ORIGINAL

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FEB 11 2003
STATE OF ILLINOIS
Pollution Control Board

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
PETITION OF METROPOLITAN WATER	)	
RECLAMATION DISTRICT OF GREATER	)	
CHICAGO FOR AN ADJUSTED STANDARD	)	
FROM 35 Ill. Adm. Code 811, 812 and 817, and	)	AS 03-02
MODIFICATION OF AS 95-4	)	(Adjusted Standard-Land)
(SLUDGE APPLICATION)	)	
	)	

NOTICE OF FILING

TO:

Division of Legal Counsel
Illinois Environmental Protection Agency
1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

Office of Legal Services
Illinois Department of
Natural Resources
524 S. Second Street
Springfield, IL. 62701-1787

PLEASE TAKE NOTICE that on February 11, **2003**, we filed the attached **Petition for an Adjusted Standard, Request to Incorporate Documents by Reference** and **Appearance** with the Clerk of the Pollution Control Board, a copy of which is herewith served upon you.

Metropolitan Water Reclamation
District of Greater Chicago,

By: ________________
Michael G. Rosenberg, its Attorney

Michael G. Rosenberg/Ronald M. Hill
Metropolitan Water Reclamation
District of Greater Chicago
100 East Erie Street
Chicago, IL 60611
(312) 751-6583

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STATE OF ILLINOIS
Pollution Control Board

ORIGINAL

**STATE OF ILLINOIS)
) SS.
 COUNTY OF COOK)**

CERTIFICATE OF SERVICE

I, Judith A. Pappalardo, being duly sworn on oath, certify that I caused a copy of the attached **Petition for an Adjusted Standard, Request to Incorporate Documents by Reference, Notice of Filing/Certificate of Service** and **Appearance** to be sent via first class U.S. Mail to the below named at their addresses as shown, with proper postage prepaid, from 100 E. Erie Street, Chicago, Illinois, at or near the hour of 4:00 p.m., this 11th day of February, 2003.

Division of Legal Counsel
Illinois Environmental Protection Agency
1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

Office of Legal Services
Illinois Department of
Natural Resources
524 S. Second Street
Springfield, IL. 62701-1787

Judith A. Pappalardo

SUBSCRIBED and SWORN to before me this 11th day of February, 2003.

Rosalie Bottari
Notary Public

"OFFICIAL SEAL"
Rosalie Bottari
Notary Public, State of Illinois
My Commission Exp. 04/10/2006

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Pollution Control Board

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
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FROM 35 Ill. Adm. Code 811, 812 and 817, and	)	AS 03-02
MODIFICATION OF AS 95-4	)	(Adjusted Standard-Land)
(SLUDGE APPLICATION)	)	
	)	

APPEARANCE

I hereby file my appearance in this proceeding on behalf of the Metropolitan Water Reclamation District of Greater Chicago.

Metropolitan Water Reclamation District of Greater Chicago

Michael G. Rosenberg, Attorney

DATED: February 11, 2003

Metropolitan Water Reclamation
District of Greater Chicago
Michael G. Rosenberg
Ronald M. Hill
100 East Erie Street
Chicago, Illinois 60611
(312)751-6583

THIS FILING IS SUBMITTED ON RECYCLED PAPER

ORIGINAL

RECEIVED
CLERK'S OFFICE
FEB 11 2003
STATE OF ILLINOIS
Pollution Control Board

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
PETITION OF METROPOLITAN WATER	)	
RECLAMATION DISTRICT OF GREATER	)	
CHICAGO FOR AN ADJUSTED STANDARD	)	
FROM 35 Ill. Adm. Code 811, 812 and 817, and	)	AS 03-02
MODIFICATION OF AS 95-4	)	(Adjusted Standard - Land)
(SLUDGE APPLICATION)	)	
	)	
	)	
	)	

PETITION FOR AN ADJUSTED STANDARD

DATED: February 11, 2003

Metropolitan Water Reclamation
District of Greater Chicago
Michael G. Rosenberg
Ronald M. Hill
100 East Erie Street
Chicago, Illinois 60611
(312)751-6583

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF: PETITION OF METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO FOR AN ADJUSTED STANDARD FROM 35 Ill. Adm. Code 811, 812 and 817, and MODIFICATION OF AS 95-4 (SLUDGE APPLICATION)	)))))))))))	AS 03-____ (Adjusted Standard - Land)

PETITION FOR AN ADJUSTED STANDARD

Petitioner, Metropolitan Water Reclamation District of Greater Chicago ("District"), by its Attorney, Michael G. Rosenberg, petitions the Illinois Pollution Control Board ("Board") under Section 28.1 of the Illinois Environmental Protection Act, 415 ILCS 5/28.1, to grant the District an adjusted standard from 35 Ill. Adm. Code 811.204, 811.314(c)(3), 812.313(d), 817.303 and 817.410(c)(2) and (3), which require use of soil as a final cover at landfills in Illinois, as well as from the final order in AS 95-4. In support hereof, the District states as follows:

I. INTRODUCTION

This petition seeks several modifications to the order of the Board entered on August 24, 1995, in the matter of *Petition of the Metropolitan Water Reclamation District of Greater Chicago for Adjusted Standard From 35 Ill. Adm. Code 811, 812, and 817 (Sludge Application),* docket number AS 95-4. (A copy of the Opinion and Order of the Board entered August 24, 1995, is marked Exhibit "A" and attached hereto.) In AS 95-4, the Board granted the District's petition for an adjusted standard to the Board's rules of general applicability found at 35 Ill.

Adm. Code 811.204, 811.314(c)(3), 812.313(d), 817.303 and 817.410(c)(2) and (3) for use of soil as a final cover at landfills in Illinois. Basically, the order authorized the use of the District's air-dried sludge material at non-hazardous waste landfills in lieu of soil material for the top protective layer for final cover to support vegetation.

As will be discussed in greater detail in this petition, the District is seeking to modify the temperature and detention time requirements in AS 95-4, which will make the proposed modifications entirely consistent with the Class B pathogen requirements of the Part 503 sludge regulations. In addition, the District is requesting that the order distinguish between biosolids and sludge.

II. PROCEDURAL BACKGROUND

On March 31, 1995, the District submitted a *Petition of the Metropolitan Water Reclamation District of Greater Chicago for Adjusted Standard From 35 Ill. Adm. Code 811, 812, and 817 (Sludge Application),* docket number AS 95-4, seeking an adjusted standard to the Board's rules of general applicability found at 35 Ill. Adm. Code 811.204, 811.314(c)(3), 812.313(d), 817.303 and 817.410(c)(2) and (3). The District sought an adjusted standard in order that the District's air-dried sludge material could be used at non-hazardous waste landfills in lieu of soil material for the top protective layer for final cover to support vegetation. On August 24, 1995, the Board issued an opinion and order granting the District the relief sought in its petition.

The relief granted by the Board in AS 95-4 was conditioned upon the sludge being processed in accordance with certain conditions enumerated in the order. Those conditions included: "Anaerobic digestion at 95° ± 1° F for a minimum of 15 days or longer, as necessary to ensure that the District's air-dried sludge product will meet the USEPA's Part 503 pathogen requirements for a Class B sludge; Storage in lagoons for a minimum of 1 and 1/2 years after the final addition of sludge; and Air-drying for a minimum of 4 weeks, or as necessary to achieve a solids content of 60 percent."

On March 13, 1998, the District filed a *Petition of the Metropolitan Water Reclamation District of Greater Chicago for Adjusted Standard From 35 Ill. Adm. Code 811, 812, and 817 (Sludge Application),* docket number AS 98-5, basically seeking a clarification of the Board's order in AS 95-4. On May 7, 1998, the Board issued an order dismissing AS 98-5. On June 2, 1998, the District filed for a motion of modification of the Board's May 7, 1998 order. The Board denied the District's request of a motion for modification on August 6, 1998, stating that "the Board's Order of May 7, 1998, clearly states the Board's position regarding the existing adjusted standard and further clarification of the Board's May 7, 1998 Order is not necessary."

A. <u>Facts Necessitating This Petition</u>

In 2001, the District reviewed AS 95-4 while in the process of preparing Standard Operating Procedures ("SOPs") for the operation of the District's sludge processing trains ("SPTs") for the National Biosolids Partnership (an alliance of the Association of Metropolitan Sewerage Agencies, Water Environment Federation, United States Environmental Protection Agency, and other stakeholders to advance environmentally sound and accepted sewage sludge management practices). During this review, it was realized that the anaerobic digestion temperature requirements of 95° ± 1° F in the Board's AS 95-4 opinion and order may not always be met at the District water reclamation plants ("WRPs") that produce sewage sludge used under AS 95-4.

The original intent of AS 95-4 was to ensure that the District's air-dried sludge product would meet the Class B pathogen requirements in the United States Environmental Protection

Agency (USEPA) Part 503 Sewage Sludge Regulations. Although the temperature in the anaerobic digesters may be lowered temporarily during digester feedings and briefly fluctuate below the minimum of the 95° ± 1°F criterion in AS 95-4, the District's digesters always achieve a monthly mean temperature of 95° F or above and meet the Part 503 Sludge Regulations time and temperature requirements for Class B sewage sludge.

In October of 1999, the USEPA issued a revised guidance document entitled *Environmental Regulations and Technology, Control of Pathogens and Vector Attraction in Sewage Sludge, (Including Domestic Septage) Under 40 CFR Part 503.* (A copy of the relevant provisions from this guidance document is marked Exhibit "B" and attached hereto.) The guidance document addresses the relevant time and temperature requirements necessary in the treatment of sludge to Class B standards when employing anaerobic digestion. The guidance document states in relevant part as follows:

> "Values for the mean cell residence time and temperature shall be between 15 days at 35°C to 55°C (95°F to 131°F) and 60 days at 20°C (68°F). Straight line interpolation to calculate mean cell residence time is allowable when the temperature falls between 35°C and 20°C."

This was the intent of AS 95-4, but it is not explicitly stated as such in AS 95-4.

The inconsistency in the time/temperature provisions of paragraph 3(a) in AS 95-4 and the Class B pathogens requirements, Appendix B(A)(3) of the Part 503 Sewage Sludge Regulations, occurred when preparing the initial submittal to the Board. (See Attachment 14 of the AS 95-4 petition, which petition the District has sought to incorporate by reference into the instant proceeding.) This inconsistency went undetected. The inconsistency also included reporting temperatures in Fahrenheit instead of Celsius. In the 350-plus pages of the proceedings for AS 95-4, there are only two narrative sentences in the District's petition that mention time/temperature, and the contents of both were inconsistent with the District's Order as proposed and adopted by the Board. This inconsistency was never one of the contested issues, and it was never commented upon during the AS 95-4 proceedings.

At the time of the development of the District's submittal to the Board for an adjusted standard, there were some uncertainties on how sewage sludge as a final protective vegetative cover for municipal solid waste landfills ("MSWLF") would be regulated under the Part 503 Sewage Sludge Regulations. The USEPA had just promulgated two sets of regulations that were relevant to the use of sewage sludge for the top protective layer in MSWLFs.

First, the USEPA regulated the type of material which may be used at non-hazardous MSWLF facilities through its RCRA Subtitle D regulations at 40 CFR 258, *Criteria for Municipal Solid Waste Landfills*, effective October 9, 1993. (See Attachment 1 of AS 95-4). The Board in AS 95-4 did not consider these regulations as a barrier to the use of the District's sewage sludge as a final cover at landfills in Illinois.

Next, the USEPA promulgated its final Part 503 Sewage Sludge Regulations for the use and disposal of municipal sludge on February 19, 1993. Not only do the Part 503 Sewage Sludge Regulations not regulate non-hazardous waste landfills, but the USEPA in the Preamble, page 9258, specifically endorsed the use of municipal sludge as a cover material in non-hazardous waste landfills for the support and enhancement of vegetative growth. (See Attachment 2 of AS 95-4.) It was concluded that sewage sludge used as a final vegetative cover at MSWLFs is not regulated by the Part 503 Sewage Sludge Regulations. Also, the adjusted standard was compatible with the sludge regulations of 40 CFR Part 503, and conformed to the amendments in 40 CFR 257 and 403 of the Clean Water Act.

The District, at the time of preparing the submittal for the adjusted standard to the Board, was also working on obtaining approval from USEPA for certification of the SPTs as equivalent to a Process to Further Reduce Pathogens (PFRP). In 1998, a letter was sent to the Pathogen Equivalence Committee (PEC) of the USEPA. (See Exhibit "C" attached hereto.) On page 3 of this letter, the District proposed modifying the codified sludge SPT operation, previously submitted to USEPA in August 1994, as follows:

> "The operating temperatures of the anaerobic digesters were codified as 35°C ± 2°C (95° ± 3.6°F), instead of 35°C ± 1°C.
>
> This change will provide operational flexibility and recognize events such as instrument malfunction, and the fact the digesters operate at detention times in excess of conventional requirements."

This is one of the current codified operational protocols that the District used to obtain approval from the PEC that the District's SPTs are equivalent to PFRP, and produce a final sewage sludge product which meets the USEPA's "Class A" numerical criteria for pathogens under the Part 503 Sewage Sludge Regulations. The AS 95-4 does not reflect this change in the codified operational protocol for the District's STPs.

The District in a letter to Mr. John Colletti, USEPA, Region V, dated November 30, 2001 Exhibit "D", submitted a request for certification of site-specific PFRP for the low solids and high solids SPTs at the Stickney and Calumet WRPs. In a letter dated June 20, 2002, to Mr. Jack Farnan, General Superintendent Exhibit "E", the USEPA, Region V, granted a conditional site-specific certification of equivalency to a PFRP for the low and high solids SPTs at the District's Stickney and Calumet WRPs.

A recent examination of the temperatures recorded during sludge treatment in the heated anaerobic digesters indicates that the temperatures occasionally fluctuate to a small degree above and below the temperature limit in paragraph 3(a) of the Board's Order in AS 95-4. However, it should be noted that the Class B pathogen requirements are always being met, although there is a small degree of temperature fluctuation when the sludge is fed into and drawn off from the anaerobic digesters. In fact, by virtue of the further processing required under AS 95-4, the sludge that is produced by the District's SPTs meets the Class A pathogen requirements of the Part 503 Sewage Sludge Regulations.

These fluctuations are implicitly accepted by the USEPA in the Part 503 Sewage Sludge Regulations, as noted previously, and in Exhibit "B". However, the current wording of AS 95-4 does not take into account these occasional temperature fluctuations. Consequently, it is prudent to make the appropriate changes to the AS 95-4, so that the language of the Board Order in AS 95-4 will be consistent with the language of the Part 503 Sewage Sludge Regulations, and consistent with the codified operational requirements of the District's site-specific equivalency certification for a PFRP process granted by the USEPA, Region V.

The District was in the early stages of codifying its operational requirements in the SPTs to produce Class A sewage sludge at the time the Board's Order on AS 95-4 was issued on August 24, 1995. Since then, there has been a marked improvement in the processing of sludge in the District's low and high solids SPTs. The District is now consistently producing a final sewage sludge product that meets the Class A pathogen requirements of the Part 503 Sewage Sludge Regulations, as verified by extensive testing of sludge samples for pathogens, and the granting of site-specific equivalency for a PFRP by the USEPA, Region V. Class B sludge is achieved after anaerobic digestion, and Class A sludge is achieved after lagooning the anaerobically digested sludge, and subsequently air-drying it, as is required by AS 95-4.

In addition, the District is seeking one further change to AS 95-4. Specifically, the District is requesting to change the terminology throughout the Order by establishing a distinction between the words "sludge" and "biosolids." This proposed modification would use the word "sludge" when referring to the solid material produced at several stages of municipal wastewater treatment that has not been treated or processed through digestion, while "biosolids" would refer to the primarily organic semi-solid product produced by wastewater treatment processes that have been treated to meet federal and state regulations for beneficial use and recycling by land application or other methods. This distinction is now uniformly recognized by the USEPA, wastewater treatment agencies, and others throughout the industry.

In view of the foregoing considerations, the District requests that the current specifications for anaerobic digestion of sludge in AS 95-4 be modified so that they are consistent with the specifications of the USEPA's Class B pathogen requirements. The temperature and detention times indicated by the standard operating procedures of the District's SPTs are consistent with the Class B pathogen requirements of the Part 503 Sewage Sludge Regulations. The District further requests that the adjusted standard draw a distinction between sludge and biosolids as described herein.

III. INFORMATIONAL REQUIREMENTS OF 35 ILL. ADM. CODE 104.406

At the outset, the District wishes to note that much of the information required by the Code in support of the District's petition has already been supplied to the Board in AS 95-4. The District has filed a request pursuant to 35 Ill. Adm. Code 101.306 asking that the petition and supporting documents filed in AS 95-4 be incorporated into this proceeding. In an effort to avoid redundancy, and to keep the record in the instant proceeding more manageable, information previously supplied to the Board in the District's prior petition will not be repeated herein, but simply incorporated herein by reference to section and page number. In addition, each section will be supplemented as necessary.

A. 104.406(a): Standard from which an adjusted standard is sought.

The District is seeking to modify the adjusted standard granted in AS 95-4, which approved the use of District sludge for final cover at non-hazardous waste landfills if the sludge meets the criteria set forth in AS 95-4. There has been no change in this requirement since AS 95-4 was approved by the Board on August 24, 1995.

In AS 95-4, the Board granted the District relief from various sections of the Code addressing soil material. The sections of the Code referencing the use of soil material at non-hazardous waste landfills are: 35 Ill. Adm. Codes 811.204, 811.314(c)(3), and 812.813(d), (effective on September 18, 1990), and 817.303 and 817.410(c)(2) and (c)3 (effective on August 1, 1994). Section 811.314 was amended on November 25, 1997, but this amendment does not impact the relief sought herein.

B. 104.406(b): Whether the regulation of general applicability was promulgated to implement, in whole or in part, the requirements of the Clean Water Act, Safe Drinking Act Water, CERCLA, Clean Air Act, or state programs concerning RCRA, UIC, or NPDES.

The District incorporates herein pages 13 and 14 of its petition in AS 95-4. The adjusted standard sought by the District, although not specifically covered by federal regulations, is entirely consistent with the biosolids regulations of 40 CFR Part 503, and conforming amendments in 40 CFR Part 257, and Section 403 of the Clean Water Act.

C. 104.406(c): The level of justification or other information or requirements specified in the regulation of general applicability or a statement that there is no such specification.

The regulation of general applicability does not specify a level of justification, or other information or requirements regarding the soil material standard for which the District is requesting an adjusted standard.

D. 104.406(d): Description of Petitioner's activity that is the subject of the proposed adjusted standard.

The activities conducted by the District were described in detail in AS 95-4, Section 106.705(d), pages 14 through 23. The District incorporates by reference the information contained therein. Furthermore, in order to update the information in our prior petition, we are attaching hereto a report dated March 13, 2002, submitted by the District to Mr. Thomas L. Bramscher, USEPA, Region V. The report describes the District's activities conducted in 2001 under the Part 503 regulations, 40 CFR Part 503. (See Exhibit "F" attached hereto.)

E. 104.406(e): Efforts needed to comply with the regulation of general applicability and compliance alternatives, including costs.

No amount of District effort will result in compliance with the regulatory requirement to use soil material. The District generates air-dried biosolids as a final component of its water reclamation processes, as described in AS 95-4. Consequently, the District believes that this informational requirement is not applicable, as described in AS 95-4, Section 106.705(e), pages 23 through 26, and incorporated herein by reference.

With respect to compliance with AS 95-4, no amount of effort or expenditures wil enable the District to comply with the anaerobic digestion temperature requirements all of the time.

F. 104.406(f): A narrative description of the proposed adjusted standard and proposed language for a Board order that would impose the standard, as well as efforts necessary to achieve the proposed standard and corresponding costs.

The District is requesting that the Board allow the application of the District's air-dried biosolids product as an alternative to soil material wherever the application of soil material is required in 35 Ill. Adm. Codes 811, 812, and 817 as the final protective layer supporting vegetation at non-hazardous waste landfills. This petition relies upon the information contained in the District's AS 95-4 petition, as well as the final opinion and order adopted by the Board on August 24, 1995, to meet the requirements of the narrative description and the efforts necessary to achieve the proposed standard and corresponding costs for this section.

The District's current wastewater processing and treatment procedures would not be changed by modifying the current AS 95-4. This is because the proposed modification would correct the wording in the Order to make it consistent with current operational protocols, the site-specific certification of equivalency for a PFRP by USEPA, Region V, and the Class B pathogen requirements in the Part 503 Sewage Sludge Regulations. Consequently, there would be no substantial change in the operating and monitoring costs associated with wastewater treatment and processing to produce a final biosolids product suitable for use as a final vegetative cover at solid waste municipal landfills. The final biosolids product currently being used for final vegetative cover at landfills under AS 95-4 meets the Class B pathogen

With respect to compliance with AS 95-4, no amount of effort or expenditures will enable the District to comply with the anaerobic digestion temperature requirements all of the time.

F. 104.406(f): A narrative description of the proposed adjusted standard and proposed language for a Board order that would impose the standard, as well as efforts necessary to achieve the proposed standard and corresponding costs.

The District is requesting that the Board allow the application of the District's air-dried biosolids product as an alternative to soil material wherever the application of soil material is required in 35 Ill. Adm. Codes 811, 812, and 817 as the final protective layer supporting vegetation at non-hazardous waste landfills. This petition relies upon the information contained in the District's AS 95-4 petition, as well as the final opinion and order adopted by the Board on August 24, 1995, to meet the requirements of the narrative description and the efforts necessary to achieve the proposed standard and corresponding costs for this section.

The District's current wastewater processing and treatment procedures would not be changed by modifying the current AS 95-4. This is because the proposed modification would correct the wording in the Order to make it consistent with current operational protocols, the site-specific certification of equivalency for a PFRP by USEPA, Region V, and the Class B pathogen requirements in the Part 503 Sewage Sludge Regulations. Consequently, there would be no substantial change in the operating and monitoring costs associated with wastewater treatment and processing to produce a final biosolids product suitable for use as a final vegetative cover at solid waste municipal landfills. The final biosolids product currently being used for final vegetative cover at landfills under AS 95-4 meets the Class B pathogen requirements of the Part 503 Sewage Sludge Regulations, and the proposed modification of the wording in the Order will not alter or change the final biosolids product being produced by the District's SPTs, as described in AS 95-4. In fact, because of the further processing required under AS 95-4, the biosolids that are produced by the District's SPTs meets the Class A pathogen requirements of the Part 503 Sewage Sludge Regulations.

The AS 95-4 petition, section 106.705 (e), pages 23 through 26, describes the cost savings to the District for substitution of its sludge for soil in landfill closure. The section also describes the estimated cost savings to the landfill operator for the substitution of the District's biosolids for soil material as a final vegetative cover. The cost savings described in AS 95-4 and the benefit to the District and its taxpayers in 1995 are the same in 2003. The proposed modification of AS 95-4 will not change the previously described costs and benefits to the District, its taxpayers, and landfill operators, and it will not change the District's current operating and monitoring costs for producing a final biosolids product suitable for use as a final vegetative cover in municipal solid waste landfills.

Proposed Order. The District, in accordance with the requirement of 104.406(f), proposes the following modification to the AS 95-4 Order adopted on August 24, 1995, with the modified Order to read as follows:

PROPOSED ORDER

The Board hereby grants the District's motion to modify the adjusted standard that was adopted in the Board Order of August 24, 1995, pursuant to the authority of Section 28.1 of the Environmental Protection Act, and the Order shall now read as follows:

1. This adjusted standard applies only to the air-dried ~~sludge~~ **biosolids** product generated by the Metropolitan Water Reclamation District of Greater Chicago (District).

2. District ~~sludge~~ **biosolids** that ~~complies~~ **comply** with the conditions in paragraph 3 below ~~is~~ **are** approved as an alternative to the soil material standard at the inert waste, the putrescible (MSWLF) and chemical waste landfills, or the steel and foundry industry potentially useable and low risk waste classes of landfills regulated at 35 Ill. Adm. Codes 810-815 and 817, for application as the final protective layer, as the final cover. The sections where the soil material standard is used are 35 Ill. Adm. Codes 811.204, 811.314(c)(3), 812.813(d), 817.303 and 817.410(c)(2) and (c)(3).

3. When providing ~~sludge~~ **biosolids** for the applications enumerated in Paragraph 2, the District shall provide air-dried ~~sludge~~ **biosolids** as described in its petition for an adjusted standard **(AS 95-4)** and in its **motion for modification** and processing in accordance with the following conditions:

   a. Anaerobic digestion**: (1)** at ~~95° ± 1°F~~ **35 to 55 degrees Celsius, except when a digester temperature, lowered temporarily due to digester feedings, might occasionally and briefly fluctuate below the minimum, and (2)** for a minimum of 15 days or longer, ~~as necessary~~ **with digestion temperatures and times (i.e. "Values for the mean cell residence time and temperature shall be between 15 days at 35 to 55 degrees Celsius and 60 days at 20 degrees Celsius") managed so as** to ensure that the District's ~~air-dried sludge~~ **anaerobically digested** product **is consistent with** ~~will meet~~ the USEPA's ~~Part 503~~ pathogen **treatment** requirements for a Class B ~~sludge~~ **biosolids**; **(40 CFR Part 503, Appendix B(A)(3))**; and

   b. Storage in lagooons for a minimum of 1 and ½ years after the final addition of ~~sludge~~ **biosolids**; and

   c. Air-drying for a minimum of 4 weeks, or as necessary to achieve a solids content of 60 percent.

4. When providing ~~sludge~~ **biosolids** for the applications enumerated in Paragraph 2, the District shall limit the ~~sludge~~ **biosolids** provided to amounts that are sufficient for a final depth of three feet as compacted using normal landscaping practices.

5. The District will report to the Agency the start up, discontinuance, and quality of ~~sludge~~ **biosolids** deliveries to each facility;

6. District ~~sludge~~ **biosolids**, when used in compliance with this adjusted standard, are not a waste.

G. 104.406(g): Quantitative and qualitative description of the impact of the petitioner's activity on the environment if the petitioner were to comply with the regulation of general applicability as compared to the quantitative and qualitative impact on the environment if the petitioner were to comply only with the proposed adjusted standard.

Modification of AS 95-4 as requested herein will have the same quantitive and qualitative impact on the environment as the original adjusted standard as set forth in AS 95-4, Section 106.705(g), pages 34 through 52, which the District incorporates herein by reference.

H. 104.406(h): A statement of justification for the proposed adjusted standard.

The regulation of general applicability does not specify a level of justification required to qualify for an adjusted standard. Therefore, the District must establish that it complies with the criteria set forth in Section 28.1(c) of the Act and the corresponding section of the Board's procedural rules at 35 Ill. Adm. Code 104.426(a).

The information provided in the District's original petition, as described in AS 95-4, Section 106.705(h), pages 52 through 58, along with the exhibits to the instant petition that supplement the original petition, fully and accurately sets forth the facts supporting an adjusted standard from the regulations of general applicability. With respect to the amendment sought in the instant petition, the facts set forth herein fully describe the differences between the relief currently sought and that granted in AS 95-4, state the factors justifying an adjusted standard, and establish that the relief sought is justified.

I. 104.406(h): Consistency of proposed adjusted standard with federal law.

The District's petition is consistent with the Part 503 Sewage Sludge Regulations and its subsequent revisions by the USEPA. On February 19, 1994, the USEPA Part 503 Regulations (*Federal Register*, Volume 58, No. 32, February 19, 1993) became effective.

The USEPA made subsequent changes to the Part 503 Regulations in 1994 (*Federal Register*, Volume 59, No. 38, February 25, 1994), 1995 (*Federal Register*, Volume 60, No. 26, October 25, 1995), and 1999 (*Federal Register*, Volume 64, No. 149, August 4, 1999). Briefly, these changes were related to deleting the pollutant limit for molybdenum in biosolids applied to land but retaining the molybdenum ceiling limit; deleting the pollutant limit for chromium in biosolids applied to land; changing the pollutant concentration limit for selenium in land applied biosolids to the ceiling limit; and allowing the permitting authority greater flexibility in reducing the monitoring requirements for compliance with the Part 503 Regulations.

These regulations do not regulate the utilization of biosolids at non-hazardous waste landfills. However, they endorse the productive use of biosolids for a final protective layer at non-hazarous waste landfills, as noted in AS 95-4.

The consistency of the proposed standard with existing federal law is the same as that described in AS 95-4, Section 106.705(i), pages 58 through 60. Furthermore, the adjusted standard sought is consistent with the USEPA's Guidance Document (See exhibit "B" attached hereto), and the site-specific certification for PFRP granted by USEPA, Region V (See Exhibit "E" attached hereto.).

J. 104.406(j): <u>A statement requesting or waiving a hearing on the Petition.</u>

The District waives a hearing on the petition.

CONCLUSION

The District's Petition seeks several minor modifications to the adjusted standard approved by the board in AS 95-4. One change will amend the time/temperature requirements in order that they are consistent with USEPA guidance, and the site-specific certification for PFRP granted by USEPA, Region V, while the other draws on a well accepted distinction between sludge and biosolids. The modifications requested are entirely consistent with federal law and will not adversely affect the environment.

WHEREFORE, the Metropolitan Water Reclamation District of Greater Chicago respectfully requests that the Board grant the District's petition for an adjusted standard.

Respectfully submitted,

Metropolitan Water Reclamation
District of Greater Chicago

Michael G. Rosenberg, its Attorney

DATED: February 6th, 2003

Michael G. Rosenberg
Ronald M. Hill
Metropolitan Water Reclamation
District of Greater Chicago
100 East Erie Street
Chicago, Illinois 60611
312.751.6583

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
PETITION OF METROPOLITAN WATER	)	
RECLAMATION DISTRICT OF GREATER	)	
CHICAGO FOR AN ADJUSTED STANDARD	)	
FROM 35 Ill. Adm. Code 811, 812 and 817, and	)	AS 03-____
MODIFICATION OF AS 95-4	)	(Adjusted Standard - Land)
(SLUDGE APPLICATION)	)	
	)	
	)	
	)	

AFFIDAVIT OF RICHARD LANYON

I, Richard Lanyon, being first duly sworn, on oath, depose and state that I am the Director of Research & Development for the Metropolitan Water Reclamation District of Greater Chicago, and that to the best of my knowledge and belief, the facts contained in the District's Petition for an Adjusted Standard are true and correct.

R. Lanyon

Richard Lanyon, Director of Research & Development, Metropolitan Water Reclamation District of Greater Chicago

Subscribed and Sworn to
before me this 6th day
of February, 2003.

Rosalie Bottari

"OFFICIAL SEAL"
Rosalie Bottari
Notary Public, State of Illinois
My Commission Exp. 04/10/2006

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
PETITION OF METROPOLITAN WATER	)	
RECLAMATION DISTRICT OF GREATER	)	
CHICAGO FOR AN ADJUSTED STANDARD	)	
FROM 35 Ill. Adm. Code 811, 812 and 817, and	)	AS 03-____
MODIFICATION OF AS 95-4	)	(Adjusted Standard - Land)
(SLUDGE APPLICATION)	)	
	)	
	)	
	)	

INDEX OF EXHIBITS FOR PETITION FOR ADJUSTED STANDARD

Opinion and Order of the Board in AS 95-4 Dated August 24, 1995.............. Exhibit A

Environmental Regulations and Technology Control of Pathogens and Vector Attraction in Sewage Sludge (Including Domestic Septage) Under 40 CFR Part 503 EPA/625/R-92-013 Revised October 1999... Exhibit B

Letter to Dr. James E. Smith, D.Sc., Chairman, Pathogen Equivalence Committee, USEPA, from Dr. Cecil Lue-Hing on April 2, 1998, "Final Report on Certification of the Sludge Process Trains of the Metropolitan Water Reclamation District of Greater Chicago (District) as Equivalent to a Process to Further Reduce Pathogens (PFRP)".. Exhibit C

Letter dated November 30, 2001, to Mr. John Colletti, USEPA, Region V, from Richard Lanyon, Director of Research and Development for the Metropolitan Water Reclamation District, Requesting Certification of Site-Specific Process to Further Reduce Pathogens Equivalency Designation for District Low Solids Sludge Processing Trains and High Solids Sludge Processing Trains at the Stickney and Calumet Water Reclamation Plants...................... Exhibit D

Letter dated June 20, 2002, from Jo Lynn Traub, Director, Water Division, USEPA, to Jack Farnan, General Superintendent, Metropolitan Water Reclamation District, granting a conditional site-specific certification of equivalency to the District................. Exhibit E

Letter to Mr. Thomas L. Bramscher, Chief of Enforcement Section I, Water Enforcement and Compliance Assurance Branch, USEPA, Region V, from Mr. Richard Lanyon on March 13, 2002, Revised 2001 Reporting Requirement Under the 40 CFR Part 503 Regulations.. Exhibit F

EXHIBIT A

Opinion and Order of the Board in AS 95-4 Dated August 24, 1995

ILLINOIS POLLUTION CONTROL BOARD
August 24, 1995

IN THE MATTER OF:	)
	)
PETITION OF THE METROPOLITAN	)
WATER RECLAMATION DISTRICT OF	)
GREATER CHICAGO FOR ADJUSTED	) AS 95-4
STANDARD FROM 35 Ill. Adm. Code	) (Adjusted Standard - Land)
811, 812, and 817 (Sludge	)
Application)	)

OPINION AND ORDER OF THE BOARD (by G. T. Girard):

This matter is before the Board on a petition for an adjusted standard filed by Metropolitan Water Reclamation District of Greater Chicago (District). The District asks that the Board grant an adjusted standard to the Board's rules of general applicability found at 35 Ill. Adm. Code 811.204, 811.314(c)(3), 812.313(d), 817.303 and 817.410(c)(2) and (3). Those sections of the Board's regulations set forth requirements for the use of soil as final cover at landfills in Illinois. The District is seeking an adjusted standard so that the District's air-dried sludge material can be used at nonhazardous waste landfills in lieu of soil material for the top protective layer for final cover to support vegetation.

The District filed its petition on March 31, 1995. The Illinois Environmental Protection Agency (Agency) filed a response to the petition on May 2, 1995. The District sought leave to file a reply, which was granted, and filed such reply on May 8, 1995. The Agency also sought leave and was granted a reply which was filed on June 12, 1995. The petitioner filed an amended response to the Agency's reply on June 12, 1995. The District waived hearing and the Board did not receive a request for a hearing. Therefore no hearing was held.

Based upon the record and upon review of the factors involved in the consideration of adjusted standards, the Board finds that the District has demonstrated that factors relating to the District are "substantially and significantly different from the factors relied upon by the Board in adopting the general regulation". Accordingly, the request for adjusted standard is granted with conditions for the reasons discussed below.

ADJUSTED STANDARD PROCEDURE

The Board's responsibility in this matter arises from the Environmental Protection Act (Act) (415 ILCS 5/1 et seq.). The Board is charged therein to "determine, define and implement the environmental control standards applicable in the State of Illinois" (415 ILCS 5/5(b)) and to "grant *** an adjusted standard for persons who can justify such an adjustment" (415

ILCS 5/28/1(a)). More generally, the Board's responsibility in this matter is based on the system of checks and balances integral to Illinois environmental governance: the Board is charged with the rulemaking and principal adjudicatory functions, and the Agency is responsible for carrying out the principal administrative duties.

The Act provides that a petitioner may request, and the Board may impose, an environmental standard that is different from the standard that would otherwise apply to the petitioner as the consequence of the operation of a rule of general applicability. Such a standard is called an adjusted standard. The general procedures that govern an adjusted standard proceeding are found at Section 28.1 of the Act and within the Board's procedural rules at 35 Ill. Adm. Code 106.

Where, as here, the regulation of general applicability does not specify a level of justification required for a petitioner to qualify for an adjusted standard, the Act at Section 28.1(c) specifies four demonstrations that must be made by a successful petitioner:

1) Factors relating to that petitioner are substantially and significantly different from the factors relied upon by the Board in adopting the general regulation applicable to that petitioner;

2) The existence of those factors justifies an adjusted standard;

3) The requested standard will not result in environmental or health effects substantially or significantly more adverse than the effects considered by the Board in adopting the rule of general applicability; and

4) The adjusted standard is consistent with any applicable federal law.

RULES OF GENERAL APPLICABILITY

35 Ill. Adm. Code 811.204, Final Cover:

> A minimum of 0.91 meter (three feet) of soil material that will support vegetation which prevents or minimizes erosion shall be applied over all disturbed areas. Where no vegetation is required for the intended postclosure land use, the requirements of Section 811.205(b) will not apply; however, the final surface shall still be designed to prevent or minimize erosion.

35 Ill. Adm. Code 811.314(c)(3):

The final protective layer shall consist of soil material capable of supporting vegetation.

35 Ill. Adm. Code 812.313(d):

A description of final protective cover, including a description of the soil and the depth necessary to maintain the proposed land use of the area;

35 Ill. Adm. Code 817.303:

Unless otherwise specified in a permit or other written Agency approval, a minimum of 0.46 meters (1.5 feet) of soil material that will support vegetation which prevents or minimizes erosion shall be applied over all disturbed areas.

35 Ill. Adm. Code 817.410(c)(2) and (3):

2) The thickness of the final protective layer shall be sufficient to protect the low permeability layer from freezing and minimize roof penetration of the low permeability layer, but shall not be less than 0.46 meter (1.5 feet).

3) The final protective layer shall consist of soil material capable of supporting vegetation.

FACILITY DESCRIPTION

The District is located within the boundaries of Cook County, Illinois, and serves an area of 872 square miles including the city of Chicago and 124 suburban communities with a combined population of 5.1 million people. (Pet. at 2.)[1] In addition, a waste load equivalent to 4.5 million people is contributed by industrial sources. (*Id.*) On a daily basis, the District treats an average of about 1500 million gallons per day (MGD) of wastewater. (Pet. at 2-3.) This wastewater flow is treated at the District's seven water reclamation plants that range in size from 3.4 MGD to 1200 MGD. (Pet. at 2-3, 15.)

Initial treatment at the water reclamation plants consists of coarse and fine screens and grit chambers followed by primary

[1] The petition for adjusted standard will be cited as "Pet. at __; the petitioner's reply to the Agency's response will be cited as "Pet. R. at __"; the petitioner's amended response to the Agency's reply, filed on June 12, 1995 will be cited as "Pet. RR at __"; the Agency's response to the petition will be cited as "Ag. Resp. at __"; the Agency's reply to the petitioner's reply will be cited as "Ag. RR at __".

settling tanks. (Pet. at 16.) Next the water reclamation plants employ the activated sludge process for secondary treatment. (*Id.*) Tertiary treatment is employed at the John E. Egan and Kirie water reclamation plants using dual media filters, while the Hanover Park water reclamation plants employs single media filters. (*Id.*) The final effluents from the Hanover Park, John E. Egan and Kirie water reclamation plants are first chlorinated and then dechlorinated before discharge. (*Id.*)

The District generates yearly about 200,000 dry tons of sludge. (Pet. at 3, 16.) Although each water reclamation plant handles its sludge in somewhat different ways depending upon local factors, the District generally processes its sludge using the following sequence of unit operations:

1. Gravity Thickening
2. Centrifuge Thickening
3. Anaerobic Digestion
4. Centrifuge or lagoon dewatering
5. Lagoon storage
6. Air-drying

(Pet. at 17.)

Solids processing at the District begins with the concentration of primary and secondary sludge in gravity concentration tanks. (*Id.*) The sludge is then anaerobically digested in heated (95° ± 1°F) high rate digesters for approximately 20 days, to reduce odor potential and destroy pathogens. (*Id.*) After anaerobic digestion, the liquid sludge (approximately four percent solids) is either mechanically dewatered using high speed centrifuges to approximately 25 to 30 percent solids or lagoon dewatered to produce 15 percent solids. (*Id.*) Both the liquid sludge and the dewatered centrifuge sludge is stored in lagoons to reduce its odor potential and further destroy pathogens. (Pet. at 17.) The sludge stored in lagoons is air-dried on asphalt paved drying beds, using a mechanical agitation process to accelerate drying and further reduce pathogens. (*Id.*) All air-dried sludge has a high solids content of about 60 percent, is soil-like in appearance, low in pathogens and high in plant nutrients. (*Id.*)

The District ultimately utilizes the majority of its sludge as a fertilizer, soil amendment, or soil substitute. (Pet. at 17.) After years of planning, the following are the options which the District presently has chosen for final disposition of its sludge product:

1. Sludge application to land in Fulton County, Illinois.

2. Sludge application to land at the Hanover Park water reclamation plant, Hanover Park, Illinois.

3. Landscaping at district water reclamation plants.

4. Distribution to large-scale users for landscaping purposes (e.g., Underwriters Laboratories, Worth Park District, Russell Road Interchange for the Illinois Tollway Commission).

5. Final protective layer for landfills.

6. Daily cover for landfills.

(Pet. at 17-18.)

RELIEF REQUESTED

The District is seeking an adjusted standard which would allow the District to use its air-dried sludge product as "an innovative technology for certain applications at nonhazardous waste landfills". (Pet. at 5.) Specifically, the District is asking the Board to allow the use of the air-dried sludge in the final protective layer supporting vegetation. (*Id.*) The specific language of the requested adjusted standard is as follows:

A. Pursuant to the authority of Section 28.1 of the Environmental Protection Act, the Board hereby adopts the following adjusted standard. This adjusted standard applies only to the air-dried sludge product generated by the Metropolitan Water Reclamation District of Greater Chicago (District).

B. District sludge that complies with the conditions in paragraph C below is approved as an alternative to the soil material standard at the inert waste, the putrescible (MSWLF) and chemical waste landfills, or the steel and foundry industry potentially usable and low risk waste classes of landfills regulated at 35 Ill. Adm. Codes 810-815 and 817, for application as the final protective layer, as the final cover. The sections where the soil material standard is used are: 35 Ill. Adm. Codes 811.204, 811.314(c)(3), 812.813(d), 817.303 and 817.410(c)(2) and (c)(3).

C. When providing sludge for the applications enumerated in Paragraph B, the District shall provide air-dried sludge as described in its petition for adjusted standard and processed in accordance with the following conditions:

1. Anaerobic digestion at 95° ± 1°F for a minimum of 15 days or longer, as necessary to ensure that the District's air-dried sludge product will meet the USEPA's Part 503 pathogen requirements for a Class B sludge; and

2. Storage in lagoons for a minimum of 1 and 1/2 years after the final addition of sludge; and

3. Air-drying for a minimum of 4 weeks; or as necessary to achieve a solids content of 60 percent.

D. When providing sludge for the applications enumerated in Paragraph B, the District shall limit the amount provided to what it estimates is sufficient to comply with the minimum depth required in the Board regulations, or in greater amounts as needed to accommodate the intended land-use including appropriate contours, final slopes, vegetation, drainage and erosion controls, and to protect the final low permeability layer against such threats as freezing and root penetrations.

(Pet. at 28-29.)

AGENCY RESPONSE

The Agency generally supports the District's request for an adjusted standard. The Agency points out that all regulatory informational requirements have been fulfilled by the District. (See generally Ag. Resp. at 4-7.) The Agency states that it "is not concerned about the District management of their sludge" and the Agency "has no technical problem with the proper use of the District sludge as a soil alternative". (Ag. RR at 2.) The Agency does, however, have one area of concern remaining. Specifically, the Agency is concerned about the ability of the Agency to monitor the use of the District's sludge at landfills which need not be permitted pursuant to Section 21(d) of the Act. (Ag. Resp. at 4.) The Agency is concerned that the use of sludge could be abused at permit exempt facilities. (*Id.*) Therefore, the Agency asks that the following conditions be added:

D. Any facility utilizing District sludge for final cover is limited to a final depth of 3 feet of sludge compacted using normal landscaping practices;

1. Anaerobic digestion at 95° ± 1°F for a minimum of 15 days or longer, as necessary to ensure that the District's air-dried sludge product will meet the USEPA's Part 503 pathogen requirements for a Class B sludge; and

2. Storage in lagoons for a minimum of 1 and 1/2 years after the final addition of sludge; and

3. Air-drying for a minimum of 4 weeks; or as necessary to achieve a solids content of 60 percent.

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D. Any facility utilizing District sludge for final cover is limited to a final depth of 3 feet of sludge compacted using normal landscaping practices;

E. The District will report to the Agency the start up, discontinuance, and quantity of sludge deliveries to each facility;

F. District sludge, when used in compliance with this adjusted standard, is not a waste.

(Ag. RR at 2.)

COMPLIANCE ALTERNATIVES

The District indicates that it believes a discussion on compliance alternatives is inapplicable as no amount of effort would result in compliance with the regulation of general applicability on the part of the District. (Pet. at 25.) The material generated by the District is air-dried sludge which is not soil. The District does not assert that the air-dried sludge is soil; rather the District maintains that the sludge can comply with the same regulatory design and performance requirements expected of soil. (*Id.*)

The District maintains that an adjusted standard allowing substitution of sludge for soil material in landfill closure as final protective layer would result in substantial cost savings to the District. The District indicated that in 1991, 1992 and 1993 the District utilized 115,118 dry tons, 25,415 dry tons and 167,053 dry tons of sludge for final protective layer for landfills in the Chicago area. (Pet. at 24.) If the District had been precluded from utilizing its sludge during that time, the District would have been required to dispose of the sludge at a cost of approximately $22 per dry ton. (Pet. at 25.) Thus, the use of sludge in 1991, 1992 and 1993 saved the District an expenditure of 6.77 million dollars. (*Id.*)

HEALTH AND ENVIRONMENTAL EFFECTS

District sludge has been routinely analyzed by both the EP toxicity test and, subsequently, the Toxicity Characteristic Leaching Procedure (TCLP) test, and has always been found to be nonhazardous. (Pet. at 34.) The District has found that air-drying to 60 percent solids produces a material with no free water as demonstrated by results of the paint filter test and, according to the District, its sludge meets all the analytical requirements for use at nonhazardous waste landfills, and it is soil-like in appearance. (Pet. at 34.) Weekly, the District analyzes sludge from each of its water reclamation plants to monitor metal content. Sludge quality has generally met the federal (40 CFR 503) high quality sludge regulation limits for land application since 1993, as a result of rigorous monitoring and enforcement conducted by the District's Industrial Waste Division. (Pet. at 34.)

The District's sludge production and management activities are covered by the federal regulations (40 CFR Part 503), as well as the Agency's sludge management permits. (Pet. at 35.) The District, therefore, routinely reports sludge analyses to both the Agency's Bureau of Water, Division of Water Pollution Control, and Region V of the United States Environmental Protection Agency. (Id.)

In 1982, the District began to participate in the closure of the municipal solid waste landfill at 103rd and Doty Avenue in Chicago. (Pet. at 35-36.) Closure was performed by contouring the site, establishing surface runoff controls, covering with a two-foot clay seal, and then applying sludge. (Pet. at 36.) As each area was completed, grass and shrubs were planted to control erosion. The result has been an aesthetically pleasing site with environmental safeguards. (Id.) Part of the closure plan called for installation of four monitoring wells installed in the limestone aquifer underlying the sites; the wells are sampled quarterly, and results are sent to the Agency Division of Land Pollution. (Pet. at 36.) There has been no significant change in groundwater quality in the ten years of monitoring. (Pet. at 36.)

The District has also been using sewage sludge for establishing a final protective layer on three coal refuse piles at its Fulton County, Illinois, land reclamation site since 1987. (Pet. at 36.) Initial reclamation activity started in 1987 at the St. David, Illinois, coal refuse pile. (Pet. at 36.) The approved reclamation procedure consisted of preliminary grading, application of agricultural limestone, application of sludge at the rate of 1,000 dry tons per acre, planting of a vegetative cover, and mulching the planted area. (Pet. at 36-37.) Planting of vegetative cover consisted of seeding with cereal rye grass as a cover crop followed by seeding with alfalfa, alsike clover, bromegrass, and tall fescue. (Id.) The St. David, Illinois, coal refuse pile was completely reclaimed with excellent vegetation cover using the described procedure by 1990. (Id.) Reclamation of a second coal refuse pile at the Morgan Mine site, consisting of 27 acres, was completed in 1991 with the approval of the Agency. (Pet. at 37.) And a third coal refuse pile known as United Electric coal refuse pile, consisting of 125 acres, was reclaimed. (Pet. at 37.)

The District's petition also addressed the potential concern that utilizing municipal sludge for productive purposes at nonhazardous waste landfills could produce leachate which would have a negative impact upon the quality of groundwater. (Pet. at 38.) Obviously, leachate can affect the groundwater under these landfills. However, there has been a USEPA study[2] of the quality of leachate, where both municipal sludge and municipal solid waste were placed in a landfill, which should alleviate these concerns. (Id.) The USEPA study reported that the addition of municipal sludge to landfills in fact improved the quality of leachate. (Pet. at 38.) During a 20-month study, test cells containing municipal sludge, and municipal solid waste produced a leachate exhibiting a chemical oxygen demand (COD) of 1500 mg/L in comparison to a leachate COD of 30,000 mg/L produced from test cells which did not have the municipal sludge. (Pet. at 38.) This represents a COD reduction of 95 percent. In addition, as shown in Attachment 12 to the District's petition, concentrations of metals such as cadmium, chromium, copper, lead, nickle, iron, and zinc were lower in the leachate from the cells containing municipal sludge than those which did not. The reductions in metals ranged from a low of 19 percent in the case of copper to a high of 97.5 percent for zinc. (Pet. at 38-39.)

The USEPA study concluded:

> It is a common misconception that introducing sludge into landfills degrades leachate quality. This study shows the reverse to be true. Results of this investigation should be made widely available to EPA and state authorities concerned with landfill regulations to improve the scientific bases for their decisions.

(Pet. at Attachment 11.)

The District asserts that using the District's sludge at landfills for final protective cover would produce results consistent with the conclusions of the USEPA study. (Pet. at 39.) The District also believes that the groundwater and surface water protection requirements of the Board's landfill regulations ensures that the use of District sludge will not adversely impact surface and groundwater quality at nonhazardous waste landfills. (Pet. at 39.) Any surface water runoff from the final protective layer containing sewage sludge should be classified as storm water runoff that can be captured in control structures built for a 25-year storm. (Id.)

[2] Farrell et al. "The Effects of Sewage Sludge on Leachates and Gas from Sludge Refuse Landfills", Presented at the Residuals Conference of the Water Pollution Control Federation, Atlanta, Georgia, April 19, 1988. (Pet. at Attachment 11.)

JUSTIFICATION

Substantially and Significantly Different Factors

The District maintains that the use of the District's air-dried sludge was "never discussed in the landfill regulatory proceedings and, thus, those factors relating to the use of District sludge are substantially and significantly different from those relied on in relation to the soil requirement." (Pet. at 55.) The District argues that during the time the Board was developing landfill regulations the District was uncertain how ongoing state and federal regulatory proceedings would address management of landfills and sludge. (Pet. at 55-56.)

Existence of the factors justifies an adjusted standard

The District maintains that the petition demonstrates the District's long-time investment in innovative technologies in order to put sludge to productive uses. (Pet. at 56.) The District argues that the loss or the beneficial productive uses of the District's air-dried sludge would be significant both environmentally and in economic terms. (*Id.*) The District asserts that air-dried sludge is "at least environmentally equivalent to soil, and is economically superior, and is consistent with both state and federal stated beneficial use policies". (Pet. at 56.)

Environmental and Health Effects

The District maintains that the petition has "amply" demonstrated that there are no substantially or significantly more adverse environmental or health effects from the rule of general applicability. (Pet. at 57; see *infra* pgs 7-9.)

Consistency with Federal Law

The District points out that sludge and use of sludge for final cover are regulated under two federal programs. The first is the RCRA Subtitle D program, under which an "alternative final cover design" which meets certain criteria may be allowed. (Pet. at 4, citing 40 CFR 258.60(a)(3).) The second is the under 40 CFR 503 which sets forth regulations for "the use and disposal of municipal sludge". (*Id.*) In the preamble to the final promulgation of the Part 503 regulations the USEPA specifically endorses the use of municipal sludge as a cover material in nonhazardous waste landfills. (*Id.*) The preamble states:

> While the use of sewage sludge for beneficial purposes is primarily related to farm and home garden use, use of sewage sludge to aid in the growth of a final vegetative cap for municipal solid waste landfills is also considered a beneficial use of sewage sludge and

> should be encouraged. By taking advantage of the nutrient content and soil amendment characteristics of sewage sludge, a vegetative cover or cap can be quickly grown to facilitate the municipal solid waste closure plan. (58 Fed. Reg. 9258.)

(Pet. at 4.)

Thus, the District maintains that the adjusted standard is consistent with federal law. (Pet. at 58.)

DISCUSSION

First, the Board notes that this adjusted standard request by the District is somewhat unique. Rather than request an adjusted standard for the use of sludge as a soil alternative at a specific site in Illinois, the District is seeking an adjusted standard which would apply throughout the State. However, the Board is convinced that the adjusted standard mechanism is appropriate to this proceeding. Although the standard is not for one specific "site", the standard is for the use of the District's air-dried sludge. The sludge will be subject to specified criteria before leaving the District's management for use as a soil alternative at landfills in Illinois. Further, the standard will only apply to sludge managed by the District and not to municipal sludge in general. Therefore, the Board believes an adjusted standard is the appropriate mechanism for relief.

The District and the Agency agree that the adjusted standard mechanism is appropriate. In fact, the Agency supports granting the adjusted standard, but is asking that certain conditions be included. (<u>See</u> *infra* 6-7.) While the District accepts two of the conditions as written, the District is concerned over the suggested condition "D". (Pet. RR at 3.) The Agency's condition D states:

> D. Any facility utilizing District sludge for final cover is limited to a final depth of 3 feet of sludge compacted using normal landscaping practices.

(Ag. RR at 2.)

The Agency is seeking imposition of this condition because of concerns about the ability of the Agency to monitor the use of the District's sludge at landfills which need not be permitted pursuant to Section 21(d) of the Act. (Ag. Resp. at 4.) The District objects to the Agency's proposed condition "D" because it would impose requirements on the operator of the facility using the sludge. (Pet. RR at 2.) The District states:

> The Condition D in the District's petition and the amended condition D in the District's Reply are limitations the District voluntarily place on itself, not arbitrarily place on the landfill operator choosing to use sludge.

(Pet. RR at 2.)

The District proposes that the condition be amended to state:

> When providing sludge for the applications enumerated in Paragraph B, the District shall limit the sludge provided to amounts that are sufficient for a final depth of three feet as compacted using normal landscaping practices.

(Pet. RR at 3.)

The Board is persuaded that the District's condition D is more appropriate. Condition D as offered in the petitioner's amended response should alleviate the concerns expressed in the Agency's reply, while at the same time placing the limitation on the District. As the District is the party seeking the adjusted standard and the District is the party which is responsible for the management of its sludge, limiting the amount of sludge the District can provide to an amount sufficient for a final depth of three feet of compacted sludge is more suitable.

CONCLUSION

The Board finds that the District has demonstrated that the adjusted standard is warranted. The District has established that the use of the District's air-dried sludge is a viable alternative to soil cover at landfills in the State of Illinois. The use of the sludge will not result in substantially or significantly more harmful health and environmental effects. In fact, the District has provided information that the use of sludge may even reduce the potential for leachate contamination of surface and groundwater at landfills by improving the quality of any leachate generated.

The District has also established that the Board did not consider the use of sludge as final cover in adopting the regulation of general applicability. Thus, the Board finds that the factors surrounding this request are substantially and significantly different from those considered by the Board in adopting the rule of general applicability. Further, the District has demonstrated that the use of sludge is beneficial and cost-efficient. Therefore, the Board finds that the factors relating to the adjusted standard request justify such an adjusted standard.

This opinion constitutes the Board findings of facts and conclusion of law.

ORDER

The Board hereby adopts the following adjusted standard, pursuant to the authority of Section 28.1 of the Environmental Protection Act:

1. This adjusted standard applies only to the air-dried sludge product generated by the Metropolitan Water Reclamation District of Greater Chicago (District).

2. District sludge that complies with the conditions in paragraph C below is approved as an alternative to the soil material standard at the inert waste, the putrescible (MSWLF) and chemical waste landfills, or the steel and foundry industry potentially usable and low risk waste classes of landfills regulated at 35 Ill. Adm. Codes 810-815 and 817, for application as the final protective layer, as the final cover. The sections where the soil material standard is used are: 35 Ill. Adm. Codes 811.204, 811.314(c)(3), 812.813(d), 817.303 and 817.410(c)(2) and (c)(3).

3. When providing sludge for the applications enumerated in Paragraph 2, the District shall provide air-dried sludge as described in its petition for adjusted standard and processed in accordance with the following conditions:

   a. Anaerobic digestion at 95° ± 1°F for a minimum of 15 days or longer, as necessary to ensure that the District's air-dried sludge product will meet the USEPA's Part 503 pathogen requirements for a Class B sludge; and

   b. Storage in lagoons for a minimum of 1 and 1/2 years after the final addition of sludge; and

   c. Air-drying for a minimum of 4 weeks, or as necessary to achieve a solids content of 60 percent.

4. When providing sludge for the applications enumerated in Paragraph B, the District shall limit the sludge provided to amounts that are sufficient for a final depth of three feet as compacted using normal landscaping practices.

5. The District will report to the Agency the start up, discontinuance, and quantity of sludge deliveries to each facility;

6. District sludge, when used in compliance with this adjusted standard, is not a waste.

IT IS SO ORDERED.

Section 41 of the Environmental Protection Act (415 ILCS 5/40.1) provides for the appeal of final Board orders within 35 days of service of this decision. The Rules of the Supreme Court of Illinois establish filing requirements. (But see also, 35 Ill. Adm. Code 101.246, Motions for Reconsideration.)

I, Dorothy M. Gunn, Clerk of the Illinois Pollution Control Board, hereby certify that the above opinion and order was adopted on the 24th day of August, 1995, by a vote of 7-0.

Dorothy M. Gunn

Dorothy M. Gunn, Clerk
Illinois Pollution Control Board

EXHIBIT B

Environmental Regulations and Technology
Control of Pathogens and Vector Attraction in Sewage Sludge
(Including Domestic Septage)
Under 40 CFR Part 503
EPA/625/R-92-013
Revised October 1999

EPA/625/R-92-01
Revised October 199

Environmental Regulations and Technology

Control of Pathogens and Vector Attraction in Sewage Sludge

(Including Domestic Septage)
Under 40 CFR Part 503

This guidance was prepared by

U.S. Environmental Protection Agency
Office of Research and Development
National Risk Management Research Laboratory
Center for Environmental Research Information
Cincinnati, OH 45268

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dence time at a specific temperature. Values for the mean cell residence time and temperature shall be between 40 days at 20°C (68°F) and 60 days at 15°C (59°F).

For temperatures between 15°C (59°F) and 20°C (68°F) use the relationship between time and temperature provided below to determine the required mean cell residence time.

$$\frac{\text{Time @T°C}}{40\ \text{d}} = 1.08^{(20-T)}$$

The regulation does not differentiate between batch, intermittently fed, and continuous operation, so any method is acceptable. The mean cell residence time is considered the residence time of the sewage sludge solids. The appropriate method for calculating residence time depends on the type of digester operation used (see Appendix E).

Continuous-Mode, No Supernatant Removal For continuous-mode digesters where no supernatant is removed, nominal residence times may be calculated by dividing liquid volume in the digester by the average daily flow rate in or out of the digester.

Continuous-Mode, Supernatant Removal In systems where the supernatant is removed from the digester and recycled, the output volume of sewage sludge can be much less than the input volume of sewage sludge. For these systems, the flow rate of the sewage sludge out of the digester is used to calculate residence times.

Continuous-Mode Feeding, Batch Removal of Sewage Sludge For some aerobic systems, the digester is initially filled above the diffusers with treated effluent, and sewage sludge is wasted daily into the digester. Periodically, aeration is stopped to allow solids to settle and supernatant to be removed. As the supernatant is drawn off, the solids content in the digester gradually increases. The process is complete when either settling or supernatant removal is inadequate to provide space for the daily sewage sludge wasting requirement, or sufficient time for digestion has been provided. The batch of digested sewage sludge is then removed and the process begun again. If the daily mass of sewage sludge solids introduced has been constant, nominal residence time is one-half the total time from initial charge to final withdrawal of the digested sewage sludge.

Batch or Staged Reactor Mode A batch reactor or two or more completely-mixed reactors in series are more effective in reducing pathogens than is a single well-mixed reactor at the same overall residence time. The residence time required for this type of system to meet pathogen reduction goals may be 30% lower than the residence time required in the PSRP definition for aerobic digestion (see Appendix E). However, since lower residence times would not comply with PSRP conditions required for aerobic digestion in the regulation, approval of the process as a PSRP by the permitting authority would be required.

Other Digesters are frequently operated in unique wa that do not fall into the categories above. Appendix E p vides information that should be helpful in developin calculation procedure for these cases. Aerobic digest carried out according to the Part 503 requirements ty cally reduces bacterial organisms by 2-log and viral path gens by 1-log. Helminth ova are reduced to varying d grees, depending on the hardiness of the individual sp cies. Aerobic digestion typically reduces the volatile sol content (the microbes' food source) of the sewage slud by 40% to 50%, depending on the conditions maintain in the system.

Vector Attraction Reduction

Vector attraction reduction for aerobically digested se age sludges is demonstrated either when the percent vo tile solids reduction during sewage sludge treatment equ or exceeds 38%, or when the specific oxygen uptake ra (SOUR) at 20°C (68°F) is less than or equal to 1.5 mg oxygen per hour per gram of total solids, or when ad tional volatile solids reduction during bench-scale aerob batch digestion for 30 additional days at 20°C (68°F) less than 15% (see Chapter 8).

Thermophilic aerobic systems (operating at higher te peratures) capable of producing Class A biosolids are d scribed in Section 7.5.

6.3 Anaerobic Digestion

Anaerobic digestion is a biological process that us bacteria that function in an oxygen-free environment convert volatile solids into carbon dioxide, methane, a ammonia. These reactions take place in an enclosed ta (see Figure 6-2) that may or may not be heated. Becau the biological activity consumes most of the volatile soli needed for further bacterial growth, microbial activity the treated sewage sludge is limited. Currently, anaerob digestion is one of the most widely used treatments f sewage sludge treatment, especially in treatment wor with average wastewater flow rates greater than 19,0 cubic meters/day (5 million gallons per day).

Most anaerobic digestion systems are classified as e ther standard-rate or high-rate systems. Standard-ra systems take place in a simple storage tank with sewa sludge added intermittently. The only agitation that occu comes from the natural mixing caused by sewage slud gases rising to the surface. Standard-rate operation c be carried out at ambient temperature, though heat is som times added to speed the biological activity.

High-rate systems use a combination of active mixi and carefully controlled, elevated temperature to increa the rate of volatile solids destruction. These systems som times use pre-thickened sewage sludge introduced a uniform rate to maintain constant conditions in the react Operating conditions in high-rate systems foster more e cient sewage sludge digestion.

The PSRP description in Part 503 for anaerobic dig tion is:

dence time at a specific temperature. Values for the mean cell residence time and temperature shall be between 40 days at 20°C (68°F) and 60 days at 15°C (59°F).

For temperatures between 15°C (59°F) and 20°C (68°F) use the relationship between time and temperature provided below to determine the required mean cell residence time.

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The regulation does not differentiate between batch, intermittently fed, and continuous operation, so any method is acceptable. The mean cell residence time is considered the residence time of the sewage sludge solids. The appropriate method for calculating residence time depends on the type of digester operation used (see Appendix E).

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Other Digesters are frequently operated in unique ways that do not fall into the categories above. Appendix E provides information that should be helpful in developing a calculation procedure for these cases. Aerobic digestion carried out according to the Part 503 requirements typically reduces bacterial organisms by 2-log and viral pathogens by 1-log. Helminth ova are reduced to varying degrees, depending on the hardiness of the individual species. Aerobic digestion typically reduces the volatile solids content (the microbes' food source) of the sewage sludge by 40% to 50%, depending on the conditions maintained in the system.

Vector Attraction Reduction

Vector attraction reduction for aerobically digested sewage sludges is demonstrated either when the percent volatile solids reduction during sewage sludge treatment equals or exceeds 38%, or when the specific oxygen uptake rate (SOUR) at 20°C (68°F) is less than or equal to 1.5 mg of oxygen per hour per gram of total solids, or when additional volatile solids reduction during bench-scale aerobic batch digestion for 30 additional days at 20°C (68°F) is less than 15% (see Chapter 8).

Thermophilic aerobic systems (operating at higher temperatures) capable of producing Class A biosolids are described in Section 7.5.

6.3 Anaerobic Digestion

Anaerobic digestion is a biological process that uses bacteria that function in an oxygen-free environment to convert volatile solids into carbon dioxide, methane, and ammonia. These reactions take place in an enclosed tank (see Figure 6-2) that may or may not be heated. Because the biological activity consumes most of the volatile solids needed for further bacterial growth, microbial activity in the treated sewage sludge is limited. Currently, anaerobic digestion is one of the most widely used treatments for sewage sludge treatment, especially in treatment works with average wastewater flow rates greater than 19,000 cubic meters/day (5 million gallons per day).

Most anaerobic digestion systems are classified as either standard-rate or high-rate systems. Standard-rate systems take place in a simple storage tank with sewage sludge added intermittently. The only agitation that occurs comes from the natural mixing caused by sewage sludge gases rising to the surface. Standard-rate operation can be carried out at ambient temperature, though heat is sometimes added to speed the biological activity.

High-rate systems use a combination of active mixing and carefully controlled, elevated temperature to increase the rate of volatile solids destruction. These systems sometimes use pre-thickened sewage sludge introduced at a uniform rate to maintain constant conditions in the reactor. Operating conditions in high-rate systems foster more efficient sewage sludge digestion.

The PSRP description in Part 503 for anaerobic digestion is:

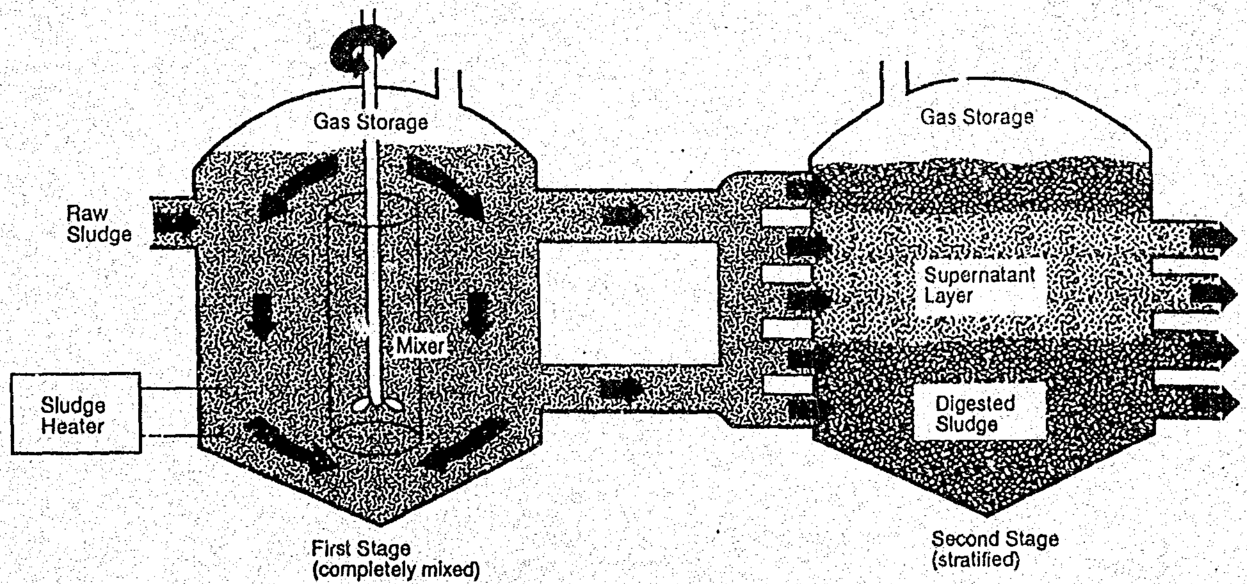


Figure 6-2. Two-stage anaerobic digestion (high rate).

- Sewage sludge is treated in the absence of air for a specific mean cell residence time at a specified temperature. Values for the mean cell residence time and temperature shall be between 15 days at 35°C to 55°C (95°F to 131°F) and 60 days at 20°C(68°F).

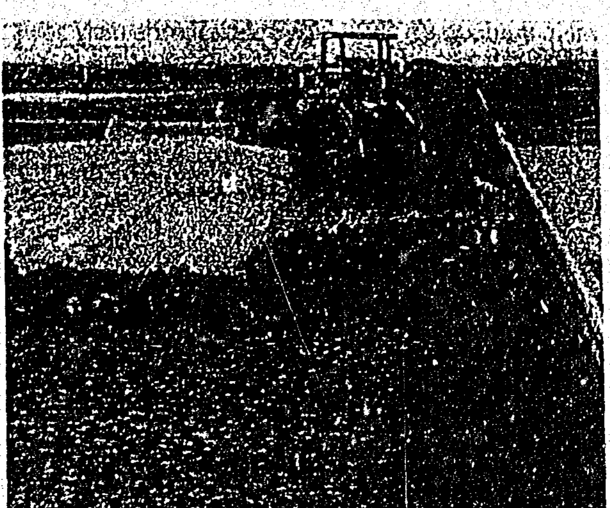
Straight-line interpolation to calculate mean cell residence time is allowable when the temperature falls between 35°C and 20°C.

Section 6.2 provides information on calculating residence times. Anaerobic digestion that meets the required residence times and temperatures typically reduces bacterial and viral pathogens by 90% or more. Viable helminth ova are not substantially reduced under mesophilic conditions (32°C to 38°C [90°F to 100°F]) and may not be completely reduced at temperatures between 38°C (100°F) and 50°C (122°F).

Anaerobic systems reduce volatile solids by 35% to 60%, depending on the nature of the sewage sludge and the system's operating conditions. Sewage sludges produced by systems that meet the operating conditions specified under Part 503 will typically have volatile solids reduced by at least 38%, which satisfies vector attraction reduction requirements. Alternatively, vector attraction reduction can be demonstrated by Option 2 of the vector attraction reduction requirements, which requires that additional volatile solids loss during bench-scale anaerobic batch digestion of the sewage sludge for 40 additional days at 30°C to 37°C (86°F to 99°F) be less than 17% (see Section 8.3). The SOUR test is an aerobic test and cannot be used for anaerobically digested sewage sludge.

6.4 Air Drying

Air drying allows partially digested sewage sludge to dry naturally in the open air (see photo). Wet sewage sludge is usually applied to a depth of approximately 23 cm (9 inches) onto sand drying beds, or even deeper on paved or unpaved basins. The sewage sludge is left to drain and dry by evaporation. Sand beds have an underlying drainage system; some type of mechanical mixing or turning is frequently added to paved or unpaved basins. The effectiveness of the air drying process depends very much on the local climate: drying occurs faster and more completely in warm, dry weather, and slower and less completely in cold, wet weather. During the drying/storage period in the bed, the sewage sludge is undergoing physical, chemical and biological changes. These include biological decomposition of organic material, ammonia production, and desiccation.



Sludge drying operation. (Photo credit: East Bay Municipal Utility District)

EXHIBIT C

Letter to Dr. James E. Smith, D.Sc., Chairman, Pathogen Equivalence Committee, USEPA, from Dr. Cecil Lue-Hing on April 2, 1998, "Final Report on Certification of the Sludge Process Trains of the Metropolitan Water Reclamation District of Greater Chicago (District) as Equivalent to a Process to Further Reduce Pathogens (PFRP)"

Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago

100 EAST ERIE STREET CHICAGO, ILLINOIS 60611-2803 312/751-5600

Cecil Lue-Hing
Director of R&D
312/751-5190

April 2, 1998

Dr. James E. Smith, D.Sc.
Chairman, Pathogen Equivalence
Committee
United States Environmental
Protection Agency
CERI
26 W. Martin Luther King Drive
Room G75
Cincinnati, Ohio 45268

Dear Jim:

As I discussed with you on March 23, 1998, attached is the report entitled, "Final Report on Certification of the Sludge Processing Trains of the Metropolitan Water Reclamation District of Greater Chicago (District) as Equivalent to a Process to Further Reduce Pathogens (PFRP)."

The District submitted a proposal to the United States Environmental Protection Agency's Pathogen Equivalence Committee (PEC) in August 1994. In this proposal an experimental program was described in which we proposed to demonstrate that the sludge processing trains (SPTs) used by the District are "equivalent to PFRP" and therefore, produce a final sludge product which meets the USEPA's "Class A" numerical criteria for pathogens under the Part 503 Sewage Sludge Regulations.

Following the submittal of the above proposal, in a telephone conversation on November 1, 1994, you presented eight issues on which the PEC sought clarification. These issues are listed below.

1. Duration of the Program

2. More Details of the SPT Operation and Sampling Program

3. PEC Offer for Participation in Process Scheme Selection

4. Temperature Measurement and Seasonal Effects

5. Contribution of Dr. Joseph Farrell

6. Analytical Detection Limits

7. Reduction of Helminths and Viruses through the SPTs

8. Moisture Content of Sludge at Various Stages in the SPT

Responses to the above issues were presented in my letter to you dated December 15, 1994. In response to this letter, you indicated in your letter of May 12, 1995, that all the District's responses to the issues were satisfactory to the PEC, except for the response to Issue No. 7.

Our experimental program began in October 1994 and ended in September 1997. Since October 1994, we have followed the protocols and procedures described in our proposal during the experimental program and concurrent full-scale operation. Although the objectives of our proposal remained the same, the dimension and scope of the program was considerably expanded. Hence, we revisited the issues listed above, and in view of the expanded dimension and scope of the experimental and full-scale programs, we are pleased to provide the following additional responses.

Issue No. 1 - Duration of the Program

The PEC asked that the District clarify the actual length of the District's proposed experimental program.

RESPONSE

Although the original experimental program was designed to be conducted over a 24 month period, the completed experimental program was conducted during a period of 2 years and 11 months, i.e., approximately three years. The additional work underscores the District's quest to make this the definitive work on process optimization for equivalency to a Process to Further Reduce Pathogens (PFRP), and to satisfy the policy demands of the PEC. The District's R&D Department collected nearly four times as many samples as originally proposed (193 samples in the proposal versus 724 collected during the study) and performed more than three times the number of microbiological analyses than proposed (772 versus 2,550). Thus, the original two-year study became the equivalent of approximately a seven-year study.

Issue No. 2 - SPT Operation and Sampling Protocol

The PEC requested additional information on the operation of the SPTs and on the sampling protocols.

RESPONSE

The codified SPT operation and sampling protocols were the same as those originally proposed with the following modifications:

1. The drying season was expanded to April through November instead of May through October to enable the air-drying of lagoon-stabilized sludge if favorable weather conditions prevail during the months added.

   This change places the decision for program start-up and termination where it belongs--in the field.

2. The operating temperatures of the anaerobic digesters were codified as 35°C ± 2°C, instead of 35°C ± 1°C (95°F ± 3.6°F).

   This change will provide operational flexibility and recognize events such as instrument malfunction, and the fact that the digesters operate at detention times in excess of conventional requirements.

3. The centrifuge cake solids concentration is now codified in the range of 20 to 30 percent instead of 25 to 30 percent as originally proposed.

   This change will provide operational flexibility and recognize seasonal changes in sludge alkalinity.

Issue No. 3 - PEC Participation in Process Scheme Selection

A question was raised as to whether the PEC members could help in selecting process combinations and operating conditions for the District's SPTs.

RESPONSE

We thank the PEC members for their offer of help to select process combinations and operating conditions for our SPTs to achieve a Class A final sludge product.

However, as we reviewed the published literature including USEPA's on pathogen inactivation in the proposed SPTs and in conjunction with the valuable long-term experience of our Maintenance and Operations Department staff, we became progressively more convinced that the process sequence which we have proposed is the most operationally efficient and cost effective scheme. We also concluded that the proposed SPTs are clearly a modification and optimization of the uncodified SPTs that have been in operation at the District for more than 20 years.

Our completed study has adequately demonstrated that the modified existing sequential scheme consisting of the various unit processes of the District's SPTs, viz., standard high rate mesophilic anaerobic digestion followed by lagoon storage and dewatering of both low and high solids sludge, and air-drying of these well stabilized sludges on paved air-drying cells will consistently yield Class A sludge in a cost effective manner.

<u>Issue No. 4 - Temperature Measurement and Seasonal Effects</u>

Questions concerning temperature measurement while sludge is being air-dried, and seasonal effects on the air-drying process were raised by the PEC.

RESPONSE

The relevant temperature data are included in <u>Appendix VII</u> of the final report in response to the PEC's request.

<u>Issue No. 5 - Contribution of Dr. Farrell</u>

The PEC suggested that the contribution of Dr. Joseph Farrell be acknowledged in the proposal.

RESPONSE

As recommended by the PEC, Dr. Farrell's services as an Advisor in the initial phases of our study are acknowledged in the Acknowledgment Section of our Final Report to the PEC.

Issue No. 6 - Analytical Detection Limits

The PEC inquired as to the percentage of District sludge samples for which microbial agents were not detected, and how these "non-detect" data were to be handled.

RESPONSE.

We made a very diligent effort to lower the analytical detection limit for viruses and helminth ova by processing much larger masses of sludge samples. As a result of this modification, the detection limits achieved for the various microbiological analyses were superior to the limits achieved by conventional analytical methodologies using smaller sample sizes, for PFRP sludges.

The improved method detection limit range for the fecal coliform organism in the lagoon draw and air-dried sludge was 0.0150 to 1.0002 MPN/g DW, respectively. The numerical limit for Class A sludge criterion for this organism is <1,000 MPN/g DW. Hence, any samples that were not Class A would be detected with the improved methods detection limits we achieved.

The method detection limits for *Salmonella Sp.* were lowered from 33.3333 MPN/4 g DW to as low as 0.01110 MPN/4g DW by increasing the sample size. The Class A numerical limit for *Salmonella Sp.* is <3 MPN/4 g DW. The superior detection limits achieved in our study should detect any samples that do not meet the Class A *Salmonella Sp.*, criterion.

The detection limits for viruses obtained in our laboratory using larger sample sizes for the combined LSSPT and HSSPT lagoon draws, and air-dried sludge, were in the range of 0.0013 to 0.025 PFU/4g DW. This compares with detection limits achieved by using smaller sample sizes which were in the range of 0.05 to 1.0 PFU/4g DW. The Class A numerical limit for viruses is <1 PFU/4g DW. Thus, the superior detection limits achieved in our study should detect viruses in any samples that do not meet the Class A virus criterion.

The detection limits for helminth ova obtained in our study using larger sample sizes for the combined LSSPT and HSSPT lagoon draws and air-dried sludge were in the range of 0.0020 to 0.25/4g DW. The limits achieved by using smaller sample sizes were in the range of 0.1316 to 1.076/4g DW. Thus, the method detection limits obtained by using larger sample sizes are far superior to those obtained with smaller sample sizes. The numerical Class A criterion for helminth ova is <1/4g DW. Thus, the superior detection limits achieved in our study should detect helminth ova in any samples that do not meet the Class A helminth ova criterion. The detailed microbiological data are presented in the final report - Appendix VII.

Both the non-detect samples and samples in which pathogens were detected, were subjected to statistical analysis. Estimated log reductions and inactivation rates were determined using all the data. We did not divide the detection limit by two as indicated in our December 15, 1994 letter, as we were able to achieve much lower detection limits.

Taking into consideration the very low detection limits achieved in this study examining numerous samples over nearly a three-year period, and the finding that all final air-dried sludge samples met the Class A numerical criteria, the District is convinced that its SPTs can produce a Class A air-dried product into perpetuity using the codified and optimized operating protocols delineated in the attached final report.

Issue No. 7 - Reduction of Helminths and Viruses through the SPTs

The PEC raised a question as to whether there would be an adequate number of helminth ova, viruses and *Salmonella Sp.*, in the raw sludge to document a significant decline of these agents throughout the SPTs, and suggested that seeding the sludge with viruses and helminth ova might be considered.

RESPONSE

In our letter to you dated December 15, 1994, we addressed the concern expressed by the PEC as to whether there would be an adequate number of helminth ova and viruses in the raw sludge to document a significant decline of these organisms through the SPTs. In your letter of May 12, 1995, you cited the policy of the PEC to demonstrate a 3-log reduction in viruses and a 2-log reduction in helminth ova, and suggested that the District consider seeding their SPTs with viruses and helminth ova in large doses.

In our correspondence to you, we explained the reasons against seeding sludge streams with heavy doses of pathogens in an attempt to demonstrate the above indicated log reductions. In addition to the public health reasons, the District believes that seeding of raw sludge with pathogens, and following their decline on a small scale does not approximate the dynamic similitude of its very large scale SPTs.

Although both sides agreed that the demonstration of log reductions is not a regulatory requirement, in our December 15, 1994 letter to you, we described and proposed an alternative approach of using larger sample sizes with improved detection limits and an innovative statistical methodology to demonstrate the capability of the District's SPTs to achieve the desired log reductions of viruses and helminth ova. A probit analytical method was described in that letter.

However, a superior statistical method was used in the present study. Briefly, the underlying principle of this methodology is that the inactivation of the surges of helminth ova and viruses follow the same pattern as that which currently occurs in the District's SPTs, and that the probabilistic distribution of the surviving helminth ova at various stages of the SPTs will be similar to the distribution of these pathogens as in the SPTs examined in this study. In this method, the effect of large hypothetical surges up to 10,000 times the initial densities of the helminth ova and viruses at various probability levels were examined. For example, if a surge of 10,000 times the average density of organisms occurs five percent of the time (0.05 probability), the final air-dried product would meet the Class A criteria at a probability of 0.99435 for total viable helminth ova and 0.99673 for total Ascaris ova.

We also examined the effect of a uniform expansion of initial virus and helminth densities. For example, if the initial total helminth ova increased a hundred fold (expansion factor of 100) and stayed at that level continuously, the probabilities that the final air-dried product would meet the Class A numerical criteria for these pathogens are 0.93505 and 0.96749, respectively.

The fact still remains, however, that the District's SPTs produced an air-dried sludge product that met the Class A sludge numerical criteria during the entire three year study 100 percent of the time. A full description of this statistical treatment is provided in Appendix V, and is a contribution of Dr. George Knafl, Professor of Statistics, DePaul University, Chicago, Illinois.

Issue No. 8 - Sludge Moisture Content

The PEC raised a question concerning the percent moisture content in the sludge through the SPTs.

RESPONSE

Data pertaining to the moisture content are given in the final report (see Final Report, Complete Data Set - Appendix VII).

These values in percent can be obtained by subtracting the percent solids content from 100.

In conclusion, the District is convinced that it conducted a well codified and optimized study which demonstrates that its SPTs consisting of high rate mesophilic anaerobic digestion followed by lagoon storage-stabilization-inactivation of dewatered anaerobically digested sludge are consistently capable of producing a Class A sludge final product.

The District has also demonstrated, for the first time, that codified high rate anaerobic digestion followed by lagoon aging-stabilization-inactivation of anaerobically digested sludge for a period of not less than 18 months consistently produces a Class A sludge product.

Based on this finding the District further concludes that the inactivation capability of the air drying unit process has not been fully challenged. The District believes, that the codified air-drying unit process following the lagoon storage-stabilization-inactivation unit process will provide additional inactivation capability for the reliable and sustainable production of a Class A final sludge product even if real surges of helminths and enteric viruses pass through its SPTs.

We wish to thank you for the professional and courteous manner in which you have dealt with this proposal over the last three plus years, and assure you that we are prepared to meet with the PEC to answer any questions which may arise from their review of this report.

We look forward to hearing from you at your earliest convenience.

Very truly yours,

Cecil

Cecil Lue-Hing, D.Sc., P.E.
Director
Research and Development

CLH:dm
Attachment
cc: McMillan
O'Connor
Lanyon
Tata
Sedita

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In conclusion, the District is convinced that it conducted a well codified and optimized study which demonstrates that its SPTs consisting of high rate mesophilic anaerobic digestion followed by lagoon storage-stabilization-inactivation of dewatered anaerobically digested sludge are consistently capable of producing a Class A sludge final product.

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Cecil Lue-Hing, D.Sc., P.E.
Director
Research and Development

CLH:dm
Attachment
cc: McMillan
O'Connor
Lanyon
Tata
Sedita

EXHIBIT D

Letter dated November 30, 2001, to Mr. John Colletti, USEPA, Region V, from Richard Lanyon, Director of Research and Development for the Metropolitan Water Reclamation District, Requesting Certification of Site-Specific Process to Further Reduce Pathogens Equivalency Designation for District Low Solids Sludge Processing Trains and High Solids Sludge Processing Trains at the Stickney and Calumet Water Reclamation Plants.

Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago
100 EAST ERIE STREET CHICAGO, ILLINOIS 60611-3154 312·751·5600

Richard Lanyon
Director of Research & Development

312·751·5190

November 30, 2001

Mr. John Colletti
United States Environmental
Protection Agency
Region V
Water Division
Technology Section (5WQP-16J)
77 West Jackson Boulevard
Chicago, IL 60604

Dear Mr. Colletti:

Subject: Request for Certification of Site-Specific Process to Further Reduce Pathogens (PFRP) Equivalency Designation for the Metropolitan Water Reclamation District of Greater Chicago's (District) Low Solids Sludge Processing Trains (LSSPTs) and High Solids Sludge Processing Trains (HSSPTs) at the Stickney Water Reclamation Plant (WRP) and the Calumet WRP.

I am writing this letter as a follow-up to the meeting you and Mr. Ash Sajjad had with Dr. Prakasam Tata, Assistant Director of Research and Development, Environmental Monitoring and Research Division and his staff on October 5, 2001 concerning the subject topic. The purpose of this letter is to request site-specific PFRP equivalency designation for the District's LSSPTs and HSSPTs at the Stickney and Calumet WRPs as provided for under Class A Alternative 6 of the Part 503 *Standards for the Use or Disposal of Sewage* promulgated in 1993 (Part 503 Standards).

<u>Reasons for Seeking Site-Specific PFRP Equivalency</u>

The Stickney and Calumet WRPs LSSPTs and HSSPTs are operated routinely following codified protocols that entail the processing sequence of anaerobic digestion, centrifugation/lagoon storage

Subject: Request for Site-Specific Process to Further Reduce Pathogens (PFRP) Equivalency Designation for the Metropolitan Water Reclamation District of Greater Chicago's (District) Low Solids Sludge Processing Trains (LSSPTs) and High Solids Sludge Processing Trains (HSSPTs) at the Stickney Water Reclamation Plant (WRP) and the Calumet WRP.

and aging, followed by air-drying of the aged sludge. The District began working to obtain PFRP equivalency for these LSSPTs and HSSPTs in 1994 and has dedicated a great deal of effort and resources to achieve this goal ever since. The rationale and supporting documents for the District's request for a site-specific PFRP designation are described below.

Subsequent to the promulgation of the Part 503 Standards in 1993, the professional staff of the District analyzed the extensive sludge monitoring data available at the time and drew the following conclusions with regard to the final air-dried biosolids produced by the Stickney and Calumet WRPs LSSPTs and HSSPTs:

1. The pollutant concentrations are routinely below the limits in <u>Table 3</u> of Section 503.13.

2. Sewage sludge pathogens are routinely reduced to below detectable limits (Section 503.32).

3. Pathogen vector attraction reduction requirements are routinely met (Section 503.33).

In summary, all of the information collected by the District prior to 1994 indicated that the LSSPTs and HSSPTs at the Calumet and Stickney WRPs were producing exceptional quality (EQ) biosolids. EQ biosolids must meet both specific concentrations of certain metals and pathogen densities specified for Class A biosolids.

Since the District's LSSPTs and HSSPTs are not covered under Class A Alternatives 1, 2, or 5 of the Part 503 Standards, a decision was made in the District to seek PFRP equivalency, as provided for under Class A Alternative 6, for the Stickney and Calumet WRPs LSSPTs and HSSPTs.

PFRP equivalency for the District's LSSPTs and HSSPTs at the Stickney and Calumet WRPs is requested for the following reasons:

- Monitoring of all batches of the final air-dried biosolids product using a complex and expensive elaborate analytical methodology will be able to be curtailed.

Subject: Request for Site-Specific Process to Further Reduce Pathogens (PFRP) Equivalency Designation for the Metropolitan Water Reclamation District of Greater Chicago's (District) Low Solids Sludge Processing Trains (LSSPTs) and High Solids Sludge Processing Trains (HSSPTs) at the Stickney Water Reclamation Plant (WRP) and the Calumet WRP.

- Significant reduction of analytical costs will be achieved as a consequence of reduced monitoring and metal analysis of the final air-dried biosolids product.

- Enhancement of public acceptance of the final air-dried biosolids product, because of the site-specific PFRP equivalency.

- A combination of the District's participation in the National Biosolids Partnership's (USEPA, Association of Metropolitan Sewerage Agencies, and Water Environment Federation) Environmental Management System (EMS) and a site-specific PFRP equivalency given by the USEPA, will benefit the District in creating additional outlets and enhancing public acceptance for District's biosolids in the local area for beneficial use projects.

What the District Has Done to Ensure That Class A Air-dried Biosolids Are Produced from the Sludge Processing Trains of the Calumet and Stickney WRPs

1. CODIFICATION OF SLUDGE PROCESSING OPERATIONS AND SUBMITTAL OF A STUDY PLAN TO THE USEPA

The District's Research and Development (R&D) Department worked together with its Maintenance and Operations (M&O) Department to optimize and codify the Stickney and Calumet WRPs LSSPTs and HSSPTs and designed a study to determine whether or not these sludge process trains (SPTs) could continually produce a Class A final air-dried biosolids product. On August 18, 1994, the proposed plan for this study was sent to Dr. James Smith, Chairman, United States Environmental Protection Agency's (USEPA) Pathogen Equivalence Committee (PEC) (Attachment A). A description of the District's codified HSSPTs and LSSPTs is presented in Attachment A.

Subject: Request for Site-Specific Process to Further Reduce Pathogens (PFRP) Equivalency Designation for the Metropolitan Water Reclamation District of Greater Chicago's (District) Low Solids Sludge Processing Trains (LSSPTs) and High Solids Sludge Processing Trains (HSSPTs) at the Stickney Water Reclamation Plant (WRP) and the Calumet WRP.

2. SUBMITTAL OF STUDY RESULTS TO THE USEPA

In April of 1998 the District submitted the results of the study which took more than three years to complete, to the PEC in the final report entitled *Final Report on Certification of the Sludge Processing Trains (SPTs) of the Metropolitan Water Reclamation District of Greater Chicago (District) as Equivalent to Process to Further Reduce Pathogens (PFRP)* (Petition) (Attachment B). These results indicated the following:

- One hundred percent of the final air-dried biosolids samples analyzed in this study complied with the Class A biosolids criteria specified in the Part 503 Rule, Section 503.32.
- Pathogen vector attraction reduction requirements are routinely met for the biosolids produced by the Stickney and Calumet WRPs LSSPTs and HSSPTs (Part 503 Rule, Section 503.13).
- Statistical analysis of the *ascaris* ova data indicated that if hypothetical surges of *ascaris* ova in the digester feed inadvertently occur at a variable frequency or remain at a constant level, they would be able to be reduced to below Class A limits in the Stickney and Calumet WRPs LSSPTs and HSSPTs.
- The results of statistical analysis clearly indicate that the Stickney and Calumet WRPs LSSPTs and HSSPTs achieve more than a two and three log reduction in viable *ascaris* ova and viruses, respectively.

3. DEMONSTRATION OF A 2-LOG REDUCTION IN *ASCARIS* OVA BY AN ALTERNATIVE METHOD

An alternative method was also used to determine that the LSSPTs and HSSPTs of the District's Calumet and Stickney WRPs were capable of achieving a 2-log reduction of viable *ascaris* ova. This method was discussed with Dr. James Smith, Jr., Chairman, USEPA PEC, and he was agreeable to follow this method. The method essentially consisted of assaying first a sufficient mass

Subject: Request for Site-Specific Process to Further Reduce Pathogens (PFRP) Equivalency Designation for the Metropolitan Water Reclamation District of Greater Chicago's (District) Low Solids Sludge Processing Trains (LSSPTs) and High Solids Sludge Processing Trains (HSSPTs) at the Stickney Water Reclamation Plant (WRP) and the Calumet WRP.

of digester feed solids from the Stickney and Calumet WRPs so that ≥100 viable *ascaris* ova were recovered from each feed. A similar or greater mass of the final air-dried biosolids collected from various batches harvested from the LSSPTs and HSSPTs of the Stickney and Calumet WRPs was then analyzed.

If the total mass of sequentially harvested batches of final air-dried biosolids needed to isolate one viable *ascaris* ovum exceeds the total mass of digester feed solids needed to isolate 100 viable *ascaris* ova, it can be agreed that the LSSPTs and HSSPTs have indeed achieved a 2-log reduction, or higher, of viable *ascaris* ova.

Data obtained from the above analyses are presented in Attachment C. As can be seen, all total aliquot masses of final air-dried biosolids samples collected from sequentially harvested batches needed to isolate one viable *ascaris* ovum exceeded the corresponding mass of digester feed solids which contained at least 100 viable *ascaris* ova. This indicates that the codified LSSPTs and HSSPTs of the Calumet and Stickney WRPs were able to achieve a 2-log reduction of viable *ascaris* ova.

Therefore, all of the data collected thus far from the analysis of numerous samples of air-dried biosolids collected from the Stickney and Calumet WRPs indicate that these WRPs consistently achieve a 2-log reduction of viable *ascaris* ova.

4. QUALITY ASSURANCE OF PATHOGEN DATA

The quality of the pathogen data collected for the Petition was ensured by a quality assurance plan covering the collection of representative samples and intra- and inter-laboratory precision studies involving the District's laboratories and independent laboratories that conduct virus and viable *ascaris* analyses for Part 503 Standard compliance. Biovir Laboratories, Benicia, CA, conducted the independent enteric virus analyses. Dr. Dale Little's Laboratory at Tulane University, conducted the independent viable *ascaris* analyses. The results of quality assurance testing conducted in the District's laboratories as well as the other laboratories indicated above are presented in Tables 43 through 46 of the Petition, and are also shown in Attachment D.

Subject: Request for Site-Specific Process to Further Reduce Pathogens (PFRP) Equivalency Designation for the Metropolitan Water Reclamation District of Greater Chicago's (District) Low Solids Sludge Processing Trains (LSSPTs) and High Solids Sludge Processing Trains (HSSPTs) at the Stickney Water Reclamation Plant (WRP) and the Calumet WRP.

The results on the interlaboratory analyses of samples indicated that the *ascaris* and viral densities of the samples examined in the District's labs and outside labs were comparable, and were not statistically different.

5. PEER REVIEW OF THE STUDY RESULTS

The results obtained in our study were subjected to Peer Review as indicated below:

- Data contained in the Petition were summarized and published in the peer-reviewed journal *Water Environment Research* (Volume 72, pages 413-422, Attachment E, and Volume 72, pages 423-431, Attachment F).

- A Peer Review Committee (Committee) assembled by the District also evaluated the Petition. This committee, comprised of nationally recognized experts in the area of biosolids management, provided an independent evaluation of the relevant issues raised in communications between the District and the USEPA's PEC. The credentials of the Committee members are listed in their final report entitled *Peer Review of Metropolitan Water Reclamation District of Greater Chicago's Application for Designation of Processes for Further Reduction of Pathogens* (Attachment G).

The final report of the Peer Review Committee concluded:

- The District has collected sufficient data to demonstrate that its sludge processing trains achieve pathogen removal as good as or better than would be required under the Alternative 3 option. Specifically, the finished sludge levels of *Salmonella*, viruses, and *ascaris* are below the maximum levels for sludge receiving Class A designation under this option.

- Therefore, the available data document that sludge from the District's Stickney and

Subject: Request for Site-Specific Process to Further Reduce Pathogens (PFRP) Equivalency Designation for the Metropolitan Water Reclamation District of Greater Chicago's (District) Low Solids Sludge Processing Trains (LSSPTs) and High Solids Sludge Processing Trains (HSSPTs) at the Stickney Water Reclamation Plant (WRP) and the Calumet WRP.

Calumet HSSPTs and LSSPTs meet the PFRP Class A designation and should so be identified.

6. CONTINUED MONITORING TO ASSURE THAT DISTRICT'S BIOSOLIDS ARE CLASS A

Currently, all batches of air-dried final biosolids product are routinely being monitored for viable *ascaris* ova and enteric viruses, even though the study was completed and it was demonstrated that the final air-dried biosolids from the Stickney and Calumet WRPs were continuously meeting Class A criteria. These data are being collected for both compliance with NPDES permits and Part 503 requirements. These data are shown in Attachment H. One hundred percent of the samples which had gone through the "codified" LSSPT or HSSPT processes were determined to be Class A. These data also show that the District's Stickney and Calumet WRPs LSSPTs and HSSPTs are capable of consistently reducing pathogens in sewage sludge to below detectable levels and produce a final product which is Class A.

7. DISTRICT'S REQUEST TO REGION V, USEPA TO MODIFY *ASCARIS* OVA ANALYTICAL METHODOLOGY

In October of 1999 the USEPA guidance document *Environmental Regulations and Technology, Control of Pathogens and Vector Attraction in Sewage Sludge*, EPA/625/R-92/013, the White House document, was revised. The revised White House document specified a sample size of 300 g for *ascaris* analysis. The previous White House document specified a sample size of 50 g for *ascaris* analysis. In 2000, as agreed by you (See Attachment I), the District began the practice of analyzing 50-g samples of biosolids for the determination of viable *ascaris* ova densities with every sixth sample being 300 g for Part 503 compliance. Since the White House document was revised and we began this practice, 32 50-g samples and 7 300-g samples of the District's biosolids were analyzed for Part 503 compliance. As indicated in Attachment H, all of these samples analyzed for viable *ascaris ova* in 2000 and 2001 were determined to be Class A.

Subject: Request for Site-Specific Process to Further Reduce Pathogens (PFRP) Equivalency Designation for the Metropolitan Water Reclamation District of Greater Chicago's (District) Low Solids Sludge Processing Trains (LSSPTs) and High Solids Sludge Processing Trains (HSSPTs) at the Stickney Water Reclamation Plant (WRP) and the Calumet WRP.

Concluding Remarks

In summary, the District has demonstrated that the Stickney and Calumet WRPs HSSPTs and LSSPTs when operated under codified protocols as delineated in the Petition, consistently and reliably reduce pathogens in sewage sludge to the same levels achievable by the PFRPs listed in Appendix B of the Part 503 Standards. Therefore, the District requests a site-specific PFRP equivalency designation for its Stickney and Calumet WRPs LSSPTs and HSSPTs.

The District will continue to monitor its final air-dried biosolids for enteric viruses, viable *ascaris* ova, and fecal coliforms following the same schedule frequency approved previously by Region V (Attachment J), even after your approving our request for site specific PFRPs equivalency of the District's HSSPTs and LSSPTs. The District believes that such a monitoring frequency will verify the production of an EQ biosolids product from its SPTs. Your favorable decision for the designation of the Stickney and Calumet WRPs LSSPTs and HSSPTs as site specific PFRPs will be highly appreciated by the District, as it will enhance the pubic acceptance and marketability of its final air-dried biosolids.

If you have any questions please contact Dr. Prakasam Tata at (708) 588-4059 or me at (312)751-5190.

Very truly yours,

R Lanyon

Richard Lanyon
Director
Research and Development

RL:PT:BS:JTZ:amj
Attachments
cc: Tata/Kollias/Sawyer/Zmuda
Smith-USEPA/Lue-Hing
(w/o attachments)

ATTACHMENT I

COPY OF THE LETTER DATED MAY 4, 2000
FROM RICHARD LANYON TO ASH SAJJAD

Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago

100 EAST ERIE STREET CHICAGO, ILLINOIS 60611-2803 312-751-5600

RICHARD LANYON
Director of Research & Development

312/751-5190

May 4, 2000

Mr. Ash Sajjad
United States Environmental
Protection Agency
Region V (WQ-16), Water Division
77 West Jackson Blvd.
Chicago, Illinois 60604

Dear Mr. Sajjad:

Recently, Dr. Prakasam Tata, Assistant Director of Research and Development, Environmental Monitoring and Research Division, of my staff had discussions with you concerning the difficulty and impracticality of routinely processing samples of 300 grams dry weight of biosolids for the determination of the density of ascaris eggs in the biosolids produced from our drying beds as per the method described in the "White House Document." I am pleased to know that you have appreciated our difficulty and agreed to the routine processing of a lower mass of solids with a limited frequency of analyzing 300-gram samples.

The purpose of this letter is to officially notify you that, as agreed by you, we have begun the practice of analyzing 50-gram samples of biosolids for the determination of ascaris ova densities with every sixth sample being 300 grams for our compliance monitoring under our NPDES permits and Part 503 requirements.

Thank you again for your consideration.

Very truly yours,

Richard Lanyon
Richard Lanyon
Director
Research and Development

RL:PT:dm
cc: P. Tata/B. Sawyer/R. Pietz/J. Zmuda
J. Smith/F. Schaefer/J. Colletti

ATTACHMENT J

REDUCTION IN FREQUENCY OF MONITORING FOR
PATHOGENS IN BIOSOLIDS

COPY OF THE APPROVED LETTER DATED JANUARY 12,
BY WATER DIVISION DIRECTOR JO LYNN TRAUB OF USEPA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

RECEIVED EM & R DIV

00 JAN 18 PM 2:20

REPLY TO THE ATTENTION OF:

WN-16J

JAN 12 2000

Dr. Dick Lanyon
Director, Research and Development
Metropolitan Water Reclamation District
of Greater Chicago
100 East Erie Street
Chicago, Illinois 60611-2803

Re: Reduction in Frequency of Monitoring for Pathogens in Biosolids

Dear Dr. Lanyon:

This is in response to verbal and written requests, regarding the referenced matter, that were made by your predecessor Dr. Cecil Lue-Hing, and Dr. Tata Prakasam, the District's Research Manager, to John Colletti and Ash Sajjad of the Regional Biosolids Team. Specifically, the District requested reduction in the frequency of monitoring for pathogens in biosolids generated at the District's Calumet and Stickney waste water treatment plants from 12 times per year to 4 times per year for reporting these data to the U.S. Environmental Protection Agency (U.S. EPA) as required by 40 Code of Federal Regulations (CFR) part 503.

Further, Dr. Lue-Hing in his June 15, 1999, letter to John Colletti referenced the biosolids pathogen data that the District collected from over 1,000 discreet samples. This was done during a period of 4 years from 1994 until 1998, as a part of the District's application to the National Pathogen Equivalency Recommendation Committee (PERC) for certification of the District's biosolids processing trains as equivalent to a Process for further Reduction of Pathogens (PFRP). As you may know, because the District's biosolids process to reduce pathogens is not listed under 40 CFR part 503, the District sought equivalency determination from the PERC. The PERC'S recommendation along with the Region's approval is necessary for the District to obtain PFRP equivalency.

After a review of the District's biosolids data, and in consideration of the District's commendable effort to characterize pathogen quality of more than 1,000 samples, the following is our response to your request.

To provide relief from the analytical burden of analyzing biosolids for pathogens 12 times per year, the U.S. EPA, Region 5, approves reducing the frequency of monitoring to 6 times per year. The reduced frequency of monitoring is effective March 1, 2000, and is renewable on a yearly basis.

If you have any questions about this matter, please contact Ash Sajjad, Regional Biosolids expert at (312) 886-6112.

Sincerely yours,

Jo Lynn Traub
Director, Water Division

cc: Dr. Tata Prakasam, MWRDGC

Exhibit E

Letter oated June 20, 2002, from Jo Lynn Traub, Director, Water Division, USEPA, to Jack Farnan, General Superintendent, Metropolitan Water Reclamation District, granting a conditional site-specific certification of equivalency to the District.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

JUN 20 2002

REPLY TO THE ATTENTION OF:

WN-16J

Mr. Jack Farnan
General Superintendent
Metropolitan Water Reclamation
District of Greater Chicago
100 East Erie Street
Chicago, Illinois 60611

REF: Mr. Richard Lanyon's November 30, 2001, Letter Request for Site-specific Equivalency Certification for the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) Biosolids Processing Trains at the Stickney and Calumet Waste Water Treatment Plants.

Dear Mr. Farnan:

We acknowledge receipt of the referenced letter request along with attachments A through I. This request conforms with the requirements of the Federal rules for the use and disposal of biosolids codified at 40 CFR part 503. These rules designate the Regional permitting authority to be responsible for determining equivalency, and require generators of biosolids to formally seek an equivalency certification of their process to further reduce pathogens (PFRP) from the permitting authority. To be equivalent, a treatment process must be able to consistently reduce pathogens to levels comparable to the other PFRP processes listed in part 503, Appendix B.

The granting of a site-specific equivalency designation by the Regional permitting authority–based on a thorough review of the adequacy of the process trains to consistently reduce pathogens in biosolids as indicated by the pathogen data, and in consultation with the Pathogen equivalency Committee (PEC)--certifies the biosolids generated by using a PFRP equivalent process is Class A with respect to pathogens. The pathogen standards are specified in section 503.32(a)(7)(i). However, the granting of a site-specific equivalency is limited to the set of process and operating conditions in use at the Stickney and Calumet waste water treatment plants at the time of the application for equivalency designation (Appendix B of the November 30, 2001, Letter Request), and as described by MWRDGC in its application for equivalency submitted to the PEC. The PEC is an US Environmental Protection Agency resource to provide technical assistance and recommendations to Regional permitting authorities regarding pathogen reduction equivalency in implementing the part 503 standards for use and disposal of biosolids.

We are familiar with the MWRDGC's request for equivalency because our biosolids team members participated in numerous phone conversations and meetings with the PEC and Dr. Prakasam Tata of your staff, and both were extremely helpful in explaining and clarifying various issues related to the subject.

Our review of the MWRDGC's biosolids data submitted for 1994 to 2001 indicates Class A biosolids were produced at the Stickney and Calumet plants as they operated their respective low-and high-solids sludge processing trains (SPTs) according to codified protocols delineated in Attachment B of Mr. Lanyon's letter request, dated November 30, 2001. The part 503 rules for PFRP equivalency require that enteric viruses and viable helminth ova are reduced to below detection level. The pathogen data obtained from actual measurements and the statistical treatment of that data by MWRDGC indicated reductions of greater than two logs. We appreciate the MWRDGC's effort in analyzing 1,400 discreet samples of biosolids for pathogens, and the professionalism and patience displayed by Dr. Prakasam Tata of your staff in responding to our queries pertaining to this matter.

In consideration of the quality of data provided for our review, the consistent achievement of a Class A product, we are pleased to grant a conditional site-specific certification of equivalency to the MWRDGC's SPTs at Stickney and Calumet waste water treatment plants for a period of two years effective August 1, 2002 to July 30, 2004, provided the following conditions are met.

1) The Stickney and Calumet plants must operate at all times according to the codified process and operating protocols referred to in the letter request dated November 30, 2001.

2) Monitor biosolids (treated sludge) at Stickney and Calumet plants once per month for the first year and subsequently, once every other month for enteric viruses and helminth ova, and certify the MWRDGC is in compliance with Class A standards and report the results semi-annually to the attention of Mr. Valdis Aistars, Mail Drop WC-15J, 77 West Jackson, Chicago, Illinois 60604.

We appreciate MWRDGC's ongoing efforts to improve the quality of its biosolids. If you have any further questions about this matter, please contact Ash Sajjad of my staff at 312-886-6112.

Sincerely yours,

Robin J. Honig
For

Jo Lynn Traub
Director, Water Division

cc: Dick Lanyon, MWRDGC
Dr. Prakasam Tata, MWRDGC
Dr. James Smith Jr., ORD, Cincinnati

EXHIBIT F

Letter to Mr. Thomas L. Bramscher, Chief of Enforcement Section I, Water Enforcement and Compliance Assurance Branch, USEPA, Region V, from Mr. Richard Lanyon on March 13, 2002, Revised 2001 Reporting Requirement Under the 40 CFR Part 503 Regulations

Dr. Piltz

Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago

100 EAST ERIE STREET CHICAGO, ILLINOIS 60611-3154 312·751·5600

Richard Lanyon
Director of Research & Development

312·751·5190

March 13, 2002

Mr. Thomas L. Bramscher
Chief of Enforcement Section I
Water Enforcement and Compliance
Assurance Branch
United States Environmental
Protection Agency Region V
77 West Jackson Blvd.
Chicago, IL 60604-3590

Dear Mr. Bramscher:

Subject: Revised 2001 Reporting Requirements Under the 40 CFR Part 503 Regulations

The Metropolitan Water Reclamation District of Greater Chicago (District) submitted to your office on February 15, 2002, the 2001 records required under the 40 CFR Part 503 Regulations.

This letter is being sent to amend the 2001 records submitted by the District. In the Section "Calumet WRP," Table 1, page 3, the overall Land Applied amount from the Calumet WRP was changed from 34,655 DT (dry tons) to 34,521 DT.

In this same section, the text was modified on page 7. The land applied total of 24,454 DT air dried EQ biosolids was changed to 24,320 DT, and the amount of air-dried biosolids distributed under the Controlled Solids Distribution Program, IEPA Permit No. 2000-SC-0872, was changed from 2,454 DT to 2,320 DT.

Subject: Revised 2001 Reporting Requirements Under the 40 CFR Part 503 Regulations

Additional changes were made in <u>Tables 2</u>, <u>8</u>, and <u>10</u> of this report. The changes made in these tables were in the mean values at the end of the tables. The mean values were corrected because the originally computed means ignored samples with less than detectable concentrations. These mean values are not used to determine compliance with Part 503.

The revised report is attached. If you have any questions, please telephone me at (312) 751-5190.

Very truly yours,

Richard Lanyon
Director
Research and Development

RL:TG:jvs
Attachments
cc w/att.: Keller (IEPA)
Kluge (IEPA)
Rogers (IEPA)
Sulski (IEPA)
Aistars (USEPA)
Farnan
O'Connor
Rosenberg
Zurad
Kollias
Tata
Pietz
Sawyer
Granato

Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago

100 EAST ERIE STREET · CHICAGO, ILLINOIS 60611-3154 · 312-751-5600

Richard Lanyon
Director of Research & Development

312-751-5190

February 15, 2002
Revised March 13, 2002

Mr. Thomas L. Bramscher
Chief of Enforcement Section I
Water Enforcement and Compliance
Assurance Branch
United States Environmental
Protection Agency Region V
77 West Jackson Blvd.
Chicago, IL 60604-3590

Dear Mr. Bramscher:

Subject: 2001 Reporting Requirements Under the 40 CFR Part 503 Regulations

The Metropolitan Water Reclamation District of Greater Chicago (District) herein submits the 2001 records required under the 40 CFR Part 503 Regulations at Section 503.18.

The District has four Illinois Environmental Protection Agency (IEPA) permitted biosolids management programs that must comply with Part 503. These programs are as follows:

1. Fulton County Dedicated Biosolids Application to Land Site (IEPA Permit Nos. 1999-SC-4219, 1999-SC-4219-1, and 1999-SC-4219-2).

2. Hanover Park Fischer Farm Biosolids Application to Land Site (IEPA Permit Nos. 1997-SC-3840 and 1997-SC-3840-1).

3. Controlled Solids Distribution Program (Biosolids Application to Land in the Chicago Area under IEPA Permit No. 2000-SC-0872).

Subject: 2001 Reporting Requirements Under the 40 CFR Part 503 Regulations

4. Land Application to Farmland (Application of biosolids from Calumet, Stickney, and John E. Egan Water Reclamation Plants (WRPs) to farmland under IEPA Permit No. 1999-SC-3932).

The 40 CFR Part 503 Regulations require that the District report certain data. In the following sections, we have prepared a short description of the sludge processing and biosolids management operations at the District's seven WRPs. The Lemont, James C. Kirie, and North Side WRPs do not produce a final biosolids product, while the Calumet, Stickney, John E. Egan, and Hanover Park WRPs produced final biosolids products in 2001. Below, we also discuss the uses for these biosolids, outline the data reporting requirements under the 40 CFR Part 503 Regulations, and present the required monitoring data in summary tables. It should be noted that the total biosolids production in any given year may not equal the amount of final biosolids product distributed, since biosolids may be distributed from production inventory from a previous year, or biosolids produced in a given year may be aged for distribution at a later time.

Lemont WRP

The Lemont WRP, located in Lemont, Illinois, has a design capacity of 2.3 mgd. Wastewater reclamation processes include both primary (primary settling) and secondary (activated sludge process) treatment. In 2001, the Lemont WRP produced 302 dry tons of solids (Table 1) which were gravity concentrated, and transported to the Stickney WRP for further processing. No final biosolids product is produced at this WRP.

James C. Kirie WRP

The James C. Kirie WRP, located in Des Plaines, Illinois, has a design capacity of 72 mgd. Wastewater reclamation processes include primary (primary settling), secondary (activated sludge process), and tertiary (sand filtration) treatment. In 2001, the Kirie WRP produced 7,693 dry tons of solids (Table 1)

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 1

2001 PRODUCTION AND USES OF SLUDGE AND BIOSOLIDS GENERATED BY THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

Production And Use	Water Reclamation Plants						
	Stickney*	Calumet*	North Side	Egan	Hanover Park*	Kirie	Lemont
	Dry Tons						
Production**	149,965	28,798	48,976	8,392	886	7,693	302
Land Applied	117,143	34,521	0	0	1,563	0	0
Surface Disposal	0	0	0	0	0	0	0
Landfilled	41,348***	3,575***	0	4,998***	0	0	0
Incinerated	0	0	0	0	0	0	0
To Other WRPs for Further Processing	0	0	48,976	3,394	0	7,693	302
Transported Interstate	43	0	0	0	0	0	0

*Stickney, Calumet, and Hanover Park used and disposed of more biosolids than they produced in 2001 due to withdrawal and processing of biosolids produced in previous years from storage lagoons.

**Stickney, Calumet, Egan, and Hanover Park produce biosolids while North Side, Kirie, and Lemont produce undigested sludge. Figures represent total solids generated at the end of each plant's process train including those generated by water reclamation and those imported from other plants for further processing.

***Co-disposed, used as daily cover with municipal solid waste, or as final vegetative cover.

Subject: 2001 Reporting Requirements Under the 40 CFR Part 503 Regulations

which were sent via force main to the John E. Egan WRP for further treatment. No final biosolids product is produced at this WRP.

John E. Egan WRP

The John E. Egan WRP, located in Schaumburg, Illinois, has a design flow of 30 mgd. Wastewater reclamation processes include primary (primary settling), secondary (activated sludge process), and tertiary (sand filtration) treatment. All solids managed at the John E. Egan WRP are anaerobically digested. During winter or when the centrifuges are not operating, liquid digested biosolids are sent via pipeline to the North Side WRP. Centrifuge centrate containing biosolids are also sent via pipeline to the North Side WRP.

In 2001, the total biosolids production at the John E. Egan WRP was 8,392 dry tons (Table 1). This total includes biosolids generated from processing of sludge originating at the John E. Egan WRP as well as the sludge that was imported from the James C. Kirie WRP for further processing. None of the biosolids produced were land applied, surface disposed, or incinerated in 2001. In 2001, 4,998 dry tons of biosolids were sent to landfills for use as daily cover and for co-disposal with municipal solid waste, practices which are exempt from the Part 503 Regulations. Of this amount, 2,171 dry tons were dried at Calumet WRP and Stickney WRP sites and were then used as daily cover, and 2,827 dry tons were co-disposed with municipal solid waste. The remaining 3,394 dry tons of biosolids were pumped to North Side WRP. Of this amount, 1,788 dry tons were conveyed to the North Side WRP in centrifuge centrate and 1,606 dry tons were conveyed as liquid digested biosolids. The John E. Egan WRP did not have any additional requirement for reporting under Part 503 in 2001.

North Side WRP

The North Side WRP, located in Skokie, Illinois, has a design capacity of 333 mgd. Wastewater reclamation processes at the North Side WRP include primary (primary settling) and secondary (activated sludge process) treatment. In 2001, the North Side WRP produced 48,976 dry tons of solids (Table 1) that were sent via pipeline to the Stickney WRP for further treatment. This total includes solids generated from water reclamation at the North Side WRP and biosolids conveyed from the John E. Egan WRP. No final biosolids product is produced at this WRP.

Calumet WRP

The Calumet WRP, located in Chicago, Illinois, has a design capacity of 354 mgd. Wastewater reclamation processes at this WRP include primary (primary settling) and secondary (activated sludge process) treatment. All solids produced at the Calumet WRP are anaerobically digested. Calumet WRP biosolids are then:

a. Placed into lagoons for dewatering, aging and stabilization, and then transported to paved cells and air-dried prior to:

   1. Application to land as Exceptional Quality (EQ) biosolids under the District's Controlled Solids Distribution Permit.

   2. Use at local municipal solid waste landfills as final landfill cover.

   3. Application to land as EQ biosolids at the Fulton County, Illinois dedicated land application site.

   4. Application to farmland as EQ biosolids by a private contractor.

   5. Disposal in local municipal solid waste landfills.

b. Dewatered by centrifuging to approximately 25 percent solids content, and then applied to farmland by a private contractor as a Class B cake.

c. Dewatered by centrifuging to approximately 25 percent solids content, and then transported to paved cells and air-dried prior to use as daily landfill cover.

d. Dewatered by centrifuging to approximately 25 percent solids content, placed into lagoons for aging and stabilization, and transported to paved cells and air-dried prior to:

   1. Application to land as EQ biosolids under the District's Controlled Solids Distribution Permit.

   2. Use at local municipal solid waste landfills as final landfill cover.

   3. Application to land as EQ biosolids at the Fulton County, Illinois dedicated land application site.

   4. Application to farmland as EQ biosolids by a private contractor.

   5. Disposal in local municipal solid waste landfills.

In 2001, the total biosolids production at the Calumet WRP was 28,798 dry tons (Table 1). The quantity of biosolids that were used and disposed of in 2001 exceeded the total production for the Calumet WRP due to processing of biosolids produced in previous years that were stored in lagoons. The Calumet WRP sent 3,575 dry tons of biosolids to landfills in 2001. Of this amount, 2,693 dry tons were used as daily cover, 335 dry tons were used as final cover, and 547 dry tons

Subject: 2001 Reporting Requirements Under the 40 CFR Part 503 Regulations

were co-disposed with municipal solid waste. These practices are exempt from the Part 503 Regulations and require no further reporting.

In 2001, the Calumet WRP land applied 10,201 dry tons of centrifuge cake biosolids to farmland under IEPA Permit No. 1999-SC-3932 through a contract with Stanley Rebacz Trucking and Excavating, Inc. In accordance with Table 1 of Section 503.16, the frequency of monitoring for this biosolids product is six times per year. All Calumet WRP centrifuge cake biosolids that were land applied in 2001 met the pollutant concentration limits in Table 3 of Section 503.13 (Table 2), the Class B pathogen anaerobic digester time and temperature requirements of Section 503.32b3 (Table 3), and the vector attraction reduction requirements of Section 503.33b10. Table 2 also contains the biosolids nitrogen concentration data that were utilized by the land applier to compute the agronomic loading rates at the farmland sites.

In 2001, the Calumet WRP land applied a total of 24,320 dry tons of air-dried EQ biosolids. Of this amount, 22,000 dry tons were trucked to the District's Fulton County, Illinois site for land application under IEPA Permit Nos. 1999-SC-4219, 1999-SC-4219-1, and 1999-SC-4219-2, and 2,320 dry tons were land applied under the Controlled Solids Distribution Program under IEPA Permit No. 2000-SC-0872 for maintenance of golf courses, landscaping, nurseries, and construction of recreation fields. In accordance with Table 1 of Section 503.16, the frequency of monitoring for this biosolids product is 12 times per year. An exception to this frequency of monitoring was granted, effective March 1, 2000 by USEPA Region V, for compliance with Class A pathogen standards. The Calumet WRP biosolids that are land applied are required to be monitored only six times per year for compliance with Class A pathogen standards in Part 503 (Attachment 1). All Calumet WRP EQ biosolids that were land applied in 2001 met the pollutant concentration limits in Table 3 of Section 503.13 (Table 4), the Class A pathogen limits of Section 503.32a6 (Table 5), and the vector attraction reduction requirements of Section 503.33b1

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 2

PART 503 COMPLIANCE DATA: NITROGEN AND METALS CONCENTRATIONS IN CENTRIFUGE CAKE BIOSOLIDS FROM THE CALUMET WATER RECLAMATION PLANT APPLIED TO FARMLAND IN 2001

Sample Date	TKN	NH_3-N	As	Cd	Cu	Hg	Mo	Ni	Pb	Se	Zn
	mg/dry kg										
01/16/01	54,074	4,655	5	3	289	0.22	9	29	58	11	1,065
01/23/01	54,870	4,892	NA	2	278	0.55	11	27	45	NA	991
01/30/01	60,844	6,166	NA	3	239	0.59	6	25	42	NA	867
02/06/01	51,196	4,826	4	4	347	0.29	9	40	65	16	1,289
02/13/01	46,264	5,622	NA	5	296	0.36	10	26	49	NA	1,074
02/20/01	48,263	4,665	NA	4	252	NA	11	32	64	NA	974
02/27/01	47,631	5,596	NA	5	331	NA	13	41	84	NA	1,191
03/06/01	42,481	5,025	4	4	341	0.51	11	45	85	13	1,154
03/13/01	35,944	4,944	NA	6	362	0.28	12	36	99	NA	1,187
03/20/01	42,909	5,422	NA	4	332	0.25	9	47	82	NA	1,137
03/27/01	41,007	4,763	NA	4	337	NA	7	47	96	NA	1,152
04/03/01	41,250	5,236	13	3	355	0.36	6	38	86	9	1,365
04/10/01	48,256	4,547	NA	5	347	0.65	8	40	123	NA	1,320
04/17/01	39,298	4,131	NA	3	350	NA	4	39	83	NA	1,311
04/24/01	37,304	4,962	NA	4	367	NA	6	33	91	NA	1,472
04/17-21/01	46,837	9,988	4	4	366	0.36	8	47	81	12	1,297
04/24-28/01	46,148	11,766	5	4	366	0.29	12	45	80	12	1,369
04/30/01	46,175	9,668	6	4	379	0.27	7	40	97	12	1,511

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 2 (Continued)

PART 503 COMPLIANCE DATA: NITROGEN AND METALS CONCENTRATIONS IN CENTRIFUGE CAKE BIOSOLIDS FROM THE CALUMET WATER RECLAMATION PLANT APPLIED TO FARMLAND IN 2001

Sample Date	TKN	NH_3-N	As	Cd	Cu	Hg	Mo	Ni	Pb	Se	Zn
	----------	----------	----------	----------	----------	mg/dry kg	----------	----------	----------	----------	----------
05/01/01	45,018	4,541	5	3	351	0.13	9	35	90	11	1,527
05/08/01	42,519	5,091	NA	3	374	NA	4	43	91	NA	1,690
05/15/01	40,658	5,160	NA	4	372	NA	<3	38	92	NA	1,724
05/22/01	41,338	4,979	NA	3	353	NA	10	39	97	NA	1,602
05/29/01	44,702	4,753	NA	3	380	NA	7	41	106	NA	1,658
06/05/01	32,776	4,029	5	4	359	0.07	8	50	99	14	1,469
06/19/01	44,282	4,656	NA	3	386	NA	10	39	110	NA	1,392
07/03/01	46,829	4,478	5	3	378	0.48	7	40	99	14	1,299
07/10/01	44,044	5,561	NA	3	372	0.48	6	41	88	NA	1,237
07/17/01	39,961	4,802	NA	4	356	NA	13	45	104	NA	1,188
07/24/01	44,944	4,566	NA	3	381	NA	14	46	85	NA	1,179
07/31/01	40,159	4,812	NA	3	387	NA	11	53	90	NA	1,196
08/07/01	43,404	4,539	6	5	359	0.50	12	59	104	12	1,149
08/14/01	38,769	3,573	NA	4	382	NA	17	39	139	NA	1,197
08/21/01	37,016	2,955	NA	3	375	NA	13	43	113	NA	1,198
08/28/01	37,497	3,638	NA	7	418	NA	17	38	141	NA	1,297
09/04/01	40,136	3,259	4	8	401	0.44	17	46	133	10	1,300
09/11/01	36,587	3,007	NA	9	388	NA	17	42	135	NA	1,226

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 2 (Continued)

PART 503 COMPLIANCE DATA: NITROGEN AND METALS CONCENTRATIONS IN CENTRIFUGE CAKE BIOSOLIDS FROM THE CALUMET WATER RECLAMATION PLANT APPLIED TO FARMLAND IN 2001

Sample Date	TKN	NH_3-N	As	Cd	Cu	Hg	Mo	Ni	Pb	Se	Zn
	mg/dry kg										
09/18/01	37,646	2,974	NA	5	370	NA	12	39	106	NA	1,186
09/25/01	37,535	3,989	NA	7	402	NA	14	39	122	NA	1,249
10/02/01	37,403	3,304	4	6	291	0.53	10	25	80	10	838
10/09/01	39,237	3,239	NA	7	382	NA	16	35	95	NA	1,172
10/16/01	49,807	3,572	NA	9	444	NA	10	40	107	NA	1,289
10/23/01	42,320	2,821	NA	10	380	NA	16	39	135	NA	1,172
10/30/01	35,210	2,764	NA	12	375	NA	14	35	130	NA	1,190
10/08-09/01	33,358	3,168	6	4	481	0.53	5	35	125	18	1,711
10/18/01	30,324	634	3	5	405	0.60	12	40	109	12	1,381
10/22/01	32,330	1,849	3	4	404	0.44	15	38	95	13	1,282
11/06/01	40,438	2,977	5	13	365	0.34	12	34	122	1[illegible]	1,248
11/13/01	40,764	3,424	NA	13	386	NA	10	40	120	NA	1,254
11/20/01	40,019	3,058	NA	12	349	NA	13	39	105	NA	1,253
11/27/01	42,096	5,042	NA	13	374	NA	10	39	110	NA	1,307
11/01-02/01	29,061	518	3	5	417	0.81	16	47	103	13	1,351
11/05-10/01	30,679	1,650	3	4	356	0.31	9	35	83	12	1,598
11/12-17/01	26,426	2,722	4	4	368	0.37	6	39	127	15	1,349
11/21-23/01	29,053	4,498	4	4	371	0.40	9	38	113	14	1,331

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 2 (Continued)

PART 503 COMPLIANCE DATA: NITROGEN AND METALS CONCENTRATIONS IN CENTRIFUGE CAKE BIOSOLIDS FROM THE CALUMET WATER RECLAMATION PLANT APPLIED TO FARMLAND IN 2001

Sample Date	TKN	NH_3-N	As	Cd	Cu	Hg	Mo	Ni	Pb	Se	Zn
	mg/dry kg										
12/04/01	45,476	4,213	3	14	372	0.33	15	42	107	10	1,324
12/11/01	48,606	4,875	NA	15	378	NA	14	34	114	NA	1,284
12/18/01	42,898	3,912	NA	14	394	NA	15	43	112	NA	1,285
12/25/01	47,268	4,427	NA	15	389	NA	11	38	121	NA	1,250
Minimum	26,426	518	3	2	239	0.07	<3	25	42	9	838
Mean*	41,540	4,395	5	6	365	0.40	11	39	99	12	1,285
Maximum	60,844	11,766	13	15	481	0.81	17	59	141	18	1,724
503 Limit	NL	NL	41	39	1,500	17.0	75	420	300	100	2,800

*In calculating the mean, values less than the detectable level were considered as the detectable level.

NA = No analysis.

NL = No limit; not applicable.

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 3

PART 503 CLASS B PATHOGENS COMPLIANCE DATA: DIGESTER TEMPERATURES AND DETENTION TIMES FOR CENTRIFUGE CAKE BIOSOLIDS FROM THE CALUMET WATER RECLAMATION PLANT THAT WERE APPLIED TO FARMLAND IN 2001

Month	Average Temperature	Average Detention time	Meets Part 503 Class B Requirements	Minimum Required Detention Time*
	°F	days		days
January	96	23.4	yes	15.0
February	94	21.4	yes	16.0
March	96	25.5	yes	15.0
April	96	25.0	yes	15.0
May	97	20.6	yes	15.0
June	97	24.1	yes	15.0
July	97	20.4	yes	15.0
August	97	21.0	yes	15.0
September	97	20.1	yes	15.0
October	97	22.1	yes	15.0
November	97	21.3	yes	15.0
December	97	28.5	yes	15.0

*Minimum detention time required to meet Part 503 Class B operational requirements at average temperature achieved.

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 4

PART 503 COMPLIANCE DATA: NITROGEN CONCENTRATIONS, VOLATILE SOLIDS REDUCTION, AND METALS CONCENTRATIONS FOR AIR-DRIED BIOSOLIDS FROM THE CALUMET WATER RECLAMATION PLANT APPLIED TO LAND IN 2001

Sample Date	TKN	NH_3-N	TVS*	TVS* Reduction	As	Cd	Cu	Hg	Mo	Ni	Pb	Se	Zn
	-- mg/dry kg --		%	%	--------------- mg/dry kg ---------------								
4/18	7,659	8	22.3	88.4	7	16	227	0.44	6	53	154	4	1,150
6/04-08	9,815	63	25.8	84.6	8	14	241	0.12	10	53	164	5	1,209
6/18-23	7,184	21	22.8	87.0	12	17	210	0.51	6	54	172	4	1,084
6/11-16	8,824	21	23.9	86.1	11	15	224	0.43	6	50	159	5	1,154
6/25-26	23,493	25	23.1	86.7	8	16	219	0.46	6	49	166	5	1,125
6/30	13,397	2,584	30.6	80.5	6	9	319	0.33	12	41	146	9	1,227
7/30-31	26,046	2,087	45.3	58.7	5	5	579	1.01	22	51	152	14	1,782
7/27	16,086	2,944	33.1	75.4	7	8	356	0.52	8	45	158	11	1,206
7/30-8/03	20,711	3,914	42.6	63.1	5	6	550	1.05	18	48	156	14	1,700
7/03-05	21,615	4,611	41.5	64.7	6	10	383	0.34	20	36	192	13	1,876
8/06	35,525	5,206	44.4	53.4	4	5	550	0.27	17	47	157	13	1,709
8/06-08	25,420	3,622	44.0	54.2	5	5	465	0.59	17	48	185	16	2,079
8/09-10	15,673	2,324	29.3	75.8	6	9	315	0.37	9	41	190	9	1,289
8/13	5,961	1,589	30.9	73.9	5	9	305	0.49	10	41	187	9	1,241
8/13-14	22,899	4,270	46.4	49.5	4	6	489	0.76	22	43	211	13	2,517

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 4 (Continued)

PART 503 COMPLIANCE DATA: NITROGEN CONCENTRATIONS, VOLATILE SOLIDS REDUCTION, AND METALS CONCENTRATIONS FOR AIR-DRIED BIOSOLIDS FROM THE CALUMET WATER RECLAMATION PLANT APPLIED TO LAND IN 2001

Sample Date	TKN	NH_3-N	TVS*	TVS* Reduction	As	Cd	Cu	Hg	Mo	Ni	Pb	Se	Zn
	-- mg/dry kg --		%	%	--------------- mg/dry kg ---------------								
8/13-17	19,902	3,785	35.5	67.9	3	7	433	0.49	15	39	168	13	1,636
8/20-24	17,828	2,766	24.9	80.7	7	8	370	0.32	11	47	143	11	1,292
3/27-28	21,068	4,021	34.1	69.8	7	8	384	0.13	16	55	152	12	1,362
8/29-31	21,047	2,744	29.8	75.2	7	8	335	0.18	9	47	155	12	1,212
7/30-8/03	20,711	3,914	42.6	63.1	5	6	550	1.05	18	48	156	14	1,700
9/04-06	11,950	2,129	32.6	74.9	6	8	346	0.62	8	50	153	9	1,420
9/07	28,772	2,906	45.6	56.5	4	6	446	1.02	27	58	203	13	2,571
9/10-14	20,903	3,812	46.0	55.8	4	7	449	0.76	22	46	214	18	2,514
9/14	19,248	3,945	41.3	63.4	6	6	444	0.57	28	40	223	16	2,474
9/17-18	18,958	323	30.9	76.8	5	9	310	0.20	15	50	155	8	1,160
4/30	10,234	623	46.8	64.4	5	8	373	0.82	15	50	217	11	2,059
5/01	14,676	820	46.5	62.0	5	8	369	0.44	17	47	220	11	2,020
5/01	9,743	571	45.4	63.6	6	8	368	0.86	13	56	234	10	2,066
6/26	14,220	1,366	42.9	66.9	5	10	368	0.80	14	43	203	12	1,924
6/27	12,299	229	42.4	67.5	6	8	370	0.61	20	41	218	11	1,931

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 4 (Continued)

PART 503 COMPLIANCE DATA: NITROGEN CONCENTRATIONS, VOLATILE SOLIDS REDUCTION, AND METALS CONCENTRATIONS FOR AIR-DRIED BIOSOLIDS FROM THE CALUMET WATER RECLAMATION PLANT APPLIED TO LAND IN 2001

Sample Date	TKN	NH_3-N	TVS*	TVS* Reduction	As	Cd	Cu	Hg	Mo	Ni	Pb	Se	Zn
	-- mg/dry kg --		%	%	--------------- mg/dry kg ---------------								
6/27	10,823	1,558	43.8	65.6	4	9	347	0.80	19	39	173	11	1,932
6/25-29	23,892	2,615	43.8	65.6	4	9	371	1.13	20	55	197	11	1,958
6/19-21	24,502	1,158	44.0	65.3	10	9	345	0.22	17	46	204	10	1,864
7/24-27	18,526	4,164	37.5	70.2	7	9	329	0.93	8	42	185	12	1,682
7/05	33,771	3,219	43.7	61.4	5	10	366	0.60	17	40	233	12	1,900
7/02-06	31,280	5,012	42.7	62.9	5	10	371	0.60	16	39	194	12	1,979
7/02	16,915	3,881	44.6	60.0	5	10	365	0.37	17	45	200	11	1,968
7/10-13	1,775	652	43.4	61.9	5	10	390	1.10	15	43	214	14	2,053
7/10-13	1,110	631	36.3	71.6	7	9	302	0.08	12	40	164	11	1,600
7/09-11	678	502	40.1	66.8	5	10	377	0.31	17	46	206	12	1,968
7/16-19	1,398	330	45.1	59.2	4	9	398	1.06	13	52	181	11	2,123
7/16-20	1,325	441	38.6	68.7	5	6	283	0.51	8	42	130	8	1,486
7/23-24	20,552	3,736	44.8	59.6	7	8	386	0.94	14	46	203	13	2,048
9/11	17,735	92	43.9	59.3	8	5	422	0.76	21	38	183	12	1,954
9/12-13	20,481	47	43.1	60.7	6	3	422	1.14	23	47	166	16	1,842

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 4 (Continued)

PART 503 COMPLIANCE DATA: NITROGEN CONCENTRATIONS, VOLATILE SOLIDS REDUCTION, AND METALS CONCENTRATIONS FOR AIR-DRIED BIOSOLIDS FROM THE CALUMET WATER RECLAMATION PLANT APPLIED TO LAND IN 2001

Sample Date	TKN	NH_3-N	TVS*	TVS* Reduction	As	Cd	Cu	Hg	Mo	Ni	Pb	Se	Zn
	-- mg/dry kg --		%	%	-------------- mg/dry kg --------------								
9/27-28	12,749	17	44.2	58.8	6	7	558	0.79	21	41	219	13	2,225
9/17-19	27,371	96	43.2	60.4	5	5	420	0.71	24	49	173	11	1,968
10/02-03	13,159	26	44.1	58.9	6	6	552	0.61	21	45	207	13	2,127
11/01-02	13,279	5	45.6	60.0	3	4	491	0.60	21	51	154	10	1,554
12/11-12	20,742	8	45.2	67.0	5	4	617	0.79	19	53	137	11	1,481
Minimum	678	5	22.3	49.5	3	3	210	0.08	6	36	130	4	1,084
Mean	16,679	1,909	39.0	67.1	6	8	389	0.61	16	46	182	11	1,748
Maximum	35,525	5,206	46.8	88.4	12	17	617	1.14	28	58	234	18	2,571
503 Limit	NL	NL	NL	38.0	41	39	1,500	17.0	75	420	300	100	2,800

*TVS = Total Volatile Solids.

NL = No limit; not applicable.

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 5

CLASS A PATHOGEN STANDARDS ANALYTICAL DATA FOR BIOSOLIDS FROM THE CALUMET WATER RECLAMATION PLANT THAT WERE LAND APPLIED IN 2001

Sample Date	Lagoon Source	% Total Solids	Fecal Coliform No. /g.	Viable Helminth Ova No./4g.	Virus PFU/4g.
04/01/01	7	72.05	<2	<0.1110	<0.2575
04/01/01	14	69.04	1	<0.1159	<0.1954
12/05/00	15	27.63	NA	<0.290	<0.8572
04/26/01	15	88.25	57	NA	NA
12/05/00	15	13.55	NA	0.59	<0.8000
04/26/01	15	91.59	74	NA	NA
06/20/01	15	74.79	170	NA	NA
12/05/00	15	17.71	NA	<0.753	<0.8333
04/26/01	15	91.73	74	NA	NA
06/20/01	15	87.82	68	NA	NA

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 5 (Continued)

CLASS A PATHOGEN STANDARDS ANALYTICAL DATA FOR BIOSOLIDS FROM THE CALUMET WATER RECLAMATION PLANT THAT WERE LAND APPLIED IN 2001

Sample Date	Lagoon Source	% Total Solids	Fecal Coliform No. /g.	Viable Helminth Ova No./4g.	Virus PFU/4g.
12/05/00	15	14.76	NA	<0.542	<0.8000
04/26/01	15	90.53	86	NA	NA
12/05/00	15	17.59	NA	<0.455	<0.8000
04/26/01	15	92.86	44	NA	NA
12/06/00	6	26.98	NA	<0.297	<0.8333
06/12/01	6	72.21	74	NA	NA
12/06/00	6	20.09	NA	<0.066	<0.8000
06/20/01	6	85.20	150	NA	NA
08/28/01	6	82.97	80	NA	NA
12/06/00	6	23.01	NA	<0.348	<0.8148
06/12/01	6	61.15	110	NA	NA

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 5 (Continued)

CLASS A PATHOGEN STANDARDS ANALYTICAL DATA FOR BIOSOLIDS FROM THE CALUMET WATER RECLAMATION PLANT THAT WERE LAND APPLIED IN 2001

Sample Date	Lagoon Source	% Total Solids	Fecal Coliform No. /g.	Viable Helminth Ova No./4g.	Virus PFU/4g.
12/06/00	6	30.20	NA	<0.265	<0.8332
06/12/01	6	63.80	140	NA	NA
12/06/00	6	19.26	NA	<0.415	<0.7999
06/20/01	6	61.94	110	NA	NA
07/17/01	1	21.29	NA	<0.0626	<0.8334
09/05/01	1	82.23	120	NA	NA
07/17/01	1	27.53	NA	<0.2906	<0.8333
08/28/01	1	84.39	600	NA	NA

NA = No analysis.

(Table 4). Management practices complied with Section 503.14 as previously described in a letter to Mr. Michael J. Mikulka dated January 28, 1994 (Attachment 2).

Stickney WRP

The Stickney WRP, located in Stickney, Illinois, has a design capacity of 1200 mgd. Wastewater reclamation processes include primary (Imhoff and primary settling) and secondary (activated sludge process) treatment. All solids produced at this WRP are anaerobically digested. Stickney WRP biosolids are then;

a. Placed into lagoons for dewatering, aging, and stabilization, and then transported to paved cells and air-dried prior to:

   1. Application to land as EQ biosolids under the District's Controlled Solids Distribution Permit.

   2. Use at local municipal solid waste landfills as final landfill cover.

   3. Application to land as EQ biosolids at the Fulton County, Illinois dedicated land application site.

   4. Application to farmland as EQ biosolids by a private contractor.

   5. Disposal in local municipal solid waste landfills.

b. Dewatered by centrifuging to approximately 25 percent solids content, and then applied to land by a private contractor as a Class B cake.

c. Dewatered by centrifuging to approximately 25 percent solids content, transported to paved cells, and air-dried prior to use as daily landfill cover.

d. Dewatered by centrifuging to approximately 25 percent solids content, placed into lagoons for aging and stabilization, and transported to paved cells and air-dried prior to:

1. Application to land as EQ biosolids under the District's Controlled Solids Distribution Permit.

2. Use at local municipal solid waste landfills as final landfill cover.

3. Application to land as EQ biosolids at the Fulton County, Illinois dedicated land application site.

4. Application to farmland as EQ biosolids by a private contractor.

5. Disposal in local municipal solid waste landfills.

In 2001, the total biosolids production at the Stickney WRP was 149,965 dry tons (Table 1). This total includes biosolids generated from processing of sludge originating at the Stickney WRP as well as the sludge that was imported from the North Side and Lemont WRPs for further processing. The quantity of biosolids that were used and disposed of in 2001 exceeded the total production for the Stickney WRP due to processing of biosolids produced in previous years that were stored in lagoons. The Stickney WRP sent 41,348 dry tons of biosolids to landfills in 2001. Of this amount, 30,869 dry tons were used as daily cover, 1,155 dry tons were used as final cover, and 9,324 dry tons were co-disposed with municipal solid waste.

These practices are exempt from the Part 503 Regulations and require no further reporting.

In 2001, the Stickney WRP land applied 40,050 dry tons of centrifuge cake biosolids to farmland under IEPA Permit No. 1999-SC-3932 through a contract with Stanley Rebacz Trucking and Excavating, Inc. In accordance with Table 1 of Section 503.16, the frequency of monitoring for this biosolids product is 12 times per year. All Stickney WRP centrifuge cake biosolids that were land applied in 2001 met the pollutant concentration limits in Table 3 of Section 503.13 (Table 6), the Class B pathogen anaerobic digester time and temperature requirements of Section 503.32b3 (Table 7), and the vector attraction reduction requirements of Section 503.33b10. Table 6 also contains the biosolids nitrogen concentration data that were used by the land applier to compute the agronomic loading rates at the farmland sites.

In 2001, the Stickney WRP land applied a total of 77,093 dry tons of air-dried EQ biosolids. Of this quantity, 76,318 dry tons were applied to farmland under IEPA Permit No. 1999-SC-3932 through a contract with Synagro-WWT, Inc., and 775 dry tons of Stickney WRP biosolids were land applied under the Controlled Solids Distribution Program under IEPA Permit No. 2000-SC-0872 for maintenance of golf courses, landscaping, nurseries, and construction of recreation fields. The controlled solids distributions from the Stickney WRP included 43 dry tons, which were distributed to the Continental Cement Company of Hannibal, Missouri. In accordance with Table 1 of Section 503.16, the frequency of monitoring for this biosolids product is 12 times per year. An exception to this frequency of monitoring was granted, effective March 1, 2000 by USEPA Region V, for compliance with Class A pathogen standards. The Stickney WRP biosolids that are land applied are required to be monitored only six times per year for compliance with Class A pathogen standards in Part 503 (Attachment 1). All Stickney WRP EQ biosolids that were land applied in 2001 met the pollutant concentration limits in Table 3 of Section 503.13 (Table 8), the Class A pathogen limits of Section 503.32a6 (Table 9), and the vector attraction reduction requirements of Sec-

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 6

PART 503 COMPLIANCE DATA: NITROGEN AND METALS CONCENTRATIONS IN CENTRIFUGE CAKE BIOSOLIDS FROM THE STICKNEY WATER RECLAMATION PLANT APPLIED TO FARMLAND IN 2001

Date	TKN	NH_3-N	As	Cd	Cu	Hg	Mo	Ni	Pb	Se	Zn
	mg/dry kg										
01/04/01	54,872	3,203	3	4	407	0.50	16	49	97	3	915
01/18/01	67,873	8,252	NA	4	333	NA	12	40	76	NA	747
02/01/01	59,582	4,284	4	5	301	0.79	12	44	87	4	767
03/01/01	49,413	4,128	9	5	388	0.42	14	50	147	2	1,067
03/15/01	49,485	4,258	NA	5	404	NA	18	55	134	NA	955
04/12/01	54,187	4,708	7	5	384	0.39	17	53	174	7	828
04/26/01	55,581	2,090	NA	4	386	NA	14	52	207	NA	948
05/03/01	57,748	2,560	5	4	342	0.71	15	59	178	3	808
05/17/01	42,318	1,849	NA	4	390	NA	14	58	195	NA	1,008
06/07/01	45,550	2,298	7	5	422	0.43	13	68	226	4	1,030
06/21/01	44,368	1,402	NA	6	405	NA	16	51	213	NA	1,017
07/05/01	42,545	2,415	7	5	392	0.58	19	61	36	4	1,034
07/19/01	45,045	1,128	NA	3	386	NA	13	50	161	NA	1,030
08/02/01	42,515	2,094	NA	4	453	NA	24	64	228	NA	1,077
08/16/01	36,975	2,633	5	4	425	0.42	21	62	226	4	1,081
09/06/01	43,815	2,035	9	5	423	0.34	19	56	218	3	1,029
09/20/01	38,439	1,458	NA	15	423	NA	20	66	208	NA	998
10/04/01	46,756	2,945	9	5	385	0.76	19	59	211	5	874
10/18/01	37,121	4,564	NA	5	410	NA	19	78	181	NA	896
11/01/01	41,648	2,177	13	3	417	0.66	16	65	186	4	845
11/15/01	44,449	2,265	NA	7	403	NA	22	68	165	NA	795
12/06/01	56,976	5,510	5	4	415	0.55	18	61	140	4	828

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 6 (Continued)

PART 503 COMPLIANCE DATA: NITROGEN AND METALS CONCENTRATIONS IN CENTRIFUGE CAKE BIOSOLIDS FROM THE STICKNEY WATER RECLAMATION PLANT APPLIED TO FARMLAND IN 2001

Date	TKN	NH_3-N	As	Cd	Cu	Hg	Mo	Ni	Pb	Se	Zn
	-----	-----	-----	-----	-----	mg/dry kg	-----	-----	-----	-----	-----
12/20/01	54,406	2,913	5	4	414	NA	18	76	141	4	913
03/14/01	55,921	6,653	6	6	447	0.28	17	56	108	2	975
03/29/01	48,777	4,534	11	5	395	0.38	15	56	149	3	909
04/23/01	50,185	5,450	8	5	404	0.73	11	54	174	5	899
05/17/01	43,303	6,870	10	4	396	0.62	11	51	176	4	913
06/20/01	40,449	4,117	10	5	461	0.25	18	59	176	5	1,048
08/20/01	54,145	6,882	4	5	435	0.44	16	59	166	4	1,052
09/06/01	47,694	9,041	3	5	399	0.18	16	52	131	3	852
09/06/01	33,475	3,274	4	5	412	0.54	13	54	204	3	979
10/08/01	52,392	5,059	12	5	440	0.87	21	67	132	3	942
Minimum	33,475	1,128	3	3	301	0.18	11	40	36	2	747
Mean	48,063	3,845	7	5	403	0.52	16	58	164	4	939
Maximum	67,873	9,041	13	15	461	0.87	24	78	228	7	1,081
503 Limit	NL	NL	41	39	1,500	17.0	75	420	300	100	2,800

NA = No analysis.

NL = No limit; not applicable.

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 7

PART 503 CLASS B PATHOGENS COMPLIANCE DATA: DIGESTER TEMPERATURES AND DETENTION TIMES FOR CENTRIFUGE CAKE BIOSOLIDS FROM THE STICKNEY WATER RECLAMATION PLANT THAT WERE APPLIED TO FARMLAND IN 2001

Month	Average Temperature	Average Detention time	Meets Part 503 Class B Requirements	Minimum Required Detention Time*
	°F	days		days
January	97	22.0	yes	15.0
February	97	18.4	yes	15.0
March	97	22.2	yes	15.0
April	97	20.2	yes	15.0
May	97	18.5	yes	15.0
June	98	19.0	yes	15.0
July	98	23.1	yes	15.0
August	97	21.4	yes	15.0
September	97	26.9	yes	15.0
October	97	27.6	yes	15.0
November	97	27.1	yes	15.0
December	97	29.6	yes	15.0

*Miniumum detention time required to meet Part 503 Class B operational requirements at average temperature achieved.

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 8

PART 503 COMPLIANCE DATA: NITROGEN CONCENTRATIONS, VOLATILE SOLIDS REDUCTION, AND METALS CONCENTRATIONS FOR AIR-DRIED BIOSOLIDS FROM THE STICKNEY WATER RECLAMATION PLANT APPLIED TO LAND IN 2001

Sample Date	TKN	NH_3-N	TVS*	TVS* Reduction	As	Cd	Cu	Hg	Mo	Ni	Pb	Se	Zn
	--- mg/dry kg ---		%	%	--------------- mg/dry kg ---------------								
6/13-21	16,207	2,438	22.0	79.8	5	6	299	0.32	6	51	118	3	695
8/13	28,760	4,487	31.3	59.1	11	8	379	0.53	14	66	168	3	848
8/13	27,886	4,142	32.2	57.3	12	8	399	0.74	16	68	184	3	877
9/13	18,451	2,945	30.0	64.7	12	10	386	0.74	14	72	173	6	882
9/18	22,528	4,860	28.6	66.9	11	8	332	0.85	10	57	164	4	770
9/25-27	25,175	4,177	30.0	64.6	9	8	306	0.87	12	62	155	4	746
10/01-04	23,003	2,302	31.1	62.7	13	9	609	0.93	11	66	188	3	954
10/20	25,992	3,012	34.5	56.4	11	9	440	0.87	14	70	183	3	992
10/22	22,377	1,271	30.7	63.4	11	9	368	0.70	19	65	176	3	850
11/07	11,054	150	19.1	82.8	5	6	262	0.76	10	54	142	2	653
6/26-29	19,349	2,962	32.5	65.5	1	8	428	0.62	8	62	165	1	1,021
7/02	14,086	3,751	29.3	72.7	14	9	397	0.68	15	61	170	3	866
10/31	20,600	241	31.9	61.2	11	18	476	0.90	12	78	220	3	1,121
11/01	20,041	1,091	35.4	59.8	4	13	512	1.16	19	82	233	3	1,211
11/05	16,647	3,010	34.3	61.8	4	21	540	1.28	19	91	254	3	1,308
11/06-07	22,220	210	36.9	57.1	3	11	492	1.19	21	77	212	4	1,226
11/15-16	21,565	128	35.9	58.9	4	10	488	1.06	19	78	205	4	1,199
4/12-13	23,513	2,814	34.0	68.3	8	8	426	0.92	14	67	178	3	931

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 8

PART 503 COMPLIANCE DATA: NITROGEN CONCENTRATIONS, VOLATILE SOLIDS REDUCTION, AND METALS CONCENTRATIONS FOR AIR-DRIED BIOSOLIDS FROM THE STICKNEY WATER RECLAMATION PLANT APPLIED TO LAND IN 2001

Sample Date	TKN	NH_3-N	TVS*	TVS* Reduction	As	Cd	Cu	Hg	Mo	Ni	Pb	Se	Zn
	--- mg/dry kg ---		%	%	--------------- mg/dry kg ---------------								
6/18-21	16,207	2,438	22.0	79.8	5	6	299	0.32	6	51	118	3	695
8/13	28,760	4,487	31.3	59.1	11	8	379	0.53	14	66	168	3	848
8/13	27,886	4,142	32.2	57.3	12	8	399	0.74	16	68	184	3	877
9/13	18,451	2,945	30.0	64.7	12	10	386	0.74	14	72	173	6	882
9/18	22,528	4,860	28.6	66.9	11	8	332	0.85	10	57	164	4	770
9/25-27	25,175	4,177	30.0	64.6	9	8	306	0.87	12	62	155	4	746
10/01-04	23,003	2,302	31.1	62.7	13	9	609	0.93	11	66	188	3	954
10/20	25,992	3,012	34.5	56.4	11	9	440	0.87	14	70	183	3	992
10/22	22,377	1,271	30.7	63.4	11	9	368	0.70	19	65	176	3	850
11/07	11,054	150	19.1	82.8	5	6	262	0.76	10	54	142	2	653
6/26-29	19,349	2,962	32.5	65.5	1	8	428	0.62	8	62	165	1	1,021
7/02	14,086	3,751	29.3	72.7	14	9	397	0.68	15	61	170	3	866
10/31	20,600	241	31.9	61.2	11	18	476	0.90	12	78	220	3	1,121
11/01	20,041	1,091	35.4	59.8	4	13	512	1.16	19	82	233	3	1,211
11/05	16,647	3,010	34.3	61.8	4	21	540	1.28	19	91	254	3	1,308
11/06-07	22,220	210	36.9	57.1	3	11	492	1.19	21	77	212	4	1,226
11/15-16	21,565	128	35.9	58.9	4	10	488	1.06	19	78	205	4	1,199
4/12-13	23,513	2,814	34.0	68.3	8	8	426	0.92	14	67	178	3	931

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 8 (Continued)

PART 503 COMPLIANCE DATA: NITROGEN CONCENTRATIONS, VOLATILE SOLIDS REDUCTION, AND METALS CONCENTRATIONS FOR AIR-DRIED BIOSOLIDS FROM THE STICKNEY WATER RECLAMATION PLANT APPLIED TO LAND IN 2001

Sample Date	TKN	NH_3-N	TVS*	TVS* Reduction	As	Cd	Cu	Hg	Mo	Ni	Pb	Se	Zn
	--- mg/dry kg ---		%	%	--------------- mg/dry kg ---------------								
4/25	20,515	1,308	36.7	64.4	7	8	474	1.10	14	67	188	4	1,036
6/14-15	22,779	4,162	37.9	56.2	1	8	464	0.47	14	63	187	1	1,084
6/25-26	21,897	3,586	31.7	66.8	1	8	400	0.45	7	61	176	1	951
6/21	19,299	1,710	32.9	64.8	1	8	396	0.50	4	60	163	1	944
6/15	14,996	3,120	32.7	65.2	1	8	388	0.60	4	62	164	1	907
8/07-10	22,744	3,448	29.1	63.1	10	9	349	0.65	13	66	162	2	803
9/14	14,699	2,536	33.4	58.7	13	19	519	1.23	17	88	229	6	1,204
9/17	28,898	7,056	42.8	38.4	12	6	420	0.83	16	56	172	7	1,118
10/22	26,922	1,748	36.9	51.7	11	11	469	1.19	11	65	198	4	1,162
10/03	17,771	1,436	21.0	78.0	12	7	251	0.61	7	53	124	2	586
7/12-13	40,300	7,432	42.5	51.2	5	5	541	0.91	21	75	184	2	1,085
7/16-20	34,394	7,421	43.2	49.8	9	5	493	0.50	21	70	180	2	1,062
7/26-27	40,463	7,798	44.7	46.7	9	5	474	0.86	19	70	189	2	1,072
7/30-31	30,142	5,260	45.4	45.1	9	5	465	0.61	20	70	178	3	1,112
8/01-02	35,931	12,159	44.0	29.4**	6	5	463	0.48	16	68	178	3	1,127
8/07-09	33,409	3,602	45.0	26.3**	4	7	487	0.81	16	68	178	3	1,163
8/14-15	33,539	3,198	43.8	29.9**	14	5	475	0.77	19	.1	189	4	1,148
10/29	26,383	1,679	37.4	50.6	13	5	442	0.72	11	61	233	4	1,183

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 8 (Continued)

PART 503 COMPLIANCE DATA: NITROGEN CONCENTRATIONS, VOLATILE SOLIDS REDUCTION, AND METALS CONCENTRATIONS FOR AIR-DRIED BIOSOLIDS FROM THE STICKNEY WATER RECLAMATION PLANT APPLIED TO LAND IN 2001

Sample Date	TKN	NH_3-N	TVS*	TVS* Reduction	As	Cd	Cu	Hg	Mo	Ni	Pb	Se	Zn
	--- mg/dry kg ---		%	%	---------------- mg/dry kg ----------------								
10/31	29,992	7,894	38.0	49.3	5	5	459	1.12	18	72	256	4	1,251
4/09	22,936	5,341	31.8	71.3	8	8	384	1.02	15	66	160	3	802
5/04	20,156	2,713	32.4	66.4	7	6	471	0.80	18	81	173	3	1,001
5/04	33,417	4,560	44.5	43.8	7	9	384	0.75	13	69	172	3	918
5/09	22,339	2,719	40.6	52.2	7	8	488	0.81	17	69	181	3	1,003
5/09	21,012	2,991	36.4	60.0	6	7	370	0.33	11	63	168	2	779
6/20	22,676	860	38.3	55.5	9	12	469	0.39	19	69	209	3	1,053
6/20	23,091	3,090	35.0	61.3	9	8	396	0.11	14	60	170	3	833
6/21	22,817	2,469	42.5	46.9	9	5	422	1.06	14	56	194	5	1,006
6/28	22,093	2,019	37.2	57.5	7	18	491	0.62	17	82	85	4	1,124
7/19	19,205	2,063	34.2	65.8	1	30	474	0.34	12	84	237	1	1,261
7/20	39,704	5,339	45.3	45.4	12	5	425	0.26	18	56	178	<1	1,054
7/27	21,634	2,166	41.9	52.5	7	6	502	0.19	19	65	220	3	1,239
7/27	23,058	779	38.6	58.6	6	6	538	0.64	18	72	210	3	1,093
8/08	32,745	3,690	38.3	44.2	6	9	600	0.97	21	78	226	3	1,237
8/08	20,349	1,080	33.8	54.0	5	6	334	0.79	8	61	153	2	684
8/07	29,640	3,553	40.5	38.8	5	6	458	0.92	15	62	180	3	1,123
8/30	28,745	1,532	39.5	41.2	4	10	461	0.55	20	69	177	4	1,068

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 8 (Continued)

PART 503 COMPLIANCE DATA: NITROGEN CONCENTRATIONS, VOLATILE SOLIDS REDUCTION, AND METALS CONCENTRATIONS FOR AIR-DRIED BIOSOLIDS FROM THE STICKNEY WATER RECLAMATION PLANT APPLIED TO LAND IN 2001

Sample Date	TKN	NH_3-N	TVS*	TVS* Reduction	As	Cd	Cu	Hg	Mo	Ni	Pb	Se	Zn
	--- mg/dry kg ---		%	%	--------------- mg/dry kg ---------------								
8/30	23,322	1,043	39.5	41.2	4	11	498	0.39	19	69	176	4	1,127
9/13	25,616	13,937	39.2	46.9	9	10	487	0.76	19	72	225	4	1,153
10/02	20,651	953	35.1	55.2	9	14	464	1.24	17	76	225	3	1,132
10/02	31,462	1,966	42.1	39.9	9	5	433	0.80	18	65	210	3	1,103
10/03	24,004	1,449	40.4	44.0	5	7	427	0.93	20	67	168	3	1,002
10/09	13,746	587	18.6	81.1	7	6	219	0.85	7	40	102	2	505
Minimum	11,054	128	18.6	38.4	1	5	219	0.11	4	40	85	<1	505
Mean***	24,316	3,291	35.7	56.2	8	9	436	0.75	15	67	183	3	1,007
Maximum	40,463	13,937	45.4	82.8	14	30	609	1.28	21	91	256	7	1,308
503 Limit	NL	NL	NL	38.0	41	39	1,500	17.0	75	420	300	100	2,800

*TVS = Total Volatile Solids.

**Biosolids did not meet vector attraction reduction requirements in Section 503.33b1, but they were managed in accordance with requirements in 503.33b10.

***In calculating the mean, values less than the detectable level were considered as the detectable level.

NL = No limit; not applicable.

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 9

CLASS A PATHOGEN STANDARDS ANALYTICAL DATA FOR BIOSOLIDS FROM THE STICKNEY WATER RECLAMATION PLANT THAT WERE PREPARED FOR LAND APPLICATION IN 2001

Sample Date	Lagoon Source	% Total Solids	Fecal Coliform No. /g.	Viable Helminth Ova No./4g.	Virus PFU/4g.
07/13/00	24	27.56	NA	<0.290	<0.3833
04/09/01	24	71.83	<2	NA	NA
10/13/00	20	40.26	NA	0.199	<0.4444
04/25/01	20	71.15	10	NA	NA
04/23/01	24	46.36	NA	<0.0288	<0.4103
06/28/01	24	86.82	66	NA	NA
04/23/01	23	35.57	NA	<0.2249	<0.4444
07/19/01	23	78.68	44	NA	NA
06/05/01	24	41.06	NA	<0.1948	<0.9998
07/19/01	24	78.75	52	NA	NA
07/02/01	24	43.83	NA	<0.1825	<0.8444
07/19/01	24	91.40	52	NA	NA

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 9 (Continued)

CLASS A PATHOGEN STANDARDS ANALYTICAL DATA FOR BIOSOLIDS FROM THE STICKNEY WATER RECLAMATION PLANT THAT WERE PREPARED FOR LAND APPLICATION IN 2001

Sample Date	Lagoon Source	% Total Solids	Fecal Coliform No. /g.	Viable Helminth Ova No./4g.	Virus PFU/4g.
07/19/01	18	83.28	NA	<0.0961	<0.8571
09/13/01	18	70.83	2	NA	NA
07/26/01	16 & 18	33.19	NA	0.9641	<0.8332
09/13/01	16 & 18	61.30	620	NA	NA
07/26/01	24	37.72	NA	<0.2121	<0.8334
08/08/01	24	82.15	120	NA	NA
09/11/01	24	72.95	4	NA	NA
07/26/01	20	39.26	NA	0.034	<0.8332
09/11/01	20	75.97	38	NA	NA
09/13/01	16	70.98	40	0.3381	<0.8716
09/13/01	23	63.61	1	<0.1258	<0.9093

NA = No analysis.

tion 503.33b1 (Table 8). Table 8 also contains biosolids nitrogen concentration data that were used by the land applier to compute the agronomic loading rates at the farmland sites. Management practices complied with Section 503.14 as previously described in a letter to Mr. Michael J. Mikulka dated January 28, 1994 (Attachment 2).

Hanover Park WRP

The Hanover Park WRP, located in Hanover Park, Illinois, has a design capacity of 12 mgd. Wastewater reclamation processes at this WRP include primary (primary settling), secondary (activated sludge process), and tertiary (sand filtration) treatment. All solids produced at the Hanover Park WRP are anaerobically digested and stored in lagoons. Lagooned, digested biosolids are then applied by injection at an on-site farm, formerly the Fischer Farm. All of the biosolids produced by the Hanover Park WRP are land applied at the Fischer Farm, which is contained on the plant grounds.

In 2001, the total biosolids production at this WRP was 886 dry tons (Table 1). Land application of liquid biosolids at the Hanover Park Fischer Farm site in 2001 utilized 1,563 dry tons. The quantity of land applied biosolids surpassed the quantity of biosolids produced in 2001 due to land application of additional biosolids that were produced in previous years and stored in a lagoon. In accordance with Table 1 of Section 503.16, the frequency of monitoring for this biosolids product is four times per year. All Hanover Park WRP centrifuge cake biosolids that were land applied in 2001 met the pollutant concentration limits in Table 3 of Section 503.13 (Table 10), the Class B pathogen anaerobic digester time and temperature requirements of Section 503.32b3 (Table 11), and the vector attraction reduction requirements of Section 503.33b1 (Table 12). Management practices at this land application site complied with Section 503.14 as previously described in a letter to Mr. Michael J. Mikulka dated January 28, 1994 (Attachment 2).

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 10

PART 503 COMPLIANCE DATA: NITROGEN AND METALS CONCENTRATIONS IN BIOSOLIDS APPLIED TO THE HANOVER PARK FISCHER FARM IN 2001

Composite Sample Date	TKN	NH_3-N	As	Cd	Cu	Hg	Mo	Ni	Pb	Se	Zn
	mg/dry kg										
04/07/01	38,116	18,091	3	4	1,054	2.07	22	51	52	3	832
04/14/01	46,358	18,827	3	4	1,045	2.10	16	54	54	3	836
04/21/01	41,030	20,163	3	4	1,046	2.26	15	54	55	3	810
04/28/01	23,190	20,162	4	6	1,043	2.12	14	51	64	3	800
05/05/01	31,295	NA	4	6	1,083	1.80	13	47	70	2	811
06/26/01	41,768	42,309	2	3	728	0.70	10	35	36	2	574
07/07/01*	383,136	255,132	17	<1	34	0.19	3	16	<2	2	52
07/14/01*	444,381	178,505	23	<1	39	0.07	3	18	<2	<1	61
07/28/01*	418,222	267,900	20	<1	37	0.14	4	20	<2	<2	58
08/18/01*	227,000	157,647	23	<1	38	<0.03	5	24	<2	5	57
08/27/01*	210,714	123,900	31	<1	46	NA	7	27	<3	<2	66
09/08/01*	208,353	94,559	21	<1	33	<0.02	5	19	<2	4	47
09/15/01*	473,000	83,253	24	<1	28	0.04	5	17	<2	8	40
09/22/01*	310,364	9,909	15	<1	40	<0.04	9	24	<3	<2	65
09/29/01*	385,400	254,400	15	<1	76	0.20	12	21	3	<2	105
12/08/01*	516,500	53,508	10	1	150	0.42	6	22	7	<2	172
12/15/01*	423,246	106,977	8	2	124	0.29	4	25	7	<2	161
12/22/01*	353,062	342,838	8	1	110	0.32	5	20	8	2	142
11/24/01	23,769	1,641	2	5	1,122	2.30	15	43	57	2	846

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 10 (Continued)

PART 503 COMPLIANCE DATA: NITROGEN AND METALS CONCENTRATIONS IN BIOSOLIDS APPLIED TO THE HANOVER PARK FISCHER FARM IN 2001

Composite Sample Date	TKN	NH_3-N	As	Cd	Cu	Hg	Mo	Ni	Pb	Se	Zn
					mg/dry kg						
12/01/01	68,029	12,655	2	5	1,191	1.61	17	50	66	1	875
12/08/01	82,952	12,733	2	5	1,118	2.33	13	46	225	1	832
12/15/01	70,959	42,491	2	4	1,077	0.4[illegible]	15	50	52	1	812
Minimum	23,190	1,641	2	<1	28	<0.02	3	16	<2	<1	40
Mean**	219,129	100,838	11	3	512	0.93	10	33	35	2	412
Maximum	516,500	342,838	31	6	1,191	2.33	22	54	225	8	875
503 Limit	NL	NL	41	39	1,500	17.0	75	420	300	100	2,800

*Biosolids applied as supernatant.

**In calculating the mean, values less than the detectable level were considered as the detectable level.

NA = No analysis.

NL = No limit; not applicable.

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 11

PART 503 CLASS B PATHOGENS COMPLIANCE DATA: DIGESTER TEMPERATURES AND DETENTION TIMES FOR BIOSOLIDS FROM THE HANOVER PARK WATER RECLAMATION PLANT THAT WERE LAND APPLIED AT THE FISCHER FARM IN 2001

Month	Average Temperature	Average Detention Time	Meets Part 503 Class B Requirements	Minimum Required Detention Time*
	°F	days		days
January	95	24.0	yes	15.3
February	95	36.1	yes	15.0
March	95	33.1	yes	15.0
April	95	30.9	yes	15.0
May	95	26.2	yes	15.0
June	95	23.6	yes	15.0
July	95	24.7	yes	15.0
August	96	34.6	yes	15.0
September	95	44.2	yes	15.0
October	95	37.6	yes	15.0
November	95	38.8	yes	15.0
December	95	39.7	yes	15.0

*Miniumum detention time required to meet Part 503 Class B operational requirements at average temperature achieved.

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TABLE 12

PART 503 COMPLIANCE DATA: VOLATILE SOLIDS REDUCTION FOR BIOSOLIDS FROM THE HANOVER PARK WATER RECLAMATION PLANT THAT WERE LAND APPLIED AT THE FISCHER FARM IN 2001

Date	Digester Feed	Digester Draw	Lagoon Biosolids	Volatile Solids Reduction*
	---- % Total Volatile Solids ---			----- % -----
April	85.55	73.99	69.68	60.49
May	83.77	73.90	68.11	63.04
June	82.66	73.08	67.23	63.44
July	84.52	76.16	66.35	62.91
August	83.32	77.41	66.75	40.13
September	80.72	75.20	69.58	49.09
November	79.62	72.01	67.33	51.18
December	81.50	73.30	61.32	61.06

*Volatile solids reduction computed using digester feed and lagoon biosolids.

Subject: 2001 Reporting Requirements Under the 40 CFR Part 503 Regulations

District Biosolids Distributed Under 40 CFR Parts 258 and 261

Biosolids from three of the District's WRPs (Stickney, Calumet, and John E. Egan) were sent to landfills in 2001 for co-disposal with municipal solid waste, use as daily cover, and use as final cover. Biosolids going to these landfills are either processed to meet the requirements of AS 95-4 and AS 98-5 (Adjusted Standards) approved by the Illinois Pollution Control Board for biosolids used as a final vegetative cover, or they are centrifuged and air-dried to various end points, and analyzed as specified in 40 CFR Part 261 to establish the nonhazardous nature of this material for biosolids used as daily cover and co-disposed. Analytical results, including TCLP constituents, PCB, cyanide, sulfide, and paint filter test, are submitted to the landfill company to satisfy the requirements of their IEPA permit. District biosolids have always met the requirements of 40 CFR Parts 258 and 261, and the Illinois nonhazardous waste landfill regulations (Title 35, Subtitle G, Chapter I, Subchapter h, Part 810).

STICKNEY WRP

A total of 41,348 dry tons of biosolids from the Stickney WRP were co-disposed, used as daily cover with municipal solid waste, or used as a final vegetative cover at nonhazardous waste landfills. A total of 9,324 dry tons were co-disposed at Land and Lakes River Bend Prairie Landfill at 801 E. 138th St., Dolton, Illinois. A total of 30,869 dry tons were used as daily cover at the Waste Management of North America, Inc., CID Recycling and Disposal Facility in Calumet City, Illinois. A total of 1,155 dry tons were used as a final vegetative cover at the Paxton II Landfill, Chicago, Illinois.

CALUMET WRP

A total of 3,575 dry tons of biosolids from the Calumet WRP were co-disposed with municipal solid waste, used as daily cover, or used as a final vegetative cover at nonhazardous waste landfills. A total of 2,693 dry tons were used as daily cover at the Waste Management of North America, Inc., CID recycling and disposal facility in Calumet City, Illinois. A total of 335 dry tons were used as a final vegetative cover at the Paxton II Landfill, Chicago, Illinois. Finally, 547 dry tons were co-disposed at Land and Lakes River Bend Prairie Landfill at 801 E. 138th St., Dolton, Illinois.

JOHN E. EGAN WRP

A total of 4,998 dry tons of biosolids from the John E. Egan WRP were co-disposed with municipal solid waste or used as daily cover at nonhazardous waste landfills. A total of 2,171 dry tons were used as daily cover at the Waste Management of North America, Inc., CID recycling and disposal facility in Calumet City, Illinois. Of this amount, 1,884 dry tons were sent to the Calumet WRP East drying facility and 287 dry tons were sent to the Stickney WRP Stony Island drying facility for air-drying prior to delivery to the landfill. Finally, 2,827 dry tons were co-disposed at Land and Lakes River Bend Prairie Landfill at 801 E. 138th St., Dolton, Illinois.

We believe this report satisfies the reporting requirements under the 40 CFR Part 503 Regulations.

Certification Statement Required for Record Keeping

"I certify under penalty of law, that the information that will be used to determine compliance with the Class A pathogen requirements, Class B pathogen requirements, vector attraction reduction requirements, management practices, site restrictions, and requirements to obtain information as described in Sections 503.32a8, 503.32b2, 503.32b3, 503.33b1, 503.33b9, 503.13, 503.14, and 503.16 for the District's land application sites was prepared under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment."

Subject: 2001 Reporting Requirements Under the 40 CFR Part 503 Regulations

If you have any questions, please telephone me at (312) 751-5190.

Very truly yours,

Richard Lanyon

Richard Lanyon
Director
Research and Development

RL:TG:jvs
Attachments
cc w/att.: Keller (IEPA
Kluge (IEPA)
Rogers (IEPA)
Sulski (IEPA)
Aistars (USEPA)
Farnan
O'Connor
Rosenberg
Zurad
Kollias
Tata
Pietz
Sawyer
Granato

ATTACHMENT I

REDUCTION IN FREQUENCY OF MONITORING FOR PATHOGENS IN BIOSOLIDS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

RECEIVED R&D LAB
EM & R DIV STICKNEY WRP

00 JAN 18 PM 2:20

File
- South &
- Chief
2/8

REPLY TO THE ATTENTION OF:

WN-16J

JAN 12 2000

Dr. Dick Lanyon
Director, Research and Development
Metropolitan Water Reclamation District
of Greater Chicago
100 East Erie Street
Chicago, Illinois 60611-2803

Re: Reduction in Frequency of Monitoring for Pathogens in Biosolids

Dear Dr. Lanyon:

This is in response to verbal and written requests, regarding the referenced matter, that were made by your predecessor Dr. Cecil Lue-Hing, and Dr. Tata Prakasam, the District's Research Manager, to John Colletti and Ash Sajjad of the Regional Biosolids Team. Specifically, the District requested reduction in the frequency of monitoring for pathogens in biosolids generated at the District's Calumet and Stickney waste water treatment plants from 12 times per year to 4 times per year for reporting these data to the U.S. Environmental Protection Agency (U.S. EPA) as required by 40 Code of Federal Regulations (CFR) part 503.

Further, Dr. Lue-Hing in his June 15, 1999, letter to John Colletti referenced the biosolids pathogen data that the District collected from over 1,000 discreet samples. This was done during a period of 4 years from 1994 until 1998, as a part of the District's application to the National Pathogen Equivalency Recommendation Committee (PERC) for certification of the District's biosolids processing trains as equivalent to a Process for further Reduction of Pathogens (PFRP). As you may know, because the District's biosolids process to reduce pathogens is not listed under 40 CFR part 503, the District sought equivalency determination from the PERC. The PERC'S recommendation along with the Region's approval is necessary for the District to obtain PFRP equivalency.

After a review of the District's biosolids data, and in consideration of the District's commendable effort to characterize pathogen quality of more than 1,000 samples, the following is our response to your request.

To provide relief from the analytical burden of analyzing biosolids for pathogens 12 times per year, the U.S. EPA, Region 5, approves reducing the frequency of monitoring to 6 times per year. The reduced frequency of monitoring is effective March 1, 2000, and is renewable on a yearly basis.

If you have any questions about this matter, please contact Ash Sajjad, Regional Biosolids expert at (312) 886-6112.

Sincerely yours,

For

Jo Lynn Traub
Director, Water Division

cc: Dr. Tata Prakasam, MWRDGC

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

RECEIVED R&D LAB
EM & R DIV - STICKNEY WRP

00 JAN 18 PM 2:20

File
- South &
- Clark
2/8

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Director, Research and Development
Metropolitan Water Reclamation District
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If you have any questions about this matter, please contact Ash Sajjad, Regional Biosolids expert at (312) 886-6112.

Sincerely yours,

Robin L. Harry
For

Jo Lynn Traub
Director, Water Division

cc: Dr. Tata Prakasam, MWRDGC

ATTACHMENT II

SLUDGE MANAGEMENT PROGRAMS OF THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO UNDER 40 CFR PART 503

Metropolitan Water Reclamation District of Greater Chicago

100 EAST ERIE STREET CHICAGO, ILLINOIS 60611 312/751-5600

Cecil Lue-Hing
Director of R & D
312/751-5190

January 28, 1994

Mr. Michael J. Mikulka
Chief of Compliance Section
United States Environmental
Protection Agency
Region V
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

Dear Mr. Mikulka:

Subject: Sludge Management Programs of the Metropolitan Water Reclamation District of Greater Chicago Under 40 CFR Part 503

The Metropolitan Water Reclamation District of Greater Chicago (District) has three sludge management programs that employ sewage sludge applications to land under the 40 CFR Part 503 Regulations. These programs are the Fulton County, Illinois land application site, the Hanover Park Fischer Farm at the Hanover Park Water Reclamation Plant, and the Controlled Solids Distribution Program. The District feels that it is important to define its interpretation of the 40 CFR Part 503 Regulations with respect to each of these programs.

On July 22, 1993, we sent Mr. John Colletti, then Acting Sludge Coordinator, a letter (copy attached), expressing our concerns regarding compliance monitoring, record keeping and reporting under 40 CFR Part 503 for each of these programs.

The District believes that its existing sludge management programs are conservative, and that monitoring and environmental protection measures far exceed the requirements of the Part 503 Regulations. This letter is designed to inform you of the conservative nature of these sludge management programs, and the fact that they are in complete compliance with the spirit and specific language of the Part 503 Regulations.

Subject: Sludge Management Programs of the Metropolitan Water Reclamation District of Greater Chicago Under 40 CFR Part 503

Fulton County Illinois Site

The District considers the application of sewage sludge at its Fulton County, Illinois site to be under "Land Application" section (subpart B) of the Part 503 Regulations. Sewage sludge is applied at rates approved by the Illinois Environmental Protection Agency (IEPA) for reclamation of disturbed strip-mine spoils. Under the current permit with the IEPA (Permit No. 1993-SC-4294 issued December 3, 1993), sewage sludge is being applied at an agronomic rate to supply nutrients for productive crop yields.

Sewage sludge applied at the site will contain metal concentrations below the pollutant limits established in Table 3 of Part 503.13, subsection b(3) of the regulations. As a result, the Part 503 cumulative pollutant limits in Table 4 of Part 503.13 substation b(4) will not apply to future applications of sewage sludge at the Fulton County site.

Sewage sludge applied at the Fulton County site will far exceed the Class B pathogen requirements by conservatively achieving operating temperature and detention times in excess of the Part 503 anaerobic digester operating requirements (§503.32b3).

The Part 503 vector attraction reduction requirements will be easily met since the District consistently reduces the volatile solids content of the Fulton County sludge far greater than the required 38 percent (§503.33b1).

The Part 503 Regulations do not specify what kind of crop can be grown under land application. Crops typically grown at the site are corn, winter wheat, and hay. Corn and winter wheat grown on sludge application fields are sold for ethanol production and animal feed. Hay grown on application fields receiving supernatant from on-site lagoons containing sewage sludge is currently harvested three times per year, as specified under the existing IEPA permit. This hay is used as animal feed or mulch for project reclamation activities.

Subject: Sludge Management Programs of the Metropolitan Water Reclamation District of Greater Chicago Under 40 CFR Part 503

The Class B pathogen requirements for the supernatant application field where hay is grown will be met by ensuring that supernatant application ceases 30 days before hay crop harvesting.

The Part 503 Regulations do not specify what kind of surface water protection system is required for land application. The permitting authority, on a case-by-case basis, may impose more stringent requirements when necessary to protect the public health and the environment. Sewage sludge application fields at the Fulton County site are bermed, and have runoff retention basins designed to capture all runoff.

Waters released from the 65 retention basins at the site must, and do meet standards specified in the existing IEPA discharge permit for pH, total suspended solids, fecal coliforms, and biochemical oxygen demand. Although not required in the Part 503 Regulations, these restrictions show that District operations at the Fulton County site are designed to minimize contamination of surface waters.

Supernatant application fields at the site are not bermed. However, supernatant application in the fields is controlled so that it does not contaminate indigenous ponds and strip-mined reservoirs. Although such restrictions are not required in the Part 503 Regulations, they prevent contamination of waters used by wildlife and water fowl.

The Class B pathogen requirements in the Part 503 Regulations dictate that public access to application fields be limited. The District will comply with the Class B pathogen requirement for restricted public access by a combination of fencing, posted signs, locked gates, and security guards. These measures are conservative and far exceed the public access requirements in the Part 503 Regulations.

The Part 503 Regulations prohibit the adverse modification or destruction of endangered species or their critical habitat. The District has no evidence to indicate that sludge applications have affected the habitat of wildlife species at the site.

Subject: Sludge Management Programs of the Metropolitan Water Reclamation District of Greater Chicago Under 40 CFR Part 503

The Part 503 Regulations do not specifically prohibit bulk sewage sludge application to flooded, frozen, or snow covered lands. The regulations state, however, that any sludge applied to these lands may not enter surface waters or wet lands. The District does not apply sewage sludge to floodplains, frozen, or snow covered ground at the Fulton County site. The site permit with the IEPA prohibits applying sewage sludge under these conditions.

The Part 503 Regulations state that bulk sewage sludge may not be applied within 10 meters of a surface water body unless authorized by a permit. The District does not apply sewage sludge within 10 meters of the waters of the state. The District's IEPA permit specifies that sludge shall not be applied to land which lies within 200 feet (61 meters) of surface waters.

The Part 503 Regulations require that the land application of bulk sewage sludge may not exceed the agronomic rate for the particular agricultural, forest or public contact site. In some cases the permitting authority may specifically authorize the application of sludge to a reclamation site at an annual rate that exceeds the agronomic rate. The District is currently applying sewage sludge at an application rate of 57 dry tons per acre per year on bermed sludge application fields, and 25 dry tons per acre per year on nonbermed fields. Technical justification for the sludge application rate of 57 dry tons per acre per year is given in the attachment entitled "Fulton County." This application rate is approved under the IEPA permit.

Hanover Park Fischer Farm

The District considers the application of sewage sludge at its Hanover Park Fischer Farm site to fall under the "Land Application" section (subpart B) of the Part 503 Regulations. Sewage sludge is applied at a rate of 20 dry tons per acre per year as specified in the IEPA permit (Permit No. 1992-SC-0942 issued August 18, 1992) for the site.

Sewage sludge applied at the site is far below the pollutant concentration limits established in Table 3 of Part 503.13, subsection b(3) of the regulations for metals.

Subject: Sludge Management Programs of the Metropolitan Water Reclamation District of Greater Chicago Under 40 CFR Part 503

Sewage sludge applied at the Hanover Park Fischer Farm site conservatively meets the Class B pathogen requirements by either fecal coliform analysis (§503.32b2), or by meeting the Part 503 anaerobic digester operating temperature and detention time requirements (§503.32b3).

The District will ensure that the Part 503 vector attraction reduction requirements are met by electing to subsurface inject all sludge applied to the site.

The Part 503 Regulations do not specify what kind of crop can be grown under land application. A straw crop is currently being grown at the site, with the straw removed and the grain left in the field.

The Part 503 Regulations do not state what type of surface and groundwater protection system is required. All fields at the site are bermed and all surface water is collected. The entire site is endowed with an extensive system of drainage tile, which collects all the soil percolate. The runoff and percolate are returned to the water reclamation plant for tertiary treatment.

The District's sludge application to land program at the Hanover Park Water Reclamation Plant far exceed any surface water and groundwater protection requirement specified in the Part 503 Regulations.

The Part 503 Class B pathogen requirements limit public access to the sludge application fields. The District operations at Hanover Park far exceed the Part 503 requirements since the entire site is fenced with locked gates and security guards.

The Part 503 Regulations prohibit the adverse modification or destruction of endangered species or their critical habitat. The District has no evidence that sludge applications have affected the habitat of wildlife species at the site.

The Part 503 Regulations do not prohibit bulk sewage sludge application to flooded, frozen, or snow covered lands.

Subject: Sludge Management Programs of the Metropolitan Water Reclamation District of Greater Chicago Under 40 CFR Part 503

The regulations state, however, that any sludge applied to these lands may not enter surface waters or wetlands. The District does not apply sewage sludge to floodplains, frozen, or snow covered ground at the Hanover Park Fischer Farm. The site IEPA permit prohibits the application of sewage sludge under these conditions.

The Part 503 Regulations state that bulk sewage sludge may not be applied within 10 meters of a surface water body unless authorized by a permit. The District does not apply sewage sludge within 10 meters of the waters of the state. The site application fields are bermed and surface runoff is collected and returned to the plant for tertiary treatment. This management practice far exceeds the Part 503 requirements.

The Part 503 Regulations require that the land application of bulk sewage sludge may not exceed the agronomic rate for the particular agricultural, forest, or public contact site. The District is applying sewage sludge at an annual application rate of 20 dry tons per acre. Technical justification for this application rate is given in the attachment entitled "Hanover Park," and is approved under the IEPA permit.

Controlled Solids Distribution

The District has a sludge management program called the Controlled Solids Distribution Program. Sewage sludge under this program is given away for beneficial use at selected sites for landscaping and soil enrichment. The application of sewage sludge under this program is covered by IEPA Permit No. 1990-SC-1100.

Through the District's efforts to reduce the metals in the sludge with a vigorous industrial waste control program, the District's sewage sludge will be well below the metal limits specified in Part 503.13, subsection b(3), (Table 3). The anaerobic digesters producing sewage sludge for the District's Controlled Solids Distribution Program have detention times and operating temperatures which easily satisfy the Part 503 Class B pathogen requirements. The sewage sludge destined for the Controlled Solids Distribution Program receives extensive treatment to reduce its volatile solids content, which far exceed the 38 percent volatile solids reduction requirement of the Part 503 vector attraction reduction requirements.

The Part 503 Regulations for land application of sewage sludge do not specify what kind of vegetation can be grown at sites receiving sludge. The District requires that only nonfood chain vegetation be grown at all sites receiving sludge under the Controlled Solids Distribution Program. This far exceeds the Part 503 requirements.

The Part 503 Regulations under 503.32(b) for Class B pathogen reduction requires that public access be restricted for one year if the site has a high potential for public exposure, and public access be restricted for 30 days at a site with a low potential for public exposure. The District will post signs and/or other means to restrict public access to these sites.

The Part 503 Regulations prohibit the adverse modification or destruction of endangered species or their critical habitat. The District has no evidence that endangered species are present in areas receiving sewage sludge under the Controlled Solids Distribution Program.

The Part 503 Regulations do not prohibit bulk sewage sludge application to flooded, frozen, or snow covered lands. The regulations state, however, that any sludge application to these lands may not enter surface waters or wetlands. The District does not apply sewage sludge to floodplains, frozen, or snow covered ground at sites receiving sludge under its Controlled Solids Distribution Program. The District's IEPA permit prohibits these activities.

The Part 503 Regulations has a specific management practice that bulk sewage sludge may not be applied within 10 meters of a surface water body unless authorized by a permit. The District does not apply sewage sludge within 10 meters of the waters of the state. The District's IEPA permit is more restrictive in that it specifies that sludge cannot be applied to land which lies within 200 feet (61 meters) of surface waters.

Subject: Sludge Management Programs of the Metropolitan Water Reclamation District of Greater Chicago Under 40 CFR Part 503

The Part 503 Regulations require that the land application of bulk sewage sludge may not exceed the agronomic rate for a particular agricultural, forest, or public contact site. In some instances, the permitting authority for a reclamation site may specifically authorize the application of sludge at an annual rate that exceeds the agronomic rate. At these sites, sewage sludge will either be applied at an agronomic application rate, or a reclamation rate depending upon the needs of the site. The District's current permit with the IEPA allows for a higher application rate related to site needs. Under the Part 503 Regulations, as noted in the attachment entitled "Fulton County," the permitting authority may authorize a variance from the agronomic rate by permit. The District has received this variance from the IEPA in its current permit for the Controlled Solids Distribution Program.

The above mentioned sludge management programs are an important part of the District's operations and planning requirements for future sludge management activities. As described, the District feels that these programs comply with the requirements described in the Part 503 Regulations.

If you require additional information or have questions, don't hesitate to telephone me at (312) 751-5190.

Very truly yours,

Cecil Lue-Hing, D.Sc., P.E.
Director
Research and Development

CLH:RIP:ns
Attachments
cc: Dalton
O'Connor
DiVita
Murray
Alan Keller, IEPA
Tim Kluge, IEPA
Ken Rogers, IEPA
Ash Sajjad, USEPA
Bill Tong, USEPA

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STATE OF ILLINOIS
Pollution Control Board

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF: PETITION OF METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO FOR AN ADJUSTED STANDARD FROM 35 Ill. Adm. Code 811, 812 and 817, and MODIFICATION OF AS 95-4 (SLUDGE APPLICATION)	AS 03-02 (Adjusted Standard - Land)

REQUEST TO INCORPORATE DOCUMENTS BY REFERENCE

Now comes the Metropolitan Water Reclamation District of Greater Chicago ("District"), by its Attorney, Michael G. Rosenberg, and pursuant to Section 101.306 of the Illinois Administrative Code, 35 Ill. Adm. Code 101.306, the District requests leave to incorporate into the instant proceeding certain materials filed in Docket Number AS 95-4. In support hereof, the District states as follows:

1. In AS 95-4, the Illinois Pollution Control Board ("Board") granted the District's request for an adjusted standard from the Board's rules of general applicability found at 35 Ill. Adm. Code 811.204, 811.314(c)(3), 812.313(d), 817.303 and 817.410(c)(2) and (3) for use of soil as a final cover at landfills in Illinois. The record in AS 95-4 consisted of more than 350 pages, and included an in-depth discussion of the District's operations as well as a thorough explanation of the technical and legal justifications for the District's request.

2. In the instant adjusted standard proceeding, the District is requesting a modification of AS 95-4. Much of the information required to be provided in this proceeding was already supplied to the Board and relied upon in granting the District the relief sought in AS 95-4. No one questioned the authenticity, credibility or relevancy of the material submitted in AS 95-4. The material facts contained in the District's Petition in AS 95-4 are the same, except as noted in the instant Petition.

3. In an effort to limit the record in the instant proceeding and to avoid redundancy, the District is requesting that the Board incorporate by reference into this proceeding the Petition and attachments thereto filed by the District in AS 95-4.

WHEREFORE, the Metropolitan Water Reclamation District of Greater Chicago, pursuant to 35 Ill. Adm. Code 101.306, requests that the Board incorporate by reference into the instant proceeding the Petition and attachments thereto filed by the District in AS 95-4.

Metropolitan Water Reclamation District of Greater Chicago

Michael G. Rosenberg, Attorney

DATED: February 11, 2003

Metropolitan Water Reclamation
District of Greater Chicago
Michael G. Rosenberg
Ronald M. Hill
100 East Erie Street
Chicago, Illinois 60611
(312)751-6583

THIS FILING IS SUBMITTED ON RECYCLED PAPER

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
PETITION OF METROPOLITAN WATER	)	
RECLAMATION DISTRICT OF GREATER	)	
CHICAGO FOR AN ADJUSTED STANDARD	)	
FROM 35 Ill. Adm. Code 811, 812 and 817	)	AS 95-4
	)	(Adjusted Standard - Land)
(SLUDGE APPLICATION)	)	
	)	
	)	
	)	

PETITION FOR AN ADJUSTED STANDARD

PETITION OF THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO (DISTRICT) FOR ADJUSTED STANDARD 35 ILL. ADM. CODE PARTS 811, 812, AND 817 (FINAL PROTECTIVE LAYER)

Introduction

In this petition before the Board, the District asks the Board to grant an adjusted standard so that the District's air-dried sludge material can be used at nonhazardous waste landfills in lieu of soil material for the top protective layer for final cover to support vegetation.*

The soil material standard for final protective layer occurs at various places within the Board's regulations at 35 Ill. Adm. Codes 811 and 812, and 817**. The District's

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*The Board's landfill regulations addressing final cover use the term "final protective layer" to identify the top cover for vegetative growth that is applied over a second "low permeability" layer. However, where there is no second low permeability layer required, as is the case with inert waste landfills and the steel and foundry potentially usable waste landfills categories, the regulations use the term "final cover" to identify the top cover for vegetative growth. In that the top final cover for vegetative growth is for protective purposes in both instances, the term "final protective layer" will be used throughout this petition.

**The Board adopted the proposal of the steel and foundry industry (R90-26, Docket A) as a final order on July 21, 1994, and it became effective on August 1, 1994. The steel and foundry amendments establish a new Part 817 for new classes of industrial landfills. These classes contain cover provisions that provide for the soil material standard essentially like that found in Parts 811 and 812.

petition is procedurally consistent with the Board's August 26, 1993 order in the Petition of Conversion System Inc. for Adjusted Standard from 35 Ill. Adm. Code Part 811 (Liner), AS 93-4 (also see Board Order of August 26, 1993 for companion Petition, AS 93-5).

FINAL PROTECTIVE LAYER

For final closure of most nonhazardous waste landfills, operators must place over a low permeability layer a top final protective layer capable of supporting vegetation. For those landfills accepting only inert wastes, or those accepting the steel and foundry industry wastes classified as potentially usable, no low permeability layer is required; just the final protective layer is required.

The top final protective layer serves a number of functions, which will be discussed in detail later in this petition. Normally, soil suitable for growing vegetation is imported to the site. The District asserts that its petition establishes that its air-dried sludge will perform all regulatory-required functions equally as well as soil.

Background

DESCRIPTION OF THE DISTRICT

The District is located within the boundaries of Cook County, Illinois, and serves an area of 872 square miles. The area served by the District includes the city of Chicago and 124 suburban communities with a combined population of 5.1 million people. In addition, a waste load equivalent to

4.5 million people is contributed by industrial sources. The District, on a daily basis, treats on the average about 1500 million gallons per day (MGD) of wastewater. This wastewater flow is treated at the District's seven water reclamation plants (WRPs).

The processing of this large volume of wastewater produces a correspondingly large quantity of sludge which must be managed. In any given year, the District generates about 200,000 dry tons of sludge at its WRPs.

The District, like most municipal agencies treating wastewater, has found that management of its sludge is one of the most difficult functions which it must perform. Factors such as increased sludge production, escalating fuel costs, air quality controls, and limited land availability have reduced the number of available options to the District for managing its sludge.

FEDERAL REGULATORY FRAMEWORK

The United States Environmental Protection Agency (USEPA) has recently promulgated two sets of regulations that are relevant to the use of sludge for the top final protective layer.

First, the USEPA regulates the type of materials which may be used at nonhazardous municipal solid waste landfill facilities (MSWLFs) through its RCRA Subtitle D regulations at 40 CFR 258, Criteria for Municipal Solid Waste Landfills, eff. October 9, 1993 (7-1-93 edition). These regulations are no barrier to Board consideration of the use of District sludge. While the closure criteria (Attachment 1) first provides for 6 inches of earthen material for the erosion layer, at Section 258.60(a)(3), p. 371, Section 258.60(b)(2), p. 371, states:

> "The Director of an approved State may approve an alternative final cover design that includes: An erosion layer that provides equivalent protection from wind and water erosion as the erosion layer specified in paragraph (a)(3) of this section."

Next, the USEPA promulgated its final Part 503 Regulations for the use and disposal of municipal sludge on February 19, 1993, with compliance with its provisions required by February 1994 (Federal Register, February 19, 1993, Vol. 58, No. 32). Although Part 503 does not regulate the use of municipal sludge for the final protective layer at nonhazardous waste landfills, in the Preamble p. 9258 (Attachment 2), the USEPA specifically endorses the use of municipal sludge as a cover material in nonhazardous waste landfills for support and enhancement of vegetative growth:

> "While the use of sewage sludge for beneficial purposes is primarily related to farm and home garden use, use of sewage sludge to aid in the growth of a final vegetative cap for municipal solid waste landfills is also considered a beneficial use of sewage sludge and should be encouraged. By taking advantage of the nutrient content and soil amendment characteristics of sewage sludge, a vegetative cover or cap can be quickly grown to facilitate the municipal solid waste closure plan."

The District notes that there is no State regulatory counterpart to USEPA's Part 503 Regulations.

STATE REGULATORY FRAMEWORK

Presently, the Board's existing regulations in 35 Ill. Adm. Codes 811, 812, and 817 do not allow District sludges to be used for the final protective layer or at nonhazardous waste landfills. Only soil material is stated for this purpose.

In April 1994, the Board received USEPA approval of the Board's amendments it adopted to conform to Subtitle D requirements. Thus, the Board's regulations became enforceable under Subtitle D. The Board's already existing requirements for the final protective layer did not need Subtitle D conforming amendments. Again, as noted above, there is no federal barrier to the Board grant of an adjusted standard.

Summary of Adjusted Standard Relief Requested

The District seeks Board adjusted standard approval of its air-dried sludge product as an innovative technology for certain applications at nonhazardous waste landfills. More specifically, the District seeks an adjusted standard for use of its sludge in the final protective layer supporting vegetation - as opposed to the low permeability layer.

The District notes that, in its first draft earlier sent to the Agency, it had included a request - now withdrawn - for Board approval of an adjusted standard for intermediate cover. The Agency challenged the need for prior Board approval, asserting that, like daily cover, the regulations allow the Agency to make such decisions through the permit process. In response, the District pointed out the inconsistencies between the imprecise regulatory language for intermediate cover and the clear regulatory language for daily cover giving the Agency authority to approve alternatives to soil. The District was also concerned about the consistency of Agency evaluation of its product in the future when responding to a landfill operator's permit or permit modification application. However, after discussion, the District did agree not to pursue this issue, and the Agency was satisfied that the use of District sludge, as compared to the use of soil, for intermediate cover presented no additional concerns.

The District believes that the performance of its air-dried sludge fully justifies its use as an alternative to the present standard specifying soil material in the regulations of general applicability.

The District sees no facility-specific or location-specific limiting factors that must be considered when using its air-dried sludge - any more than is the case with the use of soil material. Indeed, as noted earlier, the adjusted standard reflects the statement in the preamble of the recent USEPA Part 503 federal sewage sludge regulations, which expressly encourages as a beneficial use the application of sludge for the vegetative cap.

The District has received many prestigious awards for its innovative wastewater treatment and sludge management programs, from such well-known organizations as the American

Society of Civil Engineers and the USEPA. In 1974, the American Society of Civil Engineers presented the District with an award for the Fulton County Project, and in 1991 the USEPA presented the District with a special award for outstanding contributions and leadership in the beneficial use of sludge. Attachment 4 lists these and other awards and recognitions received by the District from these organizations and others.

While the District's request of the Board to use its sludge for the above requested application represents another innovative technology, such use is not new. District sludge has been used for some time at landfills for the final protective layer, as well as daily cover.

In explanation, under the Board's old Part 807 regulations, the Agency was authorized to allow the use of suitable materials for daily, intermediate, and final cover, 35 Ill. Adm. Code 807.305(a), (b), (c). What has changed is that the Board's new Parts 810 through 815 and 817 regulations now no longer provide for Agency-approved alternatives to soil material for final cover. This decision to approve alternatives for the final protective layer is now reserved to the Board.

Also, we note that, unlike the single mention in old Part 807, the soil material requirement in the new landfill regulations, from which the District is requesting relief, is essentially repeated in the final cover requirements in each of the newly created classes of landfills.

The sections specifying soil material, are:

Final Vegetative Cover. Section 811.204 (inert waste landfills), Section 811.314(c)(3) (putrescible (MSWLF)/chemical waste landfills), Section 812.313(d) (permit application for putrescible (MSWLF)/chemical waste landfill), and Section 817.303, (steel and foundry potentially usable waste landfills); and 817.410(c)(2) and (3) (steel and foundry low risk waste landfills).

The District emphasizes that it is not requesting any relief other than to permit its sludge material to be used in lieu of soil material. It is not requesting relief from any of the regulatory design or performance expectations, such as cover thickness, vegetative support, erosion control, protection of the final low permeability cover from freezing, sufficient compaction, leachate effects, and adaptability to final use, including public access.

Consultations With the Agency

The District earlier had sent a draft of its proposed petition to the Agency, followed by written exchanges and a meeting of the District with Agency staff from the Divisions of Land, Water Pollution Control, and Legal Counsel. By letter of March 21, 1995 (Attachment 3, p. 1,2), the Agency stated that all of the Agency's technical concerns have been resolved. However, the Agency also asserted that it is faced with procedural problems "unique" to the District's adjusted standard and the task of administering it, and is going to request Board guidance. While the Agency noted that the procedural aspects of its letter were not fully detailed, and thus did not request a District response at this stage, the District feels that it is important that its disagreement with the Agency's position be expressed now. The District believes that the imposition of added procedural hurdles, which the District believes are unsupportable, would threaten to sink the District's efforts to markets its sludge to landfill operators for beneficial use as the final top protective layer to support vegetation. The District would intend to later request leave to reply to the Agency's post-filing response.

At the outset, the District strongly asserts that, if the Board approves a petition of the District for an adjusted standard, the contents of that Board order, as with any Board order, specifies with what the District must comply. Accordingly it is the Board order that constitutes the District's authorization to market its complying sludge material directly to landfill operators for their use as a final protective cover as an alternative to soil material. Next, it is the Board regulations that dictate the final protective cover design and performance requirements, in 35 Ill. Adm. Code 811 and 817, with which the operators of both permitted and unpermitted facilities must comply, except that now the requirements would be the same for both District sludge and soil materials. Most important, the landfill regulations already specify the procedures the operators are to initiate when filing the Board's order with the Agency. They are contained in the procedural requirements of 35 Ill. Codes 813 and 815 for permitted and permit-exempt landfills, respectively. There is no provision for any new layer of Agency requirements, procedural or otherwise. Further - and as this petition makes clear - in contrast to most materials, the District responds to already-numerous federal and State procedural requirements that provide the long-standing assurances of quality. At the State level these assurances are evident in the District's reports to the Agency's Division of Water Pollution Control in the Bureau of Water, copies of which the District is prepared to make available to the Agency's Division of Land Pollution Control in the Bureau of Land, if that Division so desires. Consequently, the District believes that it is inappropriate for the Agency to use the District's adjusted standard petition as a vehicle for seeking "clarification" regarding its procedural/administrative problems.

The Agency identified one issue in its letter that particularly warrants some further comment. The issue concerned what procedural requirements "will be placed upon Sec. 21(d) permit-exempt facilities if they want to use District Sludge in place of soil material for final cover." (Agency March 21, 1995 letter, Attachment 3, p. 1).

During the proceedings on its proposed landfill regulations, the Board has already directly addressed the question of how onsite permit-exempt landfill facilities might proceed if desiring to use alternatives, and it does not include the imposition of new procedural requirements. The District is referring to the Development, Operating and Reporting Requirements for Non-Hazardous Waste Landfills, R88-7, (June 7, 1990), Proposed Rule, Second Notice, Board Opinion at p. 6. Page 6 of that Opinion is contained along with the Agency's letter in Attachment 3, p. 3).

In its opinion the Board noted that this is not a new problem for permit-exempt operators, except that it is larger with the new landfill regulations. The Board made quite clear that Section 21(d) of the Act makes the permit-exempt operators responsible for the use of an alternative, while noting that there may be a greater risk to the operator of enforcement if the choice fails. This is in contrast to the Agency's up-front administrative role in a permit setting. The Board then listed some options the landfill operator may desire to utilize, depending on the circumstances. One option was to seek an adjusted standard.

The District's petition for an adjusted standard is not only consistent with the Board's opinion, but is also an even more beneficial option whose benefits are not, we note, limited only to permit-exempt facilities. The District, in seeking grant of the adjusted standard beforehand, can provide up front assurance by the person responsible for the quality of the product that it can be used safely. Given that the Agency has no technical concerns with the District's proposal, and that there are no facility-specific limitations to the use of sludge by the landfill operator, the District can only conclude that the Agency is in fact struggling, as it has for some time, to find a way to cope with the frustrations flowing from the Act's Section 21(d) exemption from the permit requirements for onsite facilities. The District's petition presents nothing unique in this regard, and should not be used as a vehicle for attempting to resolve what the Agency perceives is bad law.

The Board regulations have already imposed reporting requirements for permit-exempt onsite facilities. Beyond that, the District believes that the Act does not allow the Agency to "administer" the onsite facility operations any differently under a Board-approved adjusted standard than it would were the landfill facility to use soil.

Informational Requirements From 35 Ill. Adm. Code 106.705(a) - (l)

106.705(a) - STANDARD FROM WHICH AN ADJUSTED STANDARD IS SOUGHT

The standard from which an adjusted standard is sought requires the use of soil material in nonhazardous waste landfills for the final protective layer. Unlike the formerly applicable provisions of 35 Ill. Adm. Code 807 (old Part 807), the nonhazardous waste landfills are now divided into classes. Consequently, the soil material standard is repeated in various sections of 35 Ill. Adm. Codes 811 and 812, effective September 18, 1990, and 35 Ill. Adm. Code 817, effective August 1, 1994. Please refer to subsection (f) for further explanation.

Final Protective Layer. The following sections of the Board regulations contain the standards for the final protective layer:

> Section 811.204, inert waste landfills; Section 811.314(c)(3) Putrescible (MSWLF)/chemical waste landfills; Section 812.313(d), permit application putrescible (MSWLF)/chemical waste landfills); Section 817.303, steel and foundry potentially usable waste landfills; and Section 817.410(c)(2) and (3), steel and foundry low risk waste landfills.

104.406(b)

~~106~~.705(b) - INDICATE WHETHER THE REGULATION OF GENERAL APPLICABILITY IMPLEMENTS ANY OF THE REQUIREMENTS OF THE CLEAN WATER ACT, SAFE DRINKING WATER ACT, CERCLA, CLEAN AIR ACT, OR STATE PROGRAMS CONCERNING RCRA, UNDERGROUND INJECTION CONTROL, OR NPDES

As required by Section 22.40 of the Environmental Protection Act, the Board's landfill regulations were amended (on December 16, 1993, R93-10) at 35 Ill. Adm. Code Parts 810, 811, and 814 to implement the requirements of RCRA, Subtitle D and 40 CFR 258 (Subtitle D). These amendments regarded Municipal Solid Waste Landfill Facilities (MSWLF), also classified by the Board as putrescible waste landfills. (The Subtitle D regulations do not apply to the Board's chemical or inert waste landfill regulations.) The Board received USEPA Subtitle D approval by letter on April 14,

1994. The soil material standard for which the District is requesting an adjusted standard was not altered by the Board's conforming amendments in R93-10 to implement Subtitle D.

No other federal acts or state programs were implemented by the Board's landfill regulations. The District notes that its adjusted standard, while not covered by, is nevertheless compatible with the sludge regulations of 40 CFR Part 503, and conforming amendments in 40 CFR 257, and 403 of the Clean Water Act (for which there is no state counterpart); Federal Register, February 19, 1993, Vol. 58, No. 32).

104.406(c)
~~106.705(c)~~ - THE LEVEL OF JUSTIFICATION OR OTHER INFORMATION OR REQUIREMENTS SPECIFIED IN THE REGULATION OF GENERAL APPLICABILITY OR A STATEMENT THAT THERE IS NO SUCH SPECIFICATION

The regulation of general applicability does not specify a level of justification, or other information or requirements regarding the soil material standard for which the District is requesting an adjusted standard.

104.406(d)
106.~~705~~(d) - DESCRIPTION OF PETITIONERS ACTIVITY

General Description of The District. The District is located within the boundaries of Cook County, Illinois, and serves an area of 872 square miles. The area served includes the city of Chicago and 124 communities with a population of 5.1 million people. In addition, a waste load equivalent of 4.5 million people is contributed by industrial sources, making the total population served by the District equivalent to 9.6 million people. Obviously, such a population concentration and the attendant industrial and commercial enterprises require a complex and extensive wastewater collection and treatment system. In the case of the District, this system is comprised of seven water reclamation plants and over 500 miles of intercepting sewers. The District, since its inception 105 years ago, has been at the forefront of using up-to-date processes and facilities for wastewater treatment and sludge management.

District Water Reclamation Plants (WRPs). The District's WRPs are designed to remove the soluble and insoluble organic matter in wastewater in an efficient and cost-effective manner. The final discharge from these WRPs meets or exceeds the effluent standards of the Board. The series of wastewater treatment operations that are employed to accomplish the purification process are generally classified as pretreatment, primary treatment, secondary treatment and advanced waste treatment.

The District operates seven WRPs that range in size from the 3.4 MGD (Lemont WRP), to the 1200 MGD (Stickney WRP). A listing of the daily design flows for each of the seven WRPs is as follows:

1. Lemont WRP, located in Lemont, Illinois, has a design capacity of 3.4 MGD.
2. James C. Kirie WRP, located in Des Plaines, Illinois, has a design capacity of 72 MGD.
3. John E. Egan WRP, located in Schaumburg, Illinois, has a design capacity of 30 MGD.

4. North Side WRP, located in Skokie, Illinois, has a design capacity of 333 MGD.

5. Calumet WRP, located in Chicago, Illinois, has a design capacity of 354 MGD.

6. Stickney WRP, located in Stickney, Illinois, has a design capacity of 1200 MGD.

7. Hanover Park WRP, located in Hanover Park, Illinois, has a design capacity of 12 MGD.

Generally, initial treatment at these WRPs consists of coarse and fine screens and grit chambers followed by primary settling tanks. All seven WRPs next employ the activated sludge process for secondary treatment. Tertiary treatment is employed at the John E. Egan and Kirie WRPs using dual media filters, while the Hanover Park WRP employs single media filters. The final effluents from the Hanover Park, John E. Egan and Kirie WRPs are first chlorinated and then dechlorinated before discharge.

Sludge Management. Processing wastewater is not the only aspect of wastewater treatment. Another equally important aspect is managing the sludge solids from wastewater treatment. The District generates yearly about 200,000 dry tons of sludge.

Although each WRP handles its sludge in somewhat different ways depending upon local factors, the District generally processes its sludge using the following sequence of unit operations depicted in Attachment 5.

1. Gravity Thickening
2. Centrifuge Thickening
3. Anaerobic Digestion
4. Centrifuge or lagoon dewatering
5. Lagoon storage
6. Air-drying

Solids processing at the District begins with the concentration of primary and secondary sludge in gravity concentration tanks. The sludge is then anaerobically digested in heated (95° ± 1°F) high rate digesters for approximately 20 days, to reduce odor potential and destroy pathogens. After anaerobic digestion, the liquid sludge (approximately four percent solids) is either mechanically dewatered using high speed centrifuges to approximately 25 to 30 percent solids or lagooned dewatered to produce 15 percent solids. Both the liquid sludge and the dewatered centrifuge sludge is stored in lagoons to reduce its odor potential and further destroy pathogens. The sludge stored in lagoons is air-dried on asphalt paved drying beds, using a mechanical agitation process to accelerate drying and further reduce pathogens. All air-dried sludge has a high solids content of about 60 percent, is soil-like in appearance, low in pathogens and high in plant nutrients.

Sludge Utilization By the District. In general, the District ultimately utilizes the majority of its sludge as a fertilizer, soil amendment, or soil substitute. After years of planning, the following are the options which the District presently has chosen for final disposition of its sludge product:

1. Sludge Application to Land in Fulton County, Illinois.
2. Sludge Application to Land at the Hanover Park WRP, Hanover Park, Illinois.
3. Landscaping at District WRPs.
4. Distribution to Large-Scale Users for Landscaping Purposes (e.g., Underwriters Laboratories, Worth Park District, Russell Road Interchange for the Illinois Tollway Commission).
5. Final Protective Layer for Landfills.
6. Daily Cover for Landfills.

Land Application at Fulton County. The District's Fulton County project is the embodiment of the concept of agricultural utilization of municipal sludge. Not only is the sludge used for its fertilizer value, but at the Fulton County site this sludge has the added benefit of reclaiming a previously strip-mined site.

The District currently owns 15,528 acres of mostly strip-mined land in Fulton County. Today, approximately 5,700 acres of this land is receiving sludge application, and is currently growing row crops such as corn. Previously, the land was capable of only producing livestock pasture. This increase in productivity was due to the organic matter and nutrient content of District sludge. No adverse impact on surface water and groundwater quality has been observed at the site from long-term sludge application, over the past 22 years.

Hanover Park WRP. The Hanover Park WRP contains a 120 acre farm which utilizes the sludge production from the 12 MGD Hanover Park wastewater treatment processes. Sludge is applied at the farm, which is typically planted with landscaping materials such as trees and shrubs. The applied sludge produces excellent plantings as a result of its organic matter and nutrient content.

Distribution to Private Users. District sludge is routinely utilized, mainly for landscaping purposes, under a state of Illinois permitted program (Agency Permit No. 1990-SC-1100) referred to as Controlled Solids Distribution. In this program, sludge is given to private users as a soil amendment and fertilizer. The sludge is used by such varied parties as park districts and other units of local government, industrial complexes, and commercial developers.

Landscaping of District WRPs. The District's WRPs and other facilities have been undergoing extensive landscaping to make them more aesthetically pleasing. The District has been planting trees, shrubs, flowers and grass at its WRPs. These landscaping activities require considerable top soil, and District sludge is used as an alternative. The sludge produces excellent results and has been found to have all the benefits of good top soil.

Final Protective Layer at the 103rd and Doty Municipal Solid Waste Landfill. Since 1979 the District has, with Agency approval pursuant to the old Part 807 regulations, given its sludge to landfill operators to utilize for producing a final protective layer. The single largest use of District sludge for providing a final protective layer has been at the 103rd and Doty Municipal Solid Waste Landfill. This 225 acre landfill was first covered with a low permeability layer (clay layer). It was then covered with a top layer of District sludge, which was contoured to produce an aesthetically pleasing and suitable surface for planting a vegetative cover. The use of District sludge as a final protective layer at this landfill has been extremely successful, as evidenced by the rich vegetative cover which exists there today (Attachment 6).

Illinois International Port District Site. The 103rd and Doty site, and the area immediately south are owned by the Illinois International Port District (Port District). Recently, the Port District decided to combine the two areas for development of a public golf course.

The south area contained fill material which was first covered with a clay layer that was contoured into a rolling topography, suitable for a soon-to-be-opened golf academy. District sludge was then applied as the final protective layer, after which the whole area was seeded with turfgrass. Germination and growth was aided by irrigation. The golf academy is scheduled to open in 1995. Pictures of the turf-grass at the site are shown in Attachment 7.

The 103rd and Doty Municipal Solid Waste Landfill site also was recontoured into a rolling topography similar to that of the golf academy, and will be developed into an 18-hole golf course. Since the site was already covered with a layer of sludge, no additional sludge is required before the planting of turfgrass, scheduled to take place in the fall of 1994. The golf course is scheduled to open in 1995.

Use of District Sludge for Daily Cover at Nonhazardous Waste Landfills. In 1991, under the old Part 807 landfill regulations, the District began shipping its sludge product to the CID municipal solid waste landfill, operated by Waste Management, Inc., for use as daily cover. Like soil material, this cover material reduces vectors such as rodents or flies, reduces odor emissions, and controls blowing litter and fires. Under the Board's new regulations, daily cover remains subject to Agency approval (see 35 Ill. Adm. Code 811.106). Currently, the District utilizes about 30,000 dry tons of sludge per year as daily cover at the CID landfill.

Institutional and Societal Benefits of Using District Sludge at Nonhazardous Waste Landfills. As detailed above, the District has utilized its sludge for a variety of productive beneficial purposes at nonhazardous landfills. The District has successfully utilized its sludge for building a final protective layer at the 103rd and Doty Municipal Solid Waste Landfill site and the Port District golf academy and golf course. In 1991, the District began utilizing its sludge for daily cover at Waste Management's CID site.

Utilizing sludge at nonhazardous waste landfills represents cooperation between the public and private sectors in a beneficial use program. The District as a sludge generator benefits because such a use lowers its costs of operation and keeps local taxes down. Landfill owners/operators, whether public or private, can benefit by not having to incur costs for importing soil material, thus lowering their User Charges. These costs can be significant, see 106.705(e) discussions.

The District needs as many management options for sludge as possible. The beneficial use of sludge at nonhazardous waste landfills provides a needed beneficial use option.

District sludge is a resource which should not be wasted, and in fact can be beneficially utilized. Beneficial use by nonhazardous waste landfill operators supports the concept of municipal sludge as a resource. The District believes that using its sludge for beneficial purposes at nonhazardous landfills shows its willingness to support programs where sludge can be used as a community resource, rather than as a liability. The District's belief is fully consistent with federal policy that sewage sludge can be beneficially used at landfills as evidenced by the earlier quoted preamble to Part 503, see "Federal Regulatory Framework" of this petition.

The District's efforts to minimize reliance on landfill disposal is consistent not only with federal policy, but with state policy as well. State policy is embodied in the statement of purpose contained in the Illinois Solid Waste Management Act of 1986, 415 ILCS 20/2 (b) 1992, Attachment 8 quoted in part as follows:

> "It is the purpose of this Act to reduce reliance on land disposal of solid waste, to encourage and promote alternative means of managing solid waste, and to assist local governments with solid waste planning and management. In furtherance of those aims, while recognizing that landfills will continue to be necessary, this Act establishes the following waste management hierarchy, in descending order of preference, as State policy:
>
> (1) volume reduction at the source;
> (2) recycling and reuse;
> (3) combustion with energy recovery;
> (4) combustion for volume reduction;
> (5) disposal in landfill facilities."

The five-level hierarchy lists the disposal of waste in landfill facilities as the least desirable preference, while the District's request represents a desirable preference.

Topsoil and other soils are becoming increasingly scarce in urban centers. Since less of these materials would be used at landfills if sludge were used as an alternative, the community could use these materials for other purposes at urban centers. The net landfill air-space saved by avoiding disposal is also consistent with the State's policy.

104.406(c)

~~106.705(e)~~ - EFFORTS NEEDED TO COMPLY WITH EXISTING BOARD REGULATIONS, COMPLIANCE ALTERNATIVES AND COSTS

With reference to subsection (1), the District believes that this information requirement is inapplicable. No amount of District effort will result in compliance with the regulatory requirement to use soil material. The material the District generates is air-dried sludge, generated as a component of the water reclamation processes at the District's WRPs. Air-dried sludge is not soil. In pertinent part Webster's Third New International Dictionary, 1986, defines soil as:

> "... the upper layer of the earth that may be dug or plowed; specif: the loose surface material of the earth in which plants grow, usu. consisting of disintegrated rock with an admixture of organic matter and soluble salts ..."

The District is not asserting that its sludge material is the same as soil material. The District is asserting that its air-dried sludge material can comply with the same regulatory design and performance requirements expected of soil material.

Since the new Board regulations specifically state soil material must be used for the final protective layer, the District will be prohibited in the future from using sludge as a soil substitute unless the Board grants the District's request. The District's inability to comply with the existing regulation will result in an increase in disposal costs, or costs of other more expensive options, and a loss of savings in the operation of the landfill.

In 1991, 1992, and 1993 as shown in Attachment 9, the District utilized 115,118, 25,514, and 167,053 dry tons of sludge, respectively, for providing a final protective layer for landfills in the Chicago area. If the District had been precluded during that time by Board regulations from utilizing its sludge as a final protective layer, it would have been forced to either dispose of this sludge in local landfills for a tipping fee of approximately $22/dry ton, or utilize this sludge at its Fulton County site at the same cost of $22/dry ton. Therefore, if the District had been precluded from utilizing its sludge a final protective layer for the years 1991, 1992, and 1993, the District would have been forced to spend a total of 6.77 million dollars. This expenditure did not occur in these years since the District was able to utilize its sludge as a final protective layer without incurring landfill disposal tipping fees, or the cost of transportation and sludge application at its Fulton County site. Clearly, the District would suffer a large economic burden if, in the future, the sludge management option of utilization as a final protective layer at nonhazardous landfills is precluded by Board regulations.

An adjusted standard allowing substitution of sludge for soil material in landfill closure as a final protective layer would result in substantial cost savings to the District for disposition of its sludge. The District could provide this material to landfills for use as cover rather than pay a tipping fee to dispose of it. An adjusted standard would allow the District to provide material, rather than being charged a tipping fee. In that the depth of the final protective layer has increased significantly under the new regulations, this option would represent a significant reduction in tax dollar expenditures.

There are cost savings to the landfill operator also. The cover costs for new landfills of 100 acres in Illinois was presented in the Economic Impact Study of Landfill Regulations, R88-7, p. 3-43 (Attachment 10). The final protective layer (vegetative cover) cost (1990 dollars), assuming importation of three feet of soil, was estimated to be approximately $330,000 (I.d. at p. D-16, Attachment 10). An adjusted standard allowing substitution of District sludge for soil would, accordingly, reduce these landfill operation costs.

106.705(f) - A NARRATIVE DESCRIPTION OF THE PROPOSED ADJUSTED STANDARD, PROPOSED BOARD ORDER, EFFORTS NECESSARY TO ACHIEVE PROPOSED STANDARD AND CORRESPONDING COSTS

Narrative Description. The District is requesting that the Board allow the application of the District's air-dried sludge product as an alternative to soil material wherever the application of soil material is required in 35 Ill. Adm. Codes 811, 812, and 817 as the final protective layer supporting vegetation at nonhazardous waste landfills.

The conditions in the proposed Order below reflect the USEPA's recent sludge quality provisions of the Part 503 sludge regulations (40 CFR Part 503). As earlier noted, the Part 503 Regulations include requirements for sludge when applied to land, but do not include requirements addressing landfills.

The District is not requesting any relief other than to use its sludge as an alternate to soil. It intends to comply with all other provisions, including cover thickness, vegetative support, erosion control, protection of the final low permeability cover from freezing, sufficient compaction, leachate effects comparable to clean soil, and final use and public access.

The District has been applying its sludge as cover material under Agency authorization under the provisions of old Part 807, 35 Ill. Adm. Code 870.305(a), (b), and (c). However, the District is requesting Board adjusted standard approval because it construes those sections in Parts 811, 812, and 817 which articulate the standard of soil material for final protective layer as requiring Board authorization to use alternatives to soil material. (Also see subsection (e)).

The sections specifying soil material, with brief notations, are:

Final Protective Cover. Section 811.204. Inert Waste landfills where no low permeability layer is required,

> "... a minimum of 0.91 meters (3 feet) of soil material that will support vegetation ..."

Section 811.314(c)(3). Putrescible (MSWLF)/chemical waste landfills,

> "The final protective layer shall consist of soil material capable of supporting vegetation."

Section 812.313(d). Permit application for putrescible (MSWLF)/chemical waste landfills, "A description of final protective cover, including a description of the soil and the depth necessary to maintain the proposed land use of the area; ..."

(Note however: Section 812.203 re: Inert waste landfills, asks only for description of "materials" to be used.)

Section 817.303. Steel and foundry potentially usable waste landfills,

"...a minimum of 0.46 meters (1.5 feet) of soil material that will support vegetation which prevents or minimizes erosion shall be applied over all disturbed areas."

Section 817.410(c)(2) and (3). Steel and foundry low risk waste landfills, final protective layer,

"... shall not be less than 0.46 meters (1.5 feet), and ... shall consist of soil material capable of supporting vegetation."

Proposed Order. The District, in accordance with the requirement of 106.705(f) proposes the following language for the adjusted standard to use District air-dried sludge as a substitute for soil material in the final protective layer:

Order

A. Pursuant to the authority of Section 28.1 of the Environmental Protection Act, the Board hereby adopts the following adjusted standard. This adjusted standard applies only to the air-dried sludge product generated by the Metropolitan Water Reclamation District of Greater Chicago (District).

B. District sludge that complies with the conditions in paragraph C below is approved as an alternative to the soil material standard at the inert waste, the putrescible (MSWLF) and chemical waste landfills, or the steel and foundry industry potentially usable and low risk waste classes of landfills regulated at 35

Ill. Adm. Codes 810-815 and 817, for application as the final protective layer, as the final cover. The sections where the soil material standard is used are: 35 Ill. Adm. Codes 811.204, 811.314(c)(3), 812.313(d), 817.303 and 817.410(c)(2) and (c)(3).

C. When providing sludge for the applications enumerated in Paragraph B, the District shall provide air-dried sludge as described in its petition for adjusted standard and processed in accordance with the following conditions:

1. Anaerobic digestion at 95° ± 1°F for a minimum of 15 days or longer, as necessary to ensure that the District's air-dried sludge product will meet the USEPA's Part 503 pathogen requirements for a Class B sludge; and

2. Storage in lagoons for a minimum of 1 and 1/2 years after the final addition of sludge; and

3. Air-drying for a minimum of 4 weeks, or as necessary to achieve a solids content of 60 percent.

D. When providing sludge for the applications enumerated in Paragraph B, the District shall limit the amount provided to what it estimates is sufficient to comply with the minimum depth required in the Board regulations, or in greater amounts as needed to accommodate the intended land-use including appropriate contours, final slopes, vegetation, drainage and erosion controls, and to protect the final low permeability layer against such threats as freezing and root penetrations.

Please note that the District voluntarily inserted paragraph D in the proposed <u>Order</u> not because of a problem unique to sludge, but rather because the District believes that, as a matter of good public policy, excessive depth in the final protective layer should be avoided. The District proposed to add paragraph D when the Agency, after noting that the landfill regulations require a minimum but not a maximum final protective layer depth, expressed frustration at its perceived inability to prevent an eyesore when at least one permitted landfill piled-on huge amounts of soil (not sludge) for its final protective layer. In adding the condition, however, the District is not suggesting that it construes the Board's regulations as allowing such an unlimited maximum, but it does recognize that the Board has not addressed this issue. Meanwhile, the District proposes to use its adjusted standard as a vehicle to respond to the problem with regard to its sludge. Finally, note that the minimum required cover depth in the condition was not specified as three feet because certain provisions in Part 817 allow lesser minimum depth.

The District has always strived to beneficially utilize its sludge in an environmentally safe manner. Achieving the above described adjusted standard would allow the District to continue such beneficial use. By utilizing sludge at landfills as final protective layer rather than disposal as a waste, both the District and landfill operators would benefit from significant cost savings. Disposal fees charged to the District would be avoided, and soil importation costs by landfill operators would be reduced.

The District believes that there is a marked distinction between utilization and disposal of sewage sludge in non-hazardous waste landfills. While large quantities of sludge may be disposed of in landfills, similarly, large quantities can also be beneficially utilized as a soil substitute in the final protective layer. The difference is the intention to derive benefit. If sludge is placed within the landfill (tipped in) with no intention to derive a benefit, it is being disposed of. However, if the same amount of sludge is placed on top of the landfill's low permeability layer for the intention of providing final cover, to supply nutrients and moisture to a vegetative layer, to provide physical protection of the impermeable layer, and to conserve our natural soil resources, the sludge is being beneficially used with positive multilateral economic returns.

The data presented in Attachment 9 show the sludge utilization and disposal practices for the District from 1991 through 1993. As discussed previously, if the District were precluded in 1991 through 1993 from using its sludge for the final protective layer at nonhazardous landfills, the total actual cost for utilization at the Fulton County site (with a cost of $22 per dry ton), and in private landfills (with a tipping fee of $22 per dry ton) would have been 6.77 million dollars. Clearly, the District will suffer a severe economic burden if, in the future, the sludge management option of utilization as a final protective layer at nonhazardous landfills is precluded by Board regulations.

The District believes that using sludge in the final protective layer at nonhazardous waste landfills is an important option for future sludge management. The quality of sludge produced by the District is consistent, because the treatment and processing methods used help to minimize variability. The total solids, pathogen, and elemental content of District sludge are more consistent than the variation of chemical and physical characteristics of soil materials. Sludge texture is consistent and does not vary in texture like soils. These characteristics make sludge an effective substitute for soil in the final protective layer. Establishing an effective long-term vegetative cover in the final protective layer is important, and using sludge of consistent quality will assure that the vegetative cover is established.

The District points out that its adjusted standard has added environmental "comfort level" regulatory testing and reporting components beyond what would ordinarily be the case when the Board considers materials proposed for adjusted standards: the proposed order contains a condition that relies on the provisions of an established federal regulatory program for ongoing quality control; and the data concerning the quality of District sludge has long been reported to the Agency as part of the regulatory oversight of the Agency's Division of Water Pollution Control.

<u>Efforts to Achieve Proposed Standard and Corresponding Costs</u>. In reference to the provisions in subsection (1), the specificity of the cost information requirement is not fully applicable, and unduly burdensome to prepare in the manner requested. While the District's costs relate to its responsibility to assure that the quality of the air-dried sludge delivered to the landfill operator is sufficient to

perform as would soil material, it would be quite difficult to separate those costs, with any specifity, from the District's large investment over the years to develop alternatives to disposal. The District's planning effort has long been directed towards implementing a program for multiple beneficial uses of sludge. Such uses include landscaping and gardens, golf courses, strip mine reclamation, and agricultural application - not solely for landfill cover.

The District can generally say that its efforts to upgrade its sludge management program over the past 25 years amounts to over 472.7 million dollars. The effort inimplementing these programs and upgrading its WRPs has been substantial. This total cost includes: (1) the cost of land purchase (15,528 acres) in Fulton County, Illinois; (2) developing the Fulton County site for land application of sludge; (3) adding anaerobic digesters to WRPs; (4) developing air-drying cells for dewatering sludge on asphalt drying pads; (5) adding centrifuges to dewater sludge at the Calumet, Stickney, and John Egan WRPs; (6) upgrading railroad facilities to haul sludge to the sludge drying cells; (7) upgrading sludge storage lagoons; and (8) other items related to sludge management activities.

The District also notes that the grant of an adjusted standard to the District does not relieve the landfill operators (whether required to have a permit or not, whether utilizing sludge or not) from complying with the standards for applying and maintaining final cover. While there may be cost savings using sludge, see Subsection (e), compliance with these standards remain the same.

106.705(g) - QUANTITATIVE AND QUALITATIVE IMPACT OF ADJUSTED STANDARD ON THE ENVIRONMENT

District sludge is produced by air-drying lagooned anaerobically digested primary and waste-activated sludge. This sludge has been routinely analyzed by both the EP toxicity test and, subsequently, the Toxicity Characteristic Leaching Procedure (TCLP) test, and has always been found to be nonhazardous. The District has found that air-drying to 60 percent solids produces a material with no free water as demonstrated by results of the paint filter test. District sludge, therefore, meets all the analytical requirements for use at nonhazardous waste landfills, and it is soil-like in appearance.

District Routine Sludge Monitoring. The District routinely analyzes sludge from each of its WRPs weekly to monitor metal content. The District notes that the Part 503 Regulations only require that the District analyze sludge from its WRPs on a monthly basis. Sludge quality has generally met the Part 503 high quality sludge regulation limits for land application since 1993, as a result of rigorous monitoring and enforcement conducted by the District's Industrial Waste Division. Recent District data indicates that lead in the Stickney digesters sometimes has exceeded the USEPA limits for high quality sewage sludge. A significant source of this lead is nonpoint runoff into combined sewers after rainfall. The District is currently undertaking a program to determine the routine and extent of lead inputs to the Stickney WRP. This program will lead to actions which will reduce lead inputs to this WRP and ultimately compliance with the Part 503 high quality sludge limits.

All sludges sent to landfills are analyzed annually by the TCLP test, and the paint filter test in accordance with the state landfill regulations. Sludge samples from each WRP are analyzed annually for priority pollutants as a further check on sludge quality.

The District's sludge production and management activities are covered by the 40 CFR Part 503 Regulations, as well as the Agency's sludge management permits. The District, therefore, routinely reports sludge analyses to both the Agency's Bureau of Water, Division of Water Pollution Control, and Region V of the United States Environmental Protection Agency. This monitoring includes determining the concentration of metals under the Part 503 Regulations and conducting the toxicity characteristic leaching procedure (TCLP), as specified in Section 811.404 of the Board's existing regulations, for sludge going to landfills. The District notes that its testing has never shown any hazardous characteristics. The District also notes that any Agency concern about sludge composition was resolved during prior consultations with Agency staff.

103rd and Doty Landfill Site. In 1982, the District began to participate in the closure of the municipal solid waste landfill at 103rd and Doty Avenue in Chicago. The District provided the engineering expertise and materials to perform final closure. The closure plan was approved by the Agency in 1982. Closure was performed by contouring the site, establishing surface runoff controls, covering with a two-foot clay seal, and then applying sludge. As each area was completed, grass and shrubs were planted to control erosion. The result has been an aesthetically pleasing site with environmental safeguards.

Part of the closure plan called for installation of four monitoring wells installed in the limestone aquifer underlying the site. The wells are sampled quarterly, and results are sent to the Agency Division of Land Pollution. There has been no significant change in groundwater quality in the ten years of monitoring.

Agency Approved Use of Sludge for Establishing Final Protective Layer on Coal Refuse Piles. The District has been using sewage sludge for establishing a final protective layer on coal refuse piles at its Fulton County, Illinois, land reclamation site since 1987. The application of sludge for reclaiming all coal refuse piles at the Fulton County site has been conducted under Agency Permit No. 1993-SC-4294. The District has used sludge at three coal refuse pile sites to establish a final protective layer that supports vegetation.

Initial reclamation activity started in 1987 at the St. David, Illinois, coal refuse pile. The coal refuse pile is 119 acres in size. The approved reclamation procedure consisted of preliminary grading, application of agricultural limestone, application of sludge at the rate of 1,000 dry tons per acre, planting of a vegetative cover, and mulching the planted area. Planting of vegetative cover consisted of seeding with cereal rye grass as a cover crop followed by seeding with alfalfa, alsike clover, bromegrass, and tall fescue. The St. David, Illinois, coal refuse pile was completely reclaimed with excellent vegetation cover using the described procedure by 1990.

Reclamation of a second coal refuse pile at the Morgan Mine site, consisting of 27 acres, was completed in 1991 with the approval of the Agency. Using the same procedure previously described, District sludge was incorporated at the rate of 1,000 dry tons per acre into the coal refuse material to establish a final protective layer that supported vegetation. An excellent vegetative cover was established consisting of alfalfa, alsike clover, bromegrass, and tall fescue.

The United Electric coal refuse pile, consisting of 125 acres, was reclaimed with the assistance of the Abandoned Mine Lands Reclamation Council (AMLRC) in a unique joint venture with the District. The AMLRC is a state agency whose function is to correct environmental and public safety problems associated with former coal mine sites throughout the state of Illinois. A contractor for the AMLRC regraded the coal refuse pile in 1990, and placed a clay mine soil cover over the coal refuse pile. In 1991 and 1992, the District applied 1,000 dry tons per acre of sludge to the mine soil cover to establish a final protective layer that supports vegetation. An excellent vegetative cover consisting of alfalfa, alsike clover, bromegrass, and tall fescue was established.

Reduction in the potential for surface and groundwater contamination. One of the concerns of utilizing municipal sludge for productive purposes at nonhazardous waste landfills is the impact upon the quality of leachate from these landfills. Obviously, leachate can affect the groundwater under these landfills. However, there has been a USEPA study of the quality of leachate, where both municipal sludge and municipal solid waste were placed in a landfill, which should alleviate these concerns.

Farrell et al. "The Effects of Sewage Sludge on Leachates and Gas from Sludge Refuse Landfills," Presented at the Residuals Conference of the Water Pollution Control Federation, Atlanta, Georgia, April 19, 1988) of the USEPA (Attachment 11), reported that the addition of municipal sludge to landfills in fact improved the quality of leachate. During a 20-month study, test cells containing municipal sludge, and municipal solid waste produced a leachate exhibiting a chemical oxygen demand (COD) of 1500 mg/L in comparison to a leachate COD of 30,000 mg/L produced from test cells which did not have the municipal sludge. This represents a COD reduction of 95 percent. In addition, as shown in Attachment 12, concentrations of metals such as Cd, Cr, Cu, Pb, Ni, Fe, and Zn were lower in the leachate from the cells containing municipal sludge than those which did not. The reductions in metals ranged from a low of 19 percent in the case of Cu to a high of 97.5 percent for Zn.

Farrell et al., concluded from their study the following:

> "It is a common misconception that introducing sludge into landfills degrades leachate quality. This study shows the reverse to be true. Results of this investigation should be made widely available to EPA and state authorities concerned with landfill regulations to improve the scientific basis for their decisions."

The use of District sludge at landfills would result in outcomes consistent with the conclusions of Farrell et al., in that it would reduce the potential for leachate contamination of surface and groundwater at landfills by improving the quality of any leachate generated.

The District believes that the groundwater and surface water protection requirements of the Board's landfill regulations ensures that the use of District sludge will not adversely impact surface and groundwater quality at nonhazardous waste landfills. Any surface water runoff from the final protective layer containing sewage sludge should be classified as storm water runoff that can be captured in control structures built for a 25-year storm. Following consultations, the Agency agrees.

<u>Sludge Quality</u>. The District has a pretreatment program and processing operations to control the quality of the sludge produced. These activities are conducted to assure a

quality sludge. These programs and operations have been implemented to develop a stabilized sludge that is high in total solids, low in pathogens, low in odor potential, and low in metal concentrations.

Industrial Waste Pretreatment. The means of controlling the levels of the metals in the sludges generated by the District's treatment process is to control the input at its source. The District has in place an extensive Industrial Waste Pretreatment Program which has been approved by the USEPA, and is consistent with the Board's pretreatment regulations. The core of this program is the District's Sewage and Waste Control Ordinance, which specifies limits on the quality of waste discharged by industrial users into the District's sewerage system. The Ordinance contains both the federal categorical pretreatment standards and the District's local limits. Categorical standards have been promulgated by the USEPA for specific industrial categories, and are performance standards for specific pretreatment process streams. Metal limits are included for a number of categories, such as electroplating, metal finishing, nonferrous metal manufacturing, etc.

The District's local limits are maximum concentration limits which are acceptable for discharge of wastes into the sewerage system under the jurisdiction of the District. The metals being regulated include cadmium, chromium (total), chromium (hexavalent), iron, lead, mercury, nickel, and zinc. These local limits apply to all industrial discharges.

The industrial pretreatment program controls 3,500 commercial and industrial dischargers, including 950 industrial dischargers regulated by USEPA categorical standards. Surveillance of these industries is an ongoing activity. The District, as part of its Industrial Waste Pretreatment Program to ensure compliance with the Part 503 Regulations, monitors on a continuous basis 152 industries known to be sources of the metals of concern. These industries are sampled 24 hours a day, seven days a week, 52 weeks a year. This is in addition to the routine surveillance of other industrial users within the District's system. The impact of the Industrial Waste Pretreatment Program on the reduction of cadmium at the District's Calumet WRP, in response to the Part 503 Regulations, is shown in Attachment 13.

The industrial surveillance and enforcement of the District's ordinance is carried out by the Industrial Waste Division of the Research and Development Department. This Division also administers the User Charge Program for collection of revenues from Tax-exempt and Large Commercial-Industrial Users. The Industrial Waste Division has a total of 196 persons, including engineers, pollution control officers, water samplers, and support staff. Out of the total staff of 196, 132 persons are in the Field Surveillance Section. The total 1994 budgeted cost of the Industrial Waste Division is $12,712,132.

Sludge Processing. The primary and waste-activated sludge generated at the District's WRPs is processed to achieve stabilization, dewatering, and inactivation of pathogenic organisms. The District's sludges are first treated in anaerobic digesters, and the digested sludge is then processed through two sludge processing trains (SPTs). These are the low solids SPT (LSSPT) and the high solids SPT (HSSPT) as shown in Attachment 5.

The input to the LSSPT is digester drawoff containing about 3 to 5 percent solids. In the LSSPT, aging and dewatering of the digester-draw is carried out in lagoons for approximately five years. A well-stabilized sludge containing 15 percent solids is taken out of the lagoons at the end of the aging period and air-dried on paved drying cells.

The input to the HSSPT consists of aging (stabilization of solids and inactivation of pathogens) the centrifuge cake in lagoons for approximately three years, and then air-drying the aged centrifuge cake on paved drying cells. A description of the unit processes comprising the LSSPT and HSSPT is given below.

Digesters. Both the LSSPT and HSSPT begin with the stabilization of the sludge settled in the primary settling tanks (primary sludge), and the waste-activated sludge collected from the secondary settling tanks (secondary sludge) of the District's WRPs with high rate anaerobic digesters. The primary and secondary sludges are combined and concentrated to approximately five percent solids, and subjected to anaerobic digestion in high rate digesters at a detention time of about 20 days at 35° ± 1°C. Under these conditions stabilization of the volatile solids contained in the sludge takes place, and a well-stabilized sludge with a low odor potential is produced. In addition, a significant reduction of fecal coliform bacteria and other pathogenic organisms, including viruses, helminths, and Salmonella, takes place. Anaerobic digestion as practiced at the District is a process to significantly reduce pathogens (PSRP), as defined by the USEPA, and the sludge produced from the District's anaerobic digesters conforms to the Class B sludge criteria as described in the Part 503 Regulations, pp. 9400 and 9404 (Attachment 14).

Lagoons. In the LSSPT, roughly half of the anaerobically digested sludge produced at the Districts WRPs is dewatered, and stabilized by aging in lagoons for about two to three years. During this process further inactivation of indicator and pathogenic organisms also takes place to a signisignificant extent. About a four-log reduction of fecal coliform organisms occurs due to lagoon-aging. A sludge containing approximately 15 percent solids is produced from the aging, stabilization, and dewatering that occurs in the lagoons. The odor potential of the sludge is also considerably reduced due to lagoon aging. The effect of lagoon aging on the fecal coliform content of centrifuge cake is shown in Attachment 15.

Centrifuge and Centrifuge Cake Aging in Lagoons. In the HSSPT, the other half of the anaerobically digested sludge produced at the District's WRPs is conditioned with a high molecular weight cationic polymer and dewatered in centrifuges to produce a cake containing about 25 to 30 percent solids. This cake is aged in lagoons for a minimum of 18 months to achieve further stabilization of volatile solids and inactivation of pathogenic and indicator organisms. As indicated previously, about a four-log reduction in fecal coliforms occurs due to lagoon aging.

Drying Beds. The lagoon-aged/dewatered sludge at 15 percent solids content (LSSPT sludge) and the aged centrifuge cake at about 25 to 30 percent solids content (HSSPT sludge) are air-dried on paved drying beds during the summer season to a solids content of 60 percent. Currently, this is achieved by completely turning, aerating, and agitating the sludge applied onto the drying cells using a tractor with a horizontal auger or a tiller. In the case of the LSSPT, the lagoon-aged/dewatered sludge containing 15 percent solids is subjected to air drying for six weeks to achieve a dried sludge containing 60 percent solids content. Similarly, in the HSSPT the minimum drying time used for the lagoon-aged centrifuge cake (25 to 30 percent solids) is four weeks to achieve 60 percent solids content. Precipitation plays a significant role in the drying time for sludge on the drying beds. Attachment 16 shows the drying rate for sludge during periods of low and high precipitation. Further inactivation of indicator and pathogens occurs in the drying process of both the LSSPT and HSSPT. Data show that a further reduction of 70 percent on an average occurs in fecal coliforms from the end of the lagooning process through the air-drying process.

Pathogens. The District's sludge processing produces a very stabilized sludge that is low in pathogens, and low in odor potential. The gravity thickening, centrifuge thickening, anaerobic digestion, centrifuge or lagoon de-watering, storage in lagoons for no less than 18 months, and the air-drying with agitation for no less than 4 weeks re-sults in a marked reduction in the pathogen content and the odor potential. The sludge produced has a solids content of about 60 percent, is soil-like in appearance, and is an effective substitute for soil in the intermediate and final protective layers of nonhazardous landfills.

The District is routinely producing Class B sludge with respect to the pathogen requirements in the Part 503 regula-tions. Although there are no regulatory reasons for doing so, the District believes that the production of sludge meeting the Class B pathogen requirements is an additional benefit which makes the sludge even more attractive as a soil substitute in the final protective layer, and the inter-mediate cover of nonhazardous landfills.

The District has evaluated the survival of microorgan-isms in sludge-amended soils at its Fulton County, Illinois, land reclamation site. This data is shown in Attachment 17, and it is taken from "Bacterial Levels Resulting from the Land Application of Digested Sludge," by P. O'Brien, S. J.

Sedita, D. R. Zenz, and C. Lue-Hing, pp. 255-268, in Proceedings of the First Annual Conference of Applied Research and Practice on Municipal and Industrial Waste, Madison, Wisconsin, 1978.

Metals. The District has implemented a program to produce sludge meeting the metal concentration limits for high quality sludge under the Part 503 Regulations. Sewage sludge currently being produced is meeting the metal limits required to meet this criteria. However, because of the process train previously described, including lagooning for more than 1 1/2 years, final sludge product meeting the lower metals levels of the Part 503 Regulations will not be available for routine distribution until 1997. The Part 503 metal concentration limits for high quality sludge are: 41 mg As/kg, 39 mg Cd/kg, 1200 mg Cr/kg, 1500 mg Cu/kg, 17 mg Hg/kg; 75 mg Mo/kg, 420 mg Ni/kg, 300 mg Pb/kg, 36 mg Se/kg, and 2800 mg Zn/kg.

The District has implemented this program to allow sewage sludge to be used for land application under the Part 503 Regulations. There is no regulatory requirement for sludge meeting the described metal limits to be used as a soil substitute in the final protective layer and the intermediate cover in nonhazardous landfills. The District does not believe that the metal concentrations present a problem when used as landfill cover. As noted earlier, the USEPA does not believe so either.

Proposed Substitution of District Sludge for Soil Material at Nonhazardous Landfills. 35 Ill. Adm. Code 811.314(c) and the other similar sections cited in 106.705(f) states that the final protective layer is to consist of soil material capable of supporting vegetation. Section 811.314(c) and newly adopted Part 817.410 also state that the final protective layer shall be sufficient to protect the low permeability layer from freezing, minimize the root penetration of the low permeability layer, and not be less than 0.91 meter (3 feet) in thickness, or 1.5 feet as indicated in Part 817.410.

The District proposes the use of its air-dried sludge as an alternative to soil material in the final protective layer at nonhazardous landfills. The purpose of the final protective layer is to protect the low permeability layer from freezing and desiccation, and to minimize root penetration of the low permeability layer. This final protective layer must be capable of supporting vegetation. The final cover with vegetation helps prevent rainfall from entering the landfill and, thereby, reduce leachate generation. District sludge is particularly suitable for performing this task. As earlier noted, the USEPA agrees.

District sludge has many beneficial chemical and physical properties that makes it fully capable of serving as an effective substitute for soil material as final protective layer at nonhazardous landfills. The typical chemical composition of beneficial constituents in the District air-dried product is shown in Attachment 18.

The nutrient content in District sludge is beneficial for supporting a vegetative cover. Nitrogen and phosphorus in sludge are major constituents needed for plant growth. Other constituents in sludge beneficial to plant growth include potassium, sulfur, and the micronutrients iron, manganese, zinc, and copper.

The organic matter in applied sludge is very important because it has several environmental properties. Sludge-applied organic matter supplies many plant nutrients, and increases the organic matter content of soil, which is very beneficial because it improves the capacity of the soil to store and hold water and increases plant growth. The potential for erosion on sludge-amended soils is reduced because the addition of organic matter to soils stimulates microbial activity, which leads to increased aggregation of soil particles, and this in turn results in increased soil stabilization. The increased soil stabilization decreases the soil particle detachment during rains, thus reducing the potential for soil erosion, thereby, improving the seedling emergence of the vegetative cover and planted crops.

Sludge-applied organic matter also increases the cation exchange capacity of soils. The cation exchange capacity is the sum total of exchangeable cations such as calcium, magnesium, potassium, and sodium that a soil can absorb. Soils with higher cation exchange capacity have a higher buffering capacity against changes in soil pH, which is beneficial. Such soils tend to have more available nutrients for plants.

The Agency in prior consultations expressed concern, now withdrawn, about the decomposition of sewage sludge. Approximately 67 percent of the District's final sludge product is composed of resistant mineral material, similar in composition to natural soil minerals. The third of the solids which are composed of organic matter (volatile solids) are also very stable because of the previously described sludge processing procedures.

Under conditions where sludge organic matter would be most likely to decompose, in sludges that are applied to soils and disk incorporated, very little decomposition occurs. Attachment 19 illustrates that ten years after sludge applications to select fields at the District's Fulton County site had ceased, only about 10 percent of the total organic carbon - not the total sludge mass - that had accumulated in the soils at the District's Fulton County site had decomposed. This would indicate that one could expect about one percent of the sludge volatile solids to decompose each year and, since the sludge is composed of approximately 33 percent volatile solids, only 0.33 percent of the total sludge would decompose annually. The loss of less than 5 percent of the total sludge mass over a ten year period is equivalent to normal soil settlement, and certainly not a cause for concern.

Further, one can expect that with time, the rate of decomposition of residual organic matter will decrease significantly.

The Agency had earlier requested clarification during prior consultations about the compaction characteristics of sludge. All earthen materials, including clay, sand, and all solids can be compacted, and all settle with time, so sludge is not alone in this regard. As with soil materials, provisions can be made to supply additional quantities of sludge to compensate for expected settlement or compaction so that a final desired thickness is achieved.

The District has a 1994 consulting report which describes the engineering properties of District sludge. A copy of this report titled "Geotechnical Study, MWRDGC Processed Sludge Study, Various Facilities, Metropolitan Water Reclamation District of Greater Chicago, Cook County, Illinois" prepared by the Claude H. Hurley Company is attached (Attachment 20). This report demonstrates that District sludge has excellent engineering properties and is similar to soil.

The impacts of sewage sludge on chemical and physical properties of soils is well recognized, and these impacts make sludge a particularly effective substitute for soil material in the final protective layer of nonhazardous landfills. As noted earlier, successful use of District sludge at the city of Chicago solid waste disposal site at 103rd Street and Doty Avenue in Chicago, Illinois, provides a particularly illustrative example. The dense vegetative cover at this site has reduced erosion and rainfall intrusion, thus, reducing leachate production and the potential for surface and groundwater contamination. All these factors help make District sludge an effective substitute for soil in the final protective layer of nonhazardous landfills.

While District sludge cannot be compressed as readily as most soil materials, because of the pore size distribution in the sludge, sludge will be as effective, if not more effective, than soil materials at minimizing infiltration. Sludge pores are very fine (small diameter) and they are not very permeable to water. Sludge pores are similar to the fine pores in a compacted soil material. The hydrophobic nature of the organic material in the sludge further reduces the permeability of the material to water, especially when air-dried sludge is utilized. This property of sludge makes it slow to "wet up" and, hence, dramatically reduces its permeability. If enough rainfall occurs within a short enough period, the sludge will eventually "wet up," but permeability will still be low due to the fine size of the pores. Because the pores in sludge are so fine, the total pore volume of District sludge is large. This means that District sludges can hold large volumes of water (three to four times its weight) before becoming saturated. In essence, the sludge would behave like a giant sponge, retaining rainfall and preventing it from permeating the landfill, and then releasing it through evaporation into the atmosphere. This would also minimize runoff from the site.

Finally, District sludge can be graded to prevent standing water as easily as any soil material. District sludges have been used for landscaping around the District's seven WRPs, and at numerous sites in Cook County, and there have never been any problems grading the sludge to any slope or contour desired.

106.705(h) - A STATEMENT OF JUSTIFICATION FOR THE PROPOSED ADJUSTED STANDARD

Section 28.1(a) and (c) of the Act and the companion section of the Board's procedural rules at 35 Ill. Adm. Code 706.903 address Board considerations when reaching its decision on the District's petition. The District asserts that its petition has provided sufficient justification in all respects to support the Order as proposed in response to Section 106.705(f).

The District will first address Section 28.1(a) of the Act.

Section 28.1(a) states that the justification is to be consistent with Section 27(a) of the Act. Section 27(a) states what the Board shall take into account as follows:

> "... In promulgating regulations under this Act, the Board shall take into account the existing physical conditions, the character of the area involved, including the character of surrounding land uses, zoning restrictions, the nature of the existing air quality, or receiving body of water, as the case may be, and the technical feasibility and economic reasonableness of measuring or reducing the particular type of pollution."

The District believes that its petition provides ample justification for its assertion that its air-dried sludge will comply equally with soil material, and with the requirements articulated in the Board's landfill regulations for the top final protective layer, regardless of local conditions, local persons, or individual sites.

There is no indication in the record of the R88-7 landfill proceedings that the Board took into account any local limitations that would render the District's justification inconsistent with Section 27(a). The District also notes that use of its air-dried sludge as an alternative to soil does not require any special locally-related design or operating adjustments by the landfill operator in order to comply with the Board's regulations.

Regarding interactions with the Agency, the operator would follow the procedural requirements for permitted landfills in Part 813 of the Board's regulations, or the procedural requirements for landfills exempt from permits in Part 815. (The District notes that it appears that landfills still applying final cover under the two year requirement to initiate closure pursuant to Part 814 Subpart E would continue to be subject to old Part 807.)

The justification for the use of District air-dried sludge is certainly consistent with the "technical feasibility and economic reasonableness of measuring or reducing the particular type of pollution" considerations of Section 27(a). Since the District believes that it has demonstrated that its sludge material can match all requirements applicable to soil material, its justification is inherently consistent with Section 27(a) considerations.

In any event, the record of proceedings in R88-7 does not show any technical feasibility considerations that would be inconsistent with the District's justification. And certainly, the District's petition, e.g., 106.705(3), shows that the economic reasonableness of putting District sludge to productive use is consistent with the Board's earlier Section 27(a) economic reasonableness considerations.

The rationale underlying the final protective layer requirements was discussed in "A Background Report" of March 7, 1988 (Report). The report was submitted by the Board's scientific/technical personnel, and was formally appended as an integral part of the Board's formal considerations in its final opinion adopted in support of its final order in Development, Operating, and Reporting Requirements for Nonhazardous Waste Landfills, Adopted Rule, Final Action (August 17, 1990), R88-7.

Regarding final cover, the number of layers needed for final cover was addressed in the Report, on pp. 56 and 57, in terms of both technical feasibility and economic reasonableness. The report concludes that two layers were considered sufficient, one low permeability layer and a final protective layer. In terms of the final protective layer, the areas of concern were: that the layer would be of a depth sufficient to accommodate the intended land use including the appropriate vegetation, and would be of a depth sufficient to protect the low permeability layer from freezing; that there would be well-graded soils that were easily drained; and that preferably such soils would contain sufficient organic matter, such as peat. From a technical feasibility standpoint, District air-dried sludge has been demonstrated to perform as well as, or better than, soil material in terms of the above considerations.

The District will next address the provisions of Section 28.1(c).

Section 28.1(c) applies to the District's petition because the regulation of general applicability does not specify a level of justification. Therefore, "... the Board may grant individual adjusted standards whenever the Board determines, upon adequate proof by petitioner, that:

1. <u>Factors relating to the District are substantially and significantly different from those relied on by the Board in adopting the landfill regulations</u>.

The District submits that use of the District's air-dried sludge was never discussed in the landfill regulatory proceedings and, thus, those factors relating to the use of District sludge are substantially and significantly different from those relied on in relation to the soil requirement. The District notes that, during the time that the Board was developing the landfill regulations, and until quite recently, the District was uncertain how ongoing state and federal regulatory proceedings addressing the management of landfills generally, and sludge specifically, would affect the District's sludge management program regarding landfill cover application. The District was, necessarily it believes, primarily involved in the development of the USEPA's Part 503 sludge regulatory program during this time. Now that the Part 503 Regulations as well as the RCRA Subtitle D Regulations are in place, the District believes that its request for adjusted standard is now timely.

2. The existence of the factors relating to the District justifies an adjusted standard.

The District's petition shows its long-time investment in innovative technologies, in terms of both sludge characteristics and management initiatives, in order to put its sludge to productive uses, including its use for the cover purposes requested in this petition. The District firmly believes that the factors relating to the District fully justifies the adjusted standard. The loss of the beneficial productive use of District air-dried sludge for the purposes requested would indeed be significant in both environmental and economic terms. District air-dried sludge is at least environmentally equivalent to soil, and is economically superior, and is consistent with both state and federal stated beneficial use policies.

3. The requested standard will not result in environmental or health effects substantially and significantly more adverse than those the Board

<u>considered when adopting the landfill regulations</u>.

The District believes that this adjusted standard petition has amply demonstrated that not only are there no substantially or significantly more adverse environmental or health effects, but in some respects the adjusted standard is superior to those effects considered by the Board when it established the use of soil material for the final protective layer and intermediate cover in the landfill regulations. The results of extensive laboratory and field research that has been performed on District sludge confirms this, see e.g., 107.705(g). The sludge produced by the District has been shown to be of consistent quality in terms of its total solids, pathogen, elemental content, and texture. The variability of these components in District sludge is less than the variation in the texture, and the chemical and physical characteristics of soil materials used in the final protective layer of landfills. The District's petition shows that its air-dried sludge: can be worked like soil; contains fertilizer for encouraging speedy vegetative growth; can protect the low permeability layer in the final cover from freezing; has sponge-like capacity to hold excess moisture to lessen erosion; can act to enhance leachate quality; has pathogen and metal content controls sufficient to provide a sludge suitable for public access; and its use has no greater pollution potential for surface water or groundwater than does the use of soil.

4. The District's adjusted standard is consistent with any applicable federal law.

The District's petition shows that the adjusted standard would be consistent with federal law, both with RCRA Subtitle D and with 40 CFR Part 503, and would represent a beneficial use that the USEPA encourages. (Also, see subsection (i) below.)

106.705 (i) - CONSISTENCY OF PROPOSED ADJUSTED STANDARD WITH FEDERAL LAW

It is clear that the petition is consistent with Part 503. On February 19, 1994, the USEPA Part 503 Regulations (Federal Register, Volume 58, No. 32, February 19, 1993) became effective. These regulations do not regulate the utilization of municipal sludge at nonhazardous waste landfills. However, in the preamble to the Part 503 Regulations, the USEPA specifically endorses the productive use sludge for this purpose, at p. 9258 (Attachment 2) as follows:

> "While the use of sewage sludge for beneficial purposes is primarily related to farm and home garden use, use of sewage sludge in the growth of a final vegetative cap for municipal solid waste landfills is also considered a beneficial use of sewage sludge and should be encouraged. By taking advantage of the nutrient content and soil amendment characteristics of sewage sludge, a vegetative cover or cap can be quickly grown to facilitate the municipal solid waste closure plan."

Clearly, the USEPA encourages the use of sewage sludge as a final protective layer at nonhazardous waste landfills.

The USEPA decided to place the above quoted endorsement in the Preamble to the Part 503 Regulations in 1990 after the

District pointed out the obvious advantages of utilizing sewage sludge at landfills (Attachment 21). In a letter dated May 9, 1990 to Dr. Cecil Lue-Hing, Director of Research and Development for the District (Attachment 22), Dr. Alan Rubin, Chief of the USEPA's Sludge Regulation Branch stated:

> "... I agree with you that the Environmental Protection Agency (EPA) should continue to encourage the beneficial utilization of sludge and that discussing the use of sewage sludge ... to facilitate the growth of a final cover at municipal solid waste (MSW) landfills in the preamble to the Part 503 rule would contribute to this effort."

Regarding the USEPA's Subtitle D, Part 258 regulations, in 40 CFR 258.60(a)(3), July 1, 1993 at p. 371 (Attachment 1), the USEPA includes a requirement that the cover system must:

> "Minimize erosion of the final cover by the use of an erosion layer that contains a minimum 6-inches of earthen material that is capable of sustaining native plant growth."

While the USEPA requires a lesser depth than the Board requires, the above quote does provide that the erosion layer (USEPA terminology for the final protective layer) be made of earthen material, a standard similar to the soil material standard in the Board's regulations. However, the same section, on p. 371, 258.60(b)(2), goes on to provide that the Board may approve an alternative final cover design that includes:

> "An erosion layer that provides equivalent protection from wind and water erosion as the erosion layer specified in paragraph (a)(3) of this section."

The USEPA's Subtitle D regulation, therefore, allows the use of alternative materials for construction of a final protective layer. Therefore, if the Board were to approve the District's adjusted standard, which provides equivalent protection, there would be no inconsistency with existing federal regulations.

106.705(j) - A STATEMENT REQUESTING OR WAIVING A HEARING ON THE PETITION

The District waives a hearing on the petition.

Summary Comments

The District's air-dried sludge is high in nutrients and has an excellent and demonstrated ability to support and enhance vegetative growth. It is nonhazardous, low in pathogens as a result of extensive treatment, and soil-like in appearance following dewatering and air-drying. It is an excellent soil substitute.

The placement of the final protective layer represents a major cost to nonhazardous landfill operators. Soils must be imported at considerable cost. The substitution of the District's air-dried sludge material for soil material would substantially reduce the operator's costs - the District would normally provide its air-dried sludge at no cost to the landfill operator. Of course the District would benefit economically. It would not bear the costs of disposal or more expensive options for beneficial use.

There is a tremendous societal benefit in making productive use of District sludge for the purposes requested in this adjusted standard. The air-dried sludge can be beneficially used. It is a resource which would otherwise be wasted by disposal.

Using the District's air-dried sludge in place of soil also allows a more prudent use for agricultural and other soils. These soils are a particularly scarce commodity in urban centers.

The District also suggests, as a matter of policy, that use of its sludge for such productive purposes as detailed in this petition can represent a most desirable cooperative effort by the public and private sectors.

The District believes that it has provided in this petition ample justification for a grant by the Board of an adjusted standard with the conditions proposed, and respectfully asks the Board to so grant its petition.

Respectfully submitted on
behalf of the Metropolitan
Water Reclamation District
of Greater Chicago,

by: ______________________

Cecil Lue-Hing, D.Sc., P.E.
Director, Research and Development
Metropolitan Water Reclamation
District of Greater Chicago
100 East Erie
Chicago, Illinois 60611

LIST OF ATTACHMENTS

Attachment 1 - 40 CFR Part 258, Criteria for Municipal Solid Waste Landfills, October 9, 1993, Section 258.60

Attachment 2 - Preamble, 40 CFR Part 503, Standards for the Use and Disposal of Sewage Sludge, Page 9258, Federal Register Vol. 58, No. 32, February 19, 1993

Attachment 3 - March 21, 1995 Prefiling Letter from the Agency to the Metropolitan Water Reclamation District of Greater Chicago, and p. 6 of the Board's Opinion, Development, Operating and Reporting Requirements for Non-Hazardous Waste Landfills, R88-7, (June 7, 1990), Proposed Rule, Second Notice.

Attachment 4 - Metropolitan Water Reclamation District of Greater Chicago Awards and Recognitions

Attachment 5 - Sludge Process Trains of the Metropolitan Water Reclamation District of Greater Chicago

Attachment 6 - Photographs of the Vegetative Cover in 1993 at the 103rd and Doty Municipal Solid Waste Landfill

Attachment 7 - Photographs of the Turf Grass in 1994 at the Illinois International Port District Site

Attachment 8 - Illinois Solid Waste Management Act of 1986 415 ILCS 20/2 (b), 1992

Attachment 9 - Sludge Utilization and Disposal in 1991, 1992, and 1993 by the Metropolitan Water Reclamation District of Greater Chicago

Attachment 10 - Economic Impact Study of Landfill Regulations (R88-7), Pages 3-43 and D-16

Attachment 11 - Farrell, J. B., G. K. Dotson, J. W. Stamm, and J. J. Walsh, "The Effects of Sewage Sludge on Leachates and Gas From Sludge-Refuse Landfill," Presented at Water Pollution Control Federation Conference Series - Residuals, Atlanta, Georgia, April 19, 1988

Attachment 12 - Comparison of Annual Average Metal Levels in Leachate From Solid-Waste Test Cells With and Without Municipal Sewage Sludge Two Years After Sludge Addition (From Farrell et al.)

LIST OF ATTACHMENTS (Continued)

Attachment 13 - The Impact of the Industrial Pretreatment Program on the Reduction in Cadmium in the Digester Composite at the Calumet WRP in Response to the Part 503 Regulations

Attachment 14 - Class B Pathogen Requirements for Sewage Sludge in the Part 503 Regulations (Federal Register, Volume 38, No. 32, February 19, 1993, pp. 9400 and 9404)

Attachment 15 - Effect of Lagoon Aging on the Volatile Solids Content and Bacterial Concentration of Centrifuge Cake

Attachment 16 - Air-Drying District Sludge During Periods of Low and High Precipitation

Attachment 17 - Cumulative Sludge Application to Test and Control Fields 1972-1977 and Geometric Means of Microbial Populations in Test and Control Fields Tested Annually 1975-1977, Fulton County, Illinois

Attachment 18 - Mean Values and Range of Principal Nutrients and Essential Metals of Dewatered Sewage Sludge Applied to Fields at the Fulton County, Illinois Site in 1992

Attachment 19 - Effect of Cumulative Sewage Sludge Additions to Mine Spoil Soils at Fulton County on Soil Total Organic Carbon

Attachment 20 - Claude H. Hurley Company, "Geotechnical Study, MWRDGC Processed Sludge Study, Various Facilities, Metropolitan Water Reclamation District of Greater Chicago, Cook County, Illinois." 1994.

Attachment 21 - Letter to Mr. William Diamond, Criteria Standards Division, USEPA, from Dr. Cecil Lue-Hing on May 4, 1990, Concerning the "Use of Municipal Sludge as Daily and Final Cover at Municipal Solid Waste Landfills"

Attachment 22 - Letter to Dr. Cecil Lue-Hing from Dr. Alan Rubin, Chief, Sludge Regulation and Regulation Branch, USEPA, on May 9, 1990, Concerning "Use of Municipal Sludge as Daily Cover and Final Cover at Municipal Solid Waste Landfills"

ATTACHMENT 1

40 CFR Part 258,
Criteria for Municipal Solid Waste Landfills,
October 9, 1993,
Section 258.60

not being achieved emedy selected. In such ier or operator must im- methods or techniques cticably achieve compli- requirements, unless the rator makes the deter- r § 258.58(c).

wner or operator deter- ompliance with require- 258.57(b) cannot be prac- ed with any currently nods, the owner or opera-

ertification of a qualified scientist or approval by f an approved State that ith requirements under annot be practically any currently available

nt alternate measures to are of humans or the en- residual contamination, to protect human health onment; and

nt alternate measures for e sources of contamina- removal or decontamina- ment, units, devices, or it are:

lly practicable; and

nt with the overall objec- nedy.

he State Director within report justifying the al- asures prior to imple- alternative measures has the operating record.

wastes that are managed a remedy required under interim measure required a)(3), shall be managed in

s protective of human e environment; and

omplies with applicable ments.

es selected pursuant to be considered complete

ner or operator complies ground-water protection ablished under §§ 258.55(b) oints within the plume of n that lie beyond the monitoring well system nder § 258.51(a).

(2) Compliance with the ground-water protection standards established under §§ 258.55(h) or (i) has been achieved by demonstrating that concentrations of appendix II constituents have not exceeded the ground-water protection standard(s) for a period of three consecutive years using the statistical procedures and performance standards in § 258.53(g) and (h). The Director of an approved State may specify an alternative length of time during which the owner or operator must demonstrate that concentrations of appendix II constituents have not exceeded the ground-water protection standard(s) taking into consideration:

(i) Extent and concentration of the release(s);

(ii) Behavior characteristics of the hazardous constituents in the ground-water;

(iii) Accuracy of monitoring or modeling techniques, including any seasonal, meteorological, or other environmental variabilities that may affect the accuracy; and

(iv) Characteristics of the ground-water.

(3) All actions required to complete the remedy have been satisfied.

(f) Upon completion of the remedy, the owner or operator must notify the State Director within 14 days that a certification that the remedy has been completed in compliance with the requirements of § 258.58(e) has been placed in the operating record. The certification must be signed by the owner or operator and by a qualified ground-water scientist or approved by the Director of an approved State.

(g) When, upon completion of the certification, the owner or operator determines that the corrective action remedy has been completed in accordance with the requirements under paragraph (e) of this section, the owner or operator shall be released from the requirements for financial assurance for corrective action under § 258.73.

§ 258.59 [Reserved]

Subpart F—Closure And Post-Closure Care

§ 258.60 Closure criteria.

(a) Owners or operators of MSWLF units must install a fi cover system that is designed to mi mize infiltration and erosion. The fi cover system must be designed a constructed to:

(1) Have a permeability less than equal to the permeability of any b tom liner system or natural subsc present, or a permeability no grea than 1×10^{-5} cm/sec, whichever is le and

(2) Minimize infiltration through closed MSWLF by the use of an in tration layer that contains a minim 18-inches of earthen material, and

(3) Minimize erosion of the fi cover by the use of an erosion la that contains a minimum 6-inches earthen material that is capable of taining native plant growth.

(b) The Director of an approved St may approve an alternative final co design that includes:

(1) An infiltration layer that achie an equivalent reduction in infiltrat as the infiltration layer specified paragraphs (a)(1) and (a)(2) of this tion, and

(2) An erosion layer that prov equivalent protection from wind water erosion as the erosion layer s ified in paragraph (a)(3) of this sect

(c) The owner or operator must pare a written closure plan that scribes the steps necessary to close MSWLF units at any point during t active life in accordance with the c design requirements in § 258.60(a) or as applicable. The closure plan, minimum, must include the follo information:

(1) A description of the final co designed in accordance with § 258. and the methods and procedures t used to install the cover;

(2) An estimate of the largest area of the MSWLF unit ever requiring a final cover as required under § 258.60(a) at any time during the active life;

(3) An estimate of the maximum inventory of wastes ever on-site over the active life of the landfill facility; and

(4) A schedule for completing all activities necessary to satisfy the closure criteria in § 258.60.

(d) The owner or operator must notify the State Director that a closure plan has been prepared and placed in the operating record no later than the effective date of this part, or by the initial receipt of waste, whichever is later.

(e) Prior to beginning closure of each MSWLF unit as specified in § 258.60(f), an owner or operator must notify the State Director that a notice of the intent to close the unit has been placed in the operating record.

(f) The owner or operator must begin closure activities of each MSWLF unit no later than 30 days after the date on which the MSWLF unit receives the known final receipt of wastes or, if the MSWLF unit has remaining capacity and there is a reasonable likelihood that the MSWLF unit will receive additional wastes, no later than one year after the most recent receipt of wastes. Extensions beyond the one-year deadline for beginning closure may be granted by the Director of an approved State if the owner or operator demonstrates that the MSWLF unit has the capacity to receive additional wastes and the owner or operator has taken and will continue to take all steps necessary to prevent threats to human health and the environmental from the unclosed MSWLF unit.

(g) The owner or operator of all MSWLF units must complete closure activities of each MSWLF unit in accordance with the closure plan within 180 days following the beginning of closure as specified in paragraph (f) of this section. Extensions of the closure period may be granted by the Director of an approved State if the owner or operator demonstrates that closure will, of necessity, take longer than 180 days and he has taken and will continue to take all steps to prevent threats to human health and the environment from the unclosed MSWLF unit.

(h) Following closure of each MSWLF unit, the owner or operator must notify the State Director that a certification, signed by an independent registered professional engineer or approved by Director of an approved State, verifying that closure has been completed in accordance with the closure plan, has been placed in the operating record.

(i) (1) Following closure of all MSWLF units, the owner or operator must record a notation on the deed to the landfill facility property, or some other instrument that is normally examined during title search, and notify the State Director that the notation has been recorded and a copy has been placed in the operating record.

(2) The notation on the deed must in perpetuity notify any potential purchaser of the property that:

(i) The land has been used as a landfill facility; and

(ii) Its use is restricted under § 258.61(c)(3).

(j) The owner or operator may request permission from the Director of an approved State to remove the notation from the deed if all wastes are removed from the facility.

[56 FR 51016, Oct. 9, 1991; 57 FR 28628, June 26, 1992]

§ 258.61 Post-closure care requirements.

(a) Following closure of each MSWLF unit, the owner or operator must conduct post-closure care. Post-closure care must be conducted for 30 years, except as provided under paragraph (b) of this section, and consist of at least the following:

(1) Maintaining the integrity and effectiveness of any final cover, including making repairs to the cover as necessary to correct the effects of settlement, subsidence, erosion, or other events, and preventing run-on and run-off from eroding or otherwise damaging the final cover;

(2) Maintaining and operating the leachate collection system in accordance with the requirements in § 258.4[illegible], if applicable. The Director of an approved State may allow the owner or operator to stop managing leachate if the owner or operator demonstrat[illegible]

ATTACHMENT 2

Preamble,
40 CFR Part 503,
Standards for the Use and Disposal of
Sewage Sludge,
Page 9258,
Federal Register, Vol. 58, No. 32,
February 19, 1993

hat trees grow twice as fast on sludge-amended soil. This means that a tree which would typically be cut after 60 years could be cut after only 30 years to supply lumber for a variety of purposes.

Sludge is productively used to stabilize and re-vegetate areas destroyed by mining, dredging, and construction activities. Air-dried sludge that looks like compost is frequently used to fertilize highway median strips, cloverleaf exchanges, and for covering expired landfills. Historically, land reclamation has been very successful and comparable in cost to other commercial methods. In a strip-mined area in Fulton County, IL, reclamation using municipal sewage sludge cost $3,660 an acre, as compared with a range of $3,395 to $6,290 an acre using commercial methods (Reference No. 49). Pennsylvania has used the sludge Philadelphia generates to reclaim more than 3,000 acres of devastated lands. Sludge, in combination with fly ash, is currently used in the re-vegetation of soils that have become highly contaminated from the operation of a zinc smelter in Palmerton, PA, over the past 90 years.

EPA analyses show that current beneficial use practices (i.e., land application, and sale and give-away) pose less carcinogenic risk than disposal practices. On a per ton basis, carcinogenic risks from reusing sewage sludge range from 8×10^{-8} to 4×10^{-7}, while those from incinerating and disposing of sewage sludge in monofills range from 2×10^{-7} to 5×10^{-6}.

Studies using Philadelphia sludge have shown that the microbial communities in reclaimed mined soils revert to those of normal soils within 2 to 3 years. Conventional reclamation could take as long as 10 to 15 years, or even longer (Reference No. 49).

Forest soils have been found to be well suited to sludge application because they have high rates of infiltration (which reduce run-off and ponding), large amounts of organic material (which immobilize metals from the sludge), and perennial root systems (which allow year-round application in mild climates). Although forest soils are frequently quite acidic, research at the University of Washington has found no problems with metal leaching following sludge application (Reference No. 14). In addition, studies of animals living on sludge-treated sites have found that the animals are healthier than those on control sites because of the increased production of vegetative matter.

The sale of sewage sludge products can be used to defray the costs of de-watering and composting the sewage sludge to defray the costs of de-watering sewage sludge placed in landfills or incinerated. Further, the labor, capital, and operating and maintenance costs of incinerating sewage sludge are substantially higher.

The Municipality of Metropolitan Seattle (METRO), which treats wastewater in the Seattle-King County region, began using sludge to improve soil in several Seattle area parks, restore land disturbed during strip mining, restore a gravel pit used for Interstate 90 construction, and enhance grass growth at the King County International Airport at Boeing Field. In October 1983, the METRO Council adopted a sludge management plan that outlined a goal to use at least eight alternative sludge recycling or disposal methods through the year 2000. METRO reports that its plants produced 65,000 tons of sludge in 1985 and more than 91,000 tons in 1987. Sludge production is expected to increase dramatically in the next decade after METRO's Puget Sound plants are upgraded from primary to secondary treatment. METRO says that by creating a demand for sludge and developing a variety of recycling options, it reduced program expenses from $227 per ton of sludge solids in 1983 to $148 in 1987.

The benefits of using sewage sludge to improve land productivity are substantial. However, if sewage sludge containing high levels of pathogenic organisms (e.g., viruses, bacteria) or high concentrations of pollutants is improperly handled, the sludge could contaminate the soil, water, crops, livestock, fish, and shellfish. The major human health, environmental, and aesthetic factors of concern in the land application of sewage sludge are related to pathogens, metals and persistent organic chemicals content, and odors. The standards promulgated today would prevent the contamination of soil and crops by pathogens, as well as the contamination of food and animal feed crops when sewage sludge is applied to lands used in the production of agricultural crops or to lands that may be converted to residential use.

While the use of sewage sludge for beneficial purposes is primarily related to farm and home garden use, use of sewage sludge to aid in the growth of a final vegetative cap for municipal solid waste landfills is also considered a beneficial use of sewage sludge and should be encouraged. By taking advantage of the nutrient content and soil amendment characteristics of sewage sludge, a vegetative cover or cap can be quickly grown to facilitate the municipal solid waste closure plan.

In spite of the benefits of reusing sludge generated in the United States is effectively reused by applying it to the land, or sold or given away for use in home gardens (see Table I–2). In comparison, Japan uses 42 percent of it sewage sludge for coastal reclamation and home garden or farming uses. The United Kingdom applies 51 percent of its sewage sludge to the land (Referenc No. 4).

While section 405(e) of the CWA reserves the choice of use and disposal practices to local communities, EPA's preference is for local communities to reuse this resource in beneficial ways. On June 12, 1984, the EPA published it policy on the management of sewage sludge stating that the Agency will actively promote those municipal sludge management practices that provide for the beneficial use of sludge while maintaining or improving environmental quality and protecting public health (see 49 FR 24358).

When the quality of the sewage slud appears to be a limiting factor for an otherwise desirable use, POTWs can establish discharge limits for non-domestic users discharging wastewater to the POTW. Controlling the quality o non-domestic wastewater discharged into municipal sewers is an important element in managing the quality of sewage sludge.

All dischargers of non-domestic wastewaters are required to meet all applicable National Pretreatment Standards. These may include general and specific prohibited discharge standards, categorical pretreatment standards, and local limits.

In addition, POTWs designed to accommodate design flows of more th 5 million gallons per day and smaller POTWs with significant industrial discharges are required to establish lo pretreatment programs. Currently 2,0 of the nation's POTWs operated by 1,528 authorities have local pretreatment programs. The local program must include adequate lega authorities, industrial user permittin compliance monitoring, enforcemen and public participation. These 1,52 approved programs are estimated to receive 80 percent of the national wastewater flow discharged to POT

In addition to wastewater reducti and the separation of contaminated waste from uncontaminated wastes, pretreatment of non-domestic wastewater is another key step in managing the quality of sewage slu If pretreatment does not reduce the pollutant levels sufficiently, communities may have to dispose than use their sludge and, dependi

ATTACHMENT 3

March 21, 1995 Prefiling Letter From the Agency to the Metropolitan Water Reclamation District of Greater Chicago, and p. 6 of the Board's Opinion, Development, Operating and Reporting Requirements for Non-Hazardous Waste Landfills, R88-7, (June 7, 1990), Proposed Rule, Second Notice

ENVIRONMENTAL PROTECTION AGENCY

y A. Gade, Director

2200 Churchill Road, Springfield, IL 62794-9276

(217) 782-5544

Dr. Zenz 3-23

For response.

CLH/R

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M.W.R.D.
OF GRTR. CHGO.

March 21, 1995

Dr. Cecil Lue-Hing, D.Sc., P.E.
Director
Research and Development
Metropolitan Water Reclamation
District of Greater Chicago
100 East Erie Street
Chicago, Illinois 60611

cc: Rosenberg (Hill)
Lanyon

RE: Adjusted Standard Draft Petition

Dear Dr. Lue-Hing:

Thank you for your letter dated February 23, 1995. The Agency agrees that all technical matters concerning the proposed adjusted standard have been resolved. However, the Agency and the District still seem to have a misunderstanding regarding the "permit" issue.

If the District's adjusted standard is granted by the Illinois Pollution Control Board ("Board"), the Agency will be given the task of administering it. The Agency will need Board guidance on certain procedural issues that pertain solely to the District's adjusted standard. The Agency is not trying use the District's petition to resolve issues created by a poorly written law. I wish to state unequivocally that the Agency would not try to subvert legislative channels in this manner. What the District needs to understand is that once the Board makes the decision to grant the adjusted standard, the Agency is then faced with procedural problems unique to their adjusted standard. The Agency plans to address these problems in the response they must file with the Board.

One such issue is what, if any, procedural requirements will be placed upon §21(d) permit-exempt facilities if they want to use District Sludge in place of soil material for final cover. The Agency may ask the Board to clarify the procedural requirements of permitted facilities also. The Agency does not expect the District to address these issues, however, we do want to make you aware that they exist, and that we will be addressing them.

The District also addressed the three foot minimum vegetative layer thickness issue. The condition that the District is considering adding would not be necessary for permitted facilities, as the Agency has the authority to regulate the amount of final cover used at a permitted facility. However, the condition requiring the District to send sludge in a quantity necessary to meet the minimum depth of three feet, or more if necessary to comply with a final land use plan, would be helpful to the Agency in working with permit-exempt facilities. We appreciate the District considering the addition of this condition to their adjusted standard.

Now that the Agency and the District agree on the technical issues involved in the adjusted standard, we may be at the point where the adjusted standard petition could be filed. If you have any questions or concerns regarding the issues discussed in this letter, please feel free to contact me.

Sincerely,

Melanie A. Jarvis

Melanie A. Jarvis
Assistant Counsel
Division of Legal Counsel

cc: Susan Schroeder
Ed Bakowski
Joyce Munie

MWK-

ILLINOIS POLLUTION CONTROL BOARD
June 7, 1990

IN THE MATTER OF:)
)
DEVELOPMENT, OPERATING AND) R88-7
REPORTING REQUIREMENTS FOR) (Rulemaking)
NON-HAZARDOUS WASTE LANDFILLS)

PROPOSED RULE. SECOND NOTICE.

PROPOSED OPINION OF THE BOARD (by J. Anderson):

On March 1, 1990, the Board adopted a second First Notice proposed Opinion and proposed Order in this R 88-7 regulatory proceeding. The proposed regulations were published in the Illinois Register on March 16, 1990. Today's Second Notice action is taken for the purpose of submitting the proposal to the Legislature's Joint Committee on Administrative Rules (JCAR), as required by the Administrative Procedures Act. The proposal includes modifications from the second First Notice proposal in response to hearing testimony and written comments, and the Board's Scientific/Technical Section (STS) " Response to Additional Comments on Proposed Parts 807, and 810 through 815", (STS Response) filed on this day as Ex.33). This Opinion will not repeat the discussions presented in the Board's 45 page Opinion of March 1, 1990; rather, it will reference that Opinion where necessary, and will include in its entirety in the Second Notice submittal to JCAR, as well as the STS Response and, of course, the proposed Second Notice Order. To the extent that the Board concurs with the recommendations in the STS Response, the Board accepts the rationale contained in that document, with the exceptions or additional discussion as noted herein.

The Board held a hearing on the second First Notice proposal on April 6, 1990, and accepted comments until May 1, 1990.

Apart from members of the Board's staff, the hearing participants included:

<u>Illinois Environmental Protection Agency (Agency)</u>

Gary King, Esq., Enforcement Programs
Edwin Bakowski, Manager, Solid Waste/UIC Unit, DLPC

<u>Waste Management, Inc.</u>

Percy Angelo, Esq., Meyer, Brown & Platt
John J. McDonnell, P.E. (Ex. 31), Environmental Manager WM, Inc.
John Baker, Manager, Environmental Monitoring Programs, WM, Inc.

that some clarifying language has been included in Section 811.101(b). Also, we will continue to include off-site as well as on-site landfills in the "stay". We fail to see, and the participants have not explained environmentally or otherwise, why they want to exclude off-site landfills both from the "stay" and from any December proposals they might submit. Our decision to grant the "stay" admittedly rests on the expectation that the industries will appreciate, on balance, the advantages to them of not installing new landfills during the "stay" period unless lack of air space is a critical factor, and even then will consider whether it might be more prudent to comply with these new regulations rather than the old ones, or at least seek a permit.

Finally, WMI also asked for clarification as to how onsite landfills, those operating outside the permit system, are to proceed if they wish to use alternatives to basic Board standards or when approval by the Agency is required if an alternative is to be used. This question relates to more than the "stay" issue. For example, Agency approval is required for use of alternate daily cover materials, and there any any number of instances in these rules, such as where performance standards and assessment and remedial action plans are involved, where onsite operators arguably carry a greater risk of a subsequent enforcement action for decisions made by them, outside a permit setting, as to what constitutes compliance with the rules. This is a legal as well as a practical problem that is not new, except insofar as the problem will be larger with the new regulations. Answering the question posed ultimately requires knowing what the operator wants to do and looking at the individual rule involved, considering the facts of a particular situation. However, as a general observation, the operator may have a number of options, including seeking an adjusted standard before the Board; voluntarily applying for a permit, so that modifications can be approved; informally consulting with the Agency if the Agency is willing; simply taking the course of action with confidence that the rule allows it, etc. We note that these proposed rules, particularly the reporting requirements, reflect a conclusion by the Board, based on the record, that more needs to be known about the activities of onsite facilities.

Section 811.306 Liner Systems

The Board agrees with the explanation and recommendation in the STS Response that, as an alternate to the minimum five foot compacted clay liner, a minimum three foot compacted clay liner plus a geomembrane be allowed. The Board had requested comment in its March 1, 1990, Opinion, and received testimony and comment in response. (See e.g. R. 442-524). The record indicates that a three foot compacted clay liner plus a geomembrane liner directly applied on top of it has demonstrated capabilities equal or superior to the recompacted five foot liner, at least for non-inward gradient landfills, both in terms of leachate captured and as a leachate barrier. Experience has shown that the controlling factors for the long term effectiveness of the geomembrane are

ATTACHMENT 4

Metropolitan Water Reclamation District of Greater Chicago
Awards and Recognitions

METROPOLITAN WATER RECLAMATION DISTRICT OF
GREATER CHICAGO (District)
AWARDS AND RECOGNITIONS

Awarded By	Date	Project
American Society of Civil Engineers	1955	District System Selected as one of Seven Engineering Wonders of America
National Society of Professional Engineers	1973	Fulton County Project, One of Ten Outstanding Engineering Achievements
American Society of Civil Engineers	1974	Fulton County Project, Outstanding Civil Engineering Achievement in United States
Illinois Division of the Izaak Walton League	1975	Fulton County Project Civic Award
United States Environmental Protection Agency	1982	Award of Excellence for John E. Egan Water Reclamation Plant Operation
National Society of Professional Engineers	1985	One of Ten Outstanding Engineering Achievements in the United States Award for Tunnel and Reservoir Project - Mainstream Phase I
American Society of Civil Engineers	1986	Outstanding Civil Engineering Achievement of 1986 for Mainstream System of Tunnel and Reservoir Project
Illinois Society of Professional Engineers	1986	District System Selected as one of the Ten Outstanding Illinois Engineering Achievements in the Last 100 Years

METROPOLITAN WATER RECLAMATION DISTRICT OF
GREATER CHICAGO (District)
AWARDS AND RECOGNITIONS (CONTINUED)

Awarded By	Date	Project
American Academy of Environmental Engineers	1989	Grand Prize in Planning, Excellence in Environmental Engineering, for Sidestream Elevated Pool Aeration Stations on Calumet Waterway System
Water Pollution Control Federation	1989	Award for Outstanding Achievement in Water Pollution Control for Excellence in the Improvement of Water Quality
Association of Metropolitan Sewerage Agencies	1990	Gold Award for Complete Compliance with National Pollutant Discharge Elimination System Permit Limitations - Stickney, Calumet, and North Side WRPs
Association of Metropolitan Sewerage Agencies	1991	Gold Award for Complete Compliance with National Pollutant Discharge Elimination System Permit Limitations - Stickney, Egan, and North Side WRPs
United States Environmental Protection Agency	1991	Special Award for Outstanding Contributions and Leadership in the Beneficial Use of Sludge
United States Environmental Protection	1993	Stickney Plant for Best Operated and Maintained Agency Large Capacity Secondary Treatment Plant in Region V

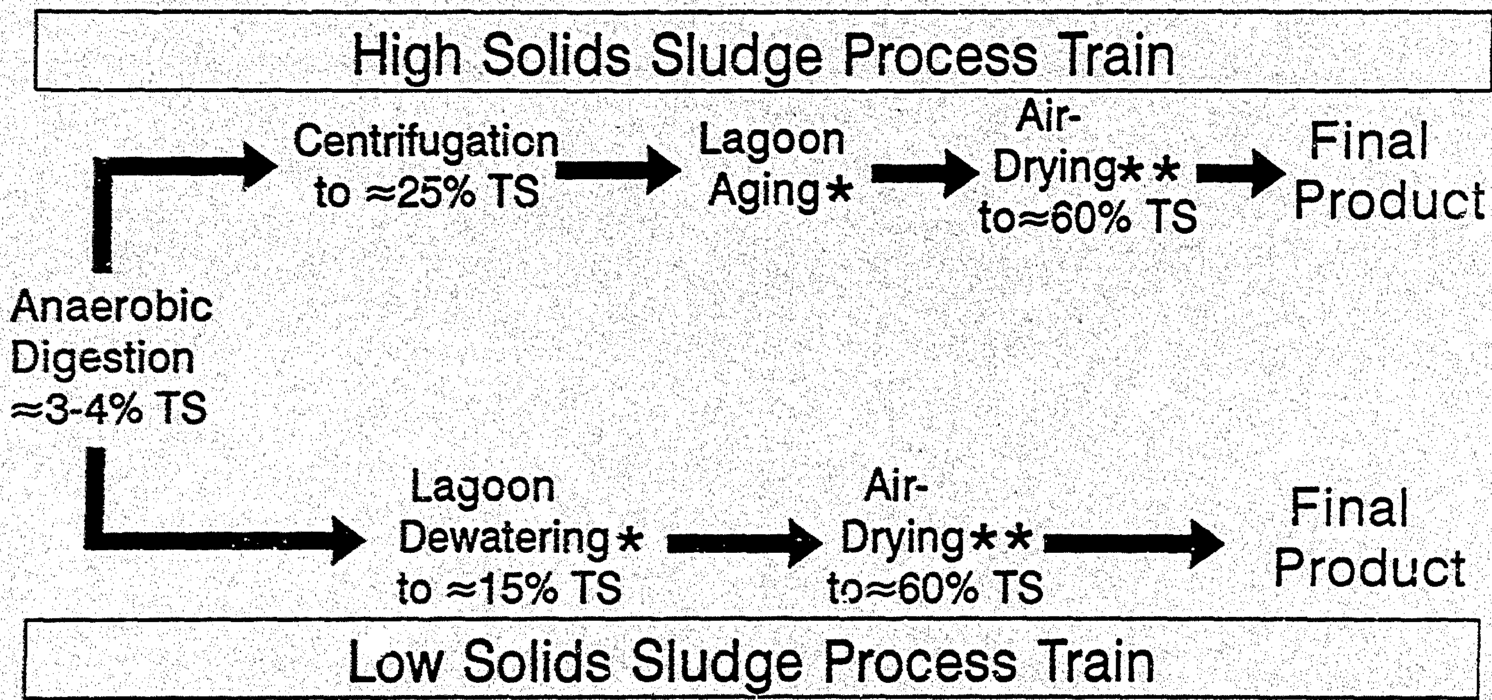
ATTACHMENT 5

Sludge Process Trains of the Metropolitan Water Reclamation District of Greater Chicago

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

Attachment 5

Sludge Process Trains Proposed as Equivalent to PFRP



*Dewatering, Stabilization and Inactivation

**Dewatering and Inactivation

ATTACHMENT 6

Photographs of the Vegetative Cover in 1993 at the 103rd and Doty Municipal Solid Waste Landfill

ATTACHMENT 8

Illinois Solid Waste Management Act of 1986
415 ILCS 20/2 (b), 1992

for vinyl, 4 and LDPE for low density polyethylene, 5 and PP for polypropylene, 6 and PS for polystyrene, and 7 and Other for other materials, including multi-layer materials. Containers with labels or base cups of different material shall be coded by their primary, basic material. However, this Section does not apply to the plastic casings on lead-acid storage batteries.

P.A. 85-1198, § 10, eff. Jan. 1, 1989. Amended by P.A. 86-177, § 1, eff. Aug. 14, 1989; P.A. 87-650, § 3, eff. Jan. 1, 1992.

Formerly Ill.Rev.Stat.1991, ch. 85, ¶ 5960.

15/10.1. Sale of beverages in plastic cans

§ 10.1. (a) No person may sell or offer for sale at retail to consumers in this State any beverage packaged in a plastic can unless such person has first demonstrated to the satisfaction of the Agency that:

(1) plastic cans can be collected and recycled in a manner that will not interfere with the processing of scrap aluminum cans; and

(2) plastic cans can be collected, processed and transported to secondary materials markets at a cost that provides a reasonable profit to recycling operations in the State.

(b) For the purpose of this Section, "plastic can" means a beverage container having a capacity of 16 fluid ounces or less, composed of clear polyethylene terephthalate thermoplastic, and where the basic structure of the container, exclusive of the closure, also includes aluminum or steel.

(c) Any person adversely affected or threatened by a final determination of the Agency under this Section may obtain review by filing a petition for review with the Pollution Control Board in the manner provided for permit appeals in the Environmental Protection Act.[1]

(d) Any person that knowingly violates this Section shall be liable for a civil penalty not to exceed $5,000 for each violation; such penalty may, upon order of a court of competent jurisdiction, be made payable to the Solid Waste Management Fund, to be used in accordance with the provisions of the Illinois Solid Waste Management Act.[2]

The State's Attorney or any person of the county in which the violation occurred, or the Attorney General, at the request of the Agency or on his own motion, may institute a civil action against any violator of this Section. The court may award costs and reasonable attorney fees to the State's Attorney, Attorney General, or other person who has prevailed against a person who has committed a willful, knowing or repeated violation of this Section.

Any funds collected in a proceeding under this subsection (d) in which the Attorney General has prevailed shall be deposited in the Solid Waste Management Fund.

P.A. 85-1198, § 10.1, added by P.A. 86-774, § 1, eff. Jan. 1, 1990.

Formerly Ill.Rev.Stat.1991, ch. 85, ¶ 5960.1.

[1] 415 ILCS 5/1 et seq.

[2] 415 ILCS 20/1 et seq.

15/11. Violations

§ 11. (a) It shall be a violation of this Act for any person:

(1) To cause or assist in the violation of Section 9 or 10 of this Act[1] or any regulation promulgated hereunder.

(2) To fail to adhere to the schedule set forth in, or pursuant to, this Act for adopting and reviewing a waste management plan.

(3) To fail to implement the recycling component of an adopted waste management plan.

P.A. 85-1198, § 11, eff. Jan. 1, 1989.

Formerly Ill.Rev.Stat.1991, ch. 85, ¶ 5961.

[1] 415 ILCS 15/9 or 15/10.

15/12. Civil penalty

§ 12. (a) Any person that violates any provision of this Act shall be liable for a civil penalty not to exceed $5,000 for such violation; such penalty may, upon order of a court of competent jurisdiction, be made payable to the Solid Waste Management Fund, to be used in accordance with the provisions of the Illinois Solid Waste Management Act.[1]

(b) The State's Attorney or any person of the county in which the violation occurred, or the Attorney General, at the request of the Agency or on his own motion, may institute a civil action against any violator of this Act. The court may award costs and reasonable attorney fees to the State's Attorney, Attorney General, or any person who has prevailed against a person who has committed a willful, knowing or repeated violation of this Act.

(c) Any funds collected under subsection (b) in which the Attorney General has prevailed shall be deposited in the Solid Waste Management Fund.

P.A. 85-1198, § 12, eff. Jan. 1, 1989.

Formerly Ill.Rev.Stat.1991, ch. 85, ¶ 5962.

[1] 415 ILCS 20/1 et seq.

ACT 20. ILLINOIS SOLID WASTE MANAGEMENT ACT

Section
20/1. Short title.
20/2. Public policy.
20/2.1. Definitions.
20/3. State agency materials recycling program.
20/3.1. Institutions of higher learning.
20/4. Projections of disposal capacity.
20/5. Information clearinghouse.
20/6. Lead agency—Powers.
20/6a. Nationally recognized recycling logos—Public education and awareness campaign.
20/6.1. Task force on degradable plastics.
20/6.2. Task force.
20/7. Legislative intent—Reports—Tax incentives.
20/7.1. Waste paint.
20/7.2. Pesticide containers.

20/1. Short title

§ 1. Short title. This Act shall be known as the Illinois Solid Waste Management Act.

P.A. 84-1319, § 1, eff. Sept. 4, 1986.

Formerly Ill.Rev.Stat.1991, ch. 111 ½, ¶ 7051.

Title of Act:

An Act in relation to solid waste management in Illinois, and to amend Acts therein named. P.A. 84-1319, approved and eff. Sept. 4, 1986.

20/2. Public policy

§ 2. Public Policy. (a) The General Assembly finds:

(1) that current solid waste disposal practices are not adequate to address the needs of many metropolitan areas in Illinois;

(2) that the generation of solid waste is increasing while landfill capacity is decreasing;

(3) that siting of new landfills, transfer stations, incinerators, recycling facilities, or other solid waste management facilities and the expansion of existing facilities is very difficult due to the public concern and competition with other land uses for suitable sites;

(4) that more effective and efficient management of solid waste is needed in a manner that promotes economic development, protects the environment and public health and safety, and allows the most practical and beneficial use of the material and energy values of solid waste;

(5) that state government policy and programs should be developed to assist local governments and private industry in seeking solutions to solid waste management problems;

(6) that the purchase of products or supplies made from recycled materials by public agencies in the State will divert significant quantities of waste from landfills, reduce disposal costs and stimulate recycling markets, thereby encouraging the further use of recycled materials and educating the public about the utility and availability of such materials;

(7) that there are wastes for which combustion would not provide practical energy recovery or practical volume reduction, which cannot be reasonably recycled or reused and which have reduced environmental threat because they are non-putrescible, homogeneous and do not contain free liquids. Such wastes bear a real and substantial difference under the purposes of the Illinois Solid Waste Management Act from solid wastes for which combustion would provide practical energy recovery or practical volume reduction, which can be reasonably recycled or reused, or which are putrescible, non-homogeneous or contain free liquids;

(8) since it is the policy of the State as set forth in the Environmental Protection Act [1] to assure that contaminants discharged into the atmosphere or waters of the State are given the degree of treatment or control necessary to prevent pollution, that wastes generated as a result of removing contaminants from the air, water or land bear a real and substantial difference from other wastes in that the generation of wastes containing pollution treatment residuals can improve the environment in Illinois and should be encouraged;

(9) since it is the policy of the State as set forth in the Environmental Protection Act to promote conservation of natural resources and minimize environmental damage by encouraging and effecting recycling and reuse of waste materials, that wastes from recycling, reclamation or reuse processes designed to remove contaminants so as to render such wastes reusable or wastes received at a landfill and recycled through an Agency permitted process bear a real and substantial difference from wastes not resulting from or subject to such recycling, reclamation, or reuse and that encouraging such recycling, reclamation or reuse furthers the purposes of the Illinois Solid Waste Management Act;

(10) that there are over 300 landfills in Illinois which are permitted to accept only demolition or construction debris or landscape waste, the vast majority of which accept less than 10,000 cubic yards per year. By themselves these wastes pose only a minimal hazard to the environment when landfilled in compliance with regulatory requirements in an Agency-permitted site without commingling with other wastes and, as such, landfills receiving only such wastes bear a real and substantial difference from landfills receiving wastes which are commingled. Disposal of these wastes in landfills permitted for municipal wastes uses up increasingly scarce capacity for garbage, general household and commercial waste. It is the policy of the State to encourage disposal of these wastes in separate landfills.

(b) It is the purpose of this Act to reduce reliance on land disposal of solid waste, to encourage and promote alternative means of managing solid waste, and to assist local governments with solid waste planning and management. In furtherance of those aims, while recognizing that landfills will continue to be necessary, this Act establishes the following waste management hierarchy, in descending order of preference, as State policy:

(1) volume reduction at the source;

(2) recycling and reuse;

(3) combustion with energy recovery;

(4) combustion for volume reduction;

(5) disposal in landfill facilities.

P.A. 84-1319, § 2, eff. Sept. 4, 1986. Amended by P.A. 85-1195, Art. III, § 4, eff. Aug. 23, 1988; P.A. 85-1196, § 2, eff. Jan. 1, 1989; P.A. 85-1440, Art. II, § 2-40, eff. Feb. 1, 1989.

Formerly Ill.Rev.Stat.1991, ch. 111 ½, ¶ 7052.

[1] 415 ILCS 5/1 et seq.

Article II of P.A. 85-1440, the Second 85th General Assembly Combining Revisory Act, resolved multiple actions and made technical corrections in P.A. 85-1015 through P.A. 85-1427.

20/2.1. Definitions

§ 2.1. Definitions. When used in this Act, unless the context otherwise requires, the following terms have the meanings ascribed to them in this Section:

"Department" means the Illinois Department of Energy and Natural Resources.

"Deinked stock" means paper that has been processed to remove inks, clays, coatings, binders and other contaminants.

"End product" means only those items that are designed to be used until disposal; items designed to be used in production of a subsequent item are excluded.

"High grade printing and writing papers" includes offset printing paper, duplicator paper, writing paper (stationery), office paper, note pads, xerographic paper, envelopes, form bond including computer paper and carbonless forms, book papers, bond papers, ledger paper, book stock and cotton fiber papers.

"Paper and paper products" means high grade printing and writing papers, tissue products, newsprint, unbleached packaging and recycled paperboard.

"Postconsumer material" means only those products generated by a business or consumer which have served their intended end uses, and which have been separated or diverted from solid waste; wastes generated during production of an end product are excluded.

"Recovered paper material" means paper waste generated after the completion of the papermaking process, such as postconsumer materials, envelope cuttings, bindery trimmings, printing waste, cutting and other converting waste, butt rolls, and mill wrappers, obsolete inventories,

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

ATTACHMENT 9

SLUDGE UTILIZATION AND DISPOSAL IN 1991, 1992, AND 1993 BY THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

Use	1991	1992	1993
	----------dry tons----------		
Application to Land in Fulton County, Illinois	88,179	120,183	0
Application to land at the Hanover Park WRP	1,360	889	1,172
Distribution to Large-Scale Private Users	1,574	13,411	2,830
Landscaping at District WRP	6,230	3	5,987
Landfill Daily Cover	43,667	33,857	45,323
Landfill Final Closure	115,118	25,514	167,053
Disposal in Private Landfill	43,662	9,344	3,509

Economic Impact Study of Landfill Regulations (R88-7)

Hearing Copy

- 3 foot layer of recompacted clay;
- 1 foot sand blanket for drainage;
- geotextile to minimize clogging; and
- construction quality assurance program.

TABLE 3-15

GENERAL SITE CHARACTERISTICS
NEW OFFSITE LANDFILLS

	50 ACRE	100 ACRE	200 ACRE
Depth Below Grade	25	25	25
Height Above Grade	50	100	125
Excavation Slope	3:1	3:1	3:1
Fill Slope	3:1	3:1	3:1
Waste/Cover Ratio	4:1	4:1	4:1
Waste in Place Density	1200 LB/CY	1200 LB/CY	1200 LB/CY
Liner/Cover Material	On Site	On Site	On Site
Operating Life	16 years	16 years	16 years
No. Operating Phases	4	4	4
Post-Closure Care Period	30 years	30 years	30 years
Tons Per Day*	400	1300	3200

CY = Cubic Yard

* To nearest hundred

are technically governed by the requirements of part 811. The costs for the last 2 items of Table D-9 were reduced for Class C facilities to $25,000 and for Class D facilities to $12,500. In particular, Class D facilities need not submit information pertaining to the design and operation of a leachate management system.

K. Closure Costs

The increased cost of closure for offsite facilities is determined as the cost of an additional 1 foot of topsoil (for vegetative cover) and 3 feet of compacted clay.

Table D-10 presents one-time additional costs for final cover at new offsite facilities.

TABLE D-10
CLOSURE COSTS
ONE-TIME COST SUMMARY

	UNIT COST	50 ACRE	100 ACRE	200 ACRE
Cost of Clay	$3.00/yd^3	$740,300	$1,490,500	$2,973,400
Cost of Soil	$2.00/yd^3	164,500	331,200	660,750
TOTAL		$904,800	$1,821,700	$3,634,150

L. POSTCLOSURE CARE

The additional costs for postclosure care do not include those costs associated with post closure operation of gas and leachate management systems or groundwater monitoring as these were specified separately in the appropriate sections above.

Table D-11 identifies the additional costs for annual surface care (erosion control, maintenance of vegetation, etc.) and the costs of inspections as required by Section 811.111 of the proposed regulations.

THE EFFECTS OF SEWAGE SLUDGE ON LEACHATES
AND GAS FROM SLUDGE-REFUSE LANDFILLS

by

J. B. Farrell, G. K. Dotson, J. W. Stamm, and J. J. Walsh*

ABSTRACT

A four year experiment has been completed on the effect of municipal wastewater sludge on leachate quality and gas production from simulated landfill test cells containing municipal solid waste. Addition of 10 to 30 percent by weight of a 16 percent solids sludge cake to the solid waste caused the initiation of rapid anaerobic biological stabilization (RBS) in about 10 months. Solid waste test cells not containing sludge required about 30 months before the onset of RBS. During the 20 month interim, the test cells containing sludge produced leachates containing about 1500 mg/L COD compared to values averaging 30,000 mg/L for the test cells without sludge. Heavy metal concentrations (Cd, Cr, Cu, Pb, Ni, Fe, Zn) in the leachage were generally lower initially in the cells containing sludge but after 4 years were about the same as for the cells containing no sludge.

INTRODUCTION

The remarkable improvement in the ability to analyze air and water for trace contaminants that has taken place over the last 15 years has greatly enhanced our ability to protect the environment. For example, our ability to analyze groundwater for trace organic compounds frequently has revealed the presence of health-threatening levels of contaminants, and identified several land use or disposal practices as the cause of the problem. Causes of contamination include leaking underground storage tanks, chemical spills, chemical waste dumps, and leachates from poorly designed landfills. Because sludge is frequently disposed to landfills, our laboratory felt it important to know the potential for sludge to worsen or improve the quality of leachate from landfills. Consequently, about five years ago, we commenced an experimental study of the impact of the addition of municipal wastewater sludge to refuse charged to landfills on the composition of leachate and gas production from the landfills.

The experimental program that was developed investigated the effect of addition of two different sludges at three levels on quality of leachate from simulated sludge-refuse landfills. Another variable investigated was the quantity of infiltration

*J.B. Farrell and G.K. Dotson are with EPA's Water Engineering Research Laboratory in Cincinnati, Ohio. J.W. Stamm and J.J. Walsh are with SCS Engineers, Inc. in Covington, Kentucky.

water entering the landfill. Also, to some of the simulated landfills, small quantities of toxic pollutants were added in order to determine whether they would be retained or would leach from the landfill. In another phase of the study, leachate from simulated landfills containing only sludge was determined.

The leaching characteristics of the toxic organic compounds in the simulated landfills have been reported elsewhere[1] and will be included in the tabulated results when EPA's project report is made available sometime in 1988.

The results for the simulated landfills containing only sludge showed that sludge type was important--limed raw sludge produced a much more contaminated leachate than anaerobically digested sludge. Sludge addition to refuse landfill test cells brought about a large reduction in the contamination, indicating that codisposal of sludge and refuse would greatly reduce net pollution to the environment. This paper concentrates on the effect of type and amount of sludge on the contamination in leachate from the simulated codisposal landfills.

MATERIALS AND METHODS

Experimental Design

The sludge-solid waste codisposal experiments utilized 20 test cells designed to simulate landfills. The experiment was a factorial design in which three variables (sludge type, infiltration rate, and percentage of sludge cake in the sludge-refuse mixture) were investigated, with sludge type and infiltration rate at two levels, and percent sludge cake at 3 levels. The experimental design is presented in Table 1, and is summarized below:

Cells	Description
1-12	The 2 x 2 x 3 factorial experiment (see above)
13-16	Replicates of the test cells (5-8) containing 20 percent sludge
17-20	Control cells containing refuse only, at two infiltration rates

Cells 13-16 received a dose of small amounts of several toxic chemicals. The toxic chemicals produced no significant effect on any other measured parameters so these cells duplicate Cells 5-8. Because the cells were installed on a limited floor space inside a building, half the cells were installed above the other half. The cells at the upper elevation (in Table 1) were about 1.6°C different in temperature. The effect of this small temperature difference proved to be small and is not discussed.

Refuse and Sludge Sources and Compositions

Required quantities of municipal refuse were obtained from City of Cincinnati collection vehicles. The purpose was to obtain a waste which typified household refuse generated in the U.S.A.

Table I. Program design.

Cell Contents	Test Cell	Sludge Type	Infiltration Rate (Low, High)	Sludge Loading (wet wt%)	Elevation (U:Upper) (G:Ground)
SW-SL	1	AD[1]	L[3]	10	U
SW-SL	2	LT[2]	L	10	G
SW-SL	3	AD	H[3]	10	G
SW-SL	4	LT	H	10	U
SW-SL	5	AD	L	20	G
SW-SL	6	LT	L	20	U
SW-SL	7	AD	H	20	U
SW-SL	8	LT	H	20	G
SW-SL	9	AD	L	30	U
SW-SL	10	LT	L	30	G
SW-SL	11	AD	H	30	G
SW-SL	12	LT	H	30	U
SW-SL[4]	13	AD	L	20	G
SW-SL[4]	14	LT	L	20	U
SW-SL[4]	15	AD	H	20	U
SW-SL[4]	16	LT	H	20	G
SW	17	NONE	L	0	U
SW	19	NONE	L	0	G
SW	18	NONE	H	0	G
SW	20	NONE	H	0	U

1. AD: Anaerobically digested sludge, 16% solids.
2. LT: Lime treated sludge, 16% solids.
3. L,H: Annual water infiltration rate (L/kg of cell waste on a dry weight basis), L = 0.5, H = 1.0.
4. Spiked with priority pollutants

Over 45 tonnes of municipal refuse was delivered to the project site where it was manually mixed. This manual mix consisted of breaking open (but not removing), all plastic bags, spreading and mixing materials, and removing large or non-representative materials. After mixing, a representative three percent sample was segregated from the waste mass and characterized physically and chemically. The refuse was manually separated and weighed to determine the physical composition. The fraction of waste in each of 14 sorting categories is shown in Table II.

Further physical and chemical analyses were carried out on refuse grab samples, which were finely ground before analysis. Results are presented in Table III. Moisture content for the unshredded, as-delivered refuse, based on 12 grab samples, averaged 42.2 percent.

Required quantities of municipal sludges were obtained from the Blue Plains Wastewater Treatment Plant in Washington, D.C. A total of about 12 tonnes of anaerobically digested (AD) and lime treated (LT) sludges were loaded in steel drums with lids and delivered by truck to the project site in Cincinnati. Samples of

TABLE II. Refuse physical composition.

Component	Percent (%) Wet Weight
Paper	45.4
Textiles	11.9
Garden Waste	10.5
Plastic	8.1
Ferrous Metal	6.3
Telephone Books	4.6
Wood	3.2
Glass	2.8
Food Waste	1.6
Diapers	1.5
Non-Ferrous Metal	1.5
Ash-Rock-Dirt	1.4
Rubber-Leather	1.1
Fines*	0.1

* Material passing through a 25 mm sieve.
Total sample weight = 1,176.5 kg.

the incoming sludges were obtained and analyzed[2] for a variety of chemical parameters shown in Table III. The sludges differed significantly in composition with notably higher levels for pH, alkalinity, and iron in the lime treated sludge.

It is clear from Table III that sludges and refuse are very different materials. Hardly any parameter agreed within a factor of two. The refuse was much lower in TKN and total P, and higher in Percent Volatile Solids and organics (COD). Alkalinity and acidity were low in the refuse. The sludges were much higher in most of the heavy metals, although copper and lead in the refuse approached the concentrations in the sludge. The greatest difference between the sludges and the refuse was in physical characteristics. The sludges were homogenous dark-colored masses with the consistency of stiff mud--they resisted penetration by water. The refuse was a heterogenous mixture best described by a glance at Table II. Even when compressed, it contained many voids and channels. It avidly absorbed water. When disposed in a landfill, containers and plastic film would form innumerable receptacles which could accumulate water. After enough water had been added to wet the solids and fill containers, voids and channels would very likely allow bypassing of freshly added water with minimal contact with the bulk of the cell contents.

Test Cell Construction

The pilot-scale test cells were designed to be durable and gas-tight. Because refuse would receive only minor preprocessing to remove oversize objects, the cells were made as large as reasonably possible to increase the likelihood that the solid waste fraction in the different cells would be similar in composition.

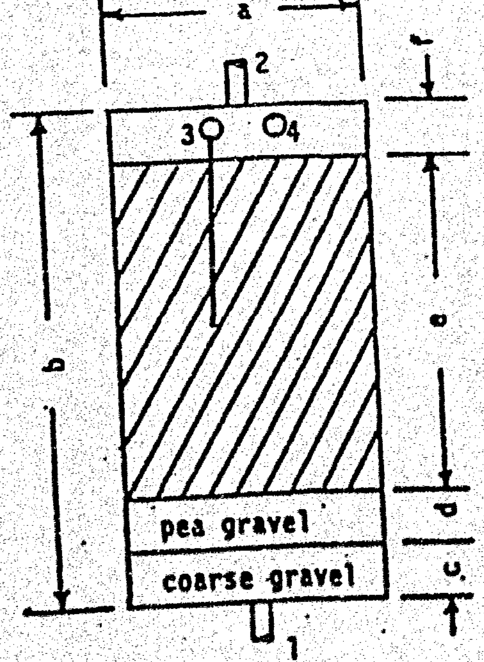
Table III. Composition of sludge and refuse (dry solids basis).

	Refuse*		Limed Sludge*		A.D. Sludge*	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
No. of Samples	5		6		6	
pH	7.62	0.03	10.86	0.07	5.51	0.24
acidity, to pH 8.3 (mg/g)	0.20	0.02	-		63.6	3.6
alkalinity, to pH 3.2 (mg/g)	25.5	0.86	300	8.1	112	22
alkalinity, to pH 4.5 (mg/g)	10.9	0.14	263	7.7	40	17
TKN (mg/g)	10.5	0.60	38.3	3.6	35.4	2.4
Total P (mg/g)	4.8	4.2	14.1	0.91	24.7	5.2
COD (mg/g)	1128	58	345	34	374	70
Inorganic Carbon (%)	10.1	1.7	9.08	0.63	6.6	0.37
TOC, soluble (mg/g)	13.0	1.4	44.1	4.7	24.3	5.2
Chlorides (mg/g)	1.96	0.19	12.3	1.4	44.2	6.3
Sulfide (mg/g)	-		2.36	0.70	1.23	0.48
Volatile Solids (%)	71.8	4.1	36.6	0.76	32.3	0.88
Metals (mg/kg)						
Cd	1.3	0.9	17.2	12	11.1	4.4
Cr	81	41	922	36	303	49
Cu	259	80	322	9	556	12
Fe	3,740	1,320	76,800	1,400	32,000	2,300
Pb	181	51	234	39	894	579
Ni	16	7	109	10	63	25
Zn	99	75	433	20	733	92

* Refuse moisture content was 42.2% before the grinding that preceded analytical determinations. (n = 12, s = 11.6%). Limed sludge and digested sludge averaged 15.7% and 15.5% solids, respectively.

The cells were rolled steel tanks, double-welded at the seams, coated with two interior coatings of an epoxy sealer to prevent rust. Cross-section of the cells is presented schematically in Figure 1. The dimensions of the cells are included on the figure. The cells were provided with infiltration lines, leachate drains, and openings for the temperature and gas probes. The infiltration lines consisted of 1-inch Schedule 40 (2.7 cm I.D.) threaded steel pipe, protruding into the head space of each cell. They were equipped with full-spray brass nozzles for distributing the monthly water doses over the entire waste surface area. The leachate drains were 2.0 inch Schedule 40 (5.2 cm I.D.), threaded steel nipples with PVC piping and valves for leachate collection. Openings for the temperature and gas probes received 1/4 inch

FIGURE 1: TEST CELL DESIGN



1. Leachate drain
2. Infiltration line
3. Temperature probe
4. Gas port

Dimensions (m)	SW, SW-SL
a	1.8
b	2.7
c	0.3
d	0.3
e	1.8
f	0.3

Schedule 40 (1 cm I.D.) brass bulkhead fittings and were sealed with silicone-based compounds. Special pains were taken to assure that the cells were gas-tight.

Test Cell Loading

Loading began with the placement of gravel layers loaded in two 0.3 m lifts into each of the cells. The first lift consisted of large Ohio Silica pebbles ranging from 1.9 cm to 3.8 cm diameter, previously washed and screened repeatedly to remove the fines prior to placement in the cells. The second lift consisted of small Ohio Silica pebbles. This stone ranged from 0.6 to 1.9 cm in diameter, and was thoroughly washed prior to loading to remove the fines. The gravel was washed in place until the wash water appeared to be free of solids.

The loading operations were performed in accordance with the program design shown in Table I. Generally, quantities of refuse and sludges were weighed, loaded, and compacted (by walking heavily on each lift) in four 0.46 m high lifts in each test cell. In the codisposal and refuse-only cells (Nos. 1 through 20), refuse quantities were loaded first, followed by designated sludge types and quantities added atop each compacted refuse layer. The cells were loaded on a lift-by-lift basis so that the first lift was completed in all cells before moving on to the second lift. Temperature probes were installed on top of the second lift and the probe lines exited through the sides of the test cells. When loading was complete, gas ports and leachate drains were installed and an infiltration spray nozzle was placed on the interior of the test cell lids.

The last steps of the loading operations included placement of the test cell lids, final connection of gas ports, temperature probes and infiltration lines, welding of the steel lids, and pressure testing to ensure air and water-tight conditions. Table IV presents the quantitative results of the loading activities for the individual cells. The time elapsed between shipment of sludge and collection of solid waste to welding of the lids on the cells was 9 days.

Operation and Monitoring

Operation and Monitoring activities were performed on a continuous basis. Test cell temperatures (one probe per test cell) were recorded on a daily basis for the first two months. Thereafter, temperatures were monitored bi-weekly or on an as-appropriate basis. Leachate was drained from each cell every month and its volume recorded. Two representative samples of the leachate were collected, one for standard chemical analysis and the other for GC/MS quantitation of trace organics.

Infiltration water was applied to every cell each month immediately after the leachate had been drained. The infiltration rates are shown in Table I. Inspection and maintenance activities were also employed each month for general housekeeping purposes and to

Table IV. Sludge and refuse quantities in test cells.

Cells	1-4	5-8	9-12	13-16	17-20
Sludge/Total (wt.%)	10.0	20.5	30.6	20.5	0
Sludge					
Percent Solids (wt.%)	15.6	15.6	15.6	15.6	--
Wet Weight (kg)	240	510	811	510	--
Dry Weight (kg)	37.5	79.5	126	79.5	--
Refuse					
Wet Weight (kg)	2165	1976	1837	1971	2139
Dry Weight (kg)	1251	1142	1062	1142	1237
Mixture					
Solids Content (wt.%)	53.6	49.1	44.8	49.1	57.8
Wet Weight (kg)	2405	2486	2648	2486	2139
Dry Weight (kg)	1289	1221	1188	1221	1236
Volume (m^3)	4.80	4.80	4.80	4.80	4.80
Density (kg/m^3)	501	518	552	518	446

ensure air and water tightness of all cells.

Monitoring activities centered on providing physical/chemical descriptions of the infiltration water, product gases, and generated leachates. Generally, monitoring parameters were tested on an on-going monthly schedule. Standard chemical analyses performed on leachate samples in the laboratory included pH, alkalinity, volatile acids, total and volatile solids, total organic carbon (TOC), total phosphate, chlorides, sulfide, seven metals, and selected trace priority pollutants.

In conjunction with the above analyses, gases generated from the cells were monitored for composition and volume. On a bimonthly basis, gas production by volume was measured for 72 hours and recorded for all test cells. Every three months, gas from the test cells were sampled and analyzed by gas chromatograph for methane, carbon dioxide, nitrogen, and oxygen content. Metals were analyzed by atomic absorption. Except for gas analyses and priority pollutant analyses, methods were drawn from Standard Methods[2].

RESULTS

Leachate Quantity

Beacause the quantities of infiltration water added every month to the various cells were constant, leachate rate eventually became constant and equalled infiltration rate for all cells.

However, in the early years of the experiment, the water-holding or water-releasing nature of the waste influenced the rate of leachate release. The extent of this effect is shown in Figure 2 for the SW cells and in Figure 3 for the SW-SL (20% AD) cells (cells containing 20 percent by weight of anaerobically digested sludge cake), where cumulative amounts of infiltration water and leachate are plotted against time. The SW cells did not release any leachate until about 6 months after infiltration water was added even at the high rate of infiltration. The SW-SL (20% AD) cells released leachate after about 4 months. The infiltration and leachate curves are parallel straight lines after about a year. The horizontal distance between the lines gives the time lag before leachate quantity equaled infiltration quantity. Time lags obtained from graphs of the data for all of the SW and SW-SL cells (duplicates are averaged) are presented in Figure 4. The lag was higher for the low infiltration rate, and addition of sludge reduced the lag. There is an indication that the lags may have been less for LT sludge. Addition of sludge clearly reduced the time lag before the test cells started producing leachate.

Moisture Content

The residual moisture content after a period of leaching is important because net leachate can then be obtained from a knowledge of initial moisture and total infiltration. Moisture contents for the SW and the SW-SL cells after 4 years were calculated from the initial moisture content and the cumulative leachate and infiltration quantities. Results presented in Figure 5 show that equilibrium moisture content of the cells increased as the percent of sludge in the cells increased.

The increase in equilibrium moisture content of the cells containing sludge reduces the impact of the initial higher moisture content of these cells on the amount of leachate produced. Table V shows initial and final moisture contents and net mass of water absorbed for the cells with various amounts of sludge addition. Considering the cells with 30 percent sludge addition, if equilibrium moisture content had not increased, they could hold back only 0.24 kg water/kg d.s. (1.47-1.23) whereas they actually held back 0.40 kg water/kg d.s. (1.63-1.23).

Chemical Oxygen Demand (COD)

Annual average COD leachate concentrations (mg/L) are shown in Table VI. Solid waste cells were the highest initially but after four years fell approximately into the same range as the SW-SL cells.

The dramatic influence of time on leachate COD for the four SW cells is presented graphically in Figure 6. The duplicate cells, 17 and 19 at low infiltration and 18 and 20 at high infiltration, started out with leachates at about equal concentrations and after 40 months were again at about equal concentrations but at a much lower level. In the intervening months, various cells dropped sharply from high to low COD's, in an apparently random manner.

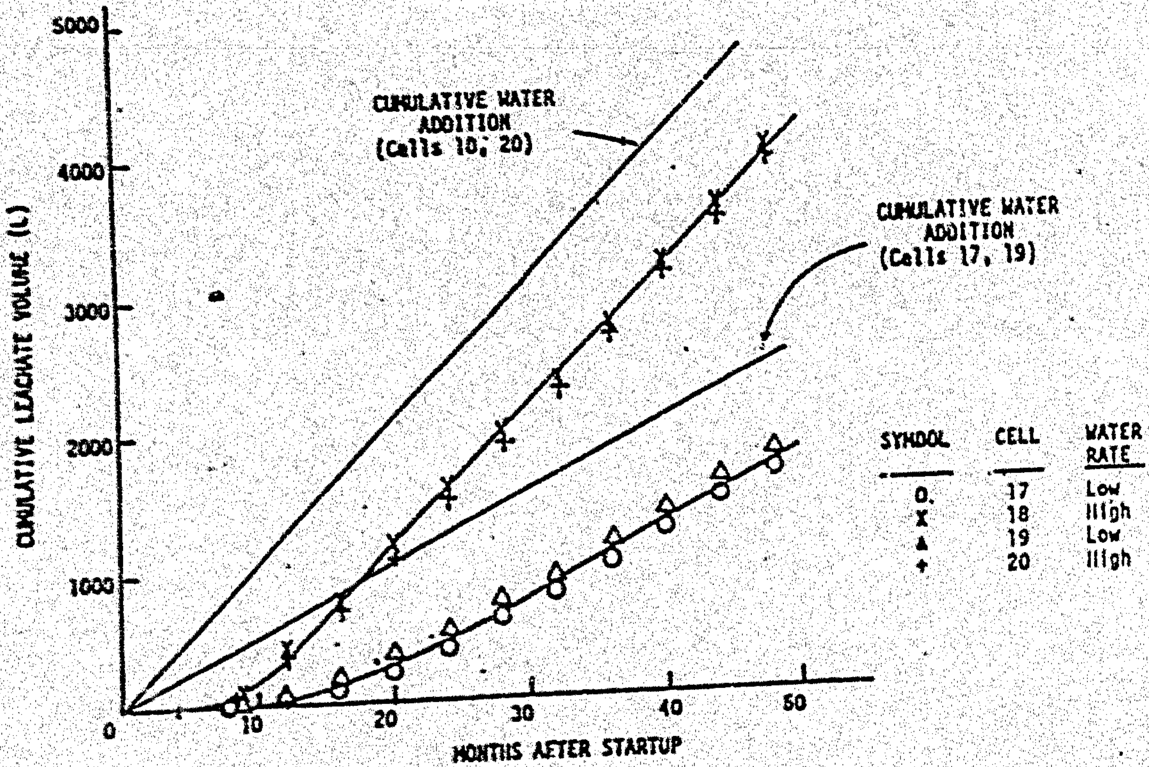


FIGURE 2. VOLUME OF LEACHATE FROM SW CELLS

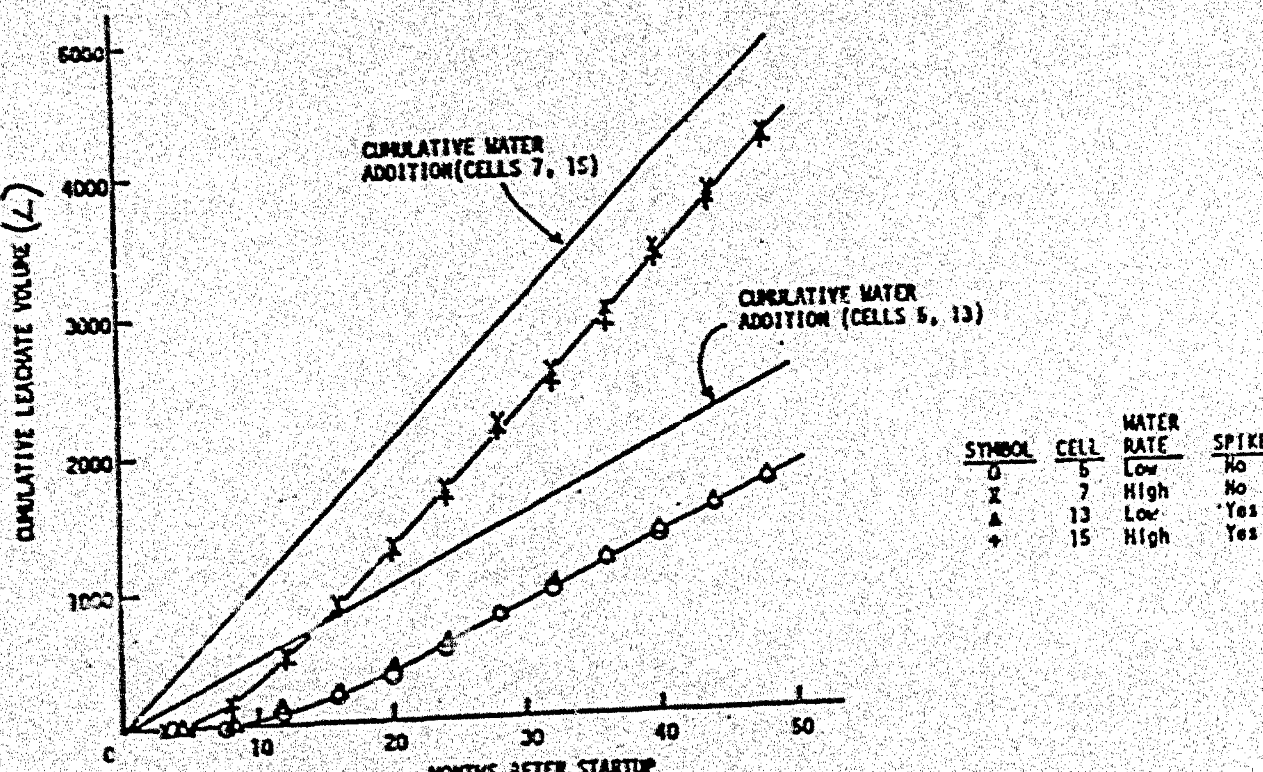


FIGURE 3. VOLUME OF LEACHATE FROM SW-SL CELLS WITH 20% DIGESTED SLUDGE

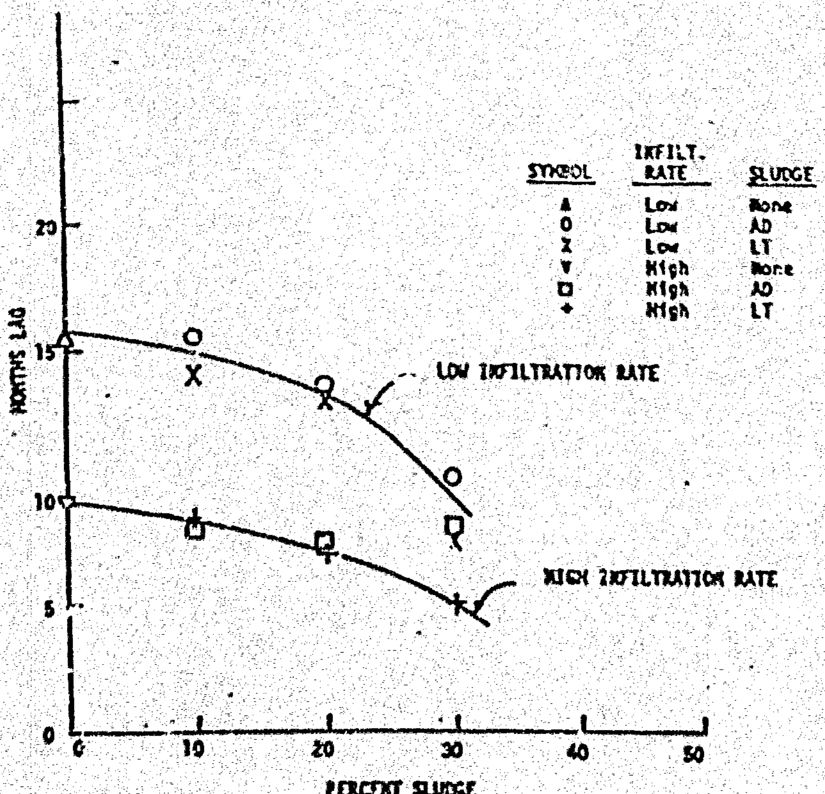


FIGURE 4. TIME LAG BEFORE LEACHATE EQUALS INFILTRATION FOR SW AND SW-SL CELLS

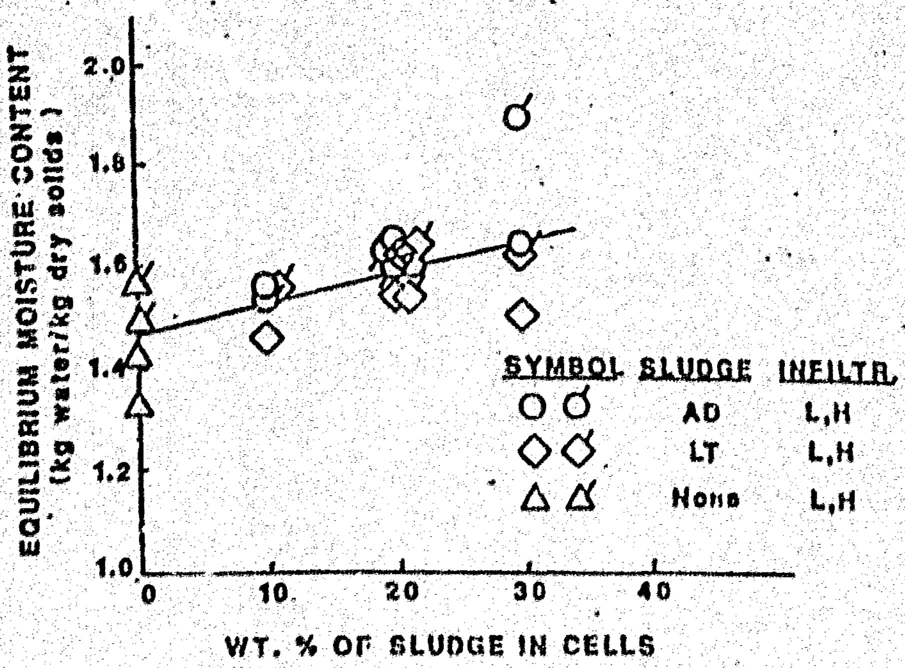


FIGURE 5. FINAL MOISTURE CONTENT OF SW AND SW-SL MIXTURES IN TEST CELLS AFTER 4 YEARS.

TABLE V. Solids content and net absorption of water by test cells

Test Cells	Initial Percent Solids	Initial Water Content (kg/kg d.s.)	Final Percent Solids[1]	Final Water Content[1] (kg/kg d.s.)	Net Mass of Water Absorbed (kg/kg d.s.)
SW	57.8	0.73	40.5[1]	1.47	0.74
SW-SL (10%)	53.6	0.87	39.6[1]	1.53	0.66
SW-SL (20%)	49.1	1.04	38.8[1]	1.58	0.54
SW-SL (30%)	44.8	1.23	38.0[1]	1.63	0.40

1. Averaged over all cells in each grouping.

TABLE VI. Annual average of COD concentrations and pH of monthly leachate collection for groups of test cells (mg/L)

Year	1	2	3	4
Test Cell Grouping				
		COD (mg/L)		
SW	39,000	39,000	16,000	1,480
SW-SL-AD	10,600	2,190	1,090	700
SW-SL-LT	26,500	9,930	1,670	930
		pH		
SW	5.64	5.64	6.30	6.81
SW-SL, low I	6.69	7.48*	7.22	6.98
SW-SL, high I	6.34	7.32	6.98	6.71

*One cell (Cell 10) excluded because its pH did not rise until late in this year.

As will become evident later (see section on pH), the drop was associated with the onset of the methanogenic processes that convert soluble organic matter to carbon dioxide and methane.

The only variable investigated in the SW cells was the infiltration rate. As can be seen in Figure 6, COD concentration was 1.5 times higher for the low infiltration rate in the early months and 2.0 times higher in the late months. Since mass rate is the product of concentration and leachate flow rate, the mass of COD leaving in the leachate was initially lower from the low infiltration cells but later became equal to the rate from the high infiltration cells.

Examination of Table VI shows that addition of sludge to the solid waste greatly lowered leachate COD in the early years.

After four years the difference between SW and SW-SL cells was not great. Results for the cells containing 20 percent anaerobically digested (AD) sludge are presented graphically in Figure 7 for the high infiltration rate. For comparison, SW cell results from Figure 6 for the high infiltration rate are presented on this diagram. It is evident that the anaerobic processes that reduce the COD of the leachate commenced much sooner for the cells containing sludge.

The SW-SL cells containing 20 percent lime-treated (LT) sludge (SW-SL-LT cells) are compared with the SW-SL-AD cells at low and high infiltration rates in Figures 8 and 9. The leachate from the AD cells was about 25 percent lower in COD than from the LT cells. This is an anticipated effect because the LT sludge had not been digested and would be expected to contribute more soluble COD than the AD sludge as it decomposed. The precipitous drop in COD occurred earlier for cells containing AD sludges--at an average of 8 months compared to 12 months for the LT sludges. This also is to be expected since the AD sludge doubtlessly contained a large population of methanogenic bacteria. In addition, the initial high pH of the LT sludge would be expected to have some inhibitory effect.

pH

Annual average values of pH for various cell groupings are presented in Table VI. The grouping of cells has been selected to make evident the differences that appeared in a preliminary analysis of the data. The SW cells showed a rise in pH in the 3rd year that continued into the fourth year. Scrutiny of the month by month values revealed the pH rise was abrupt for each cell, increasing about 1 pH unit generally in a period of 1 to 4 months. The pH changes coincided with the onset of the methanogenic processes that convert COD and volatile acids to carbon dioxide and methane (see below).

The month of the change is given below for the SW cells:

Cell	Infiltration	Elevation	Month
19	low	G	36
18	high	G	27
17	low	U	22
20	high	U	38

This small two-factor experiment indicates the following:

infiltration effect: 3.5 mo.
temperature effect: -1.5 mo.
interaction : 6.25 mo.

The large interaction relative to the main effects is unlikely. It appears that for the SW cells, the occurrence of the pH change and the start of methanogenic processes is not easily predicted.

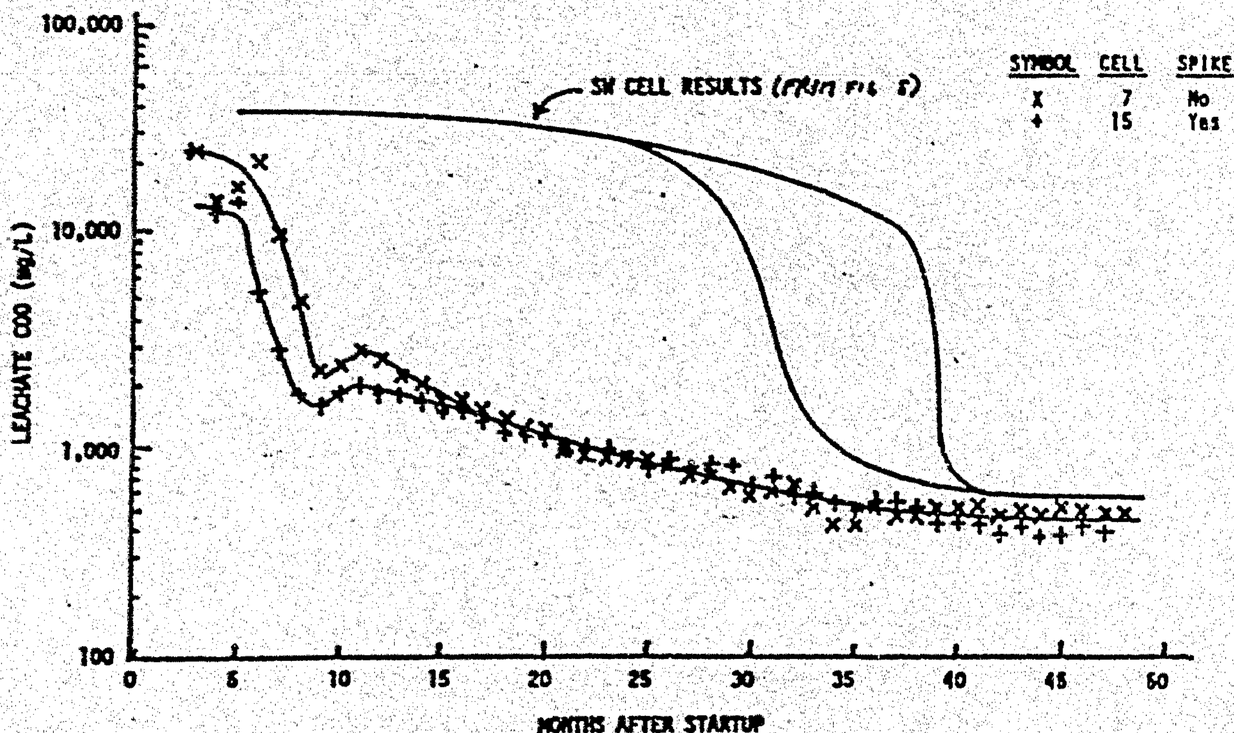


FIGURE 7. INFLUENCE OF TIME ON COD OF LEACHATE FROM SW-SL-AD (20%) CELLS AT HIGH WATER RATE: COMPARED TO SW CELLS, BOTH AT HIGH INFILTRATION RATE.

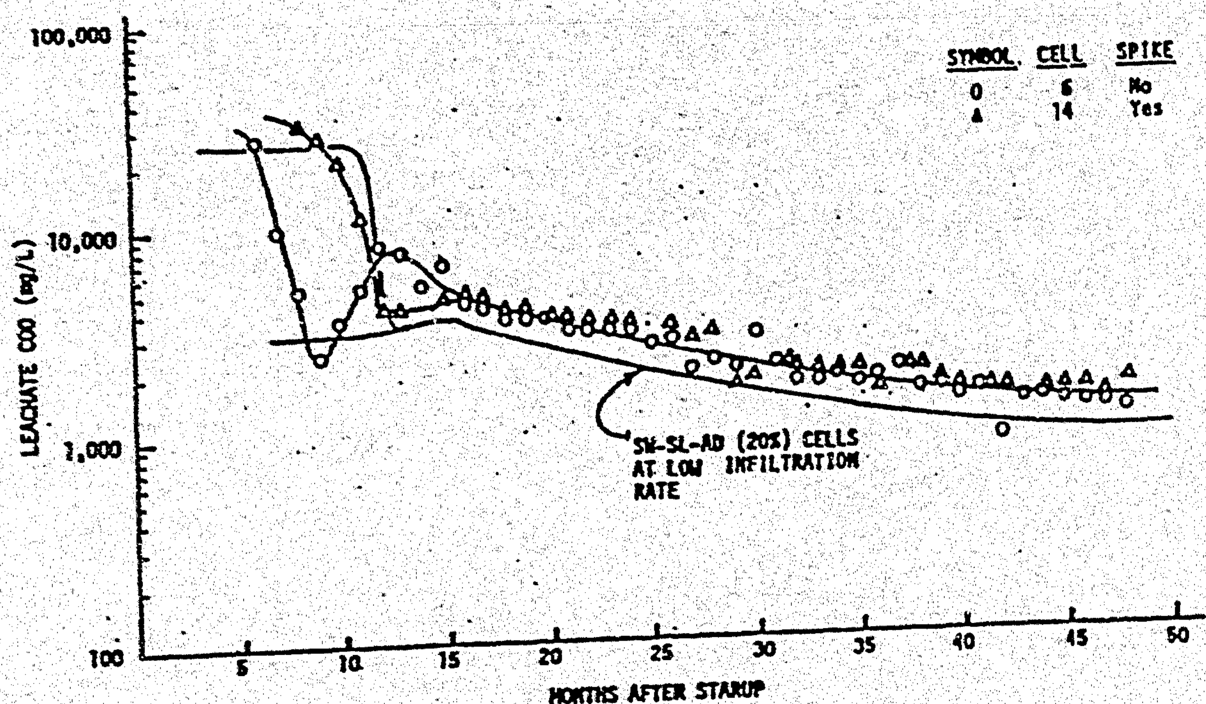


FIGURE 8. INFLUENCE OF TIME ON COD OF LEACHATE FROM SW-SL (20%) CELLS AT LOW INFILTRATION RATE: LT CELLS COMPARED TO AD CELLS

The change in pH is related to changes in other parameters. Concentrations of other parameters affected by pH or by other changes occurring simultaneously are shown for one of the SW cells (No. 19) in Figure 10. COD, Fe, and Zn concentrations as well as pH are plotted against time. The correspondence between these parameters is unmistakeable. It is not possible to be certain which change was the causative factor and which were just responses. It is likely that methanogenic processes consumed volatile acids, causing pH to rise. The fall in zinc and iron concentrations probably occurred as a result of the pH change. The pH increase noted for SW cells also occurred for the SW-SL cells but earlier. The approximate month of the increase is shown in Table VII for all SW and SW-SL cells. The months of the drop in concentrations of other leachate parameters including phosphate, Fe, Zn, COD, volatile acids, and oxygen in the gas phase are also shown. All parameters except Zn showed a good correspondence. Zn showed a correspondence only for three of the SW cells and one SW-SL cell. The Zn concentrations for all cells containing both SW and sludge (except Cell 9) were much lower than the concentrations in the leachate leaving the SW cells and showed no clear change.

Chloride

Average annual chloride concentration (mg/L) for cell groups are shown in Table VIII. SW and SW-SL cells declined in concentration in approximately the same fashion.

The chloride ion can serve as a tracer to estimate the manner in which infiltration water moves through a test cell. The highly soluble chloride ion is likely to be present at or near its maximum solution concentration as soon as the solid waste is wet with infiltration water. The chloride and its carrier water will mix with or be pushed out of the cell by incoming infiltration. This scenario would be invalidated if large deposits of chloride salts (e.g., boxes of sodium chloride) were present to slowly release chloride into the leachate stream or if chloride were precipitated. A check of calculated solubility products of lead and copper chlorides (the two most common insoluble chlorides), using actual leachate concentrations, against solubility product constants showed that precipitation would not occur. The consistency of chloride decline in all the cells indicated that deposits of chloride in some cells were not upsetting results.

To test the manner of flow of leachate through the cells, the chloride concentrations in leachates from a low and a high infiltration rate SW cell were plotted versus the logarithm of time (see Figure 11). If the infiltration water mixed with the leachate water already in the cell in the manner water mixes into a well-stirred vessel, the concentration vs. time curve would be a straight line. If the flow regime were displacement (i.e., plug) flow, concentration would be uniform at first, followed by a sharp drop to low concentrations.

TABLE VII. Correspondence Among Times of Substantial Sharp Changes in Leachate Parameters: Month of Change for the SW and SW-SL Cells

Cell No.	pH	Loss of O_2	Phosphate[1]	COD	Vol.acids	Fe	Zn[2]
1	n.c.[3]	n.c.	8	8-9	not clear	n.c.	--
2	12	7	<15 mg/L	14	14	11-12	--
3	7	10	7	8-10	12,14[4]	6-8	--
4	12	7	13	14	14,17[4]	12	--
5	n.c.	8	9	<7	not clear	10	--
6	6	10	8	6-8	9,14[4]	8	--
7	6	6	6	7-8	9,14[4]	4-8	--
8	11	8	13	13-14	14	11-14	--
9	8	10	9	9-11	11,20[4]	9-11	10-16
10	20-22	16	20	23-24	23	20-23	--
11	8	10	<15 mg/L	9-11	11,22[4]	10-11	--
12	7	8	8	8-9	9	7-10	--
13	11	8	<15 mg/L	11-12	13,20[4]	10-12	--
14	9	11	10	11-12	13,18[4]	10-12	--
15	5	11	6	6	7	5-8	--
16	8	10	9	9-10	10	6-10	--
17	22	13	24	24-25	24	21-25	--
18	26	25	30	27-30	32	24-31	27
19	35	18	36	35-37	37	25-37	36
20	38	27	30,39	33-39	40	25-38	37

1. A rapid drop in phosphate concentration was only discernible when the concentration before the onset of active methanogenesis was greater than 15 mg/L (as P).

2. For zinc, a dash indicates no drop in concentration was evident. For all these cells zinc concentration was initially very low--less than 1 mg/L--so no drop could be discerned.

3. n.c.--not clear. It was not possible to select a month of change.

4. The first drop in concentration was followed by a small rise and a second drop.

The data for the SW cells in Figure 11 show substantial scatter but the general shape of the relationship is clear. The curve resembles the fully mixed vessel behavior rather than plug flow. Several scenarios could produce this kind of a concentration vs. time curve. One would be the presence of dozens of "pockets" capable of holding water (e.g., open cans and plastic bags) that fill with relatively strong chloride salt solution. The first leachate should be fairly strong in leachate because chloride salts are readily soluble. As leaching progresses, infiltration water trickles into these pockets and well-mixed leachate, at equilibrium with the contents of the pocket, overflows to become part of the total leachate. The concentration of chloride leaving

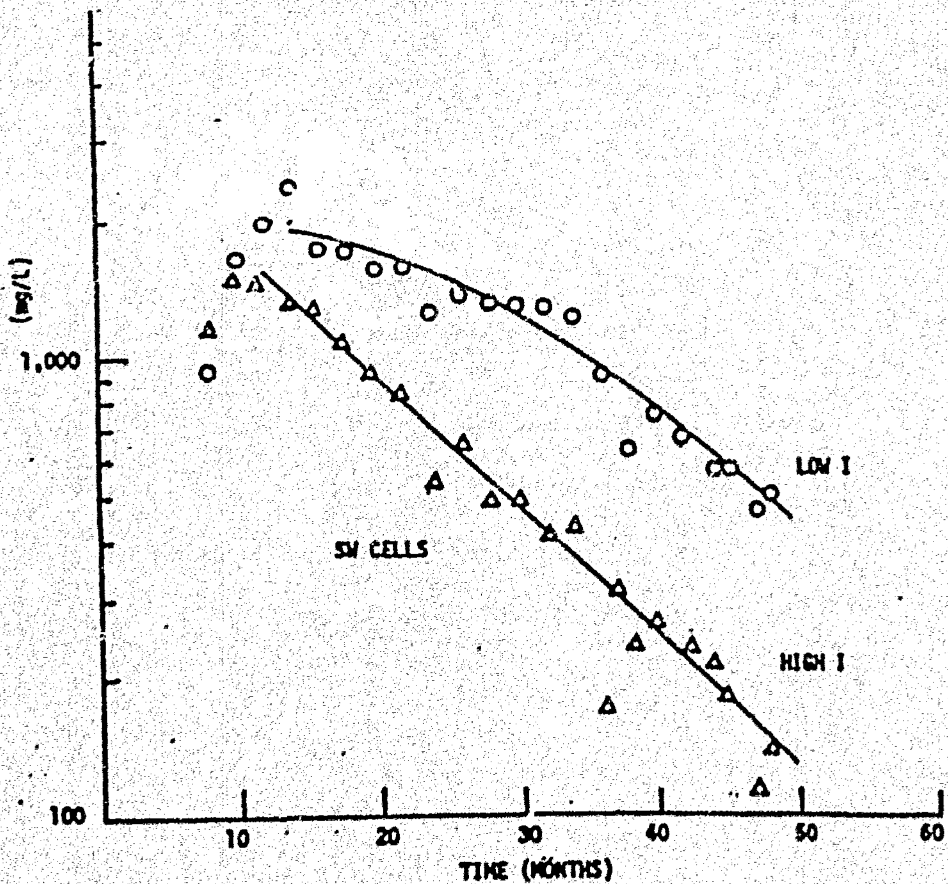


FIGURE 11. REDUCTION IN CHLORIDE CONCENTRATION: SW CELLS AT HIGH AND LOW INFILTRATION, SL CELLS AT SHORT AND TALL HEIGHT

appeared to drop in a regular fashion. However, as was pointed out in the section on pH, a large abrupt drop in phosphate occurred when pH increased with the onset of anaerobic processes. This drop occurred for all of the SW cells. The drop was from concentrations considerably greater than 15 mg/L into the range of 10-15 mg/L. After this initial drop, phosphate concentrations declined uniformly with time.

The SW-SL cells had higher average annual concentrations of phosphate than the SW cells, evidently an effect of sludge addition. For a few cells (Cells 2, 11, and 13--see Table VII), the phosphate concentrations were below 15 mg/L at the time of the pH break. In this circumstance, no phosphate break was seen.

Alkalinity

Annual average alkalinity concentrations are presented in Table VIII for various cell groupings. Alkalinity declined in a relatively regular fashion. There were no sudden drops associated with pH change or start of methanogenic activity.

Annual average alkalinities were lower for SW-SL cells than for SW cells, evidently the effect of added sludge. The decline with time was similar to the decline for SW cells. The decline in alkalinity relative to decline in chloride for SW and SW-SL cells is compared below by observing the ratio of their average concentrations for the 4 years of the experiment:

Ratio (Alk/Cl)	Year	1	2	3	4
	SW	8.6	8.5	9.3	8.2
	SW-SL	4.3	2.9	2.8	3.2

A constant ratio means that alkalinity and Cl decline in a similar fashion. For SW, the ratio is constant; for SW-SL, discounting Year 1 where conditions typically were unsettled, ratios are nearly constant. This is a surprising result, and could be interpreted to mean that alkalinity was originally present and is being washed out by dilution, just like chloride. It appears that the biological reactions that occur do not produce soluble cations, such as ammonium, that would capture carbon dioxide as bicarbonate, to produce new soluble alkalinity.

TKN

Annual average TKN (total Kjeldahl nitrogen) concentrations for various cell groupings are shown in Table VIII. Concentrations diminished regularly with time. The ratios of TKN to Cl for the successive years are shown below for SW and SW-SL cells.

Ratio (TKN/Cl)	Year	1	2	3	4
SW		1.14	1.33	1.17	0.75
SW-SL		0.74	0.69	0.58	0.63

For the SW cells, the rate of loss of TKN was lower than for chloride between Year 1 and 2, but after Year 2 the rate of loss became higher than for chloride. Assuming that the soluble TKN could not wash out faster than chloride, it appears that the soluble nitrogen that was present in the test cells in Year 2 was being retained in the test cells in subsequent years in a less soluble form, possibly in biomass. This is a reasonable explanation because the SW cells began active methanogenesis in Year 3 and was still high in Year 4.

Annual average TKN values for the SW-SL cells had slightly higher TKN concentrations and declined in concentration at a lower rate than the values for the SW cells. The ratios of TKN to Cl concentrations calculated above remained relatively constant for Years 2 to 4, indicating that TKN concentration declined at about the same rate as chloride.

Volatile Acids

The average annual volatile acid concentrations for various cell groupings are presented in Table VIII. The SW cells showed high concentrations for the first two years which dropped to a low value by Year 4. As noted earlier (see section on pH), the volatile acid concentration droped precipitously in the same month that pH abruptly increased, COD dropped, and methanogenic processes acommenced.

Volatile acid concentrations dropped sooner for SW-SL cells than for SW cells, indicating earlier commencement of the methanogenic processes that convert volatile acids to methane and carbon dioxide. Average concentrations during Years 2 and 3 averaged 7,500 mg/L lower for the SW-SL cells. In Year 4, the volatile acids for both SW and SW-SL cells averaged less than 500 mg/L.

Metals

Annual average leachate concentrations for several metals are presented for various cell groupings in Table IX. In all cases except for zinc, concentrations in leachate declined with time. The rate of decline was about the same for the SW cells as for the SW-SL cells. The SW-SL cells generally showed slightly lower concentrations at the start but concentrations in both types of cells were approximately equal after 4 years.

TABLE IX. Average annual concentrations of metals in leachate.

Cells	Metal	Year 1	2	3	4
SW	Cd	0.039	0.029	0.007	0.004
SW-SL		0.034	0.018	0.006	0.003
SW	Cr	0.142	0.096	0.042	0.019
SW-SL		0.087	0.053	0.028	0.022
SW	Cu	0.044	0.042	0.030	0.012
SW-SL		0.039	0.034	0.027	0.013
SW	Fe	1400	1330	270	78
SW-SL(AD)		450	75	51	47
SW-SL(LT)		870	32	27	32
SW	Pb	0.298	0.232	0.102	0.050
SW-SL		0.229	0.129	0.063	0.043
SW	Ni	0.64	0.60	0.35	0.21
SW-SL		0.33	0.22	0.21	0.18
SW	Zn	2.19	12.0	3.62	0.14
SW, Cell 19		4.4	39.1	5.7	0.11
SW, Cell 20		2.5	5.6	8.2	0.30
SW-SL		0.60	0.30	0.12	0.12

The behavior of zinc was peculiar for the SW cells. Leachate concentrations rose with time and then fell to low values. A possible explanation is that metallic zinc present in the solid waste gradually dissolved as acidic leachate passed over it. Pockets of water produced by the addition of leachate increased in concentration at first, and then diminished in later years as less metallic zinc remained for dissolution and as pH rose.

The rate at which concentration of the metals fell with time is compared to the rate at which chloride fell with time in Table X. Copper and nickel fell at about the same rate as chloride; lead, chromium, and cadmium fell more rapidly; and iron and nickel fell the most rapidly. The metals are arranged in approximate order of increasing rate of decline below:

$$Cl = Ni = Cu < Cr = Pb < Cd < Fe = Zn.$$

If we assume that chloride was merely being washed out of the landfill, then copper and nickel appeared to behave the same way. The concentrations of iron and zinc both showed a strong dependence on pH (see the earlier section on pH) and metallic ions in solution were evidently precipitated in the landfill as pH rises. Lead, chromium, and cadmium decreased more rapidly than chloride. However, they did not show the abrupt reductions with pH that occurred with iron and zinc. Precipitation resulting from a pH increase could still cause the higher rate of decline than simple washout, but other factors, such as reduction in concentration of chelating agents (e.g., the volatile acids) could be responsible.

TABLE X. Comparison of decline in concentration of metals to chloride for solid waste cells.

Metal	Ratio of Annual Average Concentrations: Metal/Chloride			
	Year			
	1	2	3	4
Cd ($\times 10^5$)	2.54	2.18	0.89	0.91
Cr ($\times 10^4$)	0.92	0.72	0.53	0.43
Cu ($\times 10^4$)	0.29	0.32	0.38	0.27
Fe	0.92	1.00	0.34	0.18
Pb ($\times 10^4$)	1.94	1.75	0.80	0.98
Ni ($\times 10^3$)	0.42	0.45	0.44	0.48
Zinc ($\times 10^3$)	1.43	9.0	4.6	0.32

Gas Production and Methane Content

Annual average gas production and methane content over the four year period of the experiment are presented in Table XI for various cell groupings. The SW cells generated little gas in the first year and it was of low methane content. Average gas production and methane content were highest in the fourth year.

TABLE XI. Annual average gas production and methane content, and temperatures for selected cell groupings.

Year	1	2	3	4
		Percent Methane		
SW	11.5	43.6	52.4	54.2
SW-SL	38.1	54.1	55.3	55.5
		Average Gas Production (L/hr)		
SW	1.2	4.2	7.0	7.5
SW-SL	10.0	12.1	4.9	3.0
		Temperature Inside Cells (°C)		
Upper (U)	24.6	25.1	23.6	21.9
Ground (G)	23.0	23.1	21.9	20.6
U-G	1.6	2.0	1.7	1.3

Examination of Table XI shows that for SW-SL cells, gas production was high the first year, peaked in Year 2 and fell gradually in Years 3 and 4. Average production over the four years was higher for the SW-SL cells than for the SW cells, but the SW cells had not yet reached a declining gas production stage at the end of the experiment.

Cumulative gas production can be determined by multiplying average hourly rate by 31,360 hours (gas production was measured for 3.58 years). Gas production for all cell groupings per unit mass of dry solids in the cells is shown below for all cell groupings:

	liters/kg	Est. Dry Mass Loss (%)
SW	135	17
SW-SL	180	22

According to EPA's Sludge Process Design Manual[3], gas production per pound of volatile solids destroyed when crude fiber is anaerobically digested is 13 ft^3/lb (50 percent methane) or 810 liters/kilogram. Mass loss is estimated in the above table by comparing actual gas production to this figure. The percentage loss is substantial for SW and SW-SL. SW cells show less mass loss but, as noted earlier, they were still producing gas at a relatively high rate at the termination of the 4-year period.

DISCUSSION

Onset of RBS

The most notable finding of the study was the reduction in the time for rapid biological stabilization (RBS) to take place when sludge was present in the test cells. Pohland and Harper[4] have used the term RBS to indicate the onset of methanogenesis, which causes volatile acids to be converted to methane and carbon dioxide, greatly lowering both volatile acids and COD concentrations in the leachate. Another effect of the onset of RBS is the increase in pH that occurs when the volatile acids are consumed. The increase in pH caused some metals ordinarily dissolved by acid leachates to precipitate.

Results contrast with an earlier EPA study summarized by Pohland and Harper[4]. At temperatures averaging 10°C and under conditions that allowed air to enter the simulated landfills, addition of sludge did not reduce leachate strength. Rapid anaerobic biological activity accompanied by methane production did not commence in over ten years. The higher temperature of the cells and the rigid exclusion of air in the present study are the chief differences between the two studies. It is likely that the presence of oxygen in the earlier study prevented methanogenesis. The importance of operating a landfill in a manner that excludes air becomes evident.

Stability of Results

Another notable aspect of the study was the stability of the results. No SW or SW-SL cells consistently produced aberrant results. Typically it is extremely difficult to make comparisons within a given set of lysimeters filled with the same waste because of uncertainty that they are similar in all features except for the variable being evaluated. In this experiment, six conditions were duplicated. For all of these sets, agreement was generally within reasonable bounds. For virtually all parameters measured, the calculated effects of experimental variables were consistent from year to year. The results from the set of SW-SL cells with 10 and 20 percent sludge addition gave results consistent with those obtained for the 20 and 30 percent addition cells.

There were a few instances, particularly with lead and chromium, where a single cell showed abnormal concentrations for a period of time. Such effects are inevitable, particularly for metals. It is impossible for test cells of any reasonable size to be "representative" for all substances that are disposed to landfills. Metals are frequently discarded in highly concentrated soluble forms (example are zinc chloride soldering paste, ferric chloride for fertilizer use). There might have been a dozen such "surprises" in the batch of garbage used to charge our test cells.

There is no way they can be distributed evenly among 20 test cells. In the pre-RBS stage of the landfills, they could have an enormous effect on concentrations normally measured in milligrams per liter. It is surprising tnat in our sludge, such aberrant conditions were so rarely met.

Water-holding Capacity

The leachate quantity results showed that the presence of 30 percent sludge cake in a landfill reduced the ability to retain water. Adding more than 30 percent sludge cake would reduce the absorptive capacity substantially. Equally important, adding such a large fraction of semisolid sludge in the landfill would create unpleasant and hazardous conditions for workers.

Parameters Affected by RBS

The leachate contaminants can be separated into parameters sharply affected or not sharply affected by the onset of rapid anaerobic biological stabilization (RBS). Parameters which declined sharply were leachate concentrations of COD, volatile acids (VA), TOC, volatile and total solids (VS and TS), iron, phosphate, and zinc. The pH rose sharply by about 1.0 unit. For COD, VA, TOC, VS, and TS, the overriding influence was whether RBS had occurred. Concentrations were drastically reduced by this transition. This is in accord with our knowledge of what occurs in anaerobic biological stabilization. These substances are consumed. Soluble organic substrates are reduced to simpler forms and eventually converted to methane and carbon dioxide.

For phosphate, iron, and zinc, the mechanism of removal is precipitation which is related probably primarily to pH, but also possibly to the removal of organic substances that can complex with these substances and hold them in solution, and to reduced oxidation-reduction potential.

Iron concentration appeared to be strongly influenced by pH. Concentration fell dramatically in the SW and SW-SL cells when the pH change associated with RBS occurred. Phosphate dropped in the SW and SW-SL cells but not to as low a level as might be expected considering the amount of iron in solution. Zinc only fell dramatically in 3 SW cells and one SW-SL cell where its initial concentration was unusually high. The drop appeared to be related to pH.

Parameters Not Affected by RBS

Factors not noticeably affected by RBS were chloride, alkalinity, TKN (total Kjeldahl nitrogen), cadmium, chromium, copper, lead, and nickel. Chloride is a highly soluble ion that is not consumed or precipitated in the landfill reactions. The leaching behavior of other substances has been compared against it to assess their fate in the landfill. The heterogenous nature of the landfill may partially invalidate this procedure (chloride may not be concentrated in the landfill in the same locations as the substances it is supposed to trace), so the concept should be used with caution.

Alkalinity and TKN are soluble substances that will not precipitate in landfills. However, they can increase or decrease depending on the biological activity in the landfill. Comparisons for the SW and SW-SL test cells show that except for TKN for the SW landfills, their leachate concentrations relative to chloride were constant with time, showing that they behaved like chloride. This unusual behavior requires more consideration, because one would expect both TKN and alkalinity to be produced by the anaerobic activity in the landfill. They should not leach out in the same manner as a soluble contaminant with a fixed initial concentration.

The behavior of most of the metals was similar. Cadmium, chromium, and lead declined at a rate substantially faster than chloride. This indicates conditions in the landfill were changing with time and were precipitating these metals. The ever-continuing reduction in COD and volatile acids with time reduced the amount of organic complexing agents, chloride (another complexing agent) was declining with time, and pH was generally rising towards neutrality. The exact cause of the decline cannot be identified from our results. Nickel and copper are the only metals that declined like chloride. It appears that the changing conditions that occurred with time did not reduce their solubility.

Production of Gas

The production of gas was substantial and probably about the same whether or not sludge was present in the landfill, although production peaked and fell sooner when the test cells contained sludge. Although the calculated amount of organic material consumed by conversion to gas was considerable, much potentially biodegradable material remained undecomposed. There may be some utility to injecting sludge into a landfill to start gas production or revive it after it has declined.

CONCLUSIONS

1) The presence of sludge in simulated solid waste landfills protected from incursions of air reduced by about two years the time before rapid anaerobic biological stabilization (RBS) commenced. The onset of RBS reduced chemical oxidation demand (COD) of the leachate by a factor of 20. Consequently, for two years, landfills containing sludge produced leachates containing far less COD than did landfills without sludge. RBS started sooner with anaerobically digested sludge than with lime treated raw sludge but the difference was not large.

2) Solid waste landfills absorbed infiltration water so leachate flow lagged behind infiltration by about a year. Adding sludge cake up to 30 percent by volume reduced the ability to retain infiltration by about 45 percent.

3) With the onset of RBS, many parameters underwent abrupt changes, generally in a period of 1-2 months. The pH increased about 1 unit. Chemical oxygen demand (COD) and volatile acids (VA) dropped by a factor of 20 or more. Phosphate, iron, and zinc concentrations dropped sharply. Final concentrations were similar for leachates from SW and SW-SL simulated landfills.

4) In SW and SW-SL simulated landfills, other parameters declined at rates similar to the decline of chloride, a highly soluble and inert substance in a landfill. These were alkalinity, TKN (total Kjeldahl nitrogen), copper and nickel. All parameters were initially lower in leachate from SW-SL cells but were at about the same level after 4 years.

5) In SW and SW-SL simulated landfills, cadmium declined substantially faster than the decline in chloride. Lead and chromium dropped more sharply than chloride but not as fast as cadmium. All four metals initially were lower in concentration in the SW-SL leachates but were at about the same concentrations for both SW and SW-SL cells after 4 years.

6) All test cells produced substantial amounts of methane-rich gas relative to their dry mass. Gas generation commenced and peaked sooner in the test cells containing sludge.

RECOMMENDATIONS

1) It is a popular misconception that introducing sludge into landfills degrades leachate quality. This study shows the reverse is true. Results of this investigation should be made widely available to EPA and state authorities concerned with landfill regulations to improve the scientific basis of their decisions.

2) This paper has reviewed the entire scope of the results. Because of the number of parameters investigated, average effects (for example, for all cells containing sludge) have been evaluated. More detailed consideration should be given (and is planned) of the monthly changes in parameters and the effects of different percentages and type of sludges.

2) More research on the effects of sludge in landfills is appropriate. The test cells of the present investigation should be opened and analyzed to determine the fate of organic priority pollutants which had been added to them.

ACKNOWLEDGMENT

This extensive and successful experiment is the end result of the efforts of many people too numerous to mention. Major contributions were made by Greg Vogt of SCS Engineers, and Riley Kinman and Janet Rickabaugh of the University of Cincinnati. Mr. Vogt supervised the first two years of the program, Dr. Kinman planned and directed the loading of the test cells, and Ms. Rickabaugh supervised the analytical activities.

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METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

ATTACHMENT 12

COMPARISON OF ANNUAL AVERAGE METAL LEVELS IN LEACHATE FROM SOLID-WASTE TEST CELLS WITH AND WITHOUT MUNICIPAL SEWAGE SLUDGE TWO YEARS AFTER SLUDGE ADDITION (FROM FARRELL ET AL.)

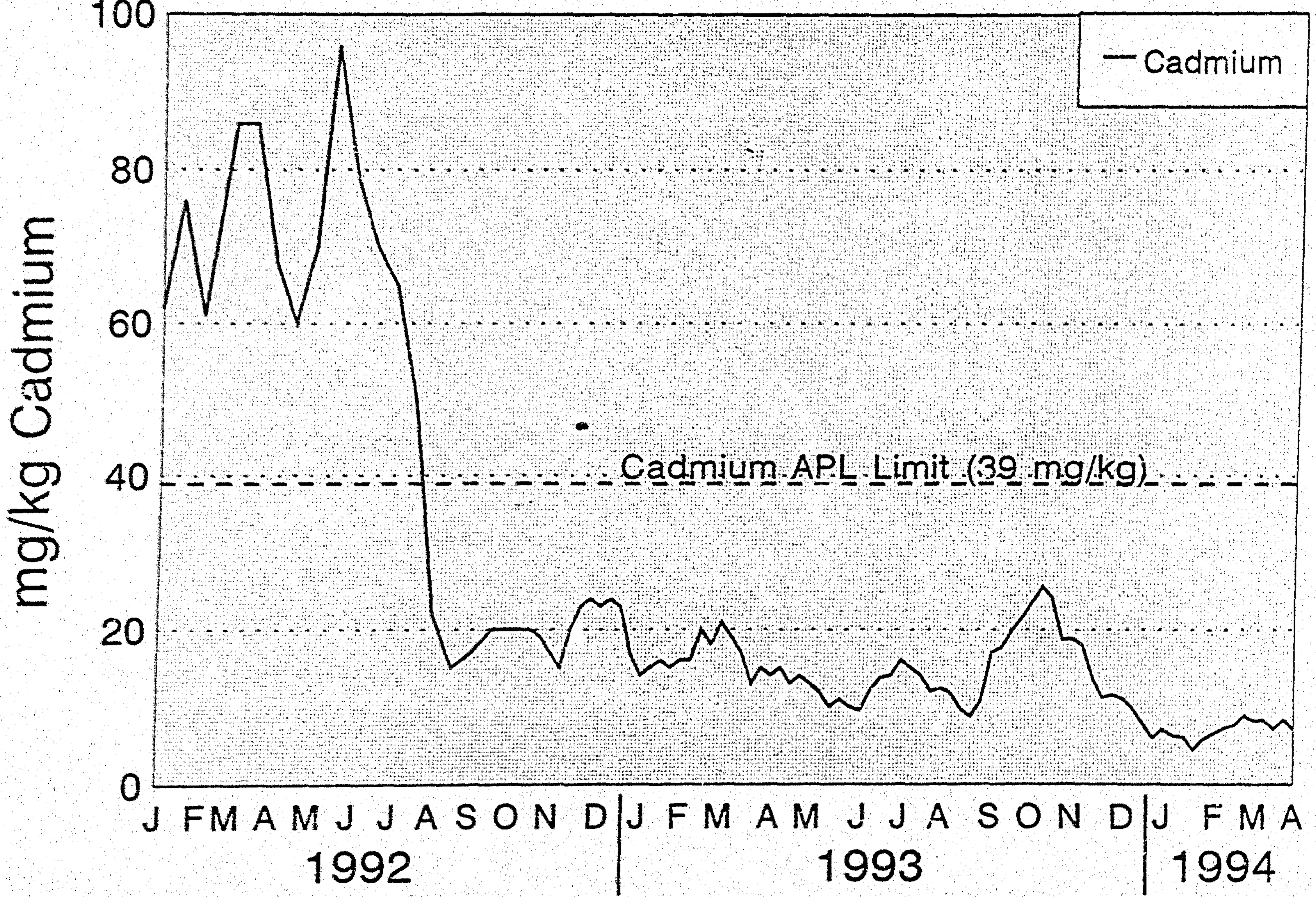
Constituent	Leachate Concentration (mg/l) With Sludge (A)	Leachate Concentration (mg/l) Without Sludge (B)	Reduction, % $\frac{(B-A)}{(B)} \times 100$
Cd	0.018	0.029	37.9
Cr	0.053	0.096	44.7
Cu	0.034	0.042	19.0
Fe	75	1330	94.3
Pb	0.129	0.232	44.3
Ni	0.22	0.60	63.3
Zn	0.30	12.0	97.5

Metropolitan Water Reclamation District of Greater Chicago

Attachment 13

Calumet Digester Composite

January 15, 1992 through April 4, 1994



lge continues to be Class A with
ject to viable helminth ova when the
ies for the pathogen treatment
cess operating parameters are
sistent with the values or ranges of
ies documented in paragraph
5)(iii)(C) of this section.

i) *Class A—Alternative 4.* (i) Either
density of fecal coliform in the
age sludge shall be less than 1000
st Probable Number per gram of total
ds (dry weight basis), or the density
almonella sp. bacteria in the sewage
lge shall be less than three Most
bable Number per four grams of total
ds (dry weight basis) at the time the
age sludge is used or disposed; at
time the sewage sludge is prepared
sale or give away in a bag or other
tainer for application to the land; or
he time the sewage sludge or
erial derived from sewage sludge is
pared to meet the requirements in
)3.10 (b), (c), (e), or (f).

i) The density of enteric viruses in
sewage sludge shall be less than one
que-forming Unit per four grams of
l solids (dry weight basis) at the time
sewage sludge is used or disposed;
he time the sewage sludge is
pared for sale or give away in a bag
ther container for application to the
d; or at the time the sewage sludge
naterial derived from sewage sludge
repared to meet the requirements in
)3.10 (b), (c), (e), or (f), unless
erwise specified by the permitting
hority.

ii) The density of viable helminth
in the sewage sludge shall be less
n one per four grams of total solids
weight basis) at the time the sewage
lge is used or disposed; at the time
sewage sludge is prepared for sale or
away in a bag or other container for
lication to the land; or at the time
sewage sludge or material derived
n sewage sludge is prepared to meet
requirements in § 503.10 (b), (c), (e),
f), unless otherwise specified by the
mitting authority.

') *Class A—Alternative 5.* (i) Either
density of fecal coliform in the
age sludge shall be less than 1000
st Probable Number per gram of total
ds (dry weight basis), or the density
almonella, sp. bacteria in the sewage
lge shall be less than three Most
bable Number per four grams of total
ds (dry weight basis) at the time the
age sludge is used or disposed; at
time the sewage sludge is prepared
sale or given away in a bag or other
tainer for application to the land; or
e time the sewage sludge or
erial derived from sewage sludge is
pared to meet the requirements in
)3.10(b), (c), (e), or (f).

(ii) Sewage sludge that is used or disposed shall be treated in one of the Processes to Further Reduce Pathogens described in appendix B of this part.

(8) *Class A—Alternative 6.* (i) Either the density of fecal coliform in the sewage sludge shall be less than 1000 Most Probable Number per gram of total solids (dry weight basis), or the density of *Salmonella*, sp. bacteria in the sewage sludge shall be less than three Most Probable Number per four grams of total solids (dry weight basis) at the time the sewage sludge is used or disposed; at the time the sewage sludge is prepared for sale or given away in a bag or other container for application to the land; or at the time the sewage sludge or material derived from sewage sludge is prepared to meet the requirements in § 503.10(b), (c), (e), or (f).

(ii) Sewage sludge that is used or disposed shall be treated in a process that is equivalent to a Process to Further Reduce Pathogens, as determined by the permitting authority.

(b) *Sewage sludge—Class B.* (1)(i) The requirements in either § 503.32(b)(2), (b)(3), or (b)(4) shall be met for a sewage sludge to be classified Class B with respect to pathogens.

(ii) The site restrictions in § 503.32(b)(5) shall be met when sewage sludge that meets the Class B pathogen requirements in § 503.32(b)(2), (b)(3), or (b)(4) is applied to the land.

(2) *Class B—Alternative 1.*

(i) Seven samples of the sewage sludge shall be collected at the time the sewage sludge is used or disposed.

(ii) The geometric mean of the density of fecal coliform in the samples collected in paragraph (b)(2)(i) of this section shall be less than either 2,000,000 Most Probable Number per gram of total solids (dry weight basis) or 2,000,000 Colony Forming Units per gram of total solids (dry weight basis).

(3) *Class B—Alternative 2.* Sewage sludge that is used or disposed shall be treated in one of the Processes to Significantly Reduce Pathogens described in appendix B of this part.

(4) *Class B—Alternative 3.* Sewage sludge that is used or disposed shall be treated in a process that is equivalent to a Process to Significantly Reduce Pathogens, as determined by the permitting authority.

(5) *Site Restrictions.* (i) Food crops with harvested parts that touch the sewage sludge/soil mixture and are totally above the land surface shall not be harvested for 14 months after application of sewage sludge.

(ii) Food crops with harvested parts below the surface of the land shall not be harvested for 20 months after application of sewage sludge when the sewage sludge remains on the land surface for four months or longer prior to incorporation into the soil.

(iii) Food crops with harvested parts below the surface of the land shall not be harvested for 38 months after application of sewage sludge when the sewage sludge remains on the land surface for less than four months prior to incorporation into the soil.

(iv) Food crops, feed crops, and fiber crops shall not be harvested for 30 days after application of sewage sludge.

(v) Animals shall not be allowed to graze on the land for 30 days after application of sewage sludge.

(vi) Turf grown on land where sewage sludge is applied shall not be harvested for one year after application of the sewage sludge when the harvested turf is placed on either land with a high potential for public exposure or a lawn, unless otherwise specified by the permitting authority.

(vii) Public access to land with a high potential for public exposure shall be restricted for one year after application of sewage sludge.

(viii) Public access to land with a low potential for public exposure shall be restricted for 30 days after application of sewage sludge.

(c) *Domestic septage.* (1) The site restrictions in § 503.32(b)(5) shall be met when domestic septage is applied to agricultural land, forest, or a reclamation site; or

(2) The pH of domestic septage applied to agricultural land, forest, or a reclamation site shall be raised to 12 or higher by alkali addition and, without the addition of more alkali, shall remain at 12 or higher for 30 minutes and the site restrictions in § 503.32 (b)(5)(i) through (b)(5)(iv) shall be met.

§ 503.33 Vector attraction reduction.

(a)(1) One of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(10) shall be met when bulk sewage sludge is applied to agricultural land, forest, a public contact site, or a reclamation site.

(2) One of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8) shall be met when bulk sewage sludge is applied to a lawn or a home garden.

(3) One of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8) shall be met when sewage sludge is sold or given away in a bag or other container for application to the land.

(4) One of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(11) shall be met when sewage sludge (other than domestic

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3.48 Reporting.

lass I sludge management facilities, TWs (as defined in 40 CFR 501.2) h a design flow rate equal to or ater than one million gallons per day, l POTWs that serve a population of 000 people or greater shall submit information in § 503.47(b) through 03.47(h) to the permitting authority February 19 of each year.

pproved by the Office of Management and dget under control number 2040–0157)

pendix A to Part 503—Procedure to termine the Annual Whole Sludge plication Rate for a Sewage Sludge

Section 503.13(a)(4)(ii) requires that the duct of the concentration for each llutant listed in Table 4 of § 503.13 in wage sludge sold or given away in a bag other container for application to the land d the annual whole sludge application rate WSAR) for the sewage sludge not cause the nual pollutant loading rate for the llutant in Table 4 of § 503.13 to be ceeded. This appendix contains the ocedure used to determine the AWSAR for sewage sludge that does not cause the nual pollutant loading rates in Table 4 of 503.13 to be exceeded.

The relationship between the annual llutant loading rate (APLR) for a pollutant d the annual whole sludge application rate WSAR) for 1a sewage sludge is shown in uation (1).

$$APLR = C \times AWSAR \times 0.001 \quad (1)$$

/here:

APLR=Annual pollutant loading rate in kilograms per hectare per 365 day period.

C=Pollutant concentration in milligrams, per kilogram of total solids (dry weight basis).

AWSAR=Annual whole sludge application rate in metric tons per hectare per 365 day period (dry weight basis).

0.001=A conversion factor.

To determine the AWSAR, equation (1) is earranged into equation (2):

$$AWSAR = \frac{APLR}{C \times 0.001} \quad (2)$$

The procedure used to determine the AWSAR for a sewage sludge is presented below.

Procedure:

1. Analyze a sample of the sewage sludge to determine the concentration for each of the pollutants listed in Table 4 of § 503.13 in the sewage sludge.

2. Using the pollutant concentrations from Step 1 and the APLRs from Table 4 of § 503.13, calculate an AWSAR for each pollutant using equation (2) above.

3. The AWSAR for the sewage sludge is the lowest AWSAR calculated in Step 2.

Appendix B to Part 503—Pathogen Treatment Processes

A. Processes to Significantly Reduce Pathogens (PSRP)

1. Aerobic digestion—Sewage sludge is agitated with air or oxygen to maintain aerobic conditions for a specific mean cell residence time at a specific temperature. Values for the mean cell residence time and temperature shall be between 40 days at 20 degrees Celsius and 60 days at 15 degrees Celsius.

2. Air drying—Sewage sludge is dried on sand beds or on paved or unpaved basins. The sewage sludge dries for a minimum of three months. During two of the three months, the ambient average daily temperature is above zero degrees Celsius.

3. Anaerobic digestion—Sewage sludge is treated in the absence of air for a specific mean cell residence time at a specific temperature. Values for the mean cell residence time and temperature shall be between 15 days at 35 to 55 degrees Celsius and 60 days at 20 degrees Celsius.

4. Composting—Using either the within-vessel, static aerated pile, or windrow composting methods, the temperature of the sewage sludge is raised to 40 degrees Celsius or higher and remains at 40 degrees Celsius or higher for five days. For four hours during the five days, the temperature in the compost pile exceeds 55 degrees Celsius.

5. Lime stabilization—Sufficient lime is added to the sewage sludge to raise the pH of the sewage sludge to 12 after two hours of contact.

B. Processes to Further Reduce Pathogens (PFRP)

1. Composting—Using either the within-vessel composting method or the static aerated pile composting method, the temperature of the sewage sludge is maintained at 55 degrees Celsius or higher for three days.

Using the windrow composting method, the temperature of the sewage sludge is maintained at 55 degrees or higher for 15 days or longer. During the period when the compost is maintained at 55 degrees or higher, there shall be a minimum of five turnings of the windrow.

2. Heat drying—Sewage sludge is dried by direct or indirect contact with hot gases to reduce the moisture content of the sewage sludge to 10 percent or lower. Either the temperature of the sewage sludge particles exceeds 80 degrees Celsius or the wet bulb temperature of the gas in contact with the sewage sludge as the sewage sludge leaves the dryer exceeds 80 degrees Celsius.

3. Heat treatment—Liquid sewage sludge is heated to a temperature of 180 degrees Celsius or higher for 30 minutes.

4. Thermophilic aerobic digestion—Liquid sewage sludge is agitated with air or oxygen to maintain aerobic conditions and the mean cell residence time of the sewage sludge is 10 days at 55 to 60 degrees Celsius.

5. Beta ray irradiation—Sewage sludge is irradiated with beta rays from an accelerator at dosages of at least 1.0 megarad at room temperature (ca. 20 degrees Celsius).

6. Gamma ray irradiation—Sewage sludge is irradiated with gamma rays from certain isotopes, such as Cobalt 60 and Cesium 137, at room temperature (ca. 20 degrees Celsius).

7. Pasteurization—The temperature of the sewage sludge is maintained at 70 degrees Celsius or higher for 30 minutes or longer.

[FR Doc. 93–2 Filed 2–18–93; 8:45 am]

BILLING CODE 6560-01-M

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Parts 122, 123, and 501

[FRL–4515–7]

National Pollutant Discharge Elimination System Sewage Sludge Permit Regulations; State Sludge Management Program Requirements

AGENCY: Environmental Protection Agency.

ACTION: Final rule; technical amendment.

SUMMARY: Under existing regulations that establish sewage sludge permitting and State sewage sludge program requirements, approximately 20,000 publicly owned treatment works and other treatment works treating domestic sewage are required to submit permit applications within 120 days after the promulgation of standards applicable to their sewage sludge use or disposal practice(s). The final sewage sludge use and disposal standards will be published in the Federal Register on or near the same date as this final rule. To facilitate the management of these applications, on May 27, 1992, EPA proposed to revise these rules to stagger the submission of permit applications. Additionally, EPA proposed to extend the time period during which the initial set of applications must be submitted from 120 days to 180 days after promulgation of the technical standards. In response to comments received on the May 27, 1992, proposal, EPA is issuing a final rule which requires permit applications in phases and extends the time period in which the initial applications are due following the publication of the final use or disposal standards.

On July 28, 1986, EPA promulgated final regulations for application requirements for facilities that dischaige only non-process wastewater, which resulted in internal recodification of § 122.21. Conforming changes were not made to § 123.25(a)(4) which refers to the relevant portions of section 122. These technical corrections are being made as part of this rule.

EFFECTIVE DATE: The effective date of this final rule is March 22, 1993.

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

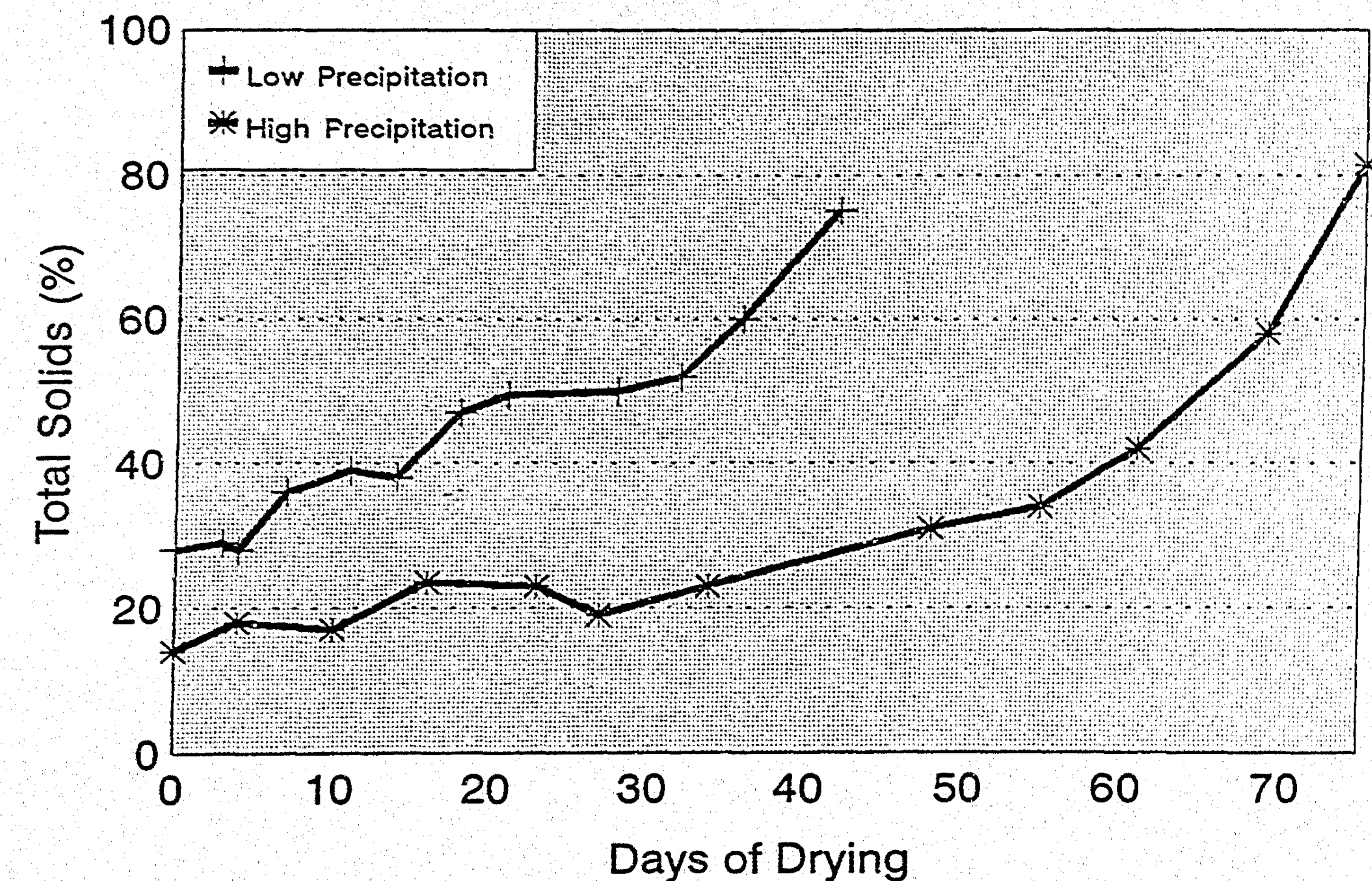
ATTACHMENT 15

EFFECT OF LAGOON AGING ON THE VOLATILE SOLIDS CONTENT AND BACTERIAL CONCENTRATION OF CENTRIFUGE CAKE

Date	Solids	Total Volatile Solids	Fecal Coliform
	-----------%	-----------	counts/dry g
7/14/92	20.1	49.2	27,000
10/26/92	19.6	45.2	6
1/25/93	19.5	46.6	21
4/19/93	20.4	48.6	12
7/7/94	19.7	48.4	5
10/28/93	21.1	42.8	20
1/24/94	18.4	42.1	4

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO
Attachment 16

Air Drying of District Sludge During Periods of Low and High Precipitation



METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

ATTACHMENT 17

CUMULATIVE SLUDGE APPLICATION TO TEST AND CONTROL FIELDS 1972-1977 AND GEOMETRIC MEANS OF MICROBIAL POPULATIONS IN TEST AND CONTROL FIELDS TESTED ANNUALLY 1975-1977, FULTON COUNTY, ILLINOIS

	Cumulative Sludge Applied	Total Coliforms	Fecal Coliforms	Fecal Streptococcus	Salmonella
	Tons/Acre Dry Solids				
Control Field					
6	0.1	1.3×10^3	2.6×10^1	2.4×10^3	NR
Test Fields					
3	77.6	3.1×10^3	2.1×10^2	2.5×10^3	NR
9	21.2	2.0×10^4	1.5×10^2	3.3×10^4	NR
20	63.8	1.7×10^3	2.3×10^1	1.5×10^1	NR
21	65.6	3.1×10^3	8.9×10^0	3.2×10^2	NR

*NR - Not recovered.

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

ATTACHMENT 18

MEAN VALUES AND RANGE OF PRINCIPAL NUTRIENTS AND ESSENTIAL METALS OF DEWATERED SEWAGE SLUDGE APPLIED TO FIELDS AT THE FULTON COUNTY, ILLINOIS SITE IN 1992*

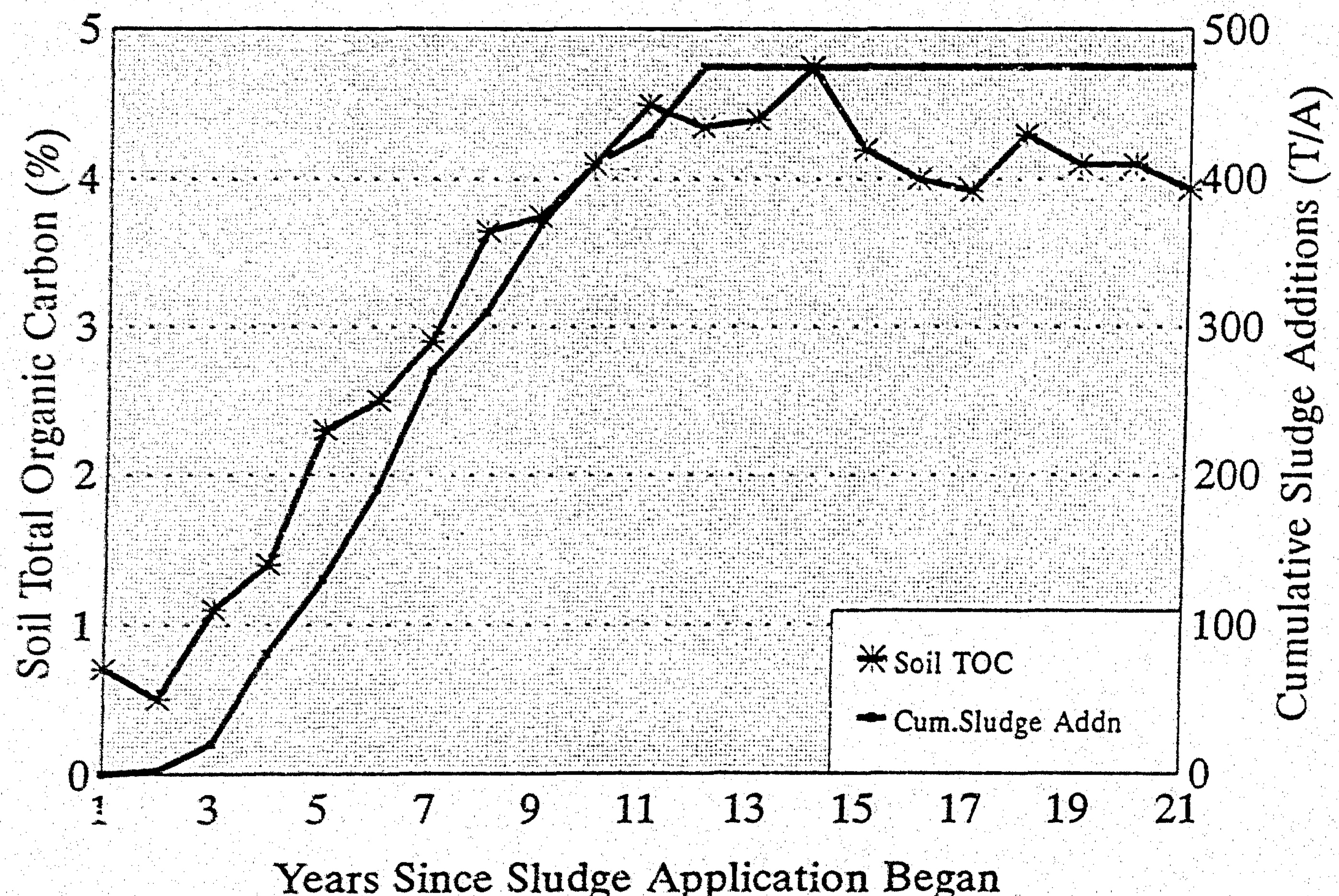
Constituent	Units	Minimum	Maximum	Mean
pH	%	5.6	7.8	6.8
Total Solids	%	55.4	79.4	66.0
Total Vol. Sol.	%	21.0	42.5	35.6
Kjeldahl-N	mg/dry kg	10,292	24,771	20,430
NH_3-N	"	786	7,796	4,255
Total P	"	11,134	27,007	21,335
Fe	"	754	48,115	25,070
Mn	"	115	910	530
Zn	"	528	4,750	2,746
Cu	"	235	1,810	1,517

*No sludge was applied in 1993.

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

Attachment 19

EFFECT OF CUMULATIVE SEWAGE SLUDGE ADDITIONS TO MINE SPOIL SOILS AT FULTON COUNTY ON SOIL TOTAL ORGANIC CARBON



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REPORT

GEOTECHNICAL STUDY

MWRDGC PROCESSED SLUDGE STUDY
VARIOUS FACILITIES
METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO
COOK COUNTY, ILLINOIS

CLAUDE H. HURLEY COMPANY

Consulting Soil and Foundation Engineers

CLAUDE H. HURLEY COMPANY
Consulting Soil and Foundation Engineers
175 WEST FIRST STREET
ELMHURST, ILLINOIS 60126
(708) 279-7762

March 15, 1994

Mr. Leo R. DiVita
Metropolitan Water Reclamation District of Greater Chicago
100 East Erie Street
Chicago, Illinois 60611

Attention: Mr. Raymond R. Rimkus
Assistant Chief Engineer

Re: MWRDGC Processed Sludge Study
Various Facilities
Metropolitan Water Reclamation District of Greater Chicago
Cook County, Illinois
HPN3-359-L

Gentlemen:

The Claude H. Hurley Company, Geotechnical Engineer has completed the above referenced study.

The work was done per the terms of a Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) July 9, 1993 Letter Work Order to Purchase Order No. A655575 for the Professional Engineering Services Agreement for Subsurface Investigation for the Sludge Drying Facility at Ridgeland Avenue MWRDGC Project 89-202-2P.

Purpose of Study

Lagoon and centrifuge cake sludge are products of the MWRDGC sludge processing. The sludge is considered for use in earth structures as embankment fill and structural fill.

The purpose of this study is to:

1. Define the engineering properties of the sludge,

2. Use the properties to estimate parameters for geotechnical design and construction of the structures, and

3. Use the parameters to evaluate the performance of the materials in the structures.

Scope of Study

General. The work included:

1. Obtaining samples of two materials from the MWRDGC and discussing the MWRDGC's observed performance of the materials under various field conditions,

2. Making a laboratory test series to classify the available soils and determine the strength, compressibility and drainage characteristics of the materials,

3. Formulating conclusions on the geotechnical design, construction and performance of the materials in earth structures, and

4. Making recommendations regarding geotechnical design criteria and construction procedures for material used as fill.

Laboratory investigations. Significant properties of the materials were determined in a laboratory testing program which included:

1. Visual classification tests and observation of change in material characteristics with time after addition of moisture, molding, preparation of test specimens, curing and testing.

2. Photo-ionizer measurement of total VOC content and flashpoint-combustion tests,

3. Grain size determination including hydrometer and fine sieve analyses,

4. Atterberg limit tests including liquid limit, plastic limit and shrinkage limit tests,

5. Specific gravity tests,

6. Total organic matter and loss-on-ignition tests,

7. Dry unit weight tests,

8. Moisture-density relationship tests per ASTM D-1557,

9. Time-swell measurement by the IBR method.

10. Controlled strain unconfined compression tests,

11. Q-Type triaxial compression tests,

12. R-Type triaxial compression tests with pore pressure measurement, and

13. One-dimensional consolidation tests including initial load, recycle, load and rebound.

The results of the study are presented herein.

Results of Investigation

Data presentation. The results of the laboratory investigations are presented on the following in Appendix A.

Item	Figure No.
Source-Classification Data	1
Grain Size Curves	
Plasticity Chart	
Moisture-Density Relationships	
Time-Swell Relationships	
Unconfined Compression Test Data	2
Triaxial Compression Test Data	
Soil No. 1 Q-Test Data	3
Soil No. 2 Q-Test Data	4
Soil No. 2 R-Test Data	
One-Dimensional Consolidation Test Data	5

The Soil and Bedrock Identification and Classification System used in the program is shown on Fig. 6 in Appendix B.

Soil source-classification data. Soil No. 1 is Blk Organic Silt, Li c-f Sand Centrifuge Cake Sludge sampled from the Drying Cells at 122nd Street and Stoney Island Avenue. Soil No. 2 is Blk Organic Silt, Li c-f Sand Lagoon Sludge from the Cells at the Lawndale Avenue Solids Management Area.

Both soils were sampled by the MWRDGC. Bulk samples were delivered to the Geotechnical Engineer's laboratory on July 8, 1993.

General soil behavior. The following soil behavior was observed by the MWRDGC during informal periods of field observation and by the Geotechnical Engineer during the laboratory studies.

1. The soils exist on the surface of haul roads in the drying cells. The soils are impacted by the traffic of trucks and other sludge processing equipment. The soils form a hard but friable dusty surface when dry. The surface is slippery when moisture is initially applied. The soils imbibe water and become very soft to soft with low stability and trafficability when subjected to sustained moisture application.

2. The soils emit a putrid odor during processing, especially when moisture is added to a relatively dry material.

3. VOC = 2.0 to 18.0 ppm developed in samples sealed in containers within 48 hr of adding water and molding test specimens.

The measured VOC did not flash and were not combustible.

4. White mold formed within 48 hr of sample preparation on samples prepared for testing and sealed in containers.

No mold formed during a maximum 18-day swell test on specimens prepared and inundated during test.

5. The soils were effectively oven dry after 18 to 24 hr of standard drying. The drying period was routinely extended to 48 hr to confirm constant weight.

Basic soil properties. The soils are moderately pervious friable Organic Silt with 2% Clay, 84 to 86% Silt and 12 to 14% Sand by weight. The soils are highly plastic air dry with LL = 85 to 88, PL = 64 to 65 and PI = 21 to 23, and non-plastic oven dry. The soils possess a moderate to high organic content with TOM = 34 to 36% and LOI = 32 to 34%.

The materials exhibit a low compacted density and high workable moisture content with a Maximum Dry Unit Weight = 65.8 to 70.5 pcf and Optimum Moisture Content = 36.7 to 42.5% per ASTM D-1557. The soils possess a corresponding low Specific Gravity = 1.93 to 2.01.

The basic soil properties are summarized graphically on Fig. 1.

Soil shrink-swell properties. Time-Swell Relationships are shown on Fig. 1. The soils exhibit a potential for high swell and corresponding loss in volume by shrinkage with change in moisture when compacted to a density of 90 to 104% of the maximum value at a moisture content 1% less than to 4% more than the optimum moisture content obtainable per ASTM D-1557.

The soils exhibited a 15.8 to 20.3% percent 10-day swell with an additional 1% swell during an ensuing 8-day observation period. Most of the swell and corresponding increase in moisture content occurred in the upper 1.5 in. of a 4.5 in. test specimen.

The friable property, moderate permeability and ability for rapid loss and absorption of water are reflected by a minimum 60% and nominal 90% ultimate swell after 24 hr of test and a minimum 89% ultimate swell after 72 hr.

Both soils exhibit the same potential to shrink or swell. The potential for volume change does not vary directly with degree of compaction or compacted moisture content.

Soil strength properties. Strength specimens were prepared or correlated for evaluation to specimens compacted to a density of 90 to 100% of the applicable control value at a moisture content 2% to 6% above the value.

Unconfined Compression Test Data are shown on Fig. 2. The prepared soils are stiff to very stiff with a measured Q_u = 1.54 to 3.20 tsf. The strength varies by soil type with higher values for the higher density Soil No. 1. The strength increases with degree of compaction at a constant moisture content and decreases with increase in moisture content at a constant degree of compaction for each soil.

Triaxial Compression Test Data are shown on Fig. 3 and 4. Design parameters are summarized in the following.

Soil No. 1 Q-Test Data

				Design Parameters				
Envelope	Degree of Compaction (%)	Optimum w (%)	Normal Stress (ksf)	C_Q (ksf)	ϕ_Q (°)	Normal Stress (tsf)	C_Q (ksf)	ϕ_Q (°)
A	90	+2.0	0.0-8.8	0.6	37	8.8+	6.6	4
B	95	+2.0	0.0-8.8	1.2	39	8.8+	8.0	3
C	100	+2.0	0.0-10.0	1.4	39	10.0+	9.8	1
D	90	+6.0	0.0-8.0	1.0	31	8.0+	4.8	5
E	95	+6.0	0.0-8.0	1.2	31	8.0+	5.4	5
F	100	+6.0	0.0-8.0	1.6	31	8.0+	5.8	5

Soil No. 2 Q-Test Data

				Design Parameters				
Envelope	Degree of Compaction (%)	Optimum w (%)	Normal Stress (ksf)	C_Q (ksf)	ϕ_Q (°)	Normal Stress (tsf)	C_Q (ksf)	ϕ_Q (°)
A	90	+2.0	0.0-6.8	1.0	25	6.8+	4.0	2
B	95	+2.0	0.0-6.8	1.2	25	6.8+	4.2	2
C	100	+2.0	0.0-6.8	1.3	34	6.8+	5.8	0
D	90	+6.0	0.0-6.6	0.6	28	6.6+	4.0	2
E	95	+6.0	0.0-6.6	0.8	30	6.6+	4.4	1
F	100	+6.0	0.0-6.6	1.2	29	6.6+	4.8	0
G	90	+6.0	-	1.2	0	-	-	-

Soil No. 2 R-Test Data

Envelope	Degree of Compaction (%)	Optimum w (%)	Design Parameters C_R (ksf)	ϕ_R (o)	$C_{\bar{R}}$ (ksf)	$\phi_{\bar{R}}$ (o)
H	90	+2.0	0.9	23	0	36
I	95	+2.0	1.0	24	0	38
J	100	+2.0	1.4	26	0	41
K	90	+6.0	0.5	26	0	32
L	95	+6.0	0.6	32	0	35
M	100	+6.0	0.7	33	0	38

The Q-test data for Soils No. 1 and 2 reflect somewhat higher strength parameters for the higher density Soil No. 1. Both soils generally exhibit higher Q-test strength with increase in degree of compaction and lower strength with increase in compacted moisture content. The Soil No. 2 R-Test Data exhibit the same relationships.

Q-test Envelopes A through F for Soils No. 1 and 2 were developed on compacted unsaturated soil specimens. Soil No. 2 Envelope G was developed on a compacted specimen saturated prior to test by backpressure. The comparative test data reflect the negative impact of saturation on the performance of the soils with a measured 75% reduction in the ultimate strength after saturation.

Soil compressibility characteristics. One-Dimensional Consolidation Test Data are shown on Fig. 5 for Soil No. 2.

The measured Compression Index, C_c = 0.173 to 0.582 for specimens prepared by compacting the soil to 87 to 98% of the control value at a moisture content 2.0 to 7.1% above the control value.

C_c and ultimate strain during the test generally decrease with increase in degree of compaction and increase with increase in compacted moisture content.

Conclusions

The following conclusions regarding geotechnical design, construction and performance of the MWRDGC Processed Sludge in earth structures are based on the results of this study.

1. The sludge possesses the following basic properties.

   a. moderate to high organic content,
   b. high plasticity when wet,
   c. moderate permeability,

d. friability and frost susceptibility,
e. low compacted density and high workable moisture content,

2. The sludge exhibits the potential for high swell and corresponding loss in volume by shrinkage with change in moisture when placed in engineered fill using typical control values.

3. The low density high workable moisture content material exhibits relatively high strength and low compressibility under a combination of compactive energy, cementation or other chemical reaction when placed in engineered fill using typical control values.

The apparent high strength is reduced and low compressibility increased by saturation in confinement similar to a completed embankment.

The apparent high strength is dramatically reduced, compressibility increased and permeability increased to unacceptable conditions in the presence of freewater at the surface of the material or in limited confinement. A corresponding but reversed change in properties occurs by shrinkage with loss-in-moisture.

4. The MWRDGC Processed Sludge is suitable for use as embankment fill, structural fill and related earthwork in limited controlled conditions.

Recommendations

The following are recommendations for geotechnical design and construction of embankment fill and structural fill using MWRDGC Processed Sludge.

1. The fill should be designed and built considering the following.

   a. Soil Strength Properties,
   b. Soil Compressibility Characteristics,
   c. Applicable factors of safety,
   d. Detailed review of the structure design and assignment of applicable parameters by the Geotechnical Engineer.

2. The design parameters recommended herein should be applied to fill designed for limited conditions of perfect protection by seal and drainage and built using controlled earthwork criteria.

a. Site drainage should include graded interior and exterior slopes, lateral and perimeter underdrains, storm sewers and ditches or other collector units.

The sludge should be capped with a minimum 4.0 ft thick seal of select cohesive fill or an equivalent to prevent slope deterioration by frost, slope deterioration by swell associated with free moisture absorption and hazards associated with odor or other unacceptable emission.

b. The parameters should be applied to materials placed and compacted to a minimum density equal to 90% of the maximum control value at a maximum moisture content equal to the optimum value plus 6.0%.

Additional Investigations

The design parameters and construction controls recommended herein for use in developing the MWRDGC Processed Sludge as embankment fill, structural fill and related earth structures are based on the use of controlled earthwork criteria for fill built to perform in limited conditions.

The parameters and controls differ significantly from the normal working properties of the sludge stored in drying cells and do not represent the properties of material in most finished earth structures. MWRDGC may consider using the sludge in other than the classic earthwork environment. Additional investigations should be made as needed to supplement the parameters and controls presented herein. The investigation should include as a minimum:

1. Review of sludge processing procedures, processing sequence of work and resultant sludge properties with the MWRDGC to define the variation in sludge properties with time and determine properties when available for earthwork.

2. Review of the measured properties, design parameters and controls developed herein relative to current or foreseeable sludge properties to establish the type and extent of additional study.

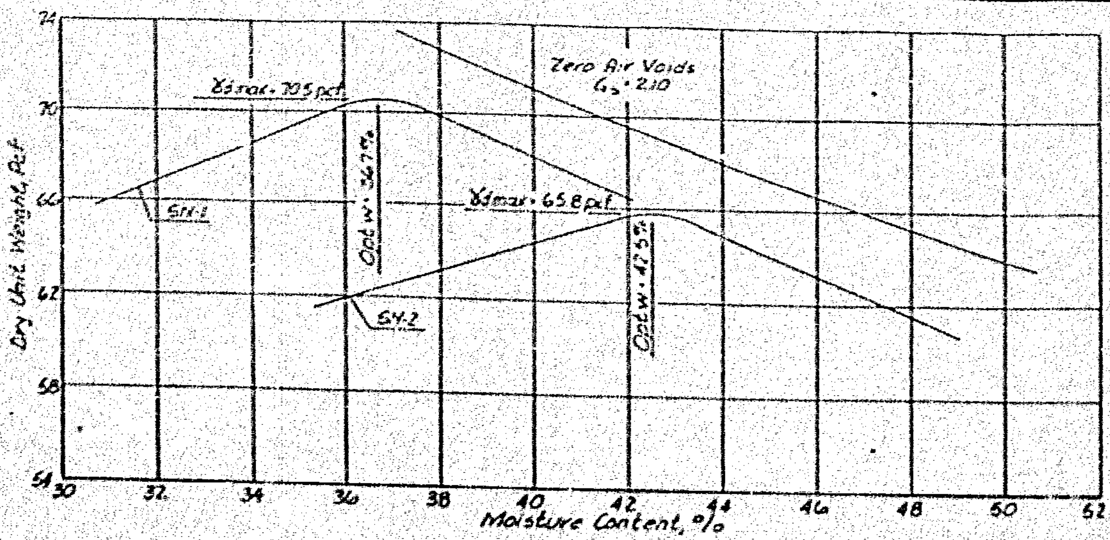
3. Making a supplemental laboratory test series to determine the strength, compressibility and drainage characteristics of the materials with a range in test controls selected based on the updated information, and

4. Formulate updated conclusions and make supplemental recommendations regarding the geotechnical design, construction and performance of earth structures built with the sludge using

APPENDIX A

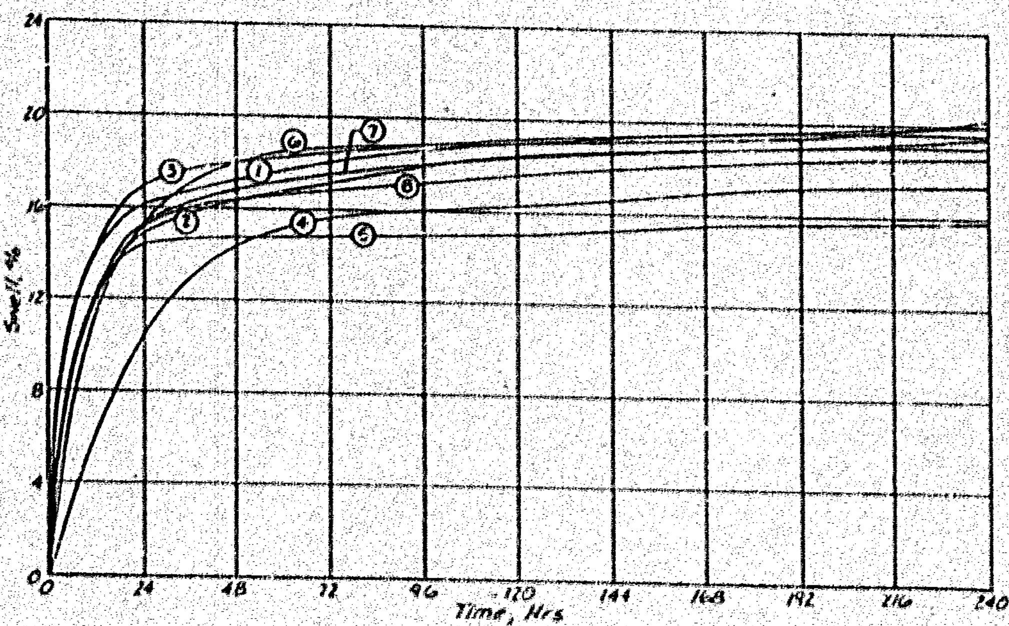
SOURCE-CLASSIFICATION DATA
GRAIN SIZE CURVES
PLASTICITY CHART
MOISTURE-DENSITY RELATIONSHIPS
TIME-SWELL RELATIONSHIPS

UNCONFINED COMPRESSION TEST DATA
TRIAXIAL COMPRESSION TEST DATA
Soil No. 1 Q-Test Data
Soil No. 2 Q-Test Data
Soil No. 2 R-Test Data
ONE-DIMENSIONAL CONSOLIDATION TEST DATA



	Atterberg Limits														Moisture-Density Relationships per D-1557	
	Air Dry				Oven Dry							Grain Size Data				
Soil No.	LL (%)	PL (%)	PI (%)	SL (%)	LL (%)	PL (%)	PI (%)	Gs	TOM (%)	LOI (%)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	γd (Pcf)	Opt w (%)
1	85	64	21	27	-	-	NP	2.01	36	34	-	12	86	2	70.5	36.7
2	88	6.	23	36	-	-	NP	1.93	34	32	-	11	85	2	65.8	42.5

MOISTURE-DENSITY RELATIONSHIPS



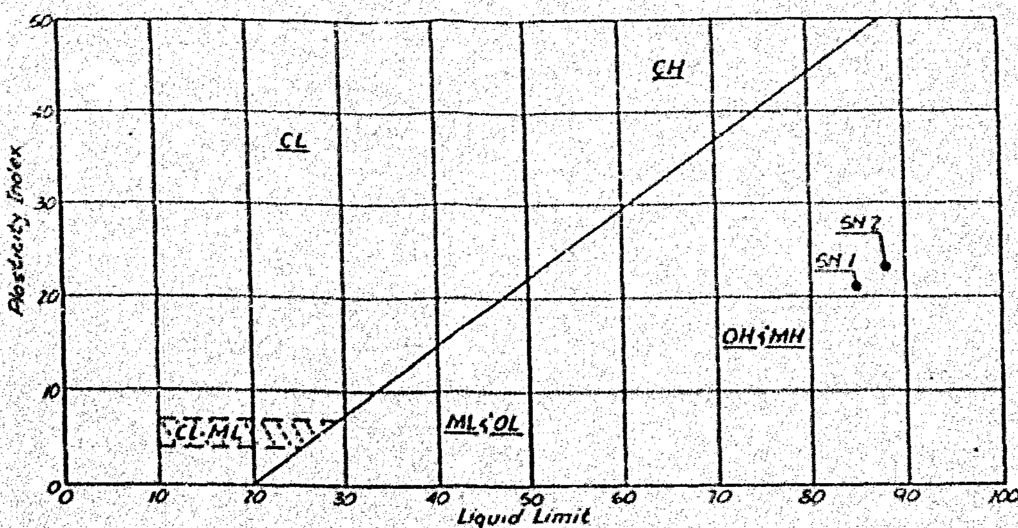
SPECIMEN DATA

Curve No.	Soil No.	Degree of Compaction (%)	Compacted Density (Pcf)	Compacted Moisture Content (%)	Final Moisture Content: Maximum(1) (%)	Range(2) (%)	Average(3) (%)	Swell at 10 Days(4) (%)
1	1	90	63.3	36.7	68.1	43.5-40.0	54.0	20.3
2	1	95	66.6	39.3	90.0	39.6-49.7	55.2	19.4
3	1	100	70.5	36.5	89.8	44.7-64.0	55.9	19.6
4	1	104	73.4	35.9	81.5	46.2-55.9	57.3	16.2
5	2	90	59.3	47.3	84.9	43.8-60.8	56.5	15.8
6	2	96	63.5	40.8	90.6	44.9-55.8	58.5	20.0
7	2	99	65.1	45.3	96.3	44.5-46.3	60.0	19.0
8	2	104	68.4	46.5	101.0	48.0-57.2	63.0	18.6

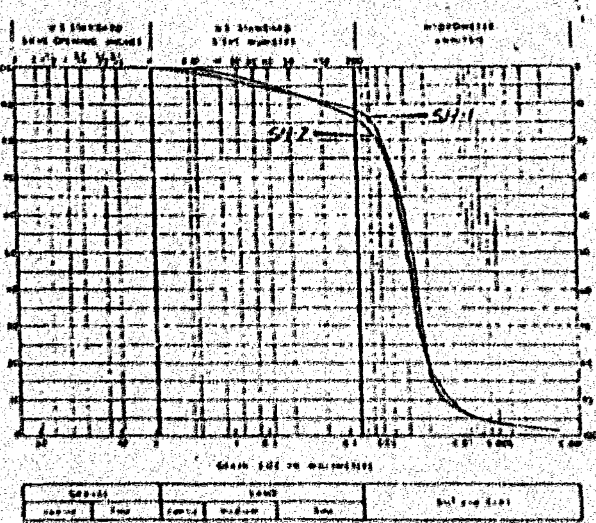
Notes

(1) Moisture Content for Upper 1.5 In. of Specimen
(2) Moisture Content for Lower 3.0 In. of Specimen.
(3) Moisture Content for Total 4.5 In. Height of Specimen.
(4) Maximum Additional 1.0% Swell After Maximum 10 Day Observation Period.

TIME - SWELL RELATIONSHIPS



PLASTICITY CHART



GRAIN SIZE CURVES

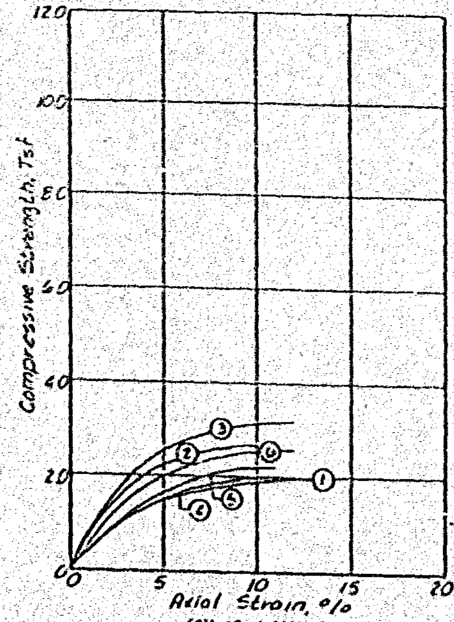
Soil No.	Source	Soil Classification	Sample Date
1	Centrifuge Cake Solids: 122nd Street and Stony Island Avenue	Blk ORGANIC SILT, tr c-f Sand	7-8-93
2	Lagoon Sludge: Lawndale Avenue Solids Management Area	Blk ORGANIC SILT, tr c-f Sand	7-8-93

SOIL SOURCE - CLASSIFICATION DATA

CLAUDE H. HURLEY COMPANY
Consulting Soil and Foundation Engineers

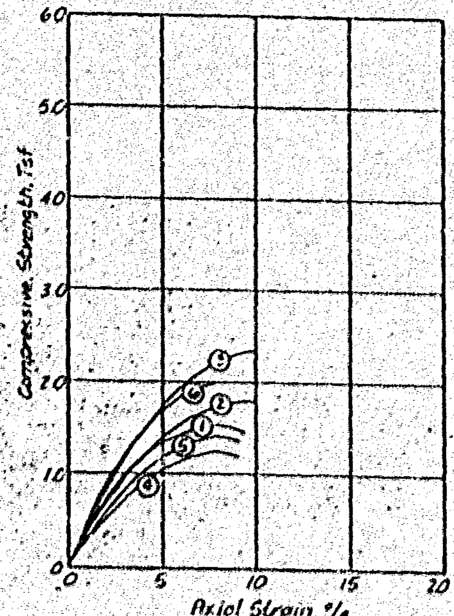
MWRDGC PROCESSED SLUDGE STUDY
VARIOUS FACILITIES
Cook County, Illinois

[illegible]	As Shown	[illegible]	WRS
[illegible]	3-15-94	[illegible]	CHH
[illegible]	3-359-L	[illegible]	1



SOIL NO. 1 SPECIMEN DATA

Curve No	Degree of Compaction (%)	Moisture Content Optimum (%)	Moisture Content Test (%)	Dry Unit Weight (Pcf)	Qu (Tsf)	Axial Strain at Failure (%)
1	90	+2.0	38.7	63.5	2.05	16
2	95	+2.0	38.7	67.0	2.71	10
3	100	+2.0	38.7	70.5	3.20	12
4	90	+6.0	42.7	63.5	2.01	12
5	95	+6.0	42.7	67.0	[illegible].22	11
6	100	+6.0	42.7	70.5	2.63	12



SOIL NO. 2 SPECIMEN DATA

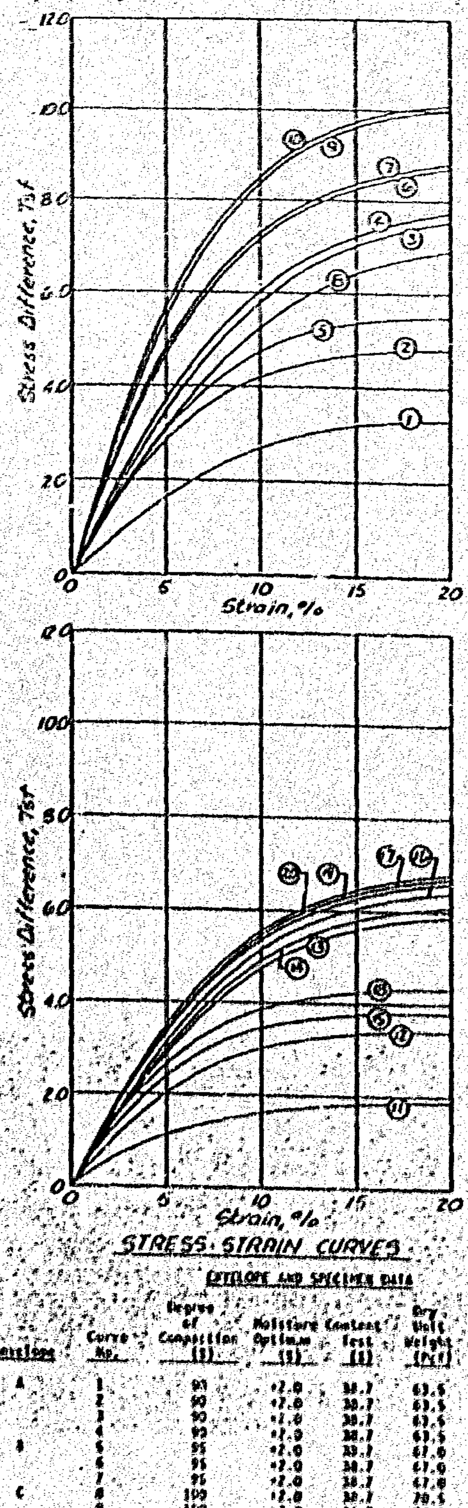
Curve No	Degree of Compaction (%)	Moisture Content Optimum (%)	Moisture Content Test (%)	Dry Unit Weight (Pcf)	Qu (Tsf)	Axial Strain at Failure (%)
1	90	+2.0	44.5	59.2	1.54	8
2	95	+2.0	44.5	62.5	1.80	10
3	100	+2.0	44.5	65.8	2.35	10
4	90	+6.0	48.5	59.2	1.25	8
5	95	+6.0	4[illegible]	62.5	1.42	8
6	100	+6.0	48.5	65.8	2.00	8

UNCONFINED COMPRESSION TEST DATA

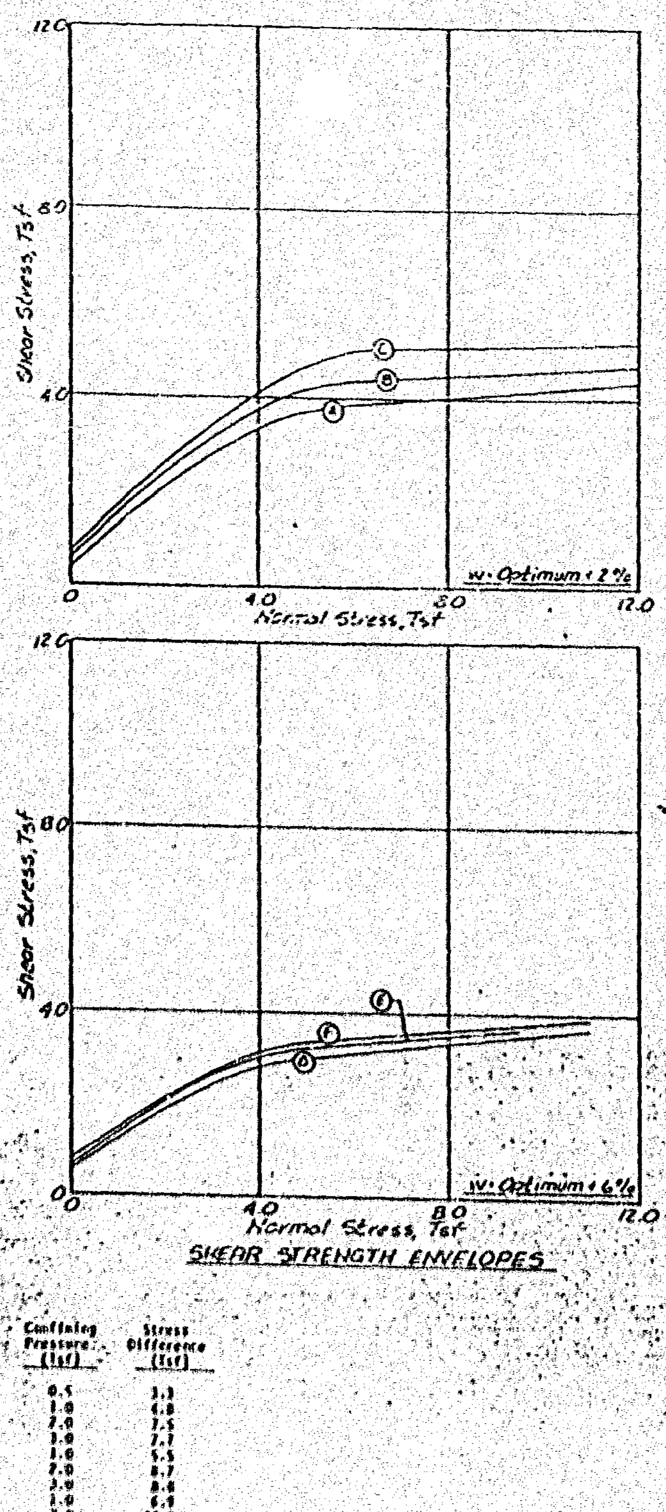
CLAUDE H. HURLEY COMPANY
Consulting Soil and Foundation Engineers

MWRDGC PROCESSED SLUDGE STUDY
VARIOUS FACILITIES
Cook County, Illinois

Scale	As Shown	Drawn By	WRS
Date	3-15-94	Checked By	CHH
Project Number	3-359-L	Sheet Number	7



STRESS-STRAIN CURVES



SHEAR STRENGTH ENVELOPES

ENVELOPE AND SPECIMEN DATA

Envelope	Curve No.	Degree of Compaction (%)	Moisture Content Optimum (%)	Moisture Content Test (%)	Dry Unit Weight (Pcf)	Confining Pressure (Tsf)	Stress Difference (Tsf)
A	1	90	+2.0	38.7	63.5	0.5	3.3
	2	90	+2.0	38.7	63.5	1.0	4.8
	3	90	+2.0	38.7	63.5	2.0	7.5
	4	90	+2.0	38.7	63.5	3.0	7.7
B	5	95	+2.0	38.7	67.0	1.0	5.5
	6	95	+2.0	38.7	67.0	2.0	8.7
	7	95	+2.0	38.7	67.0	3.0	8.8
C	8	100	+2.0	38.7	70.5	1.0	6.9
	9	100	+2.0	38.7	70.5	2.0	10.0
	10	100	+2.0	38.7	70.5	3.0	10.1
D	11	90	+6.0	42.7	63.5	0.5	1.9
	12	90	+6.0	42.7	63.5	1.0	3.4
	13	90	+6.0	42.7	63.5	2.0	5.9
	14	90	+6.0	42.7	63.5	3.0	6.1
E	15	95	+6.0	42.7	67.0	1.0	3.8
	16	95	+6.0	42.7	67.0	2.0	6.4
	17	95	+6.0	42.7	67.0	3.0	6.6
F	18	100	+6.0	42.7	70.5	1.0	4.3
	19	100	+6.0	42.7	70.5	2.0	4.7
	20	100	+6.0	42.7	70.5	3.0	6.8

SOIL NO. 1 Q-TEST DATA

TRIAXIAL COMPRESSION TEST DATA

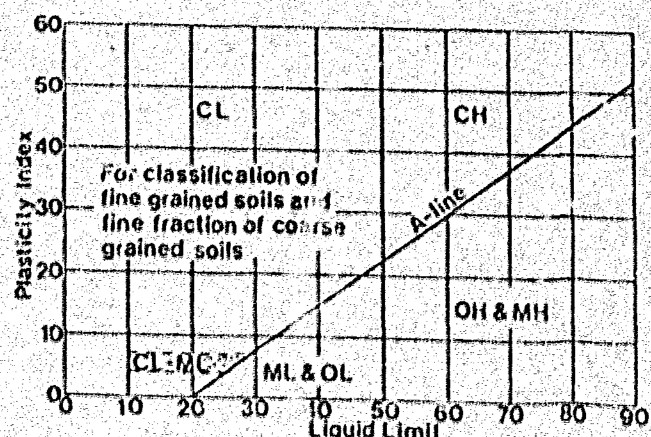
CLAUDE H. HURLEY COMPANY
Consulting Soil and Foundation Engineers

MWRDGC PROCESSED SLUDGE STUDY
VARIOUS FACILITIES
Cook County, Illinois

Scale	As Shown	Drawn By	KRS
Date	3-10-94	Approved By	CHH
Project Number	3-359-L	Figure Number	3

SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES	LABORATORY CLASSIFICATION CRITERIA		
Coarse Grained Soils (More than half of material is larger than No. 200 sieve)	Gravel (More than half of coarse fraction is larger than No. 4 sieve size)	Clean Gravel (Little or no fines)	GW	Well graded gravel, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse grained soils are classified as follows: Less than 5 percent . . . . GW, GP, SW, SP; More than 12 per cent . . . . GM, GC, SM, SC; 5 to 12 per cent . . . . Borderline cases requiring dual symbols	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4 ; $C_z = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			GP	Poorly graded gravel, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Gravel with fines (Appreciable amount of fines)	GM	Silty gravel, gravel-sand-silt mixtures		Atterberg limits below A-line or P.I. less than 4	Above A-line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
			GC	Clayey gravel, gravel-sand-clay mixtures		Atterberg limits above A-line with P.I. greater than 7	
	Sand (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean Sand (Little or no fines)	SW	Well graded sand, gravelly sand, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ greater than 6 ; $C_z = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP	Poorly graded sand, gravelly sand, little or no fines		Not meeting all gradation requirements for SW	
		Sand with fines (Appreciable amount of fines)	SM	Silty sand, sand-silt mixtures		Atterberg limits below A-line or P.I. less than 4	Limits plotting in hatched zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
			SC	Clayey sand, sand-clay mixtures		Atterberg limits above A-line with P.I. greater than 7	
Fine Grained Soils (More than half of material is smaller than No. 200 sieve)	Silt and Clay (Liquid Limit less than 50)		ML	Inorganic silt and very fine sand, rock flour, silty or clayey fine sand or clayey silt with slight plasticity			
			CL	Inorganic clay of low to medium plasticity, gravelly clay, sandy clay, silty clay			
			OL	Organic silt and organic silty clay of low plasticity			
	Silt and Clay (Liquid limit greater than 50)		MH	Inorganic silt, micaceous or diatomaceous fine sandy or silty soil, elastic silt			
			CH	Inorganic clay of high plasticity			
			OH	Organic clay of medium to high plasticity, organic silt			
	Highly Organic Soils		Pt	Peat and other highly organic soil			



PLASTICITY CHART

SOIL AND BEDROCK IDENTIFICATION AND CLASS

SOIL PROPERTIES

COHESIVE SOILS Qu (Tsf)	Consistency	GRANULAR AND INTERMEDIATE TEXTURED SOILS N-Value (Bpf)	Relative Density
<0.25	Very Soft	0 - 4	Very Loose
0.25 - 0.50	Soft	4 - 10	Loose
0.50 - 1.00	Medium Stiff	10 - 30	Medium Dense
1.00 - 2.00	Stiff	30 - 50	Dense
2.00 - 4.00	Very Stiff	50 - 80	Very Dense
4.00 - 8.00	Hard	> 80	Extremely Dense
>8.00	Very Hard		

N-Value: Blows per foot of a 140 lb. hammer falling 30 in. on a standard split-barrel sampler, except where noted.
Qu: Unconfined compressive strengh

SOIL COMPOSITION

Soil Type	Sieve Size
Boulder	>8.0 in.
Cobble	3.0 in to 8.0 in.
Coarse Gravel	0.75 in. to 3.0 in.
Fine Gravel	No.4 to 0.75 in.
Coarse Sand	No.10 to No.4
Medium Sand	No.40 to No.10
Fine Sand	No.200 to No.40
Silt	0.002 mm to No.200
Clay	<0.002 mm

Item	Percent of Dry Weight
Trace	1 to 10
Little	11 to 20
Some	21 to 35
And	36 to 50

BEDROCK PROPERTIES

RQD (%)	Quality	Qu (Psi)	Strength Classification	MR	Ratio Classification
0 - 25	Very Poor	<4,000	Very Low	<200:1	Low
25 - 50	Poor	4,000 - 8,000	Low	200:1 to 500:1	Medium
50 - 75	Fair	8,000 - 16,000	Medium	>500:1	High
75 - 90	Good	16,000 - 32,000	High		
90 - 100	Excellent	>32,000	Very High		

Recovery: Percent of drilled length recovered in core.
Rock Quality Designation: Percent of drilled length recovered in pieces 4.0 in. or greater in length.

GENERAL TERMS

ABBREVIATIONS

Lt	Light	c	Coarse	w	With
Dk	Dark	m	Medium	w/o	Without
Blk	Black	f	Fine	Occ	Occasional
Br	Brown	Tr	Trace	Psi	Pounds Per Square Inch
Gr	Gray	So	Some	Tsf	Tons Per Square Foot
Grn	Green	Lt	Little	Bpf	Blows Per Foot
Rd	Red	lb	Pound(s)	N	N-Value
Yel	Yellow	in.	Inch(es)	REC	Rock Recovery
Bl	Blue	ft	Foot/Feet	RQD	Rock Quality Designation
Pk	Pink			MR	Modulus Ratio

DRILLING AND SAMPLING TERMS

AB	Auger Boring
SB	Structure Boring
TB	Test Boring
PB	Probe Boring
HB	Hand Boring
FA	Conventional Flight Auger
HSA	Conventional Hollow Stem Auger
RW	Rotary Wash Boring
SS	Standard Split-Barrel Sample
ST	Thin-Wall Tube Sample
AU	Power Auger Sample
DB	Core Sample

IFICATION SYSTEM

CLAUDE H. HURLEY COMPANY
Consulting Soil and Foundation Engineers

MWRDGC PROCESSED SLUDGE STUDY
VARIOUS FACILITIES
Cook County, Illinois

Scale	As Shown	Drawn by	WRS
Date	3-15-94	Approved by	CHH
Project Number	3-359-L	Sheet Number	6

Protecting Our Water Environment

Metropolitan Water Reclamation District of Greater Chicago
100 EAST ERIE STREET CHICAGO, ILLINOIS 60611 312 / 751-5600

CECIL LUE-HING
Director of Research & Development

May 4, 1990

Copies to Granato, Professor O'Brien, Sedita
S.G. 5/8/9

Mr. William Diamond
Criteria and Standards
Division (WH-585)
United States Environmental
Protection Agency
401 M Street, SW
Washington, DC 20460

Dear Mr. Diamond:

Subject: Use of Municipal Sludge as Daily and Final Cover at Municipal Solid Waste Landfills

The United States Environmental Protection Agency (USEPA) is currently revising the proposed Part 503 Sludge Regulations (Standards for the Disposal of Sewage Sludge, Federal Register, Vol. 54, No. 23, pages 5746 through 5902). The USEPA's Administrator, Mr. William Reilly, has indicated that the USEPA is willing to consider information which may assist the agency in revising these regulations. Mr. Reilly, in a letter to Mr. Erwin Odeal, President of the Association of Metropolitan Sewerage Agencies dated January 9, 1990, stated that the agency would entertain any information which would help the agency develop the final Part 503 Sludge Regulations.

In the spirit of the letter to Mr. Odeal from Mr. Reilly, please find attached a document explaining and discussing the merits of using municipal sludge as a daily and final cover material at municipal solid waste landfills. The purpose of this document is to encourage the USEPA to discuss these two beneficial uses of sludge in the preamble to the Part 503 Sludge Regulations. It is hoped that this small step on the part of USEPA will help encourage state regulatory agencies to favorably consider the use of municipal sludge as daily and final cover at municipal solid waste landfills.

Subject: Use of Municipal Sludge as Daily and Final Cover at Municipal Solid Waste Landfills

If you have any questions, don't hesitate to contact me by phone at (312) 751-5190.

Very truly yours,

Cecil Lue-Hing, D.Sc., P.E.
Director
Research and Development

CLH:JG:da
Attachment

cc: Mr. Keller (IEPA)
Dalton
DiVita
Knight
Lavin
Zenz

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAY 9 1990

OFFICE OF WATER

Cecil Lue Hing, D.Sc., P.E.
Director, Research and Development
Metropolitan Water Reclamation
District of Greater Chicago
100 East Erie Street
Chicago, Illinois 60611

Dear Cecil:

This is in response to your letter of May 4, 1990 to William Diamond concerning use of municipal sludge as daily and final cover at municipal solid waste landfills. I agree with you that the Environmental Protection Agency (EPA) should continue to encourage the beneficial utilization of sludge and that discussing the use of sewage sludge for daily cover and use of sludge to facilitate the growth of a final cover at municipal solid waste (MSW) landfills in the preamble to the final Part 503 rule would contribute to this effort.

You were correct in stating that sewage sludge even if beneficially reused in the manner described in your accompanying report: "Utilization of Municipal Sludge as Daily and Final Cover at Municipal Solid Waste Landfills" will still be regulated under 40 CFR Part 258 as any other material entering a municipal solid waste landfill.

Your letter and this reply will be placed in the public record for the development of the Part 503 regulation.

Sincerely,

Alan B. Rubin, Chief
Sludge Regulation and Regulation
Branch

Copies to
Professor
Gschwind
Sedita
Granato
Richardson
Pietz
O'Brien

Hopefully the USEPA will put our suggestion in the preamble to the Part 503 regs. Time will tell. Thanks for your help.
C. L. H.

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