4.9 AIR QUALITY

4.9.1 Introduction

This chapter assesses the effects of the alternatives on future air quality conditions at regional (mesoscale) and local (microscale) levels. Section 4.9.2 identifies the air quality analysis methodology. Section 4.9.3 describes the air quality results for the alternatives and their elements. Section 4.9.4 reviews the potential temporary construction impacts and related mitigation. Section 4.9.5 presents a summary of the impacts by each alternative and Section 4.9.6 discusses regulatory compliance. Transportation-related mitigation measures are described in Chapter 4.1, *Transportation*.

The Certificate on the ENF issued by the Secretary of the Executive Office of EEA on April 3, 2009[1] identified the following aspects to be addressed in the evaluation of air quality impacts:

- A mesoscale analysis of volatile organic compounds (VOCs), nitrogen oxides (NO_X), carbon dioxide (CO_2), carbon monoxide (CO), and particulate matter (PM) associated with the project alternatives.
- A microscale analysis of CO, PM_{10}, and $PM_{2.5}$ for hotspot locations that includes vehicles and locomotives around stations and layover facilities where idling emissions will occur.
- An analysis of Greenhouse Gas (GHG) (CO_2) emissions in accordance with MEPA's policy.
- Evaluation in the GHG analysis of electric and diesel fuel options for the trains.
- Evaluation in the GHG analysis of cumulative impacts by alternatives as well as buildings comparing the current state building codes to proposed building with mitigation measures.
- Discussion and consideration in the GHG analysis of recommendations by the Massachusetts Zero Net Energy Building Task Force.
- An investigation as part of the GHG analysis of renewable energy sources and commitment to appropriate LEED and Energy Star elements.
- Evaluation in the GHG analysis of cumulative impacts and the potential effects on freight traffic.
- Commitments in the GHG analysis to using train engine plug-ins and electric block heaters at layover facilities and a discussion of how the project will meet federal locomotive emission standards.

The Secretary's Certificate on the DEIS/DEIR, issued on June 29, 2011, required further analysis or discussion on several aspects of air quality impacts in the FEIS/FEIR. The Certificate states that the FEIS/FEIR should:

[1] Massachusetts Executive Office of Energy and Environmental Affairs. Certificate of the Secretary of Energy and Environmental Affairs on the Environmental Notification Form. April 3, 2009.

- Include an evaluation of alternative fuels for the enhanced bus and feeder bus services, and commit to use of hybrid and/or other fuels to minimize emission of air pollutants to the maximum extent possible.
- Reiterate commitments to construction-related mitigation measures.
- Identify design and operational features that MassDOT will commit to in order to reduce GHG emissions [greenhouse gas]; including measures to promote GHG reductions associated with transit-oriented development facilities and other induced growth.
- Consult with the Mass Department of Energy Resources (DOER), Division of Green Communities, for assistance in developing a joint approach to promote energy efficiency and GHG reduction in SCR communities.
- Provide an update on consultations with DOER and utility companies on ways that communities can use incentives to mitigate GHG emissions from induced growth.
- Include an outline of the proposed GHG mitigation plan.
- Include the results of revised analysis of induced growth impacts on traffic and air quality.
- Describe in detail specific commitments to contribute to VMT (vehicle miles travelled) and GHG reductions through the feeder bus system.
- Document how the project will comply with MassDEP air quality regulations.

4.9.1.1 Resource Definition

Air quality refers to the ambient concentration of air pollutants in the atmosphere. Air pollutants are substances (naturally occurring or human-generated) that can have adverse effects on human health and/or natural resources. Of special concern are the respiratory effects of the pollutants and their potential toxic effects, as described in Section 4.9.1.3 below.

4.9.1.2 Regulatory Context

The USEPA is responsible for establishing the National Ambient Air Quality Standards (NAAQS), enforcing the Clean Air Act (CAA), and regulating transportation-related emission sources, such as aircraft, ships, and certain types of locomotives. The USEPA also establishes vehicular emission standards.

Clean Air Act and General Conformity Rule

The CAA defines nonattainment areas as geographic regions designated as not meeting one or more of the NAAQS. It requires that a state implementation plan (SIP) be prepared for each nonattainment area, and a maintenance plan be prepared for each former nonattainment area that subsequently demonstrated compliance with the standards. A SIP is a compilation of a state's air quality control plans and rules, approved by USEPA. Section 176(c) of the CAA provides that federal agencies cannot engage, support, or provide financial assistance for licensing, permitting, or approving any project unless the project conforms to the applicable SIP. The state and USEPAs' goals are to eliminate or reduce the severity and number of violations of the NAAQS and to achieve expeditious attainment of these standards.

Pursuant to CAA Section 176(c) requirements, USEPA promulgated Title 40 of the Code of Federal Regulations Part 51 (40 CFR 51) Subpart W and 40 CFR Part 93, Subpart B, “Determining Conformity of General Federal Actions to State or Federal Implementation Plans” (see 58 Federal Register [FR] 63214, [November 30, 1993], as amended, 75 FR 17253 [April 5, 2010]). These regulations, commonly referred to as the General Conformity Rule, apply to all federal actions except for those federal actions which are excluded from review (e.g., stationary source emissions) or related to transportation plans, programs, and projects under Title 23 U.S. Code or the Federal Transit Act, which are subject to Transportation Conformity. The General Conformity Rule applies to all federal actions not addressed by the Transportation Conformity Rule. The South Coast Rail project is not expected to involve funding or approvals from the Federal Highway Administration or the Federal Transit Administration. The Rapid Bus Alternative, which may have required approvals from the Federal Highway Administration associated with changes to the Federal Highway System or other approvals is no longer under consideration. The primary federal approvals required for the project are the NEPA Record of Decision and permits from the U.S. Army Corps of Engineers (the Corps). Therefore, Transportation Conformity does not apply and the applicable conformity regulation is the General Conformity Rule.

The General Conformity Rule is used to determine if federal actions meet the requirements of the CAA and the applicable SIP by ensuring that air emissions related to the action do not:

- Cause or contribute to new violations of a NAAQS.
- Increase the frequency or severity of any existing violation of a NAAQS.
- Delay timely attainment of a NAAQS or interim emission reduction.

A conformity determination under the General Conformity Rule is required if the federal agency determines: the action will occur in a nonattainment or maintenance area; that one or more specific exemptions do not apply to the action; the action is not included in the federal agency’s “presumed to conform” list; the emissions from the proposed action are not within the approved emissions budget for an applicable facility; and the total direct and indirect emissions of a pollutant (or its precursors), are at or above the de minimis levels established in the General Conformity regulations (75 FR 17255).

The General Conformity rule defines direct emissions as “caused or initiated by the Federal action and originate in a nonattainment or maintenance area and occur at the same time and place as the action and are reasonably foreseeable.” Indirect emissions are defined as emissions of a criteria pollutant or its precursors:

- That are caused or initiated by the Federal action and originate in the same nonattainment or maintenance area but occur at a different time or place as the action;
- That are reasonably foreseeable;
- That the agency can practically control; and
- For which the agency has continuing program responsibility.

For the purposes of this definition of indirect emissions, even if a Federal licensing, rulemaking or other approving action is a required initial step for a subsequent activity that causes emissions, such initial steps do not mean that a Federal agency can practically control any resulting emissions (.40 CFR 93.152).

For the South Coast Rail project, the Corps' Section 404 permit decision may cause temporary construction emissions that would need to be considered under General Conformity. However, the long-term locomotive emissions under the Stoughton or Whittenton Diesel Alternatives would not be subject to General Conformity requirements because the Corps would have no way of controlling the emissions nor any continuing program responsibility over commuter rail operations.

4.9.1.3 Pollutants of Concern and Attainment Status

Carbon Monoxide

CO is a colorless and odorless gas that is a product of incomplete combustion. Carbon monoxide is absorbed by the lungs and reacts with hemoglobin to reduce the oxygen carrying capacity of the blood. At low concentrations, CO has been shown to aggravate the symptoms of cardiovascular disease. It can cause headaches and nausea and, at sustained high concentration levels, can lead to coma and death.

Proposed projects that are located in CO non-attainment or maintenance attainment areas are required to evaluate their impact on CO concentrations and the NAAQS. The alternatives under consideration are located in Fall River, New Bedford, Taunton/East Taunton, Raynham, and Easton/North Easton. These cities along the various alternative corridors are in attainment of air quality standards for CO. A microscale CO analysis was not required under General Conformity because the project is not in a nonattainment or maintenance area, but was conducted for NEPA purposes to better understand the potential effects of the alternatives on air quality.

Particulate Matter

Particulate matter is made up of small solid particles and liquid droplets. PM_{10} refers to particulate matter with a nominal aerodynamic diameter of 10 micrometers or less, and $PM_{2.5}$ refers to particulate matter with an aerodynamic diameter of 2.5 micrometers or less. Particulates can enter the body through the respiratory system. Particulates over 10 micrometers in size are generally captured in the nose and throat and are readily expelled from the body. Particles smaller than 10 micrometers, and especially particles smaller than 2.5 micrometers, can reach the air ducts (bronchi) and the air sacs (alveoli) in the lungs. Particulates are associated with increased incidence of respiratory diseases, cardiopulmonary disease, and cancer. The cities along the alternatives corridors are in attainment of PM standards. A microscale PM analysis was not required under General Conformity because the project is not in a nonattainment or maintenance area, but was conducted for NEPA purposes to better understand the potential effects of the alternatives on air quality.

Ozone

Ozone is a strong oxidizer and an irritant that affects the lung tissues and respiratory functions. Exposure to ozone can impair the ability to perform physical exercise, can result in symptoms such as tightness in the chest, coughing, and wheezing, and can ultimately result in asthma, bronchitis, and emphysema.

Massachusetts has been determined to be a non-attainment area, statewide, for ozone. The Commonwealth has been divided into two non-attainment areas, Eastern and Western Massachusetts. On June 15, 2005, the USEPA revoked the 1-hour ozone standard for most areas in the country. The South Coast Rail alternatives are located in the eastern Massachusetts 8-hour ozone non-attainment area, which has been classified as "Moderate."

Volatile Organic Compounds

VOCs are a general class of compounds containing hydrogen and carbon and are a precursor to the formation of the pollutant ozone. While concentrations of VOCs in the atmosphere are not generally measured, ground-level ozone is measured and used to assess potential health effects. Emissions of VOCs and NO_X react in the presence of heat and sunlight to form ozone in the atmosphere. Accordingly, ozone is regulated as a regional pollutant and not assessed as part of microscale air quality analysis.

Nitrogen Oxides

When combustion temperatures are extremely high, as in automobile engines, atmospheric nitrogen gas may combine with oxygen gas to form various oxides of nitrogen. Of these, nitric oxide (NO) and nitrogen dioxide (NO_2) are the most significant air pollutants. This group of pollutants is generally referred to as nitrogen oxides or NO_X. Nitric oxide is relatively harmless to humans but quickly converts to NO_2. Nitrogen dioxide has been found to be a lung irritant and can lead to respiratory illnesses. Nitrogen oxides, along with VOCs, are also precursors to ozone formation.

Carbon Dioxide

Greenhouse gases (GHG) are essential to maintaining the temperature of the Earth; without them the planet would be so cold as to be uninhabitable. The earth's climate is predicted to change over time, in part because human activities are altering the chemical composition of the atmosphere through the buildup of GHGs. Climate change is having and will continue to have wide ranging impacts on water, energy, transportation, agriculture, ecosystems, and health.[2] While there are other GHGs, carbon dioxide (CO_2) is the predominant contributor to climate change, and emissions can be calculated for CO_2 with readily accessible data.

The EEA issued a policy and protocol for evaluating greenhouse gas (GHG) emissions from proposed projects with particular emphasis on CO_2 emissions.[3] This policy requires that EIR projects quantify greenhouse gas emissions generated by the project and identify measures to reduce or minimize these impacts.

To date, no national standards or thresholds for greenhouse gas emissions applicable to transit projects have been established. USEPA has identified certain greenhouse gases as pollutants under the Clean Air Act and regulatory actions to date have included emissions standards for motor vehicles, fuel standards, and carbon pollution standards for new power plants, among other actions.[4]

On February 18, 2010, the CEQ issued "Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions" for public review and comment.[5] The Draft Guidance addresses when and how to evaluate both the greenhouse gas emissions from proposed actions and the potential impacts of climate change on proposed actions. The Draft Guidance recommends 25,000 metric tons of direct CO_2-equivelent emissions per year as an indicator for when a quantitative greenhouse gas emissions analysis may be appropriate to include in NEPA documents. As of June 2013, the Draft Guidance has not been finalized.

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[2] U.S. Global Change Research Program. 2009. http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf.

[3] 2007 MEPA Greenhouse Gas Emissions Policy and Protocol. http://www.env.state.ma.us/mepa/pdffiles/misc/GHG%20Policy%20FINAL.pdf.

[4] http://www.epa.gov/climatechange/EPAactivities/regulatory-initiatives.html.

[5] http://ceq.hss.doe.gov/nepa/regs/Consideration_of_Effects_of_GHG_Draft_NEPA_Guidance_FINAL_02182010.pdf.

4.9.1.4 Air Quality Standards

The USEPA has set the primary NAAQS to protect public health. Secondary standards set limits to protect public welfare, including protection against visibility impairment, damage to animals, crops, vegetation, and buildings. Table 4.9-1 outlines the primary and secondary NAAQS for all of the criteria pollutants. The predominant source of pollution anticipated from the alternatives under consideration is emissions from project-related motor vehicle traffic. CO and PM are directly emitted by motor vehicles. CO and PM concentrations can be estimated by computer modeling, which can then be compared to the NAAQS.

Table 4.9-1 National Ambient Air Quality Standards

Pollutant		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide		primary	8-hour	9 ppm	Not to be exceeded more than once per year
			1-hour	35 ppm	
Lead		primary and secondary	Rolling 3 month average	0.15 µg/m^3	Not to be exceeded
Nitrogen Dioxide		primary	1-hour	100 ppb	98th percentile, averaged over 3 years
		primary and secondary	Annual	53 ppb	Annual Mean
Ozone		primary and secondary	8-hour	0.075 ppm	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
Particle Pollution	$PM_{2.5}$	primary	Annual	12 µg/m^3	annual mean, averaged over 3 years
		secondary	Annual	15 µg/m^3	annual mean, averaged over 3 years
		primary and secondary	24-hour	35 µg/m^3	98th percentile, averaged over 3 years
	PM_{10}	primary and secondary	24-hour	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide		primary	1-hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

Source: http://www.epa.gov/air/criteria.html. Accessed March 18, 2013.

4.9.2 Methodology

4.9.2.1 Mobile Source Air Quality Modeling Methodology

The USEPA and DEP have established guidelines that define the modeling and review criteria for local and regional air quality analyses prepared pursuant to the MEPA process. These guidelines require that a proposed project determine the change in project related vehicle emissions. If the VOC and emissions from the Build Alternatives are greater than the No-Build Alternative, then a proposed project should include all reasonable and feasible emission reduction mitigation measures. Massachusetts has incorporated this criterion into its SIP.

The USEPA and DEP guidelines require that the air quality study utilize traffic and emissions data for existing and future (No-Build and Build) conditions. The traffic and emissions data are incorporated into the USEPA air quality models and modeling procedures to generate emissions estimates that demonstrate whether or not a proposed project will have air quality impacts.

The air quality study for the project evaluated several conditions, including the 2008 existing conditions, the 2016 and 2030/2035 No-Build Alternative, and the Stoughton and Whittenton Alternatives (electric and diesel variants). The No-Build Alternative (2030 and 2035) included regional background traffic growth and planned roadway improvements. The Build Alternatives include the anticipated future changes in travel demand associated with each alternative. The year 2016 was analyzed as it represented the estimated date of completion at the time the DEIS/DEIR studies were undertaken. In addition, the year 2030 was selected as the future year of analysis for the microscale air quality assessment to be consistent with the statewide model and for consistency with the regional long-range transportation plan at the time the DEIS/DEIR was prepared. For this FEIS/FEIR, the regional (mesoscale) air quality analyses were updated for a 2035 analysis year and updated ridership projections prepared by CTPS (see Chapter 4.1, *Transportation*). Future alternative-related emission calculations are based upon changes in traffic and emission factor data. The traffic data include traffic volumes, vehicle-miles-of-travel, roadway operations, and physical roadway improvements. The emission factor data include emission reduction programs, years of analysis, and roadway speeds.

The microscale and mesoscale analyses developed traffic (volumes and speeds) and emission factor data for the No-Build and Build Alternatives. These data were incorporated into air quality models to demonstrate that the proposed South Coast Rail alternatives will meet the CAAA and SIP criteria. The mesoscale analysis evaluated the regional air quality impacts (VOCs, NO_x, CO_2, CO, and PM emissions) from the alternatives under consideration by determining the change in total ozone precursor emissions (volatile organic compounds and nitrogen oxides) for the existing and future conditions within the study area. The microscale analysis calculated the CO and PM concentrations for the same conditions at congested intersections near the project stations.

The NAAQS for CO, PM, ozone, and other criteria pollutants have been set by the USEPA to protect the public health. The Commonwealth of Massachusetts has adopted the same standards as those set by the USEPA. The predominant sources of air pollution anticipated from the alternatives include emissions of CO, PM, NO_x, and VOCs from locomotive engines and from motor vehicles traveling to and from the stations. Carbon monoxide emissions are emitted predominantly by motor vehicles. PM emissions are emitted by motor vehicles and diesel engines. The impacts of CO and PM are estimated in the microscale analysis by modeling CO and PM concentrations at congested locations, typically intersections, and comparing the results to the NAAQS. Locomotives and vehicles do not directly emit ozone, which is formed through a complex chemical process that occurs when ozone precursor emissions (NO_x and VOCs) react in the presence of sunlight and heat. The ozone impacts due to the proposed project were evaluated by assessing changes in ozone precursor emissions in the mesoscale analysis and comparing the results to the CAAA and conformity criteria.

Microscale Analysis Methodology

The microscale analysis evaluated the CO and PM concentrations at congested intersections in the study area. The intersections selected for microscale air quality modeling were selected based upon the procedures outlined by the USEPA and as referenced in the DEP guidelines.[6] These procedures require that the intersections be ranked by their level-of-service (LOS) and their total traffic volumes, and that the air quality analysis model the highest three intersections in each ranking. In addition, study intersections were added that would be impacted by station-related traffic and represent those that are in the vicinity of the proposed station sites. Intersections in the study area were ranked based on traffic volumes and level of service. The following intersections were selected for analysis because they were the most congested intersections within the vicinity of each station:

- Taunton Depot, East Taunton: Route 140 at the Route 24 Southbound Ramps
- Easton Village, Easton: Route 138 at Main Street
- Fall River Depot, Fall River: North Davol Street and South Davol Street at President Avenue
- Freetown Station, Freetown: South Main Street at Route 24 Northbound Ramps
- King's Highway, New Bedford: Church Street at Tarkiln Road
- North Easton, North Easton: Route 138 at Main Street
- Raynham Park, Raynham: Route 138 at Foundry Street/Route 106
- Dean Street, Taunton: Route 44 at Longmeadow Road
- Taunton Depot, Taunton: Route 140 at the Route 24 Northbound without Slip Ramp
- Dana Street, Taunton: Washington Street at Tremont Street
- Whale's Tooth, New Bedford: Union Street at McArthur at Route 18 at State Pier
- Relocated Stoughton Station, Stoughton: Brock Street/Kinsley Street at Washington Street

The impacts of the alternatives on the nearest residences were assessed for CO and PM emissions to determine whether the emissions are below (in compliance with) the required standards.

The microscale analysis calculated maximum 1-hour and 8-hour CO concentrations, the 24-hour and annual $PM_{2.5}$ concentrations, and the 24-hour PM_{10} concentrations. The USEPA's computer model CAL3QHC[7] was used to predict CO and PM concentrations at receptor locations for each intersection. These receptor locations were selected since they are located where the public has access and is expected to be for periods of time. Receptors were placed at the edge of the roadway, but not closer than 10 feet (3 meters) from the nearest travel lane, so that they were not within the roadway mixing cell. The results calculated at these receptor locations represent the highest concentrations at each intersection. Receptor locations farther away from the intersections will have lower concentrations because of the CO and PM dispersion characteristics. The receptor locations that are along the major

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[6] Guidelines For Modeling Carbon Monoxide From Roadway Intersection, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Technical Support Division; Research Triangle Park, NC; EPA-454/R-92-005; November 1992.

[7] User's Guide to CAL3QHC Version 2.0: A Modeling Methodology for Predicting Pollutant Concentrations Near Roadway Intersections, US Environmental Protection Agency, Office of Air Quality Planning and Standards, Technical Support Division; Research Triangle Park, NC; EPA-454/R-92-006; November 1992.

roadways in the study area are also expected to have lower CO and PM concentrations than intersection receptors. The reason for this is that emission rates for vehicles traveling along these roadways are much lower than the emission rates for vehicles queuing at intersections, with stop-and-go traffic.

Subsequent to the DEIS/DEIR, updated microscale analyses were performed to assess the effects of relocating the Stoughton Station. All other microscale analyses remain the same as presented in the DEIS/DEIR—given that the results show concentrations well below the NAAQS, updating the analyses to account for the latest ridership and operating plan would not change the conclusions regarding the effects of the alternatives on air quality at the local level.

The potential for traffic changes as a result of the selection of the Dana Street Station in Taunton to replace the Downtown Taunton Station were evaluated and it was concluded that an updated microscale analysis was not warranted. The vehicle trips related to the proposed Dana Street Station as based on ridership modeling are less than half of the previous estimates for the Downtown Taunton Station. When compared to the Downtown Taunton Station analyzed in the DEIS/DEIR, this removes a substantial amount of project-related vehicular traffic from the downtown Taunton area and reduces project impacts related to the station. Although it is projected by CTPS that a higher percentage of riders would drive to a station on Dana Street (69 percent of riders) when compared to a station in Downtown Taunton (44 percent), the overall number of vehicle trips to and from the Dana Street Station is still substantially lower compared to the Downtown Taunton station location. Therefore, the results of the DEIS/DEIR air quality impact analysis for the Washington Street at Tremont Street intersection are conservatively high. The DEIS/DEIR analysis indicated that these impacts would not be significant and further impact analysis specific to the Dana Street Station is therefore not necessary.

Background Concentrations

The 1-hour pollutant concentrations were calculated directly using the USEPA computer model, with evening peak hour traffic and emissions data.

CO Background and Persistence Factors—The 8-hour CO concentrations were derived by applying a persistence factor of 0.70 to the 1-hour CO concentrations. The concentrations are expressed in parts per million (ppm) and include a 1-hour and 8-hour background concentration of 3.0 ppm and 2.1 ppm respectively. The CO persistence factor and background concentration are based on USEPA's suggested factors. The 1-hour NAAQS for CO is 35 ppm. The emissions presented represent the highest emissions experienced at each intersection for each alternative. The air quality analysis assumes that if these intersections meet the NAAQS, then all other intersections, regardless of alternative, which would have lower volumes and better levels of service, can be assumed to also meet the NAAQS. The remaining intersections are included in Appendix 4.9-A.

PM_{10} Background and Persistence Factors—The microscale analysis calculated the 24-hour PM_{10} concentrations for the No-Build Alternative and the Build Alternatives. The 1-Hour PM_{10} concentrations were calculated directly using the USEPA's CAL3QHC model, with evening peak hour traffic and emission data. The 24-hour PM_{10} concentrations were calculated by applying the USEPA persistence factor of 0.40 to the 1-hour concentrations. The concentrations are expressed in micrograms per cubic meter ($\mu g/m^3$) and include a 24-hour background concentration of 45.7 ug/m^3, which was based on DEP air quality monitoring data. The background concentrations are conservative because they were calculated from the DEP's annual monitoring report[8] at DEP's Boston area (Kenmore Station) permanent monitoring station. The 24-hour NAAQS for PM_{10} is 150.0 μg/m³.

$PM_{2.5}$ Background and Persistence Factors—The microscale analysis calculated the 24-hour and annual $PM_{2.5}$ concentrations for the No-Build Alternative and the Build Alternatives. The 1-hour $PM_{2.5}$ concentrations were calculated directly using the USEPA's CAL3QHC model, with evening peak hour traffic and emission data. The 24-hour $PM_{2.5}$ concentrations were calculated by applying the USEPA persistence factor of 0.40 to the 1-hour concentrations and 0.08 for the annual $PM_{2.5}$. The concentrations are expressed in micrograms per cubic meter ($\mu g/m^3$) and include a 24-hour background concentration of 29.7 $\mu g/m^3$, and an annual background concentration of 11.7 $\mu g/m^3$ which was based on DEP air quality monitoring data. The background concentrations were also calculated from the DEP's annual monitoring report[9] at DEP's Boston-area (Kenmore Station) permanent monitoring station. The 24-hour NAAQS for $PM_{2.5}$ is 35.0 $\mu g/m^3$ and 15.0 $\mu g/m^3$ for the annual standard.

The highest CO, $PM_{2.5}$ and PM_{10} concentration and its receptor location presented in Section 4.9.3 represent the highest concentrations for each intersection. Receptor locations located farther away from the intersection have lower concentrations because of the pollutant's dispersion characteristics. Receptor locations that are along major roadways are also expected to have lower pollutant concentrations, because the emission factors for vehicles traveling along these roadways are much lower than the emission rates for vehicles queuing at the modeled intersections. The receptor locations for each intersection are presented in Figures 4.9-1 through 4.9-7.

Emission Factors

The vehicle emission factors used in the microscale and mesoscale analysis were obtained using the USEPA's Mobile Source Emission Factor Model, MOBILE6.2,[10] which calculates emission factors from motor vehicles in grams per vehicle-mile for existing and future conditions. The emission rates calculated in this air quality study are adjusted to reflect Massachusetts-specific conditions such as the vehicle age distribution, the statewide Inspection and Maintenance (I/M) Program, and the Stage II Vapor Recovery System.[11] VOC and NO_x emission factors for the mesoscale analysis were determined using the DEP recommended temperatures for the summer (ozone) season and similarly for the microscale analysis, the CO emission factors were determined using winter (CO) season temperatures. The MOBILE6.2 input data are presented in Appendix 4.9-A. The MOBILE6.2 model was the latest USEPA-approved mobile source emissions model at the time the DEIS/DEIR was prepared and remains appropriate for assessing the effects of the alternatives in this FEIS/FEIR.

The air quality study used traffic data (volumes, delays, and speeds) developed for each analysis condition. The microscale analysis used the evening peak hour traffic conditions during the CO season (winter).

Train Emissions for Microscale Analysis—There would be no train emissions under the electric Build Alternatives, but the diesel Build Alternatives would result in additional particulate matter emissions.

[8] 2000 Annual Report on Air Quality in New England, US Environmental Protection Agency, Region I, Lexington, Massachusetts; July 2001.

[9] 2000 Annual Report on Air Quality in New England, US Environmental Protection Agency, Region I, Lexington, Massachusetts; July 2001.

[10] MOBILE6.2 (Mobile Source Emission Factor Model), May 2004 release from US EPA, Office of Mobile Sources, Ann Arbor, MI.

[11] The Stage II Vapor Recovery System is the process of collecting gasoline vapors from vehicles as they are refueled. This requires the use of a special gasoline nozzle at the fuel pump.

These diesel train emissions were accounted for by adding the train emissions to the motor traffic-related emissions in the CAL3QHC model. Diesel locomotive emission factors were based on USEPA guidance reproduced in Appendix 4.9-A.[12] As a result, the air quality modeling for the diesel alternatives represents the total air quality impact. As discussed below, analysis also considered the impact of diesel locomotives idling at the stations (and thus generating higher pollutant concentrations than would occur with a moving train).

For the diesel Build Alternatives, two scenarios were evaluated in the analysis of each receptor; the train idling in the station and the train traveling along the rail line. The first scenario was analyzed by treating the train idling at the station in the CAL3QHC model as an unsignalized intersection with the train sitting idle for 70 seconds of the 120 second cycle which equates to a conservative 35 minutes of idling during an hour. The emission factors used for the train idling were the “Large Switch” emissions factors which are the closest locomotive emission factors for “idling” available in the USEPA guidelines. In addition to the train idling, a moving train along the rail line was also analyzed at each receptor. These moving trains were assessed as freeflow links in the CAL3QHC model and assumed “Passenger Commuter Rail” locomotive emission factors from the USEPA guidelines. The number of trains on the freeflow links (a maximum of 5 trains per hour) was based on the estimated rail schedules. The locomotive emissions factors assumed in the air quality analysis reflect the assumption that all locomotives added to the rail corridor for the South Coast Rail project would be new locomotives.

Analysis of Sensitive Areas for NO_x—In addition to air quality analysis conducted for the intersections in proximity to the stations, the impacts of the alternatives on air quality in the vicinity of proposed overnight layover facilities were examined. USEPA’s atmospheric model AERMOD modeling procedures were used to model locomotive emissions at stations, layover facilities, and environmentally sensitive areas, such as the Hockomock Swamp. AERMOD is appropriate for chemically stable, gaseous or fine particulate pollutants, such as CO, NO_x, and PM. It incorporates multiple sources, meteorological data, source emission data, stack and building geometry, and detailed surrounding land use and topography. These data were incorporated into AERMOD to generate concentrations that demonstrate whether or not the proposed project would comply with the NAAQS or cause air impacts.

Mesoscale Analysis Methodology

The predominant sources of regional pollution impacts anticipated from the proposed South Coast Rail project are emissions reductions resulting from modal travel shifts from private automobiles to rail service. The mesoscale analysis uses traffic and emissions data for existing and future (No-Build and Build) conditions for each alternative. The general modeling process to determine whether the alternatives would have air quality impacts utilized link-by-link data from the Central Transportation Planning Staff (CTPS) state-wide traffic model and emission factors derived using the USEPA’s MOBILE6.2 emission factor model. The link-by-link traffic data includes daily vehicle volumes as well as free flow and congested speeds over each link. The vehicle volumes are combined with the link lengths in order to determine the daily VMT over the link. The VMT is then multiplied by the appropriate speed-specific emission factors in order to arrive at the total daily emissions for each link.

The roadways included in the mesoscale study area include the roadways coded in the CTPS state-wide model and generally includes Eastern Massachusetts. The mesoscale analysis estimated the future regional VOCs, NO_X, CO_2, CO, and PM emissions due to the changes in average daily traffic volume,

[12] Emission Factors for Locomotives United States Environmental Protection Agency, Office of Transportation and Air Quality, EPA-420-F-09-025 April 2009.

roadway characteristics, and vehicle emissions. The mesoscale analysis traffic (volumes, delays, and speeds) and emission factor data were developed for the above listed conditions.

The objective of the mesoscale analysis was to estimate the change in area-wide emissions of ozone precursor VOCs, NO_X, CO, and PM emissions during a typical day and CO_2 emissions during the entire year resulting from implementing the proposed South Coast Rail project. The daily area-wide emissions are presented in kilograms per day to be consistent with conformity criteria and SIP budgets and in terms of tons per year to be consistent with Massachusetts GHG policy.

The air quality study used traffic data (volumes, delays, and speeds) developed for each analysis condition. The microscale analysis used the evening peak hour traffic conditions during the CO season (winter). The mesoscale analysis for VOC and NO_x emissions used typical daily peak and off-peak traffic volumes for the ozone season (summer). Vehicle speeds are developed based upon traffic volumes, observed traffic flow characteristics, and roadway capacity.

Stationary Source Air Quality Modeling Methodology

Stationary source analysis for greenhouse gases included direct and indirect CO_2 emissions. The following outlines the stationary source analysis approach for the proposed stations and layover facility alternatives.

Station Analysis—A stationary source analysis was not conducted for the stations because there are no buildings proposed as part of the stations for the South Coast Rail project. The stations would only include a platform. There are some electrical requirements for each station but the emissions related to the minimal electrical requirements are considered negligible.

Layover Facility—A stationary source analysis was conducted for the layover facilities and is presented in Section 4.9.3.8. The stationary source analysis assessed the emissions due to the trains idling and/or plugging-in at the layover facilities. The layover facilities would be open buildings with no heating fuel emissions.

Greenhouse Gas Analysis

The Massachusetts Executive Office of Energy and Environmental Affairs has established a GHG emissions policy. The policy requires that proponents of projects undergoing MEPA review quantify greenhouse gas emissions and identify measures to avoid, minimize, and mitigate those emissions. MEPA has developed procedures and guidelines for implementing this policy, which was originally released in 2007. The most recent version of the policy was released in 2010 with an effective date of May 5, 2010.

The MEPA Certificate for the South Coast Rail project called for the GHG modeling of direct and indirect sources. These sources include motor vehicles, buses, diesel trains, electric trains, stations, layover facilities, and buildings.

Additional GHG effects, including an assessment of the greenhouse implications of a Smart Growth scenario are discussed in Chapter 5, *Summary of Indirect Effects and Cumulative Impacts*. The Smart Growth scenario analyzed in Chapter 5 is primarily anticipated to affect the GHG emissions caused by motor vehicles, which would be affected by implementing smart growth and transit-oriented development policies. Smart Growth programs include other “green” policies and goals in addition to transportation improvements, such as building energy efficiency, travel behavior changes, etc. The development patterns associated with the Smart Growth programs, such as Transit Oriented Development in the vicinity of new or existing transit stations may result in different (higher) building densities, and other characteristics, thereby potentially resulting in different GHG reduction benefits, including those recognized by the State under the Global Warming Solution Act (GWSA).

Modeling

Mesoscale mobile source emissions were calculated for all of the major transportation modes in eastern Massachusetts for different years. The modes consist of on-road vehicles such as autos, trucks, and buses as well as certain off-road sources like water transportation and commuter rail. The methodology being used for the South Coast Rail project is the same one that is used for the Federal Certification Activities conducted by the Metropolitan Boston Planning Organization (Boston Region MPO). This methodology has been used in the Regional Metropolitan Transportation Planning process, Air Quality Conformity Determination, and numerous other highway and transit projects.

Mobile vehicle emissions were modeled using USEPA's MOBILE6.2 emission factor model and CTPS's regional travel demand model. This was conducted for existing conditions and No-Build and Build Alternatives. Bus emissions were calculated separately using a mesoscale analysis.

In order to have a net reduction in greenhouse gas emissions, a Build Alternative would have to divert automobile travel to transit to a degree that the reduction in motor vehicle emissions from automobiles would more than offset the increase resulting from a Build Alternative's CO_2 emissions. The extent to which Build Alternatives would reduce greenhouse gas emissions associated with vehicular travel depends on the estimated diversion of the use of motor vehicles to transit. This "mode-shift" from motor vehicles to transit results in reductions of VMT, which reduces motor vehicle emissions. It also contributes to reduction in traffic congestion, which can also reduce vehicular emissions due to lower emissions associated with improved traffic flow, rather than stop-and-go.

Motor Vehicles—The USEPA's MOBILE6.2 emission model for autos and trucks includes:

- Description of the calculation for auto and truck (motor vehicles) emissions as a function of the MOBILE6.2 emission rates and the Regional Travel Demand Models (RTDM) estimate of VMT and congested speed.
- Description of the sources of emissions rates and the method used to calculate pollutant emissions for the public transportation vehicles.
- The end product is the estimate of total emissions for a scenario and year.

The unit for measuring emission rates for motor vehicles is grams per mile and were calculated using MOBILE6.2, the software developed by USEPA. The MPO coordinated with MassDEP to develop the inputs to the MOBILE6.2 model for application by the Boston MPO in their air quality modeling. MOBILE6.2 requires a wide range of input parameters, including inspection and maintenance program information and other data such as hot/cold start mix, emission failure rates, vehicle fleet mix, and fleet age distribution. The inputs used for the 2000 Base Year were the same as those used in determining the latest emissions inventory for the Commonwealth of Massachusetts. The inputs used for the years 2009 through 2035 were also received from DEP and include information on programs that were submitted to the USEPA as the strategy for the Commonwealth to obtain ambient air quality standards.

MOBILE6.2 produces a lookup table showing grams produced per mile of travel; stratified by roadway type, and speed for each pollutants and season. Lookup table 1 contains freeway emission rates for 2035 and Lookup table 2 contains emission rates for arterials. Emissions rates are provided for the greenhouse gas (CO_2) using MOBILE6.2. It should be noted that the current MOBILE6.2 emission factor model can only generate a CO_2 grams per mile based on fleet average fuel economy for the year modeled and does not vary based on vehicle speed, or roadway type. USEPA's next motor vehicle emission model, "MOVES -Motor Vehicle Emissions Simulator", provides improved capabilities for assessing greenhouse gas emissions, but was not available for official use at the time this study was prepared.[13]

The calculation of emissions for the greenhouse gas (CO_2) produced by motor vehicles, including park-and-ride and kiss-and-ride trips are a function of four factors:

- VMT
- Congested speeds on the roadways
- Type of roadway (limited access vs. full access)
- Emission factors for the pollutants from MOBILE6.2 by season

The Regional Travel Demand Model (RTDM) includes every major highway, arterial, and collector in the study area. The centroid connectors are a proxy for the local roads. These roadways are represented as links, segments of roadways that have motor vehicles assigned to them in each alternative. Each roadway link and centroid connector has a roadway type and distance associated with it. The highway assignment process calculates how many vehicles are on each link and centroid connector and what its congested speed would be by time of day. VMT is a function of how many vehicles are on a link and the length of that link. This parameter was calculated for every link in the model area. The emission factors were held constant in this study for 2035.

The emission factor for CO_2 identified for each link and centroid connector based on its roadway type and congested speed. The emissions produced on each link and centroid connector was simply the product of the emission rate for CO_2 and the VMT. The total emissions were simply the sum of CO_2 for all of the links in the study area by time period. The four time periods are summed to arrive at an emission estimate for an average weekday in 2035.

Observed emission changes are due to mode shifts from auto to transit, resulting in lower VMT and possibly lower congested speeds on the roadway network. Hence, the more auto diversions there are, the more likely the air quality measures will improve from this mode.

Train Emissions—Diesel train emissions were modeled using the most recently approved USEPA train emission factors and the train network and volumes as discussed below. The electric train emissions are modeled based upon the amount of electricity that they use which is also discussed in more detail below.

[13] The Notice of Availability approving the MOVES2010 model for SIP development and transportation conformity regional emissions analysis was published in the Federal Register on March 2, 2010. A two-year grace period is provided before MOVES2010 is required for new regional emissions analyses. At the time of the preparation of the DEIS/DEIR, MOVES2010 had not yet been approved for project-level CO and PM hot-spot analysis pending the release of EPA guidance and a separate Federal Register notice.

The South Coast Rail train emissions are calculated by using the USEPA passenger/commuter train emission factors and the total distance between South Station and the endpoints of the Southern Triangle for each alternative. Estimates of rail emissions in the Eastern Massachusetts region are based upon the factors received by CTPS in 2009 guidance from the USEPA Office of Transportation and Air Quality (OTAQ) and documented on their web site at: www.epa.gov/otaq/locomotives.htm.

The number of train miles is estimated from a breakdown of track mileage by train line and community. Train mileage is a function of the train frequency data using present, and proposed commuter rail schedules. Multiplying the train miles per day by the vehicular emissions per train mile yields the estimated vehicular emissions per day in the Eastern Massachusetts for CO_2. Using the CO_2 emission factors provided by the E.P.A. (Emission factor = 3405.67 g/mile), the total emissions for each alternative for the years 2016 and 2030 are calculated as follows:

- Total CO_2 Emissions (by alternative) = CO_2 Passenger/Commuter Train Emission Factor (tons per year)* Total Distance Traveled by each Train * Number of trains per day

Similarly, the project CO_2 emissions produced by the electric trains in the electric alternatives were also calculated. The total amount of travel time is calculated for each train per trip, which includes the time for traveling round-trip plus the amount of time to move to the layover facility and back to the terminal station. The projected electric consumption for each train trip is calculated as follows:

- Total electric consumption = Kilowatts consumed by 1 train per trip * the amount of travel for each train trip time required for each trip (in kilowatt-hours (kWh))

The electric consumption for each train per trip in kWh is then converted into tons of CO_2 per year as follows:

- Total GHG consumption = kWh * 1megawatt-hours (mwh)/1,000kwh * number of trains per day * 1,107lbs/Mwh *0.0005 tons/lbs*365 days/year

The emission rate of 1,107 lbs of CO_2 per mwh is based on the 2005 marginal emission rate for New England electricity generation as calculated by ISO New England Inc.[14] (the New England Independent System Operator [ISO] for electricity). This rate takes into account the various electricity sources used in the New England system (coal, nuclear, natural gas, hydroelectric etc.).

4.9.3 Analysis of Impacts

The following identifies potential long-term air quality impacts resulting from implementation of the alternatives. The discussion of potential air quality impacts begins with the No-Build Alternative and continues to the Build Alternatives including alignments, stations, and layover facilities. Figure 4.8-1 shows the South Coast Rail alternatives and existing stations.

4.9.3.1 No-Build (Enhanced Bus) Alternative

The No-Build Alternative would consist of enhancing current bus service along existing roads and highways. It was assumed that the limited increase in bus service along the roadways would have a minimal effect on the air quality within the study area. Table 4.9-2 presents a summary of the air quality

[14] See the ISO New England Inc. 2007 New England Marginal Emission Rate Analysis, Table 5.6. http://www.iso-ne.com/genrtion_resrcs/reports/emission/2007_mea_report.pdf.

levels for the mesoscale (regional) analysis for the Existing Conditions and No-Build (Enhanced Bus) Alternative for the various pollutants.

Table 4.9-2 Mesoscale No-Build Analysis Emissions Results

	Units	2010 Existing	2035 No-Build
Vehicle Miles Traveled (VMT)	Average Miles/day	109,926,000	118,897,192
Volatile Organic Compounds (VOC)	Kg/day	48,810	22,200
Oxides of Nitrogen (NO_x)	Kg/day	118,010	19,256
Particulate Matter 10 (PM_{10})	Kg/day	4,780	3,240
Particulate Matter 2.5 ($PM_{2.5}$)	Kg/day	3,010	1,490
Carbon Monoxide (CO: Winter)	Kg/day	1,516,100	1,050,356
Carbon Dioxide (CO_2)[1]	Tons/year	22,334,463	24,717,339

1 The CO_2 was calculated assuming an annualization factor of 365 days/year and 1000kg/1 ton.
Note: Emissions quantities rounded to the nearest 10.

The mesoscale and microscale analyses indicate that reductions in pollutant concentrations are expected to occur over time relative to the Existing Condition. With the exception of carbon dioxide, all of the calculated future No-Build regional emissions are less than the existing conditions emissions. These reductions can be mostly attributed to more efficient vehicles with enhanced emissions control technologies and the benefits of the Massachusetts Vehicle Inspection and Maintenance program.

The intersections that were analyzed as part of the microscale analysis are representative of the air quality impacts in the study areas surrounding the proposed train stations. Table 4.9-3 summarizes the results of the No-Build conditions for the microscale analysis. Table 4.9-3 shows the highest CO, $PM_{2.5}$ and PM_{10} concentrations at each intersection under the 2016 and 2030 No-Build conditions. No exceedances of the NAAQS are anticipated.

4.9.3.2 Southern Triangle Study Area (Common to all Build Alternatives)

Portions of the rail lines within the southern part of the South Coast Rail study area are common to all Build Alternatives. These rail lines form a rough triangular shape between the Fall River Secondary and the New Bedford Main Line, and are therefore referred to as the Southern Triangle. The northern part of the South Coast Rail study area is encompassed by the other Build Alternatives described in subsequent sections.

The mesoscale analysis for the Southern Triangle is included in the alternatives analysis presented in this section (Stoughton and Whittenton Alternatives) due to the regional nature of the analysis and the need to analyze the rail line as a whole in order to assess its regional air quality benefits. The following sections summarize the microscale (local) analysis results for the Southern Triangle stations.

Fall River Secondary Rail Segment

The existing Fall River Secondary freight track would be upgraded to Federal Rail Administration (FRA) Class 5[15] for the South Coast Rail project. Public at-grade road/railroad crossings that would remain open would be reconfigured and/or improved to meet current safety standards. The existing freight service using the Fall River Secondary is diesel-powered; no electrical infrastructure is present. New

[15] 49 CFR 213.9 Classes of Track: Operating Speed Limits

catenary supports and wires would need to be constructed along the length of the line and two new traction power facilities would need to be constructed for the electric alternatives. Two new stations would be constructed in Fall River (Battleship Cove and Fall River Depot) and one new station would be constructed in Freetown (Freetown). One new layover facility would be constructed in Fall River, at either the Weaver's Cove site or the ISP site.

Tables 4.9-4 and 4.9-5 summarize the microscale (local) analysis results for the Southern Triangle portion of the project for the Fall River Secondary for the diesel and electric alternatives, respectively. As shown in the tables there are minor differences between the diesel and electric alternatives for the microscale (local) analysis. Figure 4.9-1 shows the microscale air quality study area for Fall River, and Figure 4.9-2 shows the Freetown study area. All of the pollutant concentrations are well below the NAAQS standards for both the diesel and electric alternatives.

Table 4.9-3 Microscale (Local) Predicted Maximum Pollutant Concentrations, 2016 and 2030 No-Build

Town	Station	Intersection No. and Intersection	Quadrant	2016 Carbon Monoxide (CO in ppm) 1-Hour	2016 Particulate Matter 2.5 ($PM_{2.5}$ in $\mu g/m^3$) 8-Hour	2016 $PM_{2.5}$ 24-Hour	2016 $PM_{2.5}$ Annual	2016 Particulate Matter 10 (PM_{10} in $\mu g/m^3$) 24-Hour	2030 Carbon Monoxide (CO in ppm) 1-Hour	2030 Particulate Matter 2.5 ($PM_{2.5}$ in $\mu g/m^3$) 8-Hour	2030 $PM_{2.5}$ 24-Hour	2030 $PM_{2.5}$ Annual	2030 Particulate Matter 10 (PM_{10} in $\mu g/m^3$) 24-Hour
Stoughton	Stoughton	Brock Street/Kinsley Street at Washington Street	NE	3.7	2.6	22.7	9.9	40.5	3.7	2.6	22.7	9.9	40.5
			SE	3.7	2.6	22.7	9.9	40.5	3.7	2.6	22.7	9.9	40.5
			SW	3.7	2.6	22.7	9.9	40.5	3.7	2.6	22.7	9.9	40.5
			NW	3.7	2.6	22.7	9.9	40.5	3.7	2.6	22.7	9.9	40.5
East Taunton	Taunton Depot	Route 140 at the Route 24 Southbound Ramps	E	4.2	2.9	30.5	11.9	47.3	4.2	2.9	30.5	11.9	47.3
			SW	4.3	3	30.5	11.9	47.3	4.3	3	30.5	11.9	47.3
			NW	4.3	3	30.5	11.9	47.3	4.3	3.4	30.5	11.9	47.3
Easton	Easton Village	Route 138 at Main Street	NE	4.5	3.2	30.5	11.9	47.3	4.5	3.2	30.5	11.9	47.3
			SE	4.6	3.2	30.5	11.9	47.7	4.7	3.3	30.5	11.9	47.3
			SW	4.7	3.3	30.5	11.9	47.7	4.7	3.3	30.5	11.9	47.3
			NW	4.6	3.2	30.5	11.9	47.7	4.6	3.2	30.5	11.9	47.3
Fall River	Fall River Depot	North Davol Street and South Davol Street at President Avenue	NE	4.1	2.9	30.5	11.9	46.9	4.1	2.9	30.1	11.8	46.9
			SE	4.2	2.9	30.5	11.9	46.9	4.2	2.9	30.1	11.8	46.9
			SW	3.9	2.7	30.5	11.9	46.9	4.2	2.9	31.1	12.6	46.9
			NW	4.2	2.9	30.5	11.9	47.3	4	2.9	30.5	11.9	46.9

Town	Station	Intersection No. and Intersection	Quadrant	2016 Carbon Monoxide (CO in ppm) 1-Hour	2016 Carbon Monoxide (CO in ppm) 8-Hour	2016 Particulate Matter 2.5 ($PM_{2.5}$ in $\mu g/m^3$) 24-Hour	2016 Particulate Matter 2.5 ($PM_{2.5}$ in $\mu g/m^3$) Annual	2016 Particulate Matter 10 (PM_{10} in $\mu g/m^3$) 24-Hour	2030 Carbon Monoxide (CO in ppm) 1-Hour	2030 Carbon Monoxide (CO in ppm) 8-Hour	2030 Particulate Matter 2.5 ($PM_{2.5}$ in $\mu g/m^3$) 24-Hour	2030 Particulate Matter 2.5 ($PM_{2.5}$ in $\mu g/m^3$) Annual	2030 Particulate Matter 10 (PM_{10} in $\mu g/m^3$) 24-Hour
Freetown	Freetown	South Main Street at Route 24 Northbound Ramps	N	4	2.9	30.5	11.9	47.3	4.1	2.9	30.5	11.9	46.9
			SE	4	2.8	30.5	11.9	47.3	4	2.8	30.1	11.8	46.9
			SW	4	2.8	30.5	11.9	46.9	4	2.8	30.1	11.8	46.9
New Bedford	King's Highway	Church Street at Tarkiln Road	NE	3.8	2.7	27.1	11.8	46.9	3.8	2.7	30.1	11.8	46.5
			SE	3.8	2.7	30.1	11.8	46.9	3.8	2.7	30.1	11.8	46.5
			SW	3.9	2.7	30.1	11.8	46.9	3.9	2.7	30.1	11.8	46.9
			NW	3.8	2.7	30.1	11.8	46.5	3.8	2.7	30.1	11.8	46.5
North Easton	North Easton	Route 138 at Main Street	NE	4.5	3.2	30.5	11.9	47.3	4.5	3.2	30.5	11.9	47.3
			SE	4.6	3.2	30.5	11.9	47.7	4.7	3.3	30.5	11.9	47.3
			SW	4.7	3.3	30.5	11.9	47.7	4.7	3.3	30.5	11.9	47.3
			NW	4.6	3.2	30.5	11.9	47.7	4.6	3.2	30.5	11.9	47.3
Raynham	Raynham Park	Route 138 at Foundry Street/Route 106	NE	4.1	2.9	30.5	11.9	47.3	4.1	2.9	30.5	11.9	47.3
			SE	4	2.8	30.5	11.9	47.3	4	2.8	30.5	11.9	46.9
			SW	4.1	2.9	30.5	11.9	47.3	4.1	2.9	30.5	11.9	46.9
			NW	4	2.8	30.5	11.9	47.3	4	2.8	30.5	11.9	46.9
Taunton	Dean Street	Route 44 at Longmeadow Road	NE	4.6	3.2	30.5	11.9	47.3	4.6	3.2	30.5	11.9	47.3
			SE	4.3	3	30.5	11.9	47.3	4.3	3	30.5	11.9	47.3
			SW	4.7	3.3	30.5	11.9	47.7	4.7	3.3	30.5	11.9	47.7
			NW	4.5	3.2	30.5	11.9	47.7	4.5	3.2	30.5	11.9	47.7

				2016					2030				
				Carbon Monoxide (CO in ppm)	Particulate Matter 2.5 ($PM_{2.5}$ in $\mu g/m^3$)			Particulate Matter 10 (PM_{10} in $\mu g/m^3$)	Carbon Monoxide (CO in ppm)	Particulate Matter 2.5 ($PM_{2.5}$ in $\mu g/m^3$)			Particulate Matter 10 (PM_{10} in $\mu g/m^3$)
Town	**Station**	**Intersection No. and Intersection**	**Quadrant**	**1-Hour**	**8-Hour**	**24-Hour**	**Annual**	**24-Hour**	**1-Hour**	**8-Hour**	**24-Hour**	**Annual**	**24-Hour**
Taunton	Taunton Depot	Route 140 at the Route 24 Northbound without Slip Ramp	NE	4.7	3.3	30.5	11.9	48.1	4.7	3.3	30.9	11.9	48.1
			S	4.8	3.4	30.5	11.9	48.5	4.8	3.4	32.1	12.2	49.3
			NW	4.9	3.4	30.5	11.9	48.5	4.9	3.4	30.9	11.9	48.1
Taunton	Dana Street	Washington Street at Tremont Street	NE	4.2	2.9	30.5	11.9	47.3	4.3	3	30.5	11.9	46.9
			SE	4.2	2.9	30.5	11.9	47.3	4.2	2.9	30.5	11.9	46.9
			SW	4	2.8	30.5	11.9	46.9	3.9	2.7	30.1	11.8	46.9
			NW	4.4	3.1	30.5	11.9	47.3	4.4	3.1	30.5	11.9	47.3
New Bedford	Whale's Tooth	Union Street at McArthur at Route 18 at State Pier	NE	4	2.8	30.1	11.8	46.9	4.3	3	30.1	11.8	46.9
			SE	4.2	2.9	30.5	11.9	46.9	4.5	3.2	30.1	11.8	46.9
			SW	4.2	2.9	30.5	11.9	47.3	4.7	3.3	30.5	11.9	46.9
			NW	4.4	3.1	30.5	11.9	47.3	4.8	3.4	30.1	11.9	47.3

Table 4.9-4 Predicted Maximum Pollutant Concentrations, Southern Triangle: Fall River Secondary- Electric

				Year 2016					Year 2030				
				Carbon Monoxide (CO in ppm)		Particulate Matter 2.5 ($PM_{2.5}$ in $\mu g/m^3$)		Particulate Matter 10 (PM_{10} in $\mu g/m^3$)	Carbon Monoxide (CO in ppm)		Particulate Matter 2.5 ($PM_{2.5}$ in $\mu g/m^3$)		Particulate Matter 10 (PM_{10} in $\mu g/m^3$)
Town	Station	Intersection	Receptor Location at Intersection	1-Hour	8-Hour	24-Hour	Annual	24-Hour	1-Hour	8-Hour	24-Hour	Annual	Annual
Fall River	Fall River Depot	N. Davol St. and South Davol St. at President Ave.	Northeast	4.1	2.9	30.5	11.9	46.9	4.1	2.9	30.1	11.8	46.9
			Southeast	4.2	2.9	30.5	11.9	46.9	4.2	2.9	30.1	11.8	46.9
			Southwest	3.9	2.7	30.5	11.9	46.9	4.2	2.9	30.1	11.8	46.9
			Northwest	4.2	2.9	30.5	11.9	46.9	4.2	2.9	30.1	11.8	46.9
Freetown	Freetown	S. Main St. at Rte 24 Northbound Ramps	North	4.1	2.9	30.5	11.9	47.3	4.1	2.9	30.5	11.9	46.9
			Southeast	4.0	2.8	30.5	11.9	47.3	4.0	2.8	30.1	11.8	46.9
			Southwest	4.1	2.9	30.5	11.9	46.9	4.0	2.8	30.1	11.8	46.9

Table 4.9-5 Predicted Maximum Pollutant Concentrations, Southern Triangle: Fall River Secondary- Diesel

				Year 2016					Year 2030				
				Carbon Monoxide (CO in ppm)		Particulate Matter 2.5 ($PM_{2.5}$ in μg/m3)		Particulate Matter 10 (PM_{10} in μg/m^3)	Carbon Monoxide (CO in ppm)		Particulate Matter 2.5 ($PM_{2.5}$ in μg/m^3)		Particulate Matter 10 (PM_{10} in μg/m^3)
Town	Station	Intersection	Receptor Location at Intersection	1-Hour	8-Hour	24-Hour	Annual	24-Hour	1-Hour	8-Hour	24-Hour	Annual	24-Hour
Fall River	Fall River Depot	North Davol Street and South Davol Street at President Avenue	Northeast	4.1	2.9	30.5	11.9	46.9	4.1	2.9	30.1	11.8	46.9
			Southeast	4.2	2.9	30.5	11.9	46.9	4.2	2.9	30.1	11.8	46.9
			Southwest	3.9	2.7	30.5	11.9	46.9	4.2	2.9	30.1	11.8	46.9
			Northwest	4.2	2.9	30.5	11.9	47.3	4.2	2.9	30.1	11.8	46.9
Freetown	Freetown	South Main Street at Route 24 Northbound Ramps	North	4.1	2.9	30.5	11.9	47.3	4.1	2.9	30.5	11.9	46.9
			Southeast	4.0	2.8	30.5	11.9	47.3	4.0	2.8	30.1	11.8	46.9
			Southwest	4.1	2.9	30.5	11.9	46.9	4.0	2.8	30.1	11.8	46.9

New Bedford Main Line Rail Segment

The existing New Bedford Main Line freight track would be upgraded to FRA Class 5 for the South Coast Rail project. Public at-grade road/railroad crossings that would remain open would be reconfigured and/or improved to meet current safety standards. The existing freight service using the New Bedford Main Line is diesel-powered; no electrical infrastructure is present. New catenary supports and wires would need to be constructed along the length of the line, and four or five traction power facilities (depending upon the alternative selected) would need to be constructed for the electric alternatives. Two new train stations would be constructed in New Bedford (Whale's Tooth and King's Highway) and one new train station would be constructed in Taunton (Taunton Depot). One new layover facility would be constructed in New Bedford, at the Wamsutta site.

Tables 4.9-6 and 4.9-7 summarize the microscale (local) analysis results for the Southern Triangle portion of the project for the New Bedford Main Line stations for the diesel and electric alternatives, respectively. Figure 4.9-3 shows the New Bedford microscale air quality study area. As shown in the tables there are minor differences between the diesel and electric alternatives for the microscale (local) analysis. All of the pollutant concentrations for both the diesel and electric alternatives are well below (in compliance with) the NAAQS.

4.9.3.3 Stoughton Electric Alternative

The Stoughton Electric Alternative alignment comprises a portion of the Northeast Corridor, the entire Stoughton line, and the Southern Triangle. This alternative would use the Northeast Corridor only from South Station to Canton Junction. From Canton Junction, the existing Stoughton Line would be used to the Stoughton Station. From there, commuter rail service would be extended, reconstructing a railroad on an out-of-service railroad bed, south through Raynham Junction to Weir Junction in Taunton. This alignment joins the New Bedford Main Line at Weir Junction, the northern end of the Southern Triangle. This evaluation focuses on the existing and extended Stoughton Line segment.

The existing Stoughton Line commuter rail track from Canton Junction to Stoughton Station would be upgraded to FRA Class 5 for the Stoughton Electric Alternative. New track would be placed on the out-of-service railroad bed from Stoughton Station south to Weir Junction. The existing public at-grade road/railroad crossings would be reconfigured and/or improved to meet current safety standards.

The mesoscale analysis represents travel from South Station to the southern end points in New Bedford and Fall River. The difference in average vehicles miles traveled a day between the No-Build and the Stoughton Electric is approximately a 256,000 reduction with the implementation of the Stoughton Electric Alternative. This VMT reduction results in a reduction in all of the study pollutants as well (except particulate matter), as presented in Table 4.9-8.

Table 4.9-6 Predicted Maximum Pollutant Concentrations, Southern Triangle: New Bedford Main Line- Electric

				Year 2016					Year 2030				
			Receptor Location at	Carbon Monoxide (CO in ppm)		Particulate Matter 2.5 ($PM_{2.5}$ in µg/m^3)		Particulate Matter 10 (PM^{10} in µg/m^3)	Carbon Monoxide (CO in ppm)		Particulate Matter 2.5 ($PM_{2.5}$ in µg/m^3)		Particulate Matter 10 (PM_{10} in µg/m^3)
Town	Station	Intersection	Intersection	1-hr	8-hr	24-hr	Annual	24-Hr	1-hr	8-hr	24-hr	Annual	24-Hour
New Bedford	Whale's Tooth	Union Street at McArthur at Route 18 at State Pier	Northeast	4.1	2.9	30.5	11.9	47.3	4.3	3.0	30.1	11.8	46.9
			Southeast	4.1	2.9	30.5	11.9	47.3	4.6	3.2	30.1	11.8	46.9
			Southwest	4.2	2.9	30.5	11.9	47.3	4.7	3.3	30.5	11.9	47.3
			Northwest	4.5	3.2	30.5	11.9	47.3	4.8	3.4	30.5	11.9	47.3
New Bedford	King's Highway	Church Street at Tarkiln Road	Northeast	3.8	2.7	30.1	11.8	46.9	4.1	2.9	30.1	11.8	46.9
			Southeast	3.7	2.6	30.1	11.8	46.9	4.0	2.8	30.1	11.8	46.5
			Southwest	3.9	2.7	30.1	11.8	46.9	4.0	2.8	30.1	11.8	46.9
			Northwest	3.8	2.7	30.1	11.8	46.9	4.0	2.8	30.1	11.8	46.5

Table 4.9-7 Predicted Maximum Pollutant Concentrations, Southern Triangle: New Bedford Main Line-Diesel

				Year 2016					Year 2030				
			Receptor Location at	Carbon Monoxide (CO in ppm)		Particulate Matter 2.5 ($PM_{2.5}$ in µg/m^3)		Particulate Matter 10 (PM_{10} in µg/m^3)	Carbon Monoxide (CO in ppm)		Particulate Matter 2.5 ($PM_{2.5}$ in µg/m^3)		Particulate Matter 10 (PM_{10} in µg/m^3)
Town	Station	Intersection	Intersection	1-hr	8-hr	24-hr	Ann'l	24-hr	1-hr	8-hr	24-hr	Ann'l	24-Hour
New Bedford	Whale's Tooth	Union Street at McArthur at Route 18 at State Pier	Northeast	4.1	2.9	30.5	11.9	46.9	4.3	3.0	30.1	11.8	46.9
			Southeast	4.1	2.9	30.5	11.9	47.3	4.6	3.2	30.1	11.8	46.9
			Southwest	4.2	2.9	30.5	11.9	47.3	4.7	3.3	30.1	11.8	47.3
			Northwest	4.5	3.2	30.5	11.9	47.3	4.8	3.4	30.1	11.8	47.3
New Bedford	King's Highway	Church Street at Tarkiln Road	Northeast	4.0	2.8	30.1	11.8	46.9	4.0	2.8	30.1	11.8	46.9
			Southeast	3.8	2.7	30.1	11.8	46.9	3.8	2.7	30.1	11.8	46.5
			Southwest	4.0	2.8	30.1	11.8	46.9	4.0	2.8	30.1	11.8	46.9
			Northwest	3.8	2.7	30.1	11.8	46.9	3.8	2.7	30.1	11.8	46.5

Table 4.9-8 Mesoscale Mobile Source Analysis Results, Stoughton Electric Alternative

Stoughton Electric	Units	2035 No-Build	2035 Build	Build/No-Build Difference
Vehicle Miles Traveled (VMT)[1]	Average Miles/day	118,897,192	118,641,260	-255,932
Volatile Organic Compounds (VOCs)	Kg/day	22,200	22,160	-40
Nitrogen Oxides (NO_x)	Kg/day	19,256	19,159	-98
Particulate Matter 10 (PM_{10})	Kg/day	3,240	3,240	0
Particulate Matter 2.5 ($PM_{2.5}$)	Kg/day	1,490	1,490	0
Carbon Monoxide (CO: Winter)	Kg/day	1,050,356	1,048,074	-2,281
Carbon Dioxide (CO_2)[1]	Tons/year	24,717,339	24,656,479	-60,859

1 The CO_2 was calculated assuming an annualization factor of 365 days/year and 1000kg/1 ton.

As discussed in the methodology section, the intersections that were analyzed as part of the microscale analysis are representative of the air quality impacts within the study areas surrounding the proposed train stations. Table 4.9-9 presents a summary of the results of the microscale air quality analysis for the stations associated with the Stoughton Electric Alternative. Figures 4.9-5, 4.9-6 and 4.9-7 show the microscale study areas for the Stoughton Electric Alternative. The highest CO, $PM_{2.5}$ and PM_{10} concentrations and its receptor locations are presented in Table 4.9-9. These values represent the highest concentrations for each intersection. As shown in the table, all of the pollutant concentrations at the receptors for each of the five study intersections analyzed for the Stoughton Electric Alternative are well below (in compliance with) the NAAQS. As indicated in Section 4.9.2, the study intersections presented in Table 4.9-9 represent the intersections that would incur the greatest impact from the train stations and rail lines associated with the Stoughton Electric Alternative. Since the emissions at these intersections, which represent the worst case scenario (i.e. highest volumes and delays), are well below the NAAQS standards it is expected that the remainder of the study area for the Stoughton Electric Alternative would also fall below (in compliance with) the NAAQS.

Table 4.9-9 Predicted Maximum Pollutant Concentrations, Stoughton Electric Alternative

				2016					2030				
				CO (ppm)		$PM_{2.5}$ (μg/m^3)		PM_{10} (μg/m^3)	CO (ppm)		$PM_{2.5}$ (μg/m^3)		PM_{10} (μg/m^3)
Town	Station	Intersection	Receptor Location	1-Hr	8-Hr	24-Hr	Annual	24-Hr	1-Hr	8-Hr	24-Hr	Annual	24-Hr
North Easton	North Easton	Route 138 at Main Street	Northeast	4.5	3.2	30.5	11.9	47.3	4.5	3.2	30.5	11.9	47.3
			Southeast	4.5	3.2	30.5	11.9	47.7	4.6	3.2	30.5	11.9	47.3
			Southwest	4.7	3.3	30.9	11.9	47.7	4.7	3.3	30.5	11.9	47.3
			Northwest	4.6	3.2	30.5	11.9	47.7	4.6	3.2	30.5	11.9	47.3
Easton	Easton Village	Route 138 at Main Street	Northeast	4.5	3.2	30.5	11.9	47.3	4.5	3.2	30.5	11.9	47.3
			Southeast	4.5	3.2	30.5	11.9	47.7	4.6	3.2	30.5	11.9	47.3
			Southwest	4.7	3.3	30.9	11.9	47.7	4.7	3.3	30.5	11.9	47.3
			Northwest	4.6	3.2	30.5	11.9	47.7	4.6	3.2	30.5	11.9	47.3
Raynham	Raynham Park	Route 138 at Foundry Street/Route 106	Northeast	4.2	2.9	30.5	11.9	47.3	4.1	2.9	30.5	11.9	47.3
			Southeast	4.0	2.8	30.5	11.9	47.3	4.0	2.8	30.5	11.9	46.9
			Southwest	4.1	2.9	30.5	11.9	47.3	4.1	2.9	30.5	11.9	46.9
			Northwest	4.0	2.8	30.5	11.9	47.3	4.0	2.8	30.5	11.9	46.9
Taunton	Dean Street	Route 44 at Longmeadow Road	Northeast	4.7	3.3	30.5	11.9	47.7	4.6	3.2	30.5	11.9	47.3
			Southeast	4.4	3.1	30.5	11.9	47.7	4.4	3.1	30.5	11.9	47.3
			Southwest	4.8	3.4	30.9	11.9	48.1	4.8	3.4	30.5	11.9	47.7
			Northwest	4.6	3.2	30.9	11.9	47.7	4.6	3.2	30.5	11.9	32.7
East Taunton	Taunton Depot	Route 140 at the Route 24 Southbound Ramps	East	4.2	2.9	30.5	11.9	47.3	4.2	2.9	30.5	11.9	47.7
			Southeast	4.4	3.1	30.5	11.9	47.7	4.4	3.1	30.5	11.9	47.7
			Northwest	4.5	3.2	30.5	11.9	47.7	4.5	3.2	30.5	11.9	47.7
Stoughton	Stoughton	Brock St./Kinsley St. at Washington St.	Northeast	3.7	2.6	22.7	9.9	40.5	3.7	2.6	22.7	9.9	40.5
			Southeast	3.6	2.5	22.7	9.9	40.5	3.6	2.5	22.7	9.9	40.5
			Southwest	3.6	2.5	22.7	9.9	40.5	3.6	2.5	22.7	9.9	40.5
			Northwest	3.6	2.5	22.7	9.9	40.5	3.6	2.5	22.7	9.9	40.5

4.9.3.4 Stoughton Diesel Alternative

The Stoughton Diesel Alternative is identical to the Stoughton Electric Alternative with the exception of the locomotive power source. Table 4.9-10 presents a summary of the mesoscale (regional) analysis for the Stoughton Diesel Alternative. Similar to the Stoughton Electric, the mesoscale analysis represents travel from South Station to the southern end points of New Bedford and Fall River. The estimated reduction in average number of vehicle miles traveled per day is approximately 240,000 with the implementation of the Stoughton Diesel Alternative. The estimated reduction in VMT as well as the reductions in the concentrations of pollutants is greater with the electric alternative (approximately 16,000 more). This is partially due to the greater estimated time savings experienced with the electric alternative over the diesel alternative. This time savings makes the electric alternative more attractive and thus shifts more people onto the train and out of motor vehicles. This results in greater reduction in VMT and associated air pollutants for the electric alternative compared to diesel.

Table 4.9-10 Mesoscale Mobile Source Analysis Results, Stoughton Diesel Alternative

	Units	2030 No-Build	2030 Build	Build/No-Build Difference
Vehicle Miles Traveled (VMT)[1]	Average Miles/day	118,897,192	118,656,844	-240,348
Volatile Organic Compounds (VOCs)	Kg/day	22,200	22,160	-40
Nitrogen Oxides (NO_x)	Kg/day	19,256	19,210	-46
Particulate Matter 10 (PM_{10})	Kg/day	3,240	3,241	1
Particulate Matter 2.5 ($PM_{2.5}$)	Kg/day	1,490	1,491	1
Carbon Monoxide (CO: Winter)	Kg/day	1,050,356	1,048,400	-1,956
Carbon Dioxide (CO_2)[1]	Tons/year	24,717,339	24,688,173	-29,166

1 The CO_2 was calculated assuming an annualization factor of 365 days/year and 1000kg/1 ton.

Table 4.9-11 summarizes the microscale (local) analysis results for the Stoughton Diesel Alternative. The microscale analysis for Stoughton Diesel Alternative also takes into account the emissions from the trains at the study receptors in the vicinity of the study intersections. Even with the train emissions taken into account, all pollutant concentrations under the Stoughton Diesel Alternative are well below (in compliance with) the NAAQS.

Table 4.9-11 Predicted Maximum Pollutant Concentrations, Stoughton Diesel Alternative

				2016					2030				
				Carbon Monoxide (CO in ppm)		Particulate Matter 2.5 ($PM_{2.5}$ in µg/m^3)		Particulate Matter 10 (PM_{10} in µg/m^3)	Carbon Monoxide (CO in ppm)		Particulate Matter 2.5 ($PM_{2.5}$ in µg/m^3)		Particulate Matter 10 (PM_{10} in µg/m^3)
Town	Station	Intersection	Receptor Location at Intersection	1-Hr	8-Hr	24-Hr	Ann'l	24-Hr	1-Hr	8-Hr	24-Hr	Ann'l	24-Hr
North Easton	North Easton	Route 138 at Main Street	Northeast	4.5	3.2	30.5	11.9	47.3	4.5	3.2	30.5	11.9	47.3
			Southeast	4.5	3.2	30.5	11.9	47.7	4.6	3.2	30.5	11.9	47.3
			Southwest	4.7	3.3	30.9	11.9	47.7	4.7	3.3	30.5	11.9	47.3
			Northwest	4.6	3.2	30.5	11.9	47.7	4.6	3.2	30.5	11.9	47.3
Easton	Easton Village	Route 138 at Main Street	Northeast	4.5	3.2	30.5	11.9	47.3	4.5	3.2	30.5	11.9	47.3
			Southeast	4.5	3.2	30.5	11.9	47.7	4.6	3.2	30.5	11.9	47.3
			Southwest	4.7	3.3	30.9	11.9	47.7	4.7	3.3	30.5	11.9	47.3
			Northwest	4.6	3.2	30.5	11.9	47.7	4.6	3.2	30.5	11.9	47.3
Raynham	Raynham Park	Route 138 at Foundry Street/Route 106	Northeast	4.2	2.9	30.5	11.9	47.3	4.1	2.9	30.5	11.9	47.3
			Southeast	4.0	2.8	30.5	11.9	47.3	4.0	2.8	30.5	11.9	46.9
			Southwest	4.1	2.8	30.5	11.9	47.3	4.1	2.9	30.5	11.9	46.9
			Northwest	4.0	2.8	30.5	11.9	47.3	4.0	2.8	30.5	11.9	46.9
Taunton	Dean Street	Route 44 at Longmeadow Road	Northeast	4.7	3.3	30.5	11.9	47.7	4.6	3.2	30.5	11.9	47.3
			Southeast	4.4	3.1	30.5	11.9	47.7	4.4	3.1	30.5	11.9	47.3
			Southwest	4.8	3.4	30.9	11.9	48.1	4.8	3.4	30.5	11.9	47.7
			Northwest	4.6	3.2	30.9	11.9	47.7	4.6	3.2	30.5	11.9	47.7
East Taunton	Taunton Depot	Route 140 at the Route 24 Southbound Ramps	East	4.2	2.9	30.5	11.9	47.3	4.2	2.9	30.5	11.9	49.3
			Southeast	4.4	3.1	30.5	11.9	47.7	4.4	3.1	30.5	11.9	49.3
			Northwest	4.5	3.2	30.5	11.9	47.7	4.5	3.2	30.5	11.9	49.7

4.9.3.5 Whittenton Electric Alternative

The Whittenton Electric Alternative is a variant of the Stoughton Electric Alternative alignment described in Section 4.9.3.3. At Raynham Junction, the route would divert to the southwest, following the out-of-service Whittenton Branch. This alignment would connect with the Attleboro Secondary at Whittenton Junction in Taunton, and then continue on toward the southeast to connect with the New Bedford Main Line at Weir Junction. The southernmost portion of the Stoughton Line (from Raynham Junction to Weir Junction) and the northwestern-most portion of the Attleboro Secondary (from the Attleboro Bypass to Whittenton Junction), would not be used if this alternative is selected. This evaluation focuses on the Whittenton Branch component.

Table 4.9-12 presents a summary of the mesoscale (regional) analysis for the Whittenton Electric Alternative. The mesoscale analysis represents travel from South Station all the way to the southern end points of Whale's Tooth and Battleship Cove. The difference in VMT between the No-Build and the Whittenton Electric Alternative is an approximately 201,000 reduction with the implementation of the Whittenton Electric Alternative. This VMT reduction results in a reduction in emissions of the analyzed pollutants as well.

Table 4.9-13 summarizes the microscale (local) analysis results for the Whittenton Electric Alternative stations. As shown in the table, under the Whittenton Electric Alternative all of the pollutant concentrations are well below (in compliance with) the NAAQS.

Table 4.9-12 Mesoscale Mobile Source Analysis Results, Whittenton Electric Alternative

	Units	2030 No-Build	2030 Build	Build/No-Build Difference
Vehicle Miles Traveled (VMT)[1]	Average Miles/day	118,897,192	118,695,960	-201,232
Volatile Organic Compounds (VOCs)	Kg/day	22,200	22,170	-30
Nitrogen Oxides (NO_x)	Kg/day	19,256	19,169	-88
Particulate Matter 10 (PM_{10})	Kg/day	3,240	3,240	0
Particulate Matter 2.5 ($PM_{2.5}$)	Kg/day	1,490	1,490	0
Carbon Monoxide (CO: Winter)	Kg/day	1,050,356	1,048,554	-1,801
Carbon Dioxide (CO_2)[1]	Tons/year	24,717,339	24,667,849	-49,490

1 The CO_2 was calculated assuming an annualization factor of 365 days/year and 1000kg/1 ton.

4.9.3.6 Whittenton Diesel Alternative

The Whittenton Diesel Alternative is identical to the Whittenton Electric Alternative with the exception of the locomotive power source. Table 4.9-14 presents a summary of the mesoscale (regional) analysis for the Whittenton Diesel Alternative. Similar to the previous alternatives, the mesoscale analysis represents travel from South Station to the southern end points of New Bedford and Fall River. The estimated reduction in average number of VMT per day is approximately 186,000 with the implementation of the Whittenton Diesel Alternative. The estimated reduction in VMT as well as the reductions in the concentrations of pollutants is greater with the electric alternative (approximately

15,000 more). This is partially due to the greater estimated time savings experienced with the electric alternative over the diesel alternative. This time savings makes the electric alternative more attractive and thus shifts more people onto the train and out of motor vehicles. This results in greater reduction in VMT and associated air pollutants for the electric alternative compared to diesel.

Table 4.9-15 summarizes the microscale (local) analysis results for the Whittenton Diesel Alternative stations. Similar to the previous diesel alternative, the microscale analysis for the Whittenton Diesel Alternative also takes into account the emissions from the trains at the study receptors in the vicinity of the study intersections. Even with the train emissions taken into account, under the Whittenton Diesel Alternative all pollutant concentrations are well below (in compliance with) the NAAQS.

Table 4.9-13 Predicted Maximum Pollutant Concentrations, Whittenton Electric Alternative

				2016					2030				
				Carbon Monoxide (CO in ppm)		Particulate Matter 2.5 ($PM_{2.5}$ in $\mu g/m^3$)		Particulate Matter 10 (PM_{10} in $\mu g/m^3$)	Carbon Monoxide (CO in ppm)		Particulate Matter 2.5 ($PM_{2.5}$ in $\mu g/m^3$)		Particulate Matter 10 (PM_{10} in $\mu g/m^3$)
Town	Station	Intersection	Receptor Location at Intersection	1-Hr	8-Hr	24-Hr	Ann'l	24-Hr	1-Hr	8-Hr	24-Hr	Ann'l	24-Hr
Taunton	Taunton Depot	Route 140 at the Route 24 Northbound without Slip Ramp	Northeast	4.8	3.4	30.9	11.9	48.5	4.9	3.4	30.9	11.9	48.1
			South	4.9	3.4	30.9	12.0	48.5	4.9	3.4	30.9	11.9	48.1
			Northwest	4.7	3.3	30.9	11.9	48.1	4.8	3.3	30.9	11.9	48.1
Taunton	Dana Street	Washington Street at Tremont Street	Northeast	4.2	2.9	30.5	11.9	47.3	4.2	2.9	30.5	11.9	46.9
			Southeast	4.2	2.9	30.5	11.9	47.3	4.2	2.9	30.5	11.9	47.3
			Southwest	4.0	2.8	30.5	11.9	46.9	4.0	2.8	30.5	11.9	46.9
			Northwest	4.3	3.0	30.5	11.9	47.3	4.3	3.0	30.5	11.9	47.3
East Taunton	Taunton Depot	Route 140 at the Route 24 Southbound Ramps	East	4.2	2.9	30.5	11.9	47.3	4.2	2.9	30.5	11.9	47.3
			Southeast	4.4	3.1	30.5	11.9	47.7	4.4	3.1	30.5	11.9	47.3
			Northwest	4.5	3.2	30.5	11.9	47.7	4.5	3.2	30.5	11.9	47.3

Table 4.9-14 Mesoscale Mobile Source Analysis Results, Whittenton Diesel Alternative

Whittenton Diesel	Units	2030 No-Build	2030 Build	Build/No-Build Difference
Vehicle Miles Traveled (VMT)[1]	Average Miles/day	118,897,192	118,710,886	-186,306
Volatile Organic Compounds (VOCs)	Kg/day	22,200	22,170	-30
Nitrogen Oxides (NO_x)	Kg/day	19,256	19,227	-29
Particulate Matter 10 (PM_{10})	Kg/day	3,240	3,241	1
Particulate Matter 2.5 ($PM_{2.5}$)	Kg/day	1,490	1,491	1
Carbon Monoxide (CO: Winter)	Kg/day	1,050,356	1,048,908	-1,448
Carbon Dioxide (CO_2)[1]	Tons/year	24,717,339	24,703,175	-14,164

1 The CO_2 was calculated assuming an annualization factor of 365 days/year and 1000kg/1 ton.

Table 4.9-15 Predicted Maximum Pollutant Concentrations, Whittenton Diesel Alternative

Town	Station	Intersection	Receptor Location at Intersection	2016 Carbon Monoxide (CO in ppm) 1-Hr	2016 Carbon Monoxide (CO in ppm) 8-Hr	2016 Particulate Matter 2.5 ($PM_{2.5}$ in µg/m3) 24-Hr	2016 Particulate Matter 2.5 ($PM_{2.5}$ in µg/m3) Annual	2016 Particulate Matter 10 (PM10 in µg/m3) 24-Hr	2030 Carbon Monoxide (CO in ppm) 1-Hr	2030 Carbon Monoxide (CO in ppm) 8-Hr	2030 Particulate Matter 2.5 ($PM_{2.5}$ in µg/m3) 24-Hr	2030 Particulate Matter 2.5 ($PM_{2.5}$ in µg/m3) Annual	2030 Particulate Matter 10 (PM10 in µg/m3) 24-Hr
Taunton	Taunton Depot	Route 140 at the Route 24 Northbound without Slip Ramp	Northeast	4.8	3.4	30.9	11.9	48.1	4.8	3.4	30.9	11.9	48.1
			South	4.9	3.4	30.9	11.9	48.5	4.9	3.4	30.9	11.9	48.1
			Northwest	4.6	3.2	30.9	11.9	48.1	4.7	3.3	30.9	11.9	48.1
Taunton	Dana Street	Washington Street at Tremont Street	Northeast	4.2	2.9	30.5	11.9	47.3	4.2	2.9	30.5	11.9	46.9
			Southeast	4.2	2.9	30.5	11.9	47.3	4.2	2.9	30.5	11.9	47.3
			Southwest	4.0	2.8	30.5	11.9	46.9	4.0	2.8	30.5	11.9	46.9
			Northwest	4.3	3.0	30.5	11.9	47.3	4.3	3.0	30.5	11.9	47.3
East Taunton	Taunton Depot	Route 140 at the Route 24 Southbound Ramps	East	4.2	2.9	30.5	11.9	47.3	4.2	2.9	30.5	11.9	49.3
			Southeast	4.4	3.1	30.5	11.9	47.7	4.4	3.1	30.5	11.9	49.3
			Northwest	4.5	3.2	30.5	11.9	47.7	4.5	3.2	30.5	11.9	49.7

4.9.3.7 Stations

This section evaluates the potential air quality impacts of train locomotive emissions on receptor locations adjacent to the train stations. A stationary source analysis was not conducted for the train stations because there are no buildings proposed as part of the stations for the South Coast Rail project. The stations would only include a platform. There are some electrical requirements for each station but the emissions related to the minimal electrical requirements are considered negligible. The air quality analysis evaluated the potential for impact of train locomotives on residential receptor locations adjacent to the train stations by calculating the worst-case pollutant concentrations and the distance from the train stations that they would occur. The trains that would be used on the South Coast Rail alternatives could be electric or diesel. The electric trains do not emit air pollutants and would not have any air quality impacts on receptor locations adjacent to the train stations. An analysis of the impacts of the diesel commuter rail trains on the closest residential area adjacent to the train stations was conducted using USEPA's AERMOD air dispersion model. The primary pollutants of concern from diesel trains are CO, NO_x, PM_{10}, and $PM_{2.5}$. AERMOD calculated the highest concentrations of each pollutant and the distances from the train station that they would occur. These results represent a worst-case condition.

The result of the air quality analysis demonstrates that all of the pollutant concentrations would be below the NAAQS. Receptor locations that are located further away from the train stations would experience lower pollutant concentrations due to additional dilution with greater distances. The worst-case modeling results, distances from the train stations, background, project contributions, and total concentration values are presented in Table 4.9-16. The air quality analysis represents a worst-case condition because it was conducted for 2016. While train emissions do not change frequently, it is reasonable to assume that by 2030 the train emissions and pollutant concentrations presented in Table 4.9-16 would be lower. It should be noted that the pollutant increases from train locomotives are relatively small.

Table 4.9-16 2016 Station Concentrations (μg/m^3)

Pollutant	Averaging Time	NAAQS (ug/m^3)	Distance from Emission Source (ft)	Background Concentrations (ug/m^3)	Project Contribution (ug/m^3)	Maximum Concentrations (ug/m^3)
CO	1-Hour	40,000	164	3,428.6[1]	367.0	3,795.6
	8-hour	10,000	328	2,400.0[2]	206.5	2,606.5
NO_x	Annual	100	492	44.8	1.1	45.9
PM_{10}	24-Hour	150	328	45.7	0.7	46.4
$PM_{2.5}$	24-Hour	35	328	29.7	0.7	30.4
	Annual	15	492	11.7	0.0	11.7

1 1-hr CO background concentration 3.0 ppm = 3,428.6 ug/m^3
2 8-hr CO background concentration 2.1 ppm = 2,400.1 ug/m^3

4.9.3.8 Layover Facilities

This section evaluates the potential air quality impacts of train locomotive emissions on receptor locations adjacent to the layover facilities. The layover facilities would be open air storage areas for the trains. There are some electrical requirements for each layover facility but the emissions related to the minimal electrical requirements are considered negligible. The air quality analysis evaluated the potential for impact of train locomotives on residential receptor locations adjacent to the layover facilities by calculating the worst-case pollutant concentrations and the distance from the train stations that they would occur. The trains that would be used on the South Coast Rail alternatives could be electric or diesel. Electric trains do not emit air pollutants and would not have any air quality impacts on receptor locations adjacent to the layover facilities. An analysis of the impacts of the diesel commuter rail trains on the closest residential area adjacent to the layover facilities was conducted using USEPA's AERMOD air dispersion model. The primary pollutants of concern from diesel trains are CO, NO_x, PM_{10}, and $PM_{2.5}$. AERMOD calculated the highest concentrations of each pollutant and the distances from the layover facility that they would occur. These results represent a worst-case condition for both the Wamsutta and Weaver's Cove East layover facilities.

The result of the air quality analysis demonstrates that all of the pollutant concentrations would be below (in compliance with) the NAAQS. Receptor locations that are located further away from the layover facilities would experience lower pollutant concentrations due to additional dilution with greater distances. The worst-case modeling results, distances from the layover facilities, background, project contributions, and total concentration values are presented in Table 4.9-17. It should be noted that the pollutant increases from train locomotives are small. Under the Stoughton Diesel or Whittenton Diesel Alternatives, plug-ins and electric block heaters would be used at the rail layover facilities to minimize criteria pollutant emissions.

Table 4.9-17 2016 Layover Concentrations (µg/m^3)

Pollutant	Averaging Time	NAAQS (ug/m^3)	Distance from Emission Source (ft)	Background Concentrations (ug/m^3)	Project Contribution (ug/m^3)	Maximum Concentrations (ug/m^3)
CO	1-Hour	40,000	164	3,428.6	734.0	4,162.6
	8-hour	10,000	328	2,400.0	413.1	2,813.1
NO_x	Annual	100	492	44.8	2.2	47.0
PM_{10}	24-Hour	150	328	45.7	1.3	47.0
$PM_{2.5}$	24-Hour	35	328	29.7	1.3	31.0
	Annual	15	492	11.7	0.1	11.8

The air quality analysis also calculated the potential GHG emissions from the layover facilities. The GHG emissions are the dominant emission source from diesel trains using electric plug-ins to keep the engines warm on winter nights. For analysis purposes it was assumed that the layover facilities at New Bedford and Fall River can store up to a total of 7 trains combined. The yearly electric consumption for the trains stored at the layover facilities was estimated in kilowatt hours and converted to CO_2 emissions. The results are presented in Table 4.9-18. Train activity at the two layover facilities would result in 1,272 tons of CO_2 emission per year.

Table 4.9-18 Estimated CO_2 Emissions at the Proposed Layover Facilities

	Hours/day	Number of Trains	Kwh	Mwh	Tons of CO_2/year
Layover Facilities	6	7	258	0.258	1,272

4.9.3.9 Analysis of Locomotive Emissions on Adjacent Receptors

This section evaluates the potential air quality impacts of train locomotive emissions on receptor locations adjacent to the train tracks. The air quality analysis evaluated the potential for impact of train locomotives on adjacent residential receptor locations by calculating the worst-case pollutant concentrations and the distance from the train track that they would occur. The trains that would be used on the South Coast Rail alternatives could be electric or diesel. The electric trains do not emit air pollutants and would not have any air quality impacts on receptor locations adjacent to the train tracks. An analysis of the impacts of the diesel commuter rail trains on the closest residential area adjacent to the train tracks was conducted using USEPA's AERMOD air dispersion model. The primary pollutants of concern from diesel trains are CO, NO_x, PM_{10}, and $PM_{2.5}$. AERMOD calculated the highest concentrations of each pollutant and the distances from the train tracks over which they would occur. These results represent a worst-case condition.

The results of the air quality analysis demonstrate that all of the pollutant concentrations would be below (in compliance with) the NAAQS. Receptor locations that are located further away would experience lower pollutant concentrations due to additional dilution with greater distances. The worst-case modeling results, distances from the train tracks, background, project contributions, and total concentration values are presented in Table 4.9-19. The emissions from train locomotives initially rise above the train engine due to the high exit temperatures and flow rate out of the exhaust. The emissions are subsequently carried away from the train track and gradually fall to the ground. The air quality analysis calculated the pollutant concentrations at various distances from source and sorted for the highest concentrations at the location that it would occur. Pollutant concentrations closer to the train tracks would be lower or zero depending upon the initial exhaust plume rise and rate that the train locomotive emissions fall to the ground. It should be noted that the pollutant concentration increases from train locomotives emissions are very small. These increases represent 1.5 percent or less of the worst-case total concentrations and would not result in any air quality impacts on receptor locations adjacent to the train tracks.

Table 4.9-19 2016 Train Track Concentrations ($\mu g/m^3$)

Pollutant	Averaging Time	NAAQS (ug/m^3)	Distance from Emission Source (ft)	Background Concentrations (ug/m^3)	Project Contribution (ug/m^3)	Maximum Concentrations (ug/m^3)
CO	1-Hour	40,000	164	3,428.6	7.65	3,436.25
	8-hour	10,000	328	2,400.0	4.30	2,404.30
NO_x	Annual	100	492	44.8	0.56	45.36
PM_{10}	24-Hour	150	328	45.7	0.33	46.03
$PM_{2.5}$	24-Hour	35	328	29.7	0.33	30.03
	Annual	15	492	11.7	0.01	11.71

4.9.3.10 Microscale Sensitive Area Analysis

This section evaluates the potential for aerial deposition of oxides of nitrogen (NO_X) from train-generated emissions on environmentally sensitive areas (such as the Hockomock Swamp and other wetlands adjacent to the train tracks). The air quality analysis evaluated the potential for impact of train locomotives on adjacent environmentally sensitive areas by calculating the worst-case pollutant concentrations and the distance from the train track that they would occur. The primary pollutant of concern from diesel trains passing through these environmentally sensitive areas is oxides of nitrogen (NO_X). USEPA's AERMOD air dispersion model was used calculate the worst-case concentrations of NO_X.

The air quality analysis demonstrates that the aerial deposition of train-generated emissions is not a substantial source of pollution of water resources (wetlands) because of the very low concentrations of pollutants in the vicinity of the train track. The NAAQS annual arithmetic mean of NO_X is 100 $\mu g/m^3$. The air quality analysis calculated a worst-case concentration of NO_X 45.8 $\mu g/m^3$ at a distance of 500. The background component is 44.8 $\mu g/m^3$ and the project contribution is 1.0 $\mu g/m^3$. The pollutant increases from train locomotives are very small. These increases represent 2 percent or less of the worst-case total concentrations.

The air quality analysis demonstrates that the aerial deposition of train-generated emissions is not a significant source of pollution of water resources because of the very low concentrations of pollutants in the vicinity of the track. The train-generated emissions would be lower at distances further away from the train tracks and would be reduced in the future with the use of cleaner fuels. The electric trains would have no appreciable air quality impact on environmentally sensitive receptors, such as the Hockomock Swamp and other wetlands, since they do not emit any NO_X.

4.9.4 Temporary Construction–Period Impacts

4.9.4.1 Construction Activities

Temporary air quality impacts could result from construction activities associated with utility relocation, grading, excavation, track work and installation of systems components. Such impacts may occur in residential areas and at other sensitive land uses located within several hundred feet of the alignment. In addition to direct emissions of criteria pollutants and greenhouse gases by construction equipment and construction worker travel, particulate emissions from construction sites can occur due to fugitive dust. Construction best management practices, including dust control measures, outlined in the following section can reduce these impacts and help ensure air quality standards are not exceeded.

4.9.4.2 Construction Mitigation

In an effort to reduce criteria pollutants and GHG emissions from temporary construction activities, construction contractors would be contractually required to adhere to all applicable regulations regarding control of construction vehicles emissions. This would include, but not be limited to, maintenance of all motor vehicles, machinery, and equipment associated with construction activities and proper fitting of equipment with mufflers or other regulatory-required emissions control devices. Also, the prohibition of excessive idling of construction equipment engines would be implemented, as required by MassDEP regulations in 310 CMR 7.11.

Construction specifications would stipulate that all diesel construction equipment used on-site would be fitted with after-engine emission controls such as diesel oxidation catalysts (DOCs) or diesel particulate filters (DPFs).[16] Construction contractors would be required to utilize ultra-low sulfur diesel fuel for all off-road construction vehicles as an additional measure to reduce air emissions from construction activities. Idling restriction signs would be placed on the premises to remind drivers and construction personnel of the State's idling regulation, which requires that the engine must be shut down if the vehicle will be stopped for more than five minutes (310 CMR 7.11(1)(b)).[17]

The contractor would be required to implement protective measures around the construction and demolition work to protect pedestrians and prevent dust and debris from leaving the site or entering the surrounding community. Dust generated from earthwork and other construction activities like

[16] This is consistent with the Certificate of Construction Equipment Standard Compliance Form required for all bids to the MBTA.
[17] http://www.epa.gov/region1/topics/air/sips/ma/MA_Reg11.pdf

stockpiled soils would be controlled by spraying with water to mitigate wind erosion on open soil areas. Other dust suppression methods would be implemented to ensure minimization of the off-site transport of dust. Regular sweeping of the pavement of adjacent roadway surfaces would be required during the construction period to minimize the potential for vehicular traffic to create airborne dust and particulate matter.

4.9.5 Summary of Impacts by Alternative

All alternatives comply with the Clean Air Act Amendments (CAAA) and the Executive Office of Energy and Environmental Affairs (EEA) policy on Greenhouse Gas emissions. The ozone mesoscale analysis demonstrated that the Build Alternatives would result in a decrease of VOC and NO_X emissions, as compared to the No-Build Alternative.

The alternatives would incorporate reasonable and feasible mitigation measures (as described in Chapter 4.1, *Transportation*) to reduce CO_2 and greenhouse gas (GHG) emissions consistent with DEP guidelines. All Build Alternatives meet the EEA policy on GHG emissions because they include mobile and stationary source mitigation measures that would reduce the GHG emission from levels expected from a project without mitigation.

The air quality study demonstrates that all alternatives conform to the CAAA and to the EEA GHG policy because:

- They would implement reasonable and feasible emission reduction mitigation measures.
- No new violation of the NAAQS would be created.
- No increase in the frequency or severity of any existing violations would occur.
- No delay in attainment of any NAAQS would result.

The following provides a summary of the air quality impacts of each of the South Coast Rail alternatives.

4.9.5.1 Mesoscale Analysis Results

The air quality study included a mesoscale analysis that estimates the area wide emissions of VOCs, NO_X, CO_2, CO, and PM emissions. The mesoscale analysis evaluated the changes in emissions based upon changes in the average daily traffic volumes, roadway lengths, and vehicle emission rates. To demonstrate compliance with the USEPA criteria, the air quality study must show the proposed South Coast Rail project's change in daily (24-hour period) VOC and NO_X emissions. Using USEPA recommended air quality modeling techniques, total pollutant emissions were calculated for the No-Build Alternative and the Build Alternatives. The mesoscale analysis calculated the 2035 mobile source emissions from the major roadways in the study area as well as train emissions.

The No-Build Alternative VOC and NO_X emissions are typically lower than the Existing Conditions emissions due to the implementation of state and federal emission control programs, such as the Federal Motor Vehicle Emission Control Program, the Stage II Vapor Recovery System, and the Massachusetts Inspection and Maintenance program. Table 4.9-20 presents the mesoscale analysis results for all the alternatives.

All Build Alternatives would reduce emissions of $NO_{X,}$, CO, and CO_2, in comparison to the No-Build

Alternative (See Table 4.9-20). All of the Build Alternatives have a negligible effect on particulate matter emissions. The electric alternatives all have lower emissions than the corresponding diesel alternative for all of the pollutants. The difference between the diesel and electric is most notable with the NO_X emissions where the emissions for the electric alternative are substantially less than the corresponding diesel alternative. This is due to the higher NO_X output related to the locomotives burning diesel fuel. The Stoughton Electric Alternative generally results in the greatest reduction in emissions which is consistent with the estimated highest reduction in VMT.

Transit Emissions

Feeder Bus System

A review of the feeder bus system that could be provided with the Stoughton Electric and Whittenton Electric Alternatives was conducted. Three regional transit authorities, Brockton Area Transit Authority (BAT), SRTA, and GATRA currently provide local bus service to the SCR corridor. Most of the feeder bus routes that would serve each of the proposed stations are diversions of existing routes. Based on this, it is anticipated that the feeder buses would further reduce greenhouse measures because the overall greenhouse emissions of the bus diversions would be outweighed by the VMT saving of the riders of the feeder bus system. This GHG savings, however, would be negligible compared to the overall GHG savings realized by the proposed Stoughton Electric or Whittenton Electric Alternatives. Because most of the feeder buses would be diversions of existing routes (adding approximately 22.5 miles for all the routes serving the South Coast Rail stations), it is not anticipated that a new fleet would be required to provide the feeder bus system. The existing fleet would be commissioned. It is likely that as the fleets of the various transit providers that provide feeder buses to the stations are replaced, alternative fuels would be considered for replacement.

Transit Vehicles

In addition to the assessment of auto and truck emissions related to the South Coast Rail project, the emissions related to transit systems within the study area for the No-Build Alternative, the Stoughton Electric and Whittenton Electric Alternatives were evaluated and are included in the totals shown in Table 4.9-20. The emissions savings of the replacement of the transit vehicles (No-Build TSM option) with the proposed South Coast Rail electric trains are minimal compared to the overall project emission savings (savings from the reduced VMT). The transit vehicle emission savings are the same for Stoughton and Whittenton Electric Alternatives. The transit VMT is expected to be reduced by 3,700 transit vehicles per day with replacing the transit vehicles with the electric rail which is 0.003 percent of the overall VMT for the study alternatives. This VMT equates to a savings of 6 kg/day of CO, 42 kg/day of NO_x, and 2,800 tons per year of CO_2.

Table 4.9-20 Summary of the 2035 Mesoscale (Regional) Air Quality Analysis for the South Coast Rail Alternatives

		Vehicle Miles Traveled (VMT)[1]	Volatile Organic Compound (VOC) (kg/day)	Oxides of Nitrogen (NO_x) (kg/day)	Particulate Matter 10 (PM_{10}) (kg/day)	Particulate Matter 2.5 ($PM_{2.5}$) (kg/day)	Carbon Monoxide (CO-Winter) (kg/day)	Carbon Dioxide (CO_2) (tons/year)
No-Build	Total	118,897,192	22,200	19,256	3,240	1,490	1,050,356	24,717,339
Stoughton Electric	Total	118,641,260	22,160	19,159	3,240	1,490	1,048,074	24,656,479
	Difference from No-Build	-255,932	-40	-98	0	0	-2,281	-60,859
Stoughton Diesel	Total	118,656,844	22,160	19,210	3,241	1,491	1,048,400	24,688,173
	Difference from No-Build	-240,348	-40	-46	1	1	-1,956	-29,166
Whittenton Electric	Total	118,695,960	22,170	19,169	3,240	1,490	1,048,554	24,667,849
	Difference from No-Build	-201,232	-30	-88	0	0	-1,801	-49,490
Whittenton Diesel	Total	118,710,886	22,170	19,227	3,241	1,491	1,048,908	24,703,175
	Difference from No-Build	-186,306	-30	-29	1	1	-1,448	-14,164

1 VMT represents the vehicle miles traveled on an average weekday in 2035.
2 The Build Alternatives used for the air quality analysis include the physical and operational mitigation proposed to improve traffic operations (as outlined in Chapter 4.1, *Transportation*).
Note: Includes transit-related emissions changes (bus and rail).

4.9.5.2 Microscale Analysis Results

The air quality analysis evaluated the potential for impact of motor vehicles and train locomotives on hotspot locations around stations. Hotspot locations are typically congested intersections. USEPA guidelines require that the project intersections be ranked by their level-of-service and their total traffic volumes and that the air quality analysis model the highest three intersection in each ranking. The intersections in the study area were ranked based on traffic volumes and level of service. In order to ensure adequate coverage of the study area, additional intersections were added, one for each station site that would be impacted by station-related traffic. The microscale analysis included motor vehicle and train emissions to calculate worst-case concentrations.

The trains that would be used on the Build Alternatives could be electric or diesel. The electric trains do not emit air pollutants and would not have any contribution to air quality impacts on receptor locations around the stations. The microscale analysis, which typically focuses on motor vehicle emissions, added the emissions of the diesel commuter rail trains to the intersection receptor locations to calculate the highest concentrations of CO, PM_{10}, and $PM_{2.5}$. The results represent a worst-case condition. All of the pollutant concentrations are below (in compliance with) the NAAQS. The Build Alternatives would not substantially change any of the concentrations of CO, PM_{10}, and $PM_{2.5}$. All of the increases are less than 1ppm for CO and less than 0.3 $\mu g/m^3$ for PM_{10} and $PM_{2.5}$.

The results demonstrate that all alternatives would meet the NAAQS for CO, PM_{10}, and $PM_{2.5}$. The worst-case modeling results are presented in the tables in Section 4.9.3. The alternatives would not:

- cause any new violation of the NAAQS;
- increase the frequency or severity of any existing violations; or
- delay attainment of any NAAQS.

4.9.5.3 Greenhouse Gas Emissions

The Executive Office of Energy and Environmental Affairs (EEA) has developed a policy that requires project proponents to identify and describe the feasible measures to minimize GHG emissions. The Policy requires that projects quantify the project's direct and indirect GHG emissions and identify measures to avoid, minimize, or mitigate such emissions. Projects generate GHG emissions through the use of electricity and fossil fuels typically from building sources including boilers, heaters and internal combustion engines. EEA/MEPA's GHG policy requires that the analysis include a no-build, build, and build with improvements conditions. The build condition represents the stationary source emissions that would occur if the proposed Project were to be built using typical construction materials and rooftop equipment that are built to the Massachusetts Building Code. The build with improvements condition should include improved building materials and rooftop equipment, and renewable resources, such as solar, wind, geothermal, green power, and energy star measures.

While the alternatives would help reduce GHG emissions, there would be no buildings associated with the alternatives that would generate GHG emissions. The stations and layover facilities would all be open to the outside and would not need heating/air conditioning equipment. Therefore, the air quality analysis did not evaluate cumulative impacts by alternative, nor did it compare building under the current state building codes to proposed building with mitigation measures. Because no buildings are associated with any of the alternatives, no discussion and consideration of recommendations of the

Massachusetts Zero New Energy Building Task Force was included. In absence of buildings associated with the alternatives the air quality analysis did not include an evaluation of renewable energy sources and commitment to appropriate LEED and Energy Star elements.

The air quality analysis did evaluate the motor vehicle and train locomotive GHG emissions and did discuss a commitment to using train engine plug-ins and electric block heaters at layover facilities. All Build Alternatives represent a GHG mitigation measure because they are all designed to reduce vehicle miles of travel. All Build Alternatives would reduce GHG emissions as compared to the No-Build conditions. The GHG emission results by alternative are presented in Section 4.9.3. A discussion of GHG is also included in Chapter 5.

Indirect Effects

The mobile source CO_2 emissions indirectly resulting from the No-Build Alternative would be 74,676 tons per year (tpy). For the Stoughton Electric Alternative as compared to the No-Build Alternative, mobile source GHG emissions would be reduced as a result of reductions in VMT. The Stoughton Electric Alternative would indirectly result in 74,482 tpy CO_2 emissions, a reduction of 194 tpy. The total indirect changes in GHG emissions from mobile and stationary sources would be an increase of 32, 974 tpy over the No-Build Alternative for the Stoughton Electric Alternative. For the Whittenton Electric Alternative as compared to the No-Build Alternative, mobile source GHG emissions would be reduced as a result of reductions in VMT. The Whittenton Electric Alternative would indirectly result in 74,516 tpy CO_2 emissions, a reduction of 160 tpy. The total indirect changes in GHG emissions from mobile and stationary sources would be an increase of 33,008 tpy over the No-Build Alternative for the Whittenton Electric Alternative.

4.9.5.4 Air Toxics

The air quality study qualitatively evaluated the potential for impact due to air toxics, as required in The Secretary of Environmental Affairs Certificate on the Environmental Notification Form (ENF). Most air toxics originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners) and stationary sources (e.g., factories or refineries).

Mobile sources emit “hazardous air pollutants” or air toxics that can cause cancer and other serious health effects. The Clean Air Act provided an initial list of 188 hazardous air pollutants, 93 of which USEPA has identified as being emitted by mobile sources.[18] The Clean Air Act also required USEPA to conduct research on human health effects of air toxics and prescribed the approach to setting emissions standards and other regulatory requirements to control air toxic emissions. Specific to mobile sources, Section 202(l)(2) of the Clean Air Act requires USEPA to set emission standards to control air toxics from motor vehicles and motor vehicle fuels. Unlike the criteria pollutants for which NAAQS are established, the Clean Air Act did not grant USEPA the authority to establish health-based ambient air quality standards for MSATs. As part of the 2007 Control of Hazardous Air Pollutants from Mobile Sources rule, USEPA identified seven compounds with substantial contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 1999 National Air Toxics Assessment (NATA). These are acrolein, benzene, 1,3-butadiene, diesel particulate matter plus diesel exhaust organic gases (diesel PM), formaldehyde, naphthalene, and polycyclic organic matter (POM).

For each alternative, the amount of MSATs emitted would be proportional to the VMT, assuming that

[18] U.S. Environmental Protection Agency. *Final Rule, Control of Hazardous Air Pollutants from Mobile Sources*, 72 F.R. 8427, February 26, 2007.

other variables such as fleet mix are the same for each alternative. The VMT for each alternative are presented above in Table 4.9-20. The VMT estimated for each of the Build Alternatives are lower than that for the No-Build Alternative, because any of the South Coast Rail alternatives would remove vehicles (and therefore reduce VMT) from the study area roadways by shifting mode choice to public transportation (i.e. the South Coast Rail). This reduction in VMT would lead to lower MSAT emissions for the Build Alternatives. The differences in VMT between the various alternatives would result in similar differences in the MSAT emissions.

Based on an FHWA analysis using USEPA's MOVES2010b model even if national VMT increases by 102 percent as assumed from 2010 to 2050, a combined reduction of 83 percent in the total annual emissions for the priority MSAT is projected for the same time period.[19] Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the USEPA projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in all cases.

4.9.6 Regulatory Compliance

4.9.6.1 MassDEP Air Quality Regulations

All of the pollutant concentrations at the receptors for all study intersections analyzed for the Stoughton Electric and Whittenton Electric Alternatives are well below (in compliance with) the MassDEP ambient air quality standards (310 CMR 6.0) for PM10 and CO which follow the USEPA guidelines under 40 CFR part 50. The South Coast Rail project would also follow all MassDEP regulations outlined in 310 CMR 7.0. The project would include the following (but not limited to):

- reduce single occupant commuter vehicle use;
- reduce overall emissions with the reduction of VMT; and
- require implementation of low sulfur fuel use on all construction vehicles.

4.9.6.2 General Conformity

As noted in Section 4.9.1.2, the South Coast Rail project is subject to General Conformity (Title 40 Code of Federal Regulations (CFR) Part 93, Subpart B). General conformity provisions only apply in nonattainment and maintenance areas. The project area is nonattainment for the 8 -hour ozone standard, therefore the relevant pollutants for consideration are the two ozone precursors- VOCs and NO_x. As a regional issue, microscale analysis is not applicable to ozone precursors. The long-term effect of the Stoughton and Whittenton Alternatives on VOC and NO_x emissions is beneficial (e.g. reduced emissions relative to the No-Build Alternative). Therefore, a conformity determination would not be required to address long-term operational emissions, even if such emissions could be practically controlled by the Corps. As discussed in Section 4.9.1.2, long-term operation emissions (such as from diesel locomotives under the diesel Build Alternatives), are not indirect emissions within the scope of General Conformity because the Corps cannot control them and has no continuing program control over the rail line.

However, General Conformity also applies to peak year construction emissions (unlike transportation conformity that exempts consideration of construction emissions if construction activities last less than

[19] http://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/aqintguidmem.cfm

five years in any one location). For the SCR project, construction-related emissions are a reasonably foreseeable consequence of the Corps' Section 404 permit decision. If construction emissions exceed certain de minimis criteria, a General Conformity determination could be required. The de minimis criteria for this project (ozone nonattainment area in an ozone transport region) are as follows:

- VOC- 50 tons/year
- NO_x- 100 tons/year

The construction schedule and staging of the Build Alternatives have not been defined in sufficient detail at this point in the development of the project to quantify construction period VOC and NO_x emissions for comparison to the de minimis criteria. The Corps would require the preparation of a General Conformity applicability analysis for peak construction year emissions of the preferred alternative prior to the NEPA Record of Decision. If the *de minimis* criteria are not exceeded, no further review would be required. If the criteria are exceeded, a General Conformity determination (including 30-day public review period) would be required prior to project implementation.

South Coast Rail Coordination

Ridership and traffic estimates associated with each alternative were developed and calibrated by the Central Transportation Planning Staff (CTPS) using its Regional Travel Demand Model (RTDM). The inputs for the RTDM included land use assumptions, transportation service assumptions, and modeling methods. The RTDM and the subsequent analysis were developed from information provided by and coordinated with various federal, state, regional, and local entities. Many parts of the model used in this analysis were examined and accepted by FTA as part of various New Starts and Environmental Review documents. The State of Rhode Island provided information to CTPS on the Rhode Island RTDM, including land use assumptions, and specific projects such as the TF Green Rail project. CTPS coordinated with the state of Massachusetts to ensure that utilized data was consistent across state agencies such as MassDOT and the MBTA in developing service plans. The Metropolitan Area Planning Council (MAPC), the Old Colony Planning Council (OCPC), and the Southeastern Regional Planning & Economic Development District (SRPEDD) provided information to CTPS as used in their last adopted Regional Long Rang Transportation Plan. This information generally consisted of land use assumptions, transit system details, and highway characteristics; both present and future. Local communities provided CTPS with information regarding details on where the stations would be located, the amount of parking that could be built, as well as other service characteristics. CTPS coordinated with the parties above and others in establishing appropriate planning assumptions for its Regional Travel Demand Model (RTDM).