The increased need for disposal of material dredged from numerous industrialized harbors in New England led to experiments in covering, or capping, contaminated material deposited on a level seafloor with cleaner dredged material. The assumption behind these experiments was that a sufficiently thick layer of sediment would isolate the contaminant from the aquatic ecosystem. Capping operations and associated monitoring programs were conducted as part of the Disposal Area Monitoring System (DAMOS) Program, a regional program initiated in 1977 by the New England Division (NED) of the US Army Corps of Engineers (USACE).

After more than 10 years of capping operations, enough data had been collected to warrant a retrospective volume. This monograph was compiled from three specific viewpoints :

- a historical review of capping operations from original experiments in Long Island Sound in 1979 to the present;
- a synopsis of the viability of capping as a dredged material disposal alternative;
- a practical description of capping and monitoring techniques for agencies considering this disposal practice.

When capping was first considered, technical operations were organized to address specific concerns formalized by the USACE after extensive consultation with the scientific community. These concerns included the adequacy of the available technology to point-dump; the difficulties associated with discriminating between cap and covered material; and the possibility that, on impact, cap material might displace the sediments to be covered. Not only have the concerns been addressed, but focusing on potential operational problems has also improved the techniques that have proved successful.

This monograph focuses on four early capping projects. A detailed record of both disposal operations and subsequent monitoring of these capped mounds provides a checklist of recommendations for a successful capping project. The results of the first experimental capping project (Stamford-New Haven), initiated in 1979, suggested that with careful navigational controls point-dumping at a taut-wired buoy could be used to form a discrete mound of contaminated dredged material. In addition, these results suggested that precise deposition of capping material, both at the center and at the flanks of the mound of contaminated material, could be accomplished with careful navigation and project planning.

A successful capping project requires an effective monitoring program in addition to pre-project planning and organized dredging and disposal operations. The DAMOS Program initiated a three-pronged approach to monitoring:

- ensure physical stability and complete cap coverage of the mounds;

- monitor the benthic ecosystem response and biological recovery rates;
- analyze the ability of the caps to isolate chemical contaminants.

Physical monitoring of the early capped mounds was accomplished primarily with acoustic and visual methods. These data indicate that capped mounds have been stable even after the passage of three hurricanes. There has been little evidence of erosion or physical breaching of capped mounds. Biological monitoring has confirmed that, in general, there has been no adverse effect on biota due to contaminants located within the mound (exception noted below). Whole-sediment chemistry data have been collected to assess contaminant levels at the surface of the capped mounds. These results have shown that contaminant concentrations of surface sediments have remained near background levels since capping. The term "contaminant" is used here to describe those compounds, either natural or anthropogenic, which, in high enough concentrations, may pose a human health threat.

Monitoring results have, however, also revealed problems during the developmental stage of some of the capped mounds. One capped mound in particular (MQR) showed signs of subnormal rates of biological recolonization. The complex disposal history of MQR did not conform to the idealized model of a capped mound, and, in fact, served to test the developing capping protocols. Complications discovered during monitoring were used to confirm the original recommendations for successfully capped mounds and to establish new guidelines for operational and monitoring procedures.

A coring investigation was initiated to resolve questions concerning the chemical integrity of the interior of the mounds. Many of the recovered cores showed a distinct chemical boundary between the contaminated material and the cleaner material of the cap, up to 11 years after capping. The investigation documented that the texture and distribution of contaminants in the disposed sediments depend to some extent on the dredging and disposal techniques used to form the capped mound.

Monitoring protocols have been refined since the initiation of DAMOS, and a new approach to monitoring has been developed that focuses on dredged material management. The new approach, known as tiered monitoring, uses a flow chart of monitoring approaches and results to help the dredged material manager make decisions on disposal and capping alternatives.

Final recommendations from the early DAMOS capping experience include specific tasks to be completed before, during, and after the formation of a capped mound. Pre-operational planning will ensure optimal conditions for a successfully capped mound. Dredge and disposal operations should be organized and well-documented; the use of precision navigation and a taut-wired, moored buoy to ensure precise disposal of dredged material are recommended. Finally, a reasonable and efficient monitoring program should be in place before dredging begins.