EPA-430/9-76-009

CONSTRUCTION GRANTS PROGRAM
INFORMATION

MUNICIPAL SLUDGE MANAGEMENT: EPA CONSTRUCTION GRANTS PROGRAM

An Overview of the Sludge Management Situation

APRIL 1976

U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF WATER PROGRAM OPERATIONS
MUNICIPAL CONSTRUCTION DIVISION
WASHINGTON, D.C. 20460

MCD – 30

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Municipal Construction Division
Office of Water Program Operations
U.S. Environmental Protection Agency
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MCD—30

ACKNOWLEDGEMENTS

The preparation of this report was undertaken by Robert K. Bastian of the Municipal Construction Division of EPA as an expansion of a paper presented at the 8th Annual Cornell Waste Management Conference held in Rochester, N.Y., April 28-30, 1976.

The contributions, technical assistance and review comments by many individuals, especially Mr. William A. Whittington, were invaluable in the development of the report.

FOREWORD

The requirements of the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500) emphasize the need to employ cost-effective and environmentally sound waste management technology. Achievement of higher levels of wastewater treatment required by the Act will result in a substantial increase in the quantity of sludge produced at publicly owned treatment works.

Federal grants provide as much as 75% of the capital funding for the construction of municipal wastewater treatment systems, including sludge management facilities. In managing the EPA Construction Grants Program, the Office of Water Program Operations plays a key role in the Agency's municipal sewage sludge activities.

The Office of Water Program Operations receives many requests for information on municipal sludge management. This document supplements the formal technical and administrative guidance issued by this Office and serves to collectively respond to many of the information requests received. The report was prepared primarily to provide information on those aspects of municipal sewage sludge management for which the Construction Grants Program is directly involved. The detailed involvement by other Federal agencies and EPA Offices in sludge management is not covered in this document.

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EPA Construction Grants Program
April, 1976

Introduction

Under the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500), Congress authorized EPA $18 billion in grant authority to help municipalities construct publicly owned wastewater treatment works through fiscal year 1977. The funding authority of PL 92-500 is expected to be continued for several more years. Over $9 billion has been obligated to date.

An integral part of almost any wastewater treatment plant is the sludge management system. Residual solids are produced in nearly every unit process of conventional wastewater treatment and a significant proportion of both capital outlay and O&M costs of conventional sewage treatment is associated with sludge production, conditioning and disposal facilities and operations. As manager of the EPA Construction Grants Program, the Office of Water Program Operations (OWPO) is deeply involved with municipal sewage sludge management activities and concerned with the problems communities are facing with sludge disposal.

This paper is an attempt to draw together a quick summary of available information on municipal sewage sludge production and alternatives for the disposal/utilization of municipal sewage sludge and OWPO activities in this area. The reader is referred to other information sources for more details on this subject (Appendix G).

Background

A wide variety of publications -- journal articles, conference proceedings, Agency documents, and even newsletters -- are available that deal with various aspects of municipal sewage sludge production, processing and management. However, national recognition of sludge management problems has only recently occurred and the available data base for evaluating the environmental acceptance and cost-effectiveness of various sludge management alternatives at this time is quite limited (Appendices A and G). Data summarized here represent OWPO's current reference base on nationwide municipal sewage sludge management activities and were derived for the most part from the 1968 Inventory of Municipal Waste Facilities in the United States, STORET, a 1972 survey of five EPA Regions concerning only land application of liquid sludges, the "Needs" Survey and Construction Grants files. Efforts are currently underway to improve this available information.

Quantities of Sludge:

We estimate that at this time well over 5 million dry tons of municipal sludge are being produced and disposed of in one manner or another each year. By the time secondary treatment is reached by facilities across the country this volume may reach 9 million dry tons per year. Going to secondary treatment would represent an increase of 80% in terms of dry tons of solids produced. With the extensive use of biological secondary treatment processes (such as activated sludge), the increase in wet tons of sludge to be handled would actually increase well over 100%, due to the difficulty in dewatering biological sludges.

Although this increase in sludge volume will be faced by treatment plant operators across the country, the major problem areas are in the major cities, especially those facing a phase-out of their current ocean disposal activities. The larger cities simply have greater volumes of sludge to manage and in many cases run into problems obtaining sites and local approval for implementing any of the sludge management alternatives. This is not meant to disregard or underplay the problems being faced by the numerous smaller communities across the country.

Size Distribution of Municipal Plants:

More than 22,000 municipal treatment plants exist in this country; over 5,000 are wastewater treatment ponds that generally have few if any sludge disposal problems. Of the remaining 17,000 plants, fewer than 350 are larger than 10 MGD. We estimate 65% or more of the Nation's treatment plants are actually less than 1 MGD in design flow. Well over 65% of the known non-pond systems are located in only three EPA Regions; Region III (Philadelphia), Region IV (Atlanta), and Region V (Chicago).

Current Disposition of Sludge:

The current general breakdown for disposal of municipal sewage sludge on a National basis is estimated as follows:

Method	% Total Municipal Sludge
Ocean Disposal	15
Incineration	35
Landfill	25
Land Application	25
(croplands)	(20)
(other)	(5)

This estimate does not include the surprising number of operations that simply store sludges in lagoons with no identified future disposal method. The scheduled phase-out of ocean disposal, increasing production of sludge with secondary treatment, and increasing fuel costs over the next few years could change this picture dramatically.

Both statewide and regionwide sludge disposal practices vary widely as do state regulations (Appendix E). Of course, only those areas located near the oceans have had the ocean option. Most of the communities in the State of Illinois and many other parts of the mid-West are applying sludges to the land, while incineration and landfill are most common in the major inland cities (Chicago and Denver being notable exceptions).

Costs:

Both capital and O&M costs for various sludge management alternatives vary greatly. They are dependent upon numerous variables including energy, transportation, land, and manpower costs as well as monitoring requirements and other criteria established by local, state and Federal regulatory agencies. Where sites are available and liquid sludges are accepted, landfilling is often an economical alternative if haul distances are minimal. Where land is not available, air quality criteria allow, and fuel allocations are available, incineration is often utilized. However, when land is available and the state and local regulators approve (or at least do not formally disapprove), the land application alternative is being implemented or experimented with by many communities based on cost-effectiveness (Appendices A and B).

From 30% to 50% of a conventional treatment plant's capital costs go for the sludge management system. This will involve a major portion

of the $18 billion currently authorized for capital costs of building facilities to meet the 1977 goal (PL 92-500) of secondary treatment. We estimate that more than $400 million per year are required for current O&M costs.

Environmental Impacts

From an environmental effects standpoint, when properly designed, operated and where necessary, monitored, most available sludge disposal/utilization options can be implemented in such a manner as to minimize negative impacts upon the environment by providing acceptable safeguards for the protection of human health and the ecosystems involved. However, when sewage sludges are discharged into one of the only media available -- air, land, or water -- the associated contaminants along with the potentially beneficial components may eventually migrate to another of the media. In this context, the potential inter-media environmental impacts (as well as economic and other impacts) of sludge management alternatives must be considered when designing and later when operating such systems.

One effort aimed at providing guidance along these lines has been the development of the technical bulletin, "Municipal Sludge Management: Environmental Factors," which attempts to point out the major environmental factors to consider when reviewing a proposed municipal sludge management alternative. While not a design manual per se, this bulletin does provide useful information (specific values where available and general guidance where specific values are not available) for use in considering the environmental impacts of various sludge management alternatives.

Alternatives

Currently the sludge management alternatives available to a particular city include various versions of incineration, landfill, land application and possible innovative technologies (e.g., pyrolysis, chemical fixation, strip mine reclamation, bagged and bulk sales). Ocean dumping has been effectively ruled out for municipalities since to our knowledge no current sludges meet the ocean dumping requirements (40 CFR 220). Annually renewed interim permits are being granted until these cities develop land based alternatives. As alternatives to strictly disposal options such as ocean dumping, EPA has actively encouraged the development and implementation of various beneficial uses of municipal sewage sludges, including land application options, energy recovery from incineration or pyrolysis systems, and methane recovery from landfills.

Ocean Disposal:

Although 15% of the current sludge volume produced in municipal treatment plants is now disposed of into the oceans, this practice is used by less than 160 cities and towns (Appendices B and D); there are 16 municipal sludge ocean dumping permits (for dumping at two approved sites - Philadelphia and the New York Bight) at latest count but additional cities discharge to the ocean through diffusion pipes. Where used, it has represented a least cost alternative and until recent years has been met by good public acceptance. Both the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500) and the Marine Protection, Research, and Sanctuaries Act of 1972 (PL 92-532) require the development of Federal standards on materials entering the ocean. Efforts are currently underway to phase-out most of the ocean dumpers and pipe dischargers by 1981.

The concerns over ocean disposal of sewage sludges center on potential impacts upon marine life and beaches. Various contaminants often associated with sewage sludges, including heavy metals, persistent organic pesticides, PCB's and others, are known to bioaccumulate to where they interfere with reproduction or cause toxic effects to certain marine organisms. The contaminants of immediate concern are mercury, cadmium and TICH compounds. (TICH = Total Indicated Chlorinated Hydrocarbons.) Incidents of sludge washing up on beaches have also been reported.

Incineration:

Under some circumstances, incineration can be both the most economical and environmentally acceptable disposal option. This approach significantly reduces the volume of waste for ultimate disposal (to 10 - 30% of the original dry matter volume), which is a major concern where land availability is a problem. The costs associated with disposal of the ash from incineration processing are small in comparison to the operational costs involved in the incineration process itself.

Incineration systems are, however, generally subject to marked economies of scale, often not being competitive for plants below 10 MGD. A substantial energy input, either to dewater sludge or in the form of an auxiliary fuel, is generally required for sludge incineration although some future plants may be self-sustaining once incineration has started so that auxiliary fuel requirements can be minimized. Energy recovery techniques are also being used with more recent units to help lower the total energy balance of available incinerator technologies.

Standards exist for particulates and mercury levels in emissions from incinerators, while questions remain concerning such chemical

contaminants as PCB's. The liquid phase removed by dewatering and scrubber waters from stack gas and particulate control devices must also be properly treated. Major public resistance to new incinerators has occurred in several areas in recent years due mainly to concerns about meeting air quality standards, operational costs and reliability, and potential malodor production.

Co-incineration with solid waste is being considered in many areas and being implemented by Minneapolis/St. Paul in the near future. Such systems are envisioned as helping to solve two major waste management problems at one time, while producing beneficial byproducts such as steam for use in power production.

Landfill:

Landfilling is an option that provides a means of sludge disposal in areas where suitable sites are available. When properly implemented, this practice avoids the potential public health issues that must be addressed with cropland application of sludge by burying the sludge in conventional sanitary landfills, but can affect groundwater quality where substantial leachates are produced.

The EPA Office of Solid Waste Management (OSWMP) has issued guidelines for the design and operation of Federally owned solid waste landfills, but not for sludge landfills. State and local regulatory agencies differ in their requirements for acceptance of municipal sewage sludges for landfilling (Appendix E). In several states, only dewatered sludges are acceptable for landfilling; in certain other areas, few controls are imposed on landfilling of sludges. Combining sludge with solid waste in

landfills is a common practice in areas where this is acceptable. Many cities have been placing sludge in lagoons (i.e., open landfills) and may eventually cover the lagoons after many years.

Major problems confronting landfill of sludges involve gaining public acceptance of potential landfill sites and preventing groundwater pollution from landfill leachates. Metropolitan areas are having difficulty in identifying publicly acceptable and available sites, while medium and smaller sized communities may find this aspect less limiting. Heavy metals, persistent organics and other compounds covered by drinking water standards are of concern in leachates from landfills. Recent data indicate that groundwater contamination problems due to leachates from landfills receiving sewage sludges may be more widespread than originally envisioned. Contaminants of most immediate concern are lead and mercury.

Land Application of Sludge:

The utilization of sludge by application to croplands, forests, and other sites provides a means of beneficial reuse and sludge disposal at the same time. Although low in nutrient content (approximately 3% Nitrogen, 2.5% Phosphorus and 0.3% Potassium by dry weight -- this is highly variable), sludge can serve as a valuable soil conditioner. Currently, less than 0.3% of the nation's croplands receive sewage sludge, and even if the entire municipal sludge production were to be applied at crop nitrogen requirement rates, less than 1% of the agricultural land would be involved. A 1972 CEQ/EPA report prepared by Battelle Memorial Institute, Pacific Northwest Laboratories showed that widespread use of sludge as a fertilizer could potentially satisfy only 2% of the current artificial nitrogen and phosphorus fertilizer market,

thus indicating that it is unlikely that sludge would replace conventional fertilizers in any significant way.

Land application has been preferred by communities with suitable available land, generally inland cities and smaller rural communities. Both high application rate disposal operations and systems designed to provide supplemental fertilization to agricultural crops have been used. In some cases "dedicated" or publicly owned and controlled sites have been used, but a more common practice has involved application to privately owned and managed farmland. Thirty percent of the smaller communities have applied their sludges to the land for over 40 years. Over 400 towns in Illinois and 250 in Ohio currently apply their sludges to the land. Many other communities simply stockpile dried sludges and allow the public to haul it away for their own use.

Larger communities are becoming more interested in land application options due to recent regulatory decisions, increased energy costs, and/or public opposition to other alternatives. There is also a growing interest in the potential for future cash crop returns from agricultural uses to help lower O&M costs. Several communities have been conditioning their sludge, mainly by heat drying, lagooning or composting, and selling it for use as soil conditioners for many years. Numerous major municipalities are currently using or experimenting with land application schemes (Appendix B).

The major technical problems facing land application proposals center on the potential human health risks involved in growing crops that enter the human food chain on sludge-amended soils. Sewage sludge contains human pathogens and varying amounts of a variety of potentially

"toxic" or "hazardous" materials, including heavy metals and persistent organic compounds, because of the nature of input sources (industry, homes, stormwater) into domestic sewage. Conjecture as to the potential human health effects of these materials when applied to the land has been extensive, although available data and risk interpretations are limited.

The possible immediate and long term effects of such materials when applied to agricultural soils by sewage sludge applications and their translocation into human food chain crops, are currently being investigated and debated. The issue is further complicated by the fact that the same materials of concern currently enter the human food chain through many routes, including conventional agricultural practices, and are not due to agricultural uses of sewage sludge. They are present in variable amounts in conventional inorganic fertilizers, animal manures, and soil, resulting in highly variable background levels. The problems of establishing current body burdens and acceptable safety factors for these materials are of major concern in current deliberations by FDA.

The fact remains that land application of sewage sludges has been an accepted and largely unregulated activity for many years -- without known significant negative health impacts. While there have been no reports of major problems directly resulting from this practice, some of the potential problems are long term and our system for detecting them may not be nearly sophisticated enough. Possible unnoticed problems associated with these practices are being investigated and questioned. Well managed systems can be expected to continue their operation into the future without problems assuming that future regulations will not eliminate this alternative.

Prime concerns center on the levels of certain materials that may lead to future plant toxicity (e.g., zinc, copper, nickel and herbicides) or that potentially could lead to public health problems due to bioaccumulation and/or toxicity (e.g., cadmium, lead, PCB's). Agricultural practices that allow for the safe utilization of municipal sewage sludges in agriculture (including nitrate leaching controls) are being recommended and frequently updated by USDA. No EPA, USDA or FDA standards exist for most of the areas of current concern, although guidance is being developed by EPA on the environmental acceptability of land application options. Currently, not all states have regulations controlling this practice (Appendix E). In addition, no economical technology exists to remove such contaminants as heavy metals from sludges prior to application to the land -- other than source control.

Source controls, pretreatment requirements and monitoring activities are being suggested by EPA and others. In accordance with the requirements of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500), and several recent court rulings, EPA has embarked on an accelerated program to develop (1) pretreatment standards for the most significant polluting industries, and (2) standards pertaining to the discharge of designated toxic pollutants. A concentrated effort has been initiated to implement an effective Federal pretreatment program to achieve compliance with the provisions of PL 92-500. Additionally, the Agency has revised and is preparing to issue pretreatment guidelines to assist municipalities in developing local pretreatment requirements.

Additional factors limiting land application systems are public acceptance and the fact that large cities have to transport sludge to

rural areas for agricultural use. Odors from poorly managed sludge management systems and perceived odors from anything that has to do with sewage may be the largest single problem. Reluctance of rural areas to receive urban wastes (until adequate economic incentives are offered) is also a significant factor.

Innovative Technologies:

Additional municipal sewage sludge management alternatives exist and are being more fully developed under what have been chosen here to be called "innovative technologies." Many of these technologies are offshoots of ocean disposal, incineration, landfill, and land application. These alternatives include such practices as strip mine reclamation projects, pyrolysis, metals recovery, chemical fixation, overseas shipment, and bagged or bulk sales and "Give-away" programs.

Municipal sludges are being and have been used as a soil conditioner/ stabilizer in reclaiming mine spoils, strip-mined lands and other drastically disturbed areas. Although limited to areas where transport to such sites is cost-effective and locally acceptable, this alternative offers an opportunity to use the basis of one problem to help solve another problem. The experimental use of liquid, dried or composted sludges for strip mine reclamation has been undertaken in such areas as Illinois, Ohio, Pennsylvania, Maryland, Virginia and Florida. The key to successful proposals of this type would appear to lie in gaining the support and cooperation of groups such as local, state, and Federal politicians and regulatory agency personnel, land owners, coal companies, railroads, and public works officials.

Speculation on the potentials of pyrolysis to solve the sludge management problems of major metropolitan areas has occurred for several years. Only recently, however, have funds been made available to move bench scale research systems for pyrolysis of sludge into pilot scale demonstration facilities such as the JPL/ACTS facility involving carbon recovery now in operation at Orange County, California. Another pyrolysis technique that incorporates the use of RDF (refuse-derived fuel) is being demonstrated in Contra Costa County, California. Other pilot demonstration plants involving sludge pyrolysis or co-pyrolysis with solid wastes have been planned for future construction and testing. Several comprehensive regional sludge management studies have identified pyrolysis as possibly the most cost-effective alternative for handling future sludge volumes. These conclusions have been drawn before scaled up operational experience has been gained. New York falls into this category while the recommendation for co-pyrolysis in the Minneapolis/ St. Paul area has recently been dropped in favor of co-incineration based upon a new look at the economics of by-product values.

Efforts have been and are being undertaken to evaluate the potentials for metals recovery from municipal sewage sludges. Both acid treatment and heat treatment processes are being considered. Of course these processes require considerable chemical and/or energy inputs and result in the loss of organics for uses such as soil conditioners. The problems to date generally relate to cost-effectiveness and individual unit process problems involved in specific resource recovery efforts.

Several proprietary chemical treatment processes are available that provide good performance in chemically fixing sewage sludge to allow safe landfilling and possible use in construction of highways. While

cost is a major limiting factor for the use of these processes, chemical fixation should be considered as a possible alternative for communities without adequate land availability for land application schemes, or with high levels of contaminants such as heavy metals and PCB's in their sludges.

The overseas shipment of municipal sewage sludges has been extensively examined. Proposals have been made involving shipment by ore boats, oil tankers, or sludge ships to such areas as the Bahamas and other Caribbean areas, Africa's Gold Coast, Egypt and the Middle East for use as soil conditioners. To date no projects for large scale overseas shipment of sewage sludge have been implemented.

The selling of bagged or bulk conditioned sludges has been practiced in several major areas (Los Angeles/Southern California - "Kellogg's Nitrohumus"; Milwaukee "Milorganite"; Houston "Hou-actinite"; Chicago) for many years and is being initiated or planned for other areas (Denver and Washington, D.C.). "Give-away" programs have been operated by numerous small communities as a common practice over the years, and new efforts have recently been initiated or planned for several major metropolitan areas (Philadelphia's "Philorganic" and Chicago's "Nu-Earth"). Efforts in areas such as Winston-Salem involve fortification of sludge with nitrogen to allow sale of the final product as a nutrient rich fertilizer/soil conditioner ("Organiform-SS"). A new project started in Largo, Florida will market a dried and pelletized product through a fertilizer company.

In West Hertfordshire, England, the liquid digested from a 35 mgd activated sludge secondary treatment plant is hauled to consenting farmers as "HYDIG;" there are more requests for this organic material made than can be satisfied. Sludge is managed in a similar manner in

Salem, Oregon, where "BIOGRO" is delivered to farmers requesting the material. Other cities, including Madison, Wisconsin, are considering liquid sludge management schemes by establishing fertilizer reuse programs for cooperating farmers.

There probably are many other potential "innovative technologies" that exist and should be evaluated as potential sludge management alternatives. Maybe the future will bring a "black box" solution that no one has yet considered which will provide a cost-effective, environmentally acceptable option to today's available municipal sewage sludge management alternatives.

OWPO Municipal Sludge Management Activities

Because sludge is a byproduct of sewage treatment, the Office of Water Program Operations (OWPO) is interested in identifying and refining available technology as well as encouraging the development of innovative technologies in the sludge management field. Our program activities deal with cost-effectiveness and environmental acceptability as well as operational capability of various municipal sludge management alternatives. As a result of helping fund such activities, we are also interested in related activities dealing with economics, social and institutional constraints and environmental impact studies.

At present, the only current legislative mandates we have involving the regulation of municipal sewage sludge disposal/utilization activities fall under PL 92-500, Sect. 201 (wastewater treatment facilities planning and construction), Sect. 208 (areawide waste management), Sect. 405 (sludges entering navigable waters), and PL 92-532 and its amendments relative to establishing ocean dumping criteria. We do, however, help control sludge disposal activities through control of system design to

qualify for Federal construction grant funds. An overall philosophy of our activities is to encourage the beneficial utilization of municipal sewage sludges (rather than outright disposal) wherever and whenever possible, if shown to be both cost-effective and environmentally acceptable. Some of the current and planned projects and outputs in the area of municipal sewage sludge management being developed by the Office of Water Program Operations (OWPO), in cooperation with the Office of Research and Development (ORD), the Office of Solid Waste Management (OSWMP), and the Office of Planning and Evaluation (OPE) include the following:

PROJECTS AND OUTPUTS

1. Efforts are underway to improve Headquarters/Regional/State coordination activities in sludge management matters.

2. Efforts are also being taken to coordinate activities of the Science Advisory Board, National Academy of Sciences, Government Accounting Office (GAO), and other sludge management studies and evaluations that are underway or have been completed.

3. The technical bulletin, "Municipal Sludge Management: Environmental Factors," has been prepared to assist EPA Regional Administrators in evaluating grant applications for construction of publicly owned treatment works under Section 203(a) of the Federal Water Pollution Control Act as amended. It also provides designers and municipal engineers with information for selecting a sludge management option. The proposed document for public comment will appear in the Federal Register on June 3, 1976.

4. Program guidance in sludge management was recently released concerning the grant eligibility of land acquisition costs for the ultimate disposal of residues from wastewater treatment processes (Program Guidance Memorandum No. 67 - Appendix F). Additional program guidance is being developed concerning grant eligibility for costs of easements and lease options on land for the ultimate disposal of these residues. The use of Federal lands by municipalities for sludge disposal activities is also being investigated.

5. At this time approximately $11 million in Step I (or equivalent) Construction Grants are being used for planning and pilot scale municipal sludge management projects in major metropolitan areas (Appendix C). We anticipate that such funding efforts will continue and that the number of projects will increase.

6. A grant with the Association of Metropolitan Sewerage Agencies (AMSA) will provide detailed information on sludge management practices by the major metropolitan areas. A proposed follow-on effort may provide a survey and evaluation of current municipal sewage sludge management alternatives across the entire country. Potentially, these and other efforts could provide an improved data base from which future sludge management policy decisions can be better made.

7. A grant to the National Association of Counties, in association with other public interest groups, may provide new approaches and insights into the public acceptance of beneficial uses of sewage sludge.

8. Efforts to encourage beneficial utilization alternatives (e.g., strip-mine reclamation) for sludge management are planned which will include sessions at several upcoming sludge management conferences.

9. Current assessment publications covering heavy metals research and human health hazard aspects of cropland application of municipal sewage sludges are planned based on workgroup sessions with leading heavy metals researchers and health officials. These assessment documents will be used to provide current evaluations concerning these two areas of major concern for the land application alternative of sludge management.

10. A technical report on successful examples of sludge utilization on land, complete with detailed technical and institutional information, is planned.

11. Efforts are underway to obtain translations and evaluation of overseas sludge management activities. In addition, reports of research activities by various major sewerage authorities may be made available for wider distribution.

12. A documentary film and TV Mini-Doc on available sludge management alternatives are under development. The purpose will be to expose public works officials and the public to the alternatives being used across the country and innovative technologies currently under detailed evaluation. We also hope to alert the engineering community to what alternatives should be considered in development of future municipal sludge management planning efforts.

13. Costs of various sludge utilization or disposal alternatives have been addressed in available generalized documents; reports outlining detailed and standardized cost comparisons are planned.

14. A model design report for land application of sludge is planned.

15. Future activities to better define and improve approaches to institutional constraints and public acceptance problems are being planned.

WORK NEEDED

A general result of increasing sewage treatment is the more than proportional increase in resulting sludge volumes to be disposed of or utilized by one means or another. This problem has lead to Agencywide attention. Recently, activities have greatly increased in the areas of regulating ocean disposal, Federal pretreatment guidelines development, 208 planning activities, toxic substances and hazardous materials investigations in regards to their concerns for the proper management and disposal of sewage treatment residuals (i.e., sewage sludge). These interests have been most evident during the development of the proposed Technical Bulletin, "Municipal Sludge Management: Environmental Factors."

Major OWPO engineering needs to support the Construction Grants Program involvement in municipal sewage sludge management activities actually boil down to developing the best design criteria and cost information for the available technology and the development of innovative technologies for future implementation. With the current phase-out attitude toward ocean dumping, we are providing guidance to the

Regions on the best available land-based technologies for sludge management rather than developing regulatory programs.

From our viewpoint the work most urgently needed in the municipal sewage sludge management field includes:

- resolution of health effects issues
- breakthroughs in gaining public acceptance
- continued emphasis on innovative technologies leading to beneficial use and resource recovery
- information dissemination to design engineers/operators, Federal/State/local government personnel, and local elected officials

APPENDIX A - SLUDGE INFORMATION SUMMARY

Sources:

STORET
Construction Grants Files
1974 Needs Survey
1972 Survey of Five EPA Regions on land application of liquid sludges
1968 Inventory of Municipal Waste Facilities in the U.S.

SLUDGE INFORMATION SUMMARY

1. Quantities of sludge (estimated) [Source: Construction Grants Files]

	dry tons/day	
	Current	Secondary Treatment (10 years)
Domestic	10,000	13,000
Industrial users of municipal plants	7,000	10,000
Total municipal sludge	17,000	23,000

2. Size of municipal plants [Source: 1974 Needs Survey, 1968 Inventory]

Million Gallons/Day	Total	Without Ponds*
Less than 1	15,106	11,120
1 - 5	1,676	1,558
5 - 10	265	253
10 - 25	184	180
25 - 50	54	54
50 - 100	37	37
Greater than 100	31	30
Unknown	4,892	3,983
Total	22,245	17,215

*Ponds contain the sludge and are only infrequently emptied.

3. Distribution of municipal plants by EPA Region
[Source: 1974 Needs Survey]

Region	Plants (without ponds)
1 - Boston	478
2 - New York	1158
3 - Philadelphia	3630
4 - Atlanta	3768
5 - Chicago	5029
6 - Dallas	1089
7 - Kansas City	1182
8 - Denver	323
9 - San Francisco	657
10 - Seattle	576

4. Estimated current disposition of sludge [Source: 1974 Needs Survey, 1968 Inventory, Construction Grants Files]

Method	% Total Sludge
Landfill	25
Ocean dump	15
Incineration	35
Land application	25
Croplands	(20)
Others	(5)

5. 1972 Land Spreading Survey (Liquid Sludge Only) [Source: 1972 Survey]

Regions 2,3,4,5, and 9
Mailed 1909, Responded 745 (39%)

Region	Currently Use	Will Be Using	Not Using
2	6%	6%	88%
3	27%	5%	68%
4	18%	12%	70%
5	36%	9%	55%
9	14%	6%	80%
Total	25%	8%	67%

Size MGD	Currently Use	Will Be Using	Not Using
1 - 10	27%	8%	65%
10 - 100	15%	9%	76%
Greater than 100	7%	13%	80%

6. Total Costs for Various Sludge Methods [Source: Construction Grants Files]

Includes operating and construction costs

	$/Dry Ton		
	1 MGD	10 MGD	100 MGD
Land Application	127 - 168	53 - 71	57 - 84
Landfill	171 - 208	77 - 116	63 - 98
Incineration	250 - 320	111 - 174	79 - 120
Ocean Dumping	376 - 417	93 - 134	56 - 93

7. Construction Costs for Various Sludge Methods
[Source: Construction Grants Files]

	Million $/Dry Ton		
	1 MGD	10 MGD	100 MGD
Land Application	0.27-0.36	0.04-0.06	0.07-0.10
Landfill	0.40-0.43	0.10-0.12	0.05-0.07
Incineration	0.53-0.64	0.14-0.19	0.05-0.07
Ocean Dumping	0.96-1.00	0.16-0.19	0.05-0.07

8. Estimated National Total Costs of Current Sludge Practices
[Source: Construction Grants Files]

Land Application	$470,000/Day
Landfill	570,000
Incineration	1,190,000
Ocean Dumping	240,000
Total	$2,470,000/Day

$900 Million/Year

O&M only: $400 Million/Year

9. Characteristics of Sludge [Source: STORET]

	Digested Sludge	
	Range	Typical
Volatile Solids, %	30-60	40
Nitrogen (N, % TS)	1.6-6.0	3.0
Phosphorus (P_2O_5, % TS)	1.5-4.0	2.5
Potash (K_2O, % TS)	0.0-3.0	0.5
Btu/Lb	1700-6800	4000

10. Sludge as an Agricultural Fertilizer
[Source: Construction Grants Files, 1968 Inventory, 1974 Survey, STORET]

If all sludge is applied to the land, less than 1 percent of agricultural lands would be involved. Currently, less then 0.3 percent of agricultural lands are involved.

Sludge: 6.2 Million Tons/Year
N in sludge = 186,000 Tons/Year
P_2O_5 in sludge = 155,000 Tons/Year

Sludge Nutrients as a Percentage of Total Use of Chemical Fertilizers

N = 2.3 percent
P_2O_5 = 3.1 percent

11. Metals in Sludges: mg/kg Dry Sludge (i.e., part per million) [Source: STORET]

	Range	Mean	Median
Ag, Silver	nd - 960	225	90
As, Arsenic	10 - 50	9	8
B, Boran	200 - 1430	430	350
Ba, Barium	nd - 3000	1460	1300
Be, Beryllium	nd	nd	nd
Cd, Cadmium	nd - 1100	87	20
Co, Cobalt	nd - 800	350	100
Cr, Chromium	22 - 30,000	1800	600
Cu, Copper	45 - 16,030	1250	700
Hg, Mercury	0.1 - 89	7	4
Mn, Manganese	100 - 8800	1190	400
Ni, Nickel	nd - 2800	410	100
Pb, Lead	80 - 26,000	1940	600
Sr, Strontium	nd - 2230	440	150
Se, Selenium	10 - 180	26	20
V, Vanadium	nd - 2100	510	400
Zn, Zinc	51 - 28,360	3483	1800

Other possible contaminants

Persistant organics

Pathogens

Radioactive substances

12. METAL CONTENT OF DIGESTED MUNICIPAL SLUDGES

Element	Purely Domestic[1]	Controlled Municipal[2]	Observed Maximum
Zn, ppm	750.	2500.	50,000.
Cu, ppm	250.	1000.	17,000.
Ni, ppm	25.	200.	8,000.
Cd, ppm	5.	25.	3,410.
Pb, ppm	-	1000.	10,000.
Hg, ppm	2.0	10.	100.
Cr, ppm	50.	1000.	30,000.

1/ Observed in sludges from newer suburban communities.

2/ Typical of sludges from communities without excessive industrial waste sources or with adequate source abatement. R. Chaney, 4/76

APPENDIX B - CURRENT SLUDGE DISPOSITION IN LARGEST U.S. CITIES

Current Sludge Status in Largest U.S. Cities

City	Quantity of Sludge (dry T/day)	Present Disposition
New York	230 (600)	Ocean/landfill;pyrolysis prop.
Chicago(MSD), IL	800	Land Appl/Give-away/lagoon Bulk sales
Los Angeles(&Co.), CA	500	Ocean;Compost & Bagged
Philadelphia, PA	140 (190)	Ocean;"10-pt. plan" prop.
Detroit, MI	160	Incineration
Houston, TX	160	Land Appl/Dried & Bulk sales
Baltimore, MD	140	Landfill/lagoon/land appl.
Dallas, TX	120	(Lagooning);land appl prop
Washington, DC	400	Land Appl/Compost/ Injection/Bulk sales
Cleveland, OH	200	Landfill/incineration

PROP = PROPOSED

Current Sludge Status in
Largest U.S. Cities (cont)

	City	Present Disposition
11.	Indianapolis, IN	Incineration
12.	Milwaukee, WI	Land Appl/dried & bagged sales
13.	San Francisco, CA	Land Appl/landfill
14.	San Diego, CA	Land Appl (give-away)
15.	San Antonio, TX	Lagooning;land appl
16.	Boston (MSD), MA	Ocean;incineration proposed
17.	Memphis, TN	--
18.	St. Louis, MO	Co-incineration/lagoon
19.	New Orleans, LA	Incineration
20.	Phoenix, AZ	Stockpiling
21.	Columbus, OH	Incineration/lagoon
22.	Seattle, WA	Land Appl/landfill
23.	Jacksonville, FL	Land Appl
24.	Pittsburg, PA	Incineration
25.	Denver, CO	Land Appl
26.	Kansas City, MO	Incineration/lagoon;land appl prop.
27.	Atlanta, GA	Incineration/landfill/land appl
28.	Buffalo, NY	Incineration
29.	Cincinnati, OH	Incineration;land appl (experimental)
30.	Nashville-Davidson, TN	Incineration
31.	San Jose, CA	Stockpiling/fertilizer sales
32.	Minneapolis, MN	Co-incineration
33.	Fort Worth, TX	Lagoon/land appl
34.	Topeka, KA	--
35.	Portland, OR	Landfill/lagoon/land appl
36.	Newark, NJ	Incineration
37.	Oklahoma City, OK	Landfill/land appl
38.	Oakland, CA	Landfill/land appl
39.	Louisville, KY	Landfill
40.	Long Beach, CA	Land Appl/compost & bagged

APPENDIX C - STATUS OF STEP I CONSTRUCTION GRANTS FUNDING OF SLUDGE MANAGEMENT STUDIES

Status of Step I Construction Grants*

Funded Sludge Management Studies

Region I	-	Greater Boston (MDC)	$ 90,000
	-	Putnam, Conn.	7,500
	-	several others requested	
Region II	-	Interstate Sanitary Comm. (Phase I completed)	500,000
	-	Washington, DC (finalized Dec '75)	100,000
Region III	-	Beltsville, MD (demo composting facility)	1,067,250
Region IV	-	None; Winston/Salem possible in future	
Region V	-	MSD Chicago	1,734,000**
	-	Madison, Wisc.	160,000**
	-	Hammond, Ind.	30,000**
Region VI	-	Houston (mostly sludge)	1,000,000
Region VII	-	None	
Region VIII	-	Metro Denver	124,950
Region IX	-	Los Angeles (into 2nd of 3 years).	2,000,000
	-	Bay Area (recent start)	2,000,000
	-	Orange County (pyrolysis demo) . .	2,000,000
Region X	-	None; Portland and Spokane possible	
		Total	$11,000,000

* Step I Construction Grants funds or related Federal/State matching funds

** Grant Award pending

April 1976

APPENDIX D - OCEAN DISPOSAL OF SLUDGE

April 1976

MUNICIPAL SLUDGE DISPOSAL IN THE OCEAN

LOCATION	METHOD	HOW LONG	AMOUNT	PHASE-OUT DATE	STUDIES	PLANNED ACTION	START DATE	COST/DRY TON (APPROX.)
New York Bight	barge	1924	3 mgd w/5% solids	1981	*106 funded study-2 of 3 phases complete	pyrolysis & land application	construct 1979	$25
Camden	barge	1965	15 mil gal/yr w/4% solids	1979	Step 1 level study complete on reg. basis	*incineration; possibly composting	1979	$20
Philadelphia	barge	1961	175 mil gal/yr w/8% solids	1981	1973 alt. comp. current alt. eval. for each permit renewal	*10 pt. plan; incl. land appl., pyrol., landfill	reduce to 50% by 1979	$20-may increase to $60
Boston (Bay)	outfall	1968	28,050 dryT/yr	1981	EIS for handling compl. Step 1 level study	incineration	1979	<$10
City of Los Angeles	outfall	1960	350 metric dry tons/day	1981	Step 1 level study in prog.	*interim plan landfill	1977	<$10

*uncertain at this time

OCEAN DUMPING (MUNICIPAL SEWAGE SLUDGE)
PERMITS IN FORCE DURING CALENDAR YEAR 1975

Applicant/Type Permit	Material Dumped	Date Issued	Date Expired	Est. Quant. Dumped
Region II				
Bergen Co. Sew. Auth. interim	sewage sludge	7/1/75	6/30/76	20,000 wet T.
Joint Meeting of Essex & Union Counties interim	"	"	"	116,000 wet T.
Linden Roselle Sew. Auth. interim	"	"	"	142,000 wet T.
Middlesex Co. Sew Auth. interim	"	"	"	331,000 wet T.
Middletown Sew. Auth. interim	"	"	"	20,000 wet T.
Passaic Valley Sew. Auth. interim	"	"	"	570,000 wet T.
City of Glen Cove interim	"	"	"	4,000 wet T.
City of Long Beach interim	"	"	"	7,000 wet T.
County of Nassau interim	"	"	"	349,000 wet T.
County of Westchester interim	"	"	"	112,000 wet T.
West Long Beach Sew. Dist. interim	"	"	"	600 wet T.
New York City interim	"	"	"	2,040,000 wet T.
Modern Transp. Co. interim	"	"	"	212,000 wet T.
Gen. Marine Transport Corp. interim	"	"	"	88,000 wet T.
Region III				
City of Camden interim	"	11/11/75	11/11/76	13,000,000 gal
City of Philadelphia interim	"	2/14/75	2/13/76	170,000,000 gal

APR 16 1976

OCEAN DUMPING OF
MUNICIPAL SEWAGE SLUDGE

NEW YORK BIGHT SLUDGE SITE
(Phase Out Date 1981)

PERMIT	MUNICIPALITY	
NEW YORK MUNICIPALITIES		
City of New York	City of New York, EPA	New York, N.Y.
City of Long Beach	City of Long Beach, WPCP	Long Beach, N.Y.
Nassau County	Nassau County Dept. of P.W.	Mineola, N.Y.
Westchester County	County of West Chester, Dept. of Environmental Facilities	White Plains, N.Y.
West Long Beach Sewer District	West Long Beach Sewer District	Atlantic Beach, N.Y.
City of Glen Cove	City of Glen Cove, WPC Facility	Glen Cove, N.Y.
NEW JERSEY MUNICIPALITIES		
Berger County Sewer Authority	Bergen County, S.A.	Little Ferry, N.J.
Joint Meeting of Essex and Union Counties	Joint Meeting, WTP	Elizabeth, N.J.
General Marine Transport Co.	Northeast Monmouth Reg. Sewer Authority	Monmouth Beach, N.J.
	Lindenwold Boro, MUA	Lindenwold, N.J.
Caldwell Trucking Co., Inc.	Wanaque, STP	Wanaque, N.J.
	Lincoln Park, STP	Lincoln Park, N.J.
	Montville, STP	Montville, N.J.
	Morris, STP	Morris, N.J.
	Pequannock, STP	Pequannock, N.J.
	Woodridge, STP	Woodridge, N.J.
Linden Roselle Sewerage Authority	Linden Roselle, S.A.	Linden, N.J.
	Rahway Valley, S.A.	Rahway, N.J.
Middlesex Co. Sewerage Authority	Middlessex Co., S.A.	Sayreville, N.J.
Middletown Sewerage Authority	Middletown, S.A.	Belford, N.J.
Passaic Valley Sewerage Commissioners	Passaic Valley Sewerage Commissioners	Newark, N.J.
Modern Transportation Co.	Cupsaw Lakes STP	Cupsaw Lakes, N.J.
	Erskine Lakes STP	Erskine Lakes, N.J.
	Fayson Lakes STP	Fayson Lakes, N.J.
	Greenwood Lake STP	Greenwood Lake, N.J.
	Haskell STP	Haskell, N.J.
	Kimmelon STP	Kimmelon, N.J.
	Lake Edenmald STP	Lake Edenmald, N.J.
	Lincoln Park STP	Lincoln Park, N.J.
	Northvale STP	Northvale, N.J.

PERMIT	MUNICIPALITY	
NEW JERSEY MUNICIPALITIES (CONT'D)		
Modern Transportation Co.	Caldwell STP	Caldwell, N.J.
	Collingswood STP	Collingswood, N.J.
	Kearny STP	Kearny, N.J.
	Matawan Township MUA	Matawan Township, N.
	Maxim Sewerage Corp.	Union, N.J.
	Neptune Township STP	Neptune Township, N.
	Ocean Grove STP	Ocean Grove, N.J.
	West New York STP	West New York, N.J.
	Western Monmouth UA	Marlboro, N.J.
	Wood-Ridge STP	Wood-Ridge, N.J.
	Norwood STP	Norwood, N.J.
	Oakland STP	Oakland, N.J.
	Old Tappan STP	Old Tappan, N.J.
	Pompton Lakes STP	Pompton Lakes, N.J.
	Ringwood STP	Ringwood, N.J.
	Riverdale STP	Riverdale, N.J.
	Saddle River STP	Saddle River, N.J.
	Skyline Lakes STP	Skyline, N.J.
	Upper Saddle River STP	Upper Saddle River,
	Wanaque STP	Wanaque, N.J.
	Wayne STP	Wayne, N.J.
	West Milford STP	West Milford, N.J.
	Wyckoff STP	Wyckoff, N.J.
	Cedar Grove STP	Cedar Grove, N.J.
	Chatham STP	Chatham Township, N.J
	Diamond Hill STP	Hackettstown, N.J.
	Fairfield STP	Fairfield, N.J.
	Far Hills STP	Far Hills, N.J.
	Mt. Olive STP	Mt. Olive Township, N
	Morris STP	Morris Township, N.J.
	Peapack Gladstone STP	Peapack, N.J.
	Pequannock STP	Pequannock, N.J.
	Roxbury STP	Roxbury Township, N.J
	Totowa STP	Totowa, N.J.
	Alpine STP	Alpine, N.J.
	Warren STP	Warren Township, N.J.
	Washington MUA	Washington Township,
	West Milford MUA	West Milford, N.J.
	Wynnewood Sewage Co.	Freehold, N.J.

NEW YORK BIGHT SLUDGE SITE

PERMIT	MUNICIPALITY	
INTERMITTENT OCEAN DUMPING MUNICIPALITIES NOT CURRENTLY HOLDING PERMITS		
Modern Transportation Co. or General Marine or Caldwell Trucking Co.	Fair Lawn STP	Fair Lawn, N.J.
	Dover STP	Toms River, N.J.
	Long Branch Sewerage Auth.	Long Branch, N.J.
	Pennsauken Sewerage Auth.	Pennsauken, N.J.
	Bordentown STP	Bordentown, N.J.
	Deal STP	Deal, N.J.
	Bradley Beach STP	Bradley Beach, N.J.
	Long Beach Sewerage Auth.	Brant Beach, N.J.
	Spring Lake Heights STP	Spring Lake Heights, N.J.
	Point Pleasant Beach STP	Point Pleasant Beach, N.J.
	Asbury Park STP	Asbury Park, N.J.
	Avon-by-the-Sea STP	Avon-by-the-Sea, N.J.
	Bay Head STP	Bay Head, N.J.
	Belmar STP	Belmar, N.J.
	Manasquan STP	Manasquan, N.J.
	Neptune City STP	Neptune City, N.J.
	Sea Girt STP	Sea Girt, N.J.
	Spring Lake STP	Spring Lake, N.J.
	Brick Township MUA	Brick Township, N.J.
	North Wildwood STP	North Wildwood, N.J.
	Haddon Heights STP	Haddon Heights, N.J.
	Audubon STP	Audubon, N.J.
	North Bergen STP	North Bergen, N.J.
	Lavallette STP	Lavallette, N.J.
	Sea Bright STP	Sea Bright, N.J.
	Seaside Heights STP	Seaside Heights, N.J.
	Atlantic Highlands STP	Atlantic Highlands, N.J.
	Highlands STP	Highlands, N.J.
	Seaside Park STP	Seaside Park, N.J.
	Wayne STP	Wayne, N.J.
	Hillsborough STP	Hillsborough, N.J.
	Maple Shade STP	Maple Shade, N.J.
	West Paterson STP	West Paterson, N.J.
	Clementon Sewerage Auth.	Clementon, N.J.
	Mt. Ephriam STP	Mt. Ephriam, N.J.
	Burlington STP	Burlington, N.J.
	East Hanover STP	Burlington, N.J.
	Hammonton STP	Hammonton, N.J.
	Passaic Township STP	Passaic Township, N.J.
	South Amboy STP	South Amboy, N.J.
	Parsippany-Troy Hills STP	Parsippany, N.J.

PERMIT	MUNICIPALITY	
INTERMITTENT OCEAN DUMPING MUNICIPALITIES NOT CURRENTLY HOLDING PERMITS (CONT'D)		
'odern Transportation Co. or General Marine or Caldwell Trucking Co.	Wall Township STP	Wall, N.J.
	Washington Township MUA	Washington Township, N.J.
	Atlantic City STP	Atlantic City, N.J.
	Allentown STP	Allentown, N.J.
	Bridgeton STP	Bridgeton, N.J.
	Mt. Holly STP	Mt. Holly, N.J.
	Sayreville STP	Sayreville, N.J.
	Rutherford-East Rutherford Lyndhurst Joint Meeting	East Rutherford, N.J.
	East Windsor STP	East Windsor, N.J.
	Hightstown STP	Hightstown, N.J.
	Jersey City Sewage Auth.	Jersey City, N.J.
	Rockaway Valley Sewerage Auth.	Boonton, N.J.
	Morristown STP	Morristown, N.J.
	Moorestown STP	Moorestown, N.J.
	Livingston STP	Livingston, N.J.
	Bernards STP	Bernards Township, N.J.
	Somerset-Raritan Valley Sewerage Auth.	Bound Brook, N.J.
	Berkeley Township Sewerage Auth.	Berkeley Township, N.J.
	North West Bergen County Sewerage Auth.	Walwick, N.J.
	Raritan Township STP	Raritan Township, N.J.
	Princeton STP	Princeton, N.J.
	Clinton STP	Clinton, N.J.
	Edgewater STP	Edgewater, N.J.
	Hoboken STP	Hoboken, N.J.
	Bayonne STP	Bayonne, N.J.
	Secaucus STP	Secaucus, N.J.
	Woodbridge STP	Woodbridge, N.J.
	Perth Amboy STP	Perth Amboy, N.J.
	Freehold STP	Freehold, N.J.
	West Long Branch Sewer Dist.	West Long Branch, N.J.
	Barnegat STP	Barnegat, N.J.
	Wildwood STP	Wildwood, N.J.
	Cape May Court House STP	Cape May Court House, N.J.
	Cape May STP	Cape May, N.J.
	Bayshore Regional Sewerage Auth.	Union Beach, N.J.
	Ewing-Lawrence Sewerage Auth.	Trenton, N.J.
	Bridgewater STP	Bridgewater, N.J.

PHILADELPHIA SLUDGE SITE
(Phase Out Date 1981)

PERMIT	MUNICIPALITY	
City of Philadelphia	City of Philadelphia Water Department	Philadelphia, Pa.
City of Camden	City of Camden Department of Public Works Sewer Authority	Camden, N.J.

TABLE E-2

OCEAN DISPOSAL: TYPES AND AMOUNTS, 1973*, 1974**. and 1975***

(IN TONS, APPROX.)

WASTE TYPE	ATLANTIC			GULF			PACIFIC			TOTAL		
	1973	1974	1975	1973	1974	1975	1973	1974	1975	1973	1974	1975
Industrial Waste	3,642,800	3,642,000	3,322,300	1,408,000	950,000	123,700	0	0	0	5,050,800	4,592,000	3,446,000
Sewage Sludge	4,898,900	5,010,000	5,039,600	0	0	0	0	0	0	4,898,900	5,010,000	5,039,600
Construction & Demolition Debris	973,700	770,400	395,900	0	0	0	0	00	0	973,700	770,400	395,900
Solid Waste	0	0	0	0	0	0	240	200	0	240	200	0
Explosives	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	9,515,400	9,422,400	8,757,800	1,408,000	950,000	123,700	240	200	0	10,923,640	10,372,600	8,881,500

* 1973 Source - EPA Regional Offices. Unpublished reports, 1973; updated information, 1976 (8 months of dumping activity, May to December 1973 under permits issued by Ocean Disposal Program extrapolated for 12 months to provide an annual rate).

** 1974 Source - EPA Regional Offices. Unpublished reports, 1974; updated information, 1976 (12 months of dumping activity).

*** 1975 Source - EPA Regional Offices. Unpublished reports, 1975; updated information, 1976 (12 months of dumping activity).

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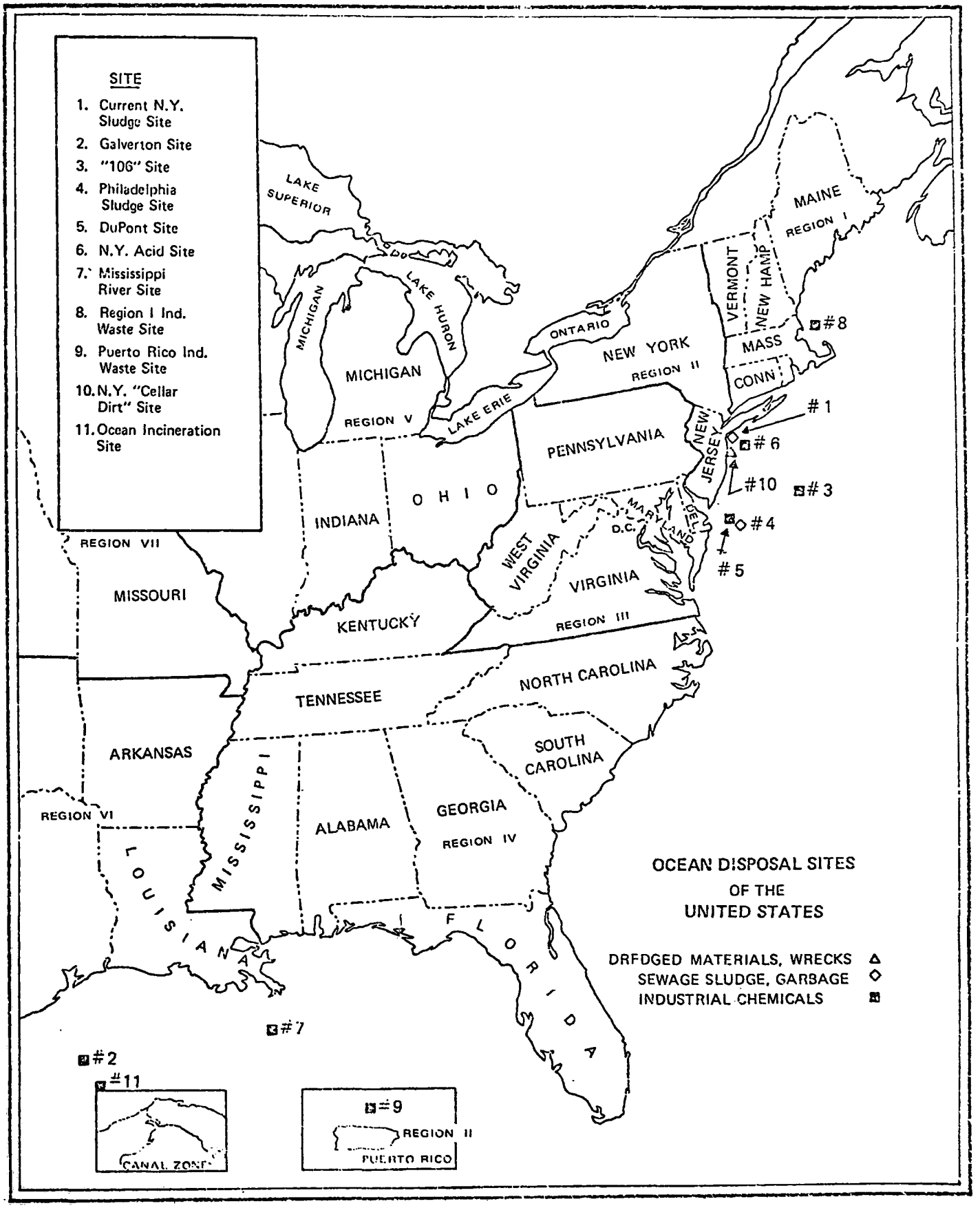
DISPOSAL SITES FOR OCEAN DUMPING

Dump Sites For Municipal And Industrial Wastes

Site	Center Points	Nature of Use	Phase Out Date for Dumpers as of Apr. '76
1. Current N.Y. Sludge Site	Lat. 40° 22' 30"N Long. 73° 41' 30"W	municipal sewage sludge	1981
2. Galveston Site	Lat. 27° 20'N Long. 94° 36'W	industrial wastes	Dumpers under strict implementation plan to develop alternatives to O. D.
3. "106" Site	Lat. 38° 50'N Long. 72° 15'W	industrial wastes	1981 (all but 4 dumpers out by Dec. 1977)
4. Philadelphia Sludge Site	Lat. 38° 21'N Long. 74° 10'W	municipal sewage sludge	January 1981
5. DuPont Site	Lat. 38° 30'N Long. 74° 15'W	acid wastes	November 1978
6. N.Y. Acid Site	Lat. 40° 18'N Long. 73° 38'W	acid wastes	1981 or bring waste within limitations of criteria
7. Mississippi River Site	Lat. 28° 05'N Long. 88° 22.5'W	industrial wastes	dumper under strict implementation plan to develop alternatives to O. D.
8. Region I Ind. Waste Site	Lat. 42° 25'N Long. 70° 35'W	industrial wastes	dumper under strict implementation plan to develop alternatives to O. D.
9. Puerto Rico Ind. Waste Site	Lat. 18° 15'N Long. 66° 42.5'W	industrial wastes	April 1978
10. N.Y. "Cellar Dirt" Site	Lat. 42° 23'N Long. 73° 49'W	construction or demolition debris	none
11. Ocean Incineration Site	Lat. 26° 40'N Long. 93° 40'W	ocean incineration	none
12. Proposed DuPont Site in S.E. Gulf of Mexico	Lat. 27° 00'N Long. 87° 00'W	industrial wastes	site never used


SITE
1. Current N.Y. Sludge Site
2. Galverton Site
3. "106" Site
4. Philadelphia Sludge Site
5. DuPont Site
6. N.Y. Acid Site
7. Mississippi River Site
8. Region I Ind. Waste Site
9. Puerto Rico Ind. Waste Site
10. N.Y. "Cellar Dirt" Site
11. Ocean Incineration Site
LAKE SUPERIOR
MICHIGAN
LAKE HURON
MICHIGAN
REGION V
ONTARIO
NEW YORK
REGION II
LAKE ERIE
PENNSYLVANIA
MAINE
REGION I
VERMONT
NEW HAMP
MASS
CONN
NEW JERSEY
#1
#6
#8
#10
#3
#4
#5
INDIANA
OHIO
REGION VII
MISSOURI
KENTUCKY
WEST VIRGINIA
VIRGINIA
MARYLAND
D.C.
DEL.
REGION III
TENNESSEE
NORTH CAROLINA
ARKANSAS
SOUTH CAROLINA
REGION VI
MISSISSIPPI
ALABAMA
GEORGIA
REGION IV
LOUISIANA
FLORIDA
#7
#2
#11
CANAL ZONE
#9
REGION II
PUERTO RICO
OCEAN DISPOSAL SITES
OF THE
UNITED STATES
DREDGED MATERIALS, WRECKS
SEWAGE SLUDGE, GARBAGE
INDUSTRIAL CHEMICALS

APPENDIX E - STATE CRITERIA FOR LAND APPLICATION OF WASTEWATER AND SLUDGE

Following is a summary table compiled by the National Commission on Water Quality of the States' criteria for land application and other uses of wastewater and sludge. The information was compiled from individual responses to their utilization of Section 201(a) - (e) of P.L. 92-500, from a table on land application prepared by Metcalf & Eddy, from specific State regulations in the Environment Reporter, and from telephone contacts.

The summary table lists the restrictions to land application and whether specific regulations are used. First, it is helpful to state the limitations of this table. It was assumed that a small percentage of states do not have regulations if they did not appear in the State responses to the NCWQ inquiry or the Environment Reporter. Some may indeed have formal health department regulations not indicated in this table. Also, a policy regarding land application of wastewater was not obtained from 5 states, and from 19 states regarding sludges.

For land application of wastewater, from a total of 54 states and territories; 22 or 41 percent have formal regulations. The State of Washington has draft regulations. Thirty-eight states or 70 percent require a minimum of secondary treatment or more stringent requirements. Application is prohibited in the District of Columbia, discouraged in Rhode Island, and generally not practiced in Nebraska, Ohio, and Iowa.

For land disposal of sludge, 21 states or 39 percent have some form of formal regulations. Of the 35 states with policies regarding sludge disposal, 18 states or 51 percent allow or regulate disposal in landfills; 20 or 57 percent evaluate disposal on an ad hoc or case-by-case basis; 5 or 14 percent require dewatering; Mississippi and Indiana require some form of stabilization; Wisconsin requires digestion; Idaho requires heat treatment; and Pennsylvania requires digestion for landfill disposal.

SUMMARY TABLE
LAND APPLICATION
OF WASTEWATER AND SLUDGE

STATE	WASTEWATER		SLUDGE	
	Regulations	Treatment and Other Restrictions	Regulations	Restrictions
Alabama	No	Secondary Treatment	No	-
Alaska	Yes	Secondary or Advanced	No	Permit Required
Arizona	Yes	" " "	No	-
Arkansas	No	Secondary	No	-
California	Yes	Primary to Advanced	No	Ad Hoc Basis
Colorado	No	Secondary & Disinfection	No	Allowed in Landfills
Connecticut	No	Ad Hoc Basis	No	-
Delaware	Yes	Secondary & Disinfection	No	Landfill - Ad Hoc
D. C.	Yes	Prohibited	No	-
Florida	Yes	Secondary to Advanced	No	Landfill - Ad Hoc
Georgia	Yes	Secondary & Disinfection	No	-
Guam	Yes	Ad Hoc Basis	-	-
Hawaii	Yes	Secondary & Disinfection	No	-
Idaho	Yes	Secondary or Sec. & Disin	Yes	Heat treatment
Illinois	Yes	Secondary	Yes	Ad Hoc Basis
Indiana	No	-	No	Stabilized
Iowa	No	Not Generally Practiced	No	Landfill if Dewatered
Kansas	No	Secondary	Yes	Ad Hoc Basis - Landfill
Kentucky	No	Secondary & Disinfection	No	Ad Hoc Basis
Louisiana	No	Secondary	No	Ad Hoc Basis
Maine	Yes	Secondary & Disinfection	-	-
Maryland	No	Secondary	-	-
Massachusetts	No	-	Yes	Landfill - Ad Hoc
Michigan	No	Prohibited; or secondary & Disinfection	Yes	Ad Hoc Basis
Minnesota	Yes	Secondary & Disinfection	No	Guidelines in Preparation
Mississippi	No	" " "	No	Stabilized - Ad Hoc
Missouri	Yes	Secondary & Disinfection	Yes	Landfill if Dewatered
Montana	No	-	Yes	Landfill if Dewatered
Nebraska	No	Not Currectly Practiced	No	-
Nevada	No	Ad Hoc by Permits	No	-
New Hampshire	Yes	Secondary & Disinfection	Yes	Permit - Ad Hoc Basis
New Jersey	Yes	Secondary - Toxics Prohib.	Yes	Landfill - mixed with refuse
New Mexico	No	-	No	-
New York	No	Secondary - Disinfection	No	Ad Hoc Basis
North Carolina	No	Advanced & Disinfection	No	Ad Hoc Basis
North Dakota	No	Secondary	Yes	Landfill
Ohio	No	If not cost effective - no disposal	Yes	Landfill - Ad Hoc
Oklahoma	No	Secondary	Yes	Landfill - Ad Hoc
Oregon	No	Secondary & Disinfection or more stringent	Yes	Landfill - Permit
Pennsylvania	Yes	Secondary & Disinfection	Yes	Landfill - Permit, if digested & Dewatered
Puerto Rico	No	-	No	-
Rhode Island	No	Discouraged	Yes	Landfill - Ad Hoc
South Carolina	No	Ad Hoc Basis	Yes	" " "
South Dakota	No	Secondary & Disinfection	No	Ad Hoc Basis
Tennessee	No	Secondary & Disinfection	Yes	Dewatering
Texas	Yes	Secondary or Secon. & Disin.	Yes	Landfill - Ad Hoc
Trust Territories	No	Ad Hoc Basis	-	-
Utah	Yes	Secondary	Yes	Digested or more Stringent
Vermont	Yes	Secondary & Disinfection to Prohibited	Yes	Landfill - Ad Hoc
Virginia	Yes	Secondary & Disinfection	No	Stabilized or more Stringent
Washington	Draft	Secondary & Disinfection	-	-
West Virginia	No	-	-	-
Wisconsin	Yes	Secondary & Disinfection	Yes	Digestion as a Minimum
Wyoming	No	Secondary	-	-

Source: Compiled by the National Commission on Water Quality.

APPENDIX F - PROGRAM GUIDANCE MEMORANDUM NO. 67:
Eligibility of Land Acquisition Costs
for the Ultimate Disposal of Residuals
from Wastewater Treatment Processes

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY APR 2 1976
WASHINGTON, D.C. 20460

PROGRAM GUIDANCE MEMORANDUM
No. 67

SUBJECT: Eligibility of Land Acquisition Costs for the Ultimate Disposal of Residues from Wastewater Treatment Processes

FROM: John T. Rhett, Deputy Assistant Administrator for Water Program Operations (WH-546)

TO: Regional Administrators

ATTN: Water Division Directors

I. PURPOSE

This memorandum provides guidance on the interpretation of Section 35.940.3 of the construction grant regulations (40 CFR Part 35) relative to the eligibility of the cost of land required for the ultimate disposal of residues resulting from wastewater treatment.

II. BACKGROUND

Program Guidance Memorandum No. 49 covers the eligibility of land acquisition costs for land treatment processes and refers to the future distribution of this guidance on the eligibility of land costs for ultimate disposal of residues.

III. POLICY

A. Allowable Costs

The cost of purchasing land for ultimate disposal of residues from wastewater treatment is allowable for Federal grant assistance. Ultimate disposal of residual wastes from wastewater treatment includes disposal of sludges, ashes, grit or other residues by means of depositing such materials in land fill sites.

Proposals to acquire land for spreading sludge may be approved if the grantee demonstrates to the satisfaction of the Regional Administrator that the primary purpose of the acquisition is disposal of such residues, and disposal by other means set out in B.2.b. of this guidance is less cost-effective or not available.

Any land areas to be purchased for land spreading, except for buffer zones, must be fully utilized for that purpose. Land requirements for the spreading of sludge shall be kept to an absolute minimum determined on the basis of the maximum sludge application rate commensurate with ensuring that ground and surface waters are protected and, in addition for agricultural lands, that cropland resources are protected and harmful contaminants are not accumulated in the human food chain. Land acquisition costs for land areas with application rates below 10 dry tons per acre per year will, in general, not be allowable, although the Regional Administrator may grant a variance for a larger land area (with a lower sludge application rate) on a case-by-case basis where more cost-effective.

The cost of land required for land fill or land spreading, irregularities in spray patterns, reasonable buffering, dikes and drainage ditches for surface runoff control, groundwater protection measures, and similar uses is allowable.

Where a purpose of a project is to improve or reclaim land as well as to dispose of residual wastes, costs may be eligible for an amount not to exceed the cost of the most cost-effective single purpose method of disposal of the residual wastes as determined in accordance with this guidance.

Where land is to be used for disposal of both residues from municipal wastewater treatment and other wastes, only the land cost properly allocable to disposal of municipal wastewater treatment residues is allowable. One example of such cost allocation would be division of costs between municipal waste treatment residues and other municipal solid wastes based on their relative dry weight proportions. If the dry weight of the treatment residues handled at the joint disposal site is less than twenty-five (25) percent of the dry weight of all the wastes to be disposed of in the land fill, no land acquisition costs for treatment residues will be allowed.

While not exclusive, the cost of land for the following uses is not allowable except where such land is also necessary for eligible residual waste management uses as listed above.

1. Sites for placement of buildings, equipment, facilities and sludge conveyance measures including pipelines, and access roads.

2. Sludge storage basins or other temporary storage facilities, sludge drying beds, waste stabilization ponds and evaporation ponds.

The cost of leasing land or of obtaining use of land under contract for residue disposal or utilization is not allowable.

B. Cost Effectiveness Analysis

1. Factors to be Considered

The facility plan for the overall waste treatment system must include a cost-effectiveness analysis of residual waste management alternatives. The choice of a residual waste management method is to be based on comparison of overall waste treatment system alternatives recognizing the close interrelationships between those facilities comprising the residual waste management subsystem and the remainder of the overall waste treatment system.

The residual waste management subsystem includes the facilities, management practices and lands required ultimately to assimilate residual wastes into land or air media, beginning with the grit, raw sludges and other residues obtained directly from wastewater treatment processes. To aid in screening residual waste management subsystems, the costs and non-monetary factors for such subsystems may be compared on a preliminary basis for each wastewater treatment process option. Alternatives which seem feasible on the basis of the preliminary comparison should be analyzed in detail.

The cost-effectiveness analysis of residual waste management options is to include consideration of the following factors, with the amount and level of detail commensurate with local conditions, the number of feasible options available, and the complexity, size and nature of the proposed waste treatment system:

a. Relations of wastewater treatment process option to volume and characteristics of sludges and residues produced.

b. Conditioning, stabilization or pre-application treatment for the disposal or utilization option.

c. Alternatives for landfill or land spreading site location and for conveyance to sites.

d. Sludge storage requirements.

e. Market for free haul or sale of processed sludge and expected net revenues from sales.

f. Option of contract payments for hauling and disposal of processed sludge.

g. Land fill management procedures.

h. Land application method and rates and resultant area required as determined by soils, climate and other site characteristics.

i. Options for obtaining necessary land management rights.

j. Necessary provisions for and costs of relocating persons, households and businesses.

k. Net revenues from sale of crops, forest products and livestock produced by land acquired for sludge application.

l. Environmental effects including impacts on air and water quality and aesthetics.

m. Odor control measures necessary for land fill or land spreading site.

n. Groundwater protection measures.

o. Surface runoff control measures.

p. Other public health measures.

q. Energy requirements and potential recovery facilities.

2. Special Considerations for Land Management Options

a. Arrangements for land management must be made to assure operation over at least a 10 year period, but ordinarily not more than 20 years, to protect investments in facilities and equipment for disposal or utilization of residual wastes.

b. The following alternatives must be considered prior to recommending outright purchase of land for land spreading of sludge or other residues:

- Sale or free haul of processed sludge or residues for use by others.

- Contractual payment for hauling processed sludge or residues for use by others.

- Contract with landowners for rights to develop land spreading site and to apply sludges, preferably with either or both tasks to be performed by owners.

- Leasing of land spreading site, preferably providing for site development or operations by owners.

- Land fill

c. The cost-effectiveness analysis should give special attention to the alternatives of sale, free-haul or contractual payment to haul which result in beneficial uses of sludge. These alternatives help achieve the wastewater treatment objectives without requiring the treatment authority to undertake a major program of land acquisition, management and utilization.

C. Land Acquisition Requirements

Grant award or written EPA approval shall be obtained prior to any acquisition of land for residual waste management in order that such costs will be allowable. The procedures for the independent appraisal and acquisition of land contained in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, (P.L. 91-646) 42 USC Section 4651 et. sq. shall be followed. The EPA Regulation implementing this statutory requirement is contained in Subpart F of Part 4 of Title 40 of the CFR, Section 4.60000 et. seq.

The grantee shall certify to the Regional Administrator that it will comply with 40 CFR Section 30.810 and specifically Section 30.810 and Section 30.810-5. The certification will be reflected as an encumbrance in the title of the land. The grantee shall obtain fee simple title to all land acquired with grant assistance, with no encumbrances other than the one protecting the Federal interest.

APPENDIX G - PARTIAL LISTING OF RECENT REPORTS ON MUNICIPAL SLUDGE MANAGEMENT

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Municipal Technology Branch
Tel: 202/426-8976

PARTIAL LISTING OF RECENT REPORTS ON MUNICIPAL SLUDGE MANAGEMENT

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