 h [b] | 0.0073 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| Mercury chloride | Ambystoma mexicanum; Axolotl | 3-4 weeks | 48 h | 0.4 mg/L | $LC_{50}$ | ECOTOX |
| | Ambystoma mexicanum; Axolotl | 3-4 weeks | 48 h | 0.27 mg/L | NOLC | ECOTOX |
| Nickel | Gastrophryne carolinensis; Narrow-mouthed toad | Embryo | 96 h | 0.05 mg/L | $LC_{50}$ | Birge et al., 1979 |
| Silver nitrate | Ambystoma opacum; Marbled salamander | NA | 8 d | 0.24 mg/L | $LC_{50}$ | AQUIRE |
| Zinc | Gastrophryne carolinensis; Narrow-mouthed toad | Embryo | 96 h | 0.01 mg/L | $LC_{50}$ | Birge et al., 1979 |
| | Xenopus laevis; Clawed toad | Embryo | 96 h | 34.5 mg/L Zn | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| Zinc Chloride | Ambystoma opacum; Marbled salamander | NA | 8 d | 2.38 mg/L | $LC_{50}$ | AQUIRE |
| PESTICIDES/PCBs | | | | | | |
| 4,4'-DDD | Bufo woodhousei fowleri; Fowler's toad | Tadpole | 96 h | 0.140 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Bufo woodhousei fowleri; Fowler's toad | Tadpole | 24 h | 0.709 mg/L | $LC_{50}$ | ECOTOX |
| 4,4'-DDT | Bufo woodhousei fowleri; Fowler's toad | Tadpole 6 wks | 96 h | 0.10 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Bufo woodhousei fowleri; Fowler's toad | Tadpole 7 wks | 96 h | 0.03 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana temporaria; Common/Grass frog | Adults | 20 d | 7.6 mg/kg (dose) | $LD_{50}$ | Devillers & Exbrayat, 1992 |

TABLE O-1.10
SUMMARY OF TOXICITY DATA FOR AMPHIBIAN RECEPTORS [a]
AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species Identification (Organism) | Age/Life Stag | Exposure Regimen | Effects Concentration | Effect | Source |
|---|---|---|---|---|---|---|
| Aldrin | Bufo woodhousei fowleri; Fowler's toad | Tadpole | 96 h | 0.068 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana pipiens; Northern leopard frog | 3.5 in/ 65 g | 30 d | 0.30 mg/L | 40% Mortality | Devillers & Exbrayat, 1992 |
| Aroclor 1242 | Bufo americanus; American toad | Embryo/Larva | 96 h [b] | 0.00271 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Bufo fowleri; Fowler's toad | Embryo/Larva | 96 h [b] | 0.01209 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| Aroclor 1254 | Bufo americanus; American toad | Embryo/Larva | 96 h [b] | 0.00202 mg/L | $LC_{50}$ | AQUIRE; 216772 |
| | Bufo fowleri; Fowler's toad | Embryo/Larva | 96 h [b] | 0.00374 mg/L | $LC_{50}$ | AQUIRE; 216772 |
| | Pleurodeles waltl; Iberian ribbed newt | Larvae, 32 mm | 12 d | 0.025 to 0.050 mg/L | Cytogenetic effects | AQUIRE; 219976 |
| | Bufo woodhousei fowleri; Fowler's toad | Egg, 2-6 h | 7 to 96 h | 0.03818 mg/L | $LC_{50}$ | AQUIRE; 216772 |
| | Bufo americanus; American toad | Egg, 2-6 h | 7 to 96 h | 0.01032 mg/L | $LC_{50}$ | AQUIRE; 216772 |
| | Bufo woodhousei fowleri; Fowler's toad | Embryo to larv | to 8 d | 0.00374 mg/L | $LC_{50}$ | AQUIRE; 216772 |
| | Bufo americanus; American toad | Embryo to larv | to 8 d | 0.00202 mg/L | $LC_{50}$ | AQUIRE; 216772 |
| gamma-BHC (Lindane) | Bufo woodhousei fowleri; Fowler's toad | Tadpole | 96 h | 3.2 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Microhyla ornata; Ornate chorus frog | Yolk plug-stage | 96 h | 23.37 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Microhyla ornata; Ornate chorus frog | Tadpole, 8d | 96 h | 7.270 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Microhyla ornata; Ornate chorus frog | Yolk plug-stage | 96 h | 20 mg/L | 47% Mortality | Devillers & Exbrayat, 1992 |
| | Microhyla ornata; Ornate chorus frog | Yolk plug-stage | 48 h | 20 mg/L | 52% Hatch abnormality | Devillers & Exbrayat, 1992 |
| | Microhyla ornata; Ornate chorus frog | Yolk plug-stage | 96 h | 10 mg/L | 12.5% Hatch abnormality | Devillers & Exbrayat, 1992 |
| | Pseudacris triseriata; Chorus frog | tadpole | 96 h | 2.65 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| Chlordane | Rana pipiens; Northern leopard frog | 3.5in / 65 g | 30 d | 0.50 mg/L | 40% Mortality | Devillers & Exbrayat, 1992 |
| | Rana pipiens; Northern leopard frog | 65 g | 30 d | <0.38 mg/L | Mortality | ECOTOX |
| Dieldrin | Bufo woodhousei fowleri; Fowler's toad | Tadpole | 96 h | 0.15 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Pseudacris triseriata; Chorus frog | Tadpole | 96 h | 0.10 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana pipiens; Northern leopard frog | 3.5in / 65 g | 30 d | 0.10 mg/L | 50% Mortality | Devillers & Exbrayat, 1992 |
| Endrin | Acris crepitans; Cricket frog | Larva | 96 h [e] | 0.010 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Acris crepitans; Cricket frog | Larva | 24 h | 0.023 mg/L | $EC_{50}$ | ECOTOX |
| | Ambystoma maculatum; Spotted salamand | Larva | 96 h [e] | 0.056 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Ambystoma maculatum; Spotted salamand | Larva | 24 h | 0.048 mg/L | $EC_{50}$ | ECOTOX |
| | Ambystoma opacum; Marbled salamander | Larva | 96 h [e] | 0.018 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Ambystoma opacum; Marbled salamander | Larva | 24 h | 0.018 mg/L | $EC_{50}$ | ECOTOX |
| | Bufo americanus; American toad | Larva | 96 h [e] | 0.010 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Bufo americanus; American toad | Larva | 24 h | 0.008 mg/L | $EC_{50}$ | ECOTOX |
| | Bufo woodhousei fowleri; Fowler's toad | Tadpole | 96 h | 0.12 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Pseudacris triseriata; Chorus frog | Tadpole | 96 h [e] | 0.18 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Pseudacris triseriata; Chorus frog | Tadpole | 24 h | 0.29 mg/L | $LC_{50}$ | ECOTOX |
| | Rana catesbeiana; Bullfrog | Larva | 96 h [e] | 0.002 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana catesbeiana; Bullfrog | Larva | 24 h | >0.040 mg/L | $EC_{50}$ | ECOTOX |
| | Rana catesbeiana; Bullfrog | Tadpole | 96 h | 0.0025 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana pipiens; Northern leopard frog | 3.5 in / 65 g | 30 d | 0.03 mg/L | 30% Mortality | Devillers & Exbrayat, 1992 |
| | Rana sphenocephala; Southern leopard fro | Egg | 24 h | 0.025 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana sphenocephala; Southern leopard fro | Young larva | 96 h | 0.006 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |

TABLE O-1.10
SUMMARY OF TOXICITY DATA FOR AMPHIBIAN RECEPTORS [a]
AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species Identification (Organism) | Age/Life Stag | Exposure Regimen | Effects Concentration | Effect | Source |
|---|---|---|---|---|---|---|
| Endrin (cont.) | Rana sphenocephala; Southern leopard fro | Older larva | 96 h | 0.006 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana sphenocephala; Southern leopard fro | Sub-adult | 96 h | 0.005 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana sphenocephala; Southern leopard fro | Larva | 96 h [e] | 0.009 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana sphenocephala; Southern leopard fro | Larva | 24 h | 0.013 mg/L | $EC_{50}$ | ECOTOX |
| | Rana sylvatica; Wood frog | Larva | 96 h [e] | 0.034 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana sylvatica; Wood frog | Larva | 24 h | <0.016 mg/L | $EC_{50}$ | ECOTOX |
| | Rana pipiens; Northern leopard frog | 65 g | 30 d | <0.02 mg/L | Mortality | ECOTOX |
| Heptachlor | Bufo woodhousei fowleri; Fowler's toad | Tadpole | 96 h | 0.435 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Bufo woodhousei fowleri; Fowler's toad | Tadpole | 24 h | 0.844 mg/L | $LC_{50}$ | ECOTOX |
| Methoxychlor | Bufo woodhousei fowleri; Fowler's toad | Tadpole 4-5 wk | 48 h | 0.100 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Bufo woodhousei fowleri; Fowler's toad | Tadpole 4-5 wk | 24 h | 0.76 mg/L | $LC_{50}$ | AQUIRE |
| | Bufo woodhousei fowleri; Fowler's toad | Tadpole 4-5 wk | 48 h | 0.11 mg/L | $LC_{50}$ | AQUIRE |
| | Pseudacris triseriata; Chorus frog | NA | 24 h | 0.44 mg/L | $LC_{50}$ | AQUIRE |
| | Pseudacris triseriata; Chorus frog | NA | 48 h | 0.42 mg/L | $LC_{50}$ | AQUIRE |
| | Pseudacris triseriata; Chorus frog | NA | 96 h | 0.33 mg/L | $LC_{50}$ | AQUIRE |
| Toxaphene | Acris crepitans; Northern cricket frog | Larva | 96 h [e] | 0.076 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Ambystoma maculatum; Spotted salamand | Larva | 96 h [e] | 0.034 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Ambystoma opacum; Marbled salamander | Larva | 96 h [e] | 0.342 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Bufo americanus; American toad | Larva | 96 h [e] | 0.034 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Bufo woodhousei fowleri; Fowler's toad | Tadpole | 96 h [e] | 0.150 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Pseudacris triseriata; Chorus frog | Tadpole | 96 h | 0.390 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana catesbeiana; Bullfrog | Larva | 96 h [e] | 0.099 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana pipiens; Northern leopard frog | 3.5 in / 63 g | 30 d | 0.060 mg/L | 25% Mortality | Devillers & Exbrayat, 1992 |
| | Rana sphenocephala; Southern leopard fro | Egg | 96 h | 0.060 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana sphenocephala; Southern leopard fro | Egg | 96 h | 0.046 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana sphenocephala; Southern leopard fro | Young larva | 96 h | 0.168 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana sphenocephala; Southern leopard fro | Young larva | 96 h | 0.065 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana sphenocephala; Southern leopard fro | Young larva | 96 h | 0.032 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana sphenocephala; Southern leopard fro | Sub-adult | 96 h | 0.378 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana sphenocephala; Southern leopard fro | Larva | 96 h [e] | 0.130 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana sylvatica; Wood frog | Larva | 96 h [e] | 0.195 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| SEMI-VOLATILE ORGANIC COMPOUNDS | | | | | | |
| 1,2-Dibromomethane | Pleurodeles waltl; Iberian ribbed newt | Larvae, 32 mm | 12 d | 1 to 5 mg/L | Cytogenetic effects | AQUIRE; 219976 |
| | Quantitative Structure-Activity Relationship | NA | NA | 540 mg/L | Narcosis | Lipnick, R.L., 1989 |
| 2-Proponone | Ambystoma mexicanum; Axolotl | 3-4 weeks | 48 h | 20,000 mg/L | $LC_{50}$ | AQUIRE; 219740 |
| | Quantitative Structure-Activity Relationship | NA | NA | 18,000 mg/L | Narcosis | Lipnick, R.L., 1989 |

TABLE O-1.10
SUMMARY OF TOXICITY DATA FOR AMPHIBIAN RECEPTORS [a]
AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species Identification (Organism) | Age/Life Stag | Exposure Regimen | Effects Concentration | Effect | Source |
|---|---|---|---|---|---|---|
| 4-Chloroaniline | Xenopus laevis; Clawed toad | Egg stage | 3 wk | 100 mg/L | Lethality | AQUIRE; 212617 |
| | Xenopus laevis; Clawed toad | Egg stage | 3 wk | 0.001 mg/L | 32% Mortality | AQUIRE; 212617 |
| | Quantitative Structure-Activity Relationship | NA | NA | 560 mg/L | Narcosis | Lipnick, R.L., 1989 |
| Anthracene | Rana pipiens; Northern leopard frog | Embryo | 24 h [c] | 0.065 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana pipiens; Northern leopard frog | Embryo | 24 h [c] | 0.11 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana pipiens; Northern leopard frog | NA | 24 h [d] | 0.025 mg/L | $LC_{50}$ | ECOTOX |
| | Quantitative Structure-Activity Relationship | NA | NA | 2.7 mg/L | Narcosis | Lipnick, R.L., 1989 |
| Benzo(a)pyrene | Pleurodeles waltl; Iberian ribbed newt | Larva (3-4 cm) | 8 d | 0.01 mg/L | TDL0 | Devillers & Exbrayat, 1992 |
| | Pleurodeles waltl; Iberian ribbed newt | Larva (3-4 cm) | 48 h | 0.20 mg/L | physiochemical | AQUIRE |
| | Bufo americanus; American toad | NA | 24 h | 5.0 mg/L | Change in lnth and/or wt | AQUIRE |
| | Rana pipiens; Northern leopard frog | NA | 24 h | 5.0 mg/L | Change in lnth and/or wt | AQUIRE |
| | Quantitative Structure-Activity Relationship | NA | NA | 0.16 mg/L | Narcosis | Lipnick, R.L., 1989 |
| Bis(2-ethylhexyl)phthalate | Bufo woodhousei fowleri; Fowler's toad | Embryo to larv | to 8 d | 3.880 mg/L | $LC_{50}$ | AQUIRE; 216772 |
| | Bufo woodhousei fowleri; Fowler's toad | Larva | 96 h | 3.880 mg/L | $LC_{50}$ | AQUIRE; 216772 |
| | Quantitative Structure-Activity Relationship | NA | NA | 1.7 mg/L | Narcosis | Lipnick, R.L., 1989 |
| Di-n-octylphthalate | Quantitative Structure-Activity Relationship | NA | NA | 0.0032mg/L | Narcosis | Lipnick, R.L., 1989 |
| Fluoranthene | Rana pipiens; Northern leopard frog | Embryo | 24 h [c] | 0.09 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Quantitative Structure-Activity Relationship | NA | NA | 1.2 mg/L | Narcosis | Lipnick, R.L., 1989 |
| Naphthalene | Xenopus laevis; Clawed toad | Larva (3 wks) | 96 h | 2.1 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Xenopus laevis; Clawed toad | Larva (3 wks) | 6 h | 3.7 mg/L | $EC_{50}$ | Devillers & Exbrayat, 1992 |
| | Xenopus laevis; Clawed toad | Larva (3 wks) | 6 h | 2.3 mg/L | $EC_{50}$ | Devillers & Exbrayat, 1992 |
| | Xenopus laevis; Clawed toad | Larva (3 wks) | ~2 h | 4.5 mg/L | Mortality | Devillers & Exbrayat, 1992 |
| | Quantitative Structure-Activity Relationship | NA | NA | 13 mg/L | Narcosis | Lipnick, R.L., 1989 |
| Nitrobenzene | Rana pipiens; Northern leopard frog | Embryo/Larva | 96 h [b] | 0.64 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Quantitative Structure-Activity Relationship | NA | NA | 420 mg/L | Narcosis | Lipnick, R.L., 1989 |
| N-Nitrosodiphenylamine | Quantitative Structure-Activity Relationship | NA | NA | 57 mg/L | Narcosis | Lipnick, R.L., 1989 |
| Pentachlorophenol | Ambystoma mexicanum; Axolotl | 3-4 weeks | 48 h | 0.3 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Ambystoma mexicanum; Axolotl | 3-4 weeks | 48 h | 0.13 mg/L | NOLC | Devillers & Exbrayat, 1992 |
| | Rana catesbeiana; Bullfrog | Tadpole | 96 h | 0.207 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Xenopus laevis; Clawed toad | 3-4 weeks | 48 h | 0.26 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Xenopus laevis; Clawed toad | 3-4 weeks | 48 h | 0.21 mg/L | NOLC | Devillers & Exbrayat, 1992 |
| | Xenopus laevis; Clawed toad | < 2 days | 100 d | 0.032 mg/L | NOLC | Devillers & Exbrayat, 1992 |
| | Quantitative Structure-Activity Relationship | NA | NA | 0.22 mg/L | Narcosis | Lipnick, R.L., 1989 |

TABLE O-1.10
SUMMARY OF TOXICITY DATA FOR AMPHIBIAN RECEPTORS [a]
AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species Identification (Organism) | Age/Life Stag | Exposure Regimen | Effects Concentration | Effect | Source |
|---|---|---|---|---|---|---|
| Phenol | Ambystoma gracile;Northwestern Salaman | Embryo/Larva | 96h | 0.38 mg/L | $LC_{50}$ | Black et al., 1982 |
| | Bufo fowleri; Fowler's toad | Embryo/Larva | 96h | 2.45 mg/L | $LC_{50}$ | Black et al., 1982 |
| | Rana pipiens; Northern leopard frog | Embryo/Larva | 96 h [b] | 0.04 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana palustris;Pickerel frog | Embryo/Larva | 96h | 9.87 mg/L | $LC_{50}$ | Black et al., 1982 |
| | Rana temporaria; Common/Grass frog | Embryo/Larva | 96h | 0.27 mg/L | $LC_{50}$ | Black et al., 1982 |
| | Xenopus laevis; Clawed toad | Embryo/Larva | 96h | 7.68 mg/L | $LC_{50}$ | Black et al., 1982 |
| | Xenopus laevis; Clawed toad | Embryo/Larva | 96h | 51.1 mg/L | $LC_{50}$ | Holcombe et al., 1987 |
| | Quantitative Structure-Activity Relationship | NA | NA | 760 mg/L | Narcosis | Lipnick, R.L., 1989 |
| Pyrene | Rana pipiens; Northern leopard frog | Embryo | 24 h [c] | 0.14 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Pleurodeles waltl; Iberian ribbed newt | Larvae, 32 mm | 12 d | 0.035 to 0.2 (F) mg/L | Cytogenetic effects | AQUIRE; 219976 |
| | Quantitative Structure-Activity Relationship | NA | NA | 0.57 mg/L | Narcosis | Lipnick, R.L., 1989 |
| VOLATILE ORGANIC COMPOUNDS | | | | | | |
| Acetone | Ambystoma mexicanum; Axolotl | 3-4 weeks | 48 h | 20,000 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Ambystoma mexicanum; Axolotl | 3-4 weeks | 48 h | 12,000 mg/L | NOLC | Devillers & Exbrayat, 1992 |
| | Xenopus laevis; Clawed toad | 3-4 weeks | 48 h | 24,000 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Xenopus laevis; Clawed toad | 3-4 weeks | 48 h | 20,000 mg/L | NOLC | Devillers & Exbrayat, 1992 |
| | Quantitative Structure-Activity Relationship | NA | NA | 18,000 mg/L | Narcosis | Lipnick, R.L., 1989 |
| Benzene | Ambystoma mexicanum; Axolotl | 3-4 weeks | 48 h | 370 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Ambystoma mexicanum; Axolotl | 3-4 weeks | 48 h | 120 mg/L | NOLC | Devillers & Exbrayat, 1992 |
| | Ambystoma gracile;Northwestern Salaman | Embryo/Larva | 96h | 5.21 mg/L | $LC_{50}$ | Black et al., 1982 |
| | Rana pipiens; Northern leopard frog | Embryo/Larva | 96 h [b] | 3.66 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Xenopus laevis; Clawed toad | 3-4 weeks | 48 h | 190 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Xenopus laevis; Clawed toad | 3-4 weeks | 48 h | 105 mg/L | NOLC | Devillers & Exbrayat, 1992 |
| | Quantitative Structure-Activity Relationship | NA | NA | 180 mg/L | Narcosis | Lipnick, R.L., 1989 |
| Bromoform | Quantitative Structure-Activity Relationship | NA | NA | 720 mg/L | Narcosis | Lipnick, R.L., 1989 |
| Carbon Tetrachloride | Rana pipiens; Northern leopard frog | Embryo/Larva | 96 h [b] | 1.64 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Rana temporaria; Common/Grass frog | Embryo/Larva | 96h | 1.16 mg/L | $LC_{50}$ | Black et al., 1982 |
| | Ambystoma mexicanum; Axolotl | Embryo/Larva | 96h | 1.98 mg/L | $LC_{50}$ | Black et al., 1982 |
| | Rana palustris; Pickerel frog | Embryo/Larva | 96h | 2.37 mg/L | $LC_{50}$ | Black et al., 1982 |
| | Bufo woodhousei fowleri; Fowler's toad | Embryo/Larva | 96h | 2.83 mg/L | $LC_{50}$ | Black et al., 1982 |
| | Xenopus laevis; Clawed toad | Embryo/Larva | 96h | 22.42 mg/L | $LC_{50}$ | Black et al., 1982 |
| | Quantitative Structure-Activity Relationship | NA | NA | 80 mg/L | Narcosis | Lipnick, R.L., 1989 |
| Chlorobenzene | Rana pipiens; Northern leopard frog | Embryo/Larva | 96 h [b] | 1.2 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Ambystoma gracile;Northwestern Salaman | Embryo/Larva | 96h | 1.15 mg/L | $LC_{50}$ | Black et al., 1982 |
| | Quantitative Structure-Activity Relationship | NA | NA | 59 mg/L | Narcosis | Lipnick, R.L., 1989 |

TABLE O-1.10
SUMMARY OF TOXICITY DATA FOR AMPHIBIAN RECEPTORS [a]
AOC 57

Remedial Investigation Report
Devens, Massachusetts

| Chemical Name | Species Identification (Organism) | Age/Life Stag | Exposure Regimen | Effects Concentration | Effect | Source |
|---|---|---|---|---|---|---|
| Chloroform | Rana pipiens; Northern leopard frog | Embryo/Larva | 96 h [b] | 4.16 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Quantitative Structure-Activity Relationship | NA | NA | 340 mg/L | Narcosis | Lipnick, R.L., 1989 |
| Dichloromethane | Rana pipiens; Northern leopard frog | Embryo/Larva | 96 h [b] | >48 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Quantitative Structure-Activity Relationship | NA | NA | 1000 mg/L | Narcosis | Lipnick, R.L., 1989 |
| Methylene chloride | Bufo woodhousei fowleri; Fowler's toad | Embryo | 7 d | > 32 mg/L | $EC_{50}$, teratogenesis | AQUIRE, 1996 |
| | Bufo woodhousei fowleri; Fowler's toad | Embryo | 3 d | > 32 mg/L | $EC_{50}$, teratogenesis | AQUIRE, 1996 |
| | Rana catesbeiana; Bullfrog | Embryo | 4 d | 30.61 mg/L | $EC_{50}$, teratogenesis | AQUIRE, 1996 |
| | Rana catesbeiana; Bullfrog | Embryo | 8 d | 17.78 mg/L | $EC_{50}$, teratogenesis | AQUIRE, 1996 |
| Toluene | Rana pipiens; Northern leopard frog | Embryo/Larva | 96 h [b] | 0.39 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Quantitative Structure-Activity Relationship | NA | NA | 61 mg/L | Narcosis | Lipnick, R.L., 1989 |
| Trichloroethylene | Ambystoma mexicanum; Axolotl | 3-4 weeks | 48 h | 48 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Ambystoma mexicanum; Axolotl | 3-4 weeks | 48 h | 29 mg/L | NOLC | Devillers & Exbrayat, 1992 |
| | Xenopus laevis; Clawed toad | 3-4 weeks | 48 h | 45 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Xenopus laevis; Clawed toad | 3-4 weeks | 48 h | 41 mg/L | NOLC | Devillers & Exbrayat, 1992 |
| | Quantitative Structure-Activity Relationship | NA | NA | 160 mg/L | Narcosis | Lipnick, R.L., 1989 |
| o-Xylene | Xenopus laevis; Clawed toad | 3-4 weeks | 48 h | 73 mg/L | $LC_{50}$ | Devillers & Exbrayat, 1992 |
| | Quantitative Structure-Activity Relationship | NA | NA | 25 mg/L | Narcosis | Lipnick, R.L., 1989 |

NOTES:
$LC_{50}$ = The concentration at which 50% of the population died (exhibited a lethal endpoint).
$LD_{50}$ = The administered dose which causes 50% of the population to die.
$EC_{50}$ = The concentration at which 50% of the population exhibited an effect.
$TL_{50}$ = Mortality endpoint; concentration represents the median tolerance limit.
NOLC = No Observed Lethal Concentration

[a] This table is intended to supplement information presented in Table O-1.9.
[b] Initiated at fertilization and maintained through 4 day posthatching.
[c] 30 minutes exposure to the sun
[d] 5 hours exposure to the sun
[e] Animals were exposed to the pesticide for 96 hours, but tabulations of mortality were made at 192 hours to account for delayed effects.
[f] Devillers & Exbrayat (1992) provides synergism data for magnesium and mercury, lead, cadmium, and manganese as % mortality.

Appendix O-1 Reference List

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# O-2 ECOLOGICAL RISK CALCULATIONS

Table O-2.1
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of RME Concentrations of CPCs in Food and Surface Soil
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| EXPOSURE CONCENTRATION DATA | | ESTIMATED CONTAMINANT CONCENTRATIONS IN PRIMARY FOOD ITEMS | | | | BAF VALUES FOR OTHER FOOD ITEMS | |
|---|---|---|---|---|---|---|---|
| ANALYTE | RME CONCENTRATION (mg/kg) | Invert BAF [a] | Concentration in Invertebrate Tissue [b] (mg/kg) | Plant BAF [a] | Concentration in Plant Tissue [c] (mg/kg) | Small Mammal BAF [a] | Small Bird BAF [a] |
| Arsenic | 2.1E+01 | 6.6E-03 | 1.4E-01 | 3.0E-01 | 6.3E+00 | 1.0E-01 | 6.0E-03 |
| Cobalt | 7.5E+00 | 1.0E+00 | 7.5E+00 | 4.0E-03 | 3.0E-02 | 1.0E+00 | 1.0E+00 |
| Copper | 1.6E+01 | 1.6E-01 | 2.5E+00 | 7.8E-01 | 1.2E+01 | 6.0E-01 | 6.0E-01 |
| Manganese | 4.8E+02 | 2.0E-02 | 9.6E+00 | 5.0E-02 | 2.4E+01 | 2.0E-02 | 2.0E-02 |
| Nickel | 3.1E+01 | 2.3E-01 | 7.1E+00 | 1.2E-02 | 3.7E-01 | 3.0E-01 | 3.0E-01 |
| Selenium | 8.8E-01 | 7.6E-01 | 6.7E-01 | 9.0E-03 | 7.9E-03 | 7.5E-01 | 5.1E-01 |
| 4,4'-DDE | 2.0E-02 | 1.7E+00 | 3.3E-02 | 1.0E-02 | 2.0E-04 | 1.2E+00 | 2.9E+00 |
| 4,4'-DDT | 2.6E-02 | 5.7E-01 | 1.5E-02 | 1.0E-02 | 2.6E-04 | 1.2E+00 | 2.9E+00 |
| 2-Methylnaphthalene | 4.3E-01 | 5.0E-02 | 2.2E-02 | 4.9E-02 | 2.1E-02 | 1.5E-01 | 1.5E-01 |
| Bis(2-ethylhexyl)phthalate | 2.7E+00 | 5.0E-02 | 1.4E-01 | 7.6E-03 | 2.1E-02 | 2.4E-01 | 2.4E-01 |
| Dibenzofuran | 1.6E-01 | 5.0E-02 | 8.0E-03 | 3.3E-02 | 5.3E-03 | 1.5E-01 | 1.5E-01 |
| Fluoranthene | 3.0E-01 | 5.0E-02 | 1.5E-02 | 4.9E-02 | 1.5E-02 | 1.5E-01 | 1.5E-01 |
| Naphthalene | 4.2E-01 | 5.0E-02 | 2.1E-02 | 4.9E-02 | 2.1E-02 | 1.5E-01 | 1.5E-01 |
| Phenanthrene | 2.8E-01 | 5.0E-02 | 1.4E-02 | 4.9E-02 | 1.4E-02 | 1.5E-01 | 1.5E-01 |
| Pyrene | 4.0E-01 | 5.0E-02 | 2.0E-02 | 4.9E-02 | 2.0E-02 | 1.5E-01 | 1.5E-01 |
| Chloroform | 8.9E-04 | NA | NA | NA | NA | NA | NA |
| Ethylbenzene | 2.4E-03 | NA | NA | NA | NA | NA | NA |
| Tetrachloroethylene | 3.0E-03 | NA | NA | NA | NA | NA | NA |
| Toluene | 3.7E-03 | NA | NA | NA | NA | NA | NA |
| Trichlorofluoromethane | 1.7E-02 | NA | NA | NA | NA | NA | NA |
| Xylenes | 2.9E-02 | NA | NA | NA | NA | NA | NA |

CPC = Contaminant of Potential Concern
[a] Bioaccumulation data presented in: Appendix O-1, Table O-1.2
[b] CPC concentration s in invertebrate tissue equals the invertebrate BAF multiplied by the RME soil concentration of the CPC.
[c] CPC concentrations in plant tissue equals the plant BAF multiplied by the RME soil concentration of the CPC.

Table O–2.1
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of RME Concentrations of CPCs in Food and Surface Soil
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

**POTENTIAL DIETARY EXPOSURE (mg/kgBW/day) [d]**

| ANALYTE | *White–footed mouse* | *American robin* | *Red fox* | *Barred owl* |
|---|---|---|---|---|
| Arsenic | 7.3E–01 | 6.1E–01 | 2.4E–05 | 9.0E–05 |
| Cobalt | 1.1E–01 | 3.5E–01 | 3.7E–05 | 1.9E–04 |
| Copper | 1.4E+00 | 1.0E+00 | 9.6E–05 | 5.6E–04 |
| Manganese | 3.9E+00 | 7.0E+00 | 2.8E–04 | 1.5E–03 |
| Nickel | 2.0E–01 | 6.0E–01 | 4.1E–05 | 1.8E–04 |
| Selenium | 1.1E–02 | 3.4E–02 | 3.1E–06 | 1.2E–05 |
| 4,4'–DDE | 4.8E–04 | 1.4E–03 | 1.9E–07 | 1.6E–06 |
| 4,4'–DDT | 2.7E–04 | 8.2E–04 | 1.0E–07 | 9.9E–07 |
| 2–Methylnaphthalene | 3.6E–03 | 6.7E–03 | 3.3E–07 | 1.8E–06 |
| Bis(2–ethylhexyl)phthalate | 1.0E–02 | 3.5E–02 | 1.9E–06 | 1.2E–05 |
| Dibenzofuran | 1.1E–03 | 2.3E–03 | 1.2E–07 | 6.5E–07 |
| Fluoranthene | 2.5E–03 | 4.6E–03 | 2.3E–07 | 1.3E–06 |
| Naphthalene | 3.5E–03 | 6.5E–03 | 3.3E–07 | 1.8E–06 |
| Phenanthrene | 2.3E–03 | 4.3E–03 | 2.2E–07 | 1.2E–06 |
| Pyrene | 3.3E–03 | 6.2E–03 | 3.1E–07 | 1.7E–06 |
| Chloroform | 2.2E–06 | 9.5E–06 | 4.0E–10 | 2.6E–09 |
| Ethylbenzene | 5.9E–06 | 2.6E–05 | 1.1E–09 | 6.9E–09 |
| Tetrachloroethylene | 7.3E–06 | 3.2E–05 | 1.3E–09 | 8.7E–09 |
| Toluene | 9.1E–06 | 4.0E–05 | 1.6E–09 | 1.1E–08 |
| Trichlorofluoromethane | 4.2E–05 | 1.8E–04 | 7.6E–09 | 4.9E–08 |
| Xylenes | 7.1E–05 | 3.1E–04 | 1.3E–08 | 8.4E–08 |

[d] Calculated by summing the products of individual prey type concentrations and percent in diet, multiplying by the ingestion rate, and dividing by body weight (Table 9–27).

Table O−2.1
Exposure Parameters and Assumptions for Terrestrial Receptors [e]
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| Representative Wildlife Species | | Percent Prey in Diet: Inverts | Plants | Small Mammals | Small Birds | Soil | Home Range (acres) | ED [f] | Site Foraging Frequency [g] | Food Ingestion Rate (kg/day) | Body Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *White−footed mouse* | (Herb. mammal) | 10% | 88% | 0% | 0% | 2% | 0.147 | 1 | 1.00E+00 | 0.0049 | 0.040 |
| *American robin* | (Omn. bird) | 33% | 57% | 0% | 0% | 10% | 0.48 | 0.75 | 1.00E+00 | 0.011 | 0.077 |
| *Red fox* | (Predatory mammal) | 20% | 10% | 57% | 10% | 3% | 1,727 | 1 | 2.90E−04 | 0.24 | 4.69 |
| *Barred owl* | (Predatory bird) | 3% | 0% | 80% | 12% | 5% | 565 | 1 | 8.85E−04 | 0.047 | 0.72 |

NOTES:

| | |
|---|---|
| SITE AREA: | 0.5 acres |

[e] Documentation of exposure parameters presented in: Appendix O−1, Table O−1.1

[f] ED = Exposure Duration (percentage of year receptor is expected to be found at study area). ED is assumed to be 1 for this risk assessment.

[g] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0)).

Table O-2.2
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of Average Exposure Concentrations of CPCs in Food and Surface Soil
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| EXPOSURE CONCENTRATION DATA | | ESTIMATED CONTAMINANT CONCENTRATIONS IN PRIMARY FOOD ITEMS | | | | BAF VALUES FOR OTHER FOOD ITEMS | |
|---|---|---|---|---|---|---|---|
| ANALYTE | AVERAGE CONCENTRATION (mg/kg) | Invert BAF[a] | Concentration in Invertebrate Tissue[b] (mg/kg) | Plant BAF[a] | Concentration in Plant Tissue[c] (mg/kg) | Small Mammal BAF[a] | Small Bird BAF[a] |
| Arsenic | 1.5E+01 | 6.6E-03 | 9.6E-02 | 3.0E-01 | 4.3E+00 | 1.0E-01 | 6.0E-03 |
| Cobalt | 4.6E+00 | 1.0E+00 | 4.6E+00 | 4.0E-03 | 1.8E-02 | 1.0E+00 | 1.0E+00 |
| Copper | 1.1E+01 | 1.6E-01 | 1.8E+00 | 7.8E-01 | 8.6E+00 | 6.0E-01 | 6.0E-01 |
| Manganese | 2.8E+02 | 2.0E-02 | 5.6E+00 | 5.0E-02 | 1.4E+01 | 2.0E-02 | 2.0E-02 |
| Nickel | 1.7E+01 | 2.3E-01 | 3.9E+00 | 1.2E-02 | 2.0E-01 | 3.0E-01 | 3.0E-01 |
| Selenium | 2.8E-01 | 7.6E-01 | 2.1E-01 | 9.0E-03 | 2.5E-03 | 7.5E-01 | 5.1E-01 |
| 4,4'-DDE | 7.0E-03 | 1.7E+00 | 1.2E-02 | 1.0E-02 | 7.0E-05 | 1.2E+00 | 2.9E+00 |
| 4,4'-DDT | 8.0E-03 | 5.7E-01 | 4.6E-03 | 1.0E-02 | 8.0E-05 | 1.2E+00 | 2.9E+00 |
| 2-Methylnaphthalene | 2.0E-01 | 5.0E-02 | 1.0E-02 | 4.9E-02 | 9.9E-03 | 1.5E-01 | 1.5E-01 |
| Bis(2-ethylhexyl)phthalate | 1.6E+00 | 5.0E-02 | 8.0E-02 | 7.6E-03 | 1.2E-02 | 2.4E-01 | 2.4E-01 |
| Dibenzofuran | 8.3E-02 | 5.0E-02 | 4.2E-03 | 3.3E-02 | 2.7E-03 | 1.5E-01 | 1.5E-01 |
| Fluoranthene | 1.6E-01 | 5.0E-02 | 8.0E-03 | 4.9E-02 | 7.9E-03 | 1.5E-01 | 1.5E-01 |
| Naphthalene | 2.1E-01 | 5.0E-02 | 1.1E-02 | 4.9E-02 | 1.0E-02 | 1.5E-01 | 1.5E-01 |
| Phenanthrene | 1.5E-01 | 5.0E-02 | 7.5E-03 | 4.9E-02 | 7.4E-03 | 1.5E-01 | 1.5E-01 |
| Pyrene | 1.8E-01 | 5.0E-02 | 9.0E-03 | 4.9E-02 | 8.9E-03 | 1.5E-01 | 1.5E-01 |
| Chloroform | 5.3E-04 | NA | NA | NA | NA | NA | NA |
| Ethylbenzene | 1.2E-03 | NA | NA | NA | NA | NA | NA |
| Tetrachloroethylene | 9.2E-04 | NA | NA | NA | NA | NA | NA |
| Toluene | 1.7E-03 | NA | NA | NA | NA | NA | NA |
| Trichlorofluoromethane | 7.5E-03 | NA | NA | NA | NA | NA | NA |
| Xylenes | 6.4E-03 | NA | NA | NA | NA | NA | NA |

CPC = Contaminant of Potential Concern
[a] Bioaccumulation data presented in: Appendix O-1, Table O-1.2
[b] CPC concentration s in invertebrate tissue equals the invertebrate BAF multiplied by the average exposure concentration of the CPC.
[c] CPC concentrations in plant tissue equals the plant BAF multiplied by the average exposure concentration of the CPC.

Table O–2.2
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of Average Exposure Concentrations of CPCs in Food and Surface Soil
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

**POTENTIAL DIETARY EXPOSURE (mg/kgBW/day) [d]**

| ANALYTE | *White–footed mouse* | *American robin* | *Red fox* | *Barred owl* |
|---|---|---|---|---|
| Arsenic | 5.1E–01 | 4.2E–01 | 1.7E–05 | 6.2E–05 |
| Cobalt | 7.0E–02 | 2.1E–01 | 2.3E–05 | 1.2E–04 |
| Copper | 9.7E–01 | 7.0E–01 | 6.7E–05 | 3.9E–04 |
| Manganese | 2.3E+00 | 4.1E+00 | 1.7E–04 | 8.7E–04 |
| Nickel | 1.1E–01 | 3.3E–01 | 2.3E–05 | 1.0E–04 |
| Selenium | 3.6E–03 | 1.1E–02 | 1.0E–06 | 3.9E–06 |
| 4,4'–DDE | 1.7E–04 | 4.9E–04 | 6.6E–08 | 5.8E–07 |
| 4,4'–DDT | 8.4E–05 | 2.5E–04 | 3.2E–08 | 3.1E–07 |
| 2–Methylnaphthalene | 1.7E–03 | 3.1E–03 | 1.6E–07 | 8.4E–07 |
| Bis(2–ethylhexyl)phthalate | 6.2E–03 | 2.1E–02 | 1.1E–06 | 6.9E–06 |
| Dibenzofuran | 5.5E–04 | 1.2E–03 | 6.1E–08 | 3.4E–07 |
| Fluoranthene | 1.3E–03 | 2.5E–03 | 1.2E–07 | 6.7E–07 |
| Naphthalene | 1.8E–03 | 3.3E–03 | 1.6E–07 | 8.8E–07 |
| Phenanthrene | 1.3E–03 | 2.3E–03 | 1.2E–07 | 6.3E–07 |
| Pyrene | 1.5E–03 | 2.8E–03 | 1.4E–07 | 7.6E–07 |
| Chloroform | 1.3E–06 | 5.7E–06 | 2.4E–10 | 1.5E–09 |
| Ethylbenzene | 2.9E–06 | 1.3E–05 | 5.3E–10 | 3.5E–09 |
| Tetrachloroethylene | 2.3E–06 | 9.9E–06 | 4.1E–10 | 2.7E–09 |
| Toluene | 4.2E–06 | 1.8E–05 | 7.6E–10 | 4.9E–09 |
| Trichlorofluoromethane | 1.8E–05 | 8.0E–05 | 3.3E–09 | 2.2E–08 |
| Xylenes | 1.6E–05 | 6.9E–05 | 2.8E–09 | 1.8E–08 |

[d] Calculated by summing the products of individual prey type concentrations and percent in diet, multiplying by the ingestion rate, and dividing by body weight (Table 9–27).

Table O−2.2
Exposure Parameters and Assumptions for Terrestrial Receptors [e]
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| Representative Wildlife Species | | Percent Prey in Diet: Inverts | Plants | Small Mammals | Small Birds | Soil | Home Range (acres) | ED [f] | Site Foraging Frequency [g] | Food Ingestion Rate (kg/day) | Body Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *White−footed mouse* | (Herb. mammal) | 10% | 88% | 0% | 0% | 2% | 0.147 | 1 | 1.00E+00 | 0.0049 | 0.040 |
| *American robin* | (Omn. bird) | 33% | 57% | 0% | 0% | 10% | 0.48 | 0.75 | 1.00E+00 | 0.011 | 0.077 |
| *Red fox* | (Predatory mammal) | 20% | 10% | 57% | 10% | 3% | 1,727 | 1 | 2.90E−04 | 0.24 | 4.69 |
| *Barred owl* | (Predatory bird) | 3% | 0% | 80% | 12% | 5% | 565 | 1 | 8.85E−04 | 0.047 | 0.72 |

NOTES:

| | |
|---|---|
| SITE AREA: | 0.5 acres |

[e] Documentation of exposure parameters presented in: Appendix O−1, Table O−1.1

[f] BD = Exposure Duration (percentage of year receptor is expected to be found at study area). ED is assumed to be 1 for this risk assessment.

[g] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0)).

Table O-[illegible]
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of RME Concentrations of CPCs in Food and Surface Soil
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| EXPOSURE CONCENTRATION DATA | | ESTIMATED CONTAMINANT CONCENTRATIONS IN PRIMARY FOOD ITEMS | | | | BAF VALUES FOR OTHER FOOD ITEMS | |
|---|---|---|---|---|---|---|---|
| ANALYTE | RME CONCENTRATION (mg/kg) | Invert BAF [a] | Concentration in Invertebrate Tissue [b] (mg/kg) | Plant BAF [a] | Concentration in Plant Tissue [c] (mg/kg) | Small Mammal BAF [a] | Small Bird BAF [a] |
| Antimony | 1.6E+00 | 5.0E-02 | 8.1E-02 | 4.0E-02 | 6.5E-02 | 5.0E-02 | 5.0E-02 |
| Copper | 3.9E+01 | 1.6E-01 | 6.3E+00 | 7.8E-01 | 3.1E+01 | 6.0E-01 | 6.0E-01 |
| Lead | 3.2E+02 | 7.8E-02 | 2.5E+01 | 9.0E-03 | 2.9E+00 | 1.5E-02 | 1.5E-02 |
| Selenium | 4.4E+00 | 7.6E-01 | 3.3E+00 | 9.0E-03 | 4.0E-02 | 7.5E-01 | 5.1E-01 |
| 4,4'-DDE | 3.4E-02 | 3.3E+00 | 1.1E-01 | 1.0E-02 | 3.4E-04 | 1.2E+00 | 2.9E+00 |
| Aroclor-1260 | 3.6E+00 | 5.8E+00 | 2.1E+01 | 1.2E-01 | 4.3E-01 | 3.8E+00 | 3.2E-01 |
| Dieldrin | 2.5E-02 | 5.5E+00 | 1.4E-01 | 1.7E-02 | 4.2E-04 | 1.5E+00 | 4.4E-01 |
| Di-n-butylphthalate | 7.7E-01 | 5.0E-02 | 3.9E-02 | 7.6E-03 | 5.9E-03 | 2.4E-01 | 2.4E-01 |
| Fluoranthene | 2.0E+00 | 5.0E-02 | 1.0E-01 | 4.9E-02 | 9.9E-02 | 1.5E-01 | 1.5E-01 |
| Phenanthrene | 1.0E+00 | 5.0E-02 | 5.0E-02 | 4.9E-02 | 4.9E-02 | 1.5E-01 | 1.5E-01 |
| Pyrene | 2.0E+00 | 5.0E-02 | 1.0E-01 | 4.9E-02 | 9.9E-02 | 1.5E-01 | 1.5E-01 |
| Methylene chloride | 8.1E-03 | NA | NA | NA | NA | NA | NA |
| Tetrachloroethylene | 1.4E-03 | NA | NA | NA | NA | NA | NA |
| Toluene | 5.1E-03 | NA | NA | NA | NA | NA | NA |
| Trichlorofluoromethane | 7.2E-03 | NA | NA | NA | NA | NA | NA |
| 4,4'-DDD | 1.0E-02 | 3.3E+00 | 3.3E-02 | 1.0E-02 | 1.0E-04 | 1.2E+00 | 2.9E+00 |
| 4,4'-DDT | 1.8E-01 | 5.7E-01 | 1.0E-01 | 1.0E-02 | 1.8E-03 | 1.2E+00 | 2.9E+00 |
| 2-Methylnaphthylene | 3.8E-01 | 5.0E-02 | 1.9E-02 | 2.5E-02 | 9.6E-03 | 1.5E-01 | 1.5E-01 |
| Acenaphthylene | 2.6E-01 | 5.0E-02 | 1.3E-02 | 2.5E-02 | 6.6E-03 | 1.5E-01 | 1.5E-01 |
| Benzo(k)fluoranthene | 6.0E-01 | 5.0E-02 | 3.0E-02 | 2.5E-02 | 1.5E-02 | 1.5E-01 | 1.5E-01 |
| Chrysene | 7.1E-01 | 5.0E-02 | 3.5E-02 | 2.5E-02 | 1.8E-02 | 1.5E-01 | 1.5E-01 |
| Naphthalene | 3.0E-01 | 5.0E-02 | 1.5E-02 | 2.5E-02 | 7.6E-03 | 1.5E-01 | 1.5E-01 |
| 1,2-Dichloroethylene (cis and trans) | 6.9E-03 | NA | 0.0E+00 | NA | 0.0E+00 | NA | NA |
| Acetone | 6.7E-02 | NA | 0.0E+00 | NA | 0.0E+00 | NA | NA |
| Ethylbenzene | 5.9E-03 | NA | 0.0E+00 | NA | 0.0E+00 | NA | NA |
| Arsenic | 4.8E+01 | 6.6E-03 | 3.2E-01 | 3.0E-01 | 1.4E+01 | 1.0E-01 | 6.0E-03 |
| Barium | 1.1E+02 | 7.5E-03 | 7.9E-01 | 3.0E-02 | 3.2E+00 | 7.5E-03 | 7.5E-03 |
| Manganese | 2.7E+02 | 2.0E-02 | 5.5E+00 | 5.0E-02 | 1.4E+01 | 2.0E-02 | 2.0E-02 |
| Zinc | 1.5E+02 | 1.8E+00 | 2.7E+02 | 6.1E-01 | 9.2E+01 | 2.1E+00 | 2.1E+00 |

CPC = Contaminant of Potential Concern
[a] Bioaccumulation data presented in: Appendix O-1, Table O-1.2
[b] CPC concentration s in invertebrate tissue equals the invertebrate BAF multiplied by the RME soil concentration of the CPC.
[c] CPC concentrations in plant tissue equals the plant BAF multiplied by the RME soil concentration of the CPC.

Table O–2.3
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of RME Concentrations of CPCs in Food and Surface Soil
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

POTENTIAL DIETARY EXPOSURE (mg/kgBW/day) [d]

| ANALYTE | White-footed mouse | American robin | Raccoon | Barred owl | Short-tailed shrew |
|---|---|---|---|---|---|
| Antimony | 1.2E–02 | 1.5E–02 | 8.1E–06 | 3.0E–06 | 1.0E–02 |
| Copper | 3.5E+00 | 1.6E+00 | 9.8E–04 | 3.7E–04 | 5.5E–01 |
| Lead | 1.4E+00 | 2.8E+00 | 1.4E–03 | 5.9E–04 | 2.3E+00 |
| Selenium | 5.6E–02 | 1.0E–01 | 4.2E–05 | 2.7E–05 | 1.3E–01 |
| 4,4'–DDE | 1.5E–03 | 2.7E–03 | 1.0E–06 | 1.1E–06 | 4.0E–03 |
| Aroclor–1260 | 3.1E–01 | 5.0E–01 | 2.6E–04 | 4.4E–04 | 7.4E–01 |
| Dieldrin | 1.8E–03 | 3.2E–03 | 1.2E–06 | 1.2E–06 | 4.8E–03 |
| Di–n–butylphthalate | 3.0E–03 | 6.2E–03 | 3.3E–06 | 1.6E–06 | 4.8E–03 |
| Fluoranthene | 1.7E–02 | 1.9E–02 | 1.1E–05 | 4.1E–06 | 1.3E–02 |
| Phenanthrene | 8.4E–03 | 9.7E–03 | 5.3E–06 | 2.1E–06 | 6.4E–03 |
| Pyrene | 1.7E–02 | 1.9E–02 | 1.1E–05 | 4.1E–06 | 1.3E–02 |
| Methylene chloride | 2.0E–05 | 5.4E–05 | 3.0E–08 | 1.4E–08 | 3.6E–05 |
| Tetrachloroethylene | 3.4E–06 | 9.4E–06 | 5.3E–09 | 2.4E–09 | 6.2E–06 |
| Toluene | 1.2E–05 | 3.4E–05 | 1.9E–08 | 8.8E–09 | 2.2E–05 |
| Trichlorofluoromethane | 1.8E–05 | 4.8E–05 | 2.7E–08 | 1.2E–08 | 3.2E–05 |
| 4,4'–DDD | 4.4E–04 | 8.0E–04 | 3.0E–07 | 3.2E–07 | 1.2E–03 |
| 4,4'–DDT | 1.9E–03 | 3.5E–03 | 1.6E–06 | 1.5E–06 | 4.3E–03 |
| 2–Methylnaphthylene | 2.2E–03 | 3.3E–03 | 1.8E–06 | 7.7E–07 | 2.4E–03 |
| Acenaphthylene | 1.5E–03 | 2.3E–03 | 1.2E–06 | 5.2E–07 | 1.6E–03 |
| Benzo(k)fluoranthene | 3.5E–03 | 5.3E–03 | 2.8E–06 | 1.2E–06 | 3.8E–03 |
| Chrysene | 4.1E–03 | 6.2E–03 | 3.3E–06 | 1.4E–06 | 4.4E–03 |
| Naphthalene | 1.7E–03 | 2.6E–03 | 1.4E–06 | 6.0E–07 | 1.9E–03 |
| 1,2–Dichloroethylene (cis and trans) | 1.7E–05 | 4.6E–05 | 2.6E–08 | 1.2E–08 | 3.0E–05 |
| Acetone | 1.6E–04 | 4.5E–04 | 2.5E–07 | 1.2E–07 | 3.0E–04 |
| Ethylbenzene | 1.4E–05 | 4.0E–05 | 2.2E–08 | 1.0E–08 | 2.6E–05 |
| Arsenic | 1.7E+00 | 8.8E–01 | 5.2E–04 | 1.1E–04 | 3.0E–01 |
| Barium | 6.1E–01 | 8.5E–01 | 4.8E–04 | 1.8E–04 | 5.1E–01 |
| Manganese | 2.2E+00 | 2.5E+00 | 1.4E–03 | 4.9E–04 | 1.5E+00 |
| Zinc | 1.4E+01 | 1.0E+01 | 6.0E–03 | 6.6E–03 | 1.0E+01 |

[d] Calculated by summing the products of individual prey type concentrations and percent in diet, multiplying by the ingestion rate, and dividing by body weight (Table 9–27).

Table O–2.3
Exposure Parameters and Assumptions for Terrestrial Receptors [e]
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| Representative Wildlife Species | | Percent Prey in Diet: Inverts | Plants | Small Mammals | Small Birds | Soil | Home Range (acres) | ED [f] | Site Foraging Frequency [g] | Food Ingestion Rate (kg/day) | Body Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *White–footed mouse* | (Herb. mammal) | 10% | 88% | 0% | 0% | 2% | 0.147 | 1 | 1.00E+00 | 0.0049 | 0.040 |
| *American robin* | (Omn. bird) | 33% | 57% | 0% | 0% | 10% | 0.48 | 0.75 | 6.25E–01 | 0.011 | 0.077 |
| *Raccoon* | (Predatory mammal) | 14% | 56% | 19% | 2% | 9% | 385 | 1 | 7.79E–04 | 0.214 | 3.99 |
| *Barred owl* | (Predatory bird) | 3% | 0% | 80% | 12% | 5% | 565 | 1 | 5.31E–04 | 0.047 | 0.72 |
| *Short–tailed shrew* | (Omn. mammal) | 78% | 12% | 0% | 0% | 10% | 0.96 | 1 | 3.12E–01 | 0.0024 | 0.017 |

NOTES:

| | |
|---|---|
| SITE AREA: | 0.3 acres |

[e] Documentation of exposure parameters presented in: Appendix O–1, Table O–1.1
[f] ED = Exposure Duration (percentage of year receptor is expected to be found at study area). ED is assumed to be 1 for this risk assessment.
[g] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0)).

Table O−2.4
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of Average Concentrations of CPCs in Food and Surface Soil
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| EXPOSURE CONCENTRATION DATA | | ESTIMATED CONTAMINANT CONCENTRATIONS IN PRIMARY FOOD ITEMS | | | | BAF VALUES FOR OTHER FOOD ITEMS | |
|---|---|---|---|---|---|---|---|
| ANALYTE | Average CONCENTRATION (mg/kg) | Invert BAF [a] | Concentration in Invertebrate Tissue [b] (mg/kg) | Plant BAF [a] | Concentration in Plant Tissue [c] (mg/kg) | Small Mammal BAF [a] | Small Bird BAF [a] |
| Antimony | 1.6E+00 | 5.0E−02 | 8.1E−02 | 4.0E−02 | 6.5E−02 | 5.0E−02 | 5.0E−02 |
| Copper | 1.6E+01 | 1.6E−01 | 2.5E+00 | 7.8E−01 | 1.2E+01 | 6.0E−01 | 6.0E−01 |
| Lead | 1.4E+02 | 7.8E−02 | 1.1E+01 | 9.0E−03 | 1.3E+00 | 1.5E−02 | 1.5E−02 |
| Selenium | 1.9E+00 | 7.6E−01 | 1.4E+00 | 9.0E−03 | 1.7E−02 | 7.5E−01 | 5.1E−01 |
| 4,4'−DDE | 1.3E−02 | 3.3E+00 | 4.3E−02 | 1.0E−02 | 1.3E−04 | 1.2E+00 | 2.9E+00 |
| Aroclor−1260 | 6.3E−01 | 5.8E+00 | 3.6E+00 | 1.2E−01 | 7.5E−02 | 3.8E+00 | 3.2E−01 |
| Dieldrin | 9.9E−03 | 5.5E+00 | 5.4E−02 | 1.7E−02 | 1.7E−04 | 1.5E+00 | 4.4E−01 |
| Di−n−butylphthalate | 3.3E−01 | 5.0E−02 | 1.6E−02 | 7.6E−03 | 2.5E−03 | 2.4E−01 | 2.4E−01 |
| Fluoranthene | 5.8E−01 | 5.0E−02 | 2.9E−02 | 4.9E−02 | 2.9E−02 | 1.5E−01 | 1.5E−01 |
| Phenanthrene | 3.9E−01 | 5.0E−02 | 1.9E−02 | 4.9E−02 | 1.9E−02 | 1.5E−01 | 1.5E−01 |
| Pyrene | 6.2E−01 | 5.0E−02 | 3.1E−02 | 4.9E−02 | 3.1E−02 | 1.5E−01 | 1.5E−01 |
| Methylene Chloride | 6.8E−03 | NA | NA | NA | NA | NA | NA |
| Tetrachloroethylene | 9.0E−04 | NA | NA | NA | NA | NA | NA |
| Toluene | 1.7E−03 | NA | NA | NA | NA | NA | NA |
| Trichlorofluoromethane | 4.8E−03 | NA | NA | NA | NA | NA | NA |
| 4,4'−DDD | 7.1E−03 | 3.3E+00 | 2.3E−02 | 1.0E−02 | 7.1E−05 | 1.2E+00 | 2.9E+00 |
| 4,4'−DDT | 3.9E−02 | 5.7E−01 | 2.2E−02 | 1.0E−02 | 3.9E−04 | 1.2E+00 | 2.9E+00 |
| 2−Methylnaphthalene | 1.8E−01 | 5.0E−02 | 8.8E−03 | 2.5E−02 | 4.5E−03 | 1.5E−01 | 1.5E−01 |
| Acenaphthylene | 1.3E−01 | 5.0E−02 | 6.5E−03 | 2.5E−02 | 3.3E−03 | 1.5E−01 | 1.5E−01 |
| Benzo[k]fluoranthene | 2.7E−01 | 5.0E−02 | 1.3E−02 | 2.5E−02 | 6.7E−03 | 1.5E−01 | 1.5E−01 |
| Chrysene | 3.9E−01 | 5.0E−02 | 1.9E−02 | 2.5E−02 | 9.8E−03 | 1.5E−01 | 1.5E−01 |
| Naphthalene | 1.4E−01 | 5.0E−02 | 7.2E−03 | 2.5E−02 | 3.6E−03 | 1.5E−01 | 1.5E−01 |
| 1,2−Dichloroethylene (cis and trans) | 3.6E−03 | NA | 0.0E+00 | NA | 0.0E+00 | NA | NA |
| Acetone | 2.9E−02 | NA | 0.0E+00 | NA | 0.0E+00 | NA | NA |
| Ethylbenzene | 3.0E−03 | NA | 0.0E+00 | NA | 0.0E+00 | NA | NA |
| Arsenic | 2.4E+01 | 6.6E−03 | 1.6E−01 | 3.0E−01 | 7.2E+00 | 1.0E−01 | 6.0E−03 |
| Barium | 4.8E+01 | 7.5E−03 | 3.6E−01 | 3.0E−02 | 1.4E+00 | 7.5E−03 | 7.5E−03 |
| Manganese | 1.5E+02 | 2.0E−02 | 3.0E+00 | 5.0E−02 | 7.4E+00 | 2.0E−02 | 2.0E−02 |
| Zinc | 5.5E+01 | 1.8E+00 | 9.9E+01 | 6.1E−01 | 3.4E+01 | 2.1E+00 | 2.1E+00 |

CPC = Contaminant of Potential Concern
[a] Bioaccumulation data presented in: Appendix O−1, Table O−1.2
[b] CPC concentrations in invertebrate tissue equals the invertebrate BAF multiplied by the average soil concentration of the CPC.
[c] CPC concentrations in plant tissue equals the plant BAF multiplied by the average soil concentration of the CPC.

Table O–2.4
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of Average Concentrations of CPCs in Food and Surface Soil
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

**POTENTIAL DIETARY EXPOSURE (mg/kgBW/day) [d]**

| ANALYTE | *White–footed mouse* | *American robin* | *Raccoon* | *Barred owl* | *Short–tailed shrew* |
|---|---|---|---|---|---|
| Antimony | 1.2E–02 | 1.5E–02 | 8.1E–06 | 3.0E–06 | 1.0E–02 |
| Copper | 1.4E+00 | 6.3E–01 | 3.9E–04 | 1.5E–04 | 2.2E–01 |
| Lead | 6.3E–01 | 1.3E+00 | 6.3E–04 | 2.6E–04 | 1.0E+00 |
| Selenium | 2.4E–02 | 4.5E–02 | 1.8E–05 | 1.2E–05 | 5.8E–02 |
| 4,4'–DDE | 5.8E–04 | 1.0E–03 | 4.0E–07 | 4.2E–07 | 1.5E–03 |
| Aroclor–1260 | 5.4E–02 | 8.7E–02 | 4.6E–05 | 7.7E–05 | 1.3E–01 |
| Dieldrin | 7.1E–04 | 1.3E–03 | 4.8E–07 | 4.9E–07 | 1.9E–03 |
| Di–n–butylphthalate | 1.3E–03 | 2.7E–03 | 1.4E–06 | 6.9E–07 | 2.0E–03 |
| Fluoranthene | 4.9E–03 | 5.7E–03 | 3.1E–06 | 1.2E–06 | 3.7E–03 |
| Phenanthrene | 3.3E–03 | 3.8E–03 | 2.1E–06 | 8.0E–07 | 2.5E–03 |
| Pyrene | 5.2E–03 | 6.1E–03 | 3.3E–06 | 1.3E–06 | 4.0E–03 |
| Methylene Chloride | 1.7E–05 | 4.6E–05 | 2.6E–08 | 1.2E–08 | 3.0E–05 |
| Tetrachloroethylene | 2.2E–06 | 6.0E–06 | 3.4E–09 | 1.6E–09 | 4.0E–06 |
| Toluene | 4.2E–06 | 1.1E–05 | 6.4E–09 | 2.9E–09 | 7.5E–06 |
| Trichlorofluoromethane | 1.2E–05 | 3.2E–05 | 1.8E–08 | 8.3E–09 | 2.1E–05 |
| 4,4'–DDD | 3.1E–04 | 5.7E–04 | 2.2E–07 | 2.3E–07 | 8.4E–04 |
| 4,4'–DDT | 4.1E–04 | 7.6E–04 | 3.4E–07 | 3.2E–07 | 9.3E–04 |
| 2–Methylnaphthalene | 1.0E–03 | 1.5E–03 | 8.3E–07 | 3.5E–07 | 1.1E–03 |
| Acenaphthylene | 7.5E–04 | 1.1E–03 | 6.1E–07 | 2.6E–07 | 8.1E–04 |
| Benzo[k]fluoranthene | 1.5E–03 | 2.3E–03 | 1.3E–06 | 5.4E–07 | 1.7E–03 |
| Chrysene | 2.2E–03 | 3.4E–03 | 1.8E–06 | 7.8E–07 | 2.4E–03 |
| Naphthalene | 8.3E–04 | 1.3E–03 | 6.8E–07 | 2.9E–07 | 9.0E–04 |
| 1,2–Dichloroethylene (cis and trans) | 8.8E–06 | 2.4E–05 | 1.4E–08 | 6.2E–09 | 1.6E–05 |
| Acetone | 7.1E–05 | 1.9E–04 | 1.1E–07 | 5.0E–08 | 1.3E–04 |
| Ethylbenzene | 7.3E–06 | 2.0E–05 | 1.1E–08 | 5.2E–09 | 1.3E–05 |
| Arsenic | 8.4E–01 | 4.4E–01 | 2.6E–04 | 5.3E–05 | 1.5E–01 |
| Barium | 2.8E–01 | 3.8E–01 | 2.2E–04 | 8.4E–05 | 2.3E–01 |
| Manganese | 1.2E+00 | 1.3E+00 | 7.5E–04 | 2.7E–04 | 8.0E–01 |
| Zinc | 5.0E+00 | 3.8E+00 | 2.2E–03 | 2.4E–03 | 3.8E+00 |

[d] Calculated by summing the products of individual prey type concentrations and percent in diet, multiplying by the ingestion rate, and dividing by body weight (Table 9–27).

Table O–2.4
Exposure Parameters and Assumptions for Terrestrial Receptors [e]
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| Representative Wildlife Species | | Percent Prey in Diet: Inverts | Plants | Small Mammals | Small Birds | Soil | Home Range (acres) | ED [f] | Site Foraging Frequency [g] | Food Ingestion Rate (kg/day) | Body Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *White–footed mouse* | (Herb. mammal) | 10% | 88% | 0% | 0% | 2% | 0.147 | 1 | 1.00E+00 | 0.0049 | 0.040 |
| *American robin* | (Omn. bird) | 33% | 57% | 0% | 0% | 10% | 0.48 | 0.75 | 6.25E–01 | 0.011 | 0.077 |
| *Raccoon* | (Predatory mammal) | 14% | 56% | 19% | 2% | 9% | 385 | 1 | 7.79E–04 | 0.214 | 3.99 |
| *Barred owl* | (Predatory bird) | 3% | 0% | 80% | 12% | 5% | 565 | 1 | 5.31E–04 | 0.047 | 0.72 |
| *Short–tailed shrew* | (Omn. mammal) | 78% | 12% | 0% | 0% | 10% | 0.96 | 1 | 3.12E–01 | 0.0024 | 0.017 |

NOTES:

| | |
|---|---|
| SITE AREA: | 0.3 acres |

[e] Documentation of exposure parameters presented in: Appendix O–1, Table O–1.1

[f] ED = Exposure Duration (percentage of year receptor is expected to be found at study area). ED is assumed to be 1 for this risk assessment.

[g] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0)).

Table O-2.5
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of RME Concentrations of CPCs in Food and Surface Soil
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| EXPOSURE CONCENTRATION DATA | | ESTIMATED CONTAMINANT CONCENTRATIONS IN PRIMARY FOOD ITEMS | | | | BAF VALUES FOR OTHER FOOD ITEMS | |
|---|---|---|---|---|---|---|---|
| ANALYTE | RME CONCENTRATION (mg/kg) | Invert BAF [a] | Concentration in Invertebrate Tissue [b] (mg/kg) | Plant BAF [a] | Concentration in Plant Tissue [c] (mg/kg) | Small Mammal BAF [a] | Small Bird BAF [a] |
| Arsenic | 4.1E+01 | 6.6E-03 | 2.7E-01 | 3.0E-01 | 1.2E+01 | 1.0E-01 | 6.0E-03 |
| Barium | Not a CPC | 7.5E-03 | 0.0E+00 | 3.0E-02 | 0.0E+00 | 7.5E-03 | 7.5E-03 |
| Cadmium | 1.5E+00 | 1.4E+00 | 2.1E+00 | 3.3E+01 | 5.0E+01 | 2.1E+00 | 3.8E-01 |
| Copper | Not a CPC | 1.6E-01 | 0.0E+00 | 7.8E-01 | 0.0E+00 | 6.0E-01 | 6.0E-01 |
| Lead | Not a CPC | 7.8E-02 | 0.0E+00 | 9.0E-03 | 0.0E+00 | 1.5E-02 | 1.5E-02 |
| Manganese | 5.5E+02 | 2.0E-02 | 1.1E+01 | 5.0E-02 | 2.7E+01 | 2.0E-02 | 2.0E-02 |
| Zinc | Not a CPC | 1.8E+00 | 0.0E+00 | 6.1E-01 | 0.0E+00 | 2.1E+00 | 2.1E+00 |
| 4,4'-DDE | 8.1E-03 | 1.7E+00 | 1.3E-02 | 1.0E-02 | 8.1E-05 | 1.2E+00 | 2.9E+00 |
| 4,4'-DDT | 2.5E-02 | 5.7E-01 | 1.4E-02 | 1.0E-02 | 2.5E-04 | 1.2E+00 | 2.9E+00 |
| Aroclor-1242 | Not a CPC | 5.8E+00 | 0.0E+00 | 1.2E-01 | 0.0E+00 | 3.8E+00 | 3.2E-01 |
| Aroclor-1260 | 4.7E-01 | 5.8E+00 | 2.7E+00 | 1.2E-01 | 5.7E-02 | 3.8E+00 | 3.2E-01 |
| Fluoranthene | 1.4E-01 | 5.0E-02 | 7.0E-03 | 4.9E-02 | 6.9E-03 | 1.5E-01 | 1.5E-01 |
| Naphthalene | 4.8E-02 | 5.0E-02 | 2.4E-03 | 4.9E-02 | 2.4E-03 | 1.5E-01 | 1.5E-01 |
| Phenanthrene | 1.1E-01 | 5.0E-02 | 5.5E-03 | 4.9E-02 | 5.4E-03 | 1.5E-01 | 1.5E-01 |
| Pyrene | 1.5E-01 | 5.0E-02 | 7.5E-03 | 4.9E-02 | 7.4E-03 | 1.5E-01 | 1.5E-01 |
| Tetrachloroethylene | Not a CPC | NA | NA | NA | NA | NA | NA |
| Toluene | 3.0E-03 | NA | NA | NA | NA | NA | NA |
| Selenium | 1.6E+00 | 7.6E-01 | 1.2E+00 | 9.0E-03 | 1.4E-02 | 7.5E-01 | 5.1E-01 |
| 4,4'-DDD | 2.7E-01 | 3.3E+00 | 8.9E-01 | 1.0E-02 | 2.7E-03 | 1.2E+00 | 2.9E+00 |
| alpha-Chlordane | 2.8E-03 | 1.6E+00 | 4.5E-03 | 5.1E-03 | 1.4E-05 | 5.5E-01 | 1.8E+00 |
| gamma-Chlordane | 2.8E-03 | 1.6E+00 | 4.5E-03 | 5.1E-03 | 1.4E-05 | 5.5E-01 | 1.8E+00 |
| 1,2-Dichlorobenzene | 3.5E-01 | 5.0E-02 | 1.7E-02 | 7.3E-02 | 2.6E-02 | 1.5E-01 | 1.5E-01 |
| 1,4-Dichlorobenzene | 4.8E-01 | 5.0E-02 | 2.4E-02 | 7.3E-02 | 3.5E-02 | 1.5E-01 | 1.5E-01 |
| Bis(2-ethylhexyl)phthalate | Not a CPC | 5.0E-02 | 0.0E+00 | 7.6E-03 | 0.0E+00 | 2.4E-01 | 2.4E-01 |
| 1,1,1-Trichloroethane | Not a CPC | NA | 0.0E+00 | NA | 0.0E+00 | NA | NA |
| Chlorobenzene | 1.2E-02 | NA | 0.0E+00 | NA | 0.0E+00 | NA | NA |
| Trichloroethylene | 4.2E-03 | NA | 0.0E+00 | NA | 0.0E+00 | NA | NA |
| Xylenes | Not a CPC | NA | 0.0E+00 | NA | 0.0E+00 | NA | NA |

CPC = Contaminant of Potential Concern
[a] Bioaccumulation data presented in: Appendix O-1, Table O-1.2
[b] CPC concentration s in invertebrate tissue equals the invertebrate BAF multiplied by the RME soil concentration of the CPC.
[c] CPC concentrations in plant tissue equals the plant BAF multiplied by the RME soil concentration of the CPC.

Table O–2.5
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of RME Concentrations of CPCs in Food and Surface Soil
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

**POTENTIAL DIETARY EXPOSURE (mg/kgBW/day) [d]**

| ANALYTE | *White–footed mouse* | *American robin* | *Red fox* | *Barred owl* |
|---|---|---|---|---|
| Arsenic | 1.4E+00 | 5.0E–01 | 1.9E–05 | 7.0E–05 |
| Barium | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Cadmium | 5.4E+00 | 1.3E+00 | 3.4E–04 | 1.8E–03 |
| Copper | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Lead | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Manganese | 4.4E+00 | 3.3E+00 | 1.3E–04 | 6.6E–04 |
| Zinc | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| 4,4'–DDE | 1.9E–04 | 2.4E–04 | 2.7E–08 | 1.4E–07 |
| 4,4'–DDT | 2.6E–04 | 3.3E–04 | 3.4E–08 | 2.1E–07 |
| Aroclor–1242 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Aroclor–1260 | 4.1E–02 | 4.4E–02 | 7.7E–06 | 2.8E–05 |
| Fluoranthene | 1.2E–03 | 9.0E–04 | 4.3E–08 | 2.1E–07 |
| Naphthalene | 4.0E–04 | 3.1E–04 | 1.5E–08 | 7.2E–08 |
| Phenanthrene | 9.2E–04 | 7.1E–04 | 3.4E–08 | 1.7E–07 |
| Pyrene | 1.3E–03 | 9.7E–04 | 4.6E–08 | 2.3E–07 |
| Tetrachloroethylene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Toluene | 7.3E–06 | 1.3E–05 | 5.3E–10 | 3.5E–09 |
| Selenium | 2.0E–02 | 2.5E–02 | 2.2E–06 | 6.7E–06 |
| 4,4'–DDD | 1.2E–02 | 1.4E–02 | 1.7E–06 | 8.5E–06 |
| alpha–Chlordane | 6.4E–05 | 7.9E–05 | 7.4E–09 | 3.0E–08 |
| gamma–Chlordane | 6.4E–05 | 7.9E–05 | 7.4E–09 | 3.0E–08 |
| 1,2–Dichlorobenzene | 3.8E–03 | 2.5E–03 | 1.2E–07 | 5.5E–07 |
| 1,4–Dichlorobenzene | 5.3E–03 | 3.4E–03 | 1.6E–07 | 7.6E–07 |
| Bis(2–ethylhexyl)phthalate | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| 1,1,1–Trichloroethane | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Chlorobenzene | 2.9E–05 | 5.4E–05 | 2.1E–09 | 1.4E–08 |
| Trichloroethylene | 1.0E–05 | 1.9E–05 | 7.5E–10 | 4.9E–09 |
| Xylenes | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |

[d] Calculated by summing the products of individual prey type concentrations and percent in diet, multiplying by the ingestion rate, and dividing by body weight (Table 9–27).

Table O-2.5
Exposure Parameters and Assumptions for Terrestrial Receptors [e]
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| Representative Wildlife Species | | Percent Prey in Diet: Inverts | Plants | Small Mammals | Small Birds | Soil | Home Range (acres) | BD [f] | Site Foraging Frequency [g] | Food Ingestion Rate (kg/day) | Body Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *White-footed mouse* | (Herb. mammal) | 10% | 88% | 0% | 0% | 2% | 0.147 | 1 | 1.00E+00 | 0.0049 | 0.040 |
| *American robin* | (Omn. bird) | 33% | 57% | 0% | 0% | 10% | 0.48 | 0.75 | 4.17E-01 | 0.011 | 0.077 |
| *Red fox* | (Predatory mammal) | 20% | 10% | 57% | 10% | 3% | 1,727 | 1 | 1.16E-04 | 0.24 | 4.69 |
| *Barred owl* | (Predatory bird) | 3% | 0% | 80% | 12% | 5% | 565 | 1 | 3.54E-04 | 0.047 | 0.72 |

NOTES:

| | |
|---|---|
| SITE AREA: | 0.2 acres |

[e] Documentation of exposure parameters presented in: Appendix O-1, Table O-1.1

[f] BD = Exposure Duration (percentage of year receptor is expected to be found at study area). BD is assumed to be 1 for this risk assessment.

[g] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0)).

Table O-2.0
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of Average Exposure Concentrations of CPCs in Food and Surface Soil
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| EXPOSURE CONCENTRATION DATA | | ESTIMATED CONTAMINANT CONCENTRATIONS IN PRIMARY FOOD ITEMS | | | | BAF VALUES FOR OTHER FOOD ITEMS | |
|---|---|---|---|---|---|---|---|
| ANALYTE | AVERAGE CONCENTRATION (mg/kg) | Invert BAF[a] | Concentration in Invertebrate Tissue[b] (mg/kg) | Plant BAF[a] | Concentration in Plant Tissue[c] (mg/kg) | Small Mammal BAF[a] | Small Bird BAF[a] |
| Arsenic | 2.5E+01 | 6.6E-03 | 1.7E-01 | 3.0E-01 | 7.5E+00 | 1.0E-01 | 6.0E-03 |
| Barium | Not a CPC | 7.5E-03 | 0.0E+00 | 3.0E-02 | 0.0E+00 | 7.5E-03 | 7.5E-03 |
| Cadmium | 9.3E-01 | 1.4E+00 | 1.3E+00 | 3.3E+01 | 3.1E+01 | 2.1E+00 | 3.8E-01 |
| Copper | Not a CPC | 1.6E-01 | 0.0E+00 | 7.8E-01 | 0.0E+00 | 6.0E-01 | 6.0E-01 |
| Lead | Not a CPC | 7.8E-02 | 0.0E+00 | 9.0E-03 | 0.0E+00 | 1.5E-02 | 1.5E-02 |
| Manganese | 2.2E+00 | 2.0E-02 | 4.4E-02 | 5.0E-02 | 1.1E-01 | 2.0E-02 | 2.0E-02 |
| Zinc | Not a CPC | 1.8E+00 | 0.0E+00 | 6.1E-01 | 0.0E+00 | 2.1E+00 | 2.1E+00 |
| 4,4'-DDE | 8.1E-03 | 1.7E+00 | 1.3E-02 | 1.0E-02 | 8.1E-05 | 1.2E+00 | 2.9E+00 |
| 4,4'-DDT | 1.4E-02 | 5.7E-01 | 7.9E-03 | 1.0E-02 | 1.4E-04 | 1.2E+00 | 2.9E+00 |
| Aroclor-1242 | Not a CPC | 5.8E+00 | 0.0E+00 | 1.2E-01 | 0.0E+00 | 3.8E+00 | 3.2E-01 |
| Aroclor-1260 | 1.2E-01 | 5.8E+00 | 7.0E-01 | 1.2E-01 | 1.5E-02 | 3.8E+00 | 3.2E-01 |
| Fluoranthene | 1.4E-01 | 5.0E-02 | 7.0E-03 | 4.9E-02 | 6.9E-03 | 1.5E-01 | 1.5E-01 |
| Naphthalene | 4.8E-02 | 5.0E-02 | 2.4E-03 | 4.9E-02 | 2.4E-03 | 1.5E-01 | 1.5E-01 |
| Phenanthrene | 1.1E-01 | 5.0E-02 | 5.5E-03 | 4.9E-02 | 5.4E-03 | 1.5E-01 | 1.5E-01 |
| Pyrene | 1.5E-01 | 5.0E-02 | 7.5E-03 | 4.9E-02 | 7.4E-03 | 1.5E-01 | 1.5E-01 |
| Tetrachloroethylene | Not a CPC | NA | NA | NA | NA | NA | NA |
| Toluene | 1.4E-03 | NA | NA | NA | NA | NA | NA |
| Selenium | 4.8E-01 | 7.6E-01 | 3.6E-01 | 9.0E-03 | 4.3E-03 | 7.5E-01 | 5.1E-01 |
| 4,4'-DDD | 6.1E-02 | 3.3E+00 | 2.0E-01 | 1.0E-02 | 6.1E-04 | 1.2E+00 | 2.9E+00 |
| alpha-Chlordane | 2.1E-03 | 1.6E+00 | 3.4E-03 | 5.1E-03 | 1.1E-05 | 5.5E-01 | 1.8E+00 |
| gamma-Chlordane | 2.1E-03 | 1.6E+00 | 3.4E-03 | 5.1E-03 | 1.1E-05 | 5.5E-01 | 1.8E+00 |
| 1,2-Dichlorobenzene | 1.3E-01 | 5.0E-02 | 6.4E-03 | 7.3E-02 | 9.4E-03 | 1.5E-01 | 1.5E-01 |
| 1,4-Dichlorobenzene | 1.6E-01 | 5.0E-02 | 7.8E-03 | 7.3E-02 | 1.1E-02 | 1.5E-01 | 1.5E-01 |
| Chlorobenzene | 3.3E-03 | NA | NA | NA | NA | NA | NA |
| Trichloroethylene | 2.1E-03 | NA | NA | NA | NA | NA | NA |

CPC = Contaminant of Potential Concern
[a] Bioaccumulation data presented in: Appendix O-1, Table O-1.2
[b] CPC concentrations in invertebrate tissue equals the invertebrate BAF multiplied by the average exposure concentration of the CPC.
[c] CPC concentrations in plant tissue equals the plant BAF multiplied by the average exposure concentration of the CPC.

Table O–2.6
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of Average Exposure Concentrations of CPCs in Food and Surface Soil
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

**POTENTIAL DIETARY EXPOSURE (mg/kgBW/day) [d]**

| ANALYTE | *White–footed mouse* | *American robin* | *Red fox* | *Barred owl* |
|---|---|---|---|---|
| Arsenic | 8.7E–01 | 3.0E–01 | 1.1E–05 | 4.2E–05 |
| Barium | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Cadmium | 3.3E+00 | 8.0E–01 | 2.1E–04 | 1.1E–03 |
| Copper | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Lead | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Manganese | 1.8E–02 | 1.3E–02 | 5.2E–07 | 2.6E–06 |
| Zinc | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| 4,4'–DDE | 1.9E–04 | 2.4E–04 | 2.7E–08 | 1.4E–07 |
| 4,4'–DDT | 1.5E–04 | 1.8E–04 | 1.9E–08 | 1.2E–07 |
| Aroclor–1242 | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Aroclor–1260 | 1.0E–02 | 1.1E–02 | 2.0E–06 | 7.1E–06 |
| Fluoranthene | 1.2E–03 | 9.0E–04 | 4.3E–08 | 2.1E–07 |
| Naphthalene | 4.0E–04 | 3.1E–04 | 1.5E–08 | 7.2E–08 |
| Phenanthrene | 9.2E–04 | 7.1E–04 | 3.4E–08 | 1.7E–07 |
| Pyrene | 1.3E–03 | 9.7E–04 | 4.6E–08 | 2.3E–07 |
| Tetrachloroethylene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Toluene | 3.4E–06 | 6.3E–06 | 2.5E–10 | 1.6E–09 |
| Selenium | 6.1E–03 | 7.6E–03 | 6.6E–07 | 2.0E–06 |
| 4,4'–DDD | 2.7E–03 | 3.3E–03 | 3.8E–07 | 1.9E–06 |
| alpha–Chlordane | 4.7E–05 | 5.9E–05 | 5.5E–09 | 2.2E–08 |
| gamma–Chlordane | 4.7E–05 | 5.9E–05 | 5.5E–09 | 2.2E–08 |
| 1,2–Dichlorobenzene | 1.4E–03 | 9.1E–04 | 4.2E–08 | 2.0E–07 |
| 1,4–Dichlorobenzene | 1.7E–03 | 1.1E–03 | 5.2E–08 | 2.5E–07 |
| Chlorobenzene | 8.1E–06 | 1.5E–05 | 5.9E–10 | 3.8E–09 |
| Trichloroethylene | 5.1E–06 | 9.4E–06 | 3.7E–10 | 2.4E–09 |

[d] Calculated by summing the products of individual prey type concentrations and percent in diet, multiplying by the ingestion rate, and dividing by body weight (Table 9–27).

Table O-2.6
Exposure Parameters and Assumptions for Terrestrial Receptors [e]
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| Representative Wildlife Species | | Percent Prey in Diet: Inverts | Plants | Small Mammals | Small Birds | Soil | Home Range (acres) | ED [f] | Site Foraging Frequency [g] | Food Ingestion Rate (kg/day) | Body Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *White-footed mouse* | (Herb. mammal) | 10% | 88% | 0% | 0% | 2% | 0.147 | 1 | 1.00E+00 | 0.0049 | 0.040 |
| *American robin* | (Omn. bird) | 33% | 57% | 0% | 0% | 10% | 0.48 | 0.75 | 4.17E-01 | 0.011 | 0.077 |
| *Red fox* | (Predatory mammal) | 20% | 10% | 57% | 10% | 3% | 1,727 | 1 | 1.16E-04 | 0.24 | 4.69 |
| *Barred owl* | (Predatory bird) | 3% | 0% | 80% | 12% | 5% | 565 | 1 | 3.54E-04 | 0.047 | 0.72 |

NOTES:

| | |
|---|---|
| SITE AREA: | 0.2 acres |

[e] Documentation of exposure parameters presented in: Appendix O-1, Table O-1.1

[f] ED = Exposure Duration (percentage of year receptor is expected to be found at study area). ED is assumed to be 1 for this risk assessment.

[g] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0)).

Table O–2.7
Estimated Chronic Exposure to Semi–Aquatic Receptors from Ingestion of RME Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

**EXPOSURE CONCENTRATION DATA**

| CHEMICAL | RME SEDIMENT CONCENTRATION (mg/kg) | RME UNFILT. SURFACE WATER CONCENTRATION (mg/L) |
|---|---|---|
| Aluminum | 1.6E+04 | 1.5E+01 |
| Arsenic | 2.2E+02 | 2.0E–01 |
| Barium | 1.6E+02 | 5.5E–01 |
| Cadmium | Not a CPC | 2.5E–02 |
| Chromium | 4.9E+01 | 3.6E–02 |
| Cobalt | 2.6E+01 | Not a CPC |
| Copper | 2.0E+02 | 3.7E–01 |
| Lead | 4.1E+02 | 9.7E–01 |
| Manganese | 3.9E+03 | 4.3E–01 |
| Mercury | 3.6E–01 | 2.4E–04 |
| Nickel | 4.3E+01 | Not a CPC |
| Selenium | 7.7E+00 | 2.4E–03 |
| Vanadium | Not a CPC | 7.2E–02 |
| Zinc | 4.7E+02 | 7.1E–01 |
| 4,4'–DDD | 4.4E–01 | Not a CPC |
| 4,4'–DDE | 1.6E–01 | Not a CPC |
| 4,4'–DDT | 7.6E–02 | Not a CPC |
| Aroclor–1260 | 3.0E–01 | Not a CPC |
| Dieldrin | 4.6E–02 | Not a CPC |
| Benzo[k]fluoranthene | 3.0E+00 | Not a CPC |
| Bis(2–ethylhexyl)phthalate | Not a CPC | 2.4E–02 |
| Fluoranthene | 6.0E+00 | Not a CPC |
| Phenanthrene | 3.0E+00 | 5.2E–04 |
| Pyrene | 6.0E+00 | Not a CPC |
| 1,2–Dichloroethylenes (cis and trans) | Not a CPC | 2.6E–02 |
| Acetone | 3.1E–01 | Not a CPC |
| Methylene chloride | 1.5E–01 | 4.1E–03 |
| Tetrachloroethylene | 7.8E–02 | 1.8E–03 |
| Toluene | 2.0E–02 | 1.1E–03 |
| Trichlorofluoromethane | 7.6E–02 | Not a CPC |

**ESTIMATED TISSUE LEVELS IN PRIMARY PREY ITEMS**

| Aquatic Organism BCF [a] | Aquatic Organism BAF [a] | Aq. Org. Tissue Level (mg/kg) | Aquatic Plant BAF [a] | Raccoon Tissue Exposure (mg/kg) | Raccoon Tissue Exposure (mg/kg) |
|---|---|---|---|---|---|
| <300 | 7.5E–02 | 1.2E+03 | 6.0E–03 | 1.2E+03 | 1.2E+03 |
| <300 | 6.6E–03 | 1.5E+00 | 3.0E–01 | 1.5E+00 | 1.5E+00 |
| <300 | 7.5E–03 | 1.2E+00 | 2.5E–02 | 1.2E+00 | 1.2E+00 |
| 3.2E+02 | NA | 7.8E+00 | NA | 7.8E+00 | 7.8E+00 |
| <300 | 1.6E–01 | 7.8E+00 | 6.3E–03 | 7.8E+00 | 7.8E+00 |
| NA | 1.0E+00 | 2.6E+01 | 9.3E–03 | 2.6E+01 | 2.6E+01 |
| 3.4E+02 | 1.6E–01 | 1.3E+02 | 6.0E–02 | 1.3E+02 | 1.3E+02 |
| <300 | 7.8E–02 | 3.2E+01 | 5.6E–02 | 3.2E+01 | 3.2E+01 |
| 1.7E+03 | 2.0E–02 | 7.2E+02 | 1.3E–01 | 7.2E+02 | 7.2E+02 |
| 6.3E+04 | 1.7E+01 | 1.5E+01 | 2.4E–01 | 1.5E+01 | 1.5E+01 |
| NA | 2.3E–01 | 9.9E+00 | 1.4E–02 | 9.9E+00 | 9.9E+00 |
| <300 | 7.6E–01 | 5.9E+00 | 1.6E–01 | 5.9E+00 | 5.9E+00 |
| <300 | NA | 0.0E+00 | NA | 0.0E+00 | 0.0E+00 |
| <300 | 1.8E+00 | 8.4E+02 | 9.2E–01 | 8.4E+02 | 8.4E+02 |
| NA | NA | NA | 1.0E–02 | 0.0E+00 [b] | 5.5E–02 [b] |
| NA | NA | NA | 1.0E–02 | 4.1E–03 [b] | 5.3E–02 [b] |
| NA | 2.1E+00 | 1.6E–01 | 1.0E–02 | 1.6E–01 | 1.6E–01 |
| NA | NA | NA | 1.2E–01 | 7.3E–02 [b] | 1.5E–01 [b] |
| NA | NA | NA | 1.7E–02 | 0.0E+00 [b] | 2.2E–03 [b] |
| NA | 5.0E–02 | 1.5E–01 | 4.9E–02 | 1.5E–01 | 1.5E–01 |
| 3.1E+02 | 5.0E–02 | 7.4E+00 | 7.6E–03 | 7.4E+00 | 7.4E+00 |
| NA | 5.0E–02 | 3.0E–01 | 4.9E–02 | 3.0E–01 | 3.0E–01 |
| 3.2E+02 | 5.0E–02 | 1.7E–01 | 4.9E–02 | 1.7E–01 | 1.7E–01 |
| NA | 5.0E–02 | 3.0E–01 | 4.9E–02 | 3.0E–01 | 3.0E–01 |
| NA | NA | NA | NA | NA | NA |
| NA | NA | NA | NA | NA | NA |
| NA | NA | NA | NA | NA | NA |
| NA | NA | NA | NA | NA | NA |
| NA | NA | NA | NA | NA | NA |
| NA | NA | NA | NA | NA | NA |

Table O–2.7
Estimated Chronic Exposure to Semi–Aquatic Receptors from Ingestion of RME Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

| EXPOSURE CONCENTRATION DATA | | | ESTIMATED TISSUE LEVELS IN PRIMARY PREY ITEMS | | | | | |
|---|---|---|---|---|---|---|---|---|
| CHEMICAL | RME SEDIMENT CONCENTRATION (mg/kg) | RME UNFILT. SURFACE WATER CONCENTRATION (mg/L) | Aquatic Organism BCF [a] | Aquatic Organism BAF [a] | Aq. Org. Tissue Level (mg/kg) | Aquatic Plant BAF [a] | Raccoon Tissue Exposure (mg/kg) | Tissue Exposure (mg/kg) |
| 1,2–Dichlorobenzene | Not a CP | Not a CPC | NA | 5.0E–02 | 0.0E+00 | 7.3E–02 | 0.0E+00 | 0.0E+00 |
| 1,4–Dichlorobenzene | Not a CP | Not a CPC | NA | 5.0E–02 | 0.0E+00 | 7.3E–02 | 0.0E+00 | 0.0E+00 |
| Benzo(b)fluoranthene | Not a CP | Not a CPC | NA | 5.0E–02 | 0.0E+00 | 2.5E–02 | 0.0E+00 | 0.0E+00 |
| Chrysene | 1.2E+00 | Not a CPC | NA | 5.0E–02 | 6.0E–02 | 2.5E–02 | 6.0E–02 | 6.0E–02 |
| Naphthalene | Not a CP | Not a CPC | NA | 5.0E–02 | 0.0E+00 | 2.5E–02 | 0.0E+00 | 0.0E+00 |
| Benzene | Not a CP | Not a CPC | NA | NA | 0.0E+00 | NA | NA | NA |
| Carbon disulfide | Not a CP | 1.1E–03 | NA | NA | 0.0E+00 | NA | NA | NA |
| Chlorobenzene | Not a CP | Not a CPC | NA | NA | 0.0E+00 | NA | NA | NA |
| Chloroform | Not a CP | 7.2E–04 | NA | NA | 0.0E+00 | NA | NA | NA |
| Trichloroethylene | 2.7E–02 | 3.5E–03 | NA | NA | 0.0E+00 | NA | NA | NA |
| Xylene | Not a CP | Not a CPC | NA | NA | 0.0E+00 | NA | NA | NA |

[a] Bioaccumulation data presented in: Appendix O, Tables O–1.2 and O–1.3 BAFs are multiplied by sediment concentrations and BCFs are multiplied by the surface water concentrations; BCFs <300 were not used as per USEPA (1989). The aquatic organism tissue level is equal to the greater of the two products.

[b] Measured crayfish and fish tissue concentrations (provided in Table O–1.3).

Table O-2.7.
Estimated Chronic Exposure to Semi-Aquatic Receptors from Ingestion of RME Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

**POTENTIAL DIETARY EXPOSURE (mg/kgBW-day) [c]**

| CHEMICAL | *Muskrat* | *Mallard* | *Raccoon* | *Great blue heron* |
|---|---|---|---|---|
| Aluminum | 1.2E+02 | 7.2E-02 | 2.5E-01 | 6.3E+01 |
| Arsenic | 5.0E+00 | 1.1E-02 | 2.1E-03 | 2.5E-01 |
| Barium | 1.3E+00 | 1.3E-03 | 1.6E-03 | 1.9E-01 |
| Cadmium | 5.4E-02 | 1.7E-05 | 7.0E-04 | 3.2E-01 |
| Chromium | 3.9E-01 | 2.3E-04 | 1.1E-03 | 3.6E-01 |
| Cobalt | 3.5E-01 | 1.7E-04 | 2.5E-03 | 1.1E+00 |
| Copper | 2.8E+00 | 2.9E-03 | 1.3E-02 | 5.4E+00 |
| Lead | 4.2E+00 | 5.3E-03 | 6.6E-03 | 1.7E+00 |
| Manganese | 5.8E+01 | 9.7E-02 | 9.9E-02 | 3.3E+01 |
| Mercury | 1.1E-01 | 4.0E-05 | 1.4E-03 | 6.3E-01 |
| Nickel | 3.8E-01 | 2.5E-04 | 1.3E-03 | 4.4E-01 |
| Selenium | 1.6E-01 | 2.3E-04 | 5.9E-04 | 2.5E-01 |
| Vanadium | 6.8E-03 | 1.2E-05 | 1.1E-05 | 7.6E-04 |
| Zinc | 3.2E+01 | 7.2E-02 | 7.9E-02 | 3.5E+01 |
| 4,4'-DDD | 3.1E-03 | 2.2E-06 | 3.9E-06 | 2.6E-03 |
| 4,4'-DDE | 1.2E-03 | 8.0E-07 | 1.8E-06 | 2.3E-03 |
| 4,4'-DDT | 1.6E-03 | 6.4E-07 | 1.5E-05 | 6.6E-03 |
| Aroclor-1260 | 3.9E-03 | 6.8E-06 | 9.1E-06 | 6.6E-03 |
| Dieldrin | 3.5E-04 | 2.8E-07 | 4.0E-07 | 1.3E-04 |
| Benzo[k]fluoranthene | 2.9E-02 | 3.4E-05 | 4.0E-05 | 8.7E-03 |
| Bis(2-ethylhexyl)phthalate | 5.1E-02 | 1.6E-05 | 6.6E-04 | 3.1E-01 |
| Fluoranthene | 5.7E-02 | 6.8E-05 | 7.9E-05 | 1.7E-02 |
| Phenanthrene | 2.9E-02 | 3.4E-05 | 4.1E-05 | 9.5E-03 |
| Pyrene | 5.7E-02 | 6.8E-05 | 7.9E-05 | 1.7E-02 |
| 1,2-Dichloroethylenes (cis and trans) | 2.5E-03 | 4.4E-06 | 4.1E-06 | 2.7E-04 |
| Acetone | 2.1E-03 | 1.0E-06 | 2.7E-06 | 2.6E-04 |
| Methylene chloride | 1.4E-03 | 1.2E-06 | 2.0E-06 | 1.7E-04 |
| Tetrachloroethylene | 6.9E-04 | 5.6E-07 | 9.7E-07 | 8.4E-05 |
| Toluene | 2.4E-04 | 2.5E-07 | 3.5E-07 | 2.8E-05 |
| Trichlorofluoromethane | 5.0E-04 | 2.5E-07 | 6.7E-07 | 6.4E-05 |

Table O–2.7
Estimated Chronic Exposure to Semi–Aquatic Receptors from Ingestion of RME Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

**POTENTIAL DIETARY EXPOSURE (mg/kgBW–day) [c]**

| CHEMICAL | *Muskrat* | *Mallard* | *Raccoon* | *Great blue heron* |
|---|---|---|---|---|
| 1,2–Dichlorobenzene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| 1,4–Dichlorobenzene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(b)fluoranthene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Chrysene | 9.9E–03 | 4.1E–06 | 1.6E–05 | 3.5E–03 |
| Naphthalene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Carbon disulfide | 1.0E–04 | 1.8E–07 | 1.7E–07 | 1.2E–05 |
| Chlorobenzene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Chloroform | 6.8E–05 | 1.2E–07 | 1.1E–07 | 7.6E–06 |
| Trichloroethylene | 5.1E–04 | 6.8E–07 | 7.9E–07 | 6.0E–05 |
| Xylene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |

[c] Calculated by summing the products of individual prey type concentrations and percent in diet with surface water and sediment exposures, multiplying by the exposure duration, SFF and ingestion rate, and dividing by body weight (Table 9–27).

Table O-2.7
Exposure Parameters and Assumptions for Semi-Aquatic Receptors
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

**EXPOSURE PARAMETERS [d]**

| Indicator Species | | Percent Prey in Diet: Aquatic Organisms | Plants | Sediment | Home Range (acres) | ED [e] | Site Foraging Frequency [f] | Dietary Ingestion Rate (kg/day) | Water Ingestion Rate (L/day) | Body Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| *Muskrat* | (Small herb. mammal) | 10% | 80% | 10% | 0.2 | 1 | 1.00E+00 | 0.084 | 0.12 | 1.27 |
| *Mallard* | (Small herb. bird) | 1% | 97% | 2% | 235 | 1 | 2.98E-03 | 0.063 | 0.064 | 1.134 |
| *Raccoon* | (Predatory mammal) | 91% | 0% | 9% | 385 | 1 | 1.82E-03 | 0.214 | 0.344 | 3.99 |
| *Great blue heron* | (Piscivorous bird) | 98% | 0% | 2% | 1.5 | 0.5 | 4.67E-01 | 0.401 | 0.101 | 2.23 |

NOTES:
[d] Documentation of exposure parameters presented in: Appendix O, Table O-1.1
[e] ED = Exposure Duration (percentage of year receptor is expected to be found at study area)
[f] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0))

| SITE AREA: | 0.7 acres |
|---|---|

Table O–2.8
Estimated Chronic Exposure to Semi–Aquatic Receptors from Ingestion of Average Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

**EXPOSURE CONCENTRATION DATA**

| CHEMICAL | AVERAGE SEDIMENT CONCENTRATION (mg/kg) | AVERAGE UNFILT. SURFACE WATER CONCENTRATION (mg/L) |
|---|---|---|
| Aluminum | 1.2E+04 | 2.6E+00 |
| Arsenic | 7.0E+01 | 5.1E–02 |
| Barium | 7.0E+01 | 1.6E–01 |
| Cadmium | Not a CP | 5.8E–03 |
| Chromium | 2.3E+01 | 8.5E–03 |
| Cobalt | 1.5E+01 | Not a CPC |
| Copper | 4.7E+01 | 7.5E–02 |
| Lead | 1.7E+02 | 2.4E–01 |
| Manganese | 1.2E+03 | 2.4E–01 |
| Mercury | 8.1E–02 | 1.4E–04 |
| Nickel | 2.9E+01 | Not a CPC |
| Selenium | 2.3E+00 | 1.5E–03 |
| Vanadium | Not a CP | 1.7E–02 |
| Zinc | 2.1E+02 | 1.8E–01 |
| 4,4'–DDD | 1.5E–01 | Not a CPC |
| 4,4'–DDE | 5.6E–02 | Not a CPC |
| 4,4'–DDT | 4.0E–02 | Not a CPC |
| Aroclor–1260 | 6.9E–02 | Not a CPC |
| Dieldrin | 9.6E–03 | Not a CPC |
| Benzo[k]fluoranthene | 5.8E–01 | Not a CPC |
| Bis(2–ethylhexyl)phthalate | Not a CP | 4.8E–03 |
| Fluoranthene | 2.2E+00 | Not a CPC |
| Phenanthrene | 8.0E–01 | 2.8E–04 |
| Pyrene | 2.3E+00 | Not a CPC |
| 1,2–Dichloroethylenes (cis and trans) | Not a CP | 3.1E–03 |
| Acetone | 8.0E–02 | Not a CPC |
| Methylene chloride | 2.2E–02 | 1.8E–03 |
| Tetrachloroethylene | 1.0E–02 | 1.1E–03 |
| Toluene | 5.0E–03 | 3.4E–04 |
| Trichlorofluoromethane | 1.3E–02 | Not a CPC |

**ESTIMATED TISSUE LEVELS IN PRIMARY PREY ITEMS**

| Aquatic Organism BCF [a] | Aquatic Organism BAF [a] | Aq. Org. Tissue Level (mg/kg) | Aquatic Plant BAF [a] | Raccoon Tissue Exposure (mg/kg) | Heron Tissue Exposure (mg/kg) |
|---|---|---|---|---|---|
| <300 | 7.5E–02 | 8.7E+02 | 6.0E–03 | 8.7E+02 | 8.7E+02 |
| <300 | 6.6E–03 | 4.6E–01 | 3.0E–01 | 4.6E–01 | 4.6E–01 |
| <300 | 7.5E–03 | 5.2E–01 | 2.5E–02 | 5.2E–01 | 5.2E–01 |
| 3.2E+02 | NA | 1.8E+00 | NA | 1.8E+00 | 1.8E+00 |
| <300 | 1.6E–01 | 3.7E+00 | 6.3E–03 | 3.7E+00 | 3.7E+00 |
| NA | 1.0E+00 | 1.5E+01 | 9.3E–03 | 1.5E+01 | 1.5E+01 |
| 3.4E+02 | 1.6E–01 | 2.5E+01 | 6.0E–02 | 2.5E+01 | 2.5E+01 |
| <300 | 7.8E–02 | 1.4E+01 | 5.6E–02 | 1.4E+01 | 1.4E+01 |
| 1.7E+03 | 2.0E–02 | 4.0E+02 | 1.3E–01 | 4.0E+02 | 4.0E+02 |
| 6.3E+04 | 1.7E+01 | 8.9E+00 | 2.4E–01 | 8.9E+00 | 8.9E+00 |
| NA | 2.3E–01 | 6.7E+00 | 1.4E–02 | 6.7E+00 | 6.7E+00 |
| <300 | 7.6E–01 | 1.7E+00 | 1.6E–01 | 1.7E+00 | 1.7E+00 |
| <300 | NA | 0.0E+00 | NA | 0.0E+00 | 0.0E+00 |
| <300 | 1.8E+00 | 3.7E+02 | 9.2E–01 | 3.7E+02 | 3.7E+02 |
| NA | NA | NA | 1.0E–02 | 0.0E+00 [b] | 5.5E–02 [b] |
| NA | NA | NA | 1.0E–02 | 4.1E–03 [b] | 5.3E–02 [b] |
| NA | 2.1E+00 | 8.4E–02 | 1.0E–02 | 8.4E–02 | 8.4E–02 |
| NA | NA | NA | 1.2E–01 | 7.3E–02 [b] | 1.5E–01 [b] |
| NA | NA | NA | 1.7E–02 | 0.0E+00 [b] | 2.2E–03 [b] |
| NA | 5.0E–02 | 2.9E–02 | 4.9E–02 | 2.9E–02 | 2.9E–02 |
| 3.1E+02 | 5.0E–02 | 1.5E+00 | 7.6E–03 | 1.5E+00 | 1.5E+00 |
| NA | 5.0E–02 | 1.1E–01 | 4.9E–02 | 1.1E–01 | 1.1E–01 |
| 3.2E+02 | 5.0E–02 | 9.1E–02 | 4.9E–02 | 9.1E–02 | 9.1E–02 |
| NA | 5.0E–02 | 1.1E–01 | 4.9E–02 | 1.1E–01 | 1.1E–01 |
| NA | NA | NA | NA | NA | NA |
| NA | NA | NA | NA | NA | NA |
| NA | NA | NA | NA | NA | NA |
| NA | NA | NA | NA | NA | NA |
| NA | NA | NA | NA | NA | NA |
| NA | NA | NA | NA | NA | NA |

Table O–2.8
Estimated Chronic Exposure to Semi–Aquatic Receptors from Ingestion of Average Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

**EXPOSURE CONCENTRATION DATA**

| CHEMICAL | AVERAGE SEDIMENT CONCENTRATION (mg/kg) | AVERAGE UNFILT. SURFACE WATER CONCENTRATION (mg/L) |
|---|---|---|
| 1,2–Dichlorobenzene | Not a CP | Not a CPC |
| 1,4–Dichlorobenzene | Not a CP | Not a CPC |
| Benzo(b)fluoranthene | Not a CP | Not a CPC |
| Chrysene | 4.7E–01 | Not a CPC |
| Naphthalene | Not a CP | Not a CPC |
| Benzene | Not a CP | Not a CPC |
| Carbon disulfide | Not a CP | 3.4E–04 |
| Chlorobenzene | Not a CP | Not a CPC |
| Chloroform | Not a CP | 3.0E–04 |
| Trichloroethylene | 4.2E–03 | 6.5E–04 |
| Xylene | Not a CP | Not a CPC |

**ESTIMATED TISSUE LEVELS IN PRIMARY PREY ITEMS**

| Aquatic Organism BCF [a] | Aquatic Organism BAF [a] | Aq. Org. Tissue Level (mg/kg) | Aquatic Plant BAF [a] | Raccoon Tissue Exposure (mg/kg) | Heron Tissue Exposure (mg/kg) |
|---|---|---|---|---|---|
| NA | 5.0E–02 | 0.0E+00 | 7.3E–02 | 0.0E+00 | 0.0E+00 |
| NA | 5.0E–02 | 0.0E+00 | 7.3E–02 | 0.0E+00 | 0.0E+00 |
| NA | 5.0E–02 | 0.0E+00 | 2.5E–02 | 0.0E+00 | 0.0E+00 |
| NA | 5.0E–02 | 2.4E–02 | 2.5E–02 | 2.4E–02 | 2.4E–02 |
| NA | 5.0E–02 | 0.0E+00 | 2.5E–02 | 0.0E+00 | 0.0E+00 |
| NA | NA | 0.0E+00 | NA | NA | NA |
| NA | NA | 0.0E+00 | NA | NA | NA |
| NA | NA | 0.0E+00 | NA | NA | NA |
| NA | NA | 0.0E+00 | NA | NA | NA |
| NA | NA | 0.0E+00 | NA | NA | NA |
| NA | NA | 0.0E+00 | NA | NA | NA |

[a] Bioaccumulation data presented in: Appendix O, Tables O–1.2 and O–1.3 BAFs are multiplied by sediment concentrations and BCFs are multiplied by the surface water concentrations; BCFs <300 were not used as per USEPA (1989). The aquatic organism tissue level is equal to the greater of the two products.

[b] Measured crayfish and fish tissue concentrations (provided in Table O–1.3).

Table O-2.8
Estimated Chronic Exposure to Semi-Aquatic Receptors from Ingestion of Average Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

**POTENTIAL DIETARY EXPOSURE (mg/kgBW-day) [c]**

| CHEMICAL | *Muskrat* | *Mallard* | *Raccoon* | *Great blue heron* |
|---|---|---|---|---|
| Aluminum | 8.6E+01 | 5.1E-02 | 1.8E-01 | 4.6E+01 |
| Arsenic | 1.6E+00 | 3.6E-03 | 6.7E-04 | 7.9E-02 |
| Barium | 5.7E-01 | 5.4E-04 | 6.8E-04 | 8.2E-02 |
| Cadmium | 1.3E-02 | 4.0E-06 | 1.6E-04 | 7.6E-02 |
| Chromium | 1.9E-01 | 1.1E-04 | 5.3E-04 | 1.7E-01 |
| Cobalt | 2.1E-01 | 9.7E-05 | 1.5E-03 | 6.3E-01 |
| Copper | 6.3E-01 | 6.6E-04 | 2.7E-03 | 1.1E+00 |
| Lead | 1.8E+00 | 2.2E-03 | 2.8E-03 | 7.1E-01 |
| Manganese | 1.9E+01 | 3.0E-02 | 4.6E-02 | 1.8E+01 |
| Mercury | 6.1E-02 | 1.8E-05 | 7.9E-04 | 3.7E-01 |
| Nickel | 2.6E-01 | 1.7E-04 | 8.5E-04 | 3.0E-01 |
| Selenium | 4.6E-02 | 7.0E-05 | 1.8E-04 | 7.4E-02 |
| Vanadium | 1.6E-03 | 2.8E-06 | 2.6E-06 | 1.8E-04 |
| Zinc | 1.4E+01 | 3.2E-02 | 3.5E-02 | 1.5E+01 |
| 4,4'-DDD | 1.1E-03 | 7.2E-07 | 1.3E-06 | 2.4E-03 |
| 4,4'-DDE | 4.0E-04 | 2.8E-07 | 8.6E-07 | 2.2E-03 |
| 4,4'-DDT | 8.4E-04 | 3.3E-07 | 7.8E-06 | 3.5E-03 |
| Aroclor-1260 | 9.0E-04 | 1.6E-06 | 7.1E-06 | 6.4E-03 |
| Dieldrin | 7.2E-05 | 5.8E-08 | 8.4E-08 | 9.7E-05 |
| Benzo[k]fluoranthene | 5.5E-03 | 6.6E-06 | 7.7E-06 | 1.7E-03 |
| Bis(2-ethylhexyl)phthalate | 1.0E-02 | 3.3E-06 | 1.3E-04 | 6.1E-02 |
| Fluoranthene | 2.1E-02 | 2.5E-05 | 2.9E-05 | 6.3E-03 |
| Phenanthrene | 8.0E-03 | 9.2E-06 | 1.5E-05 | 4.4E-03 |
| Pyrene | 2.2E-02 | 2.6E-05 | 3.0E-05 | 6.6E-03 |
| 1,2-Dichloroethylenes (cis and trans) | 2.9E-04 | 5.2E-07 | 4.9E-07 | 3.3E-05 |
| Acetone | 5.3E-04 | 2.7E-07 | 7.1E-07 | 6.7E-05 |
| Methylene chloride | 3.1E-04 | 3.7E-07 | 4.7E-07 | 3.7E-05 |
| Tetrachloroethylene | 1.7E-04 | 2.2E-07 | 2.6E-07 | 2.0E-05 |
| Toluene | 6.6E-05 | 7.4E-08 | 9.8E-08 | 7.8E-06 |
| Trichlorofluoromethane | 8.6E-05 | 4.3E-08 | 1.1E-07 | 1.1E-05 |

Table O-2.8
Estimated Chronic Exposure to Semi-Aquatic Receptors from Ingestion of Average Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

**POTENTIAL DIETARY EXPOSURE (mg/kgBW-day) [c]**

| CHEMICAL | *Muskrat* | *Mallard* | *Raccoon* | *Great blue heron* |
|---|---|---|---|---|
| 1,2-Dichlorobenzene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| 1,4-Dichlorobenzene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(b)fluoranthene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Chrysene | 3.9E-03 | 1.6E-06 | 6.2E-06 | 1.4E-03 |
| Naphthalene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Carbon disulfide | 3.3E-05 | 5.8E-08 | 5.4E-08 | 3.6E-06 |
| Chlorobenzene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Chloroform | 2.9E-05 | 5.1E-08 | 4.7E-08 | 3.2E-06 |
| Trichloroethylene | 8.9E-05 | 1.2E-07 | 1.4E-07 | 1.0E-05 |
| Xylene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |

[c] Calculated by summing the products of individual prey type concentrations and percent in diet with surface water and sediment exposures, multiplying by the exposure duration, SFF and ingestion rate, and dividing by body weight (Table 9-27).

Table O-2.8
Exposure Parameters and Assumptions for Semi-Aquatic Receptors
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

**EXPOSURE PARAMETERS [d]**

| Indicator Species | | Percent Prey in Diet: Aquatic Organisms | Plants | Sediment | Home Range (acres) | ED [e] | Site Foraging Frequency [f] | Dietary Ingestion Rate (kg/day) | Water Ingestion Rate (L/day) | Body Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| *Muskrat* | (Small herb. mammal) | 10% | 80% | 10% | 0.2 | 1 | 1.00E+00 | 0.084 | 0.12 | 1.27 |
| *Mallard* | (Herb. bird) | 1% | 97% | 2% | 235 | 1 | 2.98E-03 | 0.063 | 0.064 | 1.134 |
| *Raccoon* | (Predatory mammal) | 91% | 0% | 9% | 385 | 1 | 1.82E-03 | 0.214 | 0.344 | 3.99 |
| *Great blue heron* | (Piscivorous bird) | 98% | 0% | 2% | 1.5 | 0.5 | 4.67E-01 | 0.401 | 0.101 | 2.23 |

NOTES:
[d] Documentation of exposure parameters presented in: Appendix O, Table O-1.1
[e] ED = Exposure Duration (percentage of year receptor is expected to be found at study area)
[f] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0))

SITE AREA: 0.7 acres

Table O-2.9
Estimated Chronic Exposure to Semi-Aquatic Receptors from Ingestion of RME Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

**EXPOSURE CONCENTRATION DATA**

| CHEMICAL | RME SEDIMENT CONCENTRATION (mg/kg) | RME FILTERED SURFACE WATER CONCENTRATION (mg/L) |
|---|---|---|
| Aluminum | 1.6E+04 | Not a CPC |
| Arsenic | 2.2E+02 | 8.9E-03 |
| Barium | 1.6E+02 | 4.3E-02 |
| Cadmium | Not a CPC | Not a CPC |
| Chromium | 4.9E+01 | Not a CPC |
| Cobalt | 2.6E+01 | Not a CPC |
| Copper | 2.0E+02 | Not a CPC |
| Lead | 4.1E+02 | 2.3E-03 |
| Manganese | 3.9E+03 | 4.8E-01 |
| Mercury | 3.6E-01 | Not a CPC |
| Nickel | 4.3E+01 | Not a CPC |
| Selenium | 7.7E+00 | Not a CPC |
| Vanadium | Not a CPC | Not a CPC |
| Zinc | 4.7E+02 | 5.8E-02 |
| 4,4'-DDD | 4.4E-01 | Not a CPC |
| 4,4'-DDE | 1.6E-01 | Not a CPC |
| 4,4'-DDT | 7.6E-02 | Not a CPC |
| Aroclor-1260 | 3.0E-01 | Not a CPC |
| Dieldrin | 4.6E-02 | Not a CPC |
| Benzo[k]fluoranthene | 3.0E+00 | Not a CPC |
| Bis(2-ethylhexyl)phthalate | Not a CPC | 2.4E-02 |
| Fluoranthene | 6.0E+00 | Not a CPC |
| Phenanthrene | 3.0E+00 | 5.2E-04 |
| Pyrene | 6.0E+00 | Not a CPC |
| 1,2-Dichloroethylenes (cis an | Not a CPC | 2.6E-02 |
| Acetone | 3.1E-01 | Not a CPC |
| Methylene chloride | 1.5E-01 | 4.1E-03 |
| Tetrachloroethylene | 7.8E-02 | 1.8E-03 |
| Toluene | 2.0E-02 | 1.1E-03 |
| Trichlorofluoromethane | 7.6E-02 | Not a CPC |

**ESTIMATED TISSUE LEVELS IN PRIMARY PREY ITEMS**

| Aquatic Organism BCF [a] | Aquatic Organism BAF [a] | Aq. Org. Tissue Level (mg/kg) | Aquatic Plant BAF [a] | Raccoon Tissue Exposure (mg/kg) | Heron Tissue Exposure (mg/kg) |
|---|---|---|---|---|---|
| NA | 7.5E-02 | 1.2E+03 | 6.0E-03 | 1.2E+03 | 1.2E+03 |
| <300 | 6.6E-03 | 1.5E+00 | 3.0E-01 | 1.5E+00 | 1.5E+00 |
| <300 | 7.5E-03 | 1.2E+00 | 2.5E-02 | 1.2E+00 | 1.2E+00 |
| NA | NA | 0.0E+00 | NA | 0.0E+00 | 0.0E+00 |
| NA | 1.6E-01 | 7.8E+00 | 6.3E-03 | 7.8E+00 | 7.8E+00 |
| NA | 1.0E+00 | 2.6E+01 | 9.3E-03 | 2.6E+01 | 2.6E+01 |
| NA | 1.6E-01 | 3.2E+01 | 6.0E-02 | 3.2E+01 | 3.2E+01 |
| <300 | 7.8E-02 | 3.2E+01 | 5.6E-02 | 3.2E+01 | 3.2E+01 |
| 1.7E+03 | 2.0E-02 | 8.0E+02 | 1.3E-01 | 8.0E+02 | 8.0E+02 |
| NA | 1.7E+01 | 6.1E+00 | 2.4E-01 | 6.1E+00 | 6.1E+00 |
| NA | 2.3E-01 | 9.9E+00 | 1.4E-02 | 9.9E+00 | 9.9E+00 |
| NA | 7.6E-01 | 5.9E+00 | 1.6E-01 | 5.9E+00 | 5.9E+00 |
| NA | NA | 0.0E+00 | NA | 0.0E+00 | 0.0E+00 |
| <300 | 1.8E+00 | 8.4E+02 | 9.2E-01 | 8.4E+02 | 8.4E+02 |
| NA | NA | NA | 1.0E-02 | 0.0E+00 [b] | 5.5E-02 [b] |
| NA | NA | NA | 1.0E-02 | 4.1E-03 [b] | 5.3E-02 [b] |
| NA | 2.1E+00 | 1.6E-01 | 1.0E-02 | 1.6E-01 | 1.6E-01 |
| NA | NA | NA | 1.2E-01 | 7.3E-02 [b] | 1.5E-01 [b] |
| NA | NA | NA | 1.7E-02 | 0.0E+00 [b] | 2.2E-03 [b] |
| NA | 5.0E-02 | 1.5E-01 | 4.9E-02 | 1.5E-01 | 1.5E-01 |
| 3.1E+02 | 5.0E-02 | 7.4E+00 | 7.6E-03 | 7.4E+00 | 7.4E+00 |
| NA | 5.0E-02 | 3.0E-01 | 4.9E-02 | 3.0E-01 | 3.0E-01 |
| 3.2E+02 | 5.0E-02 | 1.7E-01 | 4.9E-02 | 1.7E-01 | 1.7E-01 |
| NA | 5.0E-02 | 3.0E-01 | 4.9E-02 | 3.0E-01 | 3.0E-01 |
| NA | NA | NA | NA | NA | NA |
| NA | NA | NA | NA | NA | NA |
| NA | NA | NA | NA | NA | NA |
| NA | NA | NA | NA | NA | NA |
| NA | NA | NA | NA | NA | NA |
| NA | NA | NA | NA | NA | NA |

Table O–2.9
Estimated Chronic Exposure to Semi–Aquatic Receptors from Ingestion of RME Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

**EXPOSURE CONCENTRATION DATA**

| CHEMICAL | RME SEDIMENT CONCENTRATION (mg/kg) | RME FILTERED SURFACE WATER CONCENTRATION (mg/L) |
|---|---|---|
| 1,2–Dichlorobenzene | Not a CP | Not a CP |
| 1,4–Dichlorobenzene | Not a CP | Not a CP |
| Benzo(b)fluoranthene | Not a CP | Not a CP |
| Chrysene | 1.2E+00 | Not a CP |
| Naphthalene | Not a CP | Not a CP |
| Benzene | Not a CP | Not a CP |
| Carbon disulfide | Not a CP | 1.1E–03 |
| Chlorobenzene | Not a CP | Not a CP |
| Chloroform | Not a CP | 7.2E–04 |
| Trichloroethylene | 2.7E–02 | 3.5E–03 |
| Xylene | Not a CP | Not a CP |

**ESTIMATED TISSUE LEVELS IN PRIMARY PREY ITEMS**

| Aquatic Organism BCF [a] | Aquatic Organism BAF [a] | Aq. Org. Tissue Level (mg/kg) | Aquatic Plant BAF [a] | Raccoon Tissue Exposure (mg/kg) | Heron Tissue Exposure (mg/kg) |
|---|---|---|---|---|---|
| NA | 5.0E–02 | 0.0E+00 | 7.3E–02 | 0.0E+00 | 0.0E+00 |
| NA | 5.0E–02 | 0.0E+00 | 7.3E–02 | 0.0E+00 | 0.0E+00 |
| NA | 5.0E–02 | 0.0E+00 | 2.5E–02 | 0.0E+00 | 0.0E+00 |
| NA | 5.0E–02 | 6.0E–02 | 2.5E–02 | 6.0E–02 | 6.0E–02 |
| NA | 5.0E–02 | 0.0E+00 | 2.5E–02 | 0.0E+00 | 0.0E+00 |
| NA | NA | 0.0E+00 | NA | NA | NA |
| NA | NA | 0.0E+00 | NA | NA | NA |
| NA | NA | 0.0E+00 | NA | NA | NA |
| NA | NA | 0.0E+00 | NA | NA | NA |
| NA | NA | 0.0E+00 | NA | NA | NA |
| NA | NA | 0.0E+00 | NA | NA | NA |

[a] Bioaccumulation data presented in: Appendix O, Tables O–1.2 and O–1.3 BAFs are multiplied by sediment concentrations and BCFs are multiplied by the surface water concentrations; BCFs <300 were not used as per USEPA (1989). The aquatic organism tissue level is equal to the greater of the two products.
[b] Measured crayfish and fish tissue concentrations (provided in Table O–1.3).

Table O–2.9
Estimated Chronic Exposure to Semi–Aquatic Receptors from Ingestion of RME Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

**POTENTIAL DIETARY EXPOSURE (mg/kgBW–day) [c]**

| CHEMICAL | *Muskrat* | *Mallard* | *Raccoon* | *Great blue heron* |
|---|---|---|---|---|
| Aluminum | 1.2E+02 | 7.0E–02 | 2.5E–01 | 6.2E+01 |
| Arsenic | 5.0E+00 | 1.1E–02 | 2.1E–03 | 2.4E–01 |
| Barium | 1.3E+00 | 1.2E–03 | 1.5E–03 | 1.8E–01 |
| Cadmium | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Chromium | 3.9E–01 | 2.2E–04 | 1.1E–03 | 3.6E–01 |
| Cobalt | 3.5E–01 | 1.7E–04 | 2.5E–03 | 1.1E+00 |
| Copper | 2.2E+00 | 2.7E–03 | 4.6E–03 | 1.5E+00 |
| Lead | 4.1E+00 | 5.1E–03 | 6.4E–03 | 1.7E+00 |
| Manganese | 5.9E+01 | 9.7E–02 | 1.1E–01 | 3.6E+01 |
| Mercury | 4.7E–02 | 2.5E–05 | 5.5E–04 | 2.5E–01 |
| Nickel | 3.8E–01 | 2.5E–04 | 1.3E–03 | 4.4E–01 |
| Selenium | 1.5E–01 | 2.3E–04 | 5.9E–04 | 2.5E–01 |
| Vanadium | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Zinc | 3.1E+01 | 7.2E–02 | 7.9E–02 | 3.5E+01 |
| 4,4'–DDD | 3.1E–03 | 2.2E–06 | 3.9E–06 | 2.6E–03 |
| 4,4'–DDE | 1.2E–03 | 8.0E–07 | 1.8E–06 | 2.3E–03 |
| 4,4'–DDT | 1.6E–03 | 6.4E–07 | 1.5E–05 | 6.6E–03 |
| Aroclor–1260 | 3.9E–03 | 6.8E–06 | 9.1E–06 | 6.6E–03 |
| Dieldrin | 3.5E–04 | 2.8E–07 | 4.0E–07 | 1.3E–04 |
| Benzo[k]fluoranthene | 2.9E–02 | 3.4E–05 | 4.0E–05 | 8.7E–03 |
| Bis(2–ethylhexyl)phthalate | 5.1E–02 | 1.6E–05 | 6.6E–04 | 3.1E–01 |
| Fluoranthene | 5.7E–02 | 6.8E–05 | 7.9E–05 | 1.7E–02 |
| Phenanthrene | 2.9E–02 | 3.4E–05 | 4.1E–05 | 9.5E–03 |
| Pyrene | 5.7E–02 | 6.8E–05 | 7.9E–05 | 1.7E–02 |
| 1,2–Dichloroethylenes (cis an | 2.5E–03 | 4.4E–06 | 4.1E–06 | 2.7E–04 |
| Acetone | 2.1E–03 | 1.0E–06 | 2.7E–06 | 2.6E–04 |
| Methylene chloride | 1.4E–03 | 1.2E–06 | 2.0E–06 | 1.7E–04 |
| Tetrachloroethylene | 6.9E–04 | 5.6E–07 | 9.7E–07 | 8.4E–05 |
| Toluene | 2.4E–04 | 2.5E–07 | 3.5E–07 | 2.8E–05 |
| Trichlorofluoromethane | 5.0E–04 | 2.5E–07 | 6.7E–07 | 6.4E–05 |

Table O–2.9
Estimated Chronic Exposure to Semi–Aquatic Receptors from Ingestion of RME Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

**POTENTIAL DIETARY EXPOSURE (mg/kgBW–day) [c]**

| CHEMICAL | *Muskrat* | *Mallard* | *Raccoon* | *Great blue heron* |
|---|---|---|---|---|
| 1,2–Dichlorobenzene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| 1,4–Dichlorobenzene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(b)fluoranthene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Chrysene | 9.9E–03 | 4.1E–06 | 1.6E–05 | 3.5E–03 |
| Naphthalene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Carbon disulfide | 1.0E–04 | 1.8E–07 | 1.7E–07 | 1.2E–05 |
| Chlorobenzene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Chloroform | 6.8E–05 | 1.2E–07 | 1.1E–07 | 7.6E–06 |
| Trichloroethylene | 5.1E–04 | 6.8E–07 | 7.9E–07 | 6.0E–05 |
| Xylene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |

[c] Calculated by summing the products of individual prey type concentrations and percent in diet with surface water and sediment exposures, multiplying by the exposure duration, SFF and ingestion rate, and dividing by body weight (Table 9–27).

Table O–2.9
Exposure Parameters and Assumptions for Semi–Aquatic Receptors
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

**EXPOSURE PARAMETERS [d]**

| Indicator Species | | Percent Prey in Diet: Aquatic Organisms | Percent Prey in Diet: Plants | Percent Prey in Diet: Sediment | Home Range (acres) | ED [e] | Site Foraging Frequency [f] | Dietary Ingestion Rate (kg/day) | Water Ingestion Rate (L/day) | Body Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| *Muskrat* | (Small herb. mammal) | 10% | 80% | 10% | 0.2 | 1 | 1.00E+00 | 0.084 | 0.12 | 1.27 |
| *Mallard* | (Herb. bird) | 1% | 97% | 2% | 235 | 1 | 2.98E–03 | 0.063 | 0.064 | 1.134 |
| *Raccoon* | (Predatory mammal) | 91% | 0% | 9% | 385 | 1 | 1.82E–03 | 0.214 | 0.344 | 3.99 |
| *Great blue heron* | (Piscivorous bird) | 98% | 0% | 2% | 1.5 | 0.5 | 4.67E–01 | 0.401 | 0.101 | 2.23 |

NOTES:

[d] Documentation of exposure parameters presented in: Appendix O, Table O–1.1

[e] ED = Exposure Duration (percentage of year receptor is expected to be found at study area)

[f] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0))

| SITE AREA: | 0.7 acres |
|---|---|

Table O–2.10
Estimated Chronic Exposure to Semi–Aquatic Receptors from Ingestion of Average Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

**EXPOSURE CONCENTRATION DATA**

| CHEMICAL | AVERAGE SEDIMENT CONCENTRATION (mg/kg) | AVERAGE FILT. SURFACE WATER CONCENTRATION (mg/L) |
|---|---|---|
| Aluminum | 1.2E+04 | Not a CPC |
| Arsenic | 7.0E+01 | 4.4E–03 |
| Barium | 7.0E+01 | 2.2E–02 |
| Cadmium | Not a CP | Not a CPC |
| Chromium | 2.3E+01 | Not a CPC |
| Cobalt | 1.5E+01 | Not a CPC |
| Copper | 4.7E+01 | Not a CPC |
| Lead | 1.7E+02 | 5.8E–03 |
| Manganese | 1.2E+03 | 2.0E–01 |
| Mercury | 8.1E–02 | Not a CPC |
| Nickel | 2.9E+01 | Not a CPC |
| Selenium | 2.3E+00 | Not a CPC |
| Vanadium | Not a CP | Not a CPC |
| Zinc | 2.1E+02 | 2.2E–02 |
| 4,4'–DDD | 1.5E–01 | Not a CPC |
| 4,4'–DDE | 5.6E–02 | Not a CPC |
| 4,4'–DDT | 4.0E–02 | Not a CPC |
| Aroclor–1260 | 6.9E–02 | Not a CPC |
| Dieldrin | 9.6E–03 | Not a CPC |
| Benzo[k]fluoranthene | 5.8E–01 | Not a CPC |
| Bis(2–ethylhexyl)phthalate | Not a CP | 4.8E–03 |
| Fluoranthene | 2.2E+00 | Not a CPC |
| Phenanthrene | 8.0E–01 | 2.8E–04 |
| Pyrene | 2.3E+00 | Not a CPC |
| 1,2–Dichloroethylenes (cis and trans) | Not a CP | 3.1E–03 |
| Acetone | 8.0E–02 | Not a CPC |
| Methylene chloride | 2.2E–02 | 1.8E–03 |
| Tetrachloroethylene | 1.0E–02 | 1.1E–03 |
| Toluene | 5.0E–03 | 3.4E–04 |
| Trichlorofluoromethane | 1.3E–02 | Not a CPC |

**ESTIMATED TISSUE LEVELS IN PRIMARY PREY ITEMS**

| Aquatic Organism BCF [a] | Aquatic Organism BAF [a] | Aq. Org. Tissue Level (mg/kg) | Aquatic Plant BAF [a] | Raccoon Tissue Exposure (mg/kg) | Heron Tissue Exposure (mg/kg) |
|---|---|---|---|---|---|
| NA | 7.5E–02 | 8.7E+02 | 6.0E–03 | 8.7E+02 | 8.7E+02 |
| <300 | 6.6E–03 | 4.6E–01 | 3.0E–01 | 4.6E–01 | 4.6E–01 |
| <300 | 7.5E–03 | 5.2E–01 | 2.5E–02 | 5.2E–01 | 5.2E–01 |
| NA | NA | 0.0E+00 | NA | 0.0E+00 | 0.0E+00 |
| NA | 1.6E–01 | 3.7E+00 | 6.3E–03 | 3.7E+00 | 3.7E+00 |
| NA | 1.0E+00 | 1.5E+01 | 9.3E–03 | 1.5E+01 | 1.5E+01 |
| NA | 1.6E–01 | 7.5E+00 | 6.0E–02 | 7.5E+00 | 7.5E+00 |
| <300 | 7.8E–02 | 1.4E+01 | 5.6E–02 | 1.4E+01 | 1.4E+01 |
| 1.7E+03 | 2.0E–02 | 3.3E+02 | 1.3E–01 | 3.3E+02 | 3.3E+02 |
| NA | 1.7E+01 | 1.4E+00 | 2.4E–01 | 1.4E+00 | 1.4E+00 |
| NA | 2.3E–01 | 6.7E+00 | 1.4E–02 | 6.7E+00 | 6.7E+00 |
| NA | 7.6E–01 | 1.7E+00 | 1.6E–01 | 1.7E+00 | 1.7E+00 |
| NA | NA | 0.0E+00 | NA | 0.0E+00 | 0.0E+00 |
| <300 | 1.8E+00 | 3.7E+02 | 9.2E–01 | 3.7E+02 | 3.7E+02 |
| NA | NA | NA | 1.0E–02 | 0.0E+00 [b] | 5.5E–02 [b] |
| NA | NA | NA | 1.0E–02 | 4.1E–03 [b] | 5.3E–02 [b] |
| NA | 2.1E+00 | 8.4E–02 | 1.0E–02 | 8.4E–02 | 8.4E–02 |
| NA | NA | NA | 1.2E–01 | 7.3E–02 [b] | 1.5E–01 [b] |
| NA | NA | NA | 1.7E–02 | 0.0E+00 [b] | 2.2E–03 [b] |
| NA | 5.0E–02 | 2.9E–02 | 4.9E–02 | 2.9E–02 | 2.9E–02 |
| 3.1E+02 | 5.0E–02 | 1.5E+00 | 7.6E–03 | 1.5E+00 | 1.5E+00 |
| NA | 5.0E–02 | 1.1E–01 | 4.9E–02 | 1.1E–01 | 1.1E–01 |
| 3.2E+02 | 5.0E–02 | 9.1E–02 | 4.9E–02 | 9.1E–02 | 9.1E–02 |
| NA | 5.0E–02 | 1.1E–01 | 4.9E–02 | 1.1E–01 | 1.1E–01 |
| NA | NA | NA | NA | NA | NA |
| NA | NA | NA | NA | NA | NA |
| NA | NA | NA | NA | NA | NA |
| NA | NA | NA | NA | NA | NA |
| NA | NA | NA | NA | NA | NA |
| NA | NA | NA | NA | NA | NA |

Table O–2.10
Estimated Chronic Exposure to Semi–Aquatic Receptors from Ingestion of Average Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

**EXPOSURE CONCENTRATION DATA**

| CHEMICAL | AVERAGE SEDIMENT CONCENTRATION (mg/kg) | AVERAGE FILT. SURFACE WATER CONCENTRATION (mg/L) |
|---|---|---|
| 1,2–Dichlorobenzene | Not a CP | Not a CPC |
| 1,4–Dichlorobenzene | Not a CP | Not a CPC |
| Benzo(b)fluoranthene | Not a CP | Not a CPC |
| Chrysene | 4.7E–01 | Not a CPC |
| Naphthalene | Not a CP | Not a CPC |
| Benzene | Not a CP | Not a CPC |
| Carbon disulfide | Not a CP | 3.4E–04 |
| Chlorobenzene | Not a CP | Not a CPC |
| Chloroform | Not a CP | 3.0E–04 |
| Trichloroethylene | 4.2E–03 | 6.5E–04 |
| Xylene | Not a CP | Not a CPC |

**ESTIMATED TISSUE LEVELS IN PRIMARY PREY ITEMS**

| Aquatic Organism BCF [a] | Aquatic Organism BAF [a] | Aq. Org. Tissue Level (mg/kg) | Aquatic Plant BAF [a] | Raccoon Tissue Exposure (mg/kg) | Heron Tissue Exposure (mg/kg) |
|---|---|---|---|---|---|
| NA | 5.0E–02 | 0.0E+00 | 7.3E–02 | 0.0E+00 | 0.0E+00 |
| NA | 5.0E–02 | 0.0E+00 | 7.3E–02 | 0.0E+00 | 0.0E+00 |
| NA | 5.0E–02 | 0.0E+00 | 2.5E–02 | 0.0E+00 | 0.0E+00 |
| NA | 5.0E–02 | 2.4E–02 | 2.5E–02 | 2.4E–02 | 2.4E–02 |
| NA | 5.0E–02 | 0.0E+00 | 2.5E–02 | 0.0E+00 | 0.0E+00 |
| NA | NA | 0.0E+00 | NA | NA | NA |
| NA | NA | 0.0E+00 | NA | NA | NA |
| NA | NA | 0.0E+00 | NA | NA | NA |
| NA | NA | 0.0E+00 | NA | NA | NA |
| NA | NA | 0.0E+00 | NA | NA | NA |
| NA | NA | 0.0E+00 | NA | NA | NA |

[a] Bioaccumulation data presented in: Appendix O, Tables O–1.2 and O–1.3 BAFs are multiplied by sediment concentrations and BCFs are multiplied by the surface water concentrations; BCFs <300 were not used as per USEPA (1989). The aquatic organism tissue level is equal to the greater of the two products.

[b] Measured crayfish and fish tissue concentrations (provided in Table O–1.3).

Table O-[illegible]0
Estimated Chronic Exposure to Semi-Aquatic Receptors from Ingestion of Average Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

**POTENTIAL DIETARY EXPOSURE (mg/kgBW-day) [c]**

| CHEMICAL | *Muskrat* | *Mallard* | *Raccoon* | *Great blue heron* |
|---|---|---|---|---|
| Aluminum | 8.6E+01 | 5.1E-02 | 1.8E-01 | 4.6E+01 |
| Arsenic | 1.6E+00 | 3.6E-03 | 6.6E-04 | 7.8E-02 |
| Barium | 5.6E-01 | 5.2E-04 | 6.6E-04 | 8.0E-02 |
| Cadmium | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Chromium | 1.9E-01 | 1.1E-04 | 5.3E-04 | 1.7E-01 |
| Cobalt | 2.1E-01 | 9.7E-05 | 1.5E-03 | 6.3E-01 |
| Copper | 5.1E-01 | 6.2E-04 | 1.1E-03 | 3.5E-01 |
| Lead | 1.8E+00 | 2.2E-03 | 2.7E-03 | 7.1E-01 |
| Manganese | 1.8E+01 | 3.0E-02 | 4.0E-02 | 1.4E+01 |
| Mercury | 1.1E-02 | 5.7E-06 | 1.2E-04 | 5.7E-02 |
| Nickel | 2.6E-01 | 1.7E-04 | 8.5E-04 | 3.0E-01 |
| Selenium | 4.6E-02 | 7.0E-05 | 1.8E-04 | 7.4E-02 |
| Vanadium | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Zinc | 1.4E+01 | 3.2E-02 | 3.5E-02 | 1.5E+01 |
| 4,4'-DDD | 1.1E-03 | 7.2E-07 | 1.3E-06 | 2.4E-03 |
| 4,4'-DDE | 4.0E-04 | 2.8E-07 | 8.6E-07 | 2.2E-03 |
| 4,4'-DDT | 8.4E-04 | 3.3E-07 | 7.8E-06 | 3.5E-03 |
| Aroclor-1260 | 9.0E-04 | 1.6E-06 | 7.1E-06 | 6.4E-03 |
| Dieldrin | 7.2E-05 | 5.8E-08 | 8.4E-08 | 9.7E-05 |
| Benzo[k]fluoranthene | 5.5E-03 | 6.6E-06 | 7.7E-06 | 1.7E-03 |
| Bis(2-ethylhexyl)phthalate | 1.0E-02 | 3.3E-06 | 1.3E-04 | 6.1E-02 |
| Fluoranthene | 2.1E-02 | 2.5E-05 | 2.9E-05 | 6.3E-03 |
| Phenanthrene | 8.0E-03 | 9.2E-06 | 1.5E-05 | 4.4E-03 |
| Pyrene | 2.2E-02 | 2.6E-05 | 3.0E-05 | 6.6E-03 |
| 1,2-Dichloroethylenes (cis and trans) | 2.9E-04 | 5.2E-07 | 4.9E-07 | 3.3E-05 |
| Acetone | 5.3E-04 | 2.7E-07 | 7.1E-07 | 6.7E-05 |
| Methylene chloride | 3.1E-04 | 3.7E-07 | 4.7E-07 | 3.7E-05 |
| Tetrachloroethylene | 1.7E-04 | 2.2E-07 | 2.6E-07 | 2.0E-05 |
| Toluene | 6.6E-05 | 7.4E-08 | 9.8E-08 | 7.8E-06 |
| Trichlorofluoromethane | 8.6E-05 | 4.3E-08 | 1.1E-07 | 1.1E-05 |

Table O–2.10
Estimated Chronic Exposure to Semi–Aquatic Receptors from Ingestion of Average Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

**POTENTIAL DIETARY EXPOSURE (mg/kgBW–day) [c]**

| CHEMICAL | *Muskrat* | *Mallard* | *Raccoon* | *Great blue heron* |
|---|---|---|---|---|
| 1,2–Dichlorobenzene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| 1,4–Dichlorobenzene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzo(b)fluoranthene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Chrysene | 3.9E–03 | 1.6E–06 | 6.2E–06 | 1.4E–03 |
| Naphthalene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Benzene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Carbon disulfide | 3.3E–05 | 5.8E–08 | 5.4E–08 | 3.6E–06 |
| Chlorobenzene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |
| Chloroform | 2.9E–05 | 5.1E–08 | 4.7E–08 | 3.2E–06 |
| Trichloroethylene | 8.9E–05 | 1.2E–07 | 1.4E–07 | 1.0E–05 |
| Xylene | 0.0E+00 | 0.0E+00 | 0.0E+00 | 0.0E+00 |

[c] Calculated by summing the products of individual prey type concentrations and percent in diet with surface water and sediment exposures, multiplying by the exposure duration, SFF and ingestion rate, and dividing by body weight (Table 9–27).

Table O-2.10
Exposure Parameters and Assumptions for Semi-Aquatic Receptors
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

**EXPOSURE PARAMETERS [d]**

| Indicator Species | | Percent Prey in Diet: Aquatic Organisms | Percent Prey in Diet: Plants | Percent Prey in Diet: Sediment | Home Range (acres) | ED [e] | Site Foraging Frequency [f] | Dietary Ingestion Rate (kg/day) | Water Ingestion Rate (L/day) | Body Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| *Muskrat* | (Small herb. mammal) | 10% | 80% | 10% | 0.2 | 1 | 1.00E+00 | 0.084 | 0.12 | 1.27 |
| *Mallard* | (Herb. bird) | 1% | 97% | 2% | 235 | 1 | 2.98E-03 | 0.063 | 0.064 | 1.134 |
| *Raccoon* | (Predatory mammal) | 91% | 0% | 9% | 385 | 1 | 1.82E-03 | 0.214 | 0.344 | 3.99 |
| *Great blue heron* | (Piscivorous bird) | 98% | 0% | 2% | 1.5 | 0.5 | 4.67E-01 | 0.401 | 0.101 | 2.23 |

NOTES:
[d] Documentation of exposure parameters presented in: Appendix O, Table O-1.1
[e] ED = Exposure Duration (percentage of year receptor is expected to be found at study area)
[f] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0))

| SITE AREA: | 0.7 acres |
|---|---|

Table O-1.11
Estimated Chronic Exposure to Semi-Aquatic Receptors from Ingestion of RME Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 3

Remedial Investigation Report, AOC 57
Devens, Massachusetts

| EXPOSURE CONCENTRATION DATA | | | ESTIMATED TISSUE LEVELS IN PRIMARY PREY ITEMS | | | | |
|---|---|---|---|---|---|---|---|
| CHEMICAL | RME SEDIMENT CONCENTRATION (mg/kg) | RME UNFILT. SURFACE WATER CONCENTRATION (mg/L) | Aquatic Organism BCF [a] | Aquatic Organism BAF [a] | Aq. Org. Tissue Level (mg/kg) | Aquatic Plant BAF [a] | Raccoon Tissue Exposure (mg/kg) |
| Arsenic | Not a CP | 1.5E-01 | <300 | 6.6E-03 | 0.0E+00 | 3.0E-01 | 0.0E+00 |
| Barium | Not a CP | 2.8E-01 | <300 | 7.5E-03 | 0.0E+00 | 2.5E-02 | 0.0E+00 |
| Copper | Not a CP | 4.4E-02 | 3.4E+02 | 1.6E-01 | 1.5E+01 | 6.0E-02 | 1.5E+01 |
| Lead | Not a CP | 1.8E-01 | <300 | 7.8E-02 | 0.0E+00 | 5.6E-02 | 0.0E+00 |
| Selenium | Not a CP | 2.5E-03 | <300 | 7.6E-01 | 0.0E+00 | 1.6E-01 | 0.0E+00 |
| Zinc | Not a CP | 4.5E-01 | <300 | 1.8E+00 | 0.0E+00 | 9.2E-01 | 0.0E+00 |
| 4,4'-DDD | 1.5E-01 | Not a CPC | NA | NA | NA | 1.0E-02 | 0.0E+00 [b] |
| Aroclor-1260 | 8.4E-01 | Not a CPC | NA | NA | NA | 1.2E-01 | 7.3E-02 [b] |
| Benzo[k]fluoranthene | 2.8E-01 | 9.4E-04 | NA | 5.0E-02 | 1.4E-02 | 4.9E-02 | 1.4E-02 |
| Fluoranthene | 6.5E-01 | Not a CPC | NA | 5.0E-02 | 3.3E-02 | 4.9E-02 | 3.3E-02 |
| Phenanthrene | 3.7E-01 | Not a CPC | 3.2E+02 | 5.0E-02 | 1.8E-02 | 4.9E-02 | 1.8E-02 |
| Pyrene | 5.6E-01 | Not a CPC | NA | 5.0E-02 | 2.8E-02 | 4.9E-02 | 2.8E-02 |
| Acetone | 2.1E-01 | Not a CPC | NA | NA | NA | NA | NA |
| Toluene | 4.8E-03 | 1.6E-03 | NA | NA | NA | NA | NA |
| 1,2-Dichlorobenzene | 3.9E-01 | Not a CPC | NA | 5.0E-02 | 2.0E-02 | 7.3E-02 | 2.0E-02 |
| 1,4-Dichlorobenzene | 1.0E+00 | Not a CPC | NA | 5.0E-02 | 5.0E-02 | 7.3E-02 | 5.0E-02 |
| Benzo(b)fluoranthene | 4.9E-01 | Not a CPC | NA | 5.0E-02 | 2.5E-02 | 2.5E-02 | 2.5E-02 |
| Chrysene | 3.4E-01 | Not a CPC | NA | 5.0E-02 | 1.7E-02 | 2.5E-02 | 1.7E-02 |
| Naphthalene | 5.3E-01 | Not a CPC | NA | 5.0E-02 | 2.7E-02 | 2.5E-02 | 2.7E-02 |
| Benzene | 3.7E-02 | Not a CPC | NA | NA | 0.0E+00 | NA | NA |
| Carbon disulfide | Not a CP | 5.8E-04 | NA | NA | 0.0E+00 | NA | NA |
| Chlorobenzene | 1.9E-02 | 4.6E-03 | NA | NA | 0.0E+00 | NA | NA |
| Xylene | 1.1E-02 | Not a CPC | NA | NA | 0.0E+00 | NA | NA |
| Antimony | Not a CP | 5.6E-03 | <300 | NA | 0.0E+00 | 4.0E-02 | 0.0E+00 |

[a] Bioaccumulation data presented in: Appendix O, Tables O-1.2 and O-1.3 BAFs are multiplied by sediment concentrations and BCFs are multiplied by the surface water concentrations; BCFs <300 were not used as per USEPA (1989). The aquatic organism tissue level is equal to the greater of the two products.

[b] Measured crayfish and fish tissue concentrations (provided in Table O-1.3).

Table O–2.11
Estimated Chronic Exposure to Semi–Aquatic Receptors from Ingestion of RME Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 3

Remedial Investigation Report, AOC 57
Devens, Massachusetts

POTENTIAL DIETARY EXPOSURE (mg/kgBW–day) [c]

| CHEMICAL | *Raccoon* |
|---|---|
| Arsenic | 6.9E–06 |
| Barium | 1.2E–05 |
| Copper | 3.8E–04 |
| Lead | 8.2E–06 |
| Selenium | 1.1E–07 |
| Zinc | 2.0E–05 |
| 4,4'–DDD | 3.8E–07 |
| Aroclor–1260 | 4.0E–06 |
| Benzo[k]fluoranthene | 1.1E–06 |
| Fluoranthene | 2.5E–06 |
| Phenanthrene | 1.4E–06 |
| Pyrene | 2.1E–06 |
| Acetone | 5.3E–07 |
| Toluene | 8.4E–08 |
| 1,2–Dichlorobenzene | 1.5E–06 |
| 1,4–Dichlorobenzene | 3.8E–06 |
| Benzo(b)fluoranthene | 1.8E–06 |
| Chrysene | 1.3E–06 |
| Naphthalene | 2.0E–06 |
| Benzene | 9.3E–08 |
| Carbon disulfide | 2.6E–08 |
| Chlorobenzene | 2.5E–07 |
| Xylene | 2.8E–08 |
| Antimony | 2.5E–07 |

[c] Calculated by summing the products of individual prey type concentrations and percent in diet with surface water and sediment exposures, multiplying by the exposure duration, SFF and ingestion rate, and dividing by body weight (Table 9–27).

Table O–2.11
Exposure Parameters and Assumptions for Semi–Aquatic Receptors
Area 3

Remedial Investigation Report, AOC 57
Devens, Massachusetts

**EXPOSURE PARAMETERS [d]**

| Indicator Species | | Percent Prey in Diet: Aquatic Organisms | Percent Prey in Diet: Plants | Sediment | Home Range (acres) | ED [e] | Site Foraging Frequency [f] | Dietary Ingestion Rate (kg/day) | Water Ingestion Rate (L/day) | Body Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| *Raccoon* | (Predatory mammal) | 91% | 0% | 9% | 385 | 1 | 5.19E–04 | 0.214 | 0.344 | 3.99 |

NOTES:
[d] Documentation of exposure parameters presented in: Appendix O, Table O–1.1
[e] ED = Exposure Duration (percentage of year receptor is expected to be found at study area)
[f] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0))

| SITE AREA: | 0.2 acres |
|---|---|

Table O–2.12
Risk from Potential Lethal or Sublethal Effects for Terrestrial Receptors from RME Concentrations of CPCs in Food and Surface Soil
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| ANALYTE | *White–footed mouse* | | | *American robin* | | | *Red fox* | | |
|---|---|---|---|---|---|---|---|---|---|
| | PDE | RTV | HQ | PDE | RTV | HQ | PDE | RTV | HQ |
| Arsenic | 7.3E–01 | 5.8E–01 | 1.3E+00 | 6.1E–01 | 1.0E+00 | 6.1E–01 | 2.4E–05 | 5.8E–01 | 4.2E–05 |
| Cobalt | 1.1E–01 | 4.2E+00 | 2.7E–02 | 3.5E–01 | 4.2E+00 | 8.3E–02 | 3.7E–05 | 4.2E+00 | 8.8E–06 |
| Copper | 1.4E+00 | 1.0E+02 | 1.4E–02 | 1.0E+00 | 1.0E+02 | 1.0E–02 | 9.6E–05 | 1.0E+02 | 9.6E–07 |
| Manganese | 3.9E+00 | 4.5E+01 | 8.6E–02 | 7.0E+00 | 4.5E+01 | 1.5E–01 | 2.8E–04 | 4.5E+01 | 6.3E–06 |
| Nickel | 2.0E–01 | 1.3E+01 | 1.5E–02 | 6.0E–01 | 5.0E+01 | 1.2E–02 | 4.1E–05 | 1.3E+01 | 3.2E–06 |
| Selenium | 1.1E–02 | 2.0E–01 | 5.6E–02 | 3.4E–02 | 6.0E–01 | 5.6E–02 | 3.1E–06 | 2.0E–01 | 1.6E–05 |
| 4,4'–DDE | 4.8E–04 | 2.0E–01 | 2.4E–03 | 1.4E–03 | 3.9E–01 | 3.6E–03 | 1.9E–07 | 1.2E+01 | 1.6E–08 |
| 4,4'–DDT | 2.7E–04 | 2.0E–01 | 1.4E–03 | 8.2E–04 | 1.4E–01 | 5.8E–03 | 1.0E–07 | 1.2E+01 | 8.6E–09 |
| 2–Methylnaphthalene | 3.6E–03 | 1.0E+01 | 3.6E–04 | 6.7E–03 | 1.0E+01 | 6.7E–04 | 3.3E–07 | 1.0E+01 | 3.3E–08 |
| Bis(2–ethylhexyl)phthalate | 1.0E–02 | 3.5E+01 | 3.0E–04 | 3.5E–02 | 3.5E+01 | 1.0E–03 | 1.9E–06 | 3.5E+01 | 5.4E–08 |
| Dibenzofuran | 1.1E–03 | 1.3E+01 | 8.5E–05 | 2.3E–03 | 1.3E+01 | 1.9E–04 | 1.2E–07 | 1.3E+01 | 9.4E–09 |
| Fluoranthene | 2.5E–03 | 1.0E+01 | 2.5E–04 | 4.6E–03 | 1.0E+01 | 4.6E–04 | 2.3E–07 | 1.0E+01 | 2.3E–08 |
| Naphthalene | 3.5E–03 | 3.6E+01 | 9.9E–05 | 6.5E–03 | 3.6E+01 | 1.8E–04 | 3.3E–07 | 3.6E+01 | 9.1E–09 |
| Phenanthrene | 2.3E–03 | 1.0E+01 | 2.3E–04 | 4.3E–03 | 1.0E+01 | 4.3E–04 | 2.2E–07 | 1.0E+01 | 2.2E–08 |
| Pyrene | 3.3E–03 | 1.0E+01 | 3.3E–04 | 6.2E–03 | 1.0E+01 | 6.2E–04 | 3.1E–07 | 1.0E+01 | 3.1E–08 |
| Chloroform | 2.2E–06 | 1.6E+02 | 1.3E–08 | 9.5E–06 | 1.6E+02 | 5.8E–08 | 4.0E–10 | 1.6E+02 | 2.4E–12 |
| Ethylbenzene | 5.9E–06 | 2.9E+02 | 2.0E–08 | 2.6E–05 | 2.9E+02 | 8.8E–08 | 1.1E–09 | 2.9E+02 | 3.7E–12 |
| Tetrachloroethylene | 7.3E–06 | 1.0E+02 | 7.4E–08 | 3.2E–05 | 1.0E+02 | 3.2E–07 | 1.3E–09 | 1.0E+02 | 1.3E–11 |
| Toluene | 9.1E–06 | 7.6E+01 | 1.2E–07 | 4.0E–05 | 7.6E+01 | 5.2E–07 | 1.6E–09 | 7.6E+01 | 2.2E–11 |
| Trichlorofluoromethane | 4.2E–05 | 3.5E+01 | 1.2E–06 | 1.8E–04 | 3.5E+01 | 5.2E–06 | 7.6E–09 | 3.5E+01 | 2.2E–10 |
| Xylenes | 7.1E–05 | 5.0E+02 | 1.4E–07 | 3.1E–04 | 5.0E+02 | 6.2E–07 | 1.3E–08 | 5.0E+02 | 2.6E–11 |
| SUMMARY HAZARD INDEX | | | 1.5E+00 | | | 9.4E–01 | | | 7.7E–05 |

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–2.12
Risk from Potential Lethal or Sublethal Effects for Terrestrial Receptors from RME Concentrations of CPCs in Food and Surface Soil
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| ANALYTE | *Barred owl* | | |
|---|---|---|---|
| | PDE | RTV | HQ |
| Arsenic | 9.0E–05 | 1.0E+00 | 9.0E–05 |
| Cobalt | 1.9E–04 | 4.2E+00 | 4.5E–05 |
| Copper | 5.6E–04 | 1.0E+02 | 5.6E–06 |
| Manganese | 1.5E–03 | 4.5E+01 | 3.3E–05 |
| Nickel | 1.8E–04 | 5.0E+01 | 3.6E–06 |
| Selenium | 1.2E–05 | 6.0E–01 | 2.1E–05 |
| 4,4'–DDE | 1.6E–06 | 3.9E–01 | 4.2E–06 |
| 4,4'–DDT | 9.9E–07 | 1.4E–01 | 7.1E–06 |
| 2–Methylnaphthalene | 1.8E–06 | 1.0E+01 | 1.8E–07 |
| Bis(2–ethylhexyl)phthalate | 1.2E–05 | 3.5E+01 | 3.3E–07 |
| Dibenzofuran | 6.5E–07 | 1.3E+01 | 5.2E–08 |
| Fluoranthene | 1.3E–06 | 1.0E+01 | 1.3E–07 |
| Naphthalene | 1.8E–06 | 3.6E+01 | 4.9E–08 |
| Phenanthrene | 1.2E–06 | 1.0E+01 | 1.2E–07 |
| Pyrene | 1.7E–06 | 1.0E+01 | 1.7E–07 |
| Chloroform | 2.6E–09 | 1.6E+02 | 1.6E–11 |
| Ethylbenzene | 6.9E–09 | 2.9E+02 | 2.4E–11 |
| Tetrachloroethylene | 8.7E–09 | 1.0E+02 | 8.7E–11 |
| Toluene | 1.1E–08 | 7.6E+01 | 1.4E–10 |
| Trichlorofluoromethane | 4.9E–08 | 3.5E+01 | 1.4E–09 |
| Xylenes | 8.4E–08 | 5.0E+02 | 1.7E–10 |
| SUMMARY HAZARD INDEX | | | 2.1E–04 |

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–2.13
Risk from Potential Lethal or Sublethal Effects for Terrestrial Receptors from Average Exposure Concentrations of CPCs in Food and Surface Soil
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| ANALYTE | *White–footed mouse* | | | *American robin* | | | *Red fox* | | |
|---|---|---|---|---|---|---|---|---|---|
| | PDE | RTV | HQ | PDE | RTV | HQ | PDE | RTV | HQ |
| Arsenic | 5.1E–01 | 5.8E–01 | 8.7E–01 | 4.2E–01 | 1.0E+00 | 4.2E–01 | 1.7E–05 | 5.8E–01 | 2.9E–05 |
| Cobalt | 7.0E–02 | 4.2E+00 | 1.7E–02 | 2.1E–01 | 4.2E+00 | 5.1E–02 | 2.3E–05 | 4.2E+00 | 5.4E–06 |
| Copper | 9.7E–01 | 1.0E+02 | 9.7E–03 | 7.0E–01 | 1.0E+02 | 7.0E–03 | 6.7E–05 | 1.0E+02 | 6.7E–07 |
| Manganese | 2.3E+00 | 4.5E+01 | 5.1E–02 | 4.1E+00 | 4.5E+01 | 9.1E–02 | 1.7E–04 | 4.5E+01 | 3.7E–06 |
| Nickel | 1.1E–01 | 1.3E+01 | 8.5E–03 | 3.3E–01 | 5.0E+01 | 6.6E–03 | 2.3E–05 | 1.3E+01 | 1.7E–06 |
| Selenium | 3.6E–03 | 2.0E–01 | 1.8E–02 | 1.1E–02 | 6.0E–01 | 1.8E–02 | 1.0E–06 | 2.0E–01 | 5.0E–06 |
| 4,4'–DDE | 1.7E–04 | 2.0E–01 | 8.4E–04 | 4.9E–04 | 3.9E–01 | 1.3E–03 | 6.6E–08 | 1.2E+01 | 5.5E–09 |
| 4,4'–DDT | 8.4E–05 | 2.0E–01 | 4.2E–04 | 2.5E–04 | 1.4E–01 | 1.8E–03 | 3.2E–08 | 1.2E+01 | 2.6E–09 |
| 2–Methylnaphthalene | 1.7E–03 | 1.0E+01 | 1.7E–04 | 3.1E–03 | 1.0E+01 | 3.1E–04 | 1.6E–07 | 1.0E+01 | 1.6E–08 |
| Bis(2–ethylhexyl)phthalate | 6.2E–03 | 3.5E+01 | 1.8E–04 | 2.1E–02 | 3.5E+01 | 5.9E–04 | 1.1E–06 | 3.5E+01 | 3.2E–08 |
| Dibenzofuran | 5.5E–04 | 1.3E+01 | 4.4E–05 | 1.2E–03 | 1.3E+01 | 9.6E–05 | 6.1E–08 | 1.3E+01 | 4.9E–09 |
| Fluoranthene | 1.3E–03 | 1.0E+01 | 1.3E–04 | 2.5E–03 | 1.0E+01 | 2.5E–04 | 1.2E–07 | 1.0E+01 | 1.2E–08 |
| Naphthalene | 1.8E–03 | 3.6E+01 | 4.9E–05 | 3.3E–03 | 3.6E+01 | 9.1E–05 | 1.6E–07 | 3.6E+01 | 4.6E–09 |
| Phenanthrene | 1.3E–03 | 1.0E+01 | 1.3E–04 | 2.3E–03 | 1.0E+01 | 2.3E–04 | 1.2E–07 | 1.0E+01 | 1.2E–08 |
| Pyrene | 1.5E–03 | 1.0E+01 | 1.5E–04 | 2.8E–03 | 1.0E+01 | 2.8E–04 | 1.4E–07 | 1.0E+01 | 1.4E–08 |
| Chloroform | 1.3E–06 | 1.6E+02 | 7.9E–09 | 5.7E–06 | 1.6E+02 | 3.5E–08 | 2.4E–10 | 1.6E+02 | 1.4E–12 |
| Ethylbenzene | 2.9E–06 | 2.9E+02 | 1.0E–08 | 1.3E–05 | 2.9E+02 | 4.4E–08 | 5.3E–10 | 2.9E+02 | 1.8E–12 |
| Tetrachloroethylene | 2.3E–06 | 1.0E+02 | 2.3E–08 | 9.9E–06 | 1.0E+02 | 9.9E–08 | 4.1E–10 | 1.0E+02 | 4.1E–12 |
| Toluene | 4.2E–06 | 7.6E+01 | 5.5E–08 | 1.8E–05 | 7.6E+01 | 2.4E–07 | 7.6E–10 | 7.6E+01 | 9.9E–12 |
| Trichlorofluoromethane | 1.8E–05 | 3.5E+01 | 5.2E–07 | 8.0E–05 | 3.5E+01 | 2.3E–06 | 3.3E–09 | 3.5E+01 | 9.5E–11 |
| Xylenes | 1.6E–05 | 5.0E+02 | 3.1E–08 | 6.9E–05 | 5.0E+02 | 1.4E–07 | 2.8E–09 | 5.0E+02 | 5.7E–12 |
| SUMMARY HAZARD INDEX | | | 9.8E–01 | | | 6.0E–01 | | | 4.5E–05 |

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–2.13
Risk from Potential Lethal or Sublethal Effects for Terrestrial Receptors from Average Exposure Concentrations of CPCs in Food and Surface Soil
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| ANALYTE | *Barred owl* | | |
|---|---|---|---|
| | PDE | RTV | HQ |
| Arsenic | 6.2E–05 | 1.0E+00 | 6.2E–05 |
| Cobalt | 1.2E–04 | 4.2E+00 | 2.8E–05 |
| Copper | 3.9E–04 | 1.0E+02 | 3.9E–06 |
| Manganese | 8.7E–04 | 4.5E+01 | 1.9E–05 |
| Nickel | 1.0E–04 | 5.0E+01 | 2.0E–06 |
| Selenium | 3.9E–06 | 6.0E–01 | 6.6E–06 |
| 4,4'–DDE | 5.8E–07 | 3.9E–01 | 1.5E–06 |
| 4,4'–DDT | 3.1E–07 | 1.4E–01 | 2.2E–06 |
| 2–Methylnaphthalene | 8.4E–07 | 1.0E+01 | 8.4E–08 |
| Bis(2–ethylhexyl)phthalate | 6.9E–06 | 3.5E+01 | 2.0E–07 |
| Dibenzofuran | 3.4E–07 | 1.3E+01 | 2.7E–08 |
| Fluoranthene | 6.7E–07 | 1.0E+01 | 6.7E–08 |
| Naphthalene | 8.8E–07 | 3.6E+01 | 2.5E–08 |
| Phenanthrene | 6.3E–07 | 1.0E+01 | 6.3E–08 |
| Pyrene | 7.6E–07 | 1.0E+01 | 7.6E–08 |
| Chloroform | 1.5E–09 | 1.6E+02 | 9.3E–12 |
| Ethylbenzene | 3.5E–09 | 2.9E+02 | 1.2E–11 |
| Tetrachloroethylene | 2.7E–09 | 1.0E+02 | 2.7E–11 |
| Toluene | 4.9E–09 | 7.6E+01 | 6.5E–11 |
| Trichlorofluoromethane | 2.2E–08 | 3.5E+01 | 6.2E–10 |
| Xylenes | 1.8E–08 | 5.0E+02 | 3.7E–11 |
| SUMMARY HAZARD INDEX | | | 1.3E–04 |

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–2.14
Risk from Potential Lethal or Sublethal Effects for Terrestrial Receptors from RME Concentrations of CPCs in Food and Surface Soil
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| ANALYTE | White–footed mouse | | | American robin | | | Raccoon | | |
|---|---|---|---|---|---|---|---|---|---|
| | PDE | RTV | HQ | PDE | RTV | HQ | PDE | RTV | HQ |
| Antimony | 1.2E–02 | 4.2E+01 | 2.9E–04 | 1.5E–02 | 4.2E+01 | 3.6E–04 | 8.1E–06 | 4.2E+01 | 1.9E–07 |
| Copper | 3.5E+00 | 1.0E+02 | 3.5E–02 | 1.6E+00 | 1.0E+02 | 1.6E–02 | 9.8E–04 | 1.0E+02 | 9.8E–06 |
| Lead | 1.4E+00 | 2.5E+00 | 5.6E–01 | 2.8E+00 | 7.5E+01 | 3.7E–02 | 1.4E–03 | 2.5E+00 | 5.7E–04 |
| Selenium | 5.6E–02 | 2.0E–01 | 2.8E–01 | 1.0E–01 | 6.0E–01 | 1.7E–01 | 4.2E–05 | 2.0E–01 | 2.1E–04 |
| 4,4'–DDE | 1.5E–03 | 2.0E–01 | 7.5E–03 | 2.7E–03 | 3.9E–01 | 7.0E–03 | 1.0E–06 | 1.2E+01 | 8.6E–08 |
| Aroclor–1260 | 3.1E–01 | 6.4E+00 | 4.9E–02 | 5.0E–01 | 9.0E–01 | 5.6E–01 | 2.6E–04 | 7.5E–03 | 3.5E–02 |
| Dieldrin | 1.8E–03 | 6.5E–01 | 2.8E–03 | 3.2E–03 | 6.0E–01 | 5.4E–03 | 1.2E–06 | 6.5E–01 | 1.9E–06 |
| Di–n–butylphthalate | 3.0E–03 | 1.1E+00 | 2.7E–03 | 6.2E–03 | 1.1E+00 | 5.7E–03 | 3.3E–06 | 1.1E+00 | 3.0E–06 |
| Fluoranthene | 1.7E–02 | 1.0E+01 | 1.7E–03 | 1.9E–02 | 1.0E+01 | 1.9E–03 | 1.1E–05 | 1.0E+01 | 1.1E–06 |
| Phenanthrene | 8.4E–03 | 1.0E+01 | 8.4E–04 | 9.7E–03 | 1.0E+01 | 9.7E–04 | 5.3E–06 | 1.0E+01 | 5.3E–07 |
| Pyrene | 1.7E–02 | 1.0E+01 | 1.7E–03 | 1.9E–02 | 1.0E+01 | 1.9E–03 | 1.1E–05 | 1.0E+01 | 1.1E–06 |
| Methylene chloride | 2.0E–05 | 5.3E+01 | 3.8E–07 | 5.4E–05 | 5.3E+01 | 1.0E–06 | 3.0E–08 | 5.3E+01 | 5.8E–10 |
| Tetrachloroethylene | 3.4E–06 | 1.0E+02 | 3.4E–08 | 9.4E–06 | 1.0E+02 | 9.4E–08 | 5.3E–09 | 1.0E+02 | 5.3E–11 |
| Toluene | 1.2E–05 | 7.6E+01 | 1.6E–07 | 3.4E–05 | 7.6E+01 | 4.5E–07 | 1.9E–08 | 7.6E+01 | 2.5E–10 |
| Trichlorofluoromethane | 1.8E–05 | 3.5E+01 | 5.0E–07 | 4.8E–05 | 3.5E+01 | 1.4E–06 | 2.7E–08 | 3.5E+01 | 7.7E–10 |
| 4,4'–DDD | 4.4E–04 | 2.0E–01 | 2.2E–03 | 8.0E–04 | 1.4E–01 | 5.7E–03 | 3.0E–07 | 1.2E+01 | 2.5E–08 |
| 4,4'–DDT | 1.9E–03 | 2.0E–01 | 9.5E–03 | 3.5E–03 | 1.4E–01 | 2.5E–02 | 1.6E–06 | 1.2E+01 | 1.3E–07 |
| 2–Methylnaphthylene | 2.2E–03 | 1.0E+01 | 2.2E–04 | 3.3E–03 | 1.0E+01 | 3.3E–04 | 1.8E–06 | 1.0E+01 | 1.8E–07 |
| Acenaphthylene | 1.5E–03 | 1.0E+01 | 1.5E–04 | 2.3E–03 | 1.0E+01 | 2.3E–04 | 1.2E–06 | 1.0E+01 | 1.2E–07 |
| Benzo(k)fluoranthene | 3.5E–03 | 1.0E+01 | 3.5E–04 | 5.3E–03 | 1.0E+01 | 5.3E–04 | 2.8E–06 | 1.0E+01 | 2.8E–07 |
| Chrysene | 4.1E–03 | 1.0E+01 | 4.1E–04 | 6.2E–03 | 1.0E+01 | 6.2E–04 | 3.3E–06 | 1.0E+01 | 3.3E–07 |
| Naphthalene | 1.7E–03 | 3.6E+01 | 4.9E–05 | 2.6E–03 | 3.6E+01 | 7.4E–05 | 1.4E–06 | 3.6E+01 | 4.0E–08 |
| 1,2–Dichloroethylene (cis and trans) | 1.7E–05 | 3.0E+01 | 5.6E–07 | 4.6E–05 | 3.0E+01 | 1.5E–06 | 2.6E–08 | 3.0E+01 | 8.7E–10 |
| Acetone | 1.6E–04 | 6.0E+02 | 2.7E–07 | 4.5E–04 | 6.0E+02 | 7.5E–07 | 2.5E–07 | 6.0E+02 | 4.2E–10 |
| Ethylbenzene | 1.4E–05 | 2.9E+02 | 5.0E–08 | 4.0E–05 | 2.9E+02 | 1.4E–07 | 2.2E–08 | 2.9E+02 | 7.6E–11 |
| Arsenic | 1.7E+00 | 5.8E–01 | 2.9E+00 | 8.8E–01 | 1.0E+00 | 8.8E–01 | 5.2E–04 | 5.8E–01 | 9.0E–04 |
| Barium | 6.1E–01 | 2.0E+02 | 3.1E–03 | 8.5E–01 | 2.0E+02 | 4.3E–03 | 4.8E–04 | 2.0E+02 | 2.4E–06 |
| Manganese | 2.2E+00 | 4.5E+01 | 4.9E–02 | 2.5E+00 | 4.5E+01 | 5.5E–02 | 1.4E–03 | 4.5E+01 | 3.1E–05 |
| Zinc | 1.4E+01 | 2.0E+02 | 6.8E–02 | 1.0E+01 | 2.0E+02 | 5.2E–02 | 6.0E–03 | 2.0E+02 | 3.0E–05 |
| SUMMARY HAZARD INDEX | | | 4.0E+00 | | | 1.8E+00 | | | 3.7E–02 |

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–2.14
Risk from Potential Lethal or Sublethal Effects for Terrestrial Receptors from RME Concentrations of CPCs in Food and Surface Soil
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| ANALYTE | *Barred owl* | | | *Short–tailed shrew* | | |
|---|---|---|---|---|---|---|
| | PDE | RTV | HQ | PDE | RTV | HQ |
| Antimony | 3.0E–06 | 4.2E+01 | 7.3E–08 | 1.0E–02 | 4.2E+01 | 2.5E–04 |
| Copper | 3.7E–04 | 1.0E+02 | 3.7E–06 | 5.5E–01 | 1.0E+02 | 5.5E–03 |
| Lead | 5.9E–04 | 7.5E+01 | 7.8E–06 | 2.3E+00 | 2.5E+00 | 9.1E–01 |
| Selenium | 2.7E–05 | 6.0E–01 | 4.6E–05 | 1.3E–01 | 2.0E–01 | 6.7E–01 |
| 4,4'–DDE | 1.1E–06 | 3.9E–01 | 2.8E–06 | 4.0E–03 | 2.0E–01 | 2.0E–02 |
| Aroclor–1260 | 4.4E–04 | 9.0E+00 | 4.9E–05 | 7.4E–01 | 6.4E+00 | 1.2E–01 |
| Dieldrin | 1.2E–06 | 6.0E–01 | 2.1E–06 | 4.8E–03 | 6.5E–01 | 7.5E–03 |
| Di–n–butylphthalate | 1.6E–06 | 1.1E+00 | 1.5E–06 | 4.8E–03 | 1.1E+00 | 4.3E–03 |
| Fluoranthene | 4.1E–06 | 1.0E+01 | 4.1E–07 | 1.3E–02 | 1.0E+01 | 1.3E–03 |
| Phenanthrene | 2.1E–06 | 1.0E+01 | 2.1E–07 | 6.4E–03 | 1.0E+01 | 6.4E–04 |
| Pyrene | 4.1E–06 | 1.0E+01 | 4.1E–07 | 1.3E–02 | 1.0E+01 | 1.3E–03 |
| Methylene chloride | 1.4E–08 | 5.3E+01 | 2.7E–10 | 3.6E–05 | 5.3E+01 | 6.8E–07 |
| Tetrachloroethylene | 2.4E–09 | 1.0E+02 | 2.4E–11 | 6.2E–06 | 1.0E+02 | 6.2E–08 |
| Toluene | 8.8E–09 | 7.6E+01 | 1.2E–10 | 2.2E–05 | 7.6E+01 | 3.0E–07 |
| Trichlorofluoromethane | 1.2E–08 | 3.5E+01 | 3.6E–10 | 3.2E–05 | 3.5E+01 | 9.1E–07 |
| 4,4'–DDD | 3.2E–07 | 1.4E–01 | 2.3E–06 | 1.2E–03 | 2.0E–01 | 5.9E–03 |
| 4,4'–DDT | 1.5E–06 | 1.4E–01 | 1.1E–05 | 4.3E–03 | 2.0E–01 | 2.2E–02 |
| 2–Methylnaphthylene | 7.7E–07 | 1.0E+01 | 7.7E–08 | 2.4E–03 | 1.0E+01 | 2.4E–04 |
| Acenaphthylene | 5.2E–07 | 1.0E+01 | 5.2E–08 | 1.6E–03 | 1.0E+01 | 1.6E–04 |
| Benzo(k)fluoranthene | 1.2E–06 | 1.0E+01 | 1.2E–07 | 3.8E–03 | 1.0E+01 | 3.8E–04 |
| Chrysene | 1.4E–06 | 1.0E+01 | 1.4E–07 | 4.4E–03 | 1.0E+01 | 4.4E–04 |
| Naphthalene | 6.0E–07 | 3.6E+01 | 1.7E–08 | 1.9E–03 | 3.6E+01 | 5.3E–05 |
| 1,2–Dichloroethylene (cis and trans) | 1.2E–08 | 3.0E+01 | 4.0E–10 | 3.0E–05 | 3.0E+01 | 1.0E–06 |
| Acetone | 1.2E–07 | 6.0E+02 | 1.9E–10 | 3.0E–04 | 6.0E+02 | 4.9E–07 |
| Ethylbenzene | 1.0E–08 | 2.9E+02 | 3.5E–11 | 2.6E–05 | 2.9E+02 | 8.9E–08 |
| Arsenic | 1.1E–04 | 1.0E+00 | 1.1E–04 | 3.0E–01 | 5.8E–01 | 5.1E–01 |
| Barium | 1.8E–04 | 2.0E+02 | 9.3E–07 | 5.1E–01 | 2.0E+02 | 2.6E–03 |
| Manganese | 4.9E–04 | 4.5E+01 | 1.1E–05 | 1.5E+00 | 4.5E+01 | 3.3E–02 |
| Zinc | 6.6E–03 | 2.0E+02 | 3.3E–05 | 1.0E+01 | 2.0E+02 | 5.2E–02 |
| SUMMARY HAZARD INDEX | | | 2.8E–04 | | | 2.4E+00 |

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–2.15
Risk from Potential Lethal or Sublethal Effects for Terrestrial Receptors from Average Concentrations of CPCs in Food and Surface Soil
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| ANALYTE | *White–footed mouse* | | | *American robin* | | | *Raccoon* | | |
|---|---|---|---|---|---|---|---|---|---|
| | PDE | RTV | HQ | PDE | RTV | HQ | PDE | RTV | HQ |
| Antimony | 1.2E–02 | 4.2E+01 | 2.9E–04 | 1.5E–02 | 4.2E+01 | 3.6E–04 | 8.1E–06 | 4.2E+01 | 1.9E–07 |
| Copper | 1.4E+00 | 1.0E+02 | 1.4E–02 | 6.3E–01 | 1.0E+02 | 6.3E–03 | 3.9E–04 | 1.0E+02 | 3.9E–06 |
| Lead | 6.3E–01 | 2.5E+00 | 2.5E–01 | 1.3E+00 | 7.5E+01 | 1.7E–02 | 6.3E–04 | 2.5E+00 | 2.5E–04 |
| Selenium | 2.4E–02 | 2.0E–01 | 1.2E–01 | 4.5E–02 | 6.0E–01 | 7.5E–02 | 1.8E–05 | 2.0E–01 | 9.0E–05 |
| 4,4'–DDE | 5.8E–04 | 2.0E–01 | 2.9E–03 | 1.0E–03 | 3.9E–01 | 2.7E–03 | 4.0E–07 | 1.2E+01 | 3.3E–08 |
| Aroclor–1260 | 5.4E–02 | 6.4E+00 | 8.4E–03 | 8.7E–02 | 9.0E–01 | 9.7E–02 | 4.6E–05 | 7.5E–03 | 6.1E–03 |
| Dieldrin | 7.1E–04 | 6.5E–01 | 1.1E–03 | 1.3E–03 | 6.0E–01 | 2.1E–03 | 4.8E–07 | 6.5E–01 | 7.4E–07 |
| Di–n–butylphthalate | 1.3E–03 | 1.1E+00 | 1.2E–03 | 2.7E–03 | 1.1E+00 | 2.4E–03 | 1.4E–06 | 1.1E+00 | 1.3E–06 |
| Fluoranthene | 4.9E–03 | 1.0E+01 | 4.9E–04 | 5.7E–03 | 1.0E+01 | 5.7E–04 | 3.1E–06 | 1.0E+01 | 3.1E–07 |
| Phenanthrene | 3.3E–03 | 1.0E+01 | 3.3E–04 | 3.8E–03 | 1.0E+01 | 3.8E–04 | 2.1E–06 | 1.0E+01 | 2.1E–07 |
| Pyrene | 5.2E–03 | 1.0E+01 | 5.2E–04 | 6.1E–03 | 1.0E+01 | 6.1E–04 | 3.3E–06 | 1.0E+01 | 3.3E–07 |
| Methylene Chloride | 1.7E–05 | 5.3E+01 | 3.2E–07 | 4.6E–05 | 5.3E+01 | 8.7E–07 | 2.6E–08 | 5.3E+01 | 4.9E–10 |
| Tetrachloroethylene | 2.2E–06 | 1.0E+02 | 2.2E–08 | 6.0E–06 | 1.0E+02 | 6.0E–08 | 3.4E–09 | 1.0E+02 | 3.4E–11 |
| Toluene | 4.2E–06 | 7.6E+01 | 5.5E–08 | 1.1E–05 | 7.6E+01 | 1.5E–07 | 6.4E–09 | 7.6E+01 | 8.4E–11 |
| Trichlorofluoromethane | 1.2E–05 | 3.5E+01 | 3.4E–07 | 3.2E–05 | 3.5E+01 | 9.2E–07 | 1.8E–08 | 3.5E+01 | 5.2E–10 |
| 4,4'–DDD | 3.1E–04 | 2.0E–01 | 1.6E–03 | 5.7E–04 | 1.4E–01 | 4.1E–03 | 2.2E–07 | 1.2E+01 | 1.8E–08 |
| 4,4'–DDT | 4.1E–04 | 2.0E–01 | 2.0E–03 | 7.6E–04 | 1.4E–01 | 5.5E–03 | 3.4E–07 | 1.2E+01 | 2.9E–08 |
| 2–Methylnaphthalene | 1.0E–03 | 1.0E+01 | 1.0E–04 | 1.5E–03 | 1.0E+01 | 1.5E–04 | 8.3E–07 | 1.0E+01 | 8.3E–08 |
| Acenaphthylene | 7.5E–04 | 1.0E+01 | 7.5E–05 | 1.1E–03 | 1.0E+01 | 1.1E–04 | 6.1E–07 | 1.0E+01 | 6.1E–08 |
| Benzo[k]fluoranthene | 1.5E–03 | 1.0E+01 | 1.5E–04 | 2.3E–03 | 1.0E+01 | 2.3E–04 | 1.3E–06 | 1.0E+01 | 1.3E–07 |
| Chrysene | 2.2E–03 | 1.0E+01 | 2.2E–04 | 3.4E–03 | 1.0E+01 | 3.4E–04 | 1.8E–06 | 1.0E+01 | 1.8E–07 |
| Naphthalene | 8.3E–04 | 3.6E+01 | 2.3E–05 | 1.3E–03 | 3.6E+01 | 3.5E–05 | 6.8E–07 | 3.6E+01 | 1.9E–08 |
| 1,2–Dichloroethylene (cis and trans) | 8.8E–06 | 3.0E+01 | 2.9E–07 | 2.4E–05 | 3.0E+01 | 8.0E–07 | 1.4E–08 | 3.0E+01 | 4.5E–10 |
| Acetone | 7.1E–05 | 6.0E+02 | 1.2E–07 | 1.9E–04 | 6.0E+02 | 3.2E–07 | 1.1E–07 | 6.0E+02 | 1.8E–10 |
| Ethylbenzene | 7.3E–06 | 2.9E+02 | 2.5E–08 | 2.0E–05 | 2.9E+02 | 6.9E–08 | 1.1E–08 | 2.9E+02 | 3.9E–11 |
| Arsenic | 8.4E–01 | 5.8E–01 | 1.4E+00 | 4.4E–01 | 1.0E+00 | 4.4E–01 | 2.6E–04 | 5.8E–01 | 4.6E–04 |
| Barium | 2.8E–01 | 2.0E+02 | 1.4E–03 | 3.8E–01 | 2.0E+02 | 1.9E–03 | 2.2E–04 | 2.0E+02 | 1.1E–06 |
| Manganese | 1.2E+00 | 4.5E+01 | 2.7E–02 | 1.3E+00 | 4.5E+01 | 3.0E–02 | 7.5E–04 | 4.5E+01 | 1.7E–05 |
| Zinc | 5.0E+00 | 2.0E+02 | 2.5E–02 | 3.8E+00 | 2.0E+02 | 1.9E–02 | 2.2E–03 | 2.0E+02 | 1.1E–05 |
| SUMMARY HAZARD INDEX | | | 1.9E+00 | | | 7.1E–01 | | | 6.9E–03 |

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–2.15
Risk from Potential Lethal or Sublethal Effects for Terrestrial Receptors from Average Concentrations of CPCs in Food and Surface Soil
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| ANALYTE | *Barred owl* | | | *Short–tailed shrew* | | |
|---|---|---|---|---|---|---|
| | PDE | RTV | HQ | PDE | RTV | HQ |
| Antimony | 3.0E–06 | 4.2E+01 | 7.3E–08 | 1.0E–02 | 4.2E+01 | 2.5E–04 |
| Copper | 1.5E–04 | 1.0E+02 | 1.5E–06 | 2.2E–01 | 1.0E+02 | 2.2E–03 |
| Lead | 2.6E–04 | 7.5E+01 | 3.5E–06 | 1.0E+00 | 2.5E+00 | 4.1E–01 |
| Selenium | 1.2E–05 | 6.0E–01 | 2.0E–05 | 5.8E–02 | 2.0E–01 | 2.9E–01 |
| 4,4'–DDE | 4.2E–07 | 3.9E–01 | 1.1E–06 | 1.5E–03 | 2.0E–01 | 7.7E–03 |
| Aroclor–1260 | 7.7E–05 | 9.0E+00 | 8.5E–06 | 1.3E–01 | 6.4E+00 | 2.0E–02 |
| Dieldrin | 4.9E–07 | 6.0E–01 | 8.2E–07 | 1.9E–03 | 6.5E–01 | 3.0E–03 |
| Di–n–butylphthalate | 6.9E–07 | 1.1E+00 | 6.3E–07 | 2.0E–03 | 1.1E+00 | 1.8E–03 |
| Fluoranthene | 1.2E–06 | 1.0E+01 | 1.2E–07 | 3.7E–03 | 1.0E+01 | 3.7E–04 |
| Phenanthrene | 8.0E–07 | 1.0E+01 | 8.0E–08 | 2.5E–03 | 1.0E+01 | 2.5E–04 |
| Pyrene | 1.3E–06 | 1.0E+01 | 1.3E–07 | 4.0E–03 | 1.0E+01 | 4.0E–04 |
| Methylene Chloride | 1.2E–08 | 5.3E+01 | 2.2E–10 | 3.0E–05 | 5.3E+01 | 5.7E–07 |
| Tetrachloroethylene | 1.6E–09 | 1.0E+02 | 1.6E–11 | 4.0E–06 | 1.0E+02 | 4.0E–08 |
| Toluene | 2.9E–09 | 7.6E+01 | 3.9E–11 | 7.5E–06 | 7.6E+01 | 9.9E–08 |
| Trichlorofluoromethane | 8.3E–09 | 3.5E+01 | 2.4E–10 | 2.1E–05 | 3.5E+01 | 6.1E–07 |
| 4,4'–DDD | 2.3E–07 | 1.4E–01 | 1.6E–06 | 8.4E–04 | 2.0E–01 | 4.2E–03 |
| 4,4'–DDT | 3.2E–07 | 1.4E–01 | 2.3E–06 | 9.3E–04 | 2.0E–01 | 4.7E–03 |
| 2–Methylnaphthalene | 3.5E–07 | 1.0E+01 | 3.5E–08 | 1.1E–03 | 1.0E+01 | 1.1E–04 |
| Acenaphthylene | 2.6E–07 | 1.0E+01 | 2.6E–08 | 8.1E–04 | 1.0E+01 | 8.1E–05 |
| Benzo[k]fluoranthene | 5.4E–07 | 1.0E+01 | 5.4E–08 | 1.7E–03 | 1.0E+01 | 1.7E–04 |
| Chrysene | 7.8E–07 | 1.0E+01 | 7.8E–08 | 2.4E–03 | 1.0E+01 | 2.4E–04 |
| Naphthalene | 2.9E–07 | 3.6E+01 | 8.1E–09 | 9.0E–04 | 3.6E+01 | 2.5E–05 |
| 1,2–Dichloroethylene (cis and trans) | 6.2E–09 | 3.0E+01 | 2.1E–10 | 1.6E–05 | 3.0E+01 | 5.3E–07 |
| Acetone | 5.0E–08 | 6.0E+02 | 8.4E–11 | 1.3E–04 | 6.0E+02 | 2.1E–07 |
| Ethylbenzene | 5.2E–09 | 2.9E+02 | 1.8E–11 | 1.3E–05 | 2.9E+02 | 4.5E–08 |
| Arsenic | 5.3E–05 | 1.0E+00 | 5.3E–05 | 1.5E–01 | 5.8E–01 | 2.6E–01 |
| Barium | 8.4E–05 | 2.0E+02 | 4.2E–07 | 2.3E–01 | 2.0E+02 | 1.2E–03 |
| Manganese | 2.7E–04 | 4.5E+01 | 5.9E–06 | 8.0E–01 | 4.5E+01 | 1.8E–02 |
| Zinc | 2.4E–03 | 2.0E+02 | 1.2E–05 | 3.8E+00 | 2.0E+02 | 1.9E–02 |
| SUMMARY HAZARD INDEX | | | 1.1E–04 | | | 1.0E+00 |

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–2.16
Risk from Potential Lethal or Sublethal Effects for Terrestrial Receptors from RME Concentrations of CPCs in Food and Surface Soil
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| ANALYTE | *White–footed mouse* | | | *American robin* | | | *Red fox* | | |
|---|---|---|---|---|---|---|---|---|---|
| | PDE | RTV | HQ | PDE | RTV | HQ | PDE | RTV | HQ |
| Arsenic | 1.4E+00 | 5.8E–01 | 2.5E+00 | 5.0E–01 | 1.0E+00 | 5.0E–01 | 1.9E–05 | 5.8E–01 | 3.3E–05 |
| Barium | 0.0E+00 | 2.0E+02 | 0.0E+00 | 0.0E+00 | 2.0E+02 | 0.0E+00 | 0.0E+00 | 2.0E+02 | 0.0E+00 |
| Cadmium | 5.4E+00 | 2.2E+01 | 2.5E–01 | 1.3E+00 | 1.0E+01 | 1.3E–01 | 3.4E–04 | 2.2E+01 | 1.6E–05 |
| Copper | 0.0E+00 | 1.0E+02 | 0.0E+00 | 0.0E+00 | 1.0E+02 | 0.0E+00 | 0.0E+00 | 1.0E+02 | 0.0E+00 |
| Lead | 0.0E+00 | 2.5E+00 | 0.0E+00 | 0.0E+00 | 7.5E+01 | 0.0E+00 | 0.0E+00 | 2.5E+00 | 0.0E+00 |
| Manganese | 4.4E+00 | 4.5E+01 | 9.8E–02 | 3.3E+00 | 4.5E+01 | 7.3E–02 | 1.3E–04 | 4.5E+01 | 2.9E–06 |
| Zinc | 0.0E+00 | 2.0E+02 | 0.0E+00 | 0.0E+00 | 2.0E+02 | 0.0E+00 | 0.0E+00 | 2.0E+02 | 0.0E+00 |
| 4,4'–DDE | 1.9E–04 | 2.0E–01 | 9.7E–04 | 2.4E–04 | 3.9E–01 | 6.1E–04 | 2.7E–08 | 1.2E+01 | 2.2E–09 |
| 4,4'–DDT | 2.6E–04 | 2.0E–01 | 1.3E–03 | 3.3E–04 | 1.4E–01 | 2.3E–03 | 3.4E–08 | 1.2E+01 | 2.8E–09 |
| Aroclor–1242 | 0.0E+00 | 6.4E+00 | 0.0E+00 | 0.0E+00 | 9.0E–01 | 0.0E+00 | 0.0E+00 | 7.5E–03 | 0.0E+00 |
| Aroclor–1260 | 4.1E–02 | 6.4E+00 | 6.4E–03 | 4.4E–02 | 9.0E–01 | 4.9E–02 | 7.7E–06 | 7.5E–03 | 1.0E–03 |
| Fluoranthene | 1.2E–03 | 1.0E+01 | 1.2E–04 | 9.0E–04 | 1.0E+01 | 9.0E–05 | 4.3E–08 | 1.0E+01 | 4.3E–09 |
| Naphthalene | 4.0E–04 | 3.6E+01 | 1.1E–05 | 3.1E–04 | 3.6E+01 | 8.7E–06 | 1.5E–08 | 3.6E+01 | 4.1E–10 |
| Phenanthrene | 9.2E–04 | 1.0E+01 | 9.2E–05 | 7.1E–04 | 1.0E+01 | 7.1E–05 | 3.4E–08 | 1.0E+01 | 3.4E–09 |
| Pyrene | 1.3E–03 | 1.0E+01 | 1.3E–04 | 9.7E–04 | 1.0E+01 | 9.7E–05 | 4.6E–08 | 1.0E+01 | 4.6E–09 |
| Tetrachloroethylene | 0.0E+00 | 1.0E+02 | 0.0E+00 | 0.0E+00 | 1.0E+02 | 0.0E+00 | 0.0E+00 | 1.0E+02 | 0.0E+00 |
| Toluene | 7.3E–06 | 7.6E–02 | 9.7E–05 | 1.3E–05 | 7.6E–02 | 1.8E–04 | 5.3E–10 | 7.6E–02 | 7.0E–09 |
| Selenium | 2.0E–02 | 2.0E–01 | 1.0E–01 | 2.5E–02 | 6.0E–01 | 4.2E–02 | 2.2E–06 | 2.0E–01 | 1.1E–05 |
| 4,4'–DDD | 1.2E–02 | 2.0E–01 | 5.9E–02 | 1.4E–02 | 1.4E–01 | 1.0E–01 | 1.7E–06 | 1.2E+01 | 1.4E–07 |
| alpha–Chlordane | 6.4E–05 | 1.6E+01 | 4.0E–06 | 7.9E–05 | 3.1E–02 | 2.6E–03 | 7.4E–09 | 1.6E+01 | 4.6E–10 |
| gamma–Chlordane | 6.4E–05 | 1.6E+01 | 4.0E–06 | 7.9E–05 | 3.1E–02 | 2.6E–03 | 7.4E–09 | 1.6E+01 | 4.6E–10 |
| 1,2–Dichlorobenzene | 3.8E–03 | 7.6E+02 | 5.1E–06 | 2.5E–03 | 7.6E+02 | 3.3E–06 | 1.2E–07 | 7.6E+02 | 1.5E–10 |
| 1,4–Dichlorobenzene | 5.3E–03 | 7.6E+02 | 6.9E–06 | 3.4E–03 | 7.6E+02 | 4.5E–06 | 1.6E–07 | 7.6E+02 | 2.1E–10 |
| Bis(2–ethylhexyl)phthalate | 0.0E+00 | 3.5E+01 | 0.0E+00 | 0.0E+00 | 3.5E+01 | 0.0E+00 | 0.0E+00 | 3.5E+01 | 0.0E+00 |
| 1,1,1–Trichloroethane | 0.0E+00 | 1.5E+03 | 0.0E+00 | 0.0E+00 | 1.5E+03 | 0.0E+00 | 0.0E+00 | 1.5E+03 | 0.0E+00 |
| Chlorobenzene | 2.9E–05 | 8.9E+01 | 3.3E–07 | 5.4E–05 | 8.9E+01 | 6.0E–07 | 2.1E–09 | 8.9E+01 | 2.4E–11 |
| Trichloroethylene | 1.0E–05 | 4.8E+02 | 2.1E–08 | 1.9E–05 | 4.8E+02 | 3.9E–08 | 7.5E–10 | 4.8E+02 | 1.6E–12 |
| Xylenes | 0.0E+00 | 5.0E+02 | 0.0E+00 | 0.0E+00 | 5.0E+02 | 0.0E+00 | 0.0E+00 | 5.0E+02 | 0.0E+00 |
| SUMMARY HAZARD INDEX | | | 3.0E+00 | | | 9.1E–01 | | | 1.1E–03 |

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–2.16
Risk from Potential Lethal or Sublethal Effects for Terrestrial Receptors from RME Concentrations of CPCs in Food and Surface Soil
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| ANALYTE | *Barred owl* | | |
|---|---|---|---|
| | PDE | RTV | HQ |
| Arsenic | 7.0E–05 | 1.0E+00 | 7.0E–05 |
| Barium | 0.0E+00 | 2.0E+02 | 0.0E+00 |
| Cadmium | 1.8E–03 | 1.0E+01 | 1.8E–04 |
| Copper | 0.0E+00 | 1.0E+02 | 0.0E+00 |
| Lead | 0.0E+00 | 7.5E+01 | 0.0E+00 |
| Manganese | 6.6E–04 | 4.5E+01 | 1.5E–05 |
| Zinc | 0.0E+00 | 2.0E+02 | 0.0E+00 |
| 4,4'–DDE | 1.4E–07 | 3.9E–01 | 3.7E–07 |
| 4,4'–DDT | 2.1E–07 | 1.4E–01 | 1.5E–06 |
| Aroclor–1242 | 0.0E+00 | 9.0E+00 | 0.0E+00 |
| Aroclor–1260 | 2.8E–05 | 9.0E+00 | 3.1E–06 |
| Fluoranthene | 2.1E–07 | 1.0E+01 | 2.1E–08 |
| Naphthalene | 7.2E–08 | 3.6E+01 | 2.0E–09 |
| Phenanthrene | 1.7E–07 | 1.0E+01 | 1.7E–08 |
| Pyrene | 2.3E–07 | 1.0E+01 | 2.3E–08 |
| Tetrachloroethylene | 0.0E+00 | 1.0E+02 | 0.0E+00 |
| Toluene | 3.5E–09 | 7.6E–02 | 4.6E–08 |
| Selenium | 6.7E–06 | 6.0E–01 | 1.1E–05 |
| 4,4'–DDD | 8.5E–06 | 1.4E–01 | 6.1E–05 |
| alpha–Chlordane | 3.0E–08 | 3.1E–02 | 9.7E–07 |
| gamma–Chlordane | 3.0E–08 | 3.1E–02 | 9.7E–07 |
| 1,2–Dichlorobenzene | 5.5E–07 | 7.6E+02 | 7.3E–10 |
| 1,4–Dichlorobenzene | 7.6E–07 | 7.6E+02 | 1.0E–09 |
| Bis(2–ethylhexyl)phthalate | 0.0E+00 | 3.5E+01 | 0.0E+00 |
| 1,1,1–Trichloroethane | 0.0E+00 | 1.5E+03 | 0.0E+00 |
| Chlorobenzene | 1.4E–08 | 8.9E+01 | 1.6E–10 |
| Trichloroethylene | 4.9E–09 | 4.8E+02 | 1.0E–11 |
| Xylenes | 0.0E+00 | 5.0E+02 | 0.0E+00 |
| SUMMARY HAZARD INDEX | | | 3.4E–04 |

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O-2.17
Risk from Potential Lethal or Sublethal Effects for Terrestrial Receptors from Average Exposure Concentrations of CPCs in Food and Surface Soil
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| ANALYTE | *White-footed mouse* | | | *American robin* | | | *Red fox* | | |
|---|---|---|---|---|---|---|---|---|---|
| | PDE | RTV | HQ | PDE | RTV | HQ | PDE | RTV | HQ |
| Arsenic | 8.7E-01 | 5.8E-01 | 1.5E+00 | 3.0E-01 | 1.0E+00 | 3.0E-01 | 1.1E-05 | 5.8E-01 | 2.0E-05 |
| Barium | 0.0E+00 | 2.0E+02 | 0.0E+00 | 0.0E+00 | 2.0E+02 | 0.0E+00 | 0.0E+00 | 2.0E+02 | 0.0E+00 |
| Cadmium | 3.3E+00 | 2.2E+01 | 1.5E-01 | 8.0E-01 | 1.0E+01 | 8.0E-02 | 2.1E-04 | 2.2E+01 | 9.9E-06 |
| Copper | 0.0E+00 | 1.0E+02 | 0.0E+00 | 0.0E+00 | 1.0E+02 | 0.0E+00 | 0.0E+00 | 1.0E+02 | 0.0E+00 |
| Lead | 0.0E+00 | 2.5E+00 | 0.0E+00 | 0.0E+00 | 7.5E+01 | 0.0E+00 | 0.0E+00 | 2.5E+00 | 0.0E+00 |
| Manganese | 1.8E-02 | 4.5E+01 | 3.9E-04 | 1.3E-02 | 4.5E+01 | 2.9E-04 | 5.2E-07 | 4.5E+01 | 1.1E-08 |
| Zinc | 0.0E+00 | 2.0E+02 | 0.0E+00 | 0.0E+00 | 2.0E+02 | 0.0E+00 | 0.0E+00 | 2.0E+02 | 0.0E+00 |
| 4,4'-DDE | 1.9E-04 | 2.0E-01 | 9.7E-04 | 2.4E-04 | 3.9E-01 | 6.1E-04 | 2.7E-08 | 1.2E+01 | 2.2E-09 |
| 4,4'-DDT | 1.5E-04 | 2.0E-01 | 7.3E-04 | 1.8E-04 | 1.4E-01 | 1.3E-03 | 1.9E-08 | 1.2E+01 | 1.6E-09 |
| Aroclor-1242 | 0.0E+00 | 6.4E+00 | 0.0E+00 | 0.0E+00 | 9.0E-01 | 0.0E+00 | 0.0E+00 | 7.5E-03 | 0.0E+00 |
| Aroclor-1260 | 1.0E-02 | 6.4E+00 | 1.6E-03 | 1.1E-02 | 9.0E-01 | 1.3E-02 | 2.0E-06 | 7.5E-03 | 2.6E-04 |
| Fluoranthene | 1.2E-03 | 1.0E+01 | 1.2E-04 | 9.0E-04 | 1.0E+01 | 9.0E-05 | 4.3E-08 | 1.0E+01 | 4.3E-09 |
| Naphthalene | 4.0E-04 | 3.6E+01 | 1.1E-05 | 3.1E-04 | 3.6E+01 | 8.7E-06 | 1.5E-08 | 3.6E+01 | 4.1E-10 |
| Phenanthrene | 9.2E-04 | 1.0E+01 | 9.2E-05 | 7.1E-04 | 1.0E+01 | 7.1E-05 | 3.4E-08 | 1.0E+01 | 3.4E-09 |
| Pyrene | 1.3E-03 | 1.0E+01 | 1.3E-04 | 9.7E-04 | 1.0E+01 | 9.7E-05 | 4.6E-08 | 1.0E+01 | 4.6E-09 |
| Tetrachloroethylene | 0.0E+00 | 1.0E+02 | 0.0E+00 | 0.0E+00 | 1.0E+02 | 0.0E+00 | 0.0E+00 | 1.0E+02 | 0.0E+00 |
| Toluene | 3.4E-06 | 7.6E-02 | 4.5E-05 | 6.3E-06 | 7.6E-02 | 8.2E-05 | 2.5E-10 | 7.6E-02 | 3.3E-09 |
| Selenium | 6.1E-03 | 2.0E-01 | 3.1E-02 | 7.6E-03 | 6.0E-01 | 1.3E-02 | 6.6E-07 | 2.0E-01 | 3.3E-06 |
| 4,4'-DDD | 2.7E-03 | 2.0E-01 | 1.3E-02 | 3.3E-03 | 1.4E-01 | 2.3E-02 | 3.8E-07 | 1.2E+01 | 3.2E-08 |
| alpha-Chlordane | 4.7E-05 | 1.6E+01 | 3.0E-06 | 5.9E-05 | 3.1E-02 | 1.9E-03 | 5.5E-09 | 1.6E+01 | 3.5E-10 |
| gamma-Chlordane | 4.7E-05 | 1.6E+01 | 3.0E-06 | 5.9E-05 | 3.1E-01 | 1.9E-04 | 5.5E-09 | 1.6E+01 | 3.5E-10 |
| 1,2-Dichlorobenzene | 1.4E-03 | 7.6E+02 | 1.9E-06 | 9.1E-04 | 7.6E+02 | 1.2E-06 | 4.2E-08 | 7.6E+02 | 5.6E-11 |
| 1,4-Dichlorobenzene | 1.7E-03 | 7.6E+02 | 2.3E-06 | 1.1E-03 | 7.6E+02 | 1.5E-06 | 5.2E-08 | 7.6E+02 | 6.8E-11 |
| Chlorobenzene | 8.1E-06 | 8.9E+01 | 9.1E-08 | 1.5E-05 | 8.9E+01 | 1.7E-07 | 5.9E-10 | 8.9E+01 | 6.6E-12 |
| Trichloroethylene | 5.1E-06 | 4.8E+02 | 1.1E-08 | 9.4E-06 | 4.8E+02 | 2.0E-08 | 3.7E-10 | 4.8E+02 | 7.8E-13 |
| SUMMARY HAZARD INDEX | | | 1.7E+00 | | | 4.4E-01 | | | 3.0E-04 |

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–2.17
Risk from Potential Lethal or Sublethal Effects for Terrestrial Receptors from Average Exposure Concentrations of CPCs in Food and Surface Soil
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| ANALYTE | *Barred owl* | | |
|---|---|---|---|
| | PDE | RTV | HQ |
| Arsenic | 4.2E–05 | 1.0E+00 | 4.2E–05 |
| Barium | 0.0E+00 | 2.0E+02 | 0.0E+00 |
| Cadmium | 1.1E–03 | 1.0E+01 | 1.1E–04 |
| Copper | 0.0E+00 | 1.0E+02 | 0.0E+00 |
| Lead | 0.0E+00 | 7.5E+01 | 0.0E+00 |
| Manganese | 2.6E–06 | 4.5E+01 | 5.9E–08 |
| Zinc | 0.0E+00 | 2.0E+02 | 0.0E+00 |
| 4,4'–DDE | 1.4E–07 | 3.9E–01 | 3.7E–07 |
| 4,4'–DDT | 1.2E–07 | 1.4E–01 | 8.3E–07 |
| Aroclor–1242 | 0.0E+00 | 9.0E+00 | 0.0E+00 |
| Aroclor–1260 | 7.1E–06 | 9.0E+00 | 7.9E–07 |
| Fluoranthene | 2.1E–07 | 1.0E+01 | 2.1E–08 |
| Naphthalene | 7.2E–08 | 3.6E+01 | 2.0E–09 |
| Phenanthrene | 1.7E–07 | 1.0E+01 | 1.7E–08 |
| Pyrene | 2.3E–07 | 1.0E+01 | 2.3E–08 |
| Tetrachloroethylene | 0.0E+00 | 1.0E+02 | 0.0E+00 |
| Toluene | 1.6E–09 | 7.6E–02 | 2.1E–08 |
| Selenium | 2.0E–06 | 6.0E–01 | 3.3E–06 |
| 4,4'–DDD | 1.9E–06 | 1.4E–01 | 1.4E–05 |
| alpha–Chlordane | 2.2E–08 | 3.1E–02 | 7.2E–07 |
| gamma–Chlordane | 2.2E–08 | 3.1E–02 | 7.2E–07 |
| 1,2–Dichlorobenzene | 2.0E–07 | 7.6E+02 | 2.7E–10 |
| 1,4–Dichlorobenzene | 2.5E–07 | 7.6E+02 | 3.2E–10 |
| Chlorobenzene | 3.8E–09 | 8.9E+01 | 4.3E–11 |
| Trichloroethylene | 2.4E–09 | 4.8E+02 | 5.1E–12 |
| SUMMARY HAZARD INDEX | | | 1.7E–04 |

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–2.18
Risk from Lethal or Sublethal Effects for Semi–Aquatic Receptors from RME Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

| CHEMICAL | Muskrat | | | Mallard | | | Raccoon | | |
|---|---|---|---|---|---|---|---|---|---|
| | PDE | RTV | HQ | PDE | RTV | HQ | PDE | RTV | HQ |
| Aluminum | 1.2E+02 | 4.3E+02 | 2.8E–01 | 7.2E–02 | 4.3E+02 | 1.7E–04 | 2.5E–01 | 4.3E+02 | 5.8E–04 |
| Arsenic | 5.0E+00 | 5.8E–01 | 8.6E+00 | 1.1E–02 | 1.0E+00 | 1.1E–02 | 2.1E–03 | 5.8E–01 | 3.6E–03 |
| Barium | 1.3E+00 | 2.0E+02 | 6.7E–03 | 1.3E–03 | 2.0E+02 | 6.4E–06 | 1.6E–03 | 2.0E+02 | 8.0E–06 |
| Cadmium | 5.4E–02 | 2.2E+01 | 2.5E–03 | 1.7E–05 | 1.0E+01 | 1.7E–06 | 7.0E–04 | 2.2E+01 | 3.3E–05 |
| Chromium | 3.9E–01 | 3.5E+00 | 1.1E–01 | 2.3E–04 | 2.5E+01 | 9.1E–06 | 1.1E–03 | 3.5E+00 | 3.2E–04 |
| Cobalt | 3.5E–01 | 4.2E+00 | 8.4E–02 | 1.7E–04 | 4.2E+00 | 4.0E–05 | 2.5E–03 | 4.2E+00 | 6.0E–04 |
| Copper | 2.8E+00 | 1.0E+02 | 2.8E–02 | 2.9E–03 | 1.0E+02 | 2.9E–05 | 1.3E–02 | 1.0E+02 | 1.3E–04 |
| Lead | 4.2E+00 | 2.5E+00 | 1.7E+00 | 5.3E–03 | 7.5E+01 | 7.0E–05 | 6.6E–03 | 2.5E+00 | 2.6E–03 |
| Manganese | 5.8E+01 | 4.5E+01 | 1.3E+00 | 9.7E–02 | 4.5E+01 | 2.1E–03 | 9.9E–02 | 4.5E+01 | 2.2E–03 |
| Mercury | 1.1E–01 | 9.0E–01 | 1.2E–01 | 4.0E–05 | 6.4E–02 | 6.3E–04 | 1.4E–03 | 1.0E–01 | 1.4E–02 |
| Nickel | 3.8E–01 | 1.3E+01 | 2.9E–02 | 2.5E–04 | 5.0E+01 | 5.1E–06 | 1.3E–03 | 1.3E+01 | 9.6E–05 |
| Selenium | 1.6E–01 | 2.0E–01 | 7.8E–01 | 2.3E–04 | 1.8E+00 | 1.3E–04 | 5.9E–04 | 2.0E–01 | 2.9E–03 |
| Vanadium | 6.8E–03 | 6.0E+00 | 1.1E–03 | 1.2E–05 | 1.1E+01 | 1.1E–06 | 1.1E–05 | 6.0E+00 | 1.9E–06 |
| Zinc | 3.2E+01 | 2.0E+02 | 1.6E–01 | 7.2E–02 | 2.0E+02 | 3.6E–04 | 7.9E–02 | 2.0E+02 | 3.9E–04 |
| 4,4'–DDD | 3.1E–03 | 2.0E–01 | 1.6E–02 | 2.2E–06 | 1.2E+00 | 1.9E–06 | 3.9E–06 | 1.2E+01 | 3.2E–07 |
| 4,4'–DDE | 1.2E–03 | 2.0E–01 | 5.8E–03 | 8.0E–07 | 5.8E–01 | 1.4E–06 | 1.8E–06 | 1.2E+01 | 1.5E–07 |
| 4,4'–DDT | 1.6E–03 | 2.0E–01 | 8.0E–03 | 6.4E–07 | 1.2E+00 | 5.5E–07 | 1.5E–05 | 1.2E+01 | 1.2E–06 |
| Aroclor–1260 | 3.9E–03 | 6.4E+00 | 6.1E–04 | 6.8E–06 | 9.0E–01 | 7.5E–06 | 9.1E–06 | 7.5E–03 | 1.2E–03 |
| Dieldrin | 3.5E–04 | 6.5E–01 | 5.3E–04 | 2.8E–07 | 2.2E+00 | 1.3E–07 | 4.0E–07 | 6.5E–01 | 6.2E–07 |
| Benzo[k]fluoranthene | 2.9E–02 | 1.0E+01 | 2.9E–03 | 3.4E–05 | 1.0E+01 | 3.4E–06 | 4.0E–05 | 1.0E+01 | 4.0E–06 |
| Bis(2–ethylhexyl)phthalate | 5.1E–02 | 3.5E+01 | 1.5E–03 | 1.6E–05 | 3.5E+01 | 4.7E–07 | 6.6E–04 | 3.5E+01 | 1.9E–05 |
| Fluoranthene | 5.7E–02 | 1.0E+01 | 5.7E–03 | 6.8E–05 | 1.0E+01 | 6.8E–06 | 7.9E–05 | 1.0E+01 | 7.9E–06 |
| Phenanthrene | 2.9E–02 | 1.0E+01 | 2.9E–03 | 3.4E–05 | 1.0E+01 | 3.4E–06 | 4.1E–05 | 1.0E+01 | 4.1E–06 |
| Pyrene | 5.7E–02 | 1.0E+01 | 5.7E–03 | 6.8E–05 | 1.0E+01 | 6.8E–06 | 7.9E–05 | 1.0E+01 | 7.9E–06 |
| 1,2–Dichloroethylenes (cis and trans) | 2.5E–03 | 3.0E+01 | 8.2E–05 | 4.4E–06 | 3.0E+01 | 1.5E–07 | 4.1E–06 | 3.0E+01 | 1.4E–07 |
| Acetone | 2.1E–03 | 6.0E+02 | 3.4E–06 | 1.0E–06 | 6.0E+02 | 1.7E–09 | 2.7E–06 | 6.0E+02 | 4.5E–09 |
| Methylene chloride | 1.4E–03 | 5.3E+01 | 2.6E–05 | 1.2E–06 | 5.3E+01 | 2.3E–08 | 2.0E–06 | 5.3E+01 | 3.7E–08 |
| Tetrachloroethylene | 6.9E–04 | 1.0E+02 | 6.9E–06 | 5.6E–07 | 1.0E+02 | 5.6E–09 | 9.7E–07 | 1.0E+02 | 9.7E–09 |
| Toluene | 2.4E–04 | 7.6E+01 | 3.1E–06 | 2.5E–07 | 7.6E+01 | 3.3E–09 | 3.5E–07 | 7.6E+01 | 4.6E–09 |
| Trichlorofluoromethane | 5.0E–04 | 3.5E+01 | 1.4E–05 | 2.5E–07 | 3.5E+01 | 7.2E–09 | 6.7E–07 | 3.5E+01 | 1.9E–08 |

Table O–2.18
Risk from Lethal or Sublethal Effects for Semi–Aquatic Receptors from RME Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

| CHEMICAL | *Muskrat* | | | *Mallard* | | | *Raccoon* | | |
|---|---|---|---|---|---|---|---|---|---|
| | PDE | RTV | HQ | PDE | RTV | HQ | PDE | RTV | HQ |
| 1,2–Dichlorobenzene | 0.0E+00 | 7.6E+02 | 0.0E+00 | 0.0E+00 | 7.6E+02 | 0.0E+00 | 0.0E+00 | 7.6E+02 | 0.0E+00 |
| 1,4–Dichlorobenzene | 0.0E+00 | 7.6E+02 | 0.0E+00 | 0.0E+00 | 7.6E+02 | 0.0E+00 | 0.0E+00 | 7.6E+02 | 0.0E+00 |
| Benzo(b)fluoranthene | 0.0E+00 | 1.0E+01 | 0.0E+00 | 0.0E+00 | 1.0E+01 | 0.0E+00 | 0.0E+00 | 1.0E+01 | 0.0E+00 |
| Chrysene | 9.9E–03 | 1.0E+01 | 9.9E–04 | 4.1E–06 | 1.0E+01 | 4.1E–07 | 1.6E–05 | 1.0E+01 | 1.6E–06 |
| Naphthalene | 0.0E+00 | 3.6E+01 | 0.0E+00 | 0.0E+00 | 3.6E+01 | 0.0E+00 | 0.0E+00 | 3.6E+01 | 0.0E+00 |
| Benzene | 0.0E+00 | 7.6E+02 | 0.0E+00 | 0.0E+00 | 7.6E+02 | 0.0E+00 | 0.0E+00 | 7.6E+02 | 0.0E+00 |
| Carbon disulfide | 1.0E–04 | 1.1E+01 | 9.4E–06 | 1.8E–07 | 1.1E+01 | 1.7E–08 | 1.7E–07 | 1.1E+01 | 1.6E–08 |
| Chlorobenzene | 0.0E+00 | 8.9E+01 | 0.0E+00 | 0.0E+00 | 8.9E+01 | 0.0E+00 | 0.0E+00 | 8.9E+01 | 0.0E+00 |
| Chloroform | 6.8E–05 | 1.6E+02 | 4.1E–07 | 1.2E–07 | 1.6E+02 | 7.4E–10 | 1.1E–07 | 1.6E+02 | 6.9E–10 |
| Trichloroethylene | 5.1E–04 | 4.8E+02 | 1.1E–06 | 6.8E–07 | 4.8E+02 | 1.4E–09 | 7.9E–07 | 4.8E+02 | 1.6E–09 |
| Xylene | 0.0E+00 | 5.0E+02 | 0.0E+00 | 0.0E+00 | 5.0E+02 | 0.0E+00 | 0.0E+00 | 5.0E+02 | 0.0E+00 |
| SUMMARY HAZARD INDEX | | | 1.3E+01 | | | 1.5E–02 | | | 2.8E–02 |

PDE = Potential Dietary Exposure (mg/kgBW–day). RTV = Reference Toxicity Value (mg/kgBW–day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–2.18
Risk from Lethal or Sublethal Effects for Semi–Aquatic Receptors from RME Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

| CHEMICAL | *Great blue heron* | | |
|---|---|---|---|
| | PDE | RTV | HQ |
| Aluminum | 6.3E+01 | 4.3E+02 | 1.5E–01 |
| Arsenic | 2.5E–01 | 1.0E+00 | 2.5E–01 |
| Barium | 1.9E–01 | 2.0E+02 | 9.5E–04 |
| Cadmium | 3.2E–01 | 1.0E+01 | 3.2E–02 |
| Chromium | 3.6E–01 | 2.5E+01 | 1.4E–02 |
| Cobalt | 1.1E+00 | 4.2E+00 | 2.6E–01 |
| Copper | 5.4E+00 | 1.0E+02 | 5.4E–02 |
| Lead | 1.7E+00 | 7.5E+01 | 2.2E–02 |
| Manganese | 3.3E+01 | 4.5E+01 | 7.3E–01 |
| Mercury | 6.3E–01 | 6.4E–02 | 9.8E+00 |
| Nickel | 4.4E–01 | 5.0E+01 | 8.8E–03 |
| Selenium | 2.5E–01 | 6.0E–01 | 4.1E–01 |
| Vanadium | 7.6E–04 | 1.1E+01 | 6.9E–05 |
| Zinc | 3.5E+01 | 2.0E+02 | 1.8E–01 |
| 4,4'–DDD | 2.6E–03 | 1.4E–01 | 1.9E–02 |
| 4,4'–DDE | 2.3E–03 | 3.9E–01 | 6.0E–03 |
| 4,4'–DDT | 6.6E–03 | 1.4E–01 | 4.7E–02 |
| Aroclor–1260 | 6.6E–03 | 9.0E+00 | 7.3E–04 |
| Dieldrin | 1.3E–04 | 6.0E–01 | 2.1E–04 |
| Benzo[k]fluoranthene | 8.7E–03 | 1.0E+01 | 8.7E–04 |
| Bis(2–ethylhexyl)phthalate | 3.1E–01 | 3.5E+01 | 8.7E–03 |
| Fluoranthene | 1.7E–02 | 1.0E+01 | 1.7E–03 |
| Phenanthrene | 9.5E–03 | 1.0E+01 | 9.5E–04 |
| Pyrene | 1.7E–02 | 1.0E+01 | 1.7E–03 |
| 1,2–Dichloroethylenes (cis and trans) | 2.7E–04 | 3.0E+01 | 9.2E–06 |
| Acetone | 2.6E–04 | 6.0E+02 | 4.3E–07 |
| Methylene chloride | 1.7E–04 | 5.3E+01 | 3.2E–06 |
| Tetrachloroethylene | 8.4E–05 | 1.0E+02 | 8.4E–07 |
| Toluene | 2.8E–05 | 7.6E+01 | 3.7E–07 |
| Trichlorofluoromethane | 6.4E–05 | 3.5E+01 | 1.8E–06 |

Table O–2.18
Risk from Lethal or Sublethal Effects for Semi–Aquatic Receptors from RME Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

| CHEMICAL | *Great blue heron* | | |
|---|---|---|---|
| | PDE | RTV | HQ |
| 1,2–Dichlorobenzene | 0.0E+00 | 7.6E+02 | 0.0E+00 |
| 1,4–Dichlorobenzene | 0.0E+00 | 7.6E+02 | 0.0E+00 |
| Benzo(b)fluoranthene | 0.0E+00 | 1.0E+01 | 0.0E+00 |
| Chrysene | 3.5E–03 | 1.0E+01 | 3.5E–04 |
| Naphthalene | 0.0E+00 | 3.6E+01 | 0.0E+00 |
| Benzene | 0.0E+00 | 7.6E+02 | 0.0E+00 |
| Carbon disulfide | 1.2E–05 | 1.1E+01 | 1.1E–06 |
| Chlorobenzene | 0.0E+00 | 8.9E+01 | 0.0E+00 |
| Chloroform | 7.6E–06 | 1.6E+02 | 4.6E–08 |
| Trichloroethylene | 6.0E–05 | 4.8E+02 | 1.2E–07 |
| Xylene | 0.0E+00 | 5.0E+02 | 0.0E+00 |
| SUMMARY HAZARD INDEX | | | 1.2E+01 |

PDE = Potential Dietary Exposure (mg/kgBW–day). RTV = Reference Toxicity Value (mg/kgBW–day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–2.19
Risk from Lethal or Sublethal Effects for Semi–Aquatic Receptors from Average Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

| CHEMICAL | Muskrat | | | Mallard | | | Raccoon | | |
|---|---|---|---|---|---|---|---|---|---|
| | PDE | RTV | HQ | PDE | RTV | HQ | PDE | RTV | HQ |
| Aluminum | 8.6E+01 | 4.3E+02 | 2.0E–01 | 5.1E–02 | 4.3E+02 | 1.2E–04 | 1.8E–01 | 4.3E+02 | 4.2E–04 |
| Arsenic | 1.6E+00 | 5.8E–01 | 2.7E+00 | 3.6E–03 | 1.0E+00 | 3.6E–03 | 6.7E–04 | 5.8E–01 | 1.1E–03 |
| Barium | 5.7E–01 | 2.0E+02 | 2.9E–03 | 5.4E–04 | 2.0E+02 | 2.7E–06 | 6.8E–04 | 2.0E+02 | 3.5E–06 |
| Cadmium | 1.3E–02 | 2.2E+01 | 5.9E–04 | 4.0E–06 | 1.0E+01 | 4.0E–07 | 1.6E–04 | 2.2E+01 | 7.6E–06 |
| Chromium | 1.9E–01 | 3.5E+00 | 5.3E–02 | 1.1E–04 | 2.5E+01 | 4.3E–06 | 5.3E–04 | 3.5E+00 | 1.5E–04 |
| Cobalt | 2.1E–01 | 4.2E+00 | 4.9E–02 | 9.7E–05 | 4.2E+00 | 2.3E–05 | 1.5E–03 | 4.2E+00 | 3.5E–04 |
| Copper | 6.3E–01 | 1.0E+02 | 6.3E–03 | 6.6E–04 | 1.0E+02 | 6.6E–06 | 2.7E–03 | 1.0E+02 | 2.7E–05 |
| Lead | 1.8E+00 | 2.5E+00 | 7.1E–01 | 2.2E–03 | 7.5E+01 | 2.9E–05 | 2.8E–03 | 2.5E+00 | 1.1E–03 |
| Manganese | 1.9E+01 | 4.5E+01 | 4.2E–01 | 3.0E–02 | 4.5E+01 | 6.6E–04 | 4.6E–02 | 4.5E+01 | 1.0E–03 |
| Mercury | 6.1E–02 | 9.0E–01 | 6.7E–02 | 1.8E–05 | 6.4E–02 | 2.8E–04 | 7.9E–04 | 1.0E–01 | 7.9E–03 |
| Nickel | 2.6E–01 | 1.3E+01 | 2.0E–02 | 1.7E–04 | 5.0E+01 | 3.5E–06 | 8.5E–04 | 1.3E+01 | 6.6E–05 |
| Selenium | 4.6E–02 | 2.0E–01 | 2.3E–01 | 7.0E–05 | 1.8E+00 | 4.0E–05 | 1.8E–04 | 2.0E–01 | 8.8E–04 |
| Vanadium | 1.6E–03 | 6.0E+00 | 2.6E–04 | 2.8E–06 | 1.1E+01 | 2.5E–07 | 2.6E–06 | 6.0E+00 | 4.3E–07 |
| Zinc | 1.4E+01 | 2.0E+02 | 6.9E–02 | 3.2E–02 | 2.0E+02 | 1.6E–04 | 3.5E–02 | 2.0E+02 | 1.7E–04 |
| 4,4'–DDD | 1.1E–03 | 2.0E–01 | 5.3E–03 | 7.2E–07 | 1.2E+00 | 6.2E–07 | 1.3E–06 | 1.2E+01 | 1.1E–07 |
| 4,4'–DDE | 4.0E–04 | 2.0E–01 | 2.0E–03 | 2.8E–07 | 5.8E–01 | 4.8E–07 | 8.6E–07 | 1.2E+01 | 7.2E–08 |
| 4,4'–DDT | 8.4E–04 | 2.0E–01 | 4.2E–03 | 3.3E–07 | 1.2E+00 | 2.9E–07 | 7.8E–06 | 1.2E+01 | 6.5E–07 |
| Aroclor–1260 | 9.0E–04 | 6.4E+00 | 1.4E–04 | 1.6E–06 | 9.0E–01 | 1.7E–06 | 7.1E–06 | 7.5E–03 | 9.5E–04 |
| Dieldrin | 7.2E–05 | 6.5E–01 | 1.1E–04 | 5.8E–08 | 2.2E+00 | 2.6E–08 | 8.4E–08 | 6.5E–01 | 1.3E–07 |
| Benzo[k]fluoranthene | 5.5E–03 | 1.0E+01 | 5.5E–04 | 6.6E–06 | 1.0E+01 | 6.6E–07 | 7.7E–06 | 1.0E+01 | 7.7E–07 |
| Bis(2–ethylhexyl)phthalate | 1.0E–02 | 3.5E+01 | 2.9E–04 | 3.3E–06 | 3.5E+01 | 9.3E–08 | 1.3E–04 | 3.5E+01 | 3.8E–06 |
| Fluoranthene | 2.1E–02 | 1.0E+01 | 2.1E–03 | 2.5E–05 | 1.0E+01 | 2.5E–06 | 2.9E–05 | 1.0E+01 | 2.9E–06 |
| Phenanthrene | 8.0E–03 | 1.0E+01 | 8.0E–04 | 9.2E–06 | 1.0E+01 | 9.2E–07 | 1.5E–05 | 1.0E+01 | 1.5E–06 |
| Pyrene | 2.2E–02 | 1.0E+01 | 2.2E–03 | 2.6E–05 | 1.0E+01 | 2.6E–06 | 3.0E–05 | 1.0E+01 | 3.0E–06 |
| 1,2–Dichloroethylenes (cis and trans) | 2.9E–04 | 3.0E+01 | 9.8E–06 | 5.2E–07 | 3.0E+01 | 1.7E–08 | 4.9E–07 | 3.0E+01 | 1.6E–08 |
| Acetone | 5.3E–04 | 6.0E+02 | 8.9E–07 | 2.7E–07 | 6.0E+02 | 4.4E–10 | 7.1E–07 | 6.0E+02 | 1.2E–09 |
| Methylene chloride | 3.1E–04 | 5.3E+01 | 6.0E–06 | 3.7E–07 | 5.3E+01 | 7.1E–09 | 4.7E–07 | 5.3E+01 | 9.0E–09 |
| Tetrachloroethylene | 1.7E–04 | 1.0E+02 | 1.7E–06 | 2.2E–07 | 1.0E+02 | 2.2E–09 | 2.6E–07 | 1.0E+02 | 2.6E–09 |
| Toluene | 6.6E–05 | 7.6E+01 | 8.6E–07 | 7.4E–08 | 7.6E+01 | 9.8E–10 | 9.8E–08 | 7.6E+01 | 1.3E–09 |
| Trichlorofluoromethane | 8.6E–05 | 3.5E+01 | 2.5E–06 | 4.3E–08 | 3.5E+01 | 1.2E–09 | 1.1E–07 | 3.5E+01 | 3.3E–09 |

Table O–2.19
Risk from Lethal or Sublethal Effects for Semi–Aquatic Receptors from Average Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

| CHEMICAL | Muskrat | | | Mallard | | | Raccoon | | |
|---|---|---|---|---|---|---|---|---|---|
| | PDE | RTV | HQ | PDE | RTV | HQ | PDE | RTV | HQ |
| 1,2–Dichlorobenzene | 0.0E+00 | 7.6E+02 | 0.0E+00 | 0.0E+00 | 7.6E+02 | 0.0E+00 | 0.0E+00 | 7.6E+02 | 0.0E+00 |
| 1,4–Dichlorobenzene | 0.0E+00 | 7.6E+02 | 0.0E+00 | 0.0E+00 | 7.6E+02 | 0.0E+00 | 0.0E+00 | 7.6E+02 | 0.0E+00 |
| Benzo(b)fluoranthene | 0.0E+00 | 1.0E+01 | 0.0E+00 | 0.0E+00 | 1.0E+01 | 0.0E+00 | 0.0E+00 | 1.0E+01 | 0.0E+00 |
| Chrysene | 3.9E–03 | 1.0E+01 | 3.9E–04 | 1.6E–06 | 1.0E+01 | 1.6E–07 | 6.2E–06 | 1.0E+01 | 6.2E–07 |
| Naphthalene | 0.0E+00 | 3.6E+01 | 0.0E+00 | 0.0E+00 | 3.6E+01 | 0.0E+00 | 0.0E+00 | 3.6E+01 | 0.0E+00 |
| Benzene | 0.0E+00 | 7.6E+02 | 0.0E+00 | 0.0E+00 | 7.6E+02 | 0.0E+00 | 0.0E+00 | 7.6E+02 | 0.0E+00 |
| Carbon disulfide | 3.3E–05 | 1.1E+01 | 3.0E–06 | 5.8E–08 | 1.1E+01 | 5.3E–09 | 5.4E–08 | 1.1E+01 | 4.9E–09 |
| Chlorobenzene | 0.0E+00 | 8.9E+01 | 0.0E+00 | 0.0E+00 | 8.9E+01 | 0.0E+00 | 0.0E+00 | 8.9E+01 | 0.0E+00 |
| Chloroform | 2.9E–05 | 1.6E+02 | 1.7E–07 | 5.1E–08 | 1.6E+02 | 3.1E–10 | 4.7E–08 | 1.6E+02 | 2.9E–10 |
| Trichloroethylene | 8.9E–05 | 4.8E+02 | 1.9E–07 | 1.2E–07 | 4.8E+02 | 2.6E–10 | 1.4E–07 | 4.8E+02 | 2.9E–10 |
| Xylene | 0.0E+00 | 5.0E+02 | 0.0E+00 | 0.0E+00 | 5.0E+02 | 0.0E+00 | 0.0E+00 | 5.0E+02 | 0.0E+00 |
| SUMMARY HAZARD INDEX | | | 4.6E+00 | | | 5.0E–03 | | | 1.4E–02 |

PDE = Potential Dietary Exposure (mg/kgBW–day). RTV = Reference Toxicity Value (mg/kgBW–day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O-2.19
Risk from Lethal or Sublethal Effects for Semi-Aquatic Receptors from Average Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sedimer
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

| CHEMICAL | *Great blue heron* | | |
|---|---|---|---|
| | PDE | RTV | HQ |
| Aluminum | 4.6E+01 | 4.3E+02 | 1.1E-01 |
| Arsenic | 7.9E-02 | 1.0E+00 | 7.9E-02 |
| Barium | 8.2E-02 | 2.0E+02 | 4.1E-04 |
| Cadmium | 7.6E-02 | 1.0E+01 | 7.6E-03 |
| Chromium | 1.7E-01 | 2.5E+01 | 6.8E-03 |
| Cobalt | 6.3E-01 | 4.2E+00 | 1.5E-01 |
| Copper | 1.1E+00 | 1.0E+02 | 1.1E-02 |
| Lead | 7.1E-01 | 7.5E+01 | 9.5E-03 |
| Manganese | 1.8E+01 | 4.5E+01 | 3.9E-01 |
| Mercury | 3.7E-01 | 6.4E-02 | 5.7E+00 |
| Nickel | 3.0E-01 | 5.0E+01 | 6.0E-03 |
| Selenium | 7.4E-02 | 6.0E-01 | 1.2E-01 |
| Vanadium | 1.8E-04 | 1.1E+01 | 1.6E-05 |
| Zinc | 1.5E+01 | 2.0E+02 | 7.7E-02 |
| 4,4'-DDD | 2.4E-03 | 1.4E-01 | 1.7E-02 |
| 4,4'-DDE | 2.2E-03 | 3.9E-01 | 5.8E-03 |
| 4,4'-DDT | 3.5E-03 | 1.4E-01 | 2.5E-02 |
| Aroclor-1260 | 6.4E-03 | 9.0E+00 | 7.1E-04 |
| Dieldrin | 9.7E-05 | 6.0E-01 | 1.6E-04 |
| Benzo[k]fluoranthene | 1.7E-03 | 1.0E+01 | 1.7E-04 |
| Bis(2-ethylhexyl)phthalate | 6.1E-02 | 3.5E+01 | 1.7E-03 |
| Fluoranthene | 6.3E-03 | 1.0E+01 | 6.3E-04 |
| Phenanthrene | 4.4E-03 | 1.0E+01 | 4.4E-04 |
| Pyrene | 6.6E-03 | 1.0E+01 | 6.6E-04 |
| 1,2-Dichloroethylenes (cis and trans) | 3.3E-05 | 3.0E+01 | 1.1E-06 |
| Acetone | 6.7E-05 | 6.0E+02 | 1.1E-07 |
| Methylene chloride | 3.7E-05 | 5.3E+01 | 7.1E-07 |
| Tetrachloroethylene | 2.0E-05 | 1.0E+02 | 2.0E-07 |
| Toluene | 7.8E-06 | 7.6E+01 | 1.0E-07 |
| Trichlorofluoromethane | 1.1E-05 | 3.5E+01 | 3.1E-07 |

Table O–2.19
Risk from Lethal or Sublethal Effects for Semi–Aquatic Receptors from Average Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sedimer
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

| CHEMICAL | *Great blue heron* | | |
|---|---|---|---|
| | PDE | RTV | HQ |
| 1,2–Dichlorobenzene | 0.0E+00 | 7.6E+02 | 0.0E+00 |
| 1,4–Dichlorobenzene | 0.0E+00 | 7.6E+02 | 0.0E+00 |
| Benzo(b)fluoranthene | 0.0E+00 | 1.0E+01 | 0.0E+00 |
| Chrysene | 1.4E–03 | 1.0E+01 | 1.4E–04 |
| Naphthalene | 0.0E+00 | 3.6E+01 | 0.0E+00 |
| Benzene | 0.0E+00 | 7.6E+02 | 0.0E+00 |
| Carbon disulfide | 3.6E–06 | 1.1E+01 | 3.3E–07 |
| Chlorobenzene | 0.0E+00 | 8.9E+01 | 0.0E+00 |
| Chloroform | 3.2E–06 | 1.6E+02 | 1.9E–08 |
| Trichloroethylene | 1.0E–05 | 4.8E+02 | 2.2E–08 |
| Xylene | 0.0E+00 | 5.0E+02 | 0.0E+00 |
| SUMMARY HAZARD INDEX | | | 6.8E+00 |

PDE = Potential Dietary Exposure (mg/kgBW–day). RTV = Reference Toxicity Value (mg/kgBW–day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–2.20
Risk from Lethal or Sublethal Effects for Semi–Aquatic Receptors from RME Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

| CHEMICAL | Muskrat | | | Mallard | | | Raccoon | | |
|---|---|---|---|---|---|---|---|---|---|
| | PDE | RTV | HQ | PDE | RTV | HQ | PDE | RTV | HQ |
| Aluminum | 1.2E+02 | 4.3E+02 | 2.8E–01 | 7.0E–02 | 4.3E+02 | 1.6E–04 | 2.5E–01 | 4.3E+02 | 5.8E–04 |
| Arsenic | 5.0E+00 | 5.8E–01 | 8.5E+00 | 1.1E–02 | 1.0E+00 | 1.1E–02 | 2.1E–03 | 5.8E–01 | 3.6E–03 |
| Barium | 1.3E+00 | 2.0E+02 | 6.4E–03 | 1.2E–03 | 2.0E+02 | 5.9E–06 | 1.5E–03 | 2.0E+02 | 7.6E–06 |
| Cadmium | 0.0E+00 | 2.2E+01 | 0.0E+00 | 0.0E+00 | 1.0E+01 | 0.0E+00 | 0.0E+00 | 2.2E+01 | 0.0E+00 |
| Chromium | 3.9E–01 | 3.5E+00 | 1.1E–01 | 2.2E–04 | 2.5E+01 | 8.9E–06 | 1.1E–03 | 3.5E+00 | 3.2E–04 |
| Cobalt | 3.5E–01 | 4.2E+00 | 8.4E–02 | 1.7E–04 | 4.2E+00 | 4.0E–05 | 2.5E–03 | 4.2E+00 | 6.0E–04 |
| Copper | 2.2E+00 | 1.0E+02 | 2.2E–02 | 2.7E–03 | 1.0E+02 | 2.7E–05 | 4.6E–03 | 1.0E+02 | 4.6E–05 |
| Lead | 4.1E+00 | 2.5E+00 | 1.7E+00 | 5.1E–03 | 7.5E+01 | 6.8E–05 | 6.4E–03 | 2.5E+00 | 2.6E–03 |
| Manganese | 5.9E+01 | 4.5E+01 | 1.3E+00 | 9.7E–02 | 4.5E+01 | 2.1E–03 | 1.1E–01 | 4.5E+01 | 2.4E–03 |
| Mercury | 4.7E–02 | 9.0E–01 | 5.3E–02 | 2.5E–05 | 6.4E–02 | 3.9E–04 | 5.5E–04 | 1.0E–01 | 5.5E–03 |
| Nickel | 3.8E–01 | 1.3E+01 | 2.9E–02 | 2.5E–04 | 5.0E+01 | 5.1E–06 | 1.3E–03 | 1.3E+01 | 9.6E–05 |
| Selenium | 1.5E–01 | 2.0E–01 | 7.7E–01 | 2.3E–04 | 1.8E+00 | 1.3E–04 | 5.9E–04 | 2.0E–01 | 2.9E–03 |
| Vanadium | 0.0E+00 | 6.0E+00 | 0.0E+00 | 0.0E+00 | 1.1E+01 | 0.0E+00 | 0.0E+00 | 6.0E+00 | 0.0E+00 |
| Zinc | 3.1E+01 | 2.0E+02 | 1.6E–01 | 7.2E–02 | 2.0E+02 | 3.6E–04 | 7.9E–02 | 2.0E+02 | 3.9E–04 |
| 4,4'–DDD | 3.1E–03 | 2.0E–01 | 1.6E–02 | 2.2E–06 | 1.2E+00 | 1.9E–06 | 3.9E–06 | 1.2E+01 | 3.2E–07 |
| 4,4'–DDE | 1.2E–03 | 2.0E–01 | 5.8E–03 | 8.0E–07 | 5.8E–01 | 1.4E–06 | 1.8E–06 | 1.2E+01 | 1.5E–07 |
| 4,4'–DDT | 1.6E–03 | 2.0E–01 | 8.0E–03 | 6.4E–07 | 1.2E+00 | 5.5E–07 | 1.5E–05 | 1.2E+01 | 1.2E–06 |
| Aroclor–1260 | 3.9E–03 | 6.4E+00 | 6.1E–04 | 6.8E–06 | 9.0E–01 | 7.5E–06 | 9.1E–06 | 7.5E–03 | 1.2E–03 |
| Dieldrin | 3.5E–04 | 6.5E–01 | 5.3E–04 | 2.8E–07 | 2.2E+00 | 1.3E–07 | 4.0E–07 | 6.5E–01 | 6.2E–07 |
| Benzo[k]fluoranthene | 2.9E–02 | 1.0E+01 | 2.9E–03 | 3.4E–05 | 1.0E+01 | 3.4E–06 | 4.0E–05 | 1.0E+01 | 4.0E–06 |
| Bis(2–ethylhexyl)phthalate | 5.1E–02 | 3.5E+01 | 1.5E–03 | 1.6E–05 | 3.5E+01 | 4.7E–07 | 6.6E–04 | 3.5E+01 | 1.9E–05 |
| Fluoranthene | 5.7E–02 | 1.0E+01 | 5.7E–03 | 6.8E–05 | 1.0E+01 | 6.8E–06 | 7.9E–05 | 1.0E+01 | 7.9E–06 |
| Phenanthrene | 2.9E–02 | 1.0E+01 | 2.9E–03 | 3.4E–05 | 1.0E+01 | 3.4E–06 | 4.1E–05 | 1.0E+01 | 4.1E–06 |
| Pyrene | 5.7E–02 | 1.0E+01 | 5.7E–03 | 6.8E–05 | 1.0E+01 | 6.8E–06 | 7.9E–05 | 1.0E+01 | 7.9E–06 |
| 1,2–Dichloroethylenes (cis and trans) | 2.5E–03 | 3.0E+01 | 8.2E–05 | 4.4E–06 | 3.0E+01 | 1.5E–07 | 4.1E–06 | 3.0E+01 | 1.4E–07 |
| Acetone | 2.1E–03 | 6.0E+02 | 3.4E–06 | 1.0E–06 | 6.0E+02 | 1.7E–09 | 2.7E–06 | 6.0E+02 | 4.5E–09 |
| Methylene chloride | 1.4E–03 | 5.3E+01 | 2.6E–05 | 1.2E–06 | 5.3E+01 | 2.3E–08 | 2.0E–06 | 5.3E+01 | 3.7E–08 |
| Tetrachloroethylene | 6.9E–04 | 1.0E+02 | 6.9E–06 | 5.6E–07 | 1.0E+02 | 5.6E–09 | 9.7E–07 | 1.0E+02 | 9.7E–09 |
| Toluene | 2.4E–04 | 7.6E+01 | 3.1E–06 | 2.5E–07 | 7.6E+01 | 3.3E–09 | 3.5E–07 | 7.6E+01 | 4.6E–09 |
| Trichlorofluoromethane | 5.0E–04 | 3.5E+01 | 1.4E–05 | 2.5E–07 | 3.5E+01 | 7.2E–09 | 6.7E–07 | 3.5E+01 | 1.9E–08 |

Table O–2.20
Risk from Lethal or Sublethal Effects for Semi–Aquatic Receptors from RME Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

| CHEMICAL | *Muskrat* | | | *Mallard* | | | *Raccoon* | | |
|---|---|---|---|---|---|---|---|---|---|
| | PDE | RTV | HQ | PDE | RTV | HQ | PDE | RTV | HQ |
| 1,2–Dichlorobenzene | 0.0E+00 | 7.6E+02 | 0.0E+00 | 0.0E+00 | 7.6E+02 | 0.0E+00 | 0.0E+00 | 7.6E+02 | 0.0E+00 |
| 1,4–Dichlorobenzene | 0.0E+00 | 7.6E+02 | 0.0E+00 | 0.0E+00 | 7.6E+02 | 0.0E+00 | 0.0E+00 | 7.6E+02 | 0.0E+00 |
| Benzo(b)fluoranthene | 0.0E+00 | 1.0E+01 | 0.0E+00 | 0.0E+00 | 1.0E+01 | 0.0E+00 | 0.0E+00 | 1.0E+01 | 0.0E+00 |
| Chrysene | 9.9E–03 | 1.0E+01 | 9.9E–04 | 4.1E–06 | 1.0E+01 | 4.1E–07 | 1.6E–05 | 1.0E+01 | 1.6E–06 |
| Naphthalene | 0.0E+00 | 3.6E+01 | 0.0E+00 | 0.0E+00 | 3.6E+01 | 0.0E+00 | 0.0E+00 | 3.6E+01 | 0.0E+00 |
| Benzene | 0.0E+00 | 7.6E+02 | 0.0E+00 | 0.0E+00 | 7.6E+02 | 0.0E+00 | 0.0E+00 | 7.6E+02 | 0.0E+00 |
| Carbon disulfide | 1.0E–04 | 1.1E+01 | 9.4E–06 | 1.8E–07 | 1.1E+01 | 1.7E–08 | 1.7E–07 | 1.1E+01 | 1.6E–08 |
| Chlorobenzene | 0.0E+00 | 8.9E+01 | 0.0E+00 | 0.0E+00 | 8.9E+01 | 0.0E+00 | 0.0E+00 | 8.9E+01 | 0.0E+00 |
| Chloroform | 6.8E–05 | 1.6E+02 | 4.1E–07 | 1.2E–07 | 1.6E+02 | 7.4E–10 | 1.1E–07 | 1.6E+02 | 6.9E–10 |
| Trichloroethylene | 5.1E–04 | 4.8E+02 | 1.1E–06 | 6.8E–07 | 4.8E+02 | 1.4E–09 | 7.9E–07 | 4.8E+02 | 1.6E–09 |
| Xylene | 0.0E+00 | 5.0E+02 | 0.0E+00 | 0.0E+00 | 5.0E+02 | 0.0E+00 | 0.0E+00 | 5.0E+02 | 0.0E+00 |
| SUMMARY HAZARD INDEX | | | 1.3E+01 | | | 1.5E–02 | | | 2.0E–02 |

PDE = Potential Dietary Exposure (mg/kgBW–day). RTV = Reference Toxicity Value (mg/kgBW–day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O-2.20
Risk from Lethal or Sublethal Effects for Semi-Aquatic Receptors from RME Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

| CHEMICAL | *Great blue heron* | | |
|---|---|---|---|
| | PDE | RTV | HQ |
| Aluminum | 6.2E+01 | 4.3E+02 | 1.5E-01 |
| Arsenic | 2.4E-01 | 1.0E+00 | 2.4E-01 |
| Barium | 1.8E-01 | 2.0E+02 | 9.2E-04 |
| Cadmium | 0.0E+00 | 1.0E+01 | 0.0E+00 |
| Chromium | 3.6E-01 | 2.5E+01 | 1.4E-02 |
| Cobalt | 1.1E+00 | 4.2E+00 | 2.6E-01 |
| Copper | 1.5E+00 | 1.0E+02 | 1.5E-02 |
| Lead | 1.7E+00 | 7.5E+01 | 2.2E-02 |
| Manganese | 3.6E+01 | 4.5E+01 | 8.1E-01 |
| Mercury | 2.5E-01 | 6.4E-02 | 3.9E+00 |
| Nickel | 4.4E-01 | 5.0E+01 | 8.8E-03 |
| Selenium | 2.5E-01 | 6.0E-01 | 4.1E-01 |
| Vanadium | 0.0E+00 | 1.1E+01 | 0.0E+00 |
| Zinc | 3.5E+01 | 2.0E+02 | 1.8E-01 |
| 4,4'-DDD | 2.6E-03 | 1.4E-01 | 1.9E-02 |
| 4,4'-DDE | 2.3E-03 | 3.9E-01 | 6.0E-03 |
| 4,4'-DDT | 6.6E-03 | 1.4E-01 | 4.7E-02 |
| Aroclor-1260 | 6.6E-03 | 9.0E+00 | 7.3E-04 |
| Dieldrin | 1.3E-04 | 6.0E-01 | 2.1E-04 |
| Benzo[k]fluoranthene | 8.7E-03 | 1.0E+01 | 8.7E-04 |
| Bis(2-ethylhexyl)phthalate | 3.1E-01 | 3.5E+01 | 8.7E-03 |
| Fluoranthene | 1.7E-02 | 1.0E+01 | 1.7E-03 |
| Phenanthrene | 9.5E-03 | 1.0E+01 | 9.5E-04 |
| Pyrene | 1.7E-02 | 1.0E+01 | 1.7E-03 |
| 1,2-Dichloroethylenes (cis and trans) | 2.7E-04 | 3.0E+01 | 9.2E-06 |
| Acetone | 2.6E-04 | 6.0E+02 | 4.3E-07 |
| Methylene chloride | 1.7E-04 | 5.3E+01 | 3.2E-06 |
| Tetrachloroethylene | 8.4E-05 | 1.0E+02 | 8.4E-07 |
| Toluene | 2.8E-05 | 7.6E+01 | 3.7E-07 |
| Trichlorofluoromethane | 6.4E-05 | 3.5E+01 | 1.8E-06 |

Table O–2.20
Risk from Lethal or Sublethal Effects for Semi–Aquatic Receptors from RME Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

| CHEMICAL | *Great blue heron* | | |
|---|---|---|---|
| | PDE | RTV | HQ |
| 1,2–Dichlorobenzene | 0.0E+00 | 7.6E+02 | 0.0E+00 |
| 1,4–Dichlorobenzene | 0.0E+00 | 7.6E+02 | 0.0E+00 |
| Benzo(b)fluoranthene | 0.0E+00 | 1.0E+01 | 0.0E+00 |
| Chrysene | 3.5E–03 | 1.0E+01 | 3.5E–04 |
| Naphthalene | 0.0E+00 | 3.6E+01 | 0.0E+00 |
| Benzene | 0.0E+00 | 7.6E+02 | 0.0E+00 |
| Carbon disulfide | 1.2E–05 | 1.1E+01 | 1.1E–06 |
| Chlorobenzene | 0.0E+00 | 8.9E+01 | 0.0E+00 |
| Chloroform | 7.6E–06 | 1.6E+02 | 4.6E–08 |
| Trichloroethylene | 6.0E–05 | 4.8E+02 | 1.2E–07 |
| Xylene | 0.0E+00 | 5.0E+02 | 0.0E+00 |
| SUMMARY HAZARD INDEX | | | 6.1E+00 |

PDE = Potential Dietary Exposure (mg/kgBW–day). RTV = Reference Toxicity Value (mg/kgBW–day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–2.21
Risk from Lethal or Sublethal Effects for Semi–Aquatic Receptors from Average Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

| CHEMICAL | *Muskrat* | | | *Mallard* | | | *Raccoon* | | |
|---|---|---|---|---|---|---|---|---|---|
| | PDE | RTV | HQ | PDE | RTV | HQ | PDE | RTV | HQ |
| Aluminum | 8.6E+01 | 4.3E+02 | 2.0E–01 | 5.1E–02 | 4.3E+02 | 1.2E–04 | 1.8E–01 | 4.3E+02 | 4.2E–04 |
| Arsenic | 1.6E+00 | 5.8E–01 | 2.7E+00 | 3.6E–03 | 1.0E+00 | 3.6E–03 | 6.6E–04 | 5.8E–01 | 1.1E–03 |
| Barium | 5.6E–01 | 2.0E+02 | 2.8E–03 | 5.2E–04 | 2.0E+02 | 2.6E–06 | 6.6E–04 | 2.0E+02 | 3.3E–06 |
| Cadmium | 0.0E+00 | 2.2E+01 | 0.0E+00 | 0.0E+00 | 1.0E+01 | 0.0E+00 | 0.0E+00 | 2.2E+01 | 0.0E+00 |
| Chromium | 1.9E–01 | 3.5E+00 | 5.3E–02 | 1.1E–04 | 2.5E+01 | 4.2E–06 | 5.3E–04 | 3.5E+00 | 1.5E–04 |
| Cobalt | 2.1E–01 | 4.2E+00 | 4.9E–02 | 9.7E–05 | 4.2E+00 | 2.3E–05 | 1.5E–03 | 4.2E+00 | 3.5E–04 |
| Copper | 5.1E–01 | 1.0E+02 | 5.1E–03 | 6.2E–04 | 1.0E+02 | 6.2E–06 | 1.1E–03 | 1.0E+02 | 1.1E–05 |
| Lead | 1.8E+00 | 2.5E+00 | 7.1E–01 | 2.2E–03 | 7.5E+01 | 2.9E–05 | 2.7E–03 | 2.5E+00 | 1.1E–03 |
| Manganese | 1.8E+01 | 4.5E+01 | 4.1E–01 | 3.0E–02 | 4.5E+01 | 6.6E–04 | 4.0E–02 | 4.5E+01 | 8.8E–04 |
| Mercury | 1.1E–02 | 9.0E–01 | 1.2E–02 | 5.7E–06 | 6.4E–02 | 8.8E–05 | 1.2E–04 | 1.0E–01 | 1.2E–03 |
| Nickel | 2.6E–01 | 1.3E+01 | 2.0E–02 | 1.7E–04 | 5.0E+01 | 3.5E–06 | 8.5E–04 | 1.3E+01 | 6.6E–05 |
| Selenium | 4.6E–02 | 2.0E–01 | 2.3E–01 | 7.0E–05 | 1.8E+00 | 4.0E–05 | 1.8E–04 | 2.0E–01 | 8.8E–04 |
| Vanadium | 0.0E+00 | 6.0E+00 | 0.0E+00 | 0.0E+00 | 1.1E+01 | 0.0E+00 | 0.0E+00 | 6.0E+00 | 0.0E+00 |
| Zinc | 1.4E+01 | 2.0E+02 | 6.9E–02 | 3.2E–02 | 2.0E+02 | 1.6E–04 | 3.5E–02 | 2.0E+02 | 1.7E–04 |
| 4,4'–DDD | 1.1E–03 | 2.0E–01 | 5.3E–03 | 7.2E–07 | 1.2E+00 | 6.2E–07 | 1.3E–06 | 1.2E+01 | 1.1E–07 |
| 4,4'–DDE | 4.0E–04 | 2.0E–01 | 2.0E–03 | 2.8E–07 | 5.8E–01 | 4.8E–07 | 8.6E–07 | 1.2E+01 | 7.2E–08 |
| 4,4'–DDT | 8.4E–04 | 2.0E–01 | 4.2E–03 | 3.3E–07 | 1.2E+00 | 2.9E–07 | 7.8E–06 | 1.2E+01 | 6.5E–07 |
| Aroclor–1260 | 9.0E–04 | 6.4E+00 | 1.4E–04 | 1.6E–06 | 9.0E–01 | 1.7E–06 | 7.1E–06 | 7.5E–03 | 9.5E–04 |
| Dieldrin | 7.2E–05 | 6.5E–01 | 1.1E–04 | 5.8E–08 | 2.2E+00 | 2.6E–08 | 8.4E–08 | 6.5E–01 | 1.3E–07 |
| Benzo[k]fluoranthene | 5.5E–03 | 1.0E+01 | 5.5E–04 | 6.6E–06 | 1.0E+01 | 6.6E–07 | 7.7E–06 | 1.0E+01 | 7.7E–07 |
| Bis(2–ethylhexyl)phthalate | 1.0E–02 | 3.5E+01 | 2.9E–04 | 3.3E–06 | 3.5E+01 | 9.3E–08 | 1.3E–04 | 3.5E+01 | 3.8E–06 |
| Fluoranthene | 2.1E–02 | 1.0E+01 | 2.1E–03 | 2.5E–05 | 1.0E+01 | 2.5E–06 | 2.9E–05 | 1.0E+01 | 2.9E–06 |
| Phenanthrene | 8.0E–03 | 1.0E+01 | 8.0E–04 | 9.2E–06 | 1.0E+01 | 9.2E–07 | 1.5E–05 | 1.0E+01 | 1.5E–06 |
| Pyrene | 2.2E–02 | 1.0E+01 | 2.2E–03 | 2.6E–05 | 1.0E+01 | 2.6E–06 | 3.0E–05 | 1.0E+01 | 3.0E–06 |
| 1,2–Dichloroethylenes (cis and trans) | 2.9E–04 | 3.0E+01 | 9.8E–06 | 5.2E–07 | 3.0E+01 | 1.7E–08 | 4.9E–07 | 3.0E+01 | 1.6E–08 |
| Acetone | 5.3E–04 | 6.0E+02 | 8.9E–07 | 2.7E–07 | 6.0E+02 | 4.4E–10 | 7.1E–07 | 6.0E+02 | 1.2E–09 |
| Methylene chloride | 3.1E–04 | 5.3E+01 | 6.0E–06 | 3.7E–07 | 5.3E+01 | 7.1E–09 | 4.7E–07 | 5.3E+01 | 9.0E–09 |
| Tetrachloroethylene | 1.7E–04 | 1.0E+02 | 1.7E–06 | 2.2E–07 | 1.0E+02 | 2.2E–09 | 2.6E–07 | 1.0E+02 | 2.6E–09 |
| Toluene | 6.6E–05 | 7.6E+01 | 8.6E–07 | 7.4E–08 | 7.6E+01 | 9.8E–10 | 9.8E–08 | 7.6E+01 | 1.3E–09 |
| Trichlorofluoromethane | 8.6E–05 | 3.5E+01 | 2.5E–06 | 4.3E–08 | 3.5E+01 | 1.2E–09 | 1.1E–07 | 3.5E+01 | 3.3E–09 |

Table O–2.21
Risk from Lethal or Sublethal Effects for Semi–Aquatic Receptors from Average Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

| CHEMICAL | *Muskrat* | | | *Mallard* | | | *Raccoon* | | |
|---|---|---|---|---|---|---|---|---|---|
| | PDE | RTV | HQ | PDE | RTV | HQ | PDE | RTV | HQ |
| 1,2–Dichlorobenzene | 0.0E+00 | 7.6E+02 | 0.0E+00 | 0.0E+00 | 7.6E+02 | 0.0E+00 | 0.0E+00 | 7.6E+02 | 0.0E+00 |
| 1,4–Dichlorobenzene | 0.0E+00 | 7.6E+02 | 0.0E+00 | 0.0E+00 | 7.6E+02 | 0.0E+00 | 0.0E+00 | 7.6E+02 | 0.0E+00 |
| Benzo(b)fluoranthene | 0.0E+00 | 1.0E+01 | 0.0E+00 | 0.0E+00 | 1.0E+01 | 0.0E+00 | 0.0E+00 | 1.0E+01 | 0.0E+00 |
| Chrysene | 3.9E–03 | 1.0E+01 | 3.9E–04 | 1.6E–06 | 1.0E+01 | 1.6E–07 | 6.2E–06 | 1.0E+01 | 6.2E–07 |
| Naphthalene | 0.0E+00 | 3.6E+01 | 0.0E+00 | 0.0E+00 | 3.6E+01 | 0.0E+00 | 0.0E+00 | 3.6E+01 | 0.0E+00 |
| Benzene | 0.0E+00 | 7.6E+02 | 0.0E+00 | 0.0E+00 | 7.6E+02 | 0.0E+00 | 0.0E+00 | 7.6E+02 | 0.0E+00 |
| Carbon disulfide | 3.3E–05 | 1.1E+01 | 3.0E–06 | 5.8E–08 | 1.1E+01 | 5.3E–09 | 5.4E–08 | 1.1E+01 | 4.9E–09 |
| Chlorobenzene | 0.0E+00 | 8.9E+01 | 0.0E+00 | 0.0E+00 | 8.9E+01 | 0.0E+00 | 0.0E+00 | 8.9E+01 | 0.0E+00 |
| Chloroform | 2.9E–05 | 1.6E+02 | 1.7E–07 | 5.1E–08 | 1.6E+02 | 3.1E–10 | 4.7E–08 | 1.6E+02 | 2.9E–10 |
| Trichloroethylene | 8.9E–05 | 4.8E+02 | 1.9E–07 | 1.2E–07 | 4.8E+02 | 2.6E–10 | 1.4E–07 | 4.8E+02 | 2.9E–10 |
| Xylene | 0.0E+00 | 5.0E+02 | 0.0E+00 | 0.0E+00 | 5.0E+02 | 0.0E+00 | 0.0E+00 | 5.0E+02 | 0.0E+00 |
| SUMMARY HAZARD INDEX | | | 4.5E+00 | | | 4.8E–03 | | | 7.4E–03 |

PDE = Potential Dietary Exposure (mg/kgBW–day). RTV = Reference Toxicity Value (mg/kgBW–day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O-2.21
Risk from Lethal or Sublethal Effects for Semi-Aquatic Receptors from Average Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

| CHEMICAL | *Great blue heron* | | |
|---|---|---|---|
| | PDE | RTV | HQ |
| Aluminum | 4.6E+01 | 4.3E+02 | 1.1E-01 |
| Arsenic | 7.8E-02 | 1.0E+00 | 7.8E-02 |
| Barium | 8.0E-02 | 2.0E+02 | 4.1E-04 |
| Cadmium | 0.0E+00 | 1.0E+01 | 0.0E+00 |
| Chromium | 1.7E-01 | 2.5E+01 | 6.8E-03 |
| Cobalt | 6.3E-01 | 4.2E+00 | 1.5E-01 |
| Copper | 3.5E-01 | 1.0E+02 | 3.5E-03 |
| Lead | 7.1E-01 | 7.5E+01 | 9.4E-03 |
| Manganese | 1.4E+01 | 4.5E+01 | 3.2E-01 |
| Mercury | 5.7E-02 | 6.4E-02 | 8.8E-01 |
| Nickel | 3.0E-01 | 5.0E+01 | 6.0E-03 |
| Selenium | 7.4E-02 | 6.0E-01 | 1.2E-01 |
| Vanadium | 0.0E+00 | 1.1E+01 | 0.0E+00 |
| Zinc | 1.5E+01 | 2.0E+02 | 7.7E-02 |
| 4,4'-DDD | 2.4E-03 | 1.4E-01 | 1.7E-02 |
| 4,4'-DDE | 2.2E-03 | 3.9E-01 | 5.8E-03 |
| 4,4'-DDT | 3.5E-03 | 1.4E-01 | 2.5E-02 |
| Aroclor-1260 | 6.4E-03 | 9.0E+00 | 7.1E-04 |
| Dieldrin | 9.7E-05 | 6.0E-01 | 1.6E-04 |
| Benzo[k]fluoranthene | 1.7E-03 | 1.0E+01 | 1.7E-04 |
| Bis(2-ethylhexyl)phthalate | 6.1E-02 | 3.5E+01 | 1.7E-03 |
| Fluoranthene | 6.3E-03 | 1.0E+01 | 6.3E-04 |
| Phenanthrene | 4.4E-03 | 1.0E+01 | 4.4E-04 |
| Pyrene | 6.6E-03 | 1.0E+01 | 6.6E-04 |
| 1,2-Dichloroethylenes (cis and trans) | 3.3E-05 | 3.0E+01 | 1.1E-06 |
| Acetone | 6.7E-05 | 6.0E+02 | 1.1E-07 |
| Methylene chloride | 3.7E-05 | 5.3E+01 | 7.1E-07 |
| Tetrachloroethylene | 2.0E-05 | 1.0E+02 | 2.0E-07 |
| Toluene | 7.8E-06 | 7.6E+01 | 1.0E-07 |
| Trichlorofluoromethane | 1.1E-05 | 3.5E+01 | 3.1E-07 |

Table O–2.21
Risk from Lethal or Sublethal Effects for Semi–Aquatic Receptors from Average Exposure Concentrations of CPCs in Food, Filtered Surface Water, and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

| CHEMICAL | *Great blue heron* | | |
|---|---|---|---|
| | PDE | RTV | HQ |
| 1,2–Dichlorobenzene | 0.0E+00 | 7.6E+02 | 0.0E+00 |
| 1,4–Dichlorobenzene | 0.0E+00 | 7.6E+02 | 0.0E+00 |
| Benzo(b)fluoranthene | 0.0E+00 | 1.0E+01 | 0.0E+00 |
| Chrysene | 1.4E–03 | 1.0E+01 | 1.4E–04 |
| Naphthalene | 0.0E+00 | 3.6E+01 | 0.0E+00 |
| Benzene | 0.0E+00 | 7.6E+02 | 0.0E+00 |
| Carbon disulfide | 3.6E–06 | 1.1E+01 | 3.3E–07 |
| Chlorobenzene | 0.0E+00 | 8.9E+01 | 0.0E+00 |
| Chloroform | 3.2E–06 | 1.6E+02 | 1.9E–08 |
| Trichloroethylene | 1.0E–05 | 4.8E+02 | 2.2E–08 |
| Xylene | 0.0E+00 | 5.0E+02 | 0.0E+00 |
| SUMMARY HAZARD INDEX | | | 1.8E+00 |

PDE = Potential Dietary Exposure (mg/kgBW–day). RTV = Reference Toxicity Value (mg/kgBW–day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O-2.22
Risk from Lethal or Sublethal Effects for Semi-Aquatic Receptors from RME Exposure Concentrations of CPCs in Food, Unfiltered Surface Water, and Sediment
Area 3

Remedial Investigation Report, AOC 57
Devens, Massachusetts

| CHEMICAL | *Raccoon* | | |
|---|---|---|---|
| | PDE | RTV | HQ |
| Arsenic | 6.9E-06 | 5.8E-01 | 1.2E-05 |
| Barium | 1.2E-05 | 2.0E+02 | 6.3E-08 |
| Copper | 3.8E-04 | 1.0E+02 | 3.8E-06 |
| Lead | 8.2E-06 | 2.5E+00 | 3.3E-06 |
| Selenium | 1.1E-07 | 2.0E-01 | 5.7E-07 |
| Zinc | 2.0E-05 | 2.0E+02 | 1.0E-07 |
| 4,4'-DDD | 3.8E-07 | 1.2E+01 | 3.1E-08 |
| Aroclor-1260 | 4.0E-06 | 7.5E-03 | 5.3E-04 |
| Benzo[k]fluoranthene | 1.1E-06 | 1.0E+01 | 1.1E-07 |
| Fluoranthene | 2.5E-06 | 1.0E+01 | 2.5E-07 |
| Phenanthrene | 1.4E-06 | 1.0E+01 | 1.4E-07 |
| Pyrene | 2.1E-06 | 1.0E+01 | 2.1E-07 |
| Acetone | 5.3E-07 | 6.0E+02 | 8.8E-10 |
| Toluene | 8.4E-08 | 7.6E+01 | 1.1E-09 |
| 1,2-Dichlorobenzene | 1.5E-06 | 7.6E+02 | 1.9E-09 |
| 1,4-Dichlorobenzene | 3.8E-06 | 7.6E+02 | 5.0E-09 |
| Benzo(b)fluoranthene | 1.8E-06 | 1.0E+01 | 1.8E-07 |
| Chrysene | 1.3E-06 | 1.0E+01 | 1.3E-07 |
| Naphthalene | 2.0E-06 | 3.6E+01 | 5.6E-08 |
| Benzene | 9.3E-08 | 7.6E+02 | 1.2E-10 |
| Carbon disulfide | 2.6E-08 | 1.1E+01 | 2.4E-09 |
| Chlorobenzene | 2.5E-07 | 8.9E+01 | 2.9E-09 |
| Xylene | 2.8E-08 | 5.0E+02 | 5.5E-11 |
| Antimony | 2.5E-07 | 4.2E+01 | 6.0E-09 |
| SUMMARY HAZARD INDEX | | | 5.5E-04 |

PDE = Potential Dietary Exposure (mg/kgBW-day). RTV = Reference Toxicity Value (mg/kgBW-day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

# O-3 ECOLOGICAL RISK CALCULATIONS FOR CPCs SUPPORTING INFORMATION

TABLE O-3.1

CHEMICALS ELIMIMATED AS ECOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN IN AREA 2 UPLAND SURFACE SOIL[1]
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

| ANALYTE | Frequency of Detection[2] | Range of SQLs[3] | Range of Detected Concentrations | Background Surface Soil Concentrations[4] | Average of all Concentrations[5] | Exposure Point Concentrations | |
|---|---|---|---|---|---|---|---|
| | | | | | | RME[6] | Average[7] |
| PAL METALS (µg/g) | | | | | | | |
| Aluminum | 5/5 | NA | 3,920 to 7,530 | 18,000 | 6,700 | 7,530 | 6,700 |
| Barium | 5/5 | NA | 18.8 to 40.9 | 54 | 26.3 | 40.9 | 26.3 |
| Beryllium | 1/5 | 0.5 | 0.71 | 0.81 | 0.34 | 0.71 | 0.34 |
| Chromium | 5/5 | NA | 7.7 to 27 | 33 | 15.9 | 27.0 | 15.9 |
| Lead | 5/5 | NA | 8.1 to 22.9 | 48 | 14.0 | 22.9 | 14.0 |
| Vanadium | 5/5 | NA | 7.6 to 15.5 | 32.3 | 12.0 | 15.5 | 12.0 |
| Zinc | 5/5 | NA | 13.7 to 38.1 | 43.9 | 24.2 | 38.1 | 24.2 |

Notes:
[1] Sample locations include: 57B-95-01X, 57B-95-02X, 57E-95-02X, 57E-95-10X, and 57E-95-25X (all collected from 0 to 2 feet below ground surface).
[2] Frequency of Detection is equal to the number of samples in which the analyte is detected in relation to the total number of samples analyzed.
[3] Sample Quantitation Limits (SQLs) are equal to the detection limit adjusted for percent moisture (solid media only) and dilutions (if any are performed).
[4] Inorganic background concentrations from the Ft. Devens background surface soil database (developed in 1993).
[5] The average of all concentrations assigns a value of 1/2 the SQL to all non-detects.
[6] Reasonable Maximum Exposure (RME) concentrations are equal to the maximum detected concentration; the 95th percent UCL was not calculated because there are fewer than 10 samples in the data set.
[7] Average Exposure Point Concentrations (EPCs) are equal to the average of all concentrations. If the average is greater than the RME, then the RME was used instead.

µg/g = micrograms per gram
AOC = Area of contamination.
CPC = Contaminant of potential concern.
NA = Not available.
PAL = Project analyte list.
RME = Reasonable maximum exposure.
SQL = Sample quantitation limit.

TABLE O-3.2

CHEMICALS ELIMIMATED AS ECOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN IN AREA 2 FLOODPLAIN SURFACE SOIL[1]

AOC 57

REMEDIAL INVESTIGATION REPORT

DEVENS, MASSACHUSETTS

| ANALYTE | Frequency of Detection[2] | Range of SQLs[3] | Range of Detected Concentrations | Background Surface Soil Concentration[4] | Average of all Concentrations[5] | Exposure Point Concentrations | |
|---|---|---|---|---|---|---|---|
| | | | | | | RME[7] | Average[8] |
| PAL METALS (µg/g) | | | | | | | |
| Aluminum | 3/3 | NA | 3,140 to 6,180 | 18,000 | 4,930 | 6,180 | 4,930 |
| Beryllium | 1/3 | 0.5 | 0.71 | 0.81 | 0.40 | 0.71 | 0.40 |
| Chromium | 3/3 | NA | 9.0 to 15.4 | 33 | 12.7 | 15.4 | 12.7 |
| Cobalt | 3/3 | NA | 1.9 to 2.3 | 4.7 | 2.1 | 2.3 | 2.1 |
| Nickel | 3/3 | NA | 6.1 to 10.4 | 14.6 | 7.9 | 10.4 | 7.9 |
| Vanadium | 3/3 | NA | 5.7 to 14 | 32.3 | 10.7 | 14 | 10.7 |

Notes:

[1] Sample locations include: 57E-95-12X, 57E-95-16X, and 57E-95-17X.

[2] Frequency of Detection is equal to the number of samples in which the analyte is detected in relation to the total number of samples analyzed.

[3] Sample Quantitation Limits (SQLs) are equal to the detection limit adjusted for percent moisture (solid media only) and dilutions (if any are performed).

[4] Inorganic background concentrations from the Ft. Devens background surface soil database (developed in 1993).

[5] The average of all concentrations assigns a value of 1/2 the SQL to all non-detects.

[6] Reasonable Maximum Exposure (RME) concentrations are equal to the maximum detected concentration; the 95th percent UCL was not calculated because there were fewer than 10 samples in the dataset.

[7] Average Exposure Point Concentrations (EPCs) are equal to the average of all concentrations. If the average is greater than the RME, then the RME was used instead.

µg/g = micrograms per gram

AOC = Area of contamination.

CPC = Contaminant of potential concern.

NA = Not available.

PAL = Project analyte list.

RME = Reasonable maximum exposure.

SQL = Sample quantitation limit.

TABLE O-3.3

CHEMICALS ELIMINATED AS ECOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN IN AREA 3 SURFACE SOIL[1]

AOC 57

REMEDIAL INVESTIGATION REPORT

DEVENS, MASSACHUSETTS

| ANALYTE | Frequency of Detection [2] | Range of SQLs [3] | Range of Detected Concentrations | Background Surface Soil Concentration [4] | Average of all Concentrations [5] | Exposure Point Concentrations | |
|---|---|---|---|---|---|---|---|
| | | | | | | RME [6] | Average [7] |
| PAL METALS (µg/g) | | | | | | | |
| Aluminum | 2/2 | NA | 6,370 to 7,100 | 18,000 | 6,740 | 7,100 | 6,740 |
| Barium | 4/4 | NA | 11.1 to 29.3 | 54 | 18.0 | 29.3 | 18.0 |
| Chromium | 2/2 | NA | 10.6 to 11.7 | 33 | 11.2 | 11.7 | 11.2 |
| Cobalt | 2/2 | NA | 2.4 to 3.2 | 4.7 | 2.8 | 3.2 | 2.8 |
| Copper | 4/4 | NA | 2.9 to 6.8 | 13.5 | 4.6 | 6.8 | 4.6 |
| Lead | 3/4 | 10.5 | 7.8 to 32.7 | 48 | 16.9 | 32.7 | 16.9 |
| Nickel | 2/2 | NA | 10.5 to 11.1 | 14.6 | 10.8 | 11.1 | 10.8 |
| Vanadium | 2/2 | NA | 9.2 to 9.4 | 32.3 | 9.3 | 9.4 | 9.3 |
| Zinc | 4/4 | NA | 15.8 to 28.5 | 43.9 | 22.1 | 28.5 | 22.1 |

Notes:

[1] Sample locations include: 57B-96-08X, 57B-96-09X, 57S-98-13X, and 57S-98-14X.

[2] Frequency of Detection is equal to the number of samples in which the analyte is detected in relation to the total number of samples analyzed.

[3] Sample Quantitation Limits (SQLs) are equal to the detection limit adjusted for percent moisture (solid media only) and dilutions (if any are performed).

[4] Inorganic background concentrations from the Ft. Devens background surface soil database (developed in 1993).

[5] The average of all concentrations assigns a value of 1/2 the SQL to all non-detects.

[6] Reasonable Maximum Exposure (RME) concentrations are equal to the maximum detected concentration; the 95th percent UCL was not calculated because there are fewer than 10 samples in the data set.

[7] Average Exposure Point Concentrations (EPCs) are equal to the average of all concentrations. If the average is greater than the RME, then the RME was used instead.

µg/g = micrograms per gram

AOC = Area of contamination.

CPC = Contaminant of potential concern.

NA = Not available.

PAL = Project analyte list.

RME = Reasonable maximum exposure.

SQL = Sample quantitation limit.

TABLE O-3.4

CHEMICALS ELIMINATED AS ECOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN IN AREA 3 SURFACE WATER[1]

AOC 57

REMEDIAL INVESTIGATION REPORT

DEVENS, MASSACHUSETTS

| ANALYTE | Frequency of Detection [2] | Range of SQLs [3] | Range of Detected Concentrations | Upgradient Surface Water Concentration [4] | Average of all Concentrations [5] | Exposure Point Concentrations | |
|---|---|---|---|---|---|---|---|
| | | | | | | RME [6] | Average [7] |
| PAL UNFILTERED METALS (µg/L) | | | | | | | |
| Manganese | 1/1 | NA | 92.8 | 131 | 92.8 | 92.8 | 92.8 |

Notes:

[1] Sample locations include: 57W-98-07X. Manganese data were rejected in 4 out of 5 surface water samples.

[2] Frequency of Detection is equal to the number of samples in which the analyte is detected in relation to the total number of samples analyzed.

[3] Sample Quantitation Limits (SQLs) are equal to the detection limit adjusted for percent moisture (solid media only) and dilutions (if any are performed).

[4] The arithmetic mean of inorganic concentrations detected in upgradient samples 57W-95-03X and -08X.

[5] The average of all concentrations assigns a value of 1/2 the SQL to all non-detects.

[6] Reasonable Maximum Exposure (RME) concentrations are equal to the maximum detected concentration; the 95th percent UCL was not calculated because there are fewer than 10 samples in the data set.

[7] Average Exposure Point Concentrations (EPCs) are equal to the average of all concentrations. If the average is greater than the RME, then the RME was used instead.

µg/L = micrograms per liter

AOC = Area of contamination.

CPC = Contaminant of potential concern.

NA = Not available.

PAL = Project analyte list.

RME = Reasonable maximum exposure.

SQL = Sample quantitation limit.

TABLE O-3.5

CHEMICALS ELIMINATED AS ECOLOGICAL CONTAMINATNS OF POTENTIAL CONCERN IN AREA 2 SEDIMENT[1]

AOC 57

REMEDIAL INVESTIGATION REPORT

DEVENS, MASSACHUSETTS

| ANALYTE | Frequency of Detection[2] | Range of SQLs[3] | Range of Detected Concentrations | Upgradient Sediment Concentration[4] | Elevated Sediment Concentration[5] | Average of all Concentrations[6] | Exposure Point Concentrations | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | RME[7] | Average[8] |
| PAL METALS (µg/g) | | | | | | | | |
| Cadmium | 1/6 | 0.70 | 2.3 | NA | 5-14 | 0.68 | 2.3 | 0.68 |
| Vanadium | 4/6 | 3.4 | 28.4 to 40.3 | 34.7 | 60-100 | 22.9 | 40.3 | 22.9 |

Notes:

[1] Sample locations include: 57D-95-04X through 57D-95-07X, 57D-95-09X, and 57D-95-10X.

[2] Frequency of Detection is equal to the number of samples in which the analyte is detected in relation to the total number of samples analyzed.

[3] Sample Quantitation Limits (SQLs) are equal to the detection limit adjusted for percent moisture (solid media only) and dilutions (if any are performed).

[4] The arithmetic mean of concentrations detected in upgradient samples 57D-95-03X and -08X.

[5] Rojko, 1990. "Proposed Classification Scheme for Sediments in Massachusetts Lakes and Ponds". Values less than the provided range are classified as "normal", and values greater than the provided range are classified as "highly elevated".

[6] The average of all concentrations assigns a value of 1/2 the SQL to all non-detects.

[7] Reasonable Maximum Exposure (RME) concentrations are equal to the maximum detected concentration; the 95th percent UCL was not calucated because there are fewer than 10 samples in the data set.

[8] Average Exposure Point Concentrations (EPCs) are equal to the lesser of the average of all concentrations and RME.

µg/g = micrograms per gram

AOC = Area of contamination.

CPC = Contaminant of potential concern.

NA = Not available.

PAL = Project analyte list.

RME = Reasonable maximum exposure.

SQL = Sample quantitation limit.

TABLE O-3.6

CHEMICALS ELIMINATED AS ECOLOGICAL CONTAMINANTS OF POTENTIAL CONCERN IN AREA 3 SEDIMENT[1]

AOC 57

REMEDIAL INVESTIGATION REPORT

DEVENS, MASSACHUSETTS

| ANALYTE | Frequency of Detection [2] | Range of SQLs [3] | Range of Detected Concentrations | Upgradient Sediment Concentration [4] | Elevated Sediment Concentration [5] | Average of all Concentrations [6] | Exposure Point Concentrations | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | RME [7] | Average [8] |
| PAL METALS (µg/g) | | | | | | | | |
| Arsenic | 5/5 | NA | 3.2 to 37.1 | 110 | 25-50 | 20.0 | 37.1 | 20.0 |
| Barium | 5/5 | NA | 16.1 to 59.8 | 101 | NA | 33.0 | 59.8 | 33.0 |
| Copper | 3/5 | 0.97 | 2.7 to 11.2 | 30.7 | 70-130 | 4.0 | 11.2 | 4.0 |
| Lead | 2/5 | 10.5 | 33.6 to 64.6 | 208 | 200-410 | 22.8 | 64.6 | 22.8 |
| Manganese | 5/5 | NA | 29 to 459 | 1,510 | 350-850 | 188 | 459 | 188 |
| Selenium | 4/5 | 0.25 | 0.72 to 1.8 | 2.8 | NA | 1.1 | 1.8 | 1.1 |
| Zinc | 1/5 | 8.0 | 90.8 | 315 | 250-450 | 21.4 | 90.8 | 21.4 |

Notes:

[1] Sample locations include: 57D-98-04X through 57D-98-08X.

[2] Frequency of Detection is equal to the number of samples in which the analyte is detected in relation to the total number of samples analyzed.

[3] Sample Quantitation Limits (SQLs) are equal to the detection limit adjusted for percent moisture (solid media only) and dilutions (if any are performed).

[4] The arithmetic mean of inorganic concentrations detected in upgradient samples 57D-95-03X and -08X.

[5] Rojko, 1990. "Proposed Classification Scheme for Sediments in Massachusetts Lakes and Ponds". Values less than the provided range are classified as "normal", and values greater than the provided range are classified as "highly elevated".

[6] The average of all concentrations assigns a value of 1/2 the SQL to all non-detects.

[7] Reasonable Maximum Exposure (RME) concentrations are equal to the maximum detected concentration; the 95th percent UCL was not calucated because there are fewer than 10 samples in the data set.

[8] Average Exposure Point Concentrations (EPCs) are equal to the average of all concentrations. If the average is greater than the RME, then the RME was used instead.

µg/g = micrograms per gram

AOC = Area of contamination.

CPC = Contaminant of potential concern.

NA = Not available.

PAL = Project analyte list.

RME = Reasonable maximum exposure.

SQL = Sample quantitation limit.

## TABLE O-3.7
## RESULTS OF FOOD-WEB MODELING FOR
## SURFACE SOIL, SEDIMENT, AND SURFACE WATER
## AOC 57

## REMEDIAL INVESTIGATION REPORT
## DEVENS, MASSACHUSETTS

| Media Evaluated / Ecological Receptor | HIs for RME Concentrations of Chemicals Eliminated as CPCs [a] | HIs for RME Concentrations of CPCs [b] | Total Risk for CPCs and Chemicals Eliminated as CPCs |
|---|---|---|---|
| **Area 2 Upland Surface Soil** | | | |
| White-footed mouse | 0.17 | 1.5 | 1.7 |
| American robin | 0.32 | 0.94 | 1.3 |
| Red fox | 0.000034 | 0.000077 | 0.00011 |
| Barred owl | 0.00011 | 0.00021 | 0.00032 |
| **Area 2 Floodplain Surface Soil** | | | |
| White-footed mouse | 0.096 | 4.0 | 4.1 |
| Short-tailed shrew | 0.20 | 2.4 | 2.6 |
| American robin | 0.17 | 1.8 | 2.0 |
| Raccoon | 0.00011 | 0.037 | 0.037 |
| Barred owl | 0.000039 | 0.00028 | 0.00032 |
| **Area 3 Surface Soil** | | | |
| White-footed mouse | 0.17 | 3.0 | 3.2 |
| American robin | 0.13 | 0.91 | 1.0 |
| Red fox | 0.000013 | 0.0011 | 0.0011 |
| Barred owl | 0.000037 | 0.00034 | 0.00038 |
| **Area 2 Sediment** | | | |
| Muskrat | 0.055 | 13 | 13 |
| Mallard | 0.000030 | 0.015 | 0.015 |
| Raccoon | 0.00015 | 0.028 | 0.028 |
| Great blue heron | 0.036 | 12 | 12 |
| **Area 3 Sediment and Unfiltered Surface Water** | | | |
| Raccoon | 0.00062 | 0.00064 | 0.0013 |

[a] The information listed is summarized from Tables O-4.1 through O-4.10 in Appendix O-4. These values are HIs calculated for all chemicals eliminated as CPCs in the baseline ERA.

[b] The information listed was obtained from Table 9-60. These values are HIs calculated for all chemicals retained as CPCs in the baseline ERA.

CPC = Chemical of Potential Concern
HI = Hazard Index
NA = Not applicable.
RME = Reasonable Maximum Exposure

## TABLE O-3.8
## SUMMARY OF ECOLOGICAL RISK FOR PLANTS AND INVERTEBRATES FROM CHEMICALS ELIMINATED AS CPCs IN AREA 2 UPLAND SURFACE SOIL
## AOC 57

### REMEDIAL INVESTIGATION REPORT
### DEVENS, MASSACHUSETTS

| Analyte | Exposure Point Concentrations [1] | | RTV (µg/g) | | RTV Exceeded? [3] (by RME / by Avg.) | |
|---|---|---|---|---|---|---|
| | RME | Average | Plant [2] | Invertebrate [2] | Plant | Invertebrate |
| **PAL Metals (µg/g)** | | | | | | |
| Aluminum | 7,530 | 6,700 | 50 | NA | Yes/Yes | NA |
| Barium | 40.9 | 26.3 | 500 | NA | No/No | NA |
| Beryllium | 0.71 | 0.34 | 10 | NA | No/No | NA |
| Chromium | 27.0 | 15.9 | 1 | 250 | Yes/Yes | No/No |
| Lead | 22.9 | 14.0 | 50 | 1,190 | No/No | No/No |
| Vanadium | 15.5 | 12.0 | 2 | NA | Yes/Yes | NA |
| Zinc | 38.1 | 24.2 | 50 | 130 | No/No | No/No |

1 Exposure Point Concentrations (EPCs) are presented in Table O-3.1.

2 Plant and invertebrate RTVs are presented in Appendix O-1, Tables O-1.7 and O-1.8 (respectively). Generally, the plant RTVs are the lowest LOEC from among plant growth studies on plants in solid media, and invertebrate RTVs are the lowest $LC_{50}$ (14-day soil test on *Eisenia foetida*) from among chemicals in the same chemical class (applies to organic compounds). A conservative factor of 0.2 was applied to invertebrate RTVs; the resultant value should be protective of 99.9% of the population from lethal effects (USEPA, 1986).

3 Comparison shown is maximum EPC to RTV/average EPC to RTV.

RTV = reference toxicity value.
µg/g = micrograms per gram.
$LC_{50}$ = concentration lethal to 50% of the test population.
LOEC = lowest observed effect concentration.
NA = Not available.
RME = Reasonable maximum exposure.
Shading indicates exceedances.

## TABLE O-3.9
## SUMMARY OF ECOLOGICAL RISK FOR PLANTS AND INVERTEBRATES FROM CHEMICALS ELIMINATED AS CPCs IN AREA 2 FLOODPLAIN SURFACE SOIL AOC 57

### REMEDIAL INVESTIGATION REPORT
### DEVENS, MASSACHUSETTS

| Analyte | Exposure Point Concentrations [1] | | RTV (µg/g) | | RTV Exceeded? [3] (by RME / by Avg.) | |
|---|---|---|---|---|---|---|
| | RME | Average | Plant [2] | Invertebrate [2] | Plant | Invertebrate |
| **PAL Metals (µg/g)** | | | | | | |
| Aluminum | 6,180 | 4,930 | 50 | NA | Yes/Yes | NA |
| Beryllium | 0.71 | 0.40 | 10 | NA | No/No | NA |
| Chromium | 15.4 | 12.7 | 1 | 250 | Yes/Yes | No/No |
| Cobalt | 2.3 | 2.1 | 20 | NA | No/No | NA |
| Nickel | 10.4 | 7.9 | 30 | 400 | No/No | No/No |
| Vanadium | 14 | 10.7 | 2 | NA | Yes/Yes | NA |

[1] Exposure Point Concentrations (EPCs) are presented in Table O-3.2.

[2] Plant and invertebrate RTVs are presented in Appendix O-1, Tables O-1.7 and O-1.8 (respectively). Generally, the plant RTVs are the lowest LOEC from among plant growth studies on plants in solid media, and invertebrate RTVs are the lowest $LC_{50}$ (14-day soil test on *Eisenia foetida*) from among chemicals in the same chemical class (applies to organic compounds). A conservative factor of 0.2 was applied to invertebrate RTVs; the resultant value should be protective of 99.9% of the population from lethal effects (USEPA, 1986).

[3] Comparison shown is maximum EPC to RTV/average EPC to RTV.

RTV = reference toxicity value.
µg/g = micrograms per gram.
$LC_{50}$ = concentration lethal to 50% of the test population.
LOEC = lowest observed effect concentration.
NA = Not available.
RME = Reasonable maximum exposure.
Shading indicates exceedances.

## TABLE O-3.10
## SUMMARY OF ECOLOGICAL RISK FOR PLANTS AND INVERTEBRATES FROM CHEMICALS ELIMINATED AS CPCs IN AREA 3 SURFACE SOIL
## AOC 57

## REMEDIAL INVESTIGATION REPORT
## DEVENS, MASSACHUSETTS

| Analyte | Exposure Point Concentrations [1] | | RTV (µg/g) | | RTV Exceeded? [3] (by RME / by Avg.) | |
|---|---|---|---|---|---|---|
| | RME | Average | Plant [2] | Invertebrate [2] | Plant | Invertebrate |
| **PAL Metals (µg/g)** | | | | | | |
| Aluminum | 7,100 | 6,740 | 50 | NA | Yes/Yes | NA |
| Barium | 29.3 | 18.0 | 500 | NA | No/No | NA |
| Chromium | 11.7 | 11.2 | 1 | 250 | Yes/Yes | No/No |
| Cobalt | 3.2 | 2.8 | 20 | NA | No/No | NA |
| Copper | 6.8 | 4.6 | 100 | 30 | No/No | No/No |
| Lead | 32.7 | 16.9 | 50 | 1,190 | No/No | No/No |
| Nickel | 11.1 | 10.8 | 30 | 400 | No/No | No/No |
| Vanadium | 9.4 | 9.3 | 2 | NA | Yes/Yes | NA |
| Zinc | 28.5 | 22.1 | 50 | 130 | No/No | No/No |

1 Exposure Point Concentrations (EPCs) are presented in Table O-3.3.

2 Plant and invertebrate RTVs are presented in Appendix O-1, Tables O-1.7 and O-1.8 (respectively). Generally, the plant RTVs are the lowest LOEC from among plant growth studies on plants in solid media, and invertebrate RTVs are the lowest $LC_{50}$ (14-day soil test on *Eisenia foetida*) from among chemicals in the same chemical class (applies to organic compounds). A conservative factor of 0.2 was applied to invertebrate RTVs; the resultant value should be protective of 99.9% of the population from lethal effects (USEPA, 1986).

3 Comparison shown is maximum EPC to RTV/average EPC to RTV.

RTV = reference toxicity value.
µg/g = micrograms per gram.
$LC_{50}$ = concentration lethal to 50% of the test population.
LOEC = lowest observed effect concentration.
NA = Not available.
RME = Reasonable maximum exposure.
Shading indicates exceedances.

## TABLE O-3.11
## COMPARISON OF AREA 3 SURFACE WATER EXPOSURE CONCENTRATIONS FOR CHEMICALS ELIMINATED AS COCs WITH TOXICITY BENCHMARK VALUES [1]
## AOC 57

### REMEDIAL INVESTIGATION REPORT
### DEVENS, MASSACHUSETTS

| Analyte | Exposure Point Concentrations | | AWQC [2] (µg/l) | AQUIRE Lowest Reported Adverse Effect Concentration [3] (µg/l) / Test Species | Result |
|---|---|---|---|---|---|
| | RME | Average | | | |
| **PAL Unfiltered Metals (µg/l)** | | | | | |
| Manganese | 92.8 | 92.8 | NA | 280/phytoplankton population endpoints | Not exceeded |

[1] Results of analyses of surface water samples are included in Section 7. Only those analytes selected as aquatic CPCs in Table O-3.4 are presented.
[2] Chronic Federal Ambient Water Quality Criteria (USEPA, 1991 and 1988).
[3] From Appendix O-1, Table O-1.9. Only growth, mortality, reproductive, and biomass effects to fish, plants, invertebrates, and amphibians were considered.

Notes:

CPC = contaminant of potential concern
µg/l = micrograms per liter
AWQC = Ambient Water Quality Criteria (guidance criteria established under the Clean Water Act)
NA = Not available

TABLE O-3.12
COMPARISON OF AREA 2 SEDIMENT EXPOSURE CONCENTRATIONS FOR CHEMICALS ELIMINATED AS CPCs
WITH TOXICITY BENCHMARK VALUES [1]
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

| Analyte | Exposure Point Concentrations | | USEPA Sediment Quality Guidelines [2] | NOAA [3] | | OME LEL [4] | NYSDEC LEL [5] | Result |
|---|---|---|---|---|---|---|---|---|
| | Maximum | Average | | ER-L | ER-M | | | |
| PAL Metals (µg/g) | | | | | | | | |
| Cadmium | 2.3 | 0.68 | NA | 1.2 | 9.6 | 0.6 | 0.6 | Exceeds benchmark |
| Vanadium | 40.3 | 22.9 | NA | NA | NA | NA | NA | No benchmark available |

[1] Results of analyses of sediment samples are included in Section 7. Only those analytes selected as aquatic CPCs in Table O-3.5 are presented.
[2] U.S. Environmental Protection Agency (USEPA, 1988) mean Sediment Quality Criteria (SQCs).
[3] National Oceanic and Atmospheric Administration (NOAA) Effects Range-Low (ER-L) and Effects Range-Median (ER-M) Sediment Guidelines correspond to the concentration that is protective of the 90th percentile and the 50th percentile of the test populations, respectively (Long et al., 1994).
[4] Ontario Ministry of the Environment (OME) Low Effects Level (LEL) Provincial Sediment Quality Guidelines (Persaud et al., 1996) correspond to a concentration that can be tolerated by the majority of benthic organisms.
[5] New York State Department of Environmental Conservation (NYSDEC) sediment criteria for evaluating chronic toxicity to benthic aquatic life (NYSDEC, 1994). The values presented for metals represent lowest effect levels (LELs).

Notes:
µg/g = micrograms per gram
NA = Not available

TABLE O-3.13
COMPARISON OF AREA 3 SEDIMENT EXPOSURE CONCENTRATIONS FOR CHEMICALS ELIMINATED AS CPCs
WITH TOXICITY BENCHMARK VALUES [1]
AOC 57

REMEDIAL INVESTIGATION REPORT
DEVENS, MASSACHUSETTS

| Analyte | Exposure Point Concentrations | | USEPA Sediment Quality Guidelines [2] | NOAA [3] | | OME LEL [4] | NYSDEC LEL [5] | Result |
|---|---|---|---|---|---|---|---|---|
| | Maximum | Average | | ER-L | ER-M | | | |
| PAL Metals (µg/g) | | | | | | | | |
| Arsenic | 37.1 | 20.0 | NA | 8.2 | 70 | 6.0 | 6.0 | Exceeded |
| Barium | 59.8 | 33.0 | NA | NA | NA | NA | NA | Exceeded [6] |
| Copper | 11.2 | 4.0 | NA | 34 | 270 | 16 | 16 | Not exceeded |
| Lead | 64.6 | 22.8 | NA | 46.7 | 218 | 31 | 31 | Exceeded |
| Manganese | 459 | 188 | NA | NA | NA | 460 | 460 | Not exceeded |
| Selenium | 1.8 | 1.1 | NA | NA | NA | NA | NA | No benchmark available |
| Zinc | 90.8 | 21.4 | NA | 150 | 410 | 120 | 120 | Not exceeded |

[1] Results of analyses of sediment samples are included in Section 7. Only those analytes selected as aquatic CPCs in Table O-3.6 are presented.
[2] U.S. Environmental Protection Agency (USEPA, 1988) mean Sediment Quality Criteria (SQCs).
[3] National Oceanic and Atmospheric Administration (NOAA) Effects Range-Low (ER-L) and Effects Range-Median (ER-M) Sediment Guidelines correspond to the concentration that is protective of the 90th percentile and the 50th percentile of the test populations, respectively (Long et al., 1994).
[4] Ontario Ministry of the Environment (OME) Low Effects Level (LEL) Provincial Sediment Quality Guidelines (Persaud et al., 1996) correspond to a concentration that can be tolerated by the majority of benthic organisms.
[5] New York State Department of Environmental Conservation (NYSDEC) sediment criteria for evaluating chronic toxicity to benthic aquatic life (NYSDEC, 1994). The values for metals represent lowest effect levels (LELs).
[6] A sediment guideline of 20 mg/kg (provided by U.S. EPA Region V for the pollution classification of Great Lakes Harbor sediment [Fitchko, 1989]) is exceeded by the RME and average barium concentrations. These concentrations for barium fall within the range of "heavily polluted" sediments.

Notes:
µg/g = micrograms per gram
NA = Not available

# O-4 ECOLOGICAL RISK CALCULATIONS FOR NON-CPCs SUPPORTING INFORMATION

Table O-4.1
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of RME Concentrations of Chemicals Eliminated as CPCs in Food and Surface Soil
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| EXPOSURE CONCENTRATION DATA | | ESTIMATED CONTAMINANT CONCENTRATIONS IN PRIMARY FOOD ITEMS | | | | BAF VALUES FOR OTHER FOOD ITEMS | |
|---|---|---|---|---|---|---|---|
| ANALYTE | RME CONCENTRATION (mg/kg) | Invert BAF [a] | Concentration in Invertebrate Tissue [b] (mg/kg) | Plant BAF [a] | Concentration in Plant Tissue [c] (mg/kg) | Small Mammal BAF [a] | Small Bird BAF [a] |
| Aluminum | 7.5E+03 | 7.5E-02 | 5.6E+02 | 8.0E-04 | 6.0E+00 | 7.5E-02 | 7.5E-02 |
| Barium | 4.1E+01 | 7.5E-03 | 3.1E-01 | 3.0E-02 | 1.2E+00 | 7.5E-03 | 7.5E-03 |
| Beryllium | 7.1E-01 | 5.0E-02 | 3.5E-02 | 2.0E-03 | 1.4E-03 | 5.0E-02 | 5.0E-02 |
| Chromium | 2.7E+01 | 1.6E-01 | 4.3E+00 | 1.5E-03 | 4.1E-02 | 2.8E-01 | 2.8E-01 |
| Lead | 2.3E+01 | 7.8E-02 | 1.8E+00 | 9.0E-03 | 2.1E-01 | 1.5E-02 | 1.5E-02 |
| Vanadium | 1.6E+01 | 1.3E-01 | 2.0E+00 | 1.1E-03 | 1.7E-02 | 1.2E-01 | 1.2E-01 |
| Zinc | 3.8E+01 | 1.8E+00 | 6.9E+01 | 6.1E-01 | 2.3E+01 | 2.1E+00 | 2.1E+00 |

CPC = Contaminant of Potential Concern
[a] Bioaccumulation data presented in: Appendix O-1, Table O-1.2
[b] CPC concentration s in invertebrate tissue equals the invertebrate BAF multiplied by the RME soil concentration of the CPC.
[c] CPC concentrations in plant tissue equals the plant BAF multiplied by the RME soil concentration of the CPC.

Table O–4.1
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of RME Concentrations of Chemicals Eliminated as CPCs in Food and Surface Soil
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

POTENTIAL DIETARY EXPOSURE (mg/kgBW/day) [d]

| ANALYTE | *White–footed mouse* | *American robin* | *Red fox* | *Barred owl* |
|---|---|---|---|---|
| Aluminum | 2.6E+01 | 1.0E+02 | 5.2E–03 | 2.6E–02 |
| Barium | 2.4E–01 | 5.2E–01 | 2.1E–05 | 1.2E–04 |
| Beryllium | 2.3E–03 | 8.9E–03 | 4.4E–07 | 2.3E–06 |
| Chromium | 1.2E–01 | 4.4E–01 | 2.9E–05 | 1.4E–04 |
| Lead | 1.0E–01 | 3.2E–01 | 1.6E–05 | 7.1E–05 |
| Vanadium | 6.4E–02 | 2.4E–01 | 1.4E–05 | 6.0E–05 |
| Zinc | 3.4E+00 | 4.3E+00 | 8.5E–04 | 5.8E–03 |

[d] Calculated by summing the products of individual prey type concentrations and percent in diet, multiplying by the ingestion rate, and dividing by body weight (Table 9–27).

Table O-4.1
Exposure Parameters and Assumptions for Terrestrial Receptors [e]
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| Representative Wildlife Species | | Percent Prey in Diet: Inverts | Plants | Small Mammals | Small Birds | Soil | Home Range (acres) | ED [f] | Site Foraging Frequency [g] | Food Ingestion Rate (kg/day) | Body Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *White-footed mouse* | (Herb. mammal) | 10% | 88% | 0% | 0% | 2% | 0.147 | 1 | 1.00E+00 | 0.0049 | 0.040 |
| *American robin* | (Omn. bird) | 33% | 57% | 0% | 0% | 10% | 0.48 | 0.75 | 1.00E+00 | 0.011 | 0.077 |
| *Red fox* | (Predatory mammal) | 20% | 10% | 57% | 10% | 3% | 1,727 | 1 | 2.90E-04 | 0.24 | 4.69 |
| *Barred owl* | (Predatory bird) | 3% | 0% | 80% | 12% | 5% | 565 | 1 | 8.85E-04 | 0.047 | 0.72 |

NOTES:

| | |
|---|---|
| SITE AREA: | 0.5 acres |

[e] Documentation of exposure parameters presented in: Appendix O-1, Table O-1.1

[f] ED = Exposure Duration (percentage of year receptor is expected to be found at study area). ED is assumed to be 1 for this risk assessment.

[g] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0)).

Table O-4.2
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of RME Concentrations of Chemicals Eliminated as CPCs in Food and Surface Soil
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| EXPOSURE CONCENTRATION DATA | | ESTIMATED CONTAMINANT CONCENTRATIONS IN PRIMARY FOOD ITEMS | | | | BAF VALUES FOR OTHER FOOD ITEMS | |
|---|---|---|---|---|---|---|---|
| ANALYTE | RME CONCENTRATION (mg/kg) | Invert BAF [a] | Concentration in Invertebrate Tissue [b] (mg/kg) | Plant BAF [a] | Concentration in Plant Tissue [c] (mg/kg) | Small Mammal BAF [a] | Small Bird BAF [a] |
| Aluminum | 6.2E+03 | 7.5E-02 | 4.6E+02 | 8.0E-04 | 4.9E+00 | 7.5E-02 | 7.5E-02 |
| Beryllium | 7.1E-01 | 5.0E-02 | 3.5E-02 | 2.0E-03 | 1.4E-03 | 5.0E-02 | 5.0E-02 |
| Chromium | 1.5E+01 | 1.6E-01 | 2.5E+00 | 1.5E-03 | 2.3E-02 | 2.8E-01 | 2.8E-01 |
| Cobalt | 2.3E+00 | 1.0E+00 | 2.3E+00 | 4.0E-03 | 9.2E-03 | 1.0E+00 | 1.0E+00 |
| Nickel | 1.0E+01 | 2.3E-01 | 2.4E+00 | 1.2E-02 | 1.2E-01 | 3.0E-01 | 3.0E-01 |
| Vanadium | 1.4E+01 | 1.3E-01 | 1.8E+00 | 1.1E-03 | 1.5E-02 | 1.2E-01 | 1.2E-01 |

CPC = Contaminant of Potential Concern
[a] Bioaccumulation data presented in: Appendix O-1, Table O-1.2
[b] CPC concentrations in invertebrate tissue equals the invertebrate BAF multiplied by the RME soil concentration of the CPC.
[c] CPC concentrations in plant tissue equals the plant BAF multiplied by the RME soil concentration of the CPC.

Table O-4.2
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of RME Concentrations of Chemicals Eliminated as CPCs in Food and Surface Soil
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

POTENTIAL DIETARY EXPOSURE (mg/kgBW/day) [d]

| ANALYTE | *White-footed mouse* | *American robin* | *Raccoon* | *Barred owl* | *Short-tailed shrew* |
|---|---|---|---|---|---|
| Aluminum | 2.1E+01 | 5.2E+01 | 2.6E-02 | 1.2E-02 | 4.3E+01 |
| Beryllium | 2.3E-03 | 5.6E-03 | 2.9E-06 | 1.3E-06 | 4.4E-03 |
| Chromium | 7.0E-02 | 1.6E-01 | 7.5E-05 | 3.7E-05 | 1.5E-01 |
| Cobalt | 3.5E-02 | 6.7E-02 | 2.6E-05 | 2.1E-05 | 8.9E-02 |
| Nickel | 6.8E-02 | 1.3E-01 | 5.8E-05 | 2.8E-05 | 1.3E-01 |
| Vanadium | 5.8E-02 | 1.3E-01 | 6.4E-05 | 2.9E-05 | 1.2E-01 |

[d] Calculated by summing the products of individual prey type concentrations and percent in diet, multiplying by the ingestion rate, and dividing by body weight (Table 9-27).

Table O-4.2
Exposure Parameters and Assumptions for Terrestrial Receptors [e]
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| Representative Wildlife Species | | Percent Prey in Diet: Inverts | Plants | Small Mammals | Small Birds | Soil | Home Range (acres) | ED [f] | Site Foraging Frequency [g] | Food Ingestion Rate (kg/day) | Body Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *White-footed mouse* | (Herb. mammal) | 10% | 88% | 0% | 0% | 2% | 0.147 | 1 | 1.00E+00 | 0.0049 | 0.040 |
| *American robin* | (Omn. bird) | 33% | 57% | 0% | 0% | 10% | 0.48 | 0.75 | 6.25E-01 | 0.011 | 0.077 |
| *Raccoon* | (Predatory mammal) | 14% | 56% | 19% | 2% | 9% | 385 | 1 | 7.79E-04 | 0.214 | 3.99 |
| *Barred owl* | (Predatory bird) | 3% | 0% | 80% | 12% | 5% | 565 | 1 | 5.31E-04 | 0.047 | 0.72 |
| *Short-tailed shrew* | (Omn. mammal) | 78% | 12% | 0% | 0% | 10% | 0.96 | 1 | 3.12E-01 | 0.0024 | 0.017 |

NOTES:

| | |
|---|---|
| SITE AREA: | 0.3 acres |

[e] Documentation of exposure parameters presented in: Appendix O-1, Table O-1.1

[f] ED = Exposure Duration (percentage of year receptor is expected to be found at study area). ED is assumed to be 1 for this risk assessment.

[g] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0)).

Table O–4.3
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of RME Concentrations of Chemicals Eliminated as CPCs in Food and Surface Soil
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| EXPOSURE CONCENTRATION DATA | | ESTIMATED CONTAMINANT CONCENTRATIONS IN PRIMARY FOOD ITEMS | | | | BAF VALUES FOR OTHER FOOD ITEMS | |
|---|---|---|---|---|---|---|---|
| ANALYTE | RME CONCENTRATION (mg/kg) | Invert BAF[a] | Concentration in Invertebrate Tissue[b] (mg/kg) | Plant BAF[a] | Concentration in Plant Tissue[c] (mg/kg) | Small Mammal BAF[a] | Small Bird BAF[a] |
| Aluminum | 7.1E+03 | 7.5E–02 | 5.3E+02 | 8.0E–04 | 5.7E+00 | 7.5E–02 | 7.5E–02 |
| Barium | 2.9E+01 | 7.5E–03 | 2.2E–01 | 3.0E–02 | 8.8E–01 | 7.5E–03 | 7.5E–03 |
| Chromium | 1.2E+01 | 1.6E–01 | 1.9E+00 | 1.5E–03 | 1.8E–02 | 2.8E–01 | 2.8E–01 |
| Cobalt | 3.2E+00 | 1.0E+00 | 3.2E+00 | 4.0E–03 | 1.3E–02 | 1.0E+00 | 1.0E+00 |
| Copper | 6.8E+00 | 1.6E–01 | 1.1E+00 | 7.8E–01 | 5.3E+00 | 6.0E–01 | 6.0E–01 |
| Lead | 3.3E+01 | 7.8E–02 | 2.6E+00 | 9.0E–03 | 2.9E–01 | 1.5E–02 | 1.5E–02 |
| Nickel | 1.1E+01 | 2.3E–01 | 2.6E+00 | 1.2E–02 | 1.3E–01 | 3.0E–01 | 3.0E–01 |
| Vanadium | 9.4E+00 | 1.3E–01 | 1.2E+00 | 1.1E–03 | 1.0E–02 | 1.2E–01 | 1.2E–01 |
| Zinc | 2.8E+01 | 1.8E+00 | 5.1E+01 | 6.1E–01 | 1.7E+01 | 2.1E+00 | 2.1E+00 |

CPC = Contaminant of Potential Concern
[a] Bioaccumulation data presented in: Appendix O–1, Table O–1.2
[b] CPC concentration s in invertebrate tissue equals the invertebrate BAF multiplied by the RME soil concentration of the CPC.
[c] CPC concentrations in plant tissue equals the plant BAF multiplied by the RME soil concentration of the CPC.

Table O–4.3
Estimated Chronic Exposure to Terrestrial Receptors from Ingestion of RME Concentrations of Chemicals Eliminated as CPCs in Food and Surface Soil
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

**POTENTIAL DIETARY EXPOSURE (mg/kgBW/day) [d]**

| ANALYTE | *White–footed mouse* | *American robin* | *Red fox* | *Barred owl* |
|---|---|---|---|---|
| Aluminum | 2.5E+01 | 4.0E+01 | 2.0E–03 | 9.2E–03 |
| Barium | 1.7E–01 | 1.6E–01 | 6.0E–06 | 3.4E–05 |
| Chromium | 5.3E–02 | 8.0E–02 | 4.8E–06 | 2.0E–05 |
| Cobalt | 4.8E–02 | 6.2E–02 | 6.0E–06 | 2.1E–05 |
| Copper | 6.0E–01 | 1.8E–01 | 1.6E–05 | 7.7E–05 |
| Lead | 1.4E–01 | 1.9E–01 | 9.1E–06 | 4.0E–05 |
| Nickel | 7.3E–02 | 9.1E–02 | 5.8E–06 | 2.1E–05 |
| Vanadium | 3.9E–02 | 6.0E–02 | 3.3E–06 | 1.3E–05 |
| Zinc | 2.6E+00 | 1.3E+00 | 2.4E–04 | 1.2E–03 |

[d] Calculated by summing the products of individual prey type concentrations and percent in diet, multiplying by the ingestion rate, and dividing by body weight (Table 9–27).

Table O-4.3
Exposure Parameters and Assumptions for Terrestrial Receptors [e]
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| Representative Wildlife Species | | Percent Prey in Diet: Inverts | Plants | Small Mammals | Small Birds | Soil | Home Range (acres) | ED [f] | Site Foraging Frequency [g] | Food Ingestion Rate (kg/day) | Body Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *White-footed mouse* | (Herb. mammal) | 10% | 88% | 0% | 0% | 2% | 0.147 | 1 | 1.00E+00 | 0.0049 | 0.040 |
| *American robin* | (Omn. bird) | 33% | 57% | 0% | 0% | 10% | 0.48 | 0.75 | 4.17E-01 | 0.011 | 0.077 |
| *Red fox* | (Predatory mammal) | 20% | 10% | 57% | 10% | 3% | 1,727 | 1 | 1.16E-04 | 0.24 | 4.69 |
| *Barred owl* | (Predatory bird) | 3% | 0% | 80% | 12% | 5% | 565 | 1 | 3.54E-04 | 0.047 | 0.72 |

NOTES:

| | |
|---|---|
| SITE AREA: | 0.2 acres |

[e] Documentation of exposure parameters presented in: Appendix O-1, Table O-1.1

[f] ED = Exposure Duration (percentage of year receptor is expected to be found at study area). ED is assumed to be 1 for this risk assessment.

[g] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0)).

Table O–4.4
Estimated Chronic Exposure to Semi–Aquatic Receptors from Ingestion of RME Concentrations of Chemicals Eliminated as CPCs in Food and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

EXPOSURE CONCENTRATION DATA

| CHEMICAL | RME SEDIMENT CONCENTRATION (mg/kg) | RME UNFILT. SURFACE WATER CONCENTRATION (mg/L) |
|---|---|---|
| Cadmium | 2.3E+00 | Not a CPC |
| Vanadium | 4.0E+01 | Not a CPC |

ESTIMATED TISSUE LEVELS IN PRIMARY PREY ITEMS

| Aquatic Organism BCF [a] | Aquatic Organism BAF [a] | Aq. Org. Tissue Level (mg/kg) | Aquatic Plant BAF [a] | Raccoon Tissue Exposure (mg/kg) | Heron Tissue Exposure (mg/kg) |
|---|---|---|---|---|---|
| NA | 1.4E+00 | 3.2E+00 | 4.1E–01 | 3.2E+00 | 3.2E+00 |
| NA | 1.3E–01 | 5.2E+00 | 1.1E–03 | 5.2E+00 | 5.2E+00 |

[a] Bioaccumulation data presented in: Appendix O, Tables O–1.2 and O–1.3 BAFs are multiplied by sediment concentrations and BCFs are multiplied by the surface water concentrations; BCFs <300 were not used as per USEPA (1989). The aquatic organism tissue level is equal to the greater of the two products.

[b] Measured crayfish and fish tissue concentrations (provided in Table O–1.3).

Table O-4.4
Estimated Chronic Exposure to Semi-Aquatic Receptors from Ingestion of RME Concentrations of Chemicals Eliminated as CPCs in Food and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

**POTENTIAL DIETARY EXPOSURE (mg/kgBW-day) [c]**

| CHEMICAL | *Muskrat* | *Mallard* | *Raccoon* | *Great blue heron* |
|---|---|---|---|---|
| Cadmium | 8.6E-02 | 1.6E-04 | 3.1E-04 | 1.3E-01 |
| Vanadium | 3.0E-01 | 1.5E-04 | 8.2E-04 | 2.5E-01 |

[c] Calculated by summing the products of individual prey type concentrations and percent in diet with surface water and sediment exposures, multiplying by the exposure duration, SFF and ingestion rate, and dividing by body weight (Table 9-27).

Table O-4.4
Exposure Parameters and Assumptions for Semi-Aquatic Receptors
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

**EXPOSURE PARAMETERS [d]**

| Indicator Species | | Percent Prey in Diet: Aquatic Organisms | Percent Prey in Diet: Plants | Sediment | Home Range (acres) | ED [e] | Site Foraging Frequency [f] | Dietary Ingestion Rate (kg/day) | Water Ingestion Rate (L/day) | Body Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| *Muskrat* | (Small herb. mammal) | 10% | 80% | 10% | 0.2 | 1 | 1.00E+00 | 0.084 | 0.12 | 1.27 |
| *Mallard* | (Small herb. bird) | 1% | 97% | 2% | 235 | 1 | 2.98E-03 | 0.063 | 0.064 | 1.134 |
| *Raccoon* | (Predatory mammal) | 91% | 0% | 9% | 385 | 1 | 1.82E-03 | 0.214 | 0.344 | 3.99 |
| *Great blue heron* | (Piscivorous bird) | 98% | 0% | 2% | 1.5 | 0.5 | 4.67E-01 | 0.401 | 0.101 | 2.23 |

NOTES:
[d] Documentation of exposure parameters presented in: Appendix O, Table O-1.1
[e] ED = Exposure Duration (percentage of year receptor is expected to be found at study area)
[f] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0))

| SITE AREA: | 0.7 acres |
|---|---|

Table O-4.5
Estimated Chronic Exposure to Semi-Aquatic Receptors from Ingestion of RME Concentrations of Chemicals Eliminated as CPCs in Food, Surface Water, and Sediment
Area 3

Remedial Investigation Report, AOC 57
Devens, Massachusetts

**EXPOSURE CONCENTRATION DATA**

| CHEMICAL | RME SEDIMENT CONCENTRATION (mg/kg) | RME UNFILT. SURFACE WATER CONCENTRATION (mg/L) |
|---|---|---|
| Arsenic | 3.7E+01 | Not a CPC |
| Barium | 6.0E+01 | Not a CPC |
| Copper | 1.1E+01 | Not a CPC |
| Lead | 6.5E+01 | Not a CPC |
| Manganese | 4.6E+02 | 9.3E-02 |
| Selenium | 1.8E+00 | Not a CPC |
| Zinc | 9.1E+01 | Not a CPC |

**ESTIMATED TISSUE LEVELS IN PRIMARY PREY ITEMS**

| Aquatic Organism BCF [a] | Aquatic Organism BAF [a] | Aq. Org. Tissue Level (mg/kg) | Aquatic Plant BAF [a] | Raccoon Tissue Exposure (mg/kg) |
|---|---|---|---|---|
| NA | 6.6E-03 | 2.4E-01 | 3.0E-01 | 2.4E-01 |
| NA | 7.5E-03 | 4.5E-01 | 2.5E-02 | 4.5E-01 |
| NA | 1.6E-01 | 1.8E+00 | 6.0E-02 | 1.8E+00 |
| NA | 7.8E-02 | 5.0E+00 | 5.6E-02 | 5.0E+00 |
| 1.7E+03 | 2.0E-02 | 1.6E+02 | 1.3E-01 | 1.6E+02 |
| NA | 7.6E-01 | 1.4E+00 | 1.6E-01 | 1.4E+00 |
| NA | 1.8E+00 | 1.6E+02 | 9.2E-01 | 1.6E+02 |

[a] Bioaccumulation data presented in: Appendix O, Tables O-1.2 and O-1.3 BAFs are multiplied by sediment concentrations and BCFs are multiplied by the surface water concentrations; BCFs <300 were not used as per USEPA (1989). The aquatic organism tissue level is equal to the greater of the two products.

[b] Measured crayfish and fish tissue concentrations (provided in Table O-1.3).

Table O–4.5
Estimated Chronic Exposure to Semi–Aquatic Receptors from Ingestion of RME Concentrations of Chemicals Eliminated as CPCs in Food, Surface Water, and Sediment
Area 3

Remedial Investigation Report, AOC 57
Devens, Massachusetts

POTENTIAL DIETARY EXPOSURE (mg/kgBW–day) [c]

| CHEMICAL | *Raccoon* |
|---|---|
| Arsenic | 9.9E–05 |
| Barium | 1.6E–04 |
| Copper | 7.4E–05 |
| Lead | 2.9E–04 |
| Manganese | 5.2E–03 |
| Selenium | 3.9E–05 |
| Zinc | 4.4E–03 |

[c] Calculated by summing the products of individual prey type concentrations and percent in diet with surface water and sediment exposures, multiplying by the exposure duration, SFF and ingestion rate, and dividing by body weight (Table 9–27).

Table O-4.5
Exposure Parameters and Assumptions for Semi-Aquatic Receptors
Area 3

Remedial Investigation Report, AOC 57
Devens, Massachusetts

**EXPOSURE PARAMETERS [d]**

| Indicator Species | | Percent Prey in Diet: Aquatic Organisms | Percent Prey in Diet: Plants | Percent Prey in Diet: Sediment | Home Range (acres) | ED [e] | Site Foraging Frequency [f] | Dietary Ingestion Rate (kg/day) | Water Ingestion Rate (L/day) | Body Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| *Raccoon* | (Predatory mammal) | 91% | 0% | 9% | 385 | 1 | 5.19E-04 | 0.214 | 0.344 | 3.99 |

NOTES:
[d] Documentation of exposure parameters presented in: Appendix O, Table O-1.1
[e] ED = Exposure Duration (percentage of year receptor is expected to be found at study area)
[f] SFF = Site Foraging Frequency (calculated by dividing site area by receptor home range (cannot exceed 1.0))

| SITE AREA: | 0.2 acres |
|---|---|

Table O–4.6
Risk of Lethal or Sublethal Effects for Terrestrial Receptors from RME Concentrations of Chemicals Eliminated as CPCs in Food and Surface Soil
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| ANALYTE | *White–footed mouse* | | | *American robin* | | | *Red fox* | | |
|---|---|---|---|---|---|---|---|---|---|
| | PDE | RTV | HQ | PDE | RTV | HQ | PDE | RTV | HQ |
| Aluminum | 2.6E+01 | 4.3E+02 | 6.1E–02 | 1.0E+02 | 4.3E+02 | 2.4E–01 | 5.2E–03 | 4.3E+02 | 1.2E–05 |
| Barium | 2.4E–01 | 2.0E+02 | 1.2E–03 | 5.2E–01 | 2.0E+02 | 2.6E–03 | 2.1E–05 | 2.0E+02 | 1.1E–07 |
| Beryllium | 2.3E–03 | 8.5E–01 | 2.7E–03 | 8.9E–03 | 8.5E–01 | 1.1E–02 | 4.4E–07 | 8.5E–01 | 5.1E–07 |
| Chromium | 1.2E–01 | 3.5E+00 | 3.5E–02 | 4.4E–01 | 2.5E+01 | 1.8E–02 | 2.9E–05 | 3.5E+00 | 8.2E–06 |
| Lead | 1.0E–01 | 2.5E+00 | 4.0E–02 | 3.2E–01 | 7.5E+01 | 4.3E–03 | 1.6E–05 | 2.5E+00 | 6.4E–06 |
| Vanadium | 6.4E–02 | 6.0E+00 | 1.1E–02 | 2.4E–01 | 1.1E+01 | 2.2E–02 | 1.4E–05 | 6.0E+00 | 2.3E–06 |
| Zinc | 3.4E+00 | 2.0E+02 | 1.7E–02 | 4.3E+00 | 2.0E+02 | 2.1E–02 | 8.5E–04 | 2.0E+02 | 4.2E–06 |
| SUMMARY HAZARD INDEX | | | 1.7E–01 | | | 3.2E–01 | | | 3.4E–05 |

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–4.6
Risk of Lethal or Sublethal Effects for Terrestrial Receptors from RME Concentrations of Chemicals Eliminated as CPCs in Food and Surface Soil
Area 2 Upland
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| ANALYTE | *Barred owl* | | |
|---|---|---|---|
| | PDE | RTV | HQ |
| Aluminum | 2.6E–02 | 4.3E+02 | 6.1E–05 |
| Barium | 1.2E–04 | 2.0E+02 | 6.1E–07 |
| Beryllium | 2.3E–06 | 8.5E–01 | 2.7E–06 |
| Chromium | 1.4E–04 | 2.5E+01 | 5.5E–06 |
| Lead | 7.1E–05 | 7.5E+01 | 9.5E–07 |
| Vanadium | 6.0E–05 | 1.1E+01 | 5.5E–06 |
| Zinc | 5.8E–03 | 2.0E+02 | 2.9E–05 |
| SUMMARY HAZARD INDEX | | | 1.1E–04 |

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–4.7
Risk of Lethal or Sublethal Effects for Terrestrial Receptors from RME Concentrations of Chemicals Eliminated as CPCs in Food and Surface Soil
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| ANALYTE | *White–footed mouse* | | | *American robin* | | | *Raccoon* | | |
|---|---|---|---|---|---|---|---|---|---|
| | PDE | RTV | HQ | PDE | RTV | HQ | PDE | RTV | HQ |
| Aluminum | 2.1E+01 | 4.3E+02 | 5.0E–02 | 5.2E+01 | 4.3E+02 | 1.2E–01 | 2.6E–02 | 4.3E+02 | 6.2E–05 |
| Beryllium | 2.3E–03 | 8.5E–01 | 2.7E–03 | 5.6E–03 | 8.5E–01 | 6.6E–03 | 2.9E–06 | 8.5E–01 | 3.4E–06 |
| Chromium | 7.0E–02 | 3.5E+00 | 2.0E–02 | 1.6E–01 | 2.5E+01 | 6.3E–03 | 7.5E–05 | 3.5E+00 | 2.1E–05 |
| Cobalt | 3.5E–02 | 4.2E+00 | 8.3E–03 | 6.7E–02 | 4.2E+00 | 1.6E–02 | 2.6E–05 | 4.2E+00 | 6.3E–06 |
| Nickel | 6.8E–02 | 1.3E+01 | 5.2E–03 | 1.3E–01 | 5.0E+01 | 2.5E–03 | 5.8E–05 | 1.3E+01 | 4.5E–06 |
| Vanadium | 5.8E–02 | 6.0E+00 | 9.7E–03 | 1.3E–01 | 1.1E+01 | 1.2E–02 | 6.4E–05 | 6.0E+00 | 1.1E–05 |
| SUMMARY HAZARD INDEX | | | 9.6E–02 | | | 1.7E–01 | | | 1.1E–04 |

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–4.7
Risk of Lethal or Sublethal Effects for Terrestrial Receptors from RME Concentrations of Chemicals Eliminated as CPCs in Food and Surface Soil
Area 2 Floodplain
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| ANALYTE | *Barred owl* | | | *Short–tailed shrew* | | |
|---|---|---|---|---|---|---|
| | PDE | RTV | HQ | PDE | RTV | HQ |
| Aluminum | 1.2E–02 | 4.3E+02 | 2.8E–05 | 4.3E+01 | 4.3E+02 | 1.0E–01 |
| Beryllium | 1.3E–06 | 8.5E–01 | 1.5E–06 | 4.4E–03 | 8.5E–01 | 5.1E–03 |
| Chromium | 3.7E–05 | 2.5E+01 | 1.5E–06 | 1.5E–01 | 3.5E+00 | 4.4E–02 |
| Cobalt | 2.1E–05 | 4.2E+00 | 5.0E–06 | 8.9E–02 | 4.2E+00 | 2.1E–02 |
| Nickel | 2.8E–05 | 5.0E+01 | 5.5E–07 | 1.3E–01 | 1.3E+01 | 9.9E–03 |
| Vanadium | 2.9E–05 | 1.1E+01 | 2.6E–06 | 1.2E–01 | 6.0E+00 | 2.1E–02 |
| SUMMARY HAZARD INDEX | | | 3.9E–05 | | | 2.0E–01 |

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing P

Table O–4.8
Risk of Lethal or Sublethal Effects for Terrestrial Receptors from RME Concentrations of Chemicals Eliminated as CPCs in Food and Surface Soil
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| ANALYTE | *White–footed mouse* | | | *American robin* | | | *Red fox* | | |
|---|---|---|---|---|---|---|---|---|---|
| | PDE | RTV | HQ | PDE | RTV | HQ | PDE | RTV | HQ |
| Aluminum | 2.5E+01 | 4.3E+02 | 5.8E–02 | 4.0E+01 | 4.3E+02 | 9.3E–02 | 2.0E–03 | 4.3E+02 | 4.6E–06 |
| Barium | 1.7E–01 | 2.0E+02 | 8.5E–04 | 1.6E–01 | 2.0E+02 | 7.9E–04 | 6.0E–06 | 2.0E+02 | 3.0E–08 |
| Chromium | 5.3E–02 | 3.5E+00 | 1.5E–02 | 8.0E–02 | 2.5E+01 | 3.2E–03 | 4.8E–06 | 3.5E+00 | 1.4E–06 |
| Cobalt | 4.8E–02 | 4.2E+00 | 1.2E–02 | 6.2E–02 | 4.2E+00 | 1.5E–02 | 6.0E–06 | 4.2E+00 | 1.4E–06 |
| Copper | 6.0E–01 | 1.0E+02 | 6.0E–03 | 1.8E–01 | 1.0E+02 | 1.8E–03 | 1.6E–05 | 1.0E+02 | 1.6E–07 |
| Lead | 1.4E–01 | 2.5E+00 | 5.7E–02 | 1.9E–01 | 7.5E+01 | 2.5E–03 | 9.1E–06 | 2.5E+00 | 3.6E–06 |
| Nickel | 7.3E–02 | 1.3E+01 | 5.6E–03 | 9.1E–02 | 5.0E+01 | 1.8E–03 | 5.8E–06 | 1.3E+01 | 4.5E–07 |
| Vanadium | 3.9E–02 | 6.0E+00 | 6.5E–03 | 6.0E–02 | 1.1E+01 | 5.5E–03 | 3.3E–06 | 6.0E+00 | 5.5E–07 |
| Zinc | 2.6E+00 | 2.0E+02 | 1.3E–02 | 1.3E+00 | 2.0E+02 | 6.6E–03 | 2.4E–04 | 2.0E+02 | 1.2E–06 |
| SUMMARY HAZARD INDEX | | | 1.7E–01 | | | 1.3E–01 | | | 1.3E–05 |

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–4.8
Risk of Lethal or Sublethal Effects for Terrestrial Receptors from RME Concentrations of Chemicals Eliminated as CPCs in Food and Surface Soil
Area 3
Remedial Investigation Report, AOC 57
Devens, Massachusetts

| ANALYTE | *Barred owl* | | |
|---|---|---|---|
| | PDE | RTV | HQ |
| Aluminum | 9.2E–03 | 4.3E+02 | 2.2E–05 |
| Barium | 3.4E–05 | 2.0E+02 | 1.7E–07 |
| Chromium | 2.0E–05 | 2.5E+01 | 7.9E–07 |
| Cobalt | 2.1E–05 | 4.2E+00 | 5.1E–06 |
| Copper | 7.7E–05 | 1.0E+02 | 7.7E–07 |
| Lead | 4.0E–05 | 7.5E+01 | 5.4E–07 |
| Nickel | 2.1E–05 | 5.0E+01 | 4.3E–07 |
| Vanadium | 1.3E–05 | 1.1E+01 | 1.2E–06 |
| Zinc | 1.2E–03 | 2.0E+02 | 6.2E–06 |
| SUMMARY HAZARD INDEX | | | 3.7E–05 |

PDE = Potential Dietary Exposure (mg/kgBW/day) RTV = Reference Toxicity Value (mg/kgBW/day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–4.9
Risk of Lethal or Sublethal Effects for Semi–Aquatic Receptors from RME Concentrations of Chemicals Eliminated as CPCs in Food and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

| CHEMICAL | *Muskrat* | | | *Mallard* | | | *Raccoon* | | |
|---|---|---|---|---|---|---|---|---|---|
| | PDE | RTV | HQ | PDE | RTV | HQ | PDE | RTV | HQ |
| Cadmium | 8.6E–02 | 2.2E+01 | 4.0E–03 | 1.6E–04 | 1.0E+01 | 1.6E–05 | 3.1E–04 | 2.2E+01 | 1.4E–05 |
| Vanadium | 3.0E–01 | 6.0E+00 | 5.1E–02 | 1.5E–04 | 1.1E+01 | 1.4E–05 | 8.2E–04 | 6.0E+00 | 1.4E–04 |
| SUMMARY HAZARD INDEX | | | 5.5E–02 | | | 3.0E–05 | | | 1.5E–04 |

PDE = Potential Dietary Exposure (mg/kgBW–day). RTV = Reference Toxicity Value (mg/kgBW–day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O–4.9
Risk of Lethal or Sublethal Effects for Semi–Aquatic Receptors from RME Concentrations of Chemicals Eliminated as CPCs in Food and Sediment
Area 2

Remedial Investigation Report, AOC 57
Devens, Massachusetts

| CHEMICAL | *Great blue heron* | | |
|---|---|---|---|
| | PDE | RTV | HQ |
| Cadmium | 1.3E–01 | 1.0E+01 | 1.3E–02 |
| Vanadium | 2.5E–01 | 1.1E+01 | 2.3E–02 |
| SUMMARY HAZARD INDEX | | | 3.6E–02 |

PDE = Potential Dietary Exposure (mg/kgBW–day). RTV = Reference Toxicity Value (mg/kgBW–day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

Table O-4.10
Risk of Lethal or Sublethal Effects for Semi-Aquatic Receptors from RME Concentrations of CPCs in Food, Surface Water, and Sediment
Area 3

Remedial Investigation Report, AOC 57
Devens, Massachusetts

| CHEMICAL | Raccoon | | |
|---|---|---|---|
| | PDE | RTV | HQ |
| Arsenic | 9.9E-05 | 5.8E-01 | 1.7E-04 |
| Barium | 1.6E-04 | 2.0E+02 | 8.1E-07 |
| Copper | 7.4E-05 | 1.0E+02 | 7.4E-07 |
| Lead | 2.9E-04 | 2.5E+00 | 1.2E-04 |
| Manganese | 5.2E-03 | 4.5E+01 | 1.1E-04 |
| Selenium | 3.9E-05 | 2.0E-01 | 2.0E-04 |
| Zinc | 4.4E-03 | 2.0E+02 | 2.2E-05 |
| SUMMARY HAZARD INDEX | | | 6.2E-04 |

PDE = Potential Dietary Exposure (mg/kgBW-day). RTV = Reference Toxicity Value (mg/kgBW-day) HQ = Hazard Quotient (calculated by dividing PDE by RTV)

# O-5 STATISTICAL ANALYSIS OF TOXICITY TESTING (MIDGE GROWTH)

Table O-5.1
Midge Growth - Copper

| Location | X | Y |
|---|---|---|
| 57D-95-04X | 201 | 1.36 |
| 57D-95-05X | 33.8 | 2 |
| 57D-95-06X | 42.3 | 1.8 |
| 57D-95-07X | 36.1 | 2.27 |
| 57D-95-08X | 33.4 | 1.81 |
| 57D-95-10X | 34.2 | 1.75 |

Regression Output:

| | |
|---|---|
| Constant | 2.0496496 |
| Std Err of Y Est | 0.2137037 |
| R Squared | 0.595026 |
| No. of Observations | 6 |
| Degrees of Freedom | 4 |
| | |
| X Coefficient(s) | -0.003435 |
| Std Err of Coef. | 0.0014167 |

Table O-5.2
Midge Growth - Lead

| Location | X | Y |
|---|---|---|
| 57D-95-04X | 410 | 1.36 |
| 57D-95-05X | 188 | 2 |
| 57D-95-06X | 281 | 1.8 |
| 57D-95-07X | 170 | 2.27 |
| 57D-95-08X | 223 | 1.81 |
| 57D-95-10X | 170 | 1.75 |

Regression Output:

| | | |
|---|---|---|
| Constant | | 2.4679626 |
| Std Err of Y Est | | 0.1917392 |
| R Squared | | 0.6739945 |
| No. of Observations | | 6 |
| Degrees of Freedom | | 4 |
| | | |
| X Coefficient(s) | -0.002648 | |
| Std Err of Coef. | 0.0009207 | |

Table O-5.3
Midge Growth - TPH Diesel Fraction

| Location | X | Y |
|---|---|---|
| 57D-95-04X | 169 | 1.36 |
| 57D-95-05X | 52.5 | 2 |
| 57D-95-06X | 62.1 | 1.8 |
| 57D-95-07X | 114 | 2.27 |
| 57D-95-08X | 51.4 | 1.81 |
| 57D-95-10X | 4 | 1.75 |

Regression Output:

| | |
|---|---|
| Constant | 1.9420641 |
| Std Err of Y Est | 0.3223102 |
| R Squared | 0.0788058 |
| No. of Observations | 6 |
| Degrees of Freedom | 4 |
| | |
| X Coefficient(s) | -0.001462 |
| Std Err of Coef. | 0.0024996 |

# ECOLOGICAL SURVEY

## APPENDIX P

## STUDY AREA AOC 57
## ECOLOGICAL SURVEY

**Baseline Ecological Risk Assessment**
**Fort Devens, Massachusetts**

### INTRODUCTION:

The following is a summary of the Ecological survey of the terrestrial and wetland habitats associated with AOC 57, which took place on October 13, 1995. The terrestrial and wetland habitats along Cold Spring Brook were characterized into major habitat types, through the qualitative analysis of plant species, microtopography, and hydrology. Individual site descriptions and plant species lists are provided below.

### SITE DESCRIPTION

A qualitative line transect survey was utilized to characterize the upland and wetland habitats associated with the AOC 57 along Cold Spring Brook. Three transects were established perpendicular to a base line running in an east-north easterly direction along Cold Spring Brook. The following descriptions of each habitat encountered along the transects progress from the south side of the brook to the north side of the brook.

**Transect 1:**
Transect 1 was established perpendicular to the stream channel, approximately 300 feet to the southwest (upstream) of the AOC 57 containment berm.

Habitat A:
The first habitat encountered was a well established upland forest, co-dominated by white pines (*Pinus strobus*) and white and red oaks (*Quercus alba* and *rubra*). The canopy was approximately 60 feet high, with 85 percent aerial coverage. The shrub subcanopy was open, with sparse beech (*Fagus grandifolia*) and white pine saplings, intermixed with an 80/20 mix of lowbush and highbush blueberry shrubs (*Vaccinium corymbosum* and *angustifolium*). Other saplings present in this habitat included sparse red and white oak saplings. The herbaceous species that dominated this habitat included gold thread (*Coptis groenlandica*). Also common along the downslope transitional area between this habitat and habitat B were, partridge berry (*Mitchella repens*), interrupted fern (*Osmunda claytoniana*), cinnamon fern (*Osmunda cinnamomea*), and lady fern (*Athyrium filix-femina*). Additionally, the ground was covered with a mat of pine needles and semi-decomposed oak leaves. The ground surface slopes steeply towards the brook at approximately a 45 degree angle. Due to the steep slope and elevation above the brook (approximately 20 feet), surface water would never be present in this habitat.

Habitat B:
The next habitat encountered along transect 1, was a scrub/shrub marsh, approximately 30 feet wide. Trees in this habitat included a few red maples (*Acer rubrum*) and white pines, with red maple being the more dominant. The trees ranged from 30 to 45 feet tall, and the canopy was

largely open. This area also contained sparse standing dead trees. The shrubs in this area included arrow-wood (*Viburnum recognitum*), highbush blueberry (*Vaccinium corymbosum*), sweet gale (*Myrica gale*), winterberry (*Ilex verticillata*), sheep laurel (*Kalmia angustifolium*), speckled alder (*Alnus rugosa*), and red choke cherry (*Prunus virginiana*). Highbush blueberry and winterberry shared dominance in this habitat. The dominant herbaceous species present in this habitat included cinnamon fern, tussock sedge (*Carex stricta*), and sphagnum (*Sphagnum palustre*). Other herbaceous species included turtle head (*Chelone glabra*), aster (*Aster novi-belgii*), New York aster (*Aster novi-belhii*), and bedstraw (*Galium asprellum*). The presence of sphagnum moss (*Sphagnum palustre*), and the distinct mound and pool microtopography in this habitat indicate the water table would be at or near the ground surface throughout the year.

Habitat C:
The next habitat encountered on this transect was an emergent marsh, approximately 60 feet wide dominated by broad-leaved cattail (*Typha latifolia*). A prominent feature of this habitat was the presence of several (est. 5 per 0.25 acre) white pine snags, which were flooded when the containment berm was constructed. This habitat included the following shrubs, speckled alder, common alder (*Sambucus canadensis*), swamp rose (*Rosa palustris*), and arrow-wood. The herbaceous layer of this habitat was dominated by tussock sedge, umbrella sedge (*Cyperus* sp.), arrow-leaved tearthumb (*Polygonum sagittatum)*, jewelweed (*Impatiens capensis*), cinnamon fern, and sensitive fern (*Onoclea sensibilis*). The presence of sphagnum moss, and the mound and pool microtopography indicate a high water table (at or near the ground surface throughout the year). This habitat is bordered by the meandering stream channel.

Habitat D:
The last habitat encountered along transect 1 was a white pine (P. strobus) dominated floodplain forest with intermixed oaks (*Quercus* spp.) and maples (*Acer* spp). This habitat is bordered by the meandering stream channel. Vegetation along the stream fringe consists of tussock sedge and various ferns (*Dryopteris* and *Osmunda* spp.). The shrub layer in this habitat is dominated by arrow-wood, and subordinate shrub species present in this habitat include highbush blueberry, sheep laurel, red-osier dogwood (*Cornus stolonifera*), and winterberry.

**Transect 2:**
Transect 2 is perpendicular to the stream channel, running over the AOC 57 containment berm.

Habitat A:
The first habitat encountered along this transect is a well developed upland forest, co-dominated by white pines, white oaks, and red oaks. The canopy was approximately 60 feet high, with 80 to 85 percent aerial coverage. The shrub canopy is open, and includes low- and highbush blueberry, sheep laurel, clubmoss (*Lycopodium* sp.). The herbaceous layer is consistent with transect 1 and 3, scattered with interrupted fern (*Osmunda claytoniana*), cinnamon fern, lady fern, and gold thread. A large percentage of the ground surface in this habitat is covered with a mat of pine needles and partially decomposed oak leaves. The ground surface is sloping towards the steam at approximately a 30 degree angle. The water table in this habitat is well below the ground surface.

Habitat B:
The next habitat encountered along transect 2, was a scrub shrub marsh, approximately 12 to 15 feet wide. Trees in this habitat included white pines grading into red maples. This habitat also included a few scattered wind-throws. The scrub shrub layer consisted mostly of white pine saplings and fetterbush *(Leucothoe racemosa)*. The herbaceous layer was dominated by tussock sedge and sphagnum. Subordinate herbaceous species included interrupted fern, gold thread, aster (*Aster novae-angliae*), goldenrods (*Solidago* sp.), turtle head, and purple loosestrife (*Lythrum salicaria*). The ground surface transitioned from relatively flat to slightly mounded and pooled. This habitat seems to be hydrologically affected by the berm, as this area seemed wetter in comparison to the other similar habitats along transects 1 and 3. At the time of the site visit the water table was at the ground surface.

Habitat C:
The next habitat encountered along this transect was a broad-leaved cattail-dominated emergent marsh, approximately 10 to 15 feet wide. This habitat ends abruptly at the stream channel, (4 to 6 feet wide) which is bordered on the opposite side by the containment berm. The shrub layer consisted of an even distribution of arrow-wood, sweet gale, winterberry, red-osier dogwood, swamp birch *(Betula pumila)*, and swamp rose. Subordinate herbaceous species included tussock sedge, meadow rue (*Thalictrum polygamum*), marsh bedstraw (*Galium palustre*), aster, purple-leaved willow herb (*Epilobium coloratum*), and joe-pye weed (*Eupatorium dubium*). This habitat was distinctly mounded and pooled, and the water table was at the ground surface.

Habitat D:
The next habitat along transect 2 was the AOC 57 containment berm, which is approximately 30 feet wide and 150 feet long. The crest of the berm is approximately 2 feet above the ponded water surface in front of the berm. This habitat is mostly vegetated with shrubs and saplings. The dominant shrub in this habitat is speckled alder, and subordinate shrubs include highbush blueberry, arrow-wood, fetterbush, dogwood, silverberry (*Elaeagnus commutata*), and swamp rose.

**Transect 3:**
Transect 3 is perpendicular to the stream channel, approximately 300 feet to the northeast (downstream) of the SA57 containment berm.

Habitat A:
The first habitat encountered along transect 3 was a well established upland forest, co-dominated by white pines, white oak, and red oak. The canopy was approximately 60 feet high, with 80 to 85 percent aerial coverage. The shrub sublayer was intermixed with white pine saplings, low- and highbush blueberry, sheep laurel, witch hazel (*Hamamelis virginiana*), nannyberry (*Viburnum lentago*), and choke cherry. The shrub layer was co-dominated by low- and highbush blueberry, of which there was approximately a 75/25 mix. The herbaceous layer within this habitat was dominated by clubmoss (*Lycopodium carolinianum*), and ferns (*Thelipteris* sp.). The ground was sloping at approximately a 15 degree angle, progressively less than transect 1 and 2. The water table in this habitat is well below the ground surface.

Habitat B: The next habitat encountered along transect 3 was a forested wetland, approximately 35 to 45 feet wide. Red maple trees, approximately 25 to 30 feet high are

sparsely scattered throughout this habitat. The shrub layer is dominated by winterberry. Other shrubs common in this habitat included maleberry *(Lyonia ligustrina)*, paper birch (*Betula papyrifera*), speckled alder, and highbush blueberry. Herbaceous species common in this habitat included tussock sedge (*Carex stricta*), interrupted fern, water-smartweed (*Polygonum* sp.), turtle head, aster, and sphagnum. The ground surface transitioned from slight to distinct mound and pool microtopography, moving from the edge of habitat A towards the stream channel. This habitat may be seasonally flooded and saturated due to the close proximity of the stream channel. At the time of the survey the water table was just below the ground surface.

Habitat C:
The next habitat encountered along transect 3 was a scrub shrub swamp, approximately 250 feet wide. This habitat contained sparsely scattered white pine snags and red maple saplings. The shrub layer was dominated by sweet gale; less dominant species included arrow-wood, winterberry, swamp rose, nannyberry, alder, red-osier dogwood, and highbush blueberry. The herbaceous layer was co-dominated by reed canary grass (*Phalaris arundinacea*) along the stream channel and open areas, and tussock sedge below the shrub layer. Subordinate herbaceous plant species include arrowhead (*Sagitaria latifolia*), yellow pond-lily (*Nuphar variegatum*), pickerelweed (*Peltandra virginica*), duckweed (*Lemna minor*), and bur-reed (*Sparganium* sp.). The stream channel becomes indistinguishable in this habitat. A dendritic flow pattern is formed by water flowing around the mounded areas that are created by shrub, sedge, and grass growth. This habitat is characterized as a large flood plain, with the water at or near the ground surface throughout the year. While conducting the ecological survey, two adult winged odonates were observed in this habitat.

Habitat D:
The final habitat encountered alone transect 3 was forest wetland, approximately 150 feet wide. The wetland was dominated by white pines which had a canopy cover of approximately 50 to 60 percent. Red maple, bigtooth aspen (*Populus grandidentata*), and oak trees were also present in this habitat. The shrub layer in this habitat contained sparsely scattered white pine saplings, nannyberry, choke cherry, arrow-wood, white oak, highbush blueberry, red-osier dogwood, and sheep laurel. The herbaceous layer in this habitat is co-dominated by tussock sedge, clubmoss, and gold thread.

# SEDIMENT TOXICITY EVALUATION

# TOXICITY EVALUATION OF SEDIMENT COLLECTED FROM SITES AT FORT DEVENS, MASSACHUSETTS

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SLI Report # 96-3-6419
SLI Study # 13109-925-6131/6132/6133

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January 10, 1997

FINAL REPORT

## TABLE OF CONTENTS

**1.0 INTRODUCTION** . . . . . 3

**2.0 MATERIALS AND METHODS** . . . . . 3
- 2.1 Test Samples . . . . . 3
- 2.2 Overlying Water . . . . . 4
- 2.3 Monitoring Environmental Conditions of the Test Systems . . . . . 4
- 2.4 Subchronic Toxicity Test with Midges . . . . . 5
  - 2.4.1 Test Method and Conduct . . . . . 5
  - 2.4.2 Test Organism . . . . . 5
  - 2.4.3 Test Procedures . . . . . 6
  - 2.4.4 Deviations to the Test Method . . . . . 7
- 2.5 Subchronic Toxicity Test with Amphipods . . . . . 7
  - 2.5.1 Test Method and Conduct . . . . . 7
  - 2.5.2 Test Organism . . . . . 8
  - 2.5.3 Test Procedures . . . . . 8
  - 2.5.4 Deviations to the Test Method . . . . . 9
- 2.6 Bioaccumulation Tests with Oligochaetes . . . . . 10
  - 2.6.1 Study Method and Conduct . . . . . 10
  - 2.6.2 Test Organism . . . . . 10
  - 2.6.3 Test Procedures . . . . . 11
  - 2.6.4 Chemical Analysis of the Xenobiotic(s) . . . . . 12
  - 2.6.5 Deviations to the Test Method . . . . . 12
- 2.7 Statistical Analysis . . . . . 12

**3.0 RESULTS AND DISCUSSION** . . . . . 13
- 3.1 Toxicity Tests . . . . . 13
  - 3.1.1 *Chironomus tentans* . . . . . 13
  - 3.1.2 *Hyalella azteca* . . . . . 13
- 3.2 Bioaccumulation Study . . . . . 14

**4.0 REFERENCES** . . . . . 15

**5.0 TABLES** . . . . . 16

**6.0 SIGNATURES AND APPROVAL** . . . . . 24

# 1.0 INTRODUCTION

Decisions regarding the need for remediation and efficacy, of remedial alternatives at sites containing waste materials, often depend on information concerning the environmental risks posed by conditions at the site. As part of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), remedial alternatives or removal actions for hazardous waste sites should include an environmental impact study. An essential part of the environmental impact study is the assessment of the degree and spatial extent of contamination in sediments and/or soils at the site.

In recognition of these concerns, ABB Environmental Services, Inc. in Wakefield, Massachusetts included a battery of screening evaluation assays with benthic organisms as a part of the environmental impact study. The toxicity of the bulk sediment samples was measured using epibenthic and benthic organisms, *Hyalella azteca* and *Chironomus tentans*, respectively. The bioaccumulation of xenobiotics in the sediments were measured using, a freshwater oligochaete, *Lumbriculus variegatus*.

The objective of this testing program was to evaluate the toxicity of contaminated bulk sediments from nine sites at Fort Devens, Massachusetts and to evaluate the bioaccumulation of xenobiotics from three of the nine sites at Fort Devens. All biological testing was conducted at Springborn Laboratories, Inc., Wareham, Massachusetts. The oligochaete tissue samples were analyzed by ESE Inc., Gainsville, Florida. All original raw data from the biological testing and the final report produced during this study are stored at Springborn.

# 2.0 MATERIALS AND METHODS

## 2.1 Test Samples

The toxicity tests were conducted using sediment collected from Fort Devens, Massachusetts. Approximately 4 liters of sediment from each location were collected by ABB

Environmental Services, Inc. personnel, with an additional 8 liters of sediment collected from the three sites for the bioaccumulation exposure. The nine samples were identified as: ZWD-95-02X, ZWD-95-03X, ZWD-95-06X, 57D-95-04X, 57D-95-05X, 57D-95-06X, 57D-95-07X, 57D-95-08X, and 57D-95-10X. The samples were received at Springborn on 15 September 1995. Three of the six sample containers for sample 57D-95-06X had lost their lids during shipping and sample 57D-95-04X was not included in this shipment. These two samples were recollected by ABB Environmental Services and they were received on 20 September 1995 in tact. Following receipt at Springborn, any samples that were not immediately tested were stored refrigerated at approximately 4 ± 2°C. Refrigerated samples were warmed to room temperature before use in the toxicity tests. Prior to use in the toxicity test, all sediment samples were passed through a 2.0 mm stainless steel sieve to remove rocks, debris and large clumps of sediment. In addition, Springborn collected sediment from Strobs Folly Brook, Wareham, MA which was used as a reference control sediment.

**2.2 Overlying Water**

Laboratory water was used for the overlying water and culture water for the midge, *Chironomus tentans*. The laboratory water was well water which had been supplemented with untreated water from the Town of Wareham, Massachusetts. The laboratory water had a total hardness of 30 mg/L as $CaCO_3$, a pH range of 7.0 to 7.2, and a specific conductivity within the range of 110 to 130 µmhos/cm.

The laboratory water was fortified to a total hardness of 160 to 180 mg/L as $CaCO_3$; alkalinity 110 to 130 mg/L as $CaCO_3$; specific conductance of 400 to 600 µmhos/cm; and a pH of 7.9 to 8.3 for the overlying water and culture water for the amphipod, *Hyalella azteca* (U.S. EPA, 1975).

**2.3 Monitoring Environmental Conditions of the Test Systems**

Dissolved oxygen concentrations were measured using a Yellow Springs Instrument (YSI) Model #57 dissolved oxygen meter and probe; pH was measured with a Jenco Model

601A pH meter and combination electrode; and daily temperature was measured with a Fisher alcohol thermometer. Total hardness concentration was measured by the EDTA titrimetric method. Total alkalinity concentration was determined by potentiometric titration to an endpoint of pH 4.5 (APHA *et. al.*, 1985). Specific conductance was measured using a YSI Model #33 conductivity meter. The temperature of the test solutions was continuously monitored throughout the study using a Fisher Min/Max thermometer. Light intensity was measured with a General Electric type 217 light meter.

## 2.4 Subchronic Toxicity Test with Midges

### 2.4.1 Test Method and Conduct

Test organisms were placed in beakers containing the sediment and clean laboratory overlying water on 25 September 1995 and were incubated under standard conditions until 5 October 1995 (10 days). After the exposure, the surviving organisms were counted and weighed. Sediment toxicity was estimated by comparing the response of exposed organisms in the test sediment with the reference sediment. Procedures used in the subchronic toxicity test with midge followed those described in the Springborn test method entitled "Static-Renewal Partial Life-Cycle Toxicity Test with Midge *Chironomus tentans*" to Meet U.S. EPA Guidelines, Springborn Laboratories Test Method #SED-Ct-101. The procedures described in this test method meet the standard procedures described in the *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates* (U.S. EPA, 1994). A copy of the test method is an attachment to this report.

### 2.4.2 Test Organism

*Chironomus tentans* were obtained from cultures maintained at Springborn. The culture system was maintained under static conditions and consisted of 38-liter glass aquaria, which contained approximately 20 L of laboratory well water, and were maintained at a temperature of 23 ± 2 °C. The culture area received a regulated photoperiod of 16 hours of light and 8 hours of darkness. Light at an intensity of 30 to 100 footcandles was provided at the culture solutions' surface by Durotest Vitalite® fluorescent bulbs. The midge cultures

were fed a combination of finely ground flaked fish food suspension (60 mg/mL) prepared at Springborn.

Midge egg masses were obtained from culture vessels by aspirating several adult male and females flies into a 250 mL flask approximately 12 to 14 days prior to test initiation. Egg masses deposited overnight, were removed and placed in a shallow glass pan with laboratory well water. Egg masses hatch occurs approximately 2 to 3 days after deposition. Larvae were fed a flaked fish food suspension (60 mg/mL) and overlying waster was replaced daily. test organisms, 9 to 11 days old (post hatch), were used to initiate the sediment exposures.

**2.4.3 Test Procedures**

Eight replicate test vessels (300-mL glass beakers) were maintained for each sediment sample and control. Each vessel contained 100 mL (wet weight) of sediment and 175 mL of laboratory water. The resultant sediment layer in each test vessel was 2 cm deep. Each sediment was tested as 100% with no dilutions. The test systems with sediment and water were allowed to sit overnight before introducing the test organisms. The test was initiated when ten midge larvae were introduced to each test vessel. Aeration was provided to each test vessel when dissolved oxygen dropped below 40% of saturation.

The test was conducted in a temperature controlled water bath designed to maintain the temperature of the test solutions at 23 ± 1 °C. The test area had a photoperiod of 16 hours of light and 8 hours of darkness, with a light intensity range of 30 to 70 footcandles. Lighting was provided by Sylvania Growlux® and Cool White® fluorescent bulbs.

The overlying water was renewed by adding two volume additions (350 mL total) per day, with a calibrated water-delivery system (Zumwalt *et al.*, 1994). Midge larvae were fed daily. The amount fed ranged between 0.5 mL and 1.5 mL of a suspension of finely ground Tetramin® flaked fish food (4.0 mg/mL), per test vessel, based on the amount of food

collected on the sediment surface. The midge larvae were not fed on Day 8 since sufficient food was available on the sediment surface in the test vessels.

Total hardness, alkalinity, specific conductance, and ammonia were determined at test initiation and test termination in the overlying water from a composite sample from all replicates. The composite sample was taken form 1 to 2 cm from the sediment surface using a pipet. Dissolved oxygen, pH, and temperature were measured in all replicate vessels at test initiation and test termination. Dissolved oxygen, pH, and temperature were monitored daily in at least one alternating replicate during the course of the study. Temperature extremes were recorded daily from readings of a minimum/maximum thermometer place in the water bath. At test initiation and at each subsequent 24-hour interval, biological observations and the physical characteristics of the test solutions were observed and recorded.

Survival was determined at test termination by sieving the sediment from each replicate test vessel to remove the midges for observation. Midge larvae weight was determined by drying the surviving test organisms at 60 ° C for 24-hours then weighing them on a calibrated analytical balance.

#### 2.4.4 Deviations to the Test Method

No deviations to the test methods occurred during this study.

### 2.5 Subchronic Toxicity Test with Amphipods

#### 2.5.1 Test Method and Conduct

Test organisms were placed in beakers containing the sediment and clean laboratory water on 25 September 1995 and were incubated under standard conditions until 5 October 1995 (10 days). After the exposure, the surviving organisms were counted. Sediment toxicity was estimated by comparing the response of exposed organisms in the test sediment with the reference control sediment. Procedures used in the acute toxicity test with amphipod followed those described in the Springborn test method entitled "Static-Renewal

Acute Toxicity Test with *Hyallela azteca*" to Meet U.S. EPA Guidelines, Springborn Laboratories Test Method #SED-Ha-121. The procedures described in this test method meet the standard procedures described in the *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates* (U.S. EPA, 1994). A copy of the test method is an attachment to this report.

**2.5.2 Test Organism**

The test organisms, *Hyalella azteca*, used in this study were obtained from Environmental Consulting and Testing. The approximately 1000 amphipods, 7 days old were received on 19 September 1995 and assigned SLI lot number 95A79. The test population was split in two groups of 500 and held for 6 days under static conditions in 9.5-liter aquaria containing 6 L of water. Amphipods were held in fortified laboratory well water and fed a suspension of yeast, cerphyl and trout food suspension (YCT) and supplemented with flake fish food, daily. Temperature was maintained at 23 ± 1$^{0}$C. The holding area received a regulated photoperiod of 16 hours of light and 8 hours of darkness. Light intensity of 30 to 100 footcandles was provided at the culture solutions' surface by Durotest Vitalite fluorescent bulbs. Amphipods used to initiate the exposure were 13 days old.

**2.5.3 Test Procedures**

Eight replicate test vessels (300-mL glass beakers) were maintained for each sediment sample and control. Each vessel contained 100 mL (wet weight) of sediment and 175 mL of laboratory water. The resultant sediment layer in each test vessel was 2 cm deep. Each sediment was tested as 100% with no dilutions. The test systems with sediment and water were allowed to sit overnight before introducing the test organisms. The test was initiated when ten amphipods were introduced to each test vessel. Aeration was provided to each test vessel when dissolved oxygen dropped below 40% of saturation.

The test was conducted in a temperature controlled water bath designed to maintain the temperature of the test solutions at 23 ± 1 °C. The test area had a photoperiod of 16

hours of light and 8 hours of darkness, with a light intensity range of 30 to 70 footcandles. Lighting was provided by Sylvania Growlux® and Cool White® fluorescent bulbs.

The overlying water was renewed by adding two volume additions (350 mL total) per day, with a calibrated water-delivery system (Zumwalt *et al.*, 1994). The amphipods were fed daily. They were fed 1.0 mL of YCT per test vessel, except on Day 0 when they were fed a 1.5 mL suspension of trout chow, per test vessel.

Total hardness, alkalinity, specific conductance, and ammonia were determined at test initiation and test termination in the overlying water form a composite sample from all replicates. The composite sample was taken form 1 to 2 cm from the sediment surface using a pipet. Dissolved oxygen and temperature were measured in all replicate vessels at test initiation and test termination. Dissolved oxygen and temperature were monitored daily in at least one alternating replicate during the course of the study. Temperature extremes were recorded daily from readings of a minimum/maximum thermometer place in the water bath. At test initiation and at each subsequent 24-hour interval, biological observations and the physical characteristics of the test solutions were observed and recorded.

Survival was determined at test termination by sieving the sediment from each replicate test vessel to remove the amphipods for observation. The amphipod weights were determined by drying the surviving test organisms at 60 ° C for 24-hours then weighing them on analytical balance.

**2.5.4 Deviations to the Test Method**

The following deviations from the test method occurred in this study.

1. Fortified well water was used for the overlying water rather than well water as stated in the test method. We do not believe this deviation adversely affected the results of this study.

2. There was 64% survival of organisms exposed to the control sediment. This was below the 80% acceptance criteria. This deviation alters statistical analysis of the data, however some inferences about sediment toxicity can still be drawn. These inferences are discussed further in the results section of the report.

## 2.6 Bioaccumulation Tests with Oligochaetes

### 2.6.1 Study Method and Conduct

Test organisms were placed in aquaria containing the sediment and laboratory water and were incubated under standard conditions for 28 days. After exposure, the surviving Oligochaetes from each sediment sample and control were placed in 1 liter glass beakers containing approximately 900 mL of laboratory water for a period of 24 hours. This 24 hour period allowed the test organisms to eliminate their gut contents. Following the 24 hour elimination period, all Oligochaetes from each sediment sample and control were frozen then shipped on dry ice for analyses. Procedures used in the bioaccumulation test with oligochaetes followed those described in the Springborn Laboratories test method entitled "Bioaccumulation Test with Oligochaete *Lumbriculus variegatus*", Springborn Laboratories Test Method #SED-Lv-160. The procedures described in this test method follow methodology presented in the *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants with Freshwater Invertebrates* (U.S. EPA, 1994).

### 2.6.2 Test Organism

*Lumbriculus variegatus* were obtained from cultures maintained at Springborn. Oligochaetes were cultured in 57-liter glass aquaria containing approximately 40 liters of laboratory water and a 3 to 5 cm layer of artificial substrate, which was maintained at a temperature of 22 ± 2 °C. The artificial substrate consists of shredded unbleached paper towel, conditioned in laboratory water. The cultures were maintained under flow through conditions. The culture area received a regulated photoperiod of 16 hours of light and 8 hours of darkness. Light at an intensity of 30 to 100 footcandles was provided at the culture solutions' surface by Durotest Vitalite® fluorescent bulbs. The overlying water was

continuously aerated with oil free air. Each culture aquaria was fed, three times per week, a 10 mL suspension of salmon starter (5 mg/mL).

**2.6.3 Test Procedures**

The test vessels used during this test were 9.5-L aquaria. Three replicate aquaria were maintained for each sediment sample and a control. Each aquaria contained 1 liter of sediment and 4 liters of overlying laboratory water. The resultant sediment layer in each test vessel was 3 cm deep. Each sediment sample was tested as 100% (no dilutions). The test system with sediment and water were allowed to sit overnight before introducing the test organisms. The test was initiated on 19 September 1995, when 100 oligochaetes were introduced to each test aquaria. Aeration was provided to each test vessel throughout the exposure period. The exposure period ended after 28 days on 17 October 1995.

The test was conducted in a temperature controlled water bath designed to maintain the temperature of the test solutions at 23 ± 1 °C. The test area had a photoperiod of 16 hours of light and 8 hours of darkness, with a light intensity range of 30 to 100 footcandles. Lighting was provided by Durotest Vitalite® fluorescent bulbs.

Renewal of the overlying water in each replicate aquaria was performed weekly by carefully siphoning off 75% (approximately 3 liters) of the existing overlying water and gently replacing it with fresh site water. Oligochaetes were not fed during the 28 day exposure. Sufficient organic matter existed (>1.25% organic carbon) in each sample to eliminate feeding during the 28 day study.

At test initiation and at each subsequent 24-hour interval, biological observations and the physical characteristics of the test solutions were observed and recorded. The dissolved oxygen concentration, pH and temperature were measured daily in alternating replicate test aquaria. At test initiation and weekly thereafter, dissolved oxygen, pH and temperature were measured in all replicate aquaria of each test sediment and control. At test initiation and

weekly thereafter until test termination, total hardness, total alkalinity, specific conductivity, and ammonia concentration of overlying water from each test sample and control were measured in alternating replicates.

Surviving biomass was determined at test termination. The oligochaetes were collected by sieving the sediment from each replicate aquaria. Following a 24 hour gut elimination period the oligochaetes were frozen awaiting shipping to the analytical laboratory.

### 2.6.4 Chemical Analysis of the Xenobiotic(s)

The three exposure oligochaete samples and one control oligochaete sample were frozen and shipped on dry ice to ESE, Inc. on 19 October 1995 via Federal Express overnight service. The chemical analysis of the samples was arranged by ABB Environmental Services.

### 2.6.5 Deviations to the Test Method

The tissue samples were delivered in a 48-hr period, rather than the 24-hr period stated in the test method. The delay in the delivery was due to a faulty fuel line on a Federal Express jet. The samples were still partially frozen upon arrival at ESE, Inc. We do not believe this deviations adversely affected the results of this study.

## 2.7 Statistical Analysis

The mean survival and growth of midge larvae and amphipods and total biomass of the oligochaetes from each test sediment and reference control sample were tested for normality and homogeneity of variance using Shapiro-Wilks Test or Chi-Square Test. Since the data passed the two qualifying tests, Dunnett's Test was used to evaluate the results of the mean survival and growth of each test sample for significant adverse effects.

# 3.0 RESULTS AND DISCUSSION

## 3.1 Toxicity Tests

### 3.1.1 *Chironomus tentans*

A summary of the water quality characteristics of overlying water during the 10-day subchronic tests with *Chironomus tentans* is presented in Table 1. A summary of the biological results from the screening tests with *C. tentans* is presented in Table 2. The midge survival and growth in the laboratory control sample exceeded acceptable test criteria. There were no statistically significant midge survival and growth effects observed in any of the study site samples, compared to the laboratory control data. However, samples ZWD-95-06X, 57D-95-04X, and 57D-95-05X had midge survival of less than 70%.

Comparison of study site samples with a reference sample (57D-95-08X) showed that no significant survival effects were observed in any samples. Midge growth in sample 57D-95-04X was significantly less than the growth observed in the reference sample. All other samples showed no significant growth effects when compared to the reference sample.

### 3.1.2 *Hyalella azteca*

A summary of the water quality characteristics of overlying water during the 10-day acute tests with *Hyalella azteca* is presented in Table 3. A summary of the biological results from the screening tests with *H. azteca* is presented in Table 4. The *H. azteca* survival in the laboratory control sample did not meet the acceptable test criteria. The cause of this failure to meet the acceptable criteria is not known. Three of the study site samples had amphipod survival which exceed 80%. All of the organisms used in this study came from the same source and were impartially distributed among the nine study site samples and the laboratory control.

Statistical comparisons of the study site samples against the laboratory control were conducted even though the control did not meet the survival acceptance criteria. Amphipod

survival in sample ZWD-95-06X was significantly less than the control survival. Sample ZWD-95-06X also had the lowest midge survival (Table 2).

Comparison of study site samples with a reference sample (57D-95-08X) showed that amphipod survival in samples ZWD-95-02X and ZWD-95-06X was significantly reduced. No significant growth effects were observed when compared with the reference sample.

**3.2 Bioaccumulation Study**

A summary of the water quality characteristics of overlying water during the 28-day exposure with *Lumbriculus variegatus* is presented in Table 5. The mean oligochaete biomass from each sample at the termination is presented in Table 6. Results of the chemical analysis of the oligochaete tissue and sediment are presented in Table 7.

Tetrachloro-m-xylene and decachlorobiphenyl were found in the three study site tissue samples and the laboratory control. Aldrin was found in two of the study site tissue samples (57D-95-08X and 57D-95-06X) and the laboratory control. None of the analities found in the oligochaete tissue were measured in the sediments from the study site. There was an unusual correlation between the concentration of the three analities found in the oligochaete tissue samples and the order of the four tissue samples. The control tissue had the highest concentration of all three analities, sample 57D-95-08X had the second highest concentration of all three analities, sample 57D-95-06X had the third highest concentration of all three analities and sample 57D-95-05X had the lowest concentration of all three analities. This trend suggests that either the quantification limits of each compound for the small mass of tissue were unreliable, or that there was some sort of systematic sample contamination. In either event, since the three analities were not found in the sediment from the study site, the tissue concentrations appear to be artifactual.

## 4.0 REFERENCES

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# 5.0 TABLES

**Table 1.** **Water quality parameters (dissolved oxygen, pH, temperature, total alkalinity, total hardness, specific conductivity) measured in the overlying water during the 10-day subchronic toxicity tests with *Chironomus tentans*.**

| Sample Identification | Dissolved Oxygen (mg/L) | | pH | | Ammonia (mg/L as N) | |
|---|---|---|---|---|---|---|
| | Day 0 | Day 10 | Day 0 | Day 10 | Day 0 | Day 10 |
| Control | 8.1-8.3 | 4.2-4.8 | 6.8 | 6.3-6.6 | 0.58 | 0.63 |
| ZWD-95-02X | 8.7 | 3.9-7.2 | 7.0-7.1 | 6.5-6.6 | 0.21 | 0.80 |
| ZWD-95-03X | 8.6-8.7 | 4.6-7.3 | 7.0 | 6.4-6.5 | 0.0 | 0.85 |
| ZWD-95-06X | 8.7-8.8 | 5.6-7.3 | 7.1 | 6.1-6.7 | 0.0 | 0.87 |
| 57D-95-04X | 8.0-8.3 | 3.1-6.8 | 6.8-6.9 | 6.4-6.5 | 0.16 | 0.87 |
| 57D-95-05X | 7.4-7.6 | 5.3-6.9 | 6.7-6.8 | 6.4-6.5 | 0.08 | 0.70 |
| 57D-95-06X | 7.9-8.3 | 5.8-7.2 | 6.8-6.9 | 6.4-6.5 | 0.16 | 0.45 |
| 57D-95-07X | 7.5-7.9 | 1.4-6.9 | 7.0 | 6.1-6.5 | 0.28 | 0.72 |
| 57D-95-08X | 8.0-8.2 | 4.6-7.1 | 6.9-7.0 | 6.4-6.5 | 0.34 | 0.79 |
| 57D-95-10X | 7.5-7.9 | 4.4-7.4 | 6.8-6.9 | 6.5 | 0.30 | 0.68 |

| Sample Identification | Alkalinity (mg/L as $CaCO_3$) | | Hardness (mg/L as $CaCO_3$) | | Conductivity (µmhos/cm) | |
|---|---|---|---|---|---|---|
| | Day 0 | Day 10 | Day 0 | Day 10 | Day 0 | Day 10 |
| Control | 20 | 20 | 44 | 32 | 160 | 110 |
| ZWD-95-02X | 22 | 30 | 44 | 40 | 160 | 120 |
| ZWD-95-03X | 22 | 26 | 40 | 36 | 170 | 110 |
| ZWD-95-06X | 20 | 32 | 40 | 40 | 170 | 120 |
| 57D-95-04X | 20 | 22 | 36 | 32 | 160 | 110 |
| 57D-95-05X | 22 | 28 | 40 | 40 | 170 | 120 |
| 57D-95-06X | 20 | 18 | 44 | 40 | 160 | 110 |
| 57D-95-07X | 24 | 26 | 44 | 48 | 170 | 130 |
| 57D-95-08X | 24 | 24 | 44 | 40 | 160 | 120 |
| 57D-95-10X | 22 | 26 | 44 | 36 | 170 | 120 |

**Table 2. Survival and average dry weights of *Chironomus tentans* at the termination of the 10-day subchronic toxicity tests.**

| Sample Identification | Mean Percent Survival (Standard Deviation) | Mean Dry Weight in mg (Standard Deviation) |
|---|---|---|
| Control | 74(19) | 1.70(0.32) |
| ZWD-95-02X | 75(15) | 2.24(0.85) |
| ZWD-95-03X | 88(14) | 2.94(0.67) |
| ZWD-95-06X | 60(19) | 2.41(0.93) |
| 57D-95-04X | 65(29) | 1.36(0.30)[a] |
| 57D-95-05X | 64(29) | 2.00(0.48) |
| 57D-95-06X | 90(8) | 1.80(0.19) |
| 57D-95-07X | 71(24) | 2.27(0.67) |
| 57D-95-08X | 84(12) | 1.81(0.30) |
| 57D-95-10X | 83(12) | 1.75(0.33) |

[a] Midge growth in this sample was significantly less than the reference sample (57D-95-08X).

**Table 3. Water quality parameters (dissolved oxygen, pH, temperature, total alkalinity, total hardness, specific conductivity) measured in the overlying water during the 10-day acute toxicity tests with *Hyalella azteca*.**

| Sample Identification | Dissolved Oxygen (mg/L) | | pH | | Ammonia (mg/L as N) | |
|---|---|---|---|---|---|---|
| | Day 0 | Day 10 | Day 0 | Day 10 | Day 0 | Day 10 |
| Control | 6.8-7.1 | 5.9-6.2 | 7.3-7.4 | 7.5-7.7 | 0.72 | 0.36 |
| ZWD-95-02X | 7.4-7.8 | 5.5-6.4 | 7.6-7.8 | 7.4-7.7 | 0.28 | 0.41 |
| ZWD-95-03X | 7.5-7.7 | 5.4-7.8 | 7.6-7.7 | 7.5-7.8 | 0.0 | 0.21 |
| ZWD-95-06X | 7.2-7.5 | 5.0-6.4 | 7.6-7.7 | 7.2-7.6 | 0.02 | 0.33 |
| 57D-95-04X | 7.5-7.8 | 5.6-6.5 | 7.5-7.6 | 7.4-7.7 | 0.13 | 0.10 |
| 57D-95-05X | 6.2-6.6 | 4.7-6.0 | 7.3-7.4 | 7.4-7.6 | 0.07 | 0.23 |
| 57D-95-06X | 6.5-6.6 | 5.5-6.2 | 7.3-7.4 | 7.3-7.7 | 0.25 | 0.32 |
| 57D-95-07X | 6.1-6.6 | 4.8-6.2 | 7.6-7.7 | 7.4-7.7 | 0.32 | 0.20 |
| 57D-95-08X | 6.3-6.5 | 5.4-6.5 | 7.5 | 7.4-7.8 | 0.42 | 0.38 |
| 57D-95-10X | 6.5-7.7 | 5.1-6.3 | 7.4-7.6 | 7.6-7.8 | 0.28 | 0.21 |

| Sample Identification | Alkalinity (mg/L as ($CaCO_3$) | | Hardness (mg/L as ($CaCO_3$) | | Conductivity (µmhos/cm) | |
|---|---|---|---|---|---|---|
| | Day 0 | Day 10 | Day 0 | Day 10 | Day 0 | Day 10 |
| Control | 98 | 112 | 156 | 164 | 500 | 500 |
| ZWD-95-02X | 124 | 114 | 168 | 176 | 500 | 500 |
| ZWD-95-03X | 110 | 112 | 168 | 172 | 450 | 500 |
| ZWD-95-06X | 116 | 112 | 168 | 172 | 500 | 500 |
| 57D-95-04X | 104 | 106 | 160 | 160 | 500 | 500 |
| 57D-95-05X | 106 | 124 | 164 | 180 | 500 | 500 |
| 57D-95-06X | 102 | 106 | 156 | 168 | 500 | 500 |
| 57D-95-07X | 112 | 120 | 172 | 172 | 500 | 500 |
| 57D-95-08X | 116 | 116 | 168 | 172 | 500 | 500 |
| 57D-95-10X | 114 | 112 | 168 | 172 | 500 | 500 |

**Table 4. Survival of *Hyalella azteca* at the termination of the 10-day acute toxicity tests.**

| Sample Identification | Mean Percent Survival (Standard Deviation) | Mean Dry Weight in mg (Standard Deviation) |
|---|---|---|
| Control | 64(18)[a] | 0.10(0.05) |
| ZWD-95-02X | 55(24)[b] | 0.15(0.07) |
| ZWD-95-03X | 66(18) | 0.10(0.05) |
| ZWD-95-06X | 36(23)[b, c] | 0.11(0.07) |
| 57D-95-04X | 83(7) | 0.08(0.01) |
| 57D-95-05X | 70(19) | 0.16(0.05) |
| 57D-95-06X | 84(9) | 0.08(0.03) |
| 57D-95-07X | 74(7) | 0.11(0.04) |
| 57D-95-08X | 80(21) | 0.10(0.03) |
| 57D-95-10X | 71(18) | 0.11(0.06) |

[a] The control survival did not meet the acceptance criteria of 80%.
[b] Amphipod survival in this sample was significantly less than the reference sample (57D-95-08X).
[c] Amphipod survival in this sample was significantly less than the control.

**Table 5. Water quality parameters (dissolved oxygen, pH, temperature, total alkalinity, total hardness, specific conductivity) measured in the overlying water during the 28-day exposure with *Lumbriculus variegatus*.**

| Sample Identification | Dissolved Oxygen (mg/L) Day 0-28 | pH Day 0-28 | Ammonia (mg/L as N) Day 0-28 |
|---|---|---|---|
| Control | 6.4-8.6 | 6.5-7.2 | 0.26-0.71 |
| 57D-95-05X | 6.4-8.1 | 6.9-7.6 | 0.47-0.79 |
| 57D-95-06X | 6.9-8.2 | 7.1-7.5 | 0.50-0.92 |
| 57D-95-08X | 6.9-8.3 | 7.2-7.6 | 0.48-0.68 |

| Sample Identification | Alkalinity (mg/L as $CaCO_3$) Day 0-28 | Hardness (mg/L as $CaCO_3$) Day 0-28 | Conductivity (µmhos/cm) Day 0-28 |
|---|---|---|---|
| Control | 16-38 | 24-56 | 90-220 |
| 57D-95-05X | 22-82 | 32-88 | 110-300 |
| 57D-95-06X | 20-63 | 40-76 | 140-250 |
| 57D-95-08X | 24-50 | 44-80 | 150-250 |

**Table 6. Mean biomass per aquarium of *Lumbriculus variegatus* at the termination of the 28-day exposure.**

| Sample Identification | Mean Biomass (g)/Aquarium (Standard Deviation) |
|---|---|
| Control | 1.37(0.09) |
| 57D-95-05X | 1.43(0.11) |
| 57D-95-06X | 1.52(0.41) |
| 57D-95-08X | 1.18(0.25) |

**Table 7. Concentration of analities measured in sediment and tissue of *Lumbriculus variegatus* after the 28-day exposure.**

| Sample Number | Sample Type | Concentration (µg/kg) Wet Weight | | |
|---|---|---|---|---|
| | | Aldrin | Tetrachloro-m-xylene | Decachlorobiphenyl |
| Control | tissue | 39.7 | 2850 | 3380 |
| 57D-95-08X | tissue | 21.6 | 919 | 1130 |
| 57D-95-06X | tissue | 16.6 | 751 | 926 |
| 57D-95-05X | tissue | <6.67 | 454 | 558 |
| Control | sediment | NA | NA | NA |
| 57D-95-08X | sediment | ND | ND | ND |
| 57D-95-06X | sediment | ND | ND | ND |
| 57D-95-05X | sediment | ND | ND | ND |

NA = not analyzed
ND = not detected

## 6.0 SIGNATURES AND APPROVAL

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