United States
Environmental Protection
Agency

Region I
J.F. Kennedy Federal Building
Boston, MA 02203

EPA

Environmental Impact Statement

Final

MDC Proposed Sludge Management Plan, Metropolitan District Commission, Boston, MA.

Part A

FINAL ENVIRONMENTAL IMPACT STATEMENT

MDC Proposed Sludge Management Plan,
Metropolitan District Commission, Boston, Massachusetts

Lead Agency:	U.S. Environmental Protection Agency Region I JFK Federal Building Boston, Massachusetts 02203
Cooperating Federal Agencies:	None
Responsible Official:	William R. Adams, Jr. Regional Administrator U.S. Environmental Protection Agency JFK Federal Building Boston, Massachusetts 02203
For Additional Information Contact:	Wallace E. Stickney, Director Environmental and Economic Impact Office JFK Federal Building Boston, Massachusetts 02203 Phone: 617-223-4635

Abstract:

This Final Environmental Impact Statement (EIS) evaluates a sludge management plan proposed by the Metropolitan District Commission (MDC) and examines other alternative systems; in an attempt to ensure the most environmentally sound and cost effective sludge management plan for the handling and disposal of primary sludge for the MDC system. Although the proposed project would involve 75% federal funding; the ultimate responsibility for implementing the selected sludge management plan lies with the MDC. The various alternatives analyzed and their environmental impacts are discussed in the EIS, and the selected alternative(s) identified.

No Administrative Action will be taken on this project until 30 days after notice of this publication appears in the Federal Register.

This Environmental Impact Statement (EIS) has been written in two parts and consists of Part A (this document) and Part B (Volumes I and II). Since this EIS was initiated there have been many changes in Federal legislation and several other Federal reports[1] have been written about the water cleanup effort in Boston Harbor. However, none of the legislative changes release the Metropolitan District Commission (MDC) from their obligation to provide an environmentally acceptable method for disposing of the primary sludge now generated (and which will continue to be generated) at the treatment plants. This obligation exists whether or not the MDC is granted a waiver from the secondary treatment requirement.

Part A of this EIS was written to reflect these changes in legislation, and the results and concerns of recent studies which were not considered during the initial preparation of the EIS. Part B (Volumes I and II) contains references to federal policy which are no longer applicable and as a result, several of the conclusions reached and judgments made in Part B are no longer valid and have been appropriately changed as discussed in Part A.

In order to provide the reader with a complete picture of the decision process and to disclose all of the available information, we are circulating both Parts A and B. Please note that Part B should be read in conjunction with Part A to clarify its content. Further, information which has changed because of change in federal legislation, policy, regulations or guidelines is screened and appears as lighter type in Part B to advise the reader that those conclusions and judgments have changed based on information discussed in Part A.

---

[1]These are:

a. Draft EIS on the Upgrading of the Metropolitan Area Sewage System
b. Draft Areawide Waste Treatment Management Plan for the Metropolitan Boston Area
c. National Science Foundation Draft Final Report - Wastewater Treatment Facilities Planning in the Boston Metropolitan Area - A Case Study

PART A

FINAL

ENVIRONMENTAL IMPACT STATEMENT

MDC PROPOSED SLUDGE MANAGEMENT PLAN,

METROPOLITAN DISTRICT COMMISSION, BOSTON, MASSACHUSETTS

Prepared By

U.S. Environmental Protection Agency
Region I
Boston, Massachusetts

Approved By:

William R. Adams, Jr.
William R. Adams, Jr.
Regional Administrator

March 15, 1979

TABLE OF CONTENTS

PART A

PREFACE

The Environmental Protection Agency (EPA), along with the Commonwealth of Massachusetts and the Metropolitan District Commission (MDC) have consistently been concerned with the continued degradation of water quality in Boston Harbor. The goal of these and other agencies has been to improve the Harbor's water quality with the resultant increased potential for recreation and use as a commercial fishery.

The discharge of digested primary sludge from the Nut and Deer Island treatment plants has been identified as a contributor to the Harbor's present poor quality. Both State and Federal Agencies agree that top priority should be given to solving this problem.

This document is the latest attempt in a series of technical and environmental studies, the purpose of which is to determine the most cost-effective and environmentally sound method for handling the sludges resulting from primary treatment.

In 1974, the MDC, which has responsibility for collection and treatment of sewage in the Metropolitan Boston area, began to design an incinerator with a waste heat recovery system to dispose of the sludge thus removing the discharge from the Harbor. Based on a report prepared for the MDC by the engineering/consulting firm of Havens & Emerson, the MDC proposed to locate three multiple hearth incinerators on Deer Island next to the existing primary treatment plant. Sludge from the Nut Island treatment plant would be pumped across the Harbor in an underwater pipeline to Deer Island for incineration. Their proposal also called for the resultant incinerator ash to be put in a landfill or a diked area adjacent to Deer Island.

Because of the public controversy surrounding construction of incinerators on Deer Island and EPA's own concern about the environmental impact of the incinerators, EPA initiated the environmental impact statement (EIS) process under the National Environmental Policy Act (NEPA) to study the proposed plan and available alternatives. Particular attention was given to the alternatives of land disposal of the sludge which MDC had evaluated in its facilities plan. Further, the possible coincineration of the sludge with solid waste from the Boston Metropolitan area was studied by the MDC on an EPA grant and the results of that study were included in the EIS. After three years of study and continuing public debate, EPA has concluded that incineration represents the most feasible and the least environmentally adverse option currently available for alleviating the continuing water quality problem created by the present sludge disposal method.

The technology and the regulations for dealing with the handling and disposal of sludge produced by municipal wastewater treatment plants are still evolving. Both EPA and the Commonwealth of Massachusetts continue to seek alternatives which might make use of the nutrient resources in the sludge. Therefore, we wish to place our recommendation for incinerators in the following perspective: Although the EIS indicates that, in order to provide continuing capability to dispose of the primary sludge and thus keep it out of Boston Harbor, the incinerators will need to be constructed, we would like to minimize the potential for air quality problems associated with them. To this end, the MDC has agreed to continue to investigate the feasibility of composting the primary sludge. In addition, EPA will condition any grants to MDC on this project to require that MDC will continue and build upon its program of composting and subsequent land disposal in consonance with findings of that feasibility study. EPA is willing to support and fund the construction costs of composting as an adjunct or alternative to incineration where it can be demonstrated that it would be environmentally sound and cost effective to do so.

Although the MDC's demonstration sludge composting project has terminated, EPA recommends that a composting operation be conducted by the MDC during the feasibility study. EPA believes that an operational, continuous composting program would serve to compliment the feasibility study. The twofold purpose of this will be to determine the technical, marketing and use opportunities for the production and disposal of a sludge based compost, and to actually dispose of as much of the digested sludge by composting as is practical.

We are critically aware of how the increasing shortages of resources in the future will make the nutrient value of sludge a commodity for which reuse will be the most cost-effective disposal method. We feel that the Joint Group of Experts on the Scientific Aspects of Marine Pollution meeting in October 1974 stated the most comprehensive and best long-term policy towards sewage sludge disposal when they said, "Ideally, the only ultimate method of eliminating waste disposal is recovery and reutilization of the materials presently considered to be wastes; other disposal options merely remove material from one part of our environment to another." However, until steps are taken to ensure that sludge can safely and economically be recycled (e.g., industrial pretreatment), some interim solution to the sludge management problem must be implemented. We believe that the proposal of this EIS, with its recovery of some of the thermal value of the sludge, is an economically and environmentally sound interim solution, but that we, the Commonwealth, and the MDC must look forward to a long-term solution. We are convinced that the actual operation of a composting program at Deer Island is the first step in that direction and expect that when the incineration facilities proposed by this project have reached the end of their useful engineering life in 15-20 years, that the technologies and economic factors affecting sludge reuse will have progressed to the point where those interim facilities will no longer be needed.

Much of the study relating to the impact of incinerators has focused on the decision as to the proper location and method of disposal for the resultant incinerator ash. During the period of preparation of the Final EIS, the question existed as to whether municipal sludges which contain materials resulting from industrial discharges would be considered to be "hazardous" under the Resource Conservation and Recovery Act (RCRA), thus requiring very high degrees of leachate control. EPA is currently in the process of developing regulations which would implement the intent of RCRA. Rather than continue to hold up the EIS for evaluation of ash disposal options, we are providing our findings to date and are prepared to fund further study by the MDC for the disposal of the ash while they proceed with design of the incinerators. We will not authorize funds for construction of the incinerators until after an environmentally acceptable ash disposal plan has been developed.

In summary, EPA is publishing this Final EIS, but with the admission that the environmental impacts of all the component elements have not been completed. We are taking this course of action because we believe that further theoretical analysis of the alternatives at the federal level will not be as effective in solving the problems of sludge management as practical planning action at the state and local levels. At those levels technical and environmental studies will continue to evaluate the extent to which composting of sludge will be a feasible and practical adjunct or alternative to incineration of the sludge, and perform an on-the-ground analysis by the MDC of the best location for an ash disposal facility. Should the follow-up environmental studies produce new information that would lead to conclusions not adequately supported by this Final EIS, EPA will publish a supplement to the Final EIS before authorizing construction funds.

SECTION I

Background

The Metropolitan District Commission (MDC) is a state agency, which is responsible for construction, maintenance and operation of water, sewer and recreational facilities for the cities and towns within the Boston metropolitan area. As such, the MDC owns and operates the metropolitan sewage system which collects industrial wastewaters and municipal sewerage from the MDC's 43 member communities, and conveys the sewage to two treatment plants located in Boston Harbor which treat the sewage prior to discharge. The two existing treatment plants are located at Nut Island, in the city of Quincy, and Deer Island, a peninsula which is part of Boston located southeast of the Point Shirley area of Winthrop. The Nut Island treatment plant serves the MDC southern service area consisting of 21 communities, which are generally residential in character, and certain portions of Boston. It processes an average daily sewage flow of 130 million gallons per day. The Deer Island plant serves the more industrialized areas of Boston, Cambridge and Somerville to the north as well as the northern suburban communities and processes an average daily flow of 320 million gallons per day.

Both of these plants provide primary wastewater treatment. Primary treatment involves the settling out by gravity of the heavier or grosser solid particles. The effluent from both plants is chlorinated to destroy pathogenic or disease causing organisms and is then discharged to Boston Harbor off Deer Island and Quincy Bay. The material removed from the sewage by the primary treatment process is called primary sludge and contains organic as well as inert materials including nitrogenous compounds, sand, grit and oil. It can also contain heavy metals, pesticides and some potentially dangerous organic materials such as PCBs.

At both locations the sludge is subject to a process called digestion which changes some of the organic constituents into usable methane gas which is utilized. Digestion reduces, but does not eliminate, one pollution-causing aspect of sludge by reducing the nitrogenous content of the sludge by about 40% and also helps recover energy from this waste product. After the sludge has been digested, it is mixed with chlorinated effluent and discharged into President Roads, the main channel in Boston Harbor. In an attempt to insure that the discharged sludge is carried out to sea and does not stay in the Harbor, it is discharged only during outgoing tides. The discharge of sludge is a significant contributer toward the total pollution problem of Boston Harbor and is contrary to the provisions of the Federal Water Pollution Control Act and the Federal Marine Protection Sanctuaries and Research Act.

The EPA is the federal agency charged with assisting municipalities and regional agencies in complying with federal water pollution control laws. As such, EPA issues and enforces the federal permits MDC holds that allow the effluent and sludge discharges and administers and grants federal monies appropriated by Congress to help communities and authorities comply with the law. In order to meet standards and deadlines set by its permit and the law, MDC intends to apply to EPA for a federal grant to purchase and construct equipment and facilities needed to manage the MSD's primary sludge. Since the method proposed by the MDC, as well as alternatives to that proposal, would cost in excess of $20 million and would have a potential for significant beneficial as well as negative environmental impacts and also because there had been significant public interest and opposition to some elements of the proposed project, EPA is required under the provisions of the National Environmental Policy Act to prepare an Environmental Impact Statement (EIS).

The environmental impact process consists of two phases: A draft document which, in this case, was published for comment in February of 1976, and this Final EIS in which EPA makes a final decision on the project which we consider to be the most cost-effective and environmentally sound and, therefore, which we will consider eligible for federal funding. Often in the case of large and complicated projects, information is developed during the design phase which results in a modification of some of the details of the project. If these modifications result in significant impacts significantly different from those we currently anticipate, a revised Final EIS may be required.

SECTION II

Summary of Proposed Action

The action proposed in this Final EIS is for the granting of funds by EPA to the MDC to design and eventually construct all necessary facilities and equipment to collect and dispose of the primary sludge generated by by the Metropolitan Sewerage District. The project would provide for the pumping and piping of the southern area sludges to Deer Island by means of two high-head, non-clog centrifugal pumps and by extending the existing sludge outfall pipe and building one completely new pipe. The existing sludge discharge line from Nut Island would be extended from its present terminus on Long Island, across President Roads to Deer Island. The new sludge force main would be constructed parallel to the existing line along the mud flats near Long Island and thence across the Harbor to Deer Island.

At Deer Island the sludge from the northern service area along with the Nut Island sludge would be chemically treated, vacuum filtered and incinerated. Incinerator equipment would consist of three multiple hearth units with a total capacity of 128 tons (dry weight basis) per day. The units would be operated two at a time with one unit for standby. The incinerators would be designed to operate autogenously (without the use of supplementary fuel) and heat would be recovered and used to generate electricity for use at the plant.

Installation of air pollution control equipment would be required on all incinerators to insure that any air quality impacts would be minimized. Incinerator emissions would be controlled by use of a Venturi-type scrubber with a 42" H_2O pressure drop through the scrubber.

In an attempt to encourage and foster growth of recycling sludges, and thereby reduce the amount that must be incinerated, the MDC has agreed to pursue its investigation of the feasibility of composting MDC sludge and will dispose of as much sludge by composting as market conditions and operating costs allow. Items to be included in this investigation are as follows:

- Determine the potential demand for composted primary sludge within the Boston Metropolitan area, particularly for use on public and non-food producing lands.

- Determine the quantities of sludge that can be composted relative to this potential demand.

- Evaluate the technology of composting primary sludge, including the MDC's pilot project.

- Evaluate site requirements and locations.

- Prepare a preliminary design for a composting project sized to meet the potential demand.

- Develop an appropriate marketing and distribution system.

- Assess the public health, energy, and resource recovery impacts associated with the project.

- Evaluate legal, institutional, financial and managerial constraints associated with the composting project.

- Estimate construction, operating and maintenance costs and possible revenue related to the project.

EPA recommends that the MDC conduct permanent and continuous sludge composting to the full extent that the feasibility study determines is practical. EPA will also provide MDC with facilities planning financial support to perform the feasibility investigation and evaluate composting as a larger scale alternative for ultimate disposal. Where it is determined that total composting is more environmentally sound and cost-effective than incineration, EPA would fund the construction costs of composting as an alternative to incineration. Deer Island will initially be considered as the composting site, but alternative sites and transportation requirements will be considered.

EPA will require as a condition of federal grants on this project, that as part of the MDC's feasibility study on composting they will conduct an actual composting operation in order to dispose of as much of the MDC primary sludge as is currently possible and practical. EPA feels that in addition to currently being able to dispose of a portion of the primary sludge through composting, small scale composting at this time would help to refine the technical questions that exist and help build a market for the compost product.

SECTION III

Areas of Controversy

As part of the EIS process, a draft document was published and circulated. Comments received on the Draft EIS were responded to and incorporated into the final document. These comments, as well as EPA's interactions with the MDC, various Department and Divisions of the Commonwealth, other governmental agencies, and community-based groups have surfaced many areas of concern and controversy. The EIS process has not resulted in a sludge management plan which will satisfy the requirements and desires of all parties who commented on or were involved in the process. However, we believe that all reasonable alternatives have been investigated or provisions have been made for them to be investigated thoroughly, and decisions have been made which reflect a sensitivity to the concerns and issues involved. We will only attempt to highlight what we feel to be the major areas of controversy.

1. There was a general feeling expressed by many commenters that the destruction of sludge by incineration results in the loss of a resource, creates adverse air quality and other environmental impacts and that there are other land-based alternatives available which are much more preferable. We agree that incineration is not the ideal long-term solution, but in order for any recovery or reuse option to be viable, it would require the implementation of pretreatment regulations, the institution of other programs to reduce the metals/toxic content of the sludge, and the development of the technologies, policies and regulations needed to ensure safety. All these developments will take a considerable amount of time to implement. Meanwhile, the discharge of sludge and its adverse impacts which we feel are much more serious than those associated with incineration will continue. We do not feel that the incineration of sludge now will prevent or hinder the MDC from exercising land disposal options in the future. In fact, the composting elements of the recommended solution will help overcome some of the obstacles that presently exist in implementing a land disposal option.

2. Considerable controversy has been generated by the potential air quality impacts the proposed incinerator will have on communities near the Deer Island site, especially the town of Winthrop. EPA believes that the proposed incinerators can be designed and constructed with pollution control devices which will reduce the emissions to levels which will not cause air quality violations. The air quality modeling done in the EIS indicated that all of the federal ambient air quality standards (Primary and Secondary) will be met. Much concern has been expressed by the residents of communities which may be impacted by the incinerators, that emissions meeting federal standards are no assurance that human health and welfare will be protected. EPA sets the National Ambient Air Quality Standards specifically for pollutants of nationwide concern that have known adverse effects on human health in order to provide such assurance. Based upon data and research, Primary and Secondary standards are established. Primary standards specify the highest concentration of a pollutant in the atmosphere that can be tolerated without endangerment to

the public health. Secondary standards (usually more stringent than the Primary) are established at a level needed to protect the public welfare from adverse effects, e.g., crop damage, animal diseases, etc. Although compliance with federal standards is not an absolute guaranty that all risks from incinerator emissions will be eliminated, EPA believes that standards do reasonably ensure and safeguard against the adverse effects associated with regulated pollutants.

Aside from the National Ambient Air Quality Standard pollutants, concern has been registered over emissions which would result from the heavy metals of the MDC sludge, specifically mercury and cadmium. Mercury is considered a "hazardous pollutant" by EPA and as such, special emission standards have been established to ensure that increases in morbidity or mortality would not result from any source emitting mercury. The predicted mercury emission rate is well below the regulated allowable levels, however, the MDC will be required to sample and report its actual mercury emissions at least once a year to ensure safety and compliance.

Emission limitations do not currently exist for cadmium. The expected concentrations of cadmium were calculated and found to be well below levels heretofore associated with harm to human beings.

Controversy exists as to whether any emissions resulting from incineration are to be tolerated. While EPA does not deny the fact that certain pollutants will be emitted as a result of sludge incineration, we do believe that compliance with Federal and Commonwealth air quality standards will ensure that significantly reduced air quality does not result. Further, these air quality impacts will not result in a danger to human health or welfare.

Concern had been expressed that air quality emissions of the proposed incinerators have been "modeled" or "predicted" along with expected 1985 background concentrations and that actual levels might be higher. While EPA has confidence in these modeling efforts and believe them to be accurate representations of future conditions and expected emissions, we will require further air monitoring to be conducted during the updating and additional facilities planning, and design stages of this project.

Additional air quality monitoring will be performed to determine with more certainty the actual levels of air pollutants and the locations of the highest of those levels. Monitors will be placed near sensitive receptors and areas where the modeling efforts indicated potential emissions problems. The monitor will most likely be located in the Point Shirley or Winthrop area. Pollutants to be monitored are: No_x, Total Suspended Particulates (TSP), Lead and SO_2.

3. Civic groups in Winthrop have shown strong opposition to the addition of any further facilities on Deer Island. That opposition has been based on the fact that the impacts of any increased construction traffic on the community would be severe and the feeling that the existing prison and sewage treatment plant and the proximity to Logan Airport has

resulted in the Town being subjected to an inordinate amount of environmental stress. EPA and the MDC, after exhaustive studies can find no alternative site for sludge disposal facilities which would be as cost-effective and have less of an environmental impact. In an attempt to reduce the impact on the community of Winthrop and in particular to mitigate the construction related impacts on that community, we will include as part of EPA's construction grant conditions (based on an evaluation) to the MDC, the requirements that the transportation of construction materials and equipment to the Deer Island site be by barge, and that access to the site by construction workers in private autos be severely restricted and the use of shuttle buses be substituted. These grant stipulations will be required of the MDC unless it is demonstrated that the costs of these mitigating measures would be excessive or unreasonable, or that greater adverse environmental impacts would result. The shore-based facilities to be constructed in support of the barging operations should be permanent for future use in MDC operations. The MDC will incorporate in its specifications and other design and contractual documents a requirement for the above. The MDC will specify sites for the shore-based facilities and the shuttle bus parking lot, and will perform an environmental assessment to insure that their selection minimizes the socio-economic and natural environmental impacts. With respect to shuttle busing, the MDC will be required to submit a transportation management plan with an environmental assessment for approval to EPA. This plan and associated assessment is to be coordinated with the involved communities. We feel the air quality impacts of the incinerator will be minimal and the aesthetic and noise impacts can be mitigated by design features and operational precautions.

4. Some concern has been expressed regarding the possibility that future sludge disposal options may be limited by the construction of the primary sludge incinerators. Specifically, as the treatment process is upgraded or flows increase and more sludge is generated, there will be pressures to expand the existing incineration facilities rather than looking at alternative disposal methods.

The EIS for upgrading the level of MDC's sewage treatment plant looked at the disposal options available and recommended a composting option. We feel that even if a waiver to secondary treatment is granted, the fact the pretreatment is being implemented and a composting operation being continued indicates that the MDC and EPA are very serious about developing non-destructive options to sludge disposal. We both look at incineration as an interim and relatively short-term alternative to be utilized until such time as other future options become practical, cost-effective, and safe from an environmental and public health point of view.

5. The final major area of controversy surrounding the project concerns the fact that the construction of an incinerator on Deer Island is not wholly in compliance with the Boston Harbor Island Plan. EPA feels that the plan, which includes reference to an expanded sewage treatment plant on the Island, is not being violated by the proposal for

an incinerator. Any other alternative site in and around the harbor, except possibly Spectacle Island, would be more crucial to the recreation objectives of the plan than the Deer Island site.

We feel that these are the major areas of controversy. We understand, however, that other individuals or organizations, because of local interests, may feel that they have serious concerns and objections to the project other than those mentioned here. All of the areas of concern which were commented on at the Draft EIS stage are in Part B, Volume I of this document and an attempt is made to respond to all of them.

SECTION IV

Issues to be Resolved

There are certain aspects of the proposed project which are not completely addressed in the EIS and which will require further environmental and feasibility studies to determine how the detailed aspects of the incineration alternative will be implemented. These additional studies will be performed by the MDC as part of an updating of the facilities planning effort and prior to the facility design phase of the project. Specifically, a historical evaluation and archeological survey of Fort Dawes and a §404 evaluation for the dredging and filling associated with the project will be completed. This update will also include such tasks as: characterization of the sludge and determination of quantities, updating of cost estimates, technical evaluation of dewatering, and a reevaluation of pumping vs. barging of sludge from Nut to Deer Island. Upon completion of the Step I updating work, the facility design phase of the project will be initiated. While Step II design proceeds, additional Step I facilities planning will be performed to: determine the actual method and location of ash disposal, and to study the feasibility of sludge composting and conduct a pilot composting operation.

Part B of the Final EIS analyzes ash disposal options for the project and makes the recommendation that if the incinerated sludge ash is determined to be hazardous it shall be disposed of in a landfill on Deer Island in order that all of the rain water leached through this material can be recovered and treated. If the ash is judged not to be hazardous as defined by regulations pursuant to the Resource Conservation and Recovery Act, it is proposed to be barged to Spectacle Island for disposal. The MDC had originally proposed to dispose of the ash in a cofferdammed area off the shore of Deer Island. This option was rejected by the EIS on the basis of federal policy at that time. The thrust of this policy was that construction on floodplains or wetlands could not be allowed if a practicable alternative existed. Because the proposed cofferdammed area was so clearly subject to this policy, EPA rejected the proposal without conducting a full-scale wetland/floodplains environmental analysis. Changes in a recently issued Presidential Executive Order and EPA's implementing regulations now require that such an analysis be performed. It is EPA's recommendation that the MDC perform such an assessment in continuation of its planning work so as to determine the full impacts of all ash disposal options and to select the most environmentally sound one. When this work is complete, EPA will fulfill its responsibilities under NEPA and amend the Final EIS if necessary.

The sludge management plan will require a §404 dredge and fill permit to be issued by the U.S. Army Corps of Engineers (COE). The construction of a cross-harbor sludge line will require some dredging, the construction of a barge pier will require a COE permit and may involve some filling and, finally, depending on the ash disposal method selected, a dredge/fill permit may be required. It will be the MDC's responsibility to perform the necessary environmental studies for submission to the COE when the permits are applied for. These studies will be performed in light of

EPA's Guidelines for the Discharge of Dredged or Fill Material into Navigable Waters (Federal Register, September 5, 1975). These guidelines will require an analysis of the physical, chemical, and biological impacts of placing ash in an open water or wetland area. Consideration will be given to impacts on: water quality; fish spawning and nursery areas; shellfish beds; food chain; wildlife areas; wetlands serving important biological functions; and aesthetic, recreational, and economic values. If analysis indicate that impacts on these resources would be unacceptable or contrary to the public interest, the permit would be denied. The MDC can reference this EIS's discussions of available alternatives and need for the project when preparing that 404 evaluation.

Finally, the EIS did not complete its study of the impacts of the project on the historical assets of Deer Island. The construction of the incinerator and ash disposal will impact other assets on Deer Island, specifically Fort Dawes. The full impact of the MDC sludge disposal operations upon the historical/archaeological assets of Fort Dawes has not been determined. This evaluation will be performed during the facilities planning update and a determination and report will be published prior to proceeding with Step II design or the start of any construction.

SECTION V

Consideration of Alternatives

During preparation of the Draft EIS, four basic broad alternatives were considered and analyzed in detail. They were: Ocean Disposal, Incineration, Land Disposal, and the alternative of No Action. Detailed analyses of these alternatives were performed based on their use of resources and energy, their economic costs, and their social and environmental impacts.

During preparation of the Final EIS, the original alternatives presented in the Draft EIS were reevaluated in light of new information developed, and federal guidelines and regulations issued between the writing of the Draft and Final EIS. In addition, early in the preparation of the Final EIS the alternative of coincineration was evaluated but eventually eliminated.

A. Alternative Analysis - Level 1

The first level of analysis involved investigation of the following four alternatives:

1. No Action - Continued digestion of sludge and discharge to President Roads on outgoing tides from both Deer and Nut Islands.

2. Ocean Disposal - Barging of dewatered sludge from Deer Island for dumping at a deep water offshore location.

3. Land Application -

- Dewatering and land application on private farmlands
- Dewatering with 50% for land application on private farmlands and 50% disposal in a landfill
- Dewatering with production and marketing as a fertilizer

4. Incineration -

- Dewatering, incineration with energy recovery in three multiple hearth incinerators and disposal of ash residue
- Incineration of the MDC wastewater sludges with solid waste from the City of Boston

1. No Action

a. Explanation of Alternative (Existing System of Disposal)

Under the No Action alternative the present method of primary sludge disposal would continue to be utilized. No additional facilities would be constructed and only routine and periodic maintenance and reconstruction would take place.

Presently the primary sludge from both the Deer and Nut Island primary treatment plants is anaerobically digested to reduce the volume and organic content of the sludge. Lime is added to aid in digestion. The digestion process produces methane gas which is used for power generation at the treatment plants. The digested sludge from both plants is disposed of by discharging to the President Roads area of the outer Harbor. The present practice consists of mixing the digested sludge with chlorinated primary effluent and discharging it for four hours at the beginning of each ebb tide. This is done in an attempt to insure that as much of the sludge as possible is carried on the outgoing tide away from the harbor. In fact, according to the July 1971 report prepared by Hydroscience, Inc. for the Massachusetts Division of Water Pollution Control (DWPC), it was determined that approximately 80% of the sewage sludge is carried out to sea with the remaining 20% returning to the harbor on the next flood tide. This results in the deposition of 15-20% of the discharged sewage sludge solids west of the outfalls near Deer Island. In addition to the sludge a minor amount of ash from a screenings and grit incinerator is pumped to the Nut Island sludge discharge line.

b. Impacts

Water Quality - The discharge of sludge from both MDC plants is a significant contributer to the total water pollution problem of Boston Harbor. It has been identified as such by numerous studies sponsored by the EPA and the Commonwealth as a result of the 1968-1971 enforcement conferences on the pollution of Boston Harbor. Those studies were performed to make specific recommendations regarding actions to be taken to improve the water quality of the Harbor to the point where it would meet the standards applied to it.

One of the specific recommendations in the final enforcement conference report was that "alternative sludge disposal methods must be found" for the Deer and Nut Island sewage treatment plants. The report stresses the impact the Harbor's poor water quality had on shellfishing and stated that "substantial economic injury results from the inability to market shellfish or shellfish products due to pollution" of the Harbor's waters. The majority of the shellfish beds in Boston Harbor were and are still closed. While the sludge discharges have never been attributed as the cause of shellfish closures, it is reasonable to conclude that the known heavy metals and other toxic materials present in the sludge are not beneficial to the biotic population of the harbor's waters.

In addition, water quality has affected the use of existing recreational facilities and the development of the full recreational potential of the Harbor, its surrounding shores, and islands. It is also reasonable to conclude that water quality is adversely affected by the more than 20% of the sludge discharges to President Roads that actually reenters the Harbor and is deposited there. The presence of these sludge deposits, with their toxic constituents, will be a restraint on plans for the future recreational development of Boston Harbor. In light of both the Commonwealth's and MDC's commitment to the development of the harbor islands as a recreational resource we see the solution to the sludge disposal problem as being a critical step in that development.

EPA is mandated to develop programs, enforce laws and regulations, and grant funds, in order to improve the quality of the surface waters of our Country. To that end we have worked with the Commonwealth to establish standards for water use which will limit the amount of pollution a water body will have to tolerate. In the case of Boston Harbor a standard of "SB" has been established. This classification means that its waters should be "suitable for bathing and recreational purposes including water contact sports". It should also have "good aesthetic value and be suitable for certain shell fisheries with depuration." The MDC in its report before the 1971 enforcement conference stated that "it is evident that the existing sludge discharges directly interfere with these assigned uses." EPA totally concurs with that finding.

Past experiences here in Boston and other areas where massive amounts of sewage sludge are disposed of to the marine environment have indicated that the hitherto unforeseen future impacts of such actions may be much more serious than the more predictable near-term impacts. Specifically the anoxic condition that occured in the sludge disposal area off New York City and New Jersey may be taken as a warning against the long term dumping of sludge. The discharge each day of over 100,000 dry lbs. of sludge solids to Boston Harbor does have an extremely severe adverse impact on the water quality of Boston Harbor. The inability of the Harbor to assimulate those waste products and maintain its classification has adversely affected its present shellfishing and recreational uses and has inhibited the future development of those resources.

<u>Economic Impacts</u> - The immediate capital cost of the No Action alternatives is zero but the long-term monetary implications to the MDC and the Boston area are very unfavorable. The facilities for digesting, pumping and piping the sludge are aging and will need replacement shortly. Since those facilities could not comply with the federal laws requiring cessation of sludge discharges they could not be eligible for an EPA grant which would provide reimbursement for the majority of the replacement costs of those facilities.

The economic loss to the area due to the unproductive shellfish beds and the lost recreational opportunities has not and probably could not be calculated. However, these very serious losses should be considered; the No Action alternative still costs the taxpayers, industry and commerical interest in the Boston area a significant amount of money.

Other Impacts - Since the discharge of sludge to the Harbor involves few interfaces with elements of the natural and man-made environment other than the Harbor and its biota, it has little if any impact on those other elements.

c. Implementation Considerations

EPA, the Commonwealth and MDC's concerns regarding the future discharge of sludge to the Harbor reflect the same concern which prompted the passage of legislation to require that such practices be eliminated. Both the Federal Water Pollution Control Act and the Marine Protection Research and Sanctuaries Act expressly prohibit the discharge or dumping of municipal wastewater sludges in rivers, harbors or the ocean. The reason for this prohibition is clear.

In 1970 the Congress had considered a report by the Council on Environmental Quality which noted that rapidly growing amounts of sewage sludge were being disposed of to the oceans and estuaries of this country, that they contained heavily concentrated toxic materials and that they created serious environmental and health conditions. Among other recommendations the report concluded that the ocean disposal of even stabilized sludges should be stopped and that "high priority should be given to protecting those portions of the marine environment which are biologically more active, namely, the estuaries and the shallows near shore areas in which many marine organisms breed or spawn. These biological areas should be delimited and protected." This finding makes it explicit that national policy was concerned not only with the impacts of these and other wastes on the deep ocean but also the more sensitive near shore areas.

In addition to the statutory prohibitions, MDC's present discharge permit, issued pursuant to the Federal Water Pollution Control Act (FWPCA) requires that the MDC cease the discharge of sludge. Failure to comply with this permit will place the MDC in violation of the federally issued permit and federal law, and thus subject the MDC to the remedies provided. These prohibitions are the most serious implementation problem associated with this option.

d. Summary of Analysis

Because of its severe water quality impacts, as reflected by its basic illegality, the no action alternative is considered unacceptable.

Elements of Proposal Common to all Action Alternatives

The determination of the EIS was that consolidation of facilities at Deer Island represented the most cost efficient and environmentally acceptable method of sludge processing. All of the final options studied involved digestion and dewatering of sludge and therefore include the following common element of pumping, piping and processing.

A new sludge pumping facility will be provided to transfer the sludge from Nut to Deer Island. These pumps will be high head, centrifugal, non-clog types with one used for service and the other for standby. The existing Nut Island sludge disposal line will be extended from the tip of Long Island to Deer Island and a new parallel sludge force main will be built across the 4.2 miles of Boston Harbor from Nut to Deer Island.

The digested sludges from the two treatment plants will be combined at Deer Island and then chemically conditioned and dewatered. At this point the three action alternatives to subsequently be discussed (ocean disposal, land application and incineration) propose different means of ultimately disposing of the digested dewatered sludge.

2. <u>Ocean Disposal</u>

a. Explanation of Alternative

The ocean disposal alternative consists of barging the dewatered Nut and Deer Island sludges from a dock/loading facility at Deer Island to a location approximately 70 nautical miles east of Boston known as the Murray/Wilkinson basin. The size of the barge/s and the number of trips per month/year needed were not developed in detail in the EIS since this alternative was eliminated fairly early in the process based on its associated environmental impacts, (discussed below) and the fact that the alternative is considered illegal and would, therefore, be impossible to implement.

b. Impacts

The ocean disposal of sludge has the potential for many adverse impacts on ocean sediments, the water column and the species of marine life which inhabit each of these. Due to the fairly high levels of heavy metals which would be present in the MDC's dewatered sludge, a marked increase in metals content would occur in the upper levels of sediment at and near the disposal site. These metals would be taken up by organisms which would inhabit the site and surrounding areas and could be passed on up the food chain to species which have a commercial use. The organic material in the sludge would cause a depletion of oxygen in the water column and an anoxic (no oxygen) condition in the sediments and the immediately adjacent water column. This would prevent the normal marine species which usually inhabit these areas from continuing to do so. Experience in the New York bight, the site of long term sewage sludge dumping, indicates that the area is totally devoid of all life and that the edges are inhabited by only the most tolerant species. In addition, the mixing of the sludge in the water column as it is dumped could result in contamination of surface water. This would allow heavy metals, toxic organic compounds, and pathogens to infect the plankton which larger species feed on and thus adversely affect the viability of commercial and recreational fisheries.

In light of the impacts associated with the ocean dumping of sludge the Congress passed the Marine Protection Research and Sanctuaries Act which prohibits the dumping of harmful sewage sludge into the ocean. Congress clearly recognized the dangers inherent in ocean disposal of harmful sewage sludge when in 1977 it passed this legislation. Congressmen William J. Hughes of New Jersey, the author of the provision, explained, "These sludges contain high concentrations of a number of metals. There are serious risks to marine life and also to humans if they should reach fish or shellfish that come from the dumping area. EPA has reported that sewage sludge dumped in 1974 in the Atlantic contained about 24 tons of cadmium and that sludge dumped in the New York bight alone contained about 2 tons of mercury. In addition, there exists the possibility that sludge dumping may contribute to the problems of excess nutrients in the ocean waters leading the algae blooms that deplete oxygen in the sea water and result in fish kills." Congressman Robert Leggett of California added that, "a large part of the opposition to elimination of ocean dumping stems from the fact that it remains the cheapest means of disposing of municipal wastes. The ocean dumping of sewage sludge usually cost $1.80 per ton while the alternative costs $5.00 per ton. My concern is that while it may be cheaper for the particular communities involved, it is quite likely very expensive for the nation as a whole. For example, the Department of Commerce has indicated that the shellfish industry has ceased harvesting in over 18.5% of the shellfish waters because of intolerable levels of pollution." The concern that congress had was emphasized when the House banned ocean dumping by a vote of 359 to 1 and the Senate followed suit by a voice vote.

Since this option has very few interfaces with elements of the natural and man-made environment other than the marine/water quality one, its impacts on other areas are negligible. The presence of a sludge barge and dock on Deer Island could have a minor adverse aesthetic impact and there is a possibility of odors from the barge and transfer facilities if proper operation and maintenance procedures are not followed. Since this alternative utilizes the most efficient method of hauling and requires no facilities for disposal it has the lowest monetary cost and is the most energy conservative.

c. Implementation Considerations

Appendix "O" of Part B, Volume II, "Review of Legal Measures and Policies Relevant to Ocean Disposal of Sludge" discusses the implementation problems and legal ramifications associated with the ocean disposal of sludge. The most important of these policies are the 1977 amendments to the Marine Protection Research and Sanctuaries Act of 1972 as follows:

Sec. 4(a) - The Administrator of the Environmental Protection Agency shall end the dumping of sewage sludge into ocean waters, ..., as soon as possible..., but in no case may the Administrator issue any permit..., which authorizes any such dumping after December 31, 1981.

Sec. 4(b) - ... the term "sewage sludge" means any solid, semisolid, or liquid waste generated by a municipal wastewater treatment plant, the ocean dumping of which may unreasonably degrade or endanger human health, welfare, amenities, or the marine environment, ecological systems or economic potentialities.

Legal interpretation of the law does not explicitly state that ocean disposal of sludge be unequivocally banned. It states rather that only sewage sludge which may unreasonably degrade the marine environment be prohibited from ocean dumping. Further, the question has arisen as to whether or not the disinfection of sewage sludge by energized electron treatment would be allowable for ocean spreading under the prohibitions of the Marine Protection, Research and Sanctuaries Act. EPA's Regional Counsel has rendered the legal opinion that this manner of disposal may be permitted under the act but only if it can be demonstrated that the dumping (spreading) will not unreasonably degrade the marine environment and that no practicable alternative exists.

The EPA Ocean Dumping Regulations published January 11, 1977, (40 CFR, Parts 220-228) require the cessation of the ocean dumping of any material which does not meet the EPA environmental impact criteria (40 CFR, Part 227, Subpart B) by December 31, 1981. This includes all sewage sludge presently being dumped. This regulation is fully consistent with the intent of the Marine Protection, Research, and Sanctuaries Act, as amended, (MPRSA), which states in Section 2(b) that it is the policy of the United States

> "to prevent or strictly limit the dumping into ocean waters of any material which would adversely affect human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities".

EPA, in following its mandate under the 1977 amendments and the Water Pollution Control Act established interim guidelines to determine the acceptability of material for ocean disposal. An analysis of the MDC's primary sludge (Table N-5, p. 96 of Part B, Vol. II) shows that it exceeded the criteria for mercury and cadmium many times over. As a result, during the early stages of alternative analysis in the EIS, the Ocean Disposal Alternative was eliminated because of the sludge's nonconformance with the interim standard.

In April 1978, EPA replaced the interim standards with final regulations. These require that material under consideration for ocean disposal be subjected to biological testing to determine if it has or will have toxic or long-term negative effects on marine biological organisms. EPA has not performed such bioassays on the MDC's primary sludge, nor are we requiring the MDC to do so.

In addition, first among those factors listed in Section 102(a) of the MPRSA, upon which EPA has based its criteria for regulating ocean dumping, is "The need for the proposed dumping." In its regulations, EPA has stated explicitly that a need for ocean dumping will be regarded as existing only when no practicable alternative to ocean dumping exists. An alternative is regarded as practicable when it is available at reasonable incremental cost and energy expenditures and when the overall environmental impact of the use of the alternative is less than that for the use of ocean dumping (40 CFR, Part 227, Subpart C).

Aside from the legal interpretations and ramifications of the Marine Protection, Research and Sanctuaries Act, EPA has rendered policy decisions with respect to the ocean disposal of sewage sludge. EPA's policy is based not so much on significant evidence directly attributed to actual harm at specific ocean disposal sites, but on the general concern of the scientific community over the continued addition of heavy metals, toxics and other pollutants to the ocean.

Former EPA Administrator Train, in previous decisions regarding the granting of permits for ocean disposal of sludge, established the framework for current EPA policy. In his decision on granting an interim ocean disposal permit to the City of Philadelphia, Train stated, "The scientific evidence surrounding this particular permit application can only be described as preliminary and, as indicated by the testimony at the hearing, is certainly subject to differing interpretations. To focus solely on whether the data show that a particular organism at the dump site has suffered adverse effects from the city's dumping activities is, in my view, to take an unnecessarily narrow view of the criteria established by Section 102 of the Act... we must take a broader view of what causes harm to that system."

Train went on to state in his decision that even assuming that no harm could presently be attributed to the ocean disposal of sludge at that point in time, it would be up to the applicant to show that continued or subsequent ocean disposal would not contribute to a general deterioration of the ocean or that such deterioration would not eventually cause adverse effects.

It is the long-term potentially adverse effects of ocean disposal which are currently unknown, and which continue to be of greatest concern to EPA. As a result, EPA policy seeks to guard against these unknown effects of ocean disposal which may only be realized in the long term. It is EPA's belief that the heavy metals, organohalogens, oils and greases contained in the MDC's primary sludge could undoubtedly "degrade or endanger human health, welfare, amenities, or the marine environment, ecological systems or economic potentialities." As such, EPA believes the MDC sludge would not qualify for acceptability for ocean disposal. The regulatory controls placed on ocean dumping require that the permittee or the party proposing to ocean dispose the sludge prove that the actions will not be harmful before a permit will be issued and that no practicable alternative exists. This shifting of the burden of proof from the regulatory agency to the proposing party, insures that only in cases where the evidence is overwhelmingly positive will permits be approved.

Thus, even if a sewage sludge could be treated so as to meet the environmental impact criteria, its dumping in the ocean would be permitted only when there was no practicable alternative. Because of the availability of practicable alternatives to ocean dumping, it is the policy of EPA that all dumping or other discharge of sewage sludge into the ocean shall be stopped as soon as possible, and that no new disposal of sewage sludge into the ocean will be permitted.

EPA feels that there has been no evidence to show that ocean disposal of sludge would not harm the marine environment. There is, however, substantial evidence which indicates that past ocean disposal practices have shown severe impacts in other areas. In addition, the MDC's sludges are known to contain heavy metals as well as substances which can be toxic or can bioaccumulate to the detriment of the marine environment. The unknown effects of sewage sludge, either ocean dumped or spread through dispersion, presents risks to the ocean's waters and biotic population which EPA, as an agency, seeks to avoid. As such, we would not be prepared to issue the necessary ocean dumping permits to the MDC and consequently, we could not fund a construction project which would not allow for compliance with Federal law.

d. Summary of Analysis

Because of the severely adverse marine/water quality impacts of ocean dumping which are reflected by its basic illegality, this option was eliminated from future consideration. However, as our knowledge of the sea and its functioning and our ability to remove toxic materials from sludge (pretreatment) improves, we may be able to look once more to the marine environment as a method to dispose of our sewage sludge. The abuses which caused anoxic conditions and the toxic uptake may eventually be understood and dealt with. If so, Congress may then lift its ban on ocean disposal. Such progress, however, is not in the foreseeable future and so ocean disposal must be considered infeasible.

3. Land Disposal

a. Explanation of Alternatives

(1) Dewatering of sludge at Deer Island followed by barge transport of sludge (in trailers) to a dedicated terminal, with truck transport to dispersed storage sites in the Connecticut River Valley and Bridgewater-Westport, Massachusetts areas. During two months of the year, sludge would be applied to privately owned, cropped farmland with application site soil analysis for nitrogen species and heavy metals on an annual basis. Application would occur two months per year (60 days) at two dry tons per acre per application. Storage would be at dedicated sites, with piles being covered to prevent contamination of runoff.

(2) Dewatering of sludge at Deer Island followed by barge transport of sludge (in trailers) to a dedicated terminal. Half of the sludge (high cadmium:zinc ratio) would be transported to a landfill located in Plainville, Massachusetts. The sludge acceptable for land application (50%) would be handled as in the alternative discussed above.

b. Impacts

Soils - potential adverse impacts which could result from the land application alternatives include:

- increase in heavy metal concentrations,
- increase in sodium and chloride ions, and
- increased plant uptake of metals upon cessation of lime application.

Heavy metals (e.g., copper, zinc, nickel and cadmium) present in the sludge could increase in concentration in the soil during land application. This is a potentially severe, long-term impact that could be controlled by employing the EPA guidelines which limit the amounts of sludge that may be applied (see Appendix R, Part B, Vol. II). Further, the application of lime (used as a conditioning chemical in dewatering) to keep the soil pH near neutral, would result in less metals leaching into the soil and being absorbed by plants.

Sodium and chloride ions would also increase in the soil during land application. Sodium ions destroy the soil structure, resulting in reduced permeability. The amount of sodium that may be applied to the soil depends on the amount of calcium and magnesium that is available to inactivate the sodium effects. The chemical models for soil (Appendix R) discuss the sodium balance for the soils. Chloride would not be expected to be a significant problem.

One major adverse effect would occur after sludge application ends. A high pH results in less heavy metals being available for crop uptake. If liming of the soil ends with the sludge application, a natural lowering of the soil pH may result in an increased availability of heavy metals thus leading to metal toxicity of plants growing on these sites.

Beneficial Impacts - Operation of land application alternatives could result in some beneficial impact on soils such as:

- lime application to raise native pH,
- increased organic content, and
- increased organic nitrogen levels.

The amount of lime applied with the sludge would be similar to the amount applied on farms. Lime application with the sludge will result in about 0.5 tons per acre of calcium oxide, which is equivalent to 0.9 tons per acre of calcium carbonate. Present agricultural practices put 1.6 tons per acre of calcium carbonate on the land (U.S. Department of Commerce, 1972).

The organic content of the soil should increase due to land application of sludge beneficially affecting the soil structure, the cation exchange capacity, and the water-holding capacity of the soil. This may be a major beneficial impact and since organic breakdown is relatively slow, would be expected to have a long-term positive effect on the soil. The organic nitrogen level would also increase and subsequently be released during organic breakdown.

The combination of potential adverse and beneficial impacts of land application on the soil would have a net adverse overall impact. The benefits to the soil to be derived from the additional nutrients added by applying limed sludge might be outweighed by the accompanying increase in heavy metals concentrations if sludge rate application guidelines are not strictly followed.

Surface and Groundwater Quality and Quantity - Implementation of the land application alternatives could have potentially severe impacts on groundwater and surface water quality. It is possible that underdraining and leachate treatment for the 4,671 ha (11,550 ac) of disposal area may be required. With an annual infiltration rate of 234 mm (10") this would result in loss of 32,500 m^3/day (8.6 mgd) from groundwater. Without leachate recovery, the impacts on water quality would be adverse because of possible excessive nitrogen loss to groundwater.

The beneficial impacts to surface water quality resulting from the land application alternative would be the reduction of BOD, solids and metals from the waters of Boston Harbor where the sludge load is presently discharged.

Air Quality Impacts - Reduced air quality would result from the increase in carbon monoxide (CO) emissions, which accompany the land application alternatives. The CO emissions would result from the use of trucks to transport the sludge from Deer Island, and would be approximately 10 times that of the incineration alternative. The areas affected by the increase in CO emissions will depend upon the routes used to transport the sludge to its associated land disposal site.

Biotic Communities - An adverse, long-term impact that could vary from minimal to severe is the heavy metal uptake by vegetation growing on the landfill (a suggested land application alternative) upon conclusion of filling operations. This impact would be dependent on plant type, depth of cover soil and the type of cover soil.

Improved water quality in Boston Harbor due to cessation of the present sludge disposal method would result in improved conditions for shellfish.

Public Health and Noise - An increase in noise would result from truck transport of sludge to the receptor site.

Economic Impacts - The land application alternative as developed in the Draft EIS with 1975 costs, would increase the costs to the MDC by 23.4% per year and have an associated cost per household of $5.79 per year.

Energy Impacts - The land application alternative as described in the Draft EIS, would require direct energy inputs of 162×10^9 BTU per year (mostly fossil fuels) and an indirect (chemical) energy input of 50×10^9 BTU per year. This energy use could be partially offset by a maximum nutrient energy recovery of 51×10^9 BTU per year resulting in a total net use of energy of 161×10^9 BTU per year.

Land Use Impacts - Land application would require the use of 40 acres of storage land and 11,500 acres of land for application. Although positive impacts on agriculture would result from land application designed and operated in accordance with the provisions of applicable state and federal regulations, the loss of this area from agriculture in the event of problems would constitute a severe negative impact. In addition, the lack of land availability for land application poses a serious barrier towards implementing the land disposal alternative.

Transportation - The extent and location of the transportation impacts of land disposal depend heavily on the mode of transportation from Deer Island to the major road network surrounding Boston. Both the MDC's studies and the EIS conclude that trucking significant quantities of sludge through the Town of Winthrop would create an unacceptably severe adverse impact over a particularly sensitive area and therefore, would require barged transportation of sludge to a landfill. The truck traffic in the communities surrounding those landfills has the potential for adverse impacts but they are much more acceptable than those in Winthrop would be.

Aesthetic Impacts - The land application of sludge would not require the construction of additional permanent facilities other than those discussed under common elements on Deer or Nut Islands and therefore, the adverse aesthetic impacts on those communities would be negligible. The construction of the barge dock on Deer Island would not be very noticeible and the unloading facilities would generally be located in an industrialized area of the waterfront and would not conflict with the aesthetic qualities of such an area. The operation of storage sites for sludge and the ultimate disposal on land in a rural/agricultural area would have some adverse aesthetic impact, but could be mitigated somewhat by operational controls and siting.

c. Implementation Considerations

In analyzing the feasibility of land application, the relative ease/difficulty of implementing such an alternative was taken into consideration. Several problems were seen to exist in implementing the land application alternatives suggested.

(1) In order to effectively dispose of sludge by the land disposal alternative suggested, land availability becomes an important factor. The amount of land which would be required (over 11,000 acres) is presently not available, nor is there any way of ensuring that the land needed would be available. Without the required land needed for storage and application this disposal alternative becomes infeasible as it would be impossible to implement.

(2) Other implementation problems exist in terms of being able to market the sludge as suggested in this alternative. Early in the EIS process EPA contracted a study to explore the existing and potential market for fertilizer produced from digested primary sludge from the Deer and Nut Island Treatment Plants. In September 1975, Development Planning and Research Associates, Inc. submitted their findings to the EPA in a report entitled, "Market Survey and Feasibility of Sludge Fertilizers". The conclusions of that report indicated that the market for an unfortified dried primary sludge produced at Deer Island by the MDC would be extremely limited. The proposed product would have a low nutrient content of approximately 2% nitrogen, 2% phosphate and a trace of potash (designated 2-2-0). Such a product could not compete effectively as a fertilizer because of its low nutrient content; and, its potential as a soil conditioner would be limited geographically because of relatively high shipping costs. In addition, the marketability study looked at a fortified dried primary sludge fertilizer (6-2-4 level) and found that only one half of the total volume of sludge generated could be sold even under the most favorable market conditions. Further, this would require an effective but costly marketing program for such a volume to be sold. As a result, use of this mechanism for disposal and/or for revenue generation was not considered feasible.

(3) The Resource Conservation and Recovery Act (RCRA) of 1976 (PL 94-580), initially was not clear as to whether or not sewage sludges would be considered as potentially hazardous materials. Draft regulations to implement proposed sections 1008 and 4004 published in the Federal Register on February 6, 1978, and unpublished drafts of other sections

contained information indicating that stringent restrictions would be placed on the land application of municipal sludges or compost. RCRA required the formulation of regulations defining hazardous wastes and the management and ash disposal criteria for such wastes.

Unpublished draft regulations defining "hazardous" and "non hazardous" indicated that one of the criteria used to define a waste as hazardous would be toxicity. As a result, the heavy metals content (cadmium, zinc, lead) of the MDC's sludges was initially considered to conform to EPA's definition of hazardous waste, and therefore, the sludges would not be available for the land disposal alternatives suggested which involved application to food chain crops. Later studies have indicated that application to lands where food crops are not involved, could be implemented safely (see discussion below under "composting").

The Draft Hazardous Wastes Regulations (Federal Register December 18, 1978) state that municipal sewage sludges will no longer be considered subject to the hazardous waste provisions of RCRA. Sewage sludge from publicly owned treatment works will be excluded from coverage under RCRA and will be regulated instead under Section 405 of the Clean Water Act of 1977.

Owners and operators of publicly owned treatment works are required by Section 405(e) to use or dispose of sludge in accordance with guidelines promulgated under Section 405(d). With respect to land disposal and landspreading, the owner or operator must assure compliance with these criteria. They must (1) analyze the sludge for cadmium and other toxic substances, (2) assure that the sludge has been appropriately stabilized, (3) determine the appropriate sludge application rates and assure that they are complied with, (4) determine what monitoring is required and assure that it is performed, and (5) develop any necessary contingency plans and assure they are complied with.

(4) The effect of various state and local laws and ordiances would also contribute to creating implementation difficulties for a land disposal alternative. For example, the Massachusetts Department of Environmental Quality Engineering (DEQE) recommended the sterilization of sludge prior to land application (letter from Anderson to Ochs, August 28, 1975). This requirement was seen to adversely affect both the energy requirements and cost effectiveness of land application of sludge. In addition, DEQE has developed an "Interim Policy on Disposal Practices for Sludge and Sludge Ash", January 24, 1979.

d. Summary of Analysis

While the concept of utilizing sludge (i.e., recycling as opposed to disposal) has definite benefits, the analysis of impacts and implementation considerations proved the land disposal alternative to be infeasible. As a result, the land disposal alternatives (land application and landfilling of sludge) were eliminated from consideration due to the uncertainty about sludge quality (heavy metals content) the amount of land which would be required (and its availability), high economic costs, and energy intensiveness.

e. Composting

The alternative of land application analyzed had been considered infeasible and rejected due to marketability problems; energy and cost intensiveness; heavy metals content; and because it did not appear to be in compliance with federal legislation and policy (i.e., RCRA). Since the time that RCRA initially designated sewage sludges as potentially hazardous materials (primarily due to heavy metals content) studies were performed whicn indicated that the levels of heavy metals found in most municipal sludges are not such that they should be considered toxic, or hazardous, nor are they seen as possibly endangering the public health. Entry of heavy metals into the food chain can also be controlled by limiting and regulating the uses of municipal sludge or compost in land application operations. As a result, recent federal guidance (October, 1978) indicates that restrictions on heavy metals content would not preclude the use of cadmium-rich municipal sludge or compost in landspreading operations where food crops were not involved.

Even when land application is restricted to non food chain uses potential benefits exists which make land application a viable and attractive alternative. There are many acceptable uses, especially for a sludge based compost, which make use of the nutrient resources in sludge and thus could be implemented with positive beneficial results. Composted sludge can be beneficially applied for use on state forests, sod farms and Christmas tree farms. It can be used in horticultural applications for growing potted plants in green houses and for shade and flowering trees in nurseries. Use of compost and compost-containing materials as soil amendments for landscaping and land reclamation purposes have also proven highly successful. Compost can safely and beneficially be used for public work projects such as highway beautification. In fact, the number of non-agricultural uses for composted sludge is increasingly large with the benefits derived from such operations indicating a positive outlook for future compost usage.

In order to investigate the feasibility and practicality of composting sludge from the MDC system, a demonstration pilot program of composting the Boston area's sewage sludge and converting it into a soil conditioner potentially useful for horticultural and landscaping applications, was initiated. In August 1977, Energy Resources Co., Inc. began a 1-year project for the MDC "... to design, construct and operate a demonstration sludge composting facility at the Deer Island wastewater treatment plant and investigate the potential demand for the compost product within a 40-mile radius of Boston." The results of this operation are contained in a report entitled "Sludge Composting Project, 1977-1978", and have shown composting to be "a potentially feasible sludge management alternative for the MDC, and that there is sufficient interest among Boston area users - for utilization of the entire present sludge product to warrant further market assessment. Composting should be continued on a modest, but steady, scale in order to gain experience with the process and to develop site-specific, time-tested information." The composting pilot program has demonstrated that there is sufficient local demand to merit the initiation of a permanent continuous sludge composting facility and that a market for composted sewage sludge, even in non-agricultural uses, exists.

The option of composting the MDC's sewage sludge becomes an attractive land disposal alternative. To transform a "waste" into a useful product has great appeal, but there are still environmental and economic/energy considerations which must be taken into account. Heavy metals and materials resulting from industrial discharges are currently a component of the MDC sludge. As such, steps must be taken (initiation of an effective pre-treatment program) to ensure that the sludge can safely and environmentally be recycled.

Further, we recognize that the utilization and marketing of a sludge compost product has not yet fully been determined. Until an active distribution effort is begun which has the support of both the state and MDC, the potential for disposing of the MDC's sewage sludge via composting can only be surmised. Further, the success of a composting operation on any scale will require a commitment on both the part of the MDC and the State. Because large scale composting would be an innovative sludge management solution departing from conventional practice, it will be necessary for the Commonwealth of Massachusetts and EPA to make firm commitments for a thorough assessment of its potential, and for its implementation if it is judged to be cost-effective and environmentally sound.

Within this framework it is seen that the land disposal alternative of composting primary sludge is a viable option deserving further evaluation for cost-effectiveness. The use of composting should be employed to the extent practical.

4. Incineration

The alternative of incineration analyzed is essentially the same proposal recommended by the MDC in their Step 1 facilities plan. An explanation and examination of the incinerator alternative is presented at this time without the question of residue ash disposal. Feasibility of incineration is not dependent upon selection at this time of an ultimate method or disposal of incinerator ash residue, although such a site must be selected before actual construction of the project begins.

a. Explanation of Alternative

(1) The basic alternative of incineration (as recommended by the MDC), involves:

(a) At Deer Island, the primary sludge from the Deer and Nut Island treatment plants would be chemically conditioned and dewatered, either by vacuum filter or filter press.

(b) The total sludge mass would then be thermally reduced by incineration with energy recovery, in two multiple hearth incinerators with a variable speed fan for intake air. (The actual installation would consist of three incinerators, with one for standby.) The design capacity of the sludge incinerators would consist of 128 tons/day (TPD), dry weight basis.

The incineration alternative includes waste heat recovery from the incinerator exhaust gases, and the generation of electric power from this energy source. The energy recovery facilities will include a boiler and a 4000 kw generator. The temperature difference through the boiler will be about 500°F. Existing dual fuel engine generators would continue operation utilizing digester gas. Outside electric power supply would be provided to supplement on-site generated power, and for stand-by service for the turbogenerator set.

Quenching and ash removal from the incinerator will be either wet or dry, with dry quenching recommended to minimize the amount of leachate to be recycled. Air pollution control will be by a high energy venturi-type scrubber with a 42" H_2O pressure drop through the scrubber.

(2) Coincineration - Early in the EIS preparation process the MDC was provided a federal grant to study the alternative of coincineration (i.e., incinerating the MDC's wastewater sludges with solid waste from the City of Boston). The Draft EIS published in March 1976 did not include the alternative of coincineration since the study on that alternative had yet to be completed. The results of that study, conducted by Stone and Webster, Inc. were presented in a report entitled "The Commonwealth of Massachusetts Metropolitan District Commission, Boston Metropolitan Area Waste Treatment Feasibility Study" in November 1976. Coincineration was evaluated for two possible locations, South Bay and Deer Island. Facilities at the South Bay site would consist of two boilers, each having a capacity of 850 TPD, sludge drying equipment, electrostatic

precipitators, ferrous recovery and residue conveyors, and an underground steam connection. The Deer Island site would incorporate the same basic systems except that steam would be piped to two 20,000 kw turbogenerators for power production instead of being piped into the existing Boston Edison direct heating system. The South Bay facility would require delivery of solid waste to the site via packer truck and transportation of dewatered sludge via truck and barge from the sewage treatment plants. The Deer Island site would necessitate truck-barging of solid waste and sludge from Nut Island to Deer Island.

In assessing the environmental impacts of a cotreatment system located at either South Bay or Deer Island, air quality, noise, terrestrial ecology, water quality and energy consumption were all taken into account. The most adverse environmental effects of cotreatment were found to be in connection with air quality.

The results of the study indicated that because of adverse environmental impacts, specifically air quality, and because of the associated costs and impacts of transport, coincineration was not feasible. In addition, the alternative had several major implementation problems which would need to be overcome before the option could be economically feasible.

Subsequent to distribution and review of the Stone & Webster report by EPA and various state agencies, consideration was given to two further sites as possible coincineration facilities. The option of coincinerating MDC's sludge with the municipal refuse currently being burned at the existing RESCO incinerator in Saugus was examined by EPA and determined to be infeasible due to transportation problems and air quality impact problems.

Consideration of the West Surburban Project (WSP) in Stoughton as a coincineration site was also eliminated for many of the same reasons the RESCO site was rejected. In addition, the possibility of codisposal at WSP was eliminated by action of the WSP policy committee.

b. Impacts

Soil - Construction of the incinerator and storage facilities could cause a slight erosion of soil. This would be a short-term adverse impact, localized in the areas of construction and could also be mitigated by erosion control procedures (e.g., mulching at 2 tons/ac) and careful site selection.

Incineration can also result in particulate fallout adding a small amount of heavy metals to the soil. This would be a negligible adverse impact, especially in comparison to the amount of heavy metals which could be introduced to the soil through use of the land application alternative.

Incineration has the potential to create problems with SO_2 emissions decreasing the pH of rainfall ("acid rains") and, hence, soil leaching.

Air Impacts - The proposed incinerator will produce certain adverse air quality impacts. None of these impacts, however, are expected to result in violations of Federal ambient air quality standards. This conclusion covers all of the pollutants which can be expected to be emitted from the sludge incinerator, and for which ambient standards have been established. Emissions and projected ambient concentrations were estimated for 1985, when the incinerator will be in full operation.

There are presently violations of the National Ambient Air Quality Standards (NAAQS) occuring in the Boston Metropolitan Area. The proposed incinerator will, however, produce no new violations. Under EPA's Interpretive Ruling Policy, a determination must be made as to whether the proposed source would contribute to the existing violations. As such, a determination was made as to the importance of the incinerator's contribution to the ambient air quality. This importance is evaluated in terms of numerical levels which have been established by EPA ("levels of significance"). Modeling efforts indicated that the levels of significance would not be exceeded for the locations monitored.

The Boston Edison Company has conducted an ambient air monitoring program on Long Island for sulfur oxides and suspended particulate matter, since April 1976. Information from this program, which was established to support a Boston Edison request for a change in Massachusetts fuel sulfur content requirements applicable to the company's generating stations, has been transmitted to the Massachusetts Department of Environmental Quality Engineering and to the Environmental Protection Agency. Data from the monitors (located 4.23 km from the site of the proposed incinerator) can be considered representative of the air quality on Deer Island and at the points of maximum ground level air quality impact expected to result from operation of the incinerator. Based upon conclusions drawn from an air quality prediction model (EPA CRSTER Model), using actual Logan Airport meteorological data for the five year period January 1970 through December 1974, these maximum impacts are expected not to exceed twenty-four hour average values of 12.5 micrograms/m^3 for suspended particulate matter and 36.8 micrograms/m^3 for sulfur oxides. The estimated maximum incinerator generated impacts, when added to the 1985 projections of Boston Edison's Long Island data indicate total expected peak 24 hour ground level concentrations during a twelve month period of 116.6 micrograms/m^3 for suspended particulate matter and 156.8 micrograms/m^3 for sulfur oxides. The second highest 24 hour peaks are predicted to be 107.8 and 151.9 micrograms/m^3 for particulate matter and sulfur oxides, respectively. The closest 24 hour National Ambient Air Quality Standards are the secondary suspended particulate matter standard of 150 micrograms/m^3 and the primary sulfur oxides standards of 365 micrograms/m^3; both standards are not to be exceeded more than once per year. Because the Federal ambient standards do allow for the concentration limits to be surpassed once in twelve months, violations are not charged unless the second highest peak also exceeds the standards. In the particular case in question, concerning predicted 1985 air quality in the area to be impacted by the proposed incinerator, neither the second highest nor maximum expected twenty-four concentrations of suspended particulates and sulfur oxides will exceed the established standards.

Since the expected particulate matter and sulfur oxides concentrations for time periods related to other standards, such as those established for annual exposures or the special three hour period specified for the secondary sulfur oxides limit, in all cases fall far below the concentration values of the standards, it can be safely assumed that no Federal ambient air quality standards will be violated for these two pollutants.

The same conclusion can be made with regard to the National Ambient Air Quality standard for lead. This standard specifies that the ambient concentration for lead, averaged over a three month period, shall not exceed 1.5 micrograms/m^3. At the present time, this standard is violated in the Boston Air Quality Control Region but it is believed that atmospheric lead concentrations will decline steadily as new vehicles capable of burning only unleaded gasoline begin to dominate the automobile population of the metropolitan area. By 1985, when the incinerator is operational, it is expected that the highest three month average ambient atmosphere lead concentration measured in the Boston Air Quality Control Region will be well below the standard.

The peak three month lead concentration monitored to date was in heavily trafficked Kenmore Square for the period January through March, 1978. This measured value was 6.6 micrograms/m^3. It is expected that the automobile population changeover to unleaded gasoline will reduce this peak value to about 1.0 micrograms/m^3 by 1985. Even with the conservative and unlikely assumption that the monitored Kenmore Square lead levels would be representative of ambient concentrations in the areas impacted by emissions from the proposed incinerator, the quantity of lead expected to be emitted from the incinerator will not produce violations of the ambient standard. The peak three month ground level impact directly related to the incinerator will be no more than 0.015 micrograms/m^3.

It is not expected, either, that there will be violations in 1985 of the National Ambient Air Quality Standards for nitrogen oxides. The annual average ambient standard is 100 micrograms/m^3. The expected NOx emissions of 4.81 micrograms/m^3 added to the background level of 86.5 micrograms/m^3 result in a total ground level concentration of 91.3 micrograms/m^3 which is less than the annual ambient standard. There are currently no short-term standards established for NOx, but EPA is considering promulgating such a standard in the future. If during design or construction of the incinerator a short-term NOx standard is established, the incinerator will be analyzed for compatibility.

Aside from the National Ambient Air Quality Standard pollutants, it is generally considered that the most important emissions from the incinerator will concern mercury and cadmium. It is expected that daily mercury emissions will approximate 1650 grams, and that the emissions of cadmium each day will total 23 grams. The expected mercury emission rate will be well within the allowed EPA emission standard for 3200 grams per day. Because the predicted emission rate will exceed 1600 grams daily, however, the Metropolitan District Commission will be required to sample and report its actual mercury emissions at least once each year.

There is no established emission limit on cadmium emissions comparable to that for mercury. The expected one hour maximum concentration of 0.012 micrograms/m^3 that could result from incinerator emissions of cadmium, however, does not appear to constitute a substantial danger to human health or welfare. Atmospheric cadmium has not been sampled routinely in the Boston metropolitan area, but samples taken elsewhere support an assumption that background concentrations should not be greater than 6 nanograms/m^3 (.006 micrograms/m^3). The sum total of assumed maximum background levels, and maximum ambient concentrations resulting from the proposed incinerator is below concentration values heretofore associated with harm to human beings 100-200 nanograms/m^3 (0.1-0.2 micrograms/m^3).

Because the proposed incinerator location on Deer Island will be in an area where particulate matter and sulfur oxides standards are now being achieved (attainment area), it is necessary to determine that the existing air quality will not deteriorate significantly due to incinerator operation. This determination was made, and was based upon evaluating the impact of the proposed incinerator against the Environmental Protection Agency's Prevention of Significant Deterioration (PSD) criteria. The evaluation indicated that none of the PSD criteria would be violated.

Marine Sediments and Water Quality - Incineration could effect surface water quality. Particulate fallout could result in a slight increase in heavy metal concentrations in the water (especially lead and mercury) resulting in a minimal adverse impact. Aquatic biota are more sensitive to heavy metal concentrations than terrestrial biota, but the small amount of surface freshwater in the East Boston-Winthrop area which is available for contamination, would result in a negligible impact. A beneficial impact could result due to the increase in pH from the particulate fallout. This pH increase could moderate to some extent a pH reduction due to sulfur dioxide emissions of the incinerator.

The greatest beneficial impact to be derived from implementing the incineration alternative will be the removal of a significant increment of pollution to Boston Harbor resulting from the complete elimination of the sludge discharge to the Harbor. The sediments of the Harbor could be improved to the point where the diverse, desirable marine life which the Harbor is theoretically capable of supporting may become reestablished.

Biotic Communities - Plant life could potentially be affected by emissions. Sulfur dioxide, released from the incinerator in gaseous form, combines with moisture to form a dilute sulfuric acid which is harmful to plant life. This could result in a moderate adverse impact. Particulate

1985 GROUND LEVEL CONCENTRATIONS (GLC) OF AIR POLLUTANTS

(ug/m^3)

	TSP	SO_2	NO_x	Pb	Cd	NOTES
ANNUAL	1.01 + 35.0 = 36.0 a. 75 (2) b. 60	2.98 + 27.0 = 29.98 a. 80 (2) b. 60	4.81 + 86.5 (3) = 91.3 a. 100 ug/m (3) b. N/A	0.006 + a. N/A b. N/A	.0002 + .006 (6) = .0062 a. N/A b. N/A	
3 MONTH	2.71 + a. N/A b. N/A	8.00 + a. N/A b. N/	12.89 + a. N/A b. N/A	0.015 + 1.0 (5) = 1.015 a. 1.5 ug/m^3 b. N/A	.0004 + a. N/A b. N/A	
24 HOUR (Highest)	12.5 + 104.1 = 116.6 a. N/A b. N/A	36.9 + 120.0 = 156.9 a. N/A b. N/A	59.2 + a. N/A b. N/A	0.06 + a. N/A b. N/A	0.002 + a. N/A b. N/A	
24 HOUR (Second Highest)	12.5 + 95.3 = 107.8 a. 260 b. 150	36.9 + 115 = 151.9 a. 365 (2) b. 260	59.2 + a. N/A b. N/A	0.06 + a. N/A b. N/A	0.002 + a. N/A b. N/A	
3 HOUR	39.8 + a. N/A b. N/A	117.4 + a. N/A b. 1300	189.4 + a. N/A b. N/A	0.18 + a. N/A b. N/A	0.006 + a. N/A b. N/A	
1 HOUR	79.9 + a. N/A b. N/A	235.7 + a. N/A b. N/A	380.3 + a. N/A (4) b. N/A	0.36 + a. N/A b. N/A	0.012 + a. N/A b. N/A	

KEY

A + B = C

A = Incinerator Contribution

B = Calculated Background

C = Total GLC (1)

a = Primary Air Pollutant Standard

b = Secondary Air Pollutant Standard

NOTES

(1) All background concentrations based on monitored air quality at Long Island except as otherwise noted.

(2) This standard is only to be used as a guide.

(3) NO_x background concentration based on monitored air quality at East Boston.

(4) A short term NO_x standard is under consideration.

(5) Pb background concentrations all based on measured concentrations at Kenmore Square reduced for expected improvements related to change in automobile population.

(6) The background concentration for Cd is an estimated value based on concentrations normally found in urban areas.

fallout on plants may also have a moderate adverse impact. Particulate dust could cause a screening of sunlight, resulting in a slightly lower photosynthetic rate.

Public Health and Noise

Noise - Noise generating activities associated with implementing the incineration alternative relate mainly to construction activities and vehicles used to transport workers to the construction site.

Occupational noise levels would range from 82-97 dBA at 25 feet (USEPA 1972), which would limit workers to three hours per day of direct exposure (Hovey, 1972).

Health Impacts - Certain air quality impacts resulting from incineration could result in respiratory interference for certain sensitive persons. However, as none of the Federal Primary or Secondary Ambient Air Standards will be violated, the proposed incineration can be considered "safe" with respect to the public's health and welfare. Federal standards are established to ensure sufficient quality of air for the general population.

The use of pollution control equipment on vehicles can reduce noise and air pollution.

Beneficial Impacts - Discontinuation of harbor disposal of sludge would result in improved beach conditions which would be beneficial for public health as well as recreational enjoyment.

Land Use Impacts - Expansion of facilities and construction of incinerators on Deer Island will result in the loss of land available for other uses of the Island. However, the improved condition of the harbor's waters could result in the other Harbor Islands being used more beneficially.

Historical and Archaeological Sites - In 1941, Fort Dawes was established at the tip of Deer Island. The Army Fort covered an area of approximately 100 acres and was separated from the rest of the Island by a 12 foot high concrete wall. The top of the hill served as the Harbor Entrance Control Post during the Second World War. According to the 1972 Boston Harbor Islands comprehensive plan, the Fort was placed on caretaker status in 1946. The Plan further describes the Fort as abandoned and as fallen into disrepair. Currently, the Fort is not listed in the National Register of Historic Places. Further, the Massachusetts Historical Commission has stated that there are no immediate plans to nominate it to the National Register, however, it is included in their inventory of historical assets of the Commonwealth. Under Section 106 of the National Historic Preservation Act of 1966, a determination is to be made as to whether or not a site is eligible for listing on the Historical Register; such a determination has not been made in the case of Fort Dawes. Prior to design of the incinerator begins or expansion of facilities on Deer Island occurs, an evaluation of the historical and archaeological assets of Fort Dawes will be required. This will be accomplished by the MDC conducting an archaeological/historical survey of the area during its updating of facilities planning. Upon completion of the survey, the MDC will consult with the State Historical Commission to ensure compliance with the National Historic Preservation Act.

Aesthetic Impacts - The impacts of construction and operation of the expanded facilities would be negligible or minimal concerning noise, appearance, and odor. The existing treatment plant on Deer Island already produces odor, noise and visual impacts. While the plant is somewhat isolated from the main residential areas of Winthrop, there will be increases in the existing adverse effects upon the inmates of the Suffolk County Prison. The addition of increased noise and odor will probably be in the range of minimal to moderate. An additional adverse impact will result from the construction of the three incinerator stacks which could be considered aestheticly displeasing. The major beneficial impact will be the improvement in the aesthetics of Boston Harbor due to the removal of the sludge discharge. Recreational uses of the harbor (bathing, fishing, boating) may also be realized.

Energy Impacts - Recovery from Incinerator Off-Gas: In their study recommending incineration to the MDC, Havens & Emerson, Ltd., included energy recovery from the hot off-gases of incineration. In the system envisioned by Havens & Emerson, the efficiency was predicted at 38%, based on the fact that the loss of efficiency (about 15%) in fuel burning normally used in power boiler computations need not be included. The best efficiency of a complete system in the power industry is approximately 38% which, with the 85% fuel efficiency, yields a boiler efficiency of 45% in comparison to the 38% predicted by Haven & Emerson.

Autogenous Operation (Operation without Auxiliary Fuel): Appendix S (Part B, Volume II) contains information on the state of the art of multiple hearth incinerators, and addresses the question of operation of the incinerators without fossil fuel imputs. In the incineration system as proposed by the MDC, autogenous operation is theoretically possible. The principal reason that additional fossil fuels are required for incinerators (based on analysis of records from existing plants) is the inability of most facilities to control the amount of excess air that is required for combustion. In existing plants, the combustion air feed is fixed, usually at 150% of the volume required. As Appendix S points out, the effect of this fixed quantity of air is that when the incinerator is running at 50% of capacity, the air supply is 300% of that required, or 200% excess air. Because the thermal energy required to heat the incoming air is about 300 BTU/pound of air, this exerts a powerful impact on fuel requirements.

For every 1% reduction in thermal efficiency below that calculated for autogeny in 1985, the daily fuel requirement would be approximately 100 gallons per day (@143,000 BTU per gallon). Because the question of energy input is so important, the MDC's consultant has developed an incineration system in which the combustion air input is variable, depending on the oxygen requirement and the percentage of incinerator capacity used. Appendix S recommends several additional measures that could be taken by the MDC to further insure autogenous operation. In addition to auxiliary fuel use, start-up fuel will be required. Each start-up will require 4000 gallons of fuel (H&E, 1973), and based on existing plant data (Appendix S), the start-up frequency will be one start every 10 days. On this basis, the average daily auxiliary fuel requirement will be 400 gallons.

Although the incineration alternative will require energy use for operation which must be drawn from existing fossil fuel sources, this use of fossil fuel can be offset by the inclusion of energy recovery. The inclusion of energy recovery will produce more total energy than will be consumed by the sludge management operation. The recovery of thermal energy in excess of that required for start operations results in a total net recovery of 52-54 x 10^9 BTU per year which is equivalent to 370,000 gallons of diesel fuel that will be saved annually by converting radial diesel pump engines to electric motors. The use of fossil fuels for start up pilot and auxiliary fuel can also be mitigated by partial use of digester gas.

In contrast, the land application alternative required direct energy inputs of 162×10^9 BTU per year (fossil fuels), and an indirect (chemical) energy input of 50×10^9 BTU per year. Although this energy use could be partially offset by nutrient energy recovery, land application would result in a total net energy use of 161×10^9 BTU per year.

<u>Economic Impacts</u> - Implementation of the incineration alternative will result in increased costs to the MDC and the member communities households which range from $3.41 - $4.16 increased cost per household, based on annual costs after grants; depending upon the ultimate method and location of ash disposal.

The beneficial economic impact of the incineration alternative results from the generation of construction jobs with federal grant funds. The 360 man years of effort required translates into about 120 jobs over a three year period.

c. Implementation Considerations

There are several pieces of federal and state legislation which would have an effect upon the implementation and feasibility of the incineration alternative and which must be taken into consideration in the analysis of that alternative.

(1) On January 16, 1979, EPA published in the Federal Register a series of regulations which are referred to as the "Interpretive Ruling." Specifically, the Interpretive Ruling governs the analysis of new sources of air pollutants, and whether or not such new sources need to be compensated for by concomitant reductions within the same air shed. This policy covers all major sources locating in a non-attainment area, or significantly impacting a non-attainment area. A major sewage sludge incinerator under this policy is defined as having potential emissions greater than 100 tons per year. Any source subject to this policy can

not be built unless several stringent conditions are met. One such condition is the greater than "one-for-one" emissions offsets that must be found by the proposed source.

(2) Amendments to the Clean Air Act were passed (as PL 95-95) in August 1977. Among other provisions, the 1977 Clean Air Act Amendments contains requirements on the Prevention of Significant Deterioration (PSD), air quality maintenance, that determinations of Best Available Control Technology must be performed on a case-by-case basis. On June 19, 1978, EPA promulgated the Prevention of Significant Air Quality Deterioration (PSD) regulations. The PSD regulations cover all pollutants regulated by the Clean Air Act, however, increments limiting pollutant concentrations have been set for particulate matter and sulfur dioxide. All sewage sludge incinerators locating in an attainment area or significantly impacting an attainment area, and having the potential to emit more than 250 tons per year of any pollutant regulated under the Act, must receive a PSD permit for that pollutant.

(3) The Resource Conservation and Recovery Act of 1976 (PL 94580, RCRA) required formulation of regulations defining hazardous wastes and the management and disposal criteria for such wastes. Draft regulations were published (February 6, 1978) detailing ultimate disposal of hazardous wastes and the environmental constraints on disposal facility siting. Regulations defining hazardous and non-hazardous wastes are still in preparation. Initially sewage sludges were designated as potentially hazardous materials. If the MDC sludges were considered hazardous as defined by RCRA, their processing, transportation and disposal would be controlled by federal regulation under that act. If non-hazardous, the sludge's management would be controlled by state regulations of the Commonwealth of Massachusetts. A designation of "hazardous" would mean that the incineration facility would have to meet the performance criteria for hazardous waste facilities (see Table III-2, Part B, Volume I). After incineration or other processing, the residue would have to undergo additional testing to see if it would be subject to RCRA.

Recent federal guidance (December 1978) indicates that municipal sewage sludges will no longer be considered subject to the hazardous waste provisions of RCRA. They will, however, be subject to guidelines being developed by the EPA in accordance with Section 405d of the Clean Water Act. Thus the federal treatment requirements for the incinerator ash residue remain incompletely defined.

d. Summary of Analysis

The analysis of incineration took into consideration the alternative's use of resources and energy, its economic cost, and the social and environmental impacts of implementing such an alternative. As a result of the analysis performed, and in comparison to the other alternatives studied, it was determined that incineration represents the most feasible and <u>least environmentally adverse</u> option for disposing of the MDC's primary sewage sludge; and thus alleviating the continuing water quality problem created by present sludge disposal practices.

Although some air quality problems are associated with the alternative of incineration, neither state nor federal air quality standards would be violated. Further, the analyses indicated that the incinerators in and of themselves would <u>not</u> result in an environmental tradeoff, i.e., improved water quality for degraded air quality. The use of a high energy scrubber system would mitigate to a great extent the emissions of the incinerator.

Finally, incineration was found to be the only alternative which could provide the continuous capability to dispose of the primary sludge and thus ensure cessation of discharge to Boston Harbor. The construction of incinerators would also not preclude the use of other sludge disposal options which make use of resource reuse, (i.e., composting) as could be effectively implemented.

B. Summary of Level I Analysis

The preceeding alternatives analysis resulted in the selection of incineration with energy recovery as the only option which could provide for the continuous disposal of primary sludge while also being the most environmentally sound method.

The No Action alternative is illegal and, therefore, cannot be implemented. Aside from the legal constraints the alternative of no action was also found to have serious environmental impacts as a result of the continuous sludge discharge to Boston Harbor. The ocean disposal alternative is also prohibited by federal law and, therefore, its implementation would be illegal. Analysis of this alternative showed that severe environmental impacts to the marine environment would be incurred even if implementation were feasible. As a result, both the No Action and Ocean Disposal alternatives were eliminated from consideration.

Several land disposal alternatives were analyzed and while the concept of reuse rather than destruction is worthwhile, all the land disposal options analyzed had several major problems associated with them. The cost of land application was so high that it was judged not to be cost-effective in comparison with alternate sludge disposal methods. Aside from costs, there are several adverse impacts associated with the alternatives. Adverse air impacts (CO emissions) are associated with land application. In addition, its metals content could preclude the use of sludge, or of a compost made from the sludge, on food chain crops. It should be noted that sludge, even with a measurable metals content, could be used safely for land application subject to sludge application rate constraints specifically designed to protect soil, plants, ground and surface waters, and human health. Implementation problems also exist with the land disposal alternatives because the land requirements would be impossible to meet. Lack of land availability makes the alternative impossible to implement. Finally, the option of producing compost for non-food chain uses was evaluated. While this alternative, if currently implemented, would be insufficient to handle the entire sludge load, composting could be employed in conjunction with another alternative. A continuous program of composting would not only make use of the sludge as a resource, but would provide for a flexible solution to the sludge management problem.

Incineration was analyzed and evaluated. Incineration would not make use of the nutrient resources in the sludge, however, the inclusion of an energy recovery system would allow for resource recovery in the form of heat. Although incineration would also have certain air impacts associated with it, it was the only alternative analyzed which could dispose of the entire primary sludge load thus avoiding the adverse environmental impacts of continuing the discharge of sludge to the Harbor. Incineration was found to be the least environmentally adverse alternative and thus the Level 1 analysis selected incineration as the recommended alternative.

C. Alternatives Analysis - Level 2

The Level 1 analysis of alternatives resulted in the selection of incineration with energy recovery as the method of choice for the disposal of the MDC's primary sludge. As was previously stated, the ultimate method and location of the incinerator ash residue was not considered in the Level 1 analysis since the feasibility and selection of incineration was not regarded as dependent upon ultimate ash disposal.

The question of ash disposal was addressed in the second level of analysis where the basic alternative of incineration was refined, based upon the methods and locations for ultimate ash disposal. Taken into consideration during this level of analysis were the implications of the Resource Conservation and Recovery Act (PL 94-580, RCRA) previously discussed. The question then existed as to whether RCRA would classify sewage sludges and ash resulting from incineration as potentially "hazardous" materials. As a result, alternatives were created which would allow for the handling of the MDC ash as either a "hazardous" or "non-hazardous" material. Those alternatives considered were:

1. Explanation of Alternatives*

- <u>Alternative 1</u>

Dry ash to be transported to a terminal by barge, thence to an inland commercial landfill site by highway.

- <u>Alternative 2</u>

Ash disposal to be on site in an enclosed, sealed fill area (cofferdam) on the east (ocean) side of Deer Island. This alternative assumed ash to be a non-hazardous waste.

- <u>Alternative 8</u>

Dry ash would be transported via truck to a landfill in the Fort Dawes area of Deer Island. This alternative assumes the ash to be a non-hazardous waste.

- <u>Alternative 9</u>

Assuming the ash to be a non-hazardous waste, it would be transported via barge from Deer to Spectacle Island for disposal as fill. Trucks or front-end loaders would carry the ash from the barges to the actual disposal site.

- <u>Alternative 10</u>

Alternative 10 has the same operational scheme as Alternative 2. It differs in that this alternative deals with the ash as a hazardous waste. The cofferdam would be located on the west (harbor) side of Deer Island to facilitate recycling of leachate for treatment of hazardous ash.

- Alternative 11

Alternative 11 has the same operational scheme as Alternative 8. It differs in that this alternative deals with ash as a hazardous waste requiring determination of impact on aquifers or lining of fill site. Dry ash disposal would be via truck to a landfill in the Fort Dawes area of Deer Island.

*Note: For consistency, the numbers used in describing alternatives, are the same ones used in Part B, Volumes I and II of this EIS. Alternative numbers 3, 4, 5, 6 and 7 refer to the options of ocean disposal, land application and no-action previously eliminated.

2. Impacts

Environmental Impacts - The environmental impacts of the aforementioned feasible alternatives were evaluated on a comparative basis. In the analysis performed (summarized in Tables A-1 - A-4, a tabulation of common and differentiating impacts of these alternatives was prepared, with the following descriptive categories being used:

- Area of Impact: area of concern to be impacted or affected, including: Soils, Marine Sediments and Water Quality, Surface and Groundwater Quality and Quantity, Air Quality, Biotic Communities, Public Health and Noise, Economic Impacts, Energy Impacts, Land Use Impacts, Transportation Impacts, Historical and Archeological Impacts, and Aesthetic Impacts.

- Action: Short description of the action causing the impact.

- Type of Impact: Short term construction impacts or long term operational impacts.

- Assessment of Impact: Adverse, potentially adverse, or beneficial.

- Areal Extent: Either localized within a few kilometers of the site, regional pertaining to the surrounding counties, or national. While all impacts theoretically have universal implications, the detectability of impacts is the basis of areal extent.

Process and Disposal Inputs - Monetary Costs - Inputs of labor, energy, materials, land, and monetary costs for construction and operation of the incineration alternatives are given in Part B, Volume I (Sections III and IV) and Volume II (Appendix T). Summaries of the required input are shown in Tables A-5 and A-6. In addition to labor, energy inputs, materials and land, Table A-5 also includes the energy recovered from digestor gas.

TABLE A-1

DIFFERENTIATING IMPACTS OF ALTERNATIVE 1

(Inland Fill)

Area of Impact	Action	Type of Impact	Assessment of Impact	Areal Extent
Soils	Increase in heavy metals concentration of landfill cover soil	Potential long term	Potentially Adverse	Landfill site
	Landfill operation, resulting in erosion and soil structure destruction	Potential long term	Potentially Adverse	Landfill site
Marine sediments and water quality	Dredging and construction for bargind	Short term	Potentially Adverse	Localized, near channel
Surface and Ground-water quality and quantity	Malfunction of leachate control at landfill	Potential short term	Potentially Adverse	Local, near fill site
Air quality	Emissions due to as transportation (fuel usage = 10,690 gal/yr)	Long term	Adverse	Localized, along truck routes
Biotic Communities	Heavy metal uptake by vegetation growing upon final landfill cover	Potential Long term	Potentially Adverse	Landfill site
	Loss of vegetation at landfill site	Short term	Adverse	Landfill site
Public Health and Noise	Noise and Emission from ash transportation.	Long term	Adverse	Sensitive reception near truck routes
	Malfunction of leachate control and contamination of useable aquifer or surface waters.	Potential Long term or Short term	Potentially Adverse	Localized near landfill site
Energy	Use of Fossil Fuels (158,520 gal/yr)	Long term	Adverse	Regional
Land Use	Use of additional landfill area causing displacement of the other uses	Long term	Adverse	Local
Transportation	Truck transport (10 trips/day) much of which is through residential neighborhood)	Long term	Adverse	Along truck routes
Historical and Archaeological	Use of landfill sites (No known historical and archaeological resources nearby)	Potentially Adverse	Potentially Adverse	Regional

TABLE A-2

DIFFERENTIATING IMPACTS OF ALTERNATIVES 2 AND 10
(Cofferdam Fill)

Area of Impact	Action	Type of Impact	Assessment of Impact	Areal Extent
Marine sediments and water quality	Construction of cofferdam resulting in a habitat loss of 2.8 ha (7 ac)	Long term	Adverse	Localized, near Deer Island
Surface and groundwater quality and quantity	*Rupture of cofferdam (pricipanny for hazardous waste)	Potential short term; long term for hazardous waste	Potentially Adverse for hazardous waste	Localized, near Deer Island
Air Quality	Emissions due to ash transportation	Long term	Potentially Adverse	Localized, near Deer Island
Biotic Communities	Construction of cofferdam causing habitat loss.	Long term	Adverse	Localized, near Deer Island
	Rupture of cofferdam	Potential long term or short term	Potentially Adverse	Localized, near Deer Island
Public Health Noise	*Rupture of cofferdam	Potential long term or short term	Potentially Adverse	Localized, near Deer Island
	Noise generation during cofferdam construction (pile driver)	Short term	Potentially Adverse	Localized, near Deer Island
	Noise emissions from ash transport	Long term	Potentially Adverse	Deer Island
Energy	Use of fossil fuels (147,900 gal/yr)	Primary long term	Adverse	Regional
Land Use	Cofferdam site usage causing displacement of other uses.	Primary long term	Adverse	Local
Aesthetic	Cofferdam construction	Short term, Long term	Adverse	Localized, near Deer Island

TABLE A-3

DIFFERENTIATING IMPACTS OF ALTERNATIVES 8 AND 11
(Fill on Deer Island)

Area of Impact	Action	Type of Impact	of Impact	Areal Extent
Soils	Increase in heavy metals concentration of landfill cover soil	Potential Long term	Potentially Adverse	Landfill site
	Landfill operation resulting in erosion and soil structure destruction	Potential Long term	Potentially Adverse	Landfill site
Surface and ground-water quality and quantity	Malfunction of leachate con-trol at landfill	Potential short term or long term	Potentially Adverse	Local near fill site
Air Quality	Emission due to ash trans-portation (Fuel usage 320 gal/yr)	Long term	Potentially Adverse	Localized, near Deer Island
Biotic Communities	Heavy metal uptake by vegetation growing upon final landfill cover	Potential Long term	Potentially Adverse	Landfill site
	Loss of vegetation at landfill site	Short term	Potentially Adverse	Landfill site
Public Health and Noise	Noise and emission from ash transportation	Long term	Potentially Adverse	Deer Island
	Malfunction of leachate control at landfill	Potential short term or long term	Potentially Adverse	Localized, near Deer Island
Energy	Use of fossil fuels (Fuel usage = 147,900 gal/yr)	Long term	Adverse	Regional
Land Use	Use of landfill area causing displacement of landuse (Pro-bable fill site is within Fort Dawes	Long term	Adverse	Local
Historical and Archeological	Use of Fort Dawses area as land-fill site (possible historical resources)	Potential Adverse	Potentially Adverse	Regional
Aesthetic	Use of Fort Dawes as a land-fill	Long term	Adverse	Local

TABLE A-4

DIFFERENTIATING IMPACTS OF ALTERNATIVE 9
(Fill on Spectacle Island)

Area of Impact	Action	Type of Impact	Assessment of Impact	Areal Extent
Marine sediments and water quality	Dredging and construction for barging	Short term	Adverse	Localized, near channel
Surface and ground-water quality and quantity	Malfunction of leachate control at landfill	Potential short term or long term	Potentially Adverse	Localized, near Spectacle Island
Air Quality	Emissions due to ash transportation (Fuel usage = 1,065 gal/yr)	Long term	Potentially Adverse	Localized, near Spectacle Island
Biotic Communities	Heavy metal uptake by vegetation growing upon final landfill cover	Potential long term	Potentially Adverse	Spectacle Island
	Loss of vegetation at fill site	Short term	Potentially Adverse	Spectacle Island
Public Health and Noise	Noise and emissions from ash transporation	Long term	Potentially Adverse	Localized, near Spectacle Island
	Malfunction of leachate control at landfill	Potential long term or short term	Potentially Adverse	Localized, near Spectacle Island
Energy	Use of fossil fuels Fuel usage = 148,865 gal/yr	Long term	Adverse	Regional
Land Use	Landfill site usage causing displacement of other land uses	Long term	Adverse	Local
Historical and Archeological Sites	Use of landfill site (Pre-historic sites are known to exist on Spectacle Island	Potential Long term	Potentially Adverse	Regional

TABLE A-5

INPUT RESOURCE USE AND PRODUCTION *

	ALTERNATIVE					
	1	2	8	9	10	11
ON-SITE ANNUAL ENERGY USE						
Electrical	57.6×10^9	57.6×10^9	57.6×10^9	57.6×10^9	57.6×10^9	57.6×10^9
Fuel	21.1×10^9	21.1×10^9	21.1×10^9	21.1×10^9	21.1×10^9	21.1×10^9
Chemical	50×10^9	50×10^9	50×10^9	50×10^9	50×10^9	50×10^9
Total	128.7×10^9	128.7×10^9	128.7×10^9	128.7×10^9	128.7×10^9	128.7×10^9
ON-SITE ANNUAL ENERGY PRODUCTION						
Electrical	161×10^9	161×10^9	161×10^9	161×10^9	161×10^9	161×10^9
Fuel	650×10^9	650×10^9	650×10^9	650×10^9	650×10^9	650×10^9
Total	811×10^9	811×10^9	811×10^9	811×10^9	811×10^9	811×10^9
NET ON-SITE ENERGY PRODUCTION	682×10^9	682×10^9	682×10^9	682×10^9	682×10^9	682×10^9
NET ON-SITE ELECTRICAL ENERGY PRODUCTION	103×10^9	103×10^9	103×10^9	103×10^9	103×10^9	103×10^9
TRANSPORT & DISPOSAL ENERGY USE	1.53×10^9	9.3×10^6	4.58×10^7	1.52×10^8	9.3×10^6	4.58×10^7
NET ENERGY PRODUCTION						
Total	680×10^9	682×10^9	682×10^9	682×10^9	682×10^9	682×10^9
Equivalent Fuel Production (Gallons of #2 Diesel Fuel/Yr.)	4.76×10^6	4.77×10^6	4.77×10^6	4.77×10^6	4.77×10^6	4.77×10^6

* All units in BTU/year except where noted

TABLE A-6

COSTS OF ALTERNATIVES (1978 DOLLARS)

	ALTERNATIVE					
	1	2	8	9	10	11
Capital Costs						
Without Grant	$31,099,100	$34,802,100	$30,591,100	$31,163,100	$34,824,100	$30,591,100
With Grant	7,774,775	8,700,525	7,647,775	7,790,775	8,706,025	7,647,775
Annual Capital Costs						
Without Grant	2,885,900	3,196,500	2,810,500	2,832,850	3,198,500	2,810,500
With Grant	748,005	800,930	704,435	720,975	801,460	704,435
Annual Operating Costs	2,653,655	2,213,020	2,213,090	2,256,975	2,212,995	2,213,090
Credit for Electrical Energy	441,000	441,000	441,000	441,000	441,000	441,000
Total Annual Costs						
Without Grant	5,098,555	4,968,520	4,582,590	4,648,825	4,970,495	4,582,590
With Grant	2,960,660	2,572,950	2,476,525	2,536,950	2,573,455	2,476,525

3. Implementation Considerations

Each of the alternatives describing the methods and locations for ultimate ash disposal has problems associated with implementation.

The major barriers to implementation of each alternative are:

- Alternative 1: Transportation of ash to the fill site (Plainville) would be under various constraints and could pose implementation problems. In addition, Alternative 1 requires access to roll-on, roll-off facilities not now available. The lack of such facilities means that this alternative would not be cost-effective. Finally, although this alternative is based on use of an existing fill site, the possibility that the ash will be considered hazardous cannot be ignored. The Plainville site is not approved for hazardous wastes.

- Alternatives 2 and 10: The principal implementation barrier to Alternative 2 is the use of coastal area for fill. The City of Boston's Conservation Commission has authority over shoreline changes. Based on EPA's guidelines and criteria for implementing Section 404 of the FWPCA, the Corp of Engineers may not be able to grant the required permits for ocean fill of ash.

- Alternative 8 and 11: Use of the Fort Dawes area for fill of ash, either hazardous or non-hazardous, is complicated by the Boston Harbor Islands Master Plan, which includes use of Fort Dawes as a recreational site. Approval for change would be necessary.

- Alternative 9: In the case of hazardous ash, the leachate from the ash fill must be treated for metals removal (in Appendix T, Part B, Volume III, treatment costs were included for this) and an NPDES permit would be necessary for discharge. The Spectacle Island site has been used as a fill area for municipal refuse, and installation of leachate control would be difficult. Because of limitations on the use of the harbor islands, the only landfill possible would be use of non-hazardous ash for surface contour regrading. The Boston Harbor Islands Plan proposes use of Spectacle Island within five years for passive recreation.

- Alternatives 10 and 11: Preparation of fill for hazardous wastes will require obtaining a permit in accordance with draft provisions of the Resource Conservation and Recovery Act (P.L. 94-580), and monitoring of groundwater observation wells, and collection and treatment of leachate must be done.

In summary, all feasible alternatives are subject to implementation difficulties but of these six alternatives, 8 and 11 will probably have the fewest implementation problems. Alternatives 2 and 10 have implementation difficulties which may be insurmountable, particularly in combination with the increased cost for cofferdam construction. Alternative 9 cannot be implemented unless the ash is considered non-hazardous.

4. Summary of Analysis

The selection process, at this point, was principally based on implementation and relative impact. Alternative 2 and 10, which include filling of ash in cofferdammed areas on either the ocean or harbor side of Deer Island, (which are elements of the Applicant's Proposed Action) were initially eliminated for the following reasons:

- The Boston Conservation Commission, which has review authority over this action, would not accept harbor fill (Beal 1975) if there were alternatives to this action.

- Based on EPA guidelines which must be used by the Corps of Engineers in evaluating filling projects the Corp may not be able to issue a filling permit if an alternative with lesser environmental impacts is available.

- The cofferdam construction made these alternatives less cost effective than Alternative 8, 9, and 11 with or without federal grants.

- The impact of harbor area lost associated with alternative 10 was considered unacceptable.

- The potential impact of cofferdam rupture due to potential storm damage and breaking of the cofferdam made both alternatives 2 and 10 unacceptable.

- Interpretation of Executive Order 11988 and 11990 required that no other viable alternatives exist before allowing wetlands fills or desruption of floodplains.

Alternative 1, using inland fill at an existing fill site, was eliminated for the following reasons:

- The sludge analysis indicated that the ash might be a hazardous material as defined by RCRA, and as such the absence of landfills in eastern Massachusetts licensed for hazardous wastes precluded use of this alternative.

- Alternative 1 was the least cost effective alternative with or without federal grants.

- The resource costs and transportation impacts were such that if other more cost effective alternatives were available this alternative would be eliminated.

Alternative 8, using an inland fill on Deer Island for non-hazardous wastes was also eliminated because of the initial assumption made that the ash would be defined as hazardous. The sole difference between Alternative 8 and 11 is the recycle of leachate for treatment.

This meant that if the sludge ash should be considered non-hazardous (probably due to a change in definition rather than a change in sludge composition) there would be no reason not to proceed with Alternative 11.

Therefore, alternatives 9 and 11 remained and became the recommended project alternatives. These had about the same level of implementation problems and associated adverse impacts. While alternative 11 was considered to be the most cost effective, its implementation could be blocked due to its inconsistency with the Boston Harbor Islands Plan. Therefore, alternative 9 was retained.

D. Conclusions Level 2 Analysis

The EIS rejected all ash disposal alternatives which involved filling of ash in a cofferdam on either the ocean or harbor side of Deer Island (Alt. 2 and 10). Alternative 10 was eliminated not only on the basis of the perceived detrimental impacts which would result from filling of the harbor; but also due to the cost of cofferdam construction and the fact that the Boston Conservation Commission has stated it would not allow construction in the harbor if other alternatives existed. Alternative 2 was eliminated because of problems with implementation, and the relative environmental impacts of that alternative. The implementation problems associated with this filling alternative were mainly concerned with an interpretation of existing Presidential Executive Orders (11990 and 11988) covering federal actions affecting wetlands and floodplains. The interpretation stated that any construction in wetlands would be prohibited if any practicable alternative exists. Present federal policy and EPA guidelines do not specifically prohibit such construction (filling), but do require that a floodplain/wetlands assessment of the project and its alternatives be undertaken and a final decision as to practicability made based on a comparison of their relative feasibility, economic costs and environmental impacts. As a result, EPA cannot at this time eliminate ash disposal alternatives solely on the basis that they require filling. While the rationale behind the elimination of alternatives requiring filling may be justified, more information on the actual "effects" and impacts of filling should be made available before a final decision is reached. Therefore, we are requiring that the MDC, as part of their facility planning prepare an environmental assessment of alternatives 2, 9, and 11 and based on a review of that assessment, EPA and MDC will select the option which proves to be the most environmentally sound and cost-effective. Since the construction of a cofferdam and its subsequent filling with ash will require that a Section 404 Dredge and Fill permit be issued by the Corps of Engineers, the assessment will use the EPA Section 404(b) guidelines to determine if the impacts are acceptable or if less damaging alternatives are available.

SECTION VI

Environmental Consequences

The environmental impacts and consequences of all the alternatives were presented and evaluated in Section III. Those impacts associated with the selected incineration alternative and the feasible ash disposal options were presented in Tables A-1 - A-4.

In general, the selection of incineration will result in several major beneficial impacts being realized. These impacts include the removal of a significant increment of pollution from Boston Harbor. The proposed action will result in the removal of approximately 80% of the sludge BOD load and an even larger portion of the sediment load now imposed on Boston Harbor by the continued outpouring of digested sludge. In addition, there will be an improvement in the aesthetics of the Harbor; the possible removal of bans on commercial and recreational shellfishing; and the increased availability of the Harbor for other recreational uses (bathing, fishing, boating). The sediments of the Harbor will be improved to the point where the diverse, desirable marine life which the Harbor is theoretically capable of supporting may become reestablished.

The principle adverse environmental consequence which will result from the implementation of the recommended plan is related to air quality. The proposed scrubber system and required air pollution control devices will, however, minimize the amount of incinerator emissions and thus mitigate the adverse impacts to the air.

SECTION VII

Public Participation

A. Public Hearing

The draft statement was available for review at least 30 days prior to the hearing, and the public hearing was held on April 16, 1976 in accordance with 40 CFR 6.402 (see Appendix AA). A transcript of that public hearing is available for public review.

B. Public Workshops

In addition to the above, EPA, Region I held two public information workshops during the course of this study for the express purpose of informing concerned interests of progress on the project, and to elicit comments and concerns from those parties.

The first workshop was held on September 4, 1975, in the 22nd floor conference room of the J.F.K. Federal Building, Boston, Massachusetts. This workshop outlined the scope of the project (including the basic alternatives to be investigated) and explained the methodology to be used in evaluating those alternatives. An informational handout was prepared for the workshop and it was made available to the participants. Appendix BB reproduces that handout, and lists the organizations that were represented at the meeting.

The second public workshop was held at the same location on November 10, 1975. This meeting presented to the participants the results of the environmental, energetic, and cost-effectiveness evaluations that had been developed in the intervening period since the first workshop.

C. Receipt and Filing of the Draft and Final Impact Statement

The draft environmental impact statement was submitted to the Council on Environmental Quality in March, 1976, for review by other Federal agencies and the public.

As a result of the transfer of impact statement filing responsibility from CEQ to EPA, (FR Vol. 42, No. 218, p. 58775), this Final EIS is being submitted to the U.S. EPA, Mail Code A-104, Washington, D.C. 20460 for clearing house action.

A P P E N D I X

APPENDIX A-1. CRSTER ANALYSIS

I. Background

EPA's Emission Offset Interpretative Ruling has established levels of significance for the impact of a new major source located in a clean zone (attaining NAAQS) on a dirty zone (not attaining NAAQS). If the impact of the new source is greater than these significance levels, then the source is subject to the requirements of the offset ruling. In addition the source is subject to EPA's PSD regulations as concerns its impact on the clean zone. This includes a demonstration that the impact of the source will not exceed the PSD defined increments and that the source will not cause a new violation of any NAAQS.

The problem at hand is that Deer Island is located in a non-attainment AQCR for TSP, but the state has designated Deer Island itself as a clean zone. The consultant's analysis of air quality impacts presented in the EIS, Part B, Volume II, Appendix V, p. 185, indicates a potential for exceeding the significance levels for TSP (24-hour average of 5 ug/m^3 and annual average of 1 ug/m^3). The applicable Class II PSD increments (24-hour average of 37 ug/m^3 and annual average of 19 ug/m^3) are shown to be met.

The type of analysis that is presented in the EIS, Part B, is known as a Worst Case Analysis. This utilizes assumed worst case meteorology that is independent of wind direction in a simple Gaussian diffusion model, e.g. PTMAX, to yield conservative upper bounds for maximum expected concentrations, as described in EPA Guidelines. [1]

This type of analysis is simple to do and is normally used as a quick screening analysis. If the maximum concentration is less than the regulatory limit of concern, then a more time consuming refined analysis is not needed. The analysis also cannot geographically locate the areas of expected maximum concentration with any degree of accuracy. Of course, if the maximum is under the limit of concern, one wouldn't be too concerned where that maximum was. If the regulatory limits themselves vary spatially, as in the case at hand, the screening analysis should yield a maximum concentration less than the lowest regulatory limit of concern.

1. Guidelines for Air Quality Maintenance Planning and Analysis Volume 10 (Revised): Procedures for Evaluating Air Quality Impact of New Stationary Sources, EPA Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina EPA-450/4-77-001, 1977.

If the worst case analysis indicates a potential for exceeding a regulatory limit, then a more refined analysis is needed. This analysis, while more resource consuming than the screening analysis, should yield more realistic estimates of maximum expected concentrations and must have spatial resolution sufficient to identify their locations. Refined analyses normally use observed meteorology in a brute force approach that calculates hour-by-hour concentrations for a suitably long period of record at many receptor locations. Hourly concentrations can be averaged every 24 hours (normally midnight-to-midnight) to yield daily averages from which the maximum daily average can be extracted. Other averaging times are handled similarly, including the annual average.

This Appendix presents such an analysis for the impact of the Deer Island Facility on TSP levels. In the following sections, the model and input data that were used are described, and the results presented. In addition to daily and annual averages, results are presented for averaging times of 1 hour, 3 hours and 3 months so that the results for TSP can be used to generate predictions for NOX, SO2 and lead that can be compared to the PSD increments for SO2, and used in NAAQS analyses for all three pollutants. NAAQS analysis requires the addition of suitable background levels of pollutant to the modeled predictions. The transformation of TSP concentrations to those for a new pollutant is done by multiplying the predicted TSP concentration by the ratio of the new pollutant emission rate to the TSP emission rate. (Predicted concentrations are directly proportional to emission rates.) The transformations and NAAQS analyses for all pollutants, including TSP, are presented in Appendix A-2.

II. Description of Model and Input

A. The Model

As recommended by EPA Guidelines[1], the EPA CRSTER model was used. This is a steady-state Gaussian plume model that uses the well known Pasquill-Gifford dispersion coefficients and Turner stability classification scheme. Plume rise is calculated via Briggs' formulas. A radial receptor network is defined by the intersections of the 36 azimuthal directions (10°, 20°, ..., 360°) and 5 downwind distances that are input by the user for a total of 180 receptors per computer run. Multiple (up to 19) stacks can be input, but they are assumed to be colocated. This is a conservative assumption. Up to one year of meteorology can be input per computer run. This consists of hourly values for windspeed and direction, stability class, mixing height

1. Guidelines on Air Quality Models, EPA Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina EPA-450/2-78-027, 1978.

and temperature. The model has a preprocessor program that converts hourly meteorological observations as would be recorded by National Weather Service stations into the required model input. Other features of the model are an urban-rural option, vertical wind shear adjustment, trapping of plumes under elevated mixing lids and a terrain adjustment. The model is well documented in a User's Guide, [1] and the reader is referred to that document for a more complete description of the model.

B. Meteorology

The model was run for the 5 year period 1970-74 (each year was run separately.) This length of record is consistent with EPA Guidelines. The meteorological input was processed from surface observations at Logan Airport and upper air soundings at Portland, Maine. Due to the proximity of Logan to Deer Island, the meteorological data base should be quite representative of the facility's site. Of the nearest radiosonde stations (Albany, Portland, New York, Chatham) Portland is judged to be the most representative of the site. The urban option of the model was used.

C. Source Data

Table 1. Source Input

emission rate (2 units)	1.68 g/sec
stack height	45.72 m (150 ft)
stack diameter	.90 m
exit velocity	10.00 m/sec
exit temperature	322.00 ^{o}K
stack base elevation	30.00 ft msl

Both stacks were colocated. Since each stack had the same source parameters, only one stack was modeled with twice the maximum emission rate per unit of .84 g/sec. The stacks will actually be separated by 40 ft, according to the EIS, Part B. While not negligible, this distance is not great enough for us to be concerned with the over-prediction that results from colocation. The stacks were located at UTM co-ordinates (4690.7, 338.5). The stack height of 150 ft (the analysis in Part B used 110 ft) is based on the downwash analysis in the draft EIS for upgrading MDC, Vol. 2, p. A-412. It is EPA's understanding from FAA that this stack height will not be a problem for aircraft operation at Logan Airport. The remaining stack parameters were taken from the EIS, Part B, Vol. II, Table V-2. Note that this table lists incorrect peak emission rates, although the consultant used the correct emission rates in his modeling.

1. User's Manual for Single-Source (CRSTER) Model, EPA Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina, EPA-450/2-77-013,1977.

D. Receptors

Ten receptor rings were chosen. Since the model can only handle 5 rings per run, this necessitated 2 runs per meteorological year. However, the density of receptor coverage this afforded is believed to yield adequate spatial resolution. The receptor rings were chosen as follows.

The PTMAX model was run for the source parameters listed above. The output was examined to determine likely distances to downwind maximum concentrations for those meteorological conditions thought to be important in producing maximum short term concentrations. The 5 distances so chosen were: 0.37, 0.67, 1.21, 2.17 and 3.89 km. In addition, the distances to 5 nearby air quality monitors of interest, as determined from their UTM co-ordinates, were calculated: 4.23, 6.00, 8.05, 11.40 and 12.16 km. All the above distances were used with the exception of 3.89 km. This distance was eliminated in order to have a receptor at Cottage Hill in Winthrop, a distance of 1.79 km. The 3.89 km distance was eliminated because of its proximity to the 4.23 km ring. Table 2 presents the locations of the monitors and Cottage Hill. Figure 1 depicts these locations and the receptor network.

Table 2. Locations of Monitors and Cottage Hill

Name	X	Y	Distance (km)	Ring	Azimuth	Direction
Cottage Hill	4692.380	337.880	1.79	4	340°	34
Long Island	4686.537	337.766	4.23	6	190°	19
Revere	4696.154	336.000	6.00	7	335°	33-34
JFK	4691.615	330.500	8.05	8	277°	28
Kenmore	4690.400	327.100	11.40	9	269°	27
Quincy	4678.600	337.300	12.16	10	186°	18-19

The receptor heights were read from USGS maps. According to restrictions imposed by the terrain adjustment in the model, one receptor height that was higher than stack height had to be adjusted downward to be less than the stack height. This adjustment was only 20 ft and it was at the last ring distance where the plant impact is shown to be negligible. In general, topography does not present any problem for this analysis. Table 3 presents the terrain heights that were input to the model.

Figure 1. Receptor and Monitor Locations

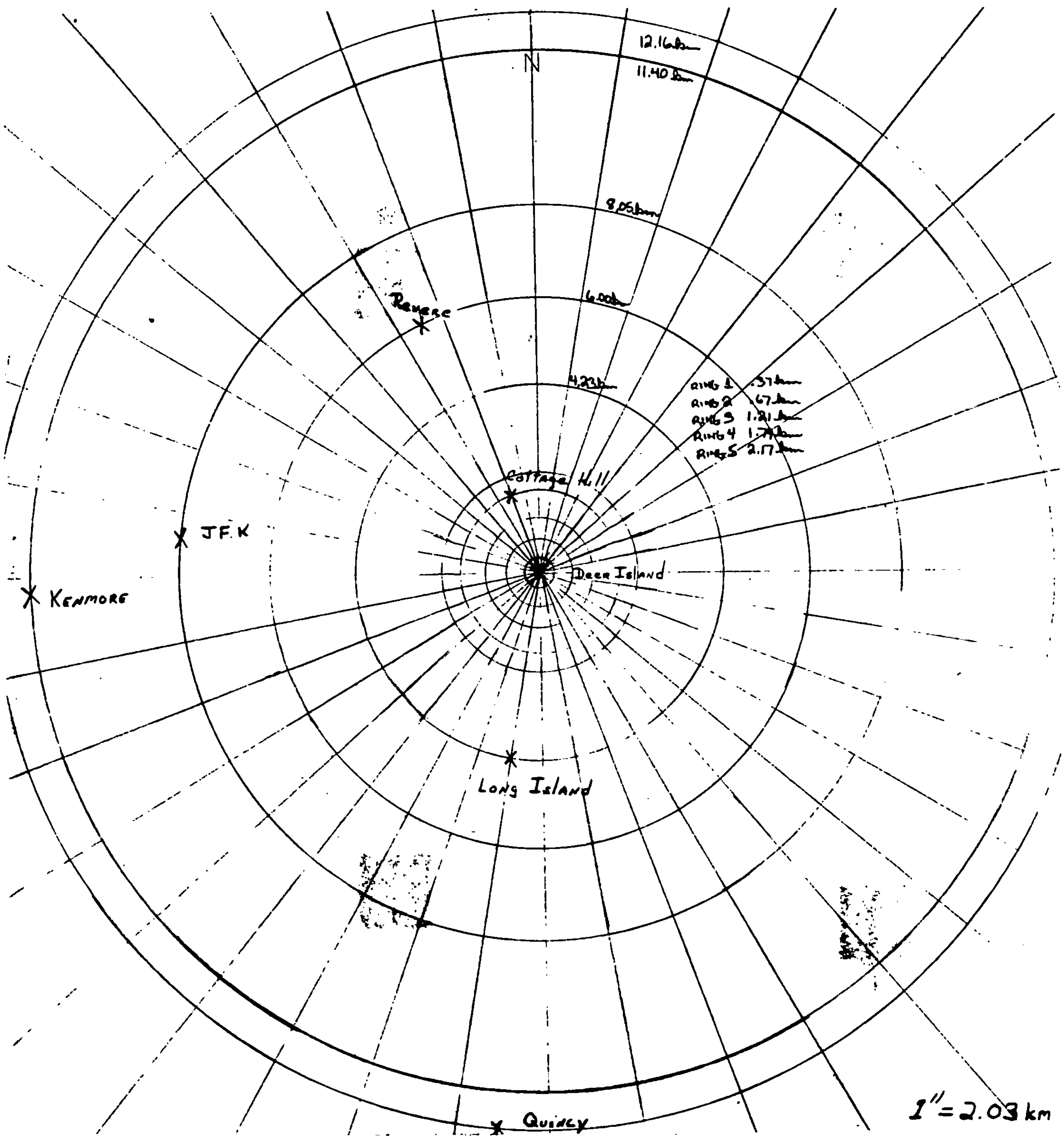


Table-3. Receptor Heights

RING DISTANCES(KM)= .37 .67 1.21 1.79 2.17

PLANT ELEVATION (FEET ABOVE SEA LEVEL)-- 30.0

RECEPTOR ELEVATIONS (FEET ABOVE SEA LEVEL)

DIRECTION	RING#1	RING#2	RING#3	RING#4	RING#5
1	.0	.0	.0	.0	.0
2	.0	.0	.0	.0	.0
3	.0	.0	.0	.0	.0
4	.0	.0	.0	.0	.0
5	.0	.0	.0	.0	.0
6	.0	.0	.0	.0	.0
7	.0	.0	.0	.0	.0
8	.0	.0	.0	.0	.0
9	.0	.0	.0	.0	.0
10	20.0	.0	.0	.0	.0
11	10.0	.0	.0	.0	.0
12	10.0	.0	.0	.0	.0
13	35.0	45.0	.0	.0	.0
14	60.0	30.0	.0	.0	.0
15	95.0	10.0	.0	.0	.0
16	110.0	10.0	.0	.0	.0
17	100.0	.0	.0	.0	.0
18	80.0	.0	.0	.0	.0
19	50.0	.0	.0	.0	.0
20	10.0	.0	.0	.0	.0
21	10.0	.0	.0	.0	.0
22	10.0	.0	.0	.0	.0
23	10.0	.0	.0	.0	.0
24	10.0	.0	.0	.0	.0
25	.0	.0	.0	.0	.0
26	10.0	.0	.0	.0	.0
27	10.0	.0	.0	.0	.0
28	10.0	10.0	.0	.0	.0
29	10.0	10.0	.0	.0	.0
30	10.0	.0	20.0	.0	.0
31	.0	.0	15.0	.0	.0
32	.0	.0	.0	.0	.0
33	.0	.0	.0	20.0	.0
34	.0	.0	.0	100.0	10.0
35	.0	.0	.0	.0	.0
36	.0	.0	.0	.0	.0

RING DISTANCES(KM)= 4.23 6.00 8.05 11.40 12.16

PLANT ELEVATION (FEET ABOVE SEA LEVEL)-- 30.0

RECEPTOR ELEVATIONS (FEET ABOVE SEA LEVEL)

DIRECTION	RING#1	RING#2	RING#3	RING#4	RING#5
1	.0	.0	.0	10.0	40.0
2	.0	.0	.0	.0	.0
3	.0	.0	.0	.0	.0
4	.0	.0	.0	.0	.0
5	.0	.0	.0	.0	.0
6	.0	.0	.0	.0	.0
7	.0	.0	.0	.0	.0
8	.0	.0	.0	.0	.0
9	.0	.0	.0	.0	.0
10	.0	.0	.0	.0	.0
11	.0	.0	.0	.0	.0
12	.0	.0	.0	.0	.0
13	.0	.0	110.0	.0	.0
14	.0	.0	.0	.0	.0
15	.0	.0	.0	.0	30.0
16	.0	.0	.0	50.0	40.0
17	.0	.0	.0	20.0	10.0
18	.0	.0	.0	10.0	10.0
19	40.0	.0	.0	.0	40.0
20	.0	.0	.0	20.0	60.0
21	50.0	.0	60.0	20.0	60.0
22	.0	.0	.0	10.0	.0
23	.0	.0	.0	40.0	80.0
24	.0	.0	10.0	100.0	60.0
25	.0	30.0	10.0	110.0	80.0
26	.0	10.0	20.0	10.0	80.0
27	10.0	.0	20.0	10.0	20.0
28	10.0	10.0	50.0	10.0	30.0
29	10.0	10.0	10.0	20.0	60.0
30	10.0	10.0	100.0	10.0	10.0
31	.0	10.0	150.0	40.0	10.0
32	10.0	10.0	179.0	50.0	140.0
33	.0	10.0	50.0	70.0	179.0
34	10.0	.0	.0	60.0	60.0
35	.0	.0	.0	10.0	30.0
36	.0	.0	.0	10.0	30.0

III. Results

A. Annual Average

Table 4. Maximum Annual Averages (ug/m^3)
Level of Significance is 1.0 ug/m^3

Year	Rings 1 - 5 .37 to 2.17 km	Rings 6 - 10 4.23 to 12.16 km
1970	.79 (.49)	.14
1971	1.00 (.49)	.14
1972	.97 (.44)	.13
1973	.76 (.45)	.13
1974	1.01 (.50)	.15

Table 5. Maximum Annual Averages Over All Years at Monitors and Cottage Hill (ug/m^3)

Cottage Hill	.24
Long Island	.06
Revere	.04
JFK	.03
Kenmore	.02
Quincy	.02

The maximum annual average over all receptors and all years was 1.01 ug/m^3. The maximum for each year was always on the top of the hill on Deer Island to the SE of the plant. The numbers in parentheses in Table 4 are the maxima over all receptors not located on Deer Island. These maxima were always 1.21 km to the ENE of the plant over the water. The maximum over all years for this receptor was .50 ug/m^3.

In summary, the level of significance is exceeded only on Deer Island itself. However, since this is a clean zone, predicted concentrations on Deer Island should be compared with the Class II PSD increment of 19 ug/m^3. This limit is easily met. Off of Deer Island, the level of significance is not threatened with maximum impacts of one half this level. The maximum impact at any monitor is only 6% of the level of significance.

B. Daily Averages

Table 6. Maximum and Highest Second-High Daily Averages (ug/m^3)
Level of Significance is 5.0 ug/m^3

Year	Rings 1 - 5 .37 to 2.17 km		Rings 6 - 10 4.23 to 12.16 km	
	MAX	HI-2-HI	MAX	HI-2-HI
1970	9.91 (5.05)	8.15	2.51	1.36
1971	12.54 (4.88)	10.25	1.38	1.16
1972	9.18 (4.71)	8.99	1.83	1.26
1973	8.33 (5.92)	7.35	3.53	1.88
1974	9.86 (4.58)	8.18	2.12	1.36

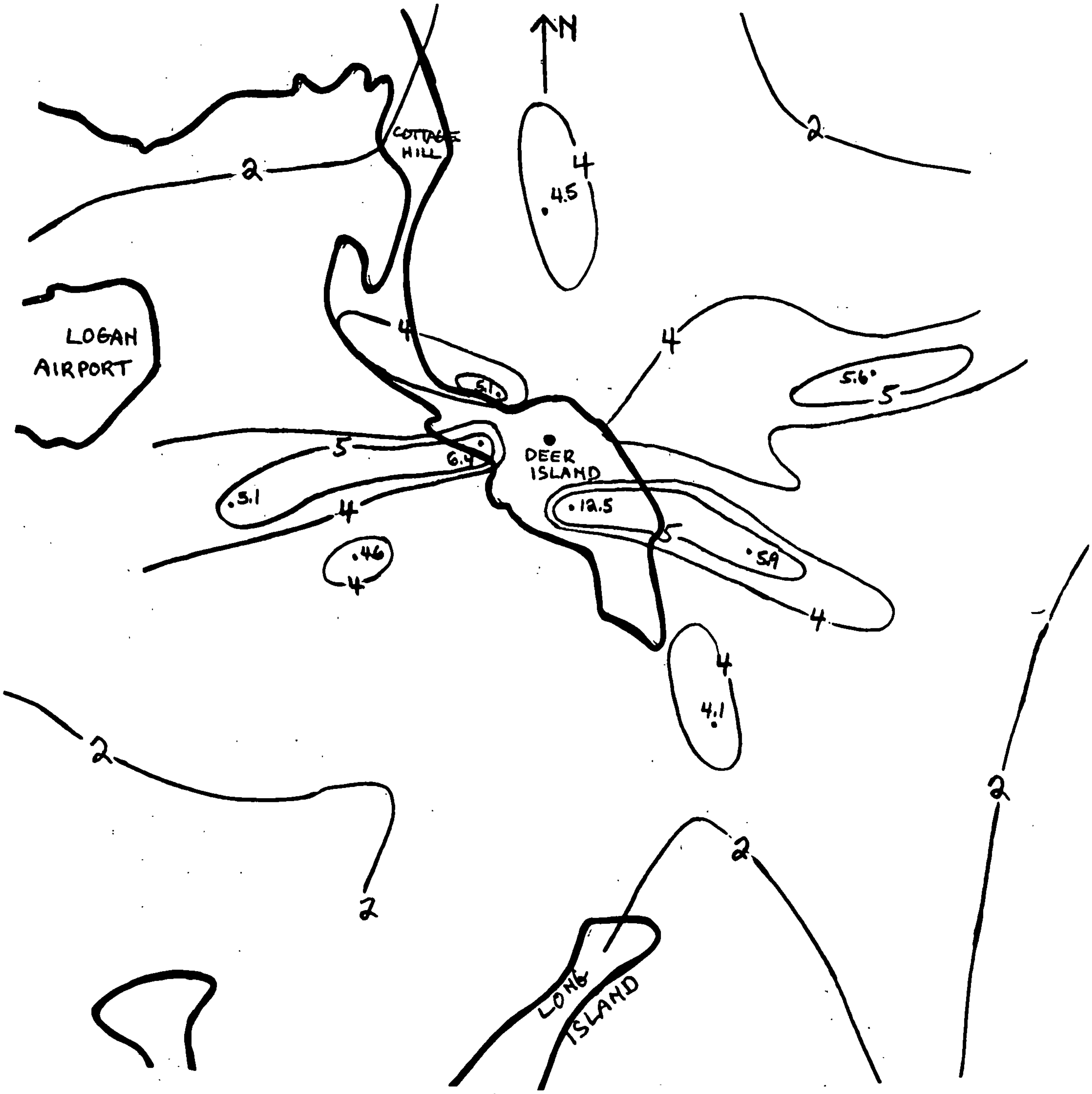
Table 7. Maximum and Highest Second-High Daily Averages Over All Years at Monitors and Cottage Hill (ug/m^3)

	MAX	HI-2-HI
Cottage Hill	3.51	2.55
Long Island	1.95	1.47
Revere	.93	.63
JFK	.81	.71
Kenmore	.54	.48
Quincy	.50	.36

The maximum daily average over all receptors and all years was 12.54 ug/m^3. The maximum for each year was always on the hill on Deer Island to the SE of the plant. The numbers in parentheses in Table 6 are the maxima over all receptors not located on Deer Island. The maximum over all years for these receptors was 5.92 ug/m^3. Figure 2 more clearly illustrates the results for maximum daily TSP levels. This map shows all areas over 4 and 5 ug/m^3. The level of significance is exceeded on Deer Island and in several areas over the waters off Deer Island within approximately 2 km distance of the plant. The only land area where the significance level is threatened, aside from Deer Island, is the neck right above Deer Island and below Cottage Hill in the vicinity of Point Shirley.

The exceedances on Deer Island do not present a problem since Deer Island is a clean zone. The applicable PSD Class II increment is 37 ug/m^3, not to be exceeded more than once per year. Thus, it is the highest second-high concentration, that is to be compared to the increment. These are also presented in Table 6. The largest highest second-high is 10.25 ug/m^3 on Deer Island. Finally, Table 7 indicates that both the level of significance and PSD increment will not be violated at any monitor or at Cottage Hill.

Figure 2. Maximum Daily TSP
(ug/m^3), 1970 - 74



C. 3-Hour and 1-Hour Averages

Table 8. Maximum and Highest Second-High 3-Hour Averages (ug/m^3)

Year	Rings 1-5 .37 to 2.17 km		Rings 6-10 4.23 to 12.16 km	
	MAX	HI-2-HI	MAX	HI-2-HI
1970	27.53	24.30	10.92	8.78
1971	39.79	37.24	7.61	5.53
1972	29.39	24.47	9.05	7.56
1973	39.57	28.92	17.55	10.67
1974	39.81	25.66	9.33	7.65

Table 9. Maximum and Highest Second-High 1-Hour Averages (ug/m^3)

Year	Rings 1-5 .37 to 2.17 km		Rings 6-10 4.23 to 12.16 km	
	MAX	HI-2-HI	MAX	HI-2-HI
1970	57.23	51.20	18.23	15.74
1971	69.70	62.20	16.59	11.17
1972	68.75	63.54	15.89	13.57
1973	79.90	78.13	20.83	20.83
1974	69.09	57.51	15.46	11.96

Table 10. Maximum and Highest Second-High 3-Hour and 1-Hour Averages Over All Years at Monitors and Cottage Hill (ug/m^3)

	3-Hour		1-Hour	
	MAX	HI-2-HI	MAX	HI-2-HI
Cottage Hill	17.99	16.15	48.44	36.19
Long Island	7.05	6.34	12.39	11.29
Revere	5.05	4.97	11.11	10.62
JFK	3.87	3.13	8.58	5.60
Kenmore	2.51	1.79	6.46	3.42
Quincy	1.89	1.64	4.62	4.23

Because there is a 3-hour PSD increment for SO_2 (as well as a 3-hour NAAQS) and a proposed 1-hour NAAQS for NOX, the above tables are presented. The maximum and highest second-high 3-hour concentrations over all years are 39.81 and 37.24 ug/m^3. The maximum and highest second-high 1-hour concentrations are 79.90 and 78.13 ug/m^3.

D. 3-Month Average

The CRSTER model does not routinely print summary tables for the 3 month averaging time as it does for the annual, daily, 3-hour and 1-hour averaging times. If the tape output option of the model is used, the user can write his own program to directly calculate 3-month averages from this tape output. The model had already been run when the request for 3-month averages came in, motivated by the new lead standard. There was not enough time to rerun the model and write the analysis program. Hence, the maximum 3-month average was estimated from the printed daily and annual maximums.

Intuitively, the maximum 3-month average will fall between the maximum daily average and the annual average for any particular year, but much closer to the annual average.

Table 11. Maximum Daily and Annual Averages (ug/m^3)

Year	Annual	Daily
1970	.79	9.91
1971	1.00	12.54
1972	.97	9.18
1973	.76	8.33
1974	1.01	9.86

EPA's subjective estimate for the maximum 3-month average would be 1-2 ug/m^3.

The CRSTER printed output does give some additional insight into the 3 month averages. For each year, the model prints out the daily maximum over all receptors for each day. By summing these daily averages one can calculate 3-month averages. These will be conservative upper bounds because we are adding together daily maxima irregardless of receptor location.

To illustrate this, let us consider two receptors, A and B. A is to our west, B is to our east and we (the source) are facing north in between A and B. On day 1, the wind blows west to east and the maximum daily average is 10 ug/m3 at point B while at point A the average for this day is zero. On day 2, the wind blows east to west and the daily maximum is 10 ug/m^3 at Point A while at point B the average for this day is zero. The two day averages at both point A and B are 5 ug/m^3. However, with the technique of adding daily maxima we get a two day average of 10 ug/m^3.

This technique was used for the year 1974 since that year had the highest annual average concentration. First, the total of the daily maxima for each month were calculated; from these running three month averages were then calculated. The results are presented in Table 12. The highest 3 month average thus caluclated was 2.71 ug/m^3. To illustrate the conservatism built into this calculation, an annual average of 2.42 ug/m^3 was calculated using the same technique. This compares with the actual maximum annual average of 1.01 ug/m^3. If the estimated 3-month average was overestimated by the same amount as the annual average, the actual 3-month average would be 1.13 ug/m^3.

Table 12. Calculated 3-Month Averages for 1974 Using Method of Adding Daily Maxima

Period		ug/m^3
JFM *	C+	2.33
FMA		2.10
MAM		2.06
AMJ	C	2.15
MJJ		2.49
JJA		2.58
JAS	C	2.71
ASO		2.67
SON		2.68
OND	C	2.50
NDJ		2.42
DJF		2.37

* JFM - January, February, March etc.

\+ C - Calendar quarter

IV. Summary and Conclusions

Table 13. Summary of Results for TSP (ug/m^3)

	Predicted Concentration	Regulatory Limit
Maximum Annual	1.01	19.0
Maximum Annual off Deer Island	.50	1.0
Maximum 24-hour	12.54	
Maximum 24-hour off Deer Island	5.92	5.0
Highest Second-High 24-hour	10.25	37.0
Maximum 3-hour	39.81	
Highest Second-High 3-hour	37.24	
Maximum 1-hour	79.90	
Highest Second-High 1-hour	78.13	
Estimated 3-Month Maximum	2.71	

For TSP, it is concluded that the PSD increments will be met in the clean zone on Deer Island. In the dirty zone, off of Deer Island, the level of significance for the annual average is met. However, it is exceeded for the 24-hour average over waters adjacent to Deer Island within approximately 2 km of the plant. The only land area in the dirty zone where the level of significance is approached is in the vicinity of Point Shirley. At the Revere monitor where non-attainment is projected for background levels in the EIS, Part B, the maximum annual concentration is predicted to be .04 ug/m^3 or 4% of the level of significance. The maximum 24-hour concentration at Revere is predicted to be .93 ug/m^3 or about 19% of the level of significance.

Appendix A-2

As mentioned in Part A-1 of this Appendix, the transformation of Total Suspended Particulates (TSP) concentrations to those for a new pollutant (SO_2, No_x, Pb and Cd) is done by multiplying the predicted TSP concentrations for any desired period (annual, 3 month, 24 hour, 3 hour and 1 hour) by the ratio of the new pollutant emission rate to the TSP emission rate for that same period. The results of these calculations are shown in Table 1 below.

Table 1

Ground Level Concentrations (ug/m^3)

	TSP*	SO_2	No_x	Pb	Cd
Annual Average	1.01	2.98	4.81	0.006	0.0002
3 Month Average	2.71	8.00	12.89	0.015	0.0004
Highest 24 Hour	12.5	36.9	59.2	0.06	0.002
Highest 3 Hour	39.8	117.4	189.4	0.18	0.006
Highest 1 Hour	79.9	235.7	380.3	0.36	0.012
Emission Rate	1.68	4.96	8.00	.00922	.00026
Ratio	1.0	$\frac{4.96}{1.68} = 2.95$	$\frac{8.00}{1.68} = 4.76$	$\frac{.00922}{1.68} = .0055$	$\frac{.00026}{1.68} = .000158$

*Predicted by CRSTER model at various locations

These incinerator-produced Ground Level Concentrations (GLC) are then added to predicted 1985 background levels of the same pollutants to determine the total GLC. In the case of TSP and SO_2, actual monitored values for those pollutants at a monitoring location on Long Island, a distance of 4.23 km (about 2 1/2 miles) from the proposed incinerator site were used. This location was determined to be the location, with air quality data available, that was most representative of the areas around the incinerator where the GLC's due to the incinerators would be a maximum. The measured values at Long Island are shown in Table 2.

Table 2

Measured Background Levels at Long Island (ug/m^3)

Pollutant	TSP	SO_2
Annual Average	35.0	27.0
Highest 24 Hour	104.1	120.5
Second Highest 24 Hour	95.3	115.3

It was assumed that since these data showed compliance with standards no improvement could be counted on and that the 1977-78 data would be representative of 1985 conditions. No_x was not monitored at the Long Island station and therefore No_x data from a monitoring site in East Boston, the closest site to the proposed incinerator, was used. The East Boston site is in an area which is more populated and subject to many more combustion emission sources than Deer Island and, therefore, data from the site is not truly applicable to Deer Island. That data is presented for comparison sake and it should be noted that judgements based on that data will be conservative. The annual average background 1985 concentration for No_x was assumed to be 85.3 ug/m^3 based on the East Boston monitoring data.

Background level data on Pb and Cd were even harder to find. The closest monitoring location measuring Pb was located in Kenmore Square. Although this site is not at all representative of Deer Island, it was the only data available and therefore was used for purposes of comparison. The 1978 monitored 3 month average was 6.6 ug/m^3. Nationally EPA has estimated that switching to unleaded gasoline will reduce the lead concentrations in an area by 89% in the ten year period from 1975 to 1985. If we assume that 30% of that reduction has taken place between 1975 and 1978 and calculated the 1975 value it would be 8.5 ug/m^3. Therefore, the calculated 1985 background level at Kenmore Square would be 0.94 or 1.0 ug/m^3.

No background levels for cadmium have been measured in the Boston area but air pollution experts at EPA's research facility at Research Triangle Park, Durham, North Carolina were contacted and they indicated that 6 to 9 manograms (10^{-9}) per cubic meter were normal urban background levels.

The addition of incinerator produced GLC and background levels is shown in Table 3. The resulting total ground level concentration for any particular time period (annual average, 3 month average, second maximum 24 hour or 3 hour period) is compared to the primary and secondary standard. As is shown in Table 3 no violations of standards occur. In the case of No_x the incinerator-produced GLC is presented but no 1985 background condition is presented. This statistic was not available. As is noted in the Table, a short term No_x standard is presently under consideration by EPA and may be promulgated as a one or 3 hour standard.

Table 3

Pollutant	Time Period	Incinerator Produced Level	+	Background Level	=	Total Ground Level Concentration	Standard (Primary/ Secondary)
TSP	Annual	1.01	+	35.0	=	36.0	75/60(b)
	24 hour	12.5	+	95.3	=	107.8	260/150
SO_2	Annual	2.98	+	27.0	=	29.98	80/NA
	24 hour	36.9	+	115	=	151.9	365/NA
	3 hour	117.4	+	(b)	=	(b)	NA/1300
No_x	Annual	4.81	+	86.5	=	91.3	100/100
	1 hour	380.3	+	(b)	=	(b)	(c)
Pb	3 month	0.015	+	1.0	=	1.015	1.5/NA

(a) This number is not a standard but only a guide.

(b) No background statistics on SO_2 for a 3 hour, or No_x for a 1 hour period was available.

(c) A short term standard for No_x is presently under consideration but none has been promulgated

Note: All results are presented in ug/m^3

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I

J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203

March 27, 1979

To: All Interested Parties, Governmental Agencies, Public Groups and Citizens

Enclosed is a copy of the Final Environmental Impact Statement (EIS) on the MDC Proposed Sludge Management Plan, Metropolitan District Commission, Boston, Massachusetts which is being sent to you for review and comment.

This Final EIS has been prepared by EPA in accordance with Section 102(2)(c) of the National Environmental Policy Act (NEPA) of 1969 (Public Law 92-190). The Draft EIS was circulated for comment on March 3, 1976. The public hearing on the Draft EIS was held on April 6, 1976 and a transcript of that hearing is available for review. Comments received on the Draft and EPA's responses are published in Section VII of Part B, Volume 1 of this Final EIS.

This Final EIS is made up of three volumes:

1. Part A
2. Part B - Volume I
3. Part B - Volume II (Technical Appendices)

Part A of the EIS presents an executive summary and incorporates the latest interpretations of Federal legislation and guidelines.

However, we are circulating Parts A and B to all readers to insure that all information is available to those who need it, and that all steps in the decision process are clearly set forth. Please note that Part B should be read in conjunction with Part A to clarify its content. Further, judgements and conclusions which have changed as a result of changes in Federal legislation, policy, regulations or guidelines are screened and appear as lighter type in Part B. This is to advise the reader that those portions have changed based on information presented and discussed in Part A. Finally, new information added since the Draft EIS was printed is identified by a black line in the right margin of Part B. All of Part A postdates the Draft.

Comments on the Final EIS and on EPA's decisions regarding the proposed project are welcome. Comments should be submitted to this Office within thirty(30) days of the date the Environmental Protection Agency publishes notice of this EIS in the Federal Register. The study and design activity proposed in the EIS cannot be initiated until at least 30 days after the notice of this Final EIS is published in the Federal Register. We anticipate that publication will occur on or about May 2, 1979.

Because of the concern and controversy over this project, EPA will hold two official Public Hearings on the Final EIS in order to explain the project and to receive comments prior to making a final federal decision or taking administrative action on the project. The Hearings will be conducted as follows:

April 25, 1979 - 7:00 - 10:00 p.m.
Winthrop Junior High School, Winthrop, MA

April 30, 1979 - 1:30 - 5:30 p.m. and 7:00 - 10:00 p.m.
Faneuil Hall, Boston, MA

Individuals wishing to present testimony or comment at either Public Hearing should contact EPA's Office of Public Awareness at 617-223-7223 at least one week in advance of the Hearing they wish to speak at in order to receive a scheduled time to do so.

We hope you will take the necessary time to review this Final EIS and attend the Public Hearings scheduled.

Please direct your comments and questions to:

U.S. Environmental Protection Agency
Environmental & Economic Impact Office
JFK Federal Building, Room 2203
Boston, MA 02203
Attn: Susan L. Santos

Sincerely,

William R. Adams, Jr.
Regional Administrator

Enclosure