



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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Construction Grants
Program Operations Memorandum
POM 80-4

SUBJECT: The Effect of the Hazardous Waste Regulations
on Management of Municipal Sewage Sludge

FROM : Eckardt C. Beck, Assistant Administrator for
Water and Waste Management (WH-556)

TO : Regional Administrators
US EPA Regions I - X

PURPOSE

To summarize the effect of the Resource Conservation and Recovery Act (RCRA) hazardous waste regulations upon construction grant activities and management of municipal sewage sludge. The term management includes the generation, transport, treatment, storage, utilization and disposal of municipal sewage sludge.

BACKGROUND

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

The final hazardous waste regulations are very comprehensive and complex. This leads to both actual and perceptual impacts upon municipal sewage sludge management including its utilization and disposal.

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

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The Administrator has not listed municipal sewage sludge as hazardous waste. Regulations have been and will be issued under the authorities of Section 405 of the Clean Water Act (CWA), Section 4004 of RCRA, and other acts which will address the proper utilization and disposal of municipal sewage sludge.

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

SUMMARY OF REGULATORY REQUIREMENTS

I. Determining Whether Sludges Are Hazardous

- (a) The Administrator has not listed municipal sewage sludges as a hazardous waste.
- (b) Therefore, municipal sewage sludges are not considered hazardous unless tested and shown to be hazardous.
- (c) Municipalities do have an obligation to determine if their sludge meets the definition of a hazardous waste. This does not mean that each POTW must test their sludge. Rather, POTW's or other waste handler must make a determination that the waste is not hazardous based upon knowledge of the waste including the contaminants, etc. In cases where there is real doubt as to whether the sludge exhibits one or more of the hazardous waste characteristics, the waste would require testing according to the appropriate test methods. In effect this means that if the POTW has reason to believe that their sludge might fail any of the hazardous tests (i.e., exhibit any of the hazardous waste characteristics), they have an obligation to test to verify whether or not they should enter the hazardous waste control program.
- (d) The characteristic most likely to cause a sludge to be hazardous would be toxicity determined by the extraction procedure (EP).
- (e) In very limited tests by EPA, cadmium is the only known element that has caused a sludge to fail the EP, i.e., be considered hazardous (See *Attachment I, page i* for additional discussion of this point).

Summary Table

Ranges of Total Contaminant Levels in Municipal Sewage Sludges
that Were Found Hazardous and Non-Hazardous by the EP Test*

Contaminant	Total Contaminant Concentrations in Municipal Sewage Sludge, mg/l	
	15 sludges tested and found not hazardous	1 sludge tested and found hazardous
Cadmium	16-282	771
Arsenic	<4-155	-
Chromium	18-6900	-
Lead	74-3520	-
Barium	54-662	-
Selenium	7-69	-

Caution: THIS INFORMATION IN THE TABLE WAS FOUND IN LIMITED EPA TESTS AND CAN NOT BE USED AS A CONCLUSIVE DETERMINATION AS TO WHETHER OR NOT A SPECIFIC SLUDGE WILL PASS THE EP TEST.

* The nature of the tests is described on page i, Attachment I and the EP test data corresponding to these total concentrations is given in Attachment I, Appendix Tables A-1 to A-5.

II. Requirements for Municipal Sewage Sludges Which Have Been Found to be Hazardous by Testing or Where Final Determination of Hazardousness Has Not Been Made

- (a) Any POTW that generates or transports a municipal sewage sludge which it believes to be hazardous and who plans to continue to generate, transport, treat or dispose of more than 1000 kg of such sludge per month or store more than 1000 kg at any time, must notify EPA of their activity by August 18, 1980 (FEDERAL REGISTER, Part IV, February 26, 1980) (EPA Form 8700-12). Any POTW that generates, treats, transports, stores, or disposes of a hazardous municipal sewage sludge without filing the notification is subject to civil or criminal penalties.
- (b) A POTW, which is only a generator of a hazardous municipal sewage sludge and that does not also treat, store, or dispose of the sludge, does not require a hazardous waste permit. This POTW generator, however, does have a major responsibility and has to follow all the provisions of 40 CFR Part 262.

- (c) A POTW would also require a hazardous waste permit if it engaged in treating, storing, or disposing of hazardous municipal sludge in the quantities described above. As part of this permitting process, an existing POTW must obtain interim status as a hazardous waste treater, storer, or disposer. To obtain this interim status the applicant POTW would have to notify EPA by August 18 and submit a completed Part A permit application to the appropriate EPA regional office by November 19, 1980.

DISCUSSION

A detailed discussion of the regulatory requirements is contained in *Attachment I**. Also included are a number of tables with EP toxicity test results.

A second attachment (*Attachment II*) consists of questions and answers that should be helpful to individual POTWs. These will be available within two weeks in booklet format and mailed directly to POTWs.

CONSTRUCTION GRANTS ACTIVITIES

Facility planning activities must include consideration of whether or not the sludge produced by a POTW will possibly be a hazardous waste. A one time EP toxicity test is an allowable cost for active and future construction grant projects when it is believed that the POTW's sludge may be hazardous and that the design of sludge disposal facilities, being funded through the grants, would be affected by such a determination. EPA estimates that the cost of one complete EP toxicity test, including sampling costs, may be as high as \$2,500. One commercial laboratory, however, is charging approximately \$325.00 per complete EP toxicity test not including sampling or any replicate analysis.

IMPLEMENTATION

This POM is effective upon issuance because of the need for possible actions by POTWs as a result of the hazardous waste regulations. However, comments on the content are invited, and the POM will be revised and reissued if comments indicate that such action is warranted.

Attachments

* *Italicized references are contained within this Program Operations Memorandum.*

ATTACHMENT I. DETAILED REGULATORY REQUIREMENTS

I. Determining Whether Sludges Are Hazardous

The characteristics of hazardous waste include:

- (a) ignitability (261.21)
- (b) corrosivity (261.22)
- (c) reactivity (261.23)
- (d) EP toxicity (261.24 and Appendix II)

The characteristics of ignitability, corrosivity, and reactivity are generally not of concern with municipal sewage sludge, and few if any municipal sludges are likely to be hazardous due to these factors. The extraction procedure (EP) toxicity characteristic will probably be the only one by which municipal sludges might be determined to be a hazardous waste at this time.

EPA has run partial EP toxicity tests on 15 municipal sewage sludges and one ash of an incinerated sludge. These tests were conducted by two separate EPA research laboratories, one in Cincinnati, Ohio and one in Las Vegas, Nevada. There was considerable variability in the results of these tests; however, both laboratories found that all 15 sludges tested passed the EP toxicity test for the six metals measured, i.e., were found not to be hazardous wastes in accordance with the EP toxicity characteristic. These measured metals included As, Cd, Cr, Pb, Ba, and Se (*Appendix Tables A-1 to A-4**). Cadmium (*Table 1*) was the metal which most closely approached the threshold concentration (*Table 2*) that would cause the sludge to fail the EP test. A recent EP test by a POTW of its municipal sewage sludge showed that the sludge failed, i.e., was hazardous, on the basis of cadmium in the EP extract being in excess of the threshold concentration. The total cadmium content of that sludge was over 700 ppm (*Appendix Table A-5*).

* *Italicized references are contained within this Program Operations Memorandum Attachment.*

Table 1

Maximum Percentage of EP Threshold Concentrations Found in EP Extract
of Tested Municipal Sludges

Contaminant Heavy metal	Maximum percentage of EP threshold concentrations found by	
	EPA-Cinn (15 sludges)	EPA-Las Vegas (7 sludges)*
As	1%	1%
Cd	27%	61%
Cr	10%	2%
Pb	0.5%	2%
Ba	--	11%
Se	--	1%

* EPA-Las Vegas only tested 7 of the 15 sludges.

Table 2

Threshold Concentrations of Contaminants
in EP Extract of the Waste for Characteristic of EP Toxicity

EPA hazardous waste number	Contaminant	Threshold concentration * µg/l
D004	Arsenic (As)	5,000
D005	Barium (Ba)	100,000
D006	Cadmium (Cd)	1,000
D007	Chromium (Cr)	5,000
D008	Lead (Pb)	5,000
D009	Mercury (Hg)	200
D010	Selenium (Se)	1,000
D011	Silver (Ag)	5,000
D012	Endrin (1,2,3,4,10,10-Hexachloro-1,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-endo, endo-5,8-dimethano naphthalene).	20
D013	Lindane (1,2,3,4,5,6-Hexachlorocyclohexane, gamma isomer.)	400
D014	Methoxychlor (1,1,1-Trichloro-2,2-bis [p-methoxyphenyl]ethane).	10,000
D015	Toxaphene (C ₁₀ H ₁₀ Cl ₈ , Technical chlorinated camphene, 67-69 percent chlorine).	500
D016	2,4-D, (2,4-Dichlorophenoxyacetic acid).	10,000
D017	2,4,5-TP [Silvex] (2,4,5-Trichlorophenoxypropionic acid).	1,000

* If concentrations of these contaminants in the EP extract of the waste equal or exceed these values, then the waste is hazardous.

Factors that are thought to be associated with increasing the concentration of heavy metals in the EP toxicity test extract include:

- (i) high total content of heavy metal in the sludge
- (ii) high total solids content of the sludge
- (iii) low alkalinity (high acidity) of the sludge
- (iv) high oxidation state of the sludge

An examination of the EP toxicity test data for municipal sludges (*Table 3*) reveals that there may be some correlation between the ratio of cadmium concentration in the EP toxicity test extract to the total concentration of cadmium in the sludge and one or more of these factors. However, the data currently available are insufficient to draw any definite conclusions.

The data on EP toxicity testing, which EPA has collected so far, suggests that few municipal sludges will be hazardous based upon the EP toxicity characteristic. On the other hand the tests are incomplete and the EP extracts of the municipal sludges have not as yet been tested for the metals mercury and silver, and the six pesticides and herbicides for which thresholds have been established. With the limited information we have at this time on the concentrations of these untested contaminants in municipal sludges and on their chemical properties, we do not expect that these contaminants will result in concentrations which exceed the hazardous threshold values in the EP toxicity test extracts.

Notwithstanding this general discussion, municipalities do have an obligation under 262.11 to determine if their sludge meets the definition of a hazardous waste. This does not mean that each POTW must test their sludge. Rather 262.11 allows the POTW or other waste handler to make a determination that the waste is not hazardous based upon knowledge of the waste including the contaminants, etc. In cases where there is real doubt as to whether the sludge exhibits one or more of the hazardous waste characteristics, the waste would require testing according to the appropriate test methods set forth in 261.21 through 261.24. In effect this means that if the POTW has reason to believe that their sludge might fail any of the hazardous tests (i.e., exhibit any of the hazardous waste characteristics), they have an obligation to test to verify whether or not they should enter the hazardous waste control program. When the testing is undertaken by the municipality or other party, a representative sample of the sludge should be collected [261.20(c) and Appendix I*] and tested (Appendix II*). If the results of these tests indicate that the sludge clearly passes the EP toxicity or other tests (and is therefore not hazardous), no further testing should be needed unless the sludge quality appreciably changes. If a hazardous test is failed, the sludge should be considered hazardous.

* Appropriate sampling and analysis methods are described in SW-846 "Test Methods for the Evaluation of Solid Waste."

Table 3.
The Relationships Among Sludge Solids Content, pH,
Degree of Oxidation, Total Sludge Cadmium,
and EP Sludge Cadmium.

Location	pH*	HOAc* pH 4.2-5.2 ml	Sludge Properties				
			Solids** (dry wt. basis)	Oxidation** State Index	Total* Cd µg/g	EP* Cd µg/g	Ratio: EP Cd to Total Cd
Pittsburgh			4	filter cake	70	<0.5	0.000714
Defiance			2	anaerobic	18	3.5	0.01944
Marion			15	-	102	<0.5	0.000490
Toledo			7	-	20	3.0	0.0150
Cincinnati (filter cake)	7.3	23.0	44	raw primary	38	10.3	0.0234
Cincinnati (digested)			-	anaerobic	48	1.0	0.0021
Cincinnati (Mill Creek)			95	incinerator ash	30	46	0.0575
Chicago (landfill)	6.9	0.75	59	-	110	270	0.2455
Chicago (Fulton)	3.0	0.38	4	anaerobic	160	2	0.00125
Chicago	5.1	0.02	99	raw heat dried	130	62	0.0477
okomo			31	-	223	6	0.0026
Tallas	7.4	0.10	4	raw primary	52	2.4	0.0046
Jones Island			1	biological	282	5	0.0018
South Shore			9	-	44	15	0.0341
Tulsa	5.2	0.20	6	-	88	7	0.0080
Fountain Valley	6.3	0.10	89	-	70	81	0.1157
Fountain Valley (reanalysis)			89	-	-	160	

* Analysis by EMSL - Las Vegas, HOAc required during EP test.
** Analysis by MERL - Cincinnati.

Hazardous municipal sewage sludges must be disposed. It is possible that some hazardous sewage sludges might be recycled by means such as spreading on land. Certain types of municipal sludge landspreading activities may constitute the type of use, reuse, recycling, or reclamation that is intended to be exempted from coverage under section 261.6 of the hazardous waste regulations. EPA will provide further guidance on this issue later. In any event the sludge transporter and/or the storage facility for the waste prior to recycling are covered by the bulk of the hazardous waste regulations (IV.B.3 and 4, 261.6).

II. Requirements for Municipal Sewage Sludges Which Have Been Found to be Hazardous by Testing or Where Final Determination of Hazardousness Has Not Been Made

Any POTW that generates or transports a municipal sewage sludge which it believes to be hazardous and who plans to continue to generate, transport, treat or dispose of more than 1000 kg of such sludge per month or store more than 1000 kg at any time, must notify EPA of their activity by August 18, 1980 (FEDERAL REGISTER, Part IV, February 26, 1980). EPA Form 8700-12 should be completed and sent to the appropriate Regional EPA office for this purpose (*Appendix B*). Any POTW who generates, treats, transports, stores, or disposes of a hazardous municipal sewage sludge without filing the notification is subject to civil or criminal penalties.

A POTW, which is only a generator of a hazardous municipal sewage sludge and that does not also treat, store, or dispose of the sludge, does not require a hazardous waste permit. This POTW generator, however, does have a major responsibility and has to follow all the provisions of 40 CFR Part 262 including the identification of disposal facilities that will be used and initiation and completion of the specified manifest system.

A POTW would also require a hazardous waste permit if it engaged in treating, storing, or disposing of hazardous municipal sludge in the quantities described above. As part of this permitting process the POTW must obtain interim status as a hazardous waste treater, storer, or disposer. To obtain this interim status the applicant POTW would have to notify EPA by August 18 and submit a completed Part A permit application to the appropriate EPA regional office by November 19, 1980.

Any facility (where EPA discovers that hazardous municipal sewage sludge is treated, stored, or disposed), that does not file a notification during the 90 day period following the initial publication of the Section 3001 regulations, will not be allowed to continue hazardous sludge treatment, storage, utilization, or disposal activities until it obtains a hazardous waste permit. Similarly, a new facility that plans to treat, store, or dispose of hazardous municipal sewage sludge must obtain a hazardous waste permit before commencing operations.

Submission of EPA Form 8700-12, is not an admission that the sewage sludge is hazardous. In cases where the final determination of hazardousness has not been made, the appropriate entry in Section IX (e) of EPA Form 8700-12 would be to check box 4 and if desired to add the words "municipal sewage sludge - a final determination of hazardousness has not been completed." Submission of EPA Form 8700-12 does not compel the sewage sludge manager to file the Part A application for permit for hazardous waste activity by November 19, 1980, if the sewage sludge is determined not to be hazardous. Filing for the permit by the November 19 deadline is only required when the sludge is known to be hazardous. Beginning on November 19, the sewage sludge manager would be obligated to comply with the interim status standards so long as the sludge was hazardous; however, the standards would not apply to the management of any sewage sludges managed in that facility whenever they were not hazardous and not mixed with hazardous wastes.

EPA will send an acknowledgement to each notifier indicating that their notification (EPA Form 8700-12) has been received. The acknowledgement will include the notifier's EPA Identification Number. This number is to be used on shipping manifests for transporting hazardous waste, on reports that are to be filed with EPA, on applications for a Federal Hazardous Waste Permit, and on all other communications with EPA regarding the notifier's hazardous waste.

Through future modifications to the hazardous waste regulations, EPA may change its procedures for identifying hazardous waste, or may revise the list of hazardous wastes. If any municipal sewage sludges are identified or listed as hazardous by an amendment to the Section 3001 regulations (40 CFR Part 261), a notification covering these wastes must be filed within 90 days after the amendment is promulgated.

If a facility begins to generate a hazardous municipal sewage sludge and has not previously filed a notification, it must comply with the regulations for obtaining an EPA Identification Number published under Section 3002 of RCRA (40 CFR Part 262) before it transports the hazardous sludge or offers the hazardous sludge to a transporter.

Similarly, if a transporter desires to transport a hazardous municipal sewage sludge and has not previously filed a notification, the transporter must comply with the regulations for obtaining an EPA Identification Number published under Section 3003 of RCRA (40 CFR Part 263) before any hazardous sludge is accepted for transport.

Conditions applicable to all RCRA hazardous waste permits are specified in section 122.7 and 122.28 of the Consolidated Permit Regulations as promulgated in the FEDERAL REGISTER on May 19, 1980. These specify a wide range of provisions concerning the hazardous waste facilities including proper operation and maintenance [122.7(e)], monitoring and records [122.7(j)], inspection rights [122.7(i)], reporting requirements [122.7(l)], etc.

POTWs, which accept a hazardous waste for treatment (by means other than what may come into the POTW in the sanitary sewer system), would be required to obtain a RCRA permit as a hazardous waste treatment facility. However, if the POTW [122.26(c)] meets the following conditions, it shall be deemed to have an acceptable RCRA hazardous waste permit without applying. (This does not apply to the treatment storage and disposal of the POTW's own sludge that originated from sewage entering the POTW in the sanitary sewer system).

- (1) Has an NPDES permit;
- (2) Complies with the conditions of that permit;
- (3) Complies with the following regulations:
 - (i) 40 CFR Section 264.11, Identification number;
 - (ii) 40 CFR Section 264.71, Use of manifest system;
 - (iii) 40 CFR Section 264.72, Manifest discrepancies;
 - (iv) 40 CFR Section 264.73 (a) and (b)(1), Operating records;
 - (v) 40 CFR Section 264.75, Annual report;
 - (vi) 40 CFR Section 264.76, Unmanifested waste report; and
- (4) If the waste meets all Federal, State, and local pretreatment requirements which would be applicable to the waste if it were being discharged into the POTW through a sewer, pipe, or similar conveyance.

General standards and interim status standards for owners and operators of hazardous municipal sewage sludge or other hazardous waste treatment, storage, and disposal facilities are contained in Parts 264 and 265, respectively, of the hazardous waste regulations. However, the requirements of Parts 264 and 265 do not apply to a person who treats, stores, or disposes of hazardous waste in a State with an authorized RCRA hazardous waste program (authorized under Subparts A and B of Part 123 or with a RCRA Phase II hazardous waste program authorized under Subpart F of Part 123 of this Chapter).

An outline of the content of the final permit standards and the interim status standards (Parts 264 and 265) has been included as *Appendix C* to this Program Operations Memorandum to provide an idea of the necessary requirements for complying with the regulations if a municipal sludge is found to be hazardous. The final permit standards (Part 264) have not been fully developed. When completed later this year, the provisions of the final permit standards will parallel the content of the interim status standards.

APPENDIX A

Table A-1

Total Metals Content (HNO_3 - ClO_4 Digestion)
of 15 Sludges and One Sludge Incinerator Ash (EPA-Cincinnati Results)

Location	As	Cd	Cr	Pb
	,ug/g (dry wt.)			
Pittsburgh	20	70	3200	1740
Defiance	--	18	18	420
Marion	20	102	840	700
Toledo	40	20	1740	300
Cincinnati (filter cake)	9	38	1000	1300
Cincinnati (digested)	18	48	1260	1400
Cincinnati (incinerator ash) Mill Creek	--	80	2340	3520
Chicago (landfill)	13	110	920	434
Chicago (Fulton)	14	160	2200	404
Chicago (heat dried)	13	130	2080	314
Kokomo	4	228	1230	1560
Dallas	<4	52	416	720
Jones Island	<4	282	6900	410
South Shore	10	44	1372	700
Tulsa	4	88	274	300
Fountain Valley	18	70	600	500

APPENDIX A

Table A-2

Metals Concentration in EP Extracts of 15 Sludges
and One Sludge Incinerator Ash (EPA-Cincinnati Results)

Location	As	Cd	Cr	Pb
	-----µg/l-----			
Pittsburgh	<4	<0.5	<2	<0.5
Defiance	<4	3.5	14	<0.5
Marion	<4	<0.5	10	<0.5
Toledo	60	3.0	14	<0.5
Cincinnati (filter cake)	41	10.8	14	21
Cincinnati (digested)	20	1.0	5	<0.5
Cincinnati (incinerator ash) Mill Creek	<20	46	510	12
Chicago (landfill)	21	270	10	12
Chicago (Fulton)	14	2	60	11
Chicago (heat dried)	<20	62	36	6
Kokomo	<20	6.0	12	<0.5
Dallas	<20	2.4	2	<0.5
Jones Island	<20	5	41	<0.5
South Shore	<20	15	25	<0.5
Tulsa	<4	7	6	17
Fountain Valley	<20	81	2	3
Fountain Valley (reanalysis)	34	160	40	17

Table A-3

Total Metals Content in 7 Sewage Sludges ($\text{HNO}_3\text{-H}_2\text{O}_2$ Digestion by EPA) Las Vegas--TriPLICATE Analysis

Sample Designation	As		Ba		Cd		Cr		Pb		Se	
	$\mu\text{g/g}$	S.D.	$\mu\text{g/g}$	S.D.	$\mu\text{g/g}$	S.D.	$\mu\text{g/g}$	S.D.	$\mu\text{g/g}$	S.D.	$\mu\text{g/g}$	S.D.
Cincinnati, OH sewage sludge	155	30	248	37	47	2	1182	115	1805	126	69	9.2
Chicago, IL landfill sludge	37	5	83	5	251	26	1458	278	603	189	33	2.7
Chicago, IL Fulton County, digested	55	1	622	40	177	4	2222	251	646	34	57	5.7
Chicago, IL heat dried	10	1	80	17	65	12	528	110	74	12	6.8	1.6
Dallas, TX primary sludge	<9	--	223	74	16	3	162	9	121	4	8.4	0.9
Tulsa, OK combined sludge	18	1	408	6	102	1	277	13	244	17	13	0.6
Fountain Valley, CA sludge	51	3	54	16	201	9	904	75	666	13	23	2.5

S.D. = Standard Deviation

Table A-4

Metals Concentration in EP Extracts of 7 Sludges by EPA-Las Vegas -- Average of Triplicate Extractions

Sample Designation	As		Ba		Cd		Cr		Pb		Se	
	$\mu\text{g/l}$	S.D.	$\mu\text{g/l}$	S.D.	$\mu\text{g/l}$	S.D.	$\mu\text{g/l}$	S.D.	$\mu\text{g/l}$	S.D.	$\mu\text{g/l}$	S.D.
Cincinnati, OH sewage sludge	31	00	530	180	18*	2	50	20	80	30	20	10
Chicago, IL landfill sludge	20	--	<450	--	275	93	<40	--	<70	--	37	1
Chicago, IL Fulton County, digested	31	6	<450	--	<20	--	<40	--	<70	--	<20	--
Chicago, IL heat dried	30	12	<450	--	116	19	123	10	<70	--	<20	--
Dallas, TX primary sludge	<20	--	500	160	7*	3	60	20	<70	--	30	20
Tulsa, OK combined sludge	<20	--	<450	--	<20	--	<40	--	<70	--	<20	--
Fountain Valley, CA sludge	34	13	<450	--	601	414	70	30	<70	--	20	10

* Single outlying value not included in mean.
S.D. = Standard Deviation.

APPENDIX A

Table A-5

Total and EP Extract Contaminant Levels of one POTW Sludge*
(Analysis by the POTW)

Contaminant	Minimum EP Toxicity Characteristic mg/l	EP Extract Concentration of POTW sludge, mg/l		Mean** total conc. in POTW sludge mg/l
		Test A 6/3/80	Test B 6/9/80	
Arsenic	5.0	<0.01	--	--
Barium	100.0	0.9	1.0	--
Cadmium	1.0	1.55	2.27	771
Chromium	5.0	0.04	0.04	1876
Lead	5.0	0.17	0.19	340
Mercury	0.2	0.0002	--	1801
Selenium	1.0	<0.01	--	--
Silver	5.0	--	--	--
Copper	--	--	--	4065
Iron	--	--	--	33700
Nickel	--	--	--	335
Zinc	--	--	--	8869
Cyanide	--	--	--	462

* Contents of total solids, total volatile solids, and calcium oxide were 20, 55 and 15% respectively.

** Mean of 23 determinations made in 1979.