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A GUIDE TO REGULATIONS AND GUIDANCE FOR THE UTILIZATION AND DISPOSAL OF MUNICIPAL SEWAGE SLUDGE

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CONTENTS

PREAMBLE

Beginning on May 14, 1980, the Environmental Protection Agency distributed for comment over 600 copies of a draft guidance document, "A Guide to Regulations and Guidance for the Utilization and Disposal of Municipal Sewage Sludge". Drafts were sent to other Federal agencies, state regulatory agencies, Canadian governmental units, environmental groups, the environmental press, municipalities, counties, cities, consultants, university extension and research groups, industries, trade associations, and special interest groups. This document provides a concise outline of the different Federal regulations and guidelines that pertain to each alternative for sludge utilization and disposal and points out how these regulations and guidelines should be addressed.

This guidance document is not an assessment of health and environmental risks. It assumes that such risks will be adequately minimized when regulations and guidelines are followed. Discussions, however, are included for dealing with potential environmental, health and other problems not addressed by the regulations and guidelines.

The written comments received were in strong support of the document and offered many constructive comments for its improvement. The comments were greatly appreciated and have been carefully considered by EPA in revising and producing this final document. We believe that the quality of the document has been significantly improved as a result of these comments.

The following is a summary of the major comments that were received and how the comments influenced the revision of this document.

1) Many commentors felt certain areas of the document required greater discussion. For example, several commentors thought that the discussion on: a) implementing disposition facilities on the local level (introduction), and b) the relation of sewage sludge disposition to the hazardous waste regulations (introduction) were inadequately dealt with. In the revised document, the discussion on both of these issues has been expanded.

A few commentors wanted a more detailed and complete cost table and an energy analysis (introduction). The cost information is given only as general guidance and more specific information was not available from the sources used. The reader should also recognize that costs are highly variable and will differ significantly depending on the individual facility. The energy analysis has not been added to the revised document, since this type of data was not available.

Many commentors felt additional discussion was needed on the many different treatment methods involved in sludge management. The Agency believes that this document's purpose can best be attained by addressing the major items of confusion in the area of sludge management: namely, guidance on what are the suitable methods for the ultimate disposition of sewage sludge and on how a facility can meet the regulatory requirements.

The only treatment methods receiving appreciable discussion were incineration and composting, since many individuals also consider that incineration and composting are major methods in the ultimate disposition of sludge. The section on incineration has been slightly expanded to include minor mention of the different methods of thermal reduction.

Many commentors requested that additional information be added to the revised document on the design of sludge disposition facilities. The Agency believes that this information is more appropriate for the Agency's design manuals. Also, some commentors requested a greater extensiveness in the problems and solutions sections. For the most part, this guidance document is limited in scope to discussing problems not alleviated by regulations. In this context, this document attempts to give general solutions to some of the more major problems encountered with the disposition of sewage sludge. More specific solutions to problems in facility design, operation and maintenance can be found in the Agency's design manuals.

One commentor felt that we should have been more specific in our discussion of the preproposal distribution and marketing regulations. This specific discussion, however, was not included since these regulations are in the early developmental stage and may, therefore, undergo frequent changes.

A few commentors requested the inclusion of more monitoring requirements for each disposition procedure, along with the specific quantitative standards. These monitoring standards have not been included in the revised document, since the Agency does not intend for this guidance to be used in place of regulations. However, specific numbers are given in this document to guide the reader to a specific regulation or to help clarify a regulation. For example, the landspreading section includes a discussion of monitoring and recordkeeping, since the regulations regarding this method of disposition are new and controversial.

Two commentors asked that the underground injection control (UIC) regulations (40 CFR, Part 146) be included in the revised document. After investigating this method of sludge disposal, the Agency has determined that the underground injection of sludge has occurred rarely and without much success. Furthermore, states have been given the authority to operate the UIC regulatory program, and hence, the state should be able to provide the needed guidance. For these reasons, the underground injection method of sludge disposal has not been addressed in the revised document.

2) Many commentors offered suggestions for improving the document's structure, thereby permitting greater readability. They also indicated a number of specific inaccuracies in the document. In the revised document, these inaccuracies were corrected and many of the suggestions given to improve the document's structure were incorporated (e.g., the separate problem and solution sections have now been combined into one section).

3) One commentor suggested that too much emphasis was placed on disposal methods and that too little emphasis was placed on utilization methods. As that commentor also pointed out, most regulations are developed to deal with conventional systems. Therefore, this document covers these regulatory areas. Unfortunately, the implementation of regulations usually lags behind the initiation of innovative and alternative technology. However, the Agency does give a favorable advantage to utilization projects in the Federal Construction Grants regulations (40 CFR, Part 35, Subpart E).

4) Some commentors pointed out that additional references would be useful. In the revised document, several more references have been added, including new publications that were not available when the draft document was sent out for review and comment.

5) A number of commentors pointed out that recycling of sewage sludge is an environmentally sound program that results in a reuse of a "waste" resource and conservation of energy. They expressed concern that sludge reuse regulations impose strict limitations in order to protect users from several contaminants. They pointed out that very strict reuse regulations could effectively eliminate the recycling option and could cause a shift to disposal options. They indicated, however, that disposal options also result in public exposure to some of the contaminants through soils and crops, drinking water and the atmosphere. They also indicated that disposal options may pose risks to the public and the environment which are equal to or greater than those from reuse options and that the disposal options may provide less benefit at costs that are equal to or greater than for the reuse options.

Finally, these commentors indicated that regulating one method for sludge disposition affects all remaining methods of disposition. They pointed out that these interacting effects among regulations should be examined, and that the risks and benefits of all methods should be compared, before imposing very stringent regulations on any one method of sludge disposition. They pointed out further that EPA should consider setting up a procedure to arbitrate a solution when different regulatory authorities promulgate regulations with restrictions that are not compatible. The Agency agrees that the impact of regulations should be carefully examined and that EPA should coordinate its regulatory efforts to the fullest extent possible. These concerns are being reconciled during the development of the comprehensive sewage sludge management regulations under the authority of section 405 of the Clean Water Act and other authorities.

6) Many commentors were concerned with specific provisions of the different regulations. In response to these comments, the development of this document is not a rulemaking activity and does not permit changes in the regulations. However, EPA will consider these comments in future research activities and in the development of policies concerning comprehensive sewage sludge management.

7) One commentor suggested that the guidance document be updated periodically. With the rapidly changing regulatory requirements, this possibility is under consideration.

Dated September 12, 1980

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INTRODUCTION

This document has been prepared to provide Environmental Protection Agency (EPA) Regional Administrators, managers and operators of publicly-owned treatment works (POTW's), consulting engineers, state and local regulatory authorities and others with a concise outline of current EPA regulations and guidelines that need to be addressed, and the problems frequently encountered, when planning and operating a sewage sludge disposition (utilization and/or disposal) facility. This document is a supplement to these regulations and guidelines (not a substitute) and should aid in the selection and implementation of an appropriate disposition technique. Coverage of each method discussed includes:

(I) background information

(II) applicable laws, regulations and guidelines

(III) procedure needed for implementing the disposition method

(IV) problems frequently associated with the disposition method that are not covered by regulations and solutions to these problems

(V) references

The background information section provides data on the current proportion of sewage sludge handled by the described disposition alternatives, salient technical facts, limitations, and other information which helps establish the current status. The applicable laws, regulations, and guidelines are brought together for each method of disposition in the second section. The procedures for implementing a disposition method, given in the third section, show which regulations need to be addressed, what the regulations require, and recommendations for meeting the regulatory requirements. This third section also addresses those regulatory measures and requirements which are necessary to safeguard human health and the environment. The fourth section addresses problems that are associated with the planning and operation of the disposition facility and various public health and environmental problems which are not covered by the regulations. In cases where Federal regulations and guidelines have not addressed a problem, examples of how state and local governments have attempted to handle the problem are given.

The disposition alternatives discussed in this guidance document can be classified into two general areas: 1) treatment and volume reduction methods and 2) ultimate utilization and disposal methods. Incineration, composting and surface impoundments are considered treatment and volume reduction methods. Landfilling, ocean disposal, landspreading, and distribution and marketing are considered ultimate utilization and disposal methods. There is some overlap between these two general classifications. Some sections of this report are longer than others, e.g., the land-spreading section, because of the need to help clarify the many questions that are arising concerning these practices.

Presently, the regulations pertaining to the utilization and disposal of municipal sludge are located in various sections of the Code of Federal Regulations (CFR). This paper attempts to bring the regulations together for each disposition method. This effort is an important step in the Agency's development of a comprehensive sewage sludge management regulation under the authority of section 405(d) of the Clean Water Act. This comprehensive regulation will bring together all regulations that pertain to sludge management. The comprehensive sludge regulation will appear in 40 CFR, Part 258. The first segment of this regulation will be the sewage sludge distribution and marketing regulations.

This guidance document is written so that only the disposition method of concern need be read by the user. As a result, there is some redundancy in the various sections discussing each disposition alternative. This introduction gives general information that is applicable to all disposition methods.

General Procedure for Implementing Practices at the Local Level

Existing regulations and guidelines often give the EPA Regional Administrators flexibility to deal with certain site specific needs. Therefore, it is best to check with Regional EPA and state or local officials on the applicable local regulations, policies, and procedures pertaining to the different sludge disposition options.

It should be emphasized that the roles of state and local authorities are paramount in the successful planning, construction, and operation of facilities and practices for sludge disposition. These tasks are mostly all handled locally and are overseen at the state and Federal levels.

Specific information which local authorities can use to obtain Federal grant assistance for the planning and construction of sludge disposition facilities is contained in the construction grants regulations (40 CFR, Part 35, Subpart E). Federal funds for assisting with the operation of these facilities are not available. Other possible sources of Federal funding are discussed in the various sections discussing each disposition alternative.

The following is an example of how a sewage sludge disposition practice might be implemented at the local level. In Montgomery County, MD, an applicant who wants to operate a sewage sludge disposition facility must supply information, each year, to the county Department of Environmental Protection. The information must include the name and location of the disposition facility, the mode of sewage sludge transportation and disposition, and the physical characteristics of the disposition site. After adequate public hearings and administrative scrutiny (by the Offices of Environmental Planning, Water Quality Control and Air Pollution Control), the county then submits the information to the State Department of Health. The State Department of Health will then consult with the

Department of Natural Resources, the Water Resource Administration, the Maryland Environmental Service, and the Maryland National Capital Park and Planning Commission. If the planned disposition practice is found to be acceptable by all the concerned county and state agencies, the State Department of Health will then issue permits to approved facilities. A facility needs to allow about a year for approval and permit issuance. Landspreading facilities follow an additional procedure that can be found in the landspreading section of this document. Public hearings are not required for the individual landspreading sites. The county Agriculture Extension Service recommends rates of sludge application after testing the soil, and recommends how many years the sludge can be applied at minimal risk. Maryland is currently finalizing regulations governing the distribution and marketing of sludge products in the state.

General Factors for Consideration in the Planning of Disposition Practices

Three of the most important considerations for implementing any of the sewage sludge disposition options are that the option be environmentally safe, reasonable in cost, and acceptable to the public. The regulations described in this guidance document have been written to assure environmentally safe disposition. Ranges in costs for the different disposition options are given in Table 1. General guidance for obtaining acceptable disposition sites and gaining public acceptance is given below.

(1) Environmental Considerations

Regulations and guidelines have been developed so that sludge disposition facilities and practices will not result in an adverse impact on human health and the environment. These regulations and guidelines have been developed over a period of time under the authority of different laws. The guidance, given in the different sections of this document, attempts to update and clarify these various regulations and guidelines.

(2) Operating and Maintenance Costs

Table 1: Estimated Operating and Maintenance Costs for Sewage Sludge Disposition Methods in 1979 dollars (2)

Disposition Method	$/dry ton
Incineration	80-240[1]
Composting (11)	70-200[2]
Surface impoundments (facultative lagoon) (8)	approx. 25[3]
Landfills	73-226[4]
Ocean dumping	30-50[5]
Ocean discharge	approx. 20[6]
Landspreading	40-210[7]
Distribution (11)	income of 12 to cost of 2[8]

[1] - includes fuel costs and dewatering costs

[2] - includes costs for dewatering, bulking agents, labor, capital amortization and distribution

[3] - located at POTW and excludes sludge removal costs

[4] - includes treatment, dewatering and transportation, but excludes monitoring

[5] - cost is based on transportation costs

[6] - through outfalls at Los Angeles, CA

[7] - includes treatment, dewatering, transportation and application

[8] - data is only for finished composted sludge (20-50% moisture); excludes treatment and preparation costs

(3) Siting of Facilities - Federal, State, and Local Roles

One of the most difficult tasks facing waste management authorities is locating "acceptable sites" for high volume waste treatment and disposal facilities. Ideally, locating these sites in relatively remote locations with buffer zones and downwind from local residences helps obtain public acceptance and lessens problems from any odors produced. Such ideal site locations, however, are rare. Thus far EPA has maintained that locating these sites is a function of the state and local government and the private sector. Historically, proposed Federal entry into land use planning activities has been vigorously opposed by state and local governments.

Political pressures from local citizens have placed local control for siting in an extremely vulnerable position. Local officials have to respond to the fears of local citizens. The broader social need for safe waste management facilities has generally not been strongly represented in the siting process. The result has been that many facilities have not been sited.

States have been taking a more active role in the siting process. For example, a number of states have passed hazardous waste siting acts, including elaborate procedures by which the state can designate a site for waste treatment or disposal. In the Maryland Hazardous Waste Facilities Program Act of 1980, provisions are included by which a site location cannot be overruled by local zoning or other ordinances once it has been formally designated. States may also pass similar legislation for siting nonhazardous waste treatment and disposal facilities.

EPA is preparing handbooks that describe the methods that state and local authorities can use to gain public approval for siting waste treatment and disposal facilities. Roles are being described for the private sector, consultants, and state and local governments. Topics covered will also include possibilities for community compensation and impartial mediation, how to consult with the public, how to identify risks, and how to select siting criteria.

(4) Public Acceptance

Securing public acceptance for a planned sludge disposition facility is necessary in order to implement the various practices. Gaining public acceptance is enhanced by working from the beginning with responsible local officials, landowners, and other affected parties. Useful recommendations for gaining public acceptance are contained in The Process Design Manual for Sludge Treatment and Disposal (8). These steps involve holding public hearings, conducting surveys and workshops, distributing pamphlets, advertising, etc. The public should be made aware of the different sludge disposal options available, along with their benefits, risks and monetary costs. Public acceptance can be increased by open discussions of the pros and cons of the various alternatives and where necessary by conducting demonstrations that can help determine the most cost effective and environmentally acceptable disposition alternative for a particular location.

Applicable Federal Laws

(1) CWA (Clean Water Act of 1977, PL 95-217 and the Federal Water Pollution Control Act of 1972, PL 92-500) authorizes Federal funding of 75% (85% for innovative and alternative technology projects) of the eligible costs involved in the construction of municipal wastewater treatment plants and sludge treatment and disposition facilities; authorizes EPA to issue comprehensive sewage sludge management guidelines and regulations; authorizes the NPDES (National Pollution Discharge Elimination System) for point source discharges and development of areawide waste treatment or water quality management plans for non-point source pollution; requires the implementation of pretreatment standards for industrial discharges that enter POTW's; and establishes a major research and demonstration program to develop improved wastewater treatment and sludge management practices.

(2) RCRA (Resource Conservation and Recovery Act of 1976, PL 94-580) provides financial assistance to state and local governments for development of solid waste management plans which provide for the safe disposal of solid waste; provides that technical assistance be provided to help establish acceptable solid waste management methods; requires regulations for the safe disposal of hazardous and non-hazardous wastes; and encourages the research and demonstration of more effective solid waste disposal and resource conservation technologies.

(3) MPRSA (Marine Protection Research and Sanctuaries Act of 1977, PL 92-532) effectively phases out ocean disposal of sewage sludge by December 31, 1981. MPRSA also gives EPA the authority to determine a reasonable compliance schedule for the implementation of land-based disposal alternatives.

(4) CAA (Clean Air Act Amendments of 1970 and 1977, PL 91-604 and PL 95-95) authorized the development of State Implementation Plans (SIP's) for the purpose of meeting Federal ambient air quality standards. To meet the CAA objectives, EPA has developed an emission offset policy for new or modified incinerator and heat drying facilities and a procedure for preventing the significant deterioration of ambient air quality. CAA also authorizes regulations for the control of hazardous air pollutants and new source performance standards.

(5) SDWA (Safe Drinking Water Act of 1975, PL 93-523) requires coordination with the CWA and RCRA to protect drinking water from contamination.

(6) NEPA (National Environmental Policy Act of 1969, PL 91-190) authorizes Regional Administrators, at their discretion, to require Environmental Impact Statements (EIS) (40 CFR, Part 6) if potential adverse social, economic or environmental impacts are suspected for a new or modified sludge disposition facility or practice. An EIS or negative declaration (40 CFR, Part 35, Sect. 35.925-8) is also required when applying for Federal Construction Grants.

(7) TSCA (Toxic Substances Control Act of 1976, PL 94-469), Section 9, requires coordination with the Clean Air Act and the Clean Water Act to restrict disposal of hazardous wastes. Presently only PCB (polychlorinated biphenyl) is specifically regulated in regards to sludge disposition.

Applicable Regulations

The following regulations apply to the various sludge disposition methods. More detailed coverage of these regulations is given in the appropriate sections of this guidance document, except for the regulations dealing with hazardous waste, industrial pretreatment and PCB's. These latter three regulations potentially apply to all disposition methods. Therefore, to avoid redundancy, they are discussed below and not in the individual sections of this guidance document.

(1) Criteria for the Classification of Solid Waste Disposal Facilities and Practices (40 CFR, Part 257; Federal Register, Sept. 13, 1979) is authorized by Section 405(d) of the CWA and 4004(a) and 1008(a)(3) of the RCRA, and is referred to in this guidance as the "Criteria". Guidance Manual SW-828 should be consulted to determine if a facility complies with the Criteria.

(2) NPDES (National Pollution Discharge Elimination System, 40 CFR, Part 125) is authorized by Section 402 of the FWPCA.

(3) Federal Construction Grants Regulations (40 CFR, Part 35, Subpart E; Federal Register, Sept. 27, 1978) are authorized by section 201 of the CWA.

(4) State or Areawide Waste Treatment Management Plans are authorized by Sect. 208 of the CWA.

(5) Air Regulations are authorized by the CAA.

(6) Ocean Dumping Regulations are authorized by MPRSA and CWA

(7) Hazardous Waste Regulations (40 CFR, Parts 260-265; FR May 19, 1980)

Subtitle C of RCRA authorized the development of hazardous waste regulations. Under the proposed hazardous waste regulations, issued on December 18, 1978 in the Federal Register, municipal sewage sludges were excluded from coverage under Subtitle C of RCRA. Subsequently, in the final regulations promulgated in the Federal Register on May 19, 1980, municipal sewage sludges were no longer excluded from coverage and thus are potentially subject to control as hazardous waste.

Domestic sewage and any mixture of domestic sewage and other wastes that passes through a sewer system to a POTW for treatment is not considered a solid waste [40 CFR Part 261.4(a)(1)]. Under all circumstances, however, municipal sewage sludge that is separated from the sewage during treatment is considered a solid waste [261.2(a)]. In general, a solid waste is a hazardous waste if it has been listed as such by the Administrator or if it exhibits any of the defined characteristics of a hazardous waste [261.3(a)].

EPA has not listed municipal sewage sludges as hazardous wastes. Therefore, municipal sewage sludges are not considered hazardous unless tested and shown to be hazardous. While not included in the Agency's listing of hazardous wastes under Subpart D, of Part 261, specific municipal sewage sludges will be considered hazardous if they exhibit any one of the four characteristics of hazardous waste (261.21 through 261.24 i.e., ignitability, corrosivity, reactivity, and EP toxicity). Specific municipal sewage sludges would also be considered hazardous if they were mixed with any hazardous waste other than those entering the publicly owned treatment works (POTWs) through a sanitary sewer system [261.3(a)(2)(ii) and 261.4(a)(1)(ii)].

Municipalities have an obligation to determine if their sludge meets the definition of a hazardous waste. This does not mean that each POTW must test their sludge. Rather, POTW's or other waste handlers must make a determination that the waste is not hazardous, based upon knowledge of the waste, including the contaminants, etc. EPA advises testing, particularly EP toxicity testing, where there are significant contributions of industrial wastewater or stormwater into the POTW or where there is any reason to believe that the sludge may exhibit the EP toxicity characteristic. EPA believes that POTW sludge will rarely, if ever, exhibit the other three characteristics of a hazardous wastes and believes that a determination can be made based on knowledge about the sludge, without need of testing.

The regulations place the responsibility of determining whether a POTW sludge is a hazardous waste squarely on the owner or operator of the POTW. He may choose any method he likes to make this determination. If he determines that his sludge is not a hazardous waste or fails to make a determination, and EPA finds that the sludge is a hazardous waste, then he is in violation of the regulations.

EPA believes that the vast majority of the POTW's do not generate a sludge which is a hazardous waste. However, we do not have a large amount of data to indicate which POTW's would be the likely sources of hazardous waste sludges. The characteristic most likely to cause a sludge to be hazardous would be toxicity, determined by the extraction procedure (EP). In very limited tests by EPA, cadmium is the only known element that has caused a sludge to fail the EP, i.e., be considered hazardous.

Any POTW that generates or transports a municipal sewage sludge which it believes to be hazardous and who plans to continue to generate, transport, treat or dispose of more than 1000 kg at any time, must notify EPA of their activity. A POTW, which is only a generator of a hazardous municipal sewage sludge and that does not also treat, store, or dispose of the sludge, does not require a hazardous waste permit. This POTW generator, however, does have a major responsibility to follow all the provisions of 40 CFR Part 262. A POTW would also require a hazardous waste permit if it engaged in treating, storing, or disposing of hazardous municipal sludge in the quantities described above. As part of this permitting process, an existing POTW must obtain interim status as a hazardous waste treater, storer, or disposer. To obtain this interim status the applicant POTW would have had to notify EPA by August 18, 1980, and submit a completed Part A permit application to the appropriate EPA regional office by November 19, 1980.

If interim status has not been obtained, then the POTW would not be able to operate under the interim status provisions of the hazardous waste regulations. The POTW would have to notify EPA that they are generating a hazardous sludge. The POTW would also have to comply with the applicable requirements of Parts 262 and 263. Finally, if the POTW treated, stored, or disposed of its hazardous sludge onsite, then it must submit Part A and Part B of a permit application in accordance with Section 122.26(b). And, because the POTW did not have Interim Status it would have to refrain from treating, storing, or disposing of its sludge onsite after November 19, 1980, until it were issued a RCRA, Subtitle C permit. While waiting for the issuance of a permit, the POTW would have to send its hazardous sludge to a hazardous waste treatment, storage, or disposal facility that has Interim Status or has been issued a RCRA, Subtitle C permit.

EPA recognizes that the lack of interim status may and often will present a very difficult problem for POTW's caught in this predicament. This is because (a) it will take time to issue a permit, (b) in the interim, it forecloses onsite digestion, dewatering and storage (except 90-day accumulation) of the large volumes of sludge typically generated

by a POTW and (c) it requires unanticipated off-site transportation of the sludge to hazardous waste facilities that may not be available or may be located long distances away. EPA is currently examining the unique problems of POTW's regarding compliance with this provision. Any POTW that generates, treats, transports, stores, or disposes of a hazardous municipal sewage sludge without filing the notification is subject to civil or criminal penalties.

See POM 80-4 and addendum 1 to POM 80-4 for additional information on the effect of hazardous waste regulations on management of municipal sewage sludge.

(8) Industrial Pretreatment Regulations

Section 307 of the CWA authorized regulations (40 CFR, Part 403) for industrial pretreatment. One of the objectives of the pretreatment regulations is to prevent the introduction of pollutants into POTW's which will contaminate the sludge and thereby impair opportunities for the utilization and cost-effective disposal of sludge. Therefore, with the various new industrial pretreatment regulations taking effect in the near future, the amount of sewage sludge suitable for disposition via the various options discussed should increase. For example, POTW's involved in landspreading practices may need to insist upon effective pretreatment of industrial waste for control of contaminants of concern in order to meet regulations designed to protect human health and the environment in a cost-effective manner.

Applicable Guidelines

The following guidelines apply to the various disposition practices. Additional specific guidelines are given in the appropriate sections of this document.

(1) US EPA, 1980. Classifying Solid Waste Disposal Facilities, A Guidance Manual. SW-828.

(2) US EPA, 1979. Process Design Manual for Sludge Treatment and Disposal. US EPA Center for Research Information. EPA-625/1-79-011.

(3) US EPA, 1978. Process Design Manual: Municipal Sludge Landfills. EPA-625/1-78-010. SW-705.

(4) US EPA, 1978. Sludge Treatment and Disposal. Technology Transfer. Vol. 2. EPA-625/4-78-012.

(5) US EPA, 1978. Applications of Sludges and Wastewaters on Agricultural Land: A Planning and Educational Guide. Office of Water Program Operations. MCD-35.

(6) US EPA, 1977. Municipal Sludge Management: Environmental Factors. Technical Bulletin. Office of Water Program Operations. MCD-28. EPA 430/9-77-004. (Referred to in this guidance document as the Sludge Technical Bulletin or STB).

(7) Guidelines Establishing Test Procedures for Analysis of Pollutants (40 CFR, Part 136).

(8) A. US EPA. Construction Grants Program Operations Memorandum POM 80-4. The Effect of the Hazardous Waste Regulations on Management of Municipal Sewage Sludge, July 1980.

B. Addendum 1 to POM 80-4, August 1980.

(9) US EPA, 1980. Draft: Construction Grants Program Requirements Memorandum (PRM). Eligibility of Land Acquisition Costs (By Either Fee Simple Purchase, Lease, or Easement) for Land Treatment of Wastewater and Sludge, and Policy Regarding "No Cost" Arrangements for Sludge Application. Office of Water Program Operations.

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(1) Haug, R.T., L. D. Tortorici and S. K. Raksit, 1977. Sludge Processing and Disposal, A State of the Art Review. Prepared for Regional Wastewater Solids Management Program, Los Angeles/Orange County Metropolitan Area.

(2) US EPA. 1979. Comprehensive Sludge Study Relevant to Section 8002(g) of the RCRA of 1976. SW-802.

(3) US EPA. 1980. Evaluation of Sludge Management Systems: Evaluation Checklist and Supporting Commentary. EPA 430/9-80-001, MCD-61.

(4) US EPA, 1980. Handbook of Procedures, Construction Grants Program for Municipal Wastewater Treatment Works, 2nd Ed. Office of Water Program Operations. MCD-03.

(5) US EPA, 1978. Innovative and Alternative Technology Assessment Manual. EPA 4-30/9-78-009. MCD-53.

(6) US EPA, 1976. Municipal Sludge Management: EPA Construction Grants Program, An Overview of the Sludge Management Situation. EPA 430/9-76-009.

(7) US EPA, 1978. Multimedium Management of Municipal Sludge. Analytical Studies for the US EPA. Vol. IX. National Academy of Sciences, Washington, DC.

(8) US EPA, 1979. Process Design Manual for Sludge Treatment and Disposal. EPA 625/1-79-011.

(9) US EPA, 1977. Sludge Handling and Disposal Practices at Selected Municipal Wastewater Treatment Plants. EPA 430/9-77-007, MCD-36.

(10) US EPA, 1977. Transport of Sewage Sludge. EPA 600/2-77-216.

(11) Walker, J.M., M. S. Winsten and J. E. Hall, 1979. A Critical Review of the Performance of Sewage Sludge Composting Operations. Presented at the National Conference on Municipal and Industrial Sludge Composting, New Carrollton, MD. Sponsor: Information Transfer, Inc., Silver Spring, MD, November, pp 5-14.

TREATMENT AND VOLUME REDUCTION METHODS

INCINERATION (THERMAL REDUCTION)

I. Background

(A) in 1978, approximately 22% of all sewage sludge was incinerated (13,14)

(B) an effective process for volume reduction and stabilization. Approximately 35% (dry wt.) and 20% (volume) of the solids remain after incineration and require disposal.

(C) in 1979 approximately 350-400 municipal sludge incinerators were in operation (13,17)

(D) 80% of sludge incinerators are multi-hearth; remainder are mostly fluidized bed reactors (11)

(E) ash may contain variable amounts of fertilizer nutrients, but the usefulness as a fertilizer can be limited by concentrated metals

(F) other methods of thermal reduction include:

(1) coincineration - with refuse, refuse derived fuel (RDF), coal, etc. (reduces the need for gas and oil as an auxiliary fuel)

(2) starved air combustion (SAC) or pyrolysis - still early in the development stage, SAC may possibly require less fuel, emit fewer particulates than conventional incinerators, and produce a low energy content gas, oil, and char

(3) heat drying - produces a usable fertilizer product that retains most of the plant available nitrogen

II. Applicable Laws, Regulations and Guidelines

(A) laws

(1) CWA
(2) CAA
(3) RCRA
(4) SDWA
(5) TSCA
(6) NEPA

(B) regulations

(1) New Source Review (NSR) is authorized by Section 110, 172 and 173 of the CAA

(2) National Ambient Air Quality Standards (NAAQS) is authorized by Section 109 of the CAA

(3) National Emission Standards for Hazardous Air Pollutants (NESHAP) is authorized by Section 112 of the CAA

(4) New Source Performance Standards (NSPS) is authorized by Section 111 of the CAA

(5) Prevention of Significant Deterioration (PSD) is authorized by Section 160-169 of the CAA

(6) State Implementation Plans are authorized by Section 110 of the CAA

(7) Criteria for the Classification of Solid Waste Disposal Facilities and Practices (40 CFR, Part 257; FR, Sept. 21, 1979)

(8) Construction Grants Regulations (40 CFR, Part 35, Subpart E)

(9) PCB Regulations (40 CFR, Part 761)

(10) NPDES Permits (40 CFR, Part 125)

(11) Hazardous Waste Regulations (40 CFR, Parts 260-265; FR, May 19, 1980)

(12) Distribution and Marketing Regulations (Preproposal Draft, May 6, 1980)

(C) guidelines

(1) Sludge Process Design Manual (EPA-625/1-79-011)

(2) Sludge Technical Bulletin (EPA/430-9-77-004)

III. Procedure for Starting a New or Modified Facility

Three basic regulatory areas need to be addressed when a facility is planning to dispose of sludge by incineration. These include: air quality regulations, ash disposal regulations, and Federal Construction Grants regulations. The same regulations apply for thermal drying of sludge that apply for incineration, except that the distribution and marketing regulations (now being developed) will cover the dried sludge product (instead of the Criteria which pertains to ash disposal). The process required to obtain the necessary permits can take from 6 to 42 months to complete (1).

(A) air quality regulations

Air quality regulations apply to all the methods used in the thermal reduction of sludge, e.g., conventional incineration, coincineration, pyrolysis, heat drying, etc.

For certain air pollutants, EPA has set primary and secondary National Ambient Air Quality Standards (NAAQS; 40 CFR, Part 50). The CAA of 1970 required that each state develop its own control strategy or State Implementation Plan (SIP), subject to EPA approval, to meet the NAAQS. Federal standards have also been developed for the control of hazardous pollutants and for new source performance.

The SIP (40 CFR, Part 51 and 52) is required to provide for emission controls, source and ambient air quality monitoring, emission offset policies, procedures for the review and approval of new sources of air pollution prior to construction (New Source Review Rule; 40 CFR, Part 51, Sect. 51.18), and procedures to prevent the significant deterioration of ambient air quality (Prevention of Significant Deterioration; 40 CFR, Part 51, Sect. 51.24 and Part 52, Sect. 52.21).

There are three general air quality requirements that sludge incinerators should comply with: 1) compliance with the SIP; 2) compliance with National Emission Standards for Hazardous Air Pollutants (NESHAP) and New Source Performance Standards (NSPS) (unless the state in question included the NESHAP and NSPS in their SIP); and 3) compliance with any additional provisions of the SIP, not required by Federal law.

(1) compliance with State Implementation Plan (SIP)

SIP's require the preconstruction or new source review (NSR) for any new sludge incinerator construction or modifications if a specified emission rate is expected to be exceeded. SIP's have EPA approved compliance schedules to meet primary and secondary ambient air quality standards. National primary ambient air quality standards define levels of air quality which are necessary and which include an adequate margin of safety to protect the public health. National secondary ambient air quality standards define levels of air quality which are necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant. National primary and secondary ambient air quality standards are given for the following pollutants: sulfur dioxide, particulate matter, carbon monoxide, photochemical oxidants, hydrocarbons, nitrogen dioxide and lead.

(a) SIP's will have strict emission limits if the facility is in a non-attainment area for a specific pollutant. A non-attainment area has an ambient air quality that is worse than the NAAQS for a specific pollutant. For pollutant emissions in a non-attainment area the facility may need to acquire an emission offset that is greater than one-to-one from within the facility or from a

neighboring facility; demonstrate that, based on technical feasibility, the facility is producing the Lowest Achievable Emission Rate (LAER) for the violating pollutants; and assure that all other major sources within the facility are on an approved compliance schedule for the violating pollutants included in the SIP.

Coincineration is exempt from the Federal emission offset policy for non-attainment areas (however, it may not be excluded from the state policy), if the Best Available Control Technology (BACT) is used to limit emissions and if more than 50% of the heat input is used for generating steam or electricity. In addition, the use of refuse derived fuel in an existing boiler would not be considered a modification and, hence, would not be subject to the emission offset policy (FR, Jan. 16, 1979, 3274-3285).

(b) if the facility is in an attainment area (an area where specific pollutant emissions result in ambient air quality at a level equivalent to, or better than the NAAQS) then the facility must comply with regulations pertaining to the Prevention of Significant Deterioration (PSD). The PSD regulations (40 CFR, Part 51, Section 51.24 and Part 52, Sect. 52.21) require the facility to perform air quality modeling and monitoring for the specific pollutants to assure that neither the PSD increments nor the NAAQS are violated. Also, the facility must demonstrate that based on cost, energy and technical feasibility, the Best Available Control Technology (BACT) is used to limit emissions of any pollutants controlled under the CAA.

(c) since the NSR regulations apply to pollutants on an individual basis, most facilities will likely have to follow the permitting procedures for each specific pollutant (depending upon the area's designation for the specific pollutant as a non-attainment or attainment area).

(2) compliance with National Emission Standards for Hazardous Air Pollutants (NESHAP) and New Source Performance Standards (NSPS)

Federal standards for mercury emissions are given in NESHAP (40 CFR, Part 61, Subpart A and E). Minimum Federal requirements for particulate matter discharge, opacity and monitoring are given in NSPS (40 CFR, Part 60, Subparts A, E, and O). Some states incorporate NESHAP and NSPS into the EPA approved SIP, so the facility should consult with a state air quality official to determine the extent of the SIP coverage.

(3) compliance with additional SIP provisions, not required by Federal law

The facility should consult with appropriate state officials to determine what further requirements of the SIP must be met, that are not required by Federal law

(B) ash disposal regulations

An incinerator facility that disposes of its ash in a landfill must comply with the Criteria for Classification of Solid Waste Disposal Facilities and Practices (40 CFR 257; 44 FR 53438) for floodplains, endangered species, surface water, ground water, air, disease and safety. Refer to the section of this document on landfills for a more detailed discussion of the requirements of the Criteria for disposal into a landfill.

(C) Federal Construction Grants regulations (40 CFR, Part 35, Subpart E)

(1) sewage sludge incinerator construction or modification may be eligible for a maximum 75% Federal construction grant funds (generally 75% funding of eligible capital costs). The modification must meet applicable regulations and result in a water quality benefit.

(2) a "self-sustaining" facility may be eligible for additional Federal grant support as an innovative/alternative technology. A "self-sustaining" facility produces an equal or greater amount of energy than it consumes, which includes energy used for dewatering, afterburning, etc.

(3) sludge related parts of coincineration facilities with heat recovery equipment may also be eligible for additional Federal grant support as an alternative technology at the 85% level. The amount of funding for the sludge related part is determined using the Alternative Justifiable Expenditure Method (AJE) found in PRM 77-4.

(4) energy efficient facilities for thermally drying sewage sludge that will be used as a fertilizer may also qualify as an alternative technology

(D) PCB recommendations

EPA recommends that if a sludge contains greater than 25 ppm PCB, then the incinerator facility should increase the temperature and residence time to ensure that at least 95% of the PCB is destroyed (5). However, if the sludge contains greater than 50 ppm, then the incineration facility must comply with the PCB regulations (40 CFR, Part 761).

IV. Problems Associated with Sludge Incineration and Solutions

(A) *one of the biggest problems facing municipalities that operate sludge incinerators is the high cost of energy that is needed both for the actual incineration process (including the evaporation of excess moisture) and for air pollution control (e.g. it requires about 50 gallons of number 2 fuel oil to burn 1 ton dry solids or 4-5 tons dewatered sludge) (21). The use of afterburners for air pollution control may require an additional 70-135 gallons of number 2 fuel oil per 1 ton dry solids incinerated (22). Approximately 15-20% of sludge incinerators constructed since 1970 are no longer in operation (8) primarily due to high operating costs for energy. Furthermore, conventional sludge incineration and ash disposal waste a valuable fertilizer and soil conditioning resource.*

The 1978 EPA Needs Survey (17) estimates that there are approximately 350 municipal sewage sludge incinerators. In a recent survey conducted for EPA (19), 150 sludge incinerators were studied. Of this number, 13 were shut down either because they were unable to meet the air quality standards, but more often because of the high cost of energy; and 26 were in violation of their SIP.

the high cost of energy for operating municipal sludge incinerators may be reduced by a number of measures including the following:

(1) installation and use of heat recovery equipment, e.g., hot exhaust gases can be used directly for drying sludge, conditioning sludge, for pre-heating intake air or to heat water to produce steam for electricity production

(2) install dewatering equipment that can produce a 30-35% solids sludge that will burn autogenously. In this manner, supplemental fuel requirements would be drastically reduced (20).

(3) use alternative fuel sources (e.g., coincineration with refuse or refuse derived fuel, coal, methane, etc.). Approximately 75% of the contents of municipal refuse is combustible with an energy potential of 9 million BTU's/ton (15). Coincineration facilities that are presently operating in this country are located in Ansonia, CT; Harrisburg, PA; and Duluth, MN.

(4) operate the facility with frequent and properly engineered combustion analysis, making appropriate adjustments for air flow, fuel injection, temperature, etc.

(5) new interest in energy recovery and energy efficient designs in incineration (thermal conversion) systems may help overcome the current energy consumption and cost problems facing many conventionally designed incinerators

(6) dry and market the sludge, rather than incinerating and disposing of the ash

(7) a number of municipalities have abandoned their incinerators to save on fuel costs. For example, by converting from incineration to lime stabilization for land application, East Fitchburg, MA saved $95,000 in 1978 in fuel costs and gained about $25,000 worth of nutrients (20). But, land application is not advised when the sludge contains a relatively high concentration of contaminants.

(B) *existing municipal sludge incinerators, that utilize low pressure scrubbers for particulate removal, have been found to emit up to 30% of the cadmium that is incinerated into the atmosphere. High pressure scrubbers may not be much more efficient in cadmium removal (11). Thus far, there are no Federal standards directed specifically at controlling cadmium emissions from incinerators.*

Further research is needed to determine the amount of cadmium and other metals that are emitted from new sludge incinerators that have efficient particulate removal devices. Research should also determine whether the amount of metals, released into the environment from sludge incinerators, is sufficient to result in a potential impact on human health and the environment. Therefore, future research may show a need for increased removal of metals like cadmium and, hence, a Federal standard to limit such emissions.

V. References

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(3) Federal Register, 1979. Criteria for the Classification of Solid Waste Disposal Facilities and Practices. 44 FR 53438 - 53468, September 13.

(4) Federal Register, 1979. Emission Offset Interpretative Ruling. 44 FR 3274-3285, January 16.

(5) Federal Register, 1977. Municipal Sludge Management: Environmental Factor; Technical Bulletin. pp. 57427, November 2.

(6) Federal Register, 1978. National Primary and Secondary Ambient Air Quality Standards for Lead. 43 FR 46246, October 5.

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(17) US EPA, 1979. 1978 Needs Survey Conveyance and Treatment of Municipal Wastewater. Summaries of Technical Data. Office of Water Programs Operations. EPA-430/9-79-002, FRD-2.

(18) US EPA, 1976. Refuse-Fired Energy Systems in Europe: An Evaluation of Design Practices. Office of Solid Waste. SW-771.

(19) US EPA, 1980. Retrieval Edit Report, Compliance Data System: Incinerators Compliance Status. Office of Enforcement, Washington, DC, March 13.

(20) Walker, J.M., 1979. Overview: Costs, Benefits, and Problems of Utilization of Sludges. In Proc. of 8th National Conference on Municipal Sludge Management. Miami, Florida, March 1. Information Transfer, Inc., Silver Spring, MD.

(21) Walker, J.M., 1979. Using Municipal Sewage Sludge on Land Makes Sense. Compost Science 19:28, 29, 43.

(22) Wells, J. F. and F. J. Drehuring, 1977. Sludge Incineration Takes on New Image or What to Do Before You Get Burned Trying to Incinerate Waste Activated Sludges. 15th Conf. WPCF, Phila, PA.

COMPOSTING

I. Background (10)

(A) process involves sludge stabilization by aerobic microbial decomposition

(B) compost is useful as a soil conditioner and low grade fertilizer, but typically contains lower concentrations of nitrogen than uncomposted sludge. The usefulness of compost, as with other forms of sludge, may be limited if there is a relatively high concentration of heavy metals and/or toxic organics

(C) the most common composting methods are the aerated pile method for raw or digested sludge and the windrow method for digested sludge (using raw sludge in the windrow method can create excessive odors)

(D) in-vessel systems for composting sewage sludge have been utilized successfully in Europe. These facilities have generally processed less than 10 dry tons of sludge per day. These in-vessel systems are beginning to be tested for operation in the United States.

(E) composted sludge is generally more publicly acceptable (marketable) for land application than liquid or vacuum dewatered sludges for several reasons:

(1) reduced odor potential

(2) easy to store

(3) decreased levels of persistent organics and pathogens

(F) sludge composting facilities presently operating include those located in Washington, DC; Camden, NJ; Bangor, ME; Durham, NH; Windsor, Ontario, Canada; Los Angeles County, CA; Upper Occoquan, VA; Philadelphia, PA; and Beltsville, MD.

II. Applicable Laws, Regulations & Guidelines

(A) laws

(1) CWA
(2) RCRA
(3) TSCA
(4) NEPA
(5) SDWA

(B) regulations

(1) Criteria for the Classification of Solid Waste Disposal Facilities and Practices (40 CFR, Part 257; FR September 13, 1979)

(2) Federal Construction Grants Regulations (40 CFR, Part 35, Subpart E)

(3) Distribution and Marketing Regulations (Preproposal Draft, May 6, 1980)

(4) Hazardous Waste Regulations (40 CFR, Part 260-265; FR, May 19, 1980)

(c) guidelines (10)

(1) Process Design Manual for Sludge Treatment and Disposal (EPA-625/1-79-011)

(2) Technical Bulletin: Composting Processes to Stabilize and Disinfect Municipal Sewage Sludge. Preliminary Draft. Office of Water Program Operations. July, 1980.

III. Requirements for Implementing a New Sludge Composting Facility

(A) compost process

(1) data from presently operating windrow and aerated pile composting facilities have shown that approximately 1 acre of land is needed for each 4 dry tons of sludge composted each day (10). Additional land is needed for storage and curing.

(2) meet the requirements of the Criteria. The pathogen reduction provisions can be met by satisfying the composting time and temperature requirements given in Appendix II, Sections A and B of the Criteria.

(B) disposition of compost

(1) currently, composted sludge is applied to land, sold, given-away or hauled away for a fee

(2) for a discussion of the disposition methods appropriate for composted sludge refer to the selections on landspreading, distribution and marketing, and landfills

(C) Federal Construction Grants

(1) composting of sewage sludge is considered an alternative technology by the EPA and may be eligible for up to an 85% Federal construction grant funds to pay for land, equipment, and construction costs

IV. Problems Associated With Sludge Composting Operations and Solutions to Problems

(A) *the composting of large amounts of sewage sludge is a relatively new technology. The simplist systems (static aerated pile and windrow) are becoming well established in the United States. In order to make their operations less labor intensive and more mechanically reliable, several municipalities have been modifying their static aerated pile and windrow operations with more capital intensive equipment. Also, other municipalities are considering the adoption of various in-vessel composting systems. The modifications in the static aerated pile and windrow systems have not always resulted in a more efficient operation, and the proposed in-vessel systems have had limited testing and operational experience for composting sewage sludge in the United States.*

refinements in static aerated pile and windrow methods and adoption of the in-vessel system should be piloted before being operated on a full scale, in order to establish the system's efficiency and reliability

(B) *excessive rainfall usually creates a potential for poor aeration, odor, and leachate runoff*

odor production and leachate runoff have been successfully managed by using overhead roofs for initial mixing sites, scrubber piles for trapping malodorous gases from forced air systems and/or turning during processing, use of a paved base that is cleaned regularly, temporary storage or landfill backup for handling excessive amounts of sludge that cannot be composted during periods of wet weather, and separate treatment or recycling of leachate back to the POTW

(C) *low cost bulking agents may not always be available and a change in bulking agents may create problems in initial mixing and subsequent recovery of bulking agents from the finished compost*

provide a flexible system design, so that machinery and equipment can easily accept and process alternative bulking agents, including previously composted sludge

(D) *a suitable give-away or sale market should be developed*

development of a suitable market takes considerable expertise and time, especially where large quantities of composted sludge are involved (1). A continual supply of compost is required, since a sudden cutoff can cause a permanent shift to the use of a substitute product. Proper instructions for safe use must accompany the compost to the user.

A variety of options for the disposition of the compost product should be available, since the compost may not be usable if an occasional batch is improperly composted or adversely contaminated. Such alternative options for disposition may include temporary storage facilities, landfills, and use on certain government owned lands.

(E) *there is a concern for the possibility of an adverse health impact on compost workers and nearby residents from the inhalation of an excessive number of spores of the fungus, Aspergillus fumigatus*

the amount of dust released should be limited. Compost workers could be required to wear dust masks and be tested periodically for sensitivity to Aspergillus fumigatus. The use of recycled compost as a bulking agent may reduce the level of A. fumigatus.

(F) *ease of handling, low cost and low nitrogen content may prompt the user to exceed recommended application rates. This could result in higher soil additions of contaminants.*

clear labeling should accompany the product for its proper use. In addition, the compost distributor may want to charge an amount comparable with other competitive commercial products. Hence, users would tend not to exceed the recommended application rate.

References

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(4) USDA, 1979. Use of Sewage Sludge Compost for Soil Improvement and Plant Growth. Science and Education Administration. ARM-NE-6.

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SURFACE IMPOUNDMENTS (LAGOONS AND STORAGE BASINS)

I. Background

(A) in 1978, 11% of the sewage sludge produced was disposed of in lagoons (2)

(B) surface impoundments can be used as a back-up or temporary storage method for other disposition options, a sludge stabilization method prior to land application, or as a dedicated (permanent) or long-term disposal site for liquid, dewatered, heat-dried or composted sludge

(C) in humid areas, sludge has been stored in lagoons for long periods of time, although there may be some problem of water build-up during wet seasons. In areas where there is net positive evaporation, such as the southwestern U.S., a liquid stabilized sludge can be permanently disposed of in a surface impoundment by utilizing solar energy and by limiting the sludge loading rate. However, a permanent surface impoundment can waste a usable resource.

(D) surface impoundments tend to increase the sludge solids concentration, stabilization, and pathogen destruction, with the use of minimal energy, but tie up the land involved

II. Laws, Regulations, and Guidelines

(A) laws

(1) CWA
(2) RCRA
(3) SDWA
(4) TSCA
(5) NEPA

(B) regulations

(1) Criteria for the Classification of Solid Waste Disposal Facilities and Practices (40 CFR, Part 257; FR, September 13, 1979)

(2) PCB Regulations (40 CFR, part 761)

(3) Federal Construction Grants Regulations (40 CFR, Part 35, Subpart E)

(4) NPDES Regulations (40 CFR, Part 125)

(5) state regulations

(6) Hazardous Waste Regulations (40 CFR, Parts 260-265; FR, May 19, 1980)

(C) guidelines

(1) Classifying Solid Waste Disposal Facilities, A Guidance Manual (SW-828)

(2) A Manual for Evaluating Contamination Potential of Surface Impoundments (EPA 570/9-78-003)

(3) Sludge Process Design Manual (EPA 625/1-79-011)

III. Procedure for Implementing a Surface Impoundment Practice

(A) meet local and state requirements for surface impoundments. The state requirements are to be based upon the minimum standards contained in the Criteria for the Classification of Solid Waste Disposal Facilities and Practices. State regulations can, however, be more restrictive than the Criteria.

(B) meet the EPA Criteria for Classification of Solid Waste Disposal Facilities and Practices for safety, surface water, ground water, endangered species, disease (vectors), floodplains, and air

(1) facilities must immediately be in compliance with the Criteria. If the facility is not in compliance, the facility must either cease operations or apply to the state solid waste management authority for a compliance schedule. The state may grant any facility built prior to January 1986 up to five years (not to extend beyond January, 1986) to meet the Criteria. The compliance schedule will involve steps to either upgrade or close the facility. EPA recommends that the factors used by the state to determine if a compliance schedule should be granted or how the compliance schedule should be formulated should be based on the following: availability of disposal at other facilities, cost constraints, existing contractual agreements, likelihood of incremental environmental damage and other pertinent factors.

(2) the Criteria is enforceable through the solid waste management programs of each state and/or through the Federal courts under RCRA provisions. If a state does not enforce the Criteria directly through its solid waste management program, the state or a private citizen could seek enforcement of the Criteria in Federal court through the "citizen suit" provision of RCRA. The Criteria is enforceable by EPA under Section 405(e) of the CWA.

(3) the practice must use fences or other methods to control public access to the facility

(4) the facility must obtain an NPDES permit if there is a point source discharge into surface waters. Point source discharges can be avoided by proper site selection, design, operation and maintenance practices, such as leachate management and protecting the site from floodwaters. Facilities must also comply with areawide plan for non-point source pollution of surface water, authorized by Section 208 of the CWA.

(5) facilities must avoid the contamination of underground drinking water sources beyond the waste boundary as described below. "Contaminate" and "underground drinking water source" are terms specifically defined in the Criteria. Appendix I of the Criteria lists contaminant levels of concern, based on the SDWA. The Criteria provides a mechanism by which States can establish alternative boundaries to be used in lieu of the waste boundary. Compliance may be achieved by proper site selection, design, operation, and maintenance practices. Natural or artificial liners beneath the surface impoundment may be needed for leachate management. The use of ground water wells is advisable to monitor the effectiveness of compliance controls and analytical methods for monitoring should be consulted (40 CFR Part 141).

(6) if the facility is located in the critical habitat of an endangered or threatened species then the facility must not contribute to the taking of the species, or result in an adverse modification of the species critical habitat. A list of endangered or threatened species and their critical habitats is contained in 50 CFR, Part 17.

(7) the facility must minimize the onsite population of disease vectors (e.g. mosquitos). This can be accomplished by several methods. For lagoons, mechanical surface mixers can be used for agitation to eliminate stagnant water. If necessary, insecticides can be used, but biological controls are preferred (e.g., predatory and reproductive controls).

(8) in general, surface impoundments can be located in floodplain areas if the facility does not (a) cause the restriction of base flood waters (base flood has a 1% or greater chance of recurring in any year or a flood of a magnitude equalled or exceeded once in 100 years on the average), (b) reduce the temporary water storage capacity of the floodplain or (c) result in the washout of the stored sludge (SW-828). Berms or dikes can be used to meet these requirements. The construction of berms or dikes requires a Section 404 (CWA) dredge and fill permit if the facility is also located in a wetland.

(C) apply for Federal construction grant funding (40 CFR, Part 35, Subpart E). Seventy-five percent Federal funding is available for eligible costs, i.e., for the planning, design, construction and land that is needed for a surface impoundment, if the practice is the most cost-effective and environmentally acceptable alternative and if necessary state and Federal requirements are met.

IV. Problems Associated with Surface Impoundments and Solutions to Problems

(A) *suitable sites are difficult to obtain due to the following reasons:*

(1) *public opposition to nearby surface impoundment*

discussion on public acceptance and siting is given in the introduction section of this document

(2) *some sites are not adequate for preventing migration of contaminants to ground water*

these site limitations can be mitigated by appropriate design. For example, the lack of a clay layer can be compensated for by installation of plastic liners

(B) *a major problem with surface impoundments is their potential for odor production. Odors occur when an inadequately stabilized sludge is stored, where the impoundment is overloaded, and/or where the impoundment is improperly designed.*

odor potential can be minimized by surface impounding well stabilized sludge (e.g. Chicago, Illinois, uses an anaerobic lagoon with an approximate loading rate of 36 to 50 pounds of volatile solids/1000 ft^2/day from liquid sludge that has been well stabilized by anaerobic digestion) (3). Chicago reports that they digest their sludge in high-rate heated anaerobic digestors at 98°F for an average retention of 14-15 days and that they presently experience no odor problems. Dewatered sludge can also be stockpiled. However, adequate anaerobic digestion is necessary to minimize problems with odor. Nonetheless, there may be some odor problems when removing stockpiled dewatered sludge or when removing lagooned sludge.

well stabilized liquid sludge can also be surface impounded with minimal odor production in facultative (aerobic and anaerobic) lagoons (e.g., Sacramento, California, presently operates 40 acres of facultative sludge lagoons with no odor problems). To maintain the aerobic portion of the lagoon, two procedures are practiced at Sacramento: 1) the loading of volatile solids is limited to 20 lbs/1000 ft^2/day (double in the summer), and 2) mechanical surface mixers are utilized. The costs for mitigating odors, however, were appreciable at Sacramento.

V. References

(1) US EPA, 1978. A Manual for Evaluating Contamination Potential of Surface Impoundments, EPA 570/9-78-003.

(2) US EPA, 1980. First Draft. Current Production and Utilization of Wastewater and Sludge. Office of Water Program Operations, Washington, D.C.

(3) US EPA, 1978. Process Design Manual: Sludge Treatment and Disposal, EPA 625/1-79-011.

ULTIMATE UTILIZATION AND DISPOSAL METHODS

LANDFILLS

I. Background

(A) in 1978, approximately 33% of the sewage sludge produced was landfilled (5)

(B) landfilling is a suitable disposal method for sludges that are currently high in heavy metals or toxic organics and of limited value for use in land application. Industrial pretreatment may improve the quality of these sludges in the future. Hence, sludge recycling opportunities may increase. Landfilling is also suitable as a backup disposal option to other sludge management alternatives.

(C) landfilling can be a cost-effective method of disposal, but suitable sites are becoming difficult to obtain

(D) generally, sludges should be dewatered to at least a 15% solid content for disposal in a sludge-only landfill (6). Sludges with a solid content less than 15% may be codisposed with municipal refuse, if the sludge makes up only a small portion of the total amount of waste being landfilled. An acceptable ratio of refuse to sludge depends on many factors (e.g., sludge solids content, type of refuse, site characteristics and climate). Refuse to total liquid ratios from 5:1 to as low as 2:1 have been reported (1).

(E) before the issuance of the Criteria for Classification of Solid Waste Disposal Facilities and Practices, the disposal of sludge into landfills was regulated by EPA Guidelines for Land Disposal of Solid Wastes (40 CFR, Part 241). Landfilling is now regulated by the Criteria.

II. Laws, Regulations and Guidelines

(A) laws

(1) CWA
(2) RCRA
(3) SDWA
(4) TSCA
(5) NEPA

(B) regulations

(1) Criteria for the Classification of Solid Waste Disposal Facilities and Practices (40 CFR, Part 257; FR, September 13, 1979)

(2) PCB Regulations (40 CFR, Part 761)

(3) Federal Construction Grants Regulations (40 CFR, Part 35, Subpart E)

(4) NPDES Regulations (40 CFR, Part 125)

(5) state regulations

(6) Hazardous Waste Regulations (40 CFR, Parts 260-265; FR, May 19, 1980)

(C) guidelines

(1) Classifying Solid Waste Disposal Facilities, A Guidance Manual (SW-828)

(2) Sludge Technical Bulletin (EPA-430/9-77-004)

(3) Sludge Treatment and Disposal (EPA-625/4-78-012)

(4) Process Design Manual: Municipal Sludge Landfills (EPA-625/1-78-010; SW-705)

(5) Sludge Process Design Manual (EPA-625/1-79-011)

III. Procedure for Implementing a Landfilling Practice

(A) meet local and state requirements for landfills. The state requirements are to be based upon the minimum standards contained in the Criteria for the Classification of Solid Waste Disposal Facilities and Practices. State regulations can, however, be more restrictive than the Criteria. For example, some states require that the sludge be dewatered prior to landfilling to avoid leachate production and possible contamination of ground water or surface water.

(B) meet EPA Criteria for the Classification of Solid Waste Disposal Facilities and Practices for floodplains, surface water, ground water, disease (vectors), safety, air and endangered species

(1) facilities must immediately be in compliance with the Criteria. If the facility is not in compliance, the facility must either cease operations or apply to the state solid waste management authority for a compliance schedule. The state may grant any facility built prior to January 1986 up to five years (not to extend beyond January, 1986) to meet the Criteria. The compliance schedule will involve steps to either upgrade or close the facility. EPA recommends that the factors used by the state to determine if a compliance schedule should be granted or how the compliance schedule should be formulated should be based on the following: availability of disposal at other facilities, cost constraints, existing contractual agreements, likelihood of incremental environmental damage and other pertinent factors.

(2) the Criteria is enforceable through the solid waste management programs of each state and/or through Federal courts under RCRA provisions. If a state does not enforce the Criteria directly through its solid waste management program, the state or a private citizen could seek enforcement of the Criteria in Federal court through the "citizen suit" provision of RCRA. The Criteria is enforceable by EPA under Section 405(e) of the CWA.

(3) in general, landfills can be located in floodplain areas if the facility does not (a) cause the restriction of base flood waters (base flood has a 1% or greater chance of recurring in any year or a flood of a magnitude equalled or exceeded once in 100 years on the average), (b) reduce the temporary water storage capacity of the floodplain or (c) result in the washout of landfilled sewage sludge (SW-828). Berms or dikes can be used to meet these requirements. The construction of berms or dikes requires a Section 404 (CWA) dredge and fill permit if the facility is also located in a wetland.

(4) the facility must obtain an NPDES permit if there is a point source discharge into surface waters. Point source discharges can be avoided by proper site selection, design, operation and maintenance practices, such as leachate management and protecting the site from floodwaters. Facilities must also comply with areawide plan for non-point source pollution of surface water, authorized by Section 208 of the CWA.

(5) facilities must avoid the contamination of underground drinking water sources beyond the waste boundary as described below. "Contaminate" and "underground drinking water source" are terms specifically defined in the Criteria. Appendix I of the Criteria lists contaminant levels of concern, based on the SDWA. The Criteria provides a mechanism by which States can establish alternative boundaries to be used in lieu of the waste boundary. Compliance may be achieved by proper site selection, design, operation, and maintenance practices. Natural or artificial liners beneath the landfill may be used for leachate management. The use of groundwater wells is advisable to monitor the effectiveness of compliance controls and analytical methods for monitoring should be consulted (40 CFR Part 141).

(6) the facility must minimize the onsite population of disease vectors by periodic application of cover material or other appropriate techniques (e.g., increased sludge stabilization; leachate management; if necessary, chemical control agents).

(7) access restrictions (e.g., fencing) are required. There also are provisions regarding bird hazards to airports and hazards from explosive methane gases.

(8) if the facility is located in the critical habitat of an endangered or threatened species then the facility must not contribute to the taking of the species, or result in an adverse modification of the species critical habitat. A list of endangered or threatened species and their critical habitats is contained in 50 CFR, Part 17.

(C) Federal construction grant funding of 75% (40 CFR Part 35, subpart E) is available for eligible costs, such as the planning, design, and construction of landfills for sludge disposal if landfilling is the most cost-effective and environmentally acceptable alternative and if other necessary state and Federal requirements are met. Co-disposal and methane recovery are considered alternative technologies and may be eligible for up to an 85% Federal grant. If the landfill accepts both sludge and other solid waste, then multipurpose funding considerations apply. The amount of funding for the sludge related part is determined by using the Alternative Justifiable Expenditure Method (AJE) found in PRM 77-4. Land for landfilling may also be grant eligible (PRM 75-39).

Funding to support the development and implementation of the State Solid Waste Management Plan is available under RCRA (FR, July 31, 1979, pp. 45066). These funds go to the state and are not available to the municipality for funding the construction of landfill facilities.

IV. Problems Associated with Sludge Landfills and Solutions to Problems

(A) *suitable sites are difficult to obtain due to the following reasons:*

(1) *public opposition to nearby landfill*

discussion on public acceptance and siting is given in the introduction section of this document

(2) *some sites are not adequate for preventing migration of contaminants to groundwater*

these site limitations can be mitigated by appropriate design. For example, lack of a clay layer can be compensated for by installation of plastic liners. Also, co-disposal can be used to reduce leachate problems that are associated with sludge-only landfills.

(B) *waste of a useable resource*

to be potentially eligible for 85% Federal construction grant funding as an alternative technology, the facility should investigate the possibility for methane recovery from the landfill. The facility should also investigate other disposition methods that are also considered alternative technologies (e.g., landspreading, composting, distribution, and heat recovery from coincineration).

(C) *odor*

adequate stabilization of sludge and prompt application of cover material are necessary to minimize odors

VI. References

(1) Huitric, R., S. Raksit and R. Haug, 1979. In Place Capacity of Refuse to Absorb Liquid Waste. Presented at 2nd Nat. Conf. on Hazardous Materials Management. Feb. 27 - March 2. San Diego, CA.

(2) US EPA, 1980. Classifying Solid Waste Disposal Facilities, A Guidance Manual. SW-828.

(3) US EPA, 1980. Co-disposal of Municipal Solid Waste and Sewage Sludge, An Analysis of Constraints. SW-184.

(4) US EPA, 1980. Design and Construction of Covers for Solid Waste Landfills. EPA-600/2-79-165.

(5) US EPA, 1980, First Draft. Current Production and Utilization of Wastewater and Sludge. Office of Water Program Operations. Washington, D.C.

(6) US EPA, 1978. Process Design Manual: Municipal Sludge Landfills. EPA-625/1-78-010. SW-705.

(7) US EPA, 1978. Sewage Sludge Entrenchment System for Use by Small Municipalities. EPA 600/2-78-018.

(8) US EPA, 1975. Trench Incorporation of Sewage Sludge in Marginal Agricultural Land. EPA 600/2-75-034.

OCEAN DUMPING AND DISCHARGE

I. Background

(A) in 1978, approximately 10 percent of the sewage sludge produced was disposed of in the ocean (3)

(B) ocean dumping provisions of the MPRSA are sufficiently stringent that they effectively phase out ocean dumping of sewage sludge by December 31, 1981

(C) ocean dumping is regulated by interim permits under authority of Section 102(a) of the MPRSA

(D) ocean discharge through outfalls is regulated by conditional NPDES permits, or an EPA approved state compliance plan, authorized by Section 301(h), 402 and 403 of the CWA

(E) presently there are no sewage sludges that comply with the ocean dumping and ocean discharge criteria and standards. Hence, all sludges currently being disposed of in the ocean are authorized by interim and conditional permits. These permits provide for implementation of other alternatives to ocean disposal of sludge, according to compliance schedules.

(F) since 1973, 118 ocean dumping practices have been phased out. Presently, there are 26 ocean dumpers, with 23 on compliance schedules. There are currently only two municipalities discharging sewage sludge (through outfalls) into the ocean.

II. Applicable Laws, Regulations and Guidelines

(A) laws

(1) CWA
(2) MPRSA
(3) RCRA
(4) TSCA
(5) NEPA

(B) regulations

(1) NPDES (40 CFR, Part 125)

(2) Ocean Dumping Permits (40 CFR, Parts 220-230)

(3) PCB Regulations (40 CFR, Part 761)

(4) Ocean Discharge Criteria (45 FR 9548)

(5) Secondary Treatment Information (40 CFR, Part 133)

(6) Hazardous Waste Regulations (40 CFR, Parts 260-265; FR, May 9, 1980)

(C) guidelines

(1) Guidelines Establishing Test Procedures for Analysis of Pollutants (40 CFR, Part 136)

(2) Bioassay Procedure for Ocean Disposal Permit Program (EPA-600/9-78-010)

III. How to Get an Ocean Dumping Interim Permit Reissued

(A) apply for reissuance of an interim permit with the Regional Administrator. Sewage sludges currently being generated are not meeting the criteria for obtaining an ocean dumping permit, so interim ocean dumping permits are only reissued to facilities that are already ocean dumping on a compliance schedule. An interim permit may be reissued if the Regional Administrator determines that the applicant has made his best effort to satisfy all the requirements of the interim permit previously issued.

(B) interim permits are issued for no more than one year

(C) when specific provisions are absent, any permit revisions or revocations are at the discretion of the Regional Administrator. However, the Regional Administrator is authorized to request that the information provided on previous applications be updated or revised when needed.

(D) 40 CFR, Part 224 requires that records be kept on the physical and chemical characteristics of the material dumped, pursuant to the permit; the precise times and locations of dumping; and any other information required by the Regional Administrator.

The physical and chemical characteristics of the sludge, which must be analyzed in order to keep acceptable records, are usually the concentrations of mercury, cadmium, organohalogens, oils and greases, liquid constituents immiscible with or slightly soluble in seawater (eg. benzene, zylene, toluene), radioactive materials and pathogens. Other sludge characteristics that must be determined are the pH, BOD and calculation of the limiting permissible concentration (LPC) of the sludge, size of the release zone and degree of initial mixing (1). Calculation procedures (40 CFR, Part 227, Subpart G) require that a bioassay be performed on an appropriate marine organism. Bioassay procedures that are approved by EPA are found in "Bioassay Procedure for Ocean Disposal Permit Program" (EPA-600/9-78-010).

(E) the decision of the Regional Administrator to reissue, revise or deny an interim permit is based, in part, on the applicant's effort to meet the compliance schedule of the previous permit

IV. How to Get a Conditional NPDES Ocean Discharge Permit Reissued

(A) apply for the reissuance of a conditional NPDES Ocean Discharge Permit with the Regional Administrator. Sewage sludges currently being generated are not meeting the Criteria and Standards for the

NPDES Ocean Discharge permit, so conditional NPDES permits are only reissued to the facilities that are already ocean discharging on a compliance schedule. Generally, conditional NPDES permits are issued for no more than 9 months. The Regional Administrator's decision to reissue, revise, or deny a conditional NPDES Ocean Discharge Permit is based on the applicant's effort to meet the compliance schedule of the previous permit. The Regional Administrator has the authority to request that additional information be provided from the applicant for permit revisions.

(B) proposed Ocean Discharge Criteria (40 CFR, Part 125, Subpart M), which will apply to sludge disposal through outfalls, were published in the Federal Register, February 12, 1980, p. 9548. The toxic control program (Section 125.126) of the proposed criteria requires the submittal of a quantitative chemical analysis for the toxic pollutants potentially found in the discharge. The discharge must be analyzed for a list of 65 toxic pollutants found in 40 CFR, Part 403, Appendix B. Analysis methods are provided in "Guidelines Establishing Test Procedures for Analysis of Pollutants" (40 CFR, Part 136).

V. Problems Associated With Ocean Disposal of Sludge and Solutions to the Problems

since those sewage sludges that are currently being disposed of in the ocean are exceeding the regulatory criteria established to protect the marine environment, no new permits are being issued at this time for ocean disposal of sewage sludge and enforcement compliance schedules are being issued to phase out existing ocean disposal practices

investigate and implement other sludge disposition methods

VI. References

(1) Teeter, A.M. and D.J. Baumgartner. 1978. Predictions of Initial Mixing for Municipal Ocean Discharges. Environmental Research Laboratory Publication 043. Corvallis, Oregon.

(2) US EPA, 1979. Annual Report to Congress. January-December 1978. On Administration of MPRSA of 1972, as Amended (PL 92-532) and Implementing the International Ocean Dumping Convention. Office of Water Programs. June 1979.

(3) US EPA, 1980. First Draft. Current Production and Utilization of Wastewater and Sludge. Office of Water Program Operations. Washington, D.C.

LANDSPREADING

I. Background

(A) in 1978, approximately 24% of the sludge produced was applied to land (7)

(B) municipal sewage sludge is a useful material for conditioning soils and providing plant nutrients, but its usefulness becomes limited when concentrations of pollutants are high

(C) the utilization of municipal sludge for plant production or land reclamation helps fulfill the goal of Congress and EPA for waste recycling

II. Applicable Laws, Regulations, and Guidelines

(A) laws

(1) CWA
(2) RCRA
(3) TSCA
(4) SDWA
(5) NEPA

(B) regulations

(1) Criteria for the Classification and Solid Waste Disposal Facilities and Practices (40 CFR, Part 257; FR, September 13, 1979)

(2) Federal Construction Grants Regulation (40 CFR, Part 35, Subpart E)

(3) state regulations

(4) PCB Regulations (40 CFR, Part 761)

(5) NPDES Regulations (40 CFR, Part 125)

(6) Hazardous Waste Regulations (40 CFR, Parts 260-265; FR, May 19, 1980)

(C) guidelines

(1) Classifying Solid Waste Disposal Facilities, A Guidance Manual (SW-828)

(2) Sludge Technical Bulletin (EPA 430/9-77-004; MCD-28)

(3) Application of Sludges and Wastewaters on Agricultural Land: A Planning and Educational Guide (MCD-35)

(4) Sludge Treatment and Disposal (EPA-625/4-78-012)

(5) Sludge Process Design Manual (EPA-625/1-79-011)

III. Procedure for Implementing Sludge Landspreading Practices

(A) meet local, state, and Federal requirements for landspreading. The state requirements are to be based upon the minimum standards contained in the Criteria for the Classification of Solid Waste Disposal Facilities and Practices. State regulations can, however, be more restrictive than the Criteria

(B) an existing or planned facility for landspreading sewage sludge must comply with the Criteria

(1) facilities must immediately be in compliance with the Criteria. If the facility is not in compliance, the facility must either cease operations or apply to the state solid waste management authority for a compliance schedule. The state may grant any facility built prior to January 1986, up to five years (not to extend beyond January, 1986) to meet the Criteria. The compliance schedule will involve steps to either upgrade or close the facility. EPA recommends that the factors used by the state to determine if a compliance schedule should be granted or how the compliance schedule should be formulated should be based on the following: availability of disposal at other facilities, cost constraints, existing contractual agreement, likelihood of incremental environmental damage and other pertinent factors.

(2) the Criteria is enforceable through the solid waste management programs of each state and/or through Federal courts under RCRA provisions. If a state does not enforce the Criteria directly through its solid waste management program, the state or a private citizen could seek enforcement of the Criteria in Federal court through the "citizen suit" provision of RCRA. The Criteria is enforceable by EPA under Section 405(e) of the CWA.

(3) a landspreading facility must meet the provisions in the Criteria for surface water, ground water, disease, endangered species, safety, floodplains, air, and food-chain crops. Provisions in the Criteria relating especially to sludge landspreading (i.e., sections 257.3-5, 257.3-6(b) and Appendix II of the Criteria) are interim final. Interim final status is the same as final status for regulations with respect to enforceability (i.e., the interim final provisions in the Criteria apply now as written). The difference, however is that comments are received and considered for possible change. Finalization with possible change is expected by early 1981.

(a) a landspreading facility, where the waste has been incorporated into the soil for the enhancement of vegetative growth, is not normally considered as having a point source discharge (EPA Criteria Guidance, SW-828). This is true even though there may be a discharge to waters of the United States from an outfall or clearly delineated channel that drains the landspreading area. "Incorporate into the soil" means the injection or mixing of the sludge into the soil.

A landspreading facility must also comply with the state or local areawide plan for non-point source pollution of surface waters (authorized by Section 208 of the CWA). Non-point source pollution from landspreading can be minimized by good soil conservation management practices, including use of a grassed border (e.g., 15 feet in width) downslope from an application site. Research in Minnesota has shown that polluted surface water runoff can be minimized when liquid sludge (about 1/2 inch) has been applied at about one half to one day before the next rainfall.

(b) all waste disposal facilities, including landspreading operations, must generally avoid the contamination of underground drinking water sources beyond the waste boundary (257.3-4). A sludge landspreading practice will not normally contaminate underground drinking water where the sludge has been applied to the soil for the enhancement of vegetative growth, especially where the sludge application rate provides nitrogen in amounts equivalent to the needs of the vegetation. The potential for ground water contamination from landspreading increases as sludge application rate and level of contaminants increase, where the soil is more porous, and where there is appreciable rainfall. The Sludge Technical Bulletin (STB) guidance for determining the nitrogen needs of the crop and subsequent rates of sludge application to avoid nitrogen contamination of ground water should be followed.

(c) interim final provisions in the Criteria in the disease section, regarding pathogen reduction, must be met by all practices that apply sewage sludge to the soil surface or incorporate it into the soil. Sludge must be treated by a Process to Significantly Reduce Pathogens (PSRP) before the application or incorporation. Public access to the facility must be controlled for at least 12 months, and grazing by animals whose products are consumed by humans must be prevented for at least 1 month. PSRP are defined in Appendix II of the Criteria.

Sludge must be treated by a Process to Further Reduce Pathogens (PFRP) prior to application to land (i) where crops for direct human consumption are planted within 18 months after application and (ii) if the sludge will be in contact with the edible portion of the crop. PFRP are defined in Appendix II of the Criteria. Contact between the edible portion of the crop and the sludge is considered to be by either direct application of the sludge to the growing crop or by rainfall splash after the sludge application. The points of concern in determining the potential for contact are the timing and method of application and the type of crop grown. Taller growing crops such as many grains and citrus fruits can be considered as not having contact with the sludge as long as it is applied in a manner or at a time that direct contact with the crop does not occur.

(d) if a landspreading facility is properly designed and operated, then access by the public to the landspreading site should not result in potential health and safety hazards. If there is some aspect of the operation that could expose the public to potential health and safety hazards (e.g., spray application of liquid sludge and surface application in playgrounds), then the practice may need fences or other methods (e.g., hedges, ditches, remoteness, and/or controls within the facility) to control public access to the site. If the sludge has undergone PFRP prior to landspreading, then the facility would not need access controls.

(e) sewage sludges can be applied to soils in floodplains provided the facility does not (i) cause the restriction of base flood waters (base flood has a 1% or greater chance of recurring in any year or a flood of a magnitude equalled or exceeded once in 100 years on the average), (ii) reduce the temporary water storage capacity of the floodplain or (iii) result in the washout of the sludge. EPA expects that if sludge is applied to the surface and incorporated into the soil and if vegetation is grown, the Criteria should be satisfied.

(f) the interim-final provisions for food chain landspreading provide limits on the amount of cadmium and PCB that can be added to the soil. Food chain crops are defined as crops grown for human consumption, tobacco and feed for animals whose products are consumed by humans. When the project involves high application rates of sludges with a relatively high concentration of contaminants, it may be necessary for the Regional Administrator to consult with USDA and FDA as part of the review process.

(i) Cadmium: Two options are provided for controlling cadmium additions to food chain land. Option I specifies phased in controls on annual application rates and maximum cumulative cadmium loadings, with the soil pH being controlled. Annual limits for cadmium additions to soils on which vegetables, rootcrops, and tobacco are grown are initially more restrictive than for other food chain crops. Option II allows unlimited application providing (1) crops grown are used only for animal feed, (2) soil pH is controlled, (3) facility operating plan prevents human ingestion of crops, and (4) future owners of the land are provided notice in the land deed that the soil has received high cadmium additions and that food chain crops should not be grown.

(ii) Polychlorinated biphenyls (PCB): PCB limits in the sludge have been based upon causing levels in soils and crops to be low enough to meet FDA's tolerance levels for animal feeds and milk fat. Currently, therefore, the Criteria allow for the surface application of sludges containing up to 10 mg/kg PCB, dry weight basis. Where PCB levels in the sludge are above 10 mg/kg, direct contact with crops could cause the FDA tolerances to be violated. In this case the Criteria requires that the waste be incorporated into the soil rather than spread on the soil/crop surface. If analysis of the sludge shows PCB to be greater than 50 ppm, see 40 CFR Part 761 for the appropriate disposal procedures.

(C) funding

(1) Federal construction grant funding (85 percent of eligible costs, 40 CFR Part 35, subpart E) is available for the design, and construction of landspreading facilities for sludge utilization if it is the most cost-effective and environmentally acceptable alternative and if the various necessary state and Federal requirements are met. The purchase or lease of land for landspreading is also potentially grant eligible (PRM 75-39).

(2) funding to support the development and implementation of the State Solid Waste Management Plan is available under RCRA (FR, July 31, 1979, p. 45066). These funds go to the state and are not available to the municipality for funding the construction of landspreading facilities.

(D) monitoring and recordkeeping

Federal regulations are currently being drafted by the Office of Water and Waste Management. In these draft regulations, EPA is considering requiring that records be kept for landspreading practices. Until the regulations are finalized (expected sometime in 1981), the following voluntary monitoring and recordkeeping recommendations are provided to assure that the landspreading practice does not result in an adverse environmental effect.

(1) as mentioned in the STB, the monitoring plan should be specifically designed for local conditions, including site and sludge characteristics, proposed rate of application, crops to be grown, size of the project, etc. In addition to the contaminants of concern that are presently addressed in the Criteria, the monitoring plan should also address other heavy metals, persistent organics, and pathogens, as well as nitrates in ground water, surface water, sludge and soils. If the facility is aware of a high contaminant input into the treatment plant by a local industrial source, or if the treatment process adds contaminants to the sludge (e.g., chlorination of sludge for stabilization), then these contaminants should also be addressed in the monitoring plan.

(2) the STB guidance that heavy metal additions be most restricted and the least amount of sludge be applied to privately owned agricultural land should still be followed. Since the levels of sludge and metals added to privately owned agricultural land would be low, the level of monitoring suggested is minimized. On the other hand, sludge contaminant limits are higher on dedicated disposal sites. Likewise, the degree of necessary control, via monitoring, permits, etc., increases. In other words, where the potential for pollution is greater, the level of control and monitoring should also be greater.

(3) municipalities are generally responsible for the analysis of their sludges. They should maintain records on the sludge pH; lime level; N, P, K, Mg, and organic matter contents; concentrations of Zn, Pb, Cu, Ni, Cd, and PCB; and method and extent of stabilization.

(4) soils that receive sludges should also be analyzed. Important parameters include pH, cation exchange capacity, and cadmium concentration. There also should be a knowledge of the crops that will be grown. A number of states (e.g., MD, OH, WI, and OR) have arranged for testing of the soils by the State or County Agricultural Extension Service. These groups also recommend rates of sludge application and years of effective site life based upon the soil, crop, and sludge characteristics. Records should also be maintained by each municipality on site locations, the annual and total amounts of sludge each site has received, the crops grown, and the soil pH.

(E) in the Criteria, the Agency has indicated its preference for the application of sewage sludge to non-food chain land rather than to agricultural lands. However, the Agency believes that food chain land application practices which comply with the Criteria will pose no reasonable probability of adverse effects on public health or the environment.

IV. Problems Associated with Sludge Landspreading Practices and Solutions to Problems

(A) *many sludge land application systems have been publicly opposed in the past, even though facilities that have undergone proper environmental assessments are operating with no apparent demonstrated odor, health or safety problems*

the public should be made aware that the landspreading of sewage sludge can be a cost effective and beneficial method for waste recycling (e.g., plant production, land reclamation). The public should also be made aware that all methods of sludge disposal have risks and that few adverse environmental effects result from landspreading when regulations and good management practices are followed. A general discussion on gaining public acceptance is contained in the introduction section of this document.

(B) *Federal regulations for non-food chain landspreading have not been developed for the control of cadmium and PCB additions to the soil. However, after receiving sludge applications, non-food chain-land may be converted to food chain land. Hence, it is argued that the regulations should be the same for both types of landspreading.*

the issue of conversion of non-food chain land to food chain land will be considered more fully in the rulemaking process at a later time. Meanwhile where it is rather certain that non-food chain land will not be converted to food chain uses, more liberal amounts of contaminants such as cadmium and PCB's might be permitted.

(C) *operators of landspreading facilities and food processors who utilize crops grown on sludge ammended soils have expressed concern that they may be held liable for possible adverse environmental and health effects that may result from landspreading sewage sludge*

the issue of liability for any possible adverse consequences of landspreading municipal sewage sludge has been raised in the various states where sewage sludge is spread on privately owned land. Ultimately such questions of liability are matters for the courts to resolve and are primarily matters of State law. Under most circumstances, compliance with Federal or state and regulations guidelines concerning landspreading may provide a strong defense for POTW's against charges that they are responsible for the adverse consequences associated with the landspreading of their sludge. Likewise, written disclaimers of responsibility for the effects of the sludge may also protect a POTW from liability. Nevertheless, it should be made clear that neither compliance with Federal or state regulations, nor written disclaimers, can guarantee that those participating in a sludge landspreading program would not be held liable for adverse consequences. While EPA does not necessarily endorse their approach, the following are examples of state programs that could be relevant to questions of liability:

(1) Maryland (1): Guidelines are provided for the application of sewage sludge to land by the University of Maryland. These guidelines give guidance for submitting soil samples to the University's Agronomy Department for determining the sludge application rate. The State Department of Health issues permits for sludge landspreading projects. While the University indicates that sewage sludge can provide valuable plant nutrients in its sludge application recommendation, the University disavows responsibility for possible unforeseen long-term effects of sewage sludge on the environment.

(2) Ohio (4): Ohio provides guidelines for land application of sewage sludge. These include the need for information on the composition of sludge to be applied, the properties of the soil, and the nature of the crop to be grown. The Ohio Extension Service provides a soil testing service, makes recommendations for amounts of sludge to be added and provides for reporting to the Ohio Environmental Protection Agency (OEPA). The guidance states that an approved plan for sludge application does not remove a landowners responsibility for water pollution or health hazards that may result from the application of sludge on their land. Plan approval means that in the judgement of OEPA, the proposed system should function satisfactorily. If unforeseen problems arise, OEPA gives the landowner a reasonable period of time to rectify the problem. The guidance suggests that a written contract be negotiated between the landowner and the sewage sludge applicator and suggests items for inclusion in the contract. The treatment plant is responsible for keeping accurate records of the sludge quality.

(3) Oregon (2): The Oregon guidelines provide guidance for safe beneficial use of sludge. Oregon regulates land application practices by issuing permits to municipal authorities in charge of operating POTW's. These authorities must keep records of the sludge quality and application sites and rates. The authorities are responsible for conducting their landspreading in accord with the Oregon guidance and the facility permit.

(4) Michigan (3): The Michigan guidelines were prepared by the Michigan Department of Natural Resources. The guidelines emphasize beneficial use in a safe manner. They utilize state-issued NPDES permits to regulate sludge disposal. The wastewater treatment plant has the responsibility for effective sludge management.

(D) *availability of sites may be limited by the weather, cropping patterns and the allowable annual or cummulative application rates*

since landspreading is seasonal and an adequate number of landspreading sites may not always be available, the facility should have adequate storage and/or a back-up disposal method.

(E) *some landspreading practices can lead to odor production*

odor from landspreading sludge can be minimized by proper sludge stabilization before application and prompt incorporation of sludge into the soil.

V. References

(1) Guidelines for the Application of Sewage Sludge to Land, 1976. University of Maryland Agronomy Mimeo No. 10, June.

(2) Land Application of Treated Sewage Sludge: Guidelines for Communities and Farm Operators, 1978. Extension Special Report 499, Oregon State University, February.

(3) Municipal Wastewater Sludge Management/Application to Land, 1979. Staff Report to Michigan Environmental Review Board, February.

(4) Ohio Guide for Land Application of Sewage Sludge. 1979 Research Bulletin 1079 (Revised) CARDC and Bulletin 598 (revised) CES, Ohio State University, June.

(5) US EPA, 1976. Application of Sewage Sludge to Cropland, Appraisal of Potential Hazards of the Heavy Metals to Plants and Animals. MCD-33.

(6) US EPA, 1977. Cost of Landspreading and Hauling Sludge From Municipal Wastewater Treatment Plants, Case Studies. EPA/530/SW-619.

(7) US EPA, 1980. First Draft. Current Production and Utilization of Wastewater and Sludge. Office of Water Program Operations. Washington, DC.

(8) Walker, J. M., 1978. Municipal Sludge on Land Utilization/Disposal Guidance, Regulations and Guidelines. p. 6-11. In 5th National Conf. on Acceptable Sludge Disposal Techniques, Orlando, FL. Information Transfer, Inc., Rockville, MD.

DISTRIBUTION AND MARKETING (GIVEAWAY/SALE)

I. Background

(A) regulations concerning distribution and marketing of sludge and sludge products are currently being drafted by the EPA Office of Water and Waste Management. A preproposal version was released to the public for comment on May 6, 1980. Publication of the proposed regulations in the Federal Register is planned by the end of 1980.

(B) at present there are no Federal regulations that pertain specifically to the distribution and marketing of sludge and sludge products. However, the Criteria and the Sludge Technical Bulletin (STB) have some applicability with respect to cadmium, PCB's, pathogens, monitoring, recordkeeping, and surface and ground water protection.

(C) distribution and marketing of sewage sludge to the public means that the POTW does not have a comprehensive management role in the landspreading or specialty use that follows the transfer or sale of the POTW sludge. Such landspreading or specialty use generally includes the domestic use of sludge, as well as use on urban and community parks, recreation areas, roadsides, nurseries, golf courses, and the like. In general, controls on the site and the use of sludge products, as well as comprehensive site recordkeeping requirements, cannot be practically implemented by an individual POTW for sites which are very small or numerous. Therefore, the sludge quality and type of use must be regulated.

(D) many municipalities presently are involved in giving away sludge and sludge products free to the public: e.g., Philadelphia's Philorganic and the giveaway of air-dried sludges by many small communities

(E) sludge products currently sold commercially include Milwaukee's "Milorganite" (heat dried), Kellogg's "Nitrohumus" (composted), and Houston's "Houactinite" (heat dried). Chicago, Illinois and Largo, Florida are also involved in distributing heat-dried sludge products.

II. Applicable Laws, Regulations, and Guidelines

(A) laws

(1) CWA
(2) RCRA
(3) TSCA
(4) NEPA
(5) Consumer Product Safety Act (CPSA)

(B) regulations

(1) a preproposal draft has been released by the Office of Water and Waste Management for comment. This proposal draft should not be considered as Agency policy, nor should it be used to regulate the distribution and marketing of sludge, since it has not been through the formal Agency review and clearance process. It is likely that significant changes will be made to the draft prior to publication of proposed regulations in the Federal Register.

(2) at the present time the Criteria provides some guidance (see landspreading section).

(3) Hazardous Waste Regulations (40 CFR, Part 260-265; FR, May 19, 1980)

(C) guidelines

(1) at the present time the STB provides some guidance (see landspreading section)

III. Potential Requirements of the Distribution and Marketing Regulations

The following are ideas which are being considered for incorporation into draft regulations on distribution and marketing (give-away and sale) of sludge products. Since these regulations are in the early developmental stage, each idea may undergo substantial change as a result of the comments received and of all other data obtained during the rulemaking process.

(A) the manufacturer of the sludge product will likely be regulated. The manufacturer is defined as the firm or POTW that produces, packages and labels the finished sludge product for use.

(B) regulations will likely deal with sludge fertilizer products and sludge soil conditioners separately, based in part on nitrogen, moisture contents, and possibly end use

(C) the sludge constituent of the fertilizer product or soil conditioner may require treatment by a Process to Further Reduce Pathogens as described in Appendix II, Part B of the Criteria

(D) sludge fertilizer products may be less stringently regulated than sludge soil conditioners, but have a nitrogen/contaminant limit and may require labels specifying instructions for use

(E) the controls on sludge soil conditioners may recognize the concept of a "good sludge"

(1) minimal requirements to define a good or clean sludge (Note, the concept of a good or clean sludge may also be applied to soil fertilizer products.) for unrestricted use might include specific limiting concentrations for certain contaminants such as cadmium, PCB's and lead; a requirement for a minimal content of lime as an internal protection against heavy metal availability; adequate stabilization to eliminate pathogens and malodor; and controlling the cadmium to zinc ratio in the sludge as another internal protective mechanism to preclude problems with cadmium in the diet.

(F) sludge soil conditioners not meeting the "good sludge" requirements may be classified into two separate categories based on the end use of the product

(1) products for restricted-general use may require the sludge producer to include labels or invoices that give the user application rates and instructions for use. The label may also contain warnings which restrict certain usage based on the specific contaminant content.

(2) products for governmental use may be utilized under governmental or POTW supervision on publicly-owned land, and the product would have maximum concentration limits for specific contaminants

(G) sludge producers may be required to analyze their sludges and keep records on levels of cadmium, lead, PCB, nitrogen, phosphorus, potassium, lime, boron and certain other metals contained in the sludge (e.g., zinc, copper, and nickel). Also, records may be required on the method used to reduce pathogens (e.g., temperature, residence time, etc.).

IV. Problems Associated with the Distribution and Marketing of Sludge and Sludge Products and Solutions to Problems

uncertainty about how to proceed with the distribution and marketing of sludge products until regulations have been promulgated

some useful guidance for the use of sludge products has been developed by the US Department of Agriculture (2)

VI. Reference

(1) Black, C.A. (ed.), 1965. Methods of Soil Analysis, Agronomy Monograph No. 9. Amer. Soc. of Agronomy. Madison, Wisconsin.

(2) Hornick, S.B., J.J. Murray, R.L. Chaney, L.J. Sikora, J.F. Parr, W.D. Burge, G.B. Willson, and C.F. Tester, 1979. Use of Sewage Sludge Compost for Soil Improvement and Plant Growth. US Department of Agriculture, SEA, Agricultural Review and Manuals ARM-NE-6, August.

(3) US EPA, 1980. Pre-Proposal Draft Regulation. Distribution and Marketing of Sewage Sludge Products. Office of Solid Waste. May 6.