Developing a Manual for Management of Sludge and Biosolids at Jordanian Wastewater Treatment Plants

A Technical Report

Prepared

for

The Sustainable Development of Dry Lands Project
The Jordan Component
International Arid Lands Consortium
The University of Arizona
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Date: September 28, 2010

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Report for the Management of Sludge and Biosolids at Jordan Wastewater Treatment Plants

Introduction

This report is compiled based partially on a survey that the biosolids *ad hoc* committee requested in 2006. The survey was conducted by a subcommittee from within the biosolids *ad hoc* committee which was assigned the task and was headed by Royal Scientific Society representative. Information gathered throughout the project years was gathered, reviewed and was presented in a concise manner in this report. Other information in this report was gathered independently by the author by working in the area of specialty.

The survey gathered information from 16 of the 24 wastewater treatment facilities (WTF) in Jordan. The information detailed processes used in each plant, characteristics of influent and effluent, amounts of sludge generated and their fate. The reason that only 16 WTF were selected is due to the fact that the other 8 WTF are either too small or in the process of being reconstructed and updated.

This report is compiled in a manner that summarizes the results of the survey while updating the information provided by the survey whenever possible, adding more information about sludge, occurrence and types of pathogens present in biosolids, treatment technologies and regulations.

The information presented in this report are intended to be the basis for developing an Arabic language manual for the operators working in the WTFs in Jordan who deal with sludge and biosolids to improve their safety and well being.

The information presented in this report are geared towards sludge and biosolids generated from activated sludge treatment processes since almost all treatment plants in Jordan use this technology or in the process to convert to the use of this technology.

Objective

The objective of this report is to compile information regarding the current sludge and biosolids management and handling techniques at the Wastewater Treatment Plants level in Jordan to develop a manual to improve management practices in order to minimize health risks associated with handling sludge and biosolids by the treatment plants' operators.

Sources and Composition of Sludge and Biosolids

Sources of sludge and biosolids in a wastewater treatment plant depend on the plant type and the type of treatment processes used. Coarse solids are removed by screening, grit and scum are removed by grit removal equipment, primary solids are removed during primary sedimentation, and finally suspended solids generated by the biological conversion of organic matter are removed using secondary sedimentation.

To efficiently treat solids and dispose of them safely it is important to know their composition. The characteristics of solids depend on their origin, their age and the type of processes they were exposed to.

Total dry solids percentage (TS, %) in untreated primary sludge varies from 5 to 9% with a typical value of 6% for domestic wastewater. The total solids present in digested primary sludge ranges between 2 and 5% with a typical value of 4% solids. However, for untreated activated sludge, the percent total solids ranges between 0.8 and 1.2%. Table 1 lists typical values of the constituents of the total dry solids as percent of total solids (% of TS).

Occurring of Pathogens in Wastewater and Biosolids

A waterborne pathogen is a microorganism capable of causing disease in humans and animals and is transmitted by the fecal-oral route. This is why we should be concerned about pathogens in wastewater and biosolids. There are three major types of waterborne pathogens: viruses, bacteria and *Ascaris*.

Viruses, the most challenging to disinfect is Poliovirus Type I where its first site of infection is the gastrointestinal tract, but may invade other organs. Bacteria, such as *Salmonella* spp. has more than 2400 serotypes known and they cause diarrhea. Parasites are the most challenging organism to treat. Such parasite is the *Ascaris* Ova which survives in anaerobic and aerobic digested sludge and can survive up to two years in the environment.

Necessary Treatment to Reduce Pathogens

To reduce the occurrence of pathogens in sludge, thickening and stabilization are important steps for better handling, storing and/or pumping of the sludge.

Thickening

Solids content of different types of sludge (primary, activated, trickling, or mixed sludge) varies. Thickening of sludge (sludge concentration) reduces its volume which in return reduces pumping and storage requirements many fold. For example, the solids content of activated sludge before thickening can be as low as 0.5% dry solids and 4 to 5% dry solids after thickening, or a 10 fold reduction in volume which is very desirable when liquid sludge is transported by tank trucks for direct application to land as a soil conditioner.

Centrifugal thickening can be used for both dewatering and thickening sludge. Centrifugal thickening is usually employed to thicken Wasted Activated Sludge (WAS). Polymer is not used under normal conditions; to improve thickening performance however, polymer ranging from 0 to 8 lb per ton of dry solids can be added. It should be mentioned here that centrifugal thickening requires high maintenance, increased power cost and the availability of highly skilled operators. The operational variables which the operator must manage include: the characteristics of the feed sludge, rotational speed required, hydraulic loading rate, the depth of the liquid pool in the centrifugal bowl, differential speed of the screw conveyor and the need for polymers to improve performance. Therefore, centrifugal thickening is recommended to be used for treatment plants that are handling more than 20,000 m^3/day influent flow rate.

There are many other types of thickening technologies. One of which is the simple gravity thickening that is used in many of the treatment plants in Jordan. Sludge is usually retained in a holding tank for some time during which heavy sludge settles by gravity to the bottom of the tank and pumped frequently and the water is decanted on the top of the tank where it spells over through a pipe to the headworks for treatment.

Stabilization

Stabilization of biosolids is performed to reduce or eliminate pathogens, odors and putrefaction. This is achieved through the processes acting on the volatile solids which are present as the organic fraction of the solids and biosolids. Reducing pathogens, eliminating odor and putrefaction in biosolids is accomplished by not allowing the microorganisms to flourish and survive on the organic load present in the biosolids. The flourishing of the microorganisms can be stopped or slowed by biological reduction of the volatile content using anaerobic bacteria and the addition of chemicals to the biosolids.

Biosolids Treatment Methods

In the United States, treatment methods are categorized based on their ability to reduce pathogens. There are two types of processes that reduce pathogens: processes Which Significantly Reduce Pathogens (PSRP), detectable levels of pathogens remain in the biosolids and this type of generated biosolids is termed Class B. The second types of processes are termed Processes to Further Reduce Pathogens (PFRP), no detectable levels of pathogens remain in the generated biosolids and this type of biosolids is termed Class A.

Processes That Significantly Reduce Pathogens (PSRP) – Class B

1. Aerobic Digestion: sludge is held at 20° C for 40 days or for 60 days at 15° C.
2. Air Drying: sludge is held in drying beds for 3 months with at least 2 of the 3 months at temperature above 0° C.
3. Anaerobic Digestion: Sludge is held for 15 days at 35 to 55° C or it can be held for 60 days at 20° C.

4. Composting: in this method sludge is held at 40° C for 5 days and at least for 4 hours temperature has to exceed 55° C.
5. Lime Stabilization: sludge is held at pH of 12 for 2 hours.

Processes That Further Reduce Pathogens (PFRP) – Class A

1. Composting: sludge is held at 55° C for 3 days in vessel (enclosed reactors) or static pile (aerated by a series of perforated pipes running underneath each pile); or it can be held at 55° C for 15 days in windrows (aerated mechanically by turning of the piles).
2. Heat Drying: sludge is heated to achieve moisture reduction to less than 10% and when sludge leaves the drier it should be in contact with air that is 80° C.
3. Heat Treatment: Liquid sludge is heated to 180° C for 30 minutes.
4. Beta or Gamma Irradiation: Sludge is exposed to 1.0 Mrad at 20° C
5. Pasteurization: sludge is pasteurized or is heated to 70° C and the temperature is held up to 30 minutes.
6. Thermophilic Aerobic Digestion: Sludge is held for 10 days at 55 to 60° C

Table 2 shows the affects of some of the treatment methods presented earlier on the reduction of pathogens in the sludge. When 1 $\log_{10}$ reduction takes place that means the pathogen concentration in the sludge is reduced 10 folds, 2 $\log_{10}$ reductions means a reduction in pathogen concentration of 100 folds and 3 $\log_{10}$ reductions is a reduction of 1000 folds.

It should be noticed that 3 out of the 5 listed treatment methods do not inactivate Helminth ova as presented earlier in this report.

Biosolids Regulations

In Jordan, biosolids are characterized in the Jordanian Standard JS: 1145/2006 as Types I, II and III. Table 3 shows chemical, physical and pathogenic concentration requirements for each type (Suleiman et al. 2010). Currently there are no advanced treatment techniques of sludge to produce Type I biosolids that have been certified as acceptable in Jordan.

Type I biosolids classification in the Jordanian Standard JS: 1145/2006 is equivalent to Class A biosolids based on U.S. EPA 503 rule (U.S. EPA 1993a and 1993b). However, JS: 1145/2006 requires the testing of Salmonella and Intestinal Pathogenic Nematodes counts even if the Fecal Coliforms count is less than 1000 MPN/g. This requirement is not present in the U.S. EPA 503 rule. A non-official copy of the JS: 1145/2006 is shown in appendix A of this report.

The United States Environmental Protection Agency promulgated in 1993, Title 40 Code of Federal Regulation Part 503 (40 CFR Part 503) (U.S. EPA, 1993a and 1993b) through which the agency established numerical pollutant limits and management practices for the reuse and disposal of biosolids generated at domestic wastewater treatment facilities. Subpart B of CFR

Part 503 regulates land application, Subpart C regulates surface disposal, subpart D regulates pathogens and vector attraction reduction, while Subpart E regulates incineration of biosolids.

Complete details about rule 503 can be found online at http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=f8625d7ca2f38bb3a61aa3017deefbbd&rgn=div5&view=text&node=40:29.0.1.2.41&idno=40 and are listed in Appendix B of this report.

Survey Results

In this section, a summary of sludge and biosolids management of the surveyed treatment plants will be presented and discussed.

Table 4 shows the 16 surveyed treatment facilities in Jordan with their location, start of operations, type of treatment system, capacity and actual load and the size of population being served by the facility.

It can be seen that the As-Samra facility came online in 2008 after reconstruction and its actual load reached about 53% of its design capacity. As-Samra facility handles more than 85% of the wastewater generated in Jordan and it is expected to reach its design capacity in 2020. As-Samra facility generates Class B biosolids or Type II according to the JS: 1145/2006 using anaerobic mesophilic digestion process. Sludge is then left in lagoons to dry to about 90% total solids based on dry weight and is then stored on site for future reuse for land application.

It should be noticed that some of the treatment facilities presented in Table 4 were constructed in the 1980s and their actual load exceeds their design load. This is why some of these treatment facilities are being or are planned to be reconstructed and upgraded.

Table 5 describe the influent characteristics regarding total suspended solids and the biological oxygen demand as indicators of the amount of sludge that will be generated after wastewater treatment.

Table 6 presents the treatment method that is used in each surveyed treatment facility and the amounts and types of sludge/biosolids generated. The predominant treatment technology used is the drying beds. Only two treatment facilities implement the anaerobic digestion method which generates Class B or Type II biosolids if monitored for retention time and temperature.

Table 6 also indicates that most of the generated biosolids are either landfilled in dumping sites when possible, hauled to bigger treatment facilities as liquid sludge or are stored in the treatment plant after drying.

Acknowledgement

The author of this report would like to acknowledge the financial support of the Jordan component of the Sustainable Development Drylands Project in Asia and the Middle East being funded by the United States Agency for International Development (USAID) through a cooperative agreement with the International Arid Lands Consortium (IALC) at the University of Arizona. In addition, the author would like to acknowledge the ad hoc subcommittee members for the first draft of survey and the initiation of volume of the operational manuals: Engr. Saleh Malkawi: Ministry of Water and Irrigation / Water Authority of Jordan (MWI/WAJ), Engr. Ahmad Ulimat: MWI/WAJ, Engr. Wa'el Suleiman: Environmental Research Center ERC /RSS and Engr. Asma Alsheraideh: ERC /RSS.. Also, the author would like to thank the Water Authority of Jordan (WAJ) and each member of the *ad hoc committee* who initiated the idea of the operational manuals and for their generous co-operation and valuable time and advice in steering this activity in particular and all the project biosolids activities in general. The ad hoc committee members represented the following organizations and agencies: Royal Scientific Society / Environmental Research Center; Jordan University of Science and Technology; University of Jordan; Ministry of Water and Irrigation / Water Authority of Jordan; Jordan Institute for Standards and Metrology; Ministry of Environment; Ministry of Agriculture, Aqaba Special Economic Zone Authority; The National Center for Agricultural Research and Technology Transfer (NCARTT), Badia Research and Development Center and USAID – Amman Mission.

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Tables

Table 1*: Constituent of Total Solids Present in Different Sludge

Constituent	Typical Values (% of TS)	
	Untreated Primary Sludge	Untreated Waste Activated Sludge (WAS)
Volatile Solids (Organics)	65**	73
Grease and Fats:		
Ether Soluble	6-30	
Ether Extract	7-35	5
Protein	25	32
Nitrogen (N)	2.5	4
Phosphorus (P_2O_5)	1.6	6
Potash (K_2O)	0.4	0.6
Cellulose	10	
Silica (SiO_2)	15-20	10-20

*Adapted from Metcalf & Eddy, 2003
**Percentages may not add up to 100%

Table 2: Summary of Microbial Reduction during Sludge Treatment

Treatment Method	Log_{10} Reduction Due to Treatment Method		
	Bacteria	Viruses	Helminth Ova
Anaerobic Digestion [a]	1 – 2	1 – 2	0
Aerobic Digestion	1 - 2	1	0
Composting	2 – 3	2 – 3	2 – 3
Air Drying [b]	2 – 3	1 – 3	1 – 3
Lime Stabilization	2 – 3	3	0

[a] **Mesophilic temperatures (27–37 °C)**
[b] **Effects depend on moisture levels**

Table 3: Requirements for biosolids Types in JS: 1145/2006 (Suleiman et.al. 2010)

Parameter	Unit	Concentration		
		Type I	Type II	Type III
As	mg/kg DW*	41	75	75
Cd	mg/kg DW	40	40	85
Cr	mg/kg DW	900	900	3,000
Cu	mg/kg DW	1,500	3,000	4,300
Hg	mg/kg DW	17	57	57
Mo	mg/kg DW	75	75	75
Ni	mg/kg DW	300	400	420
Se	mg/kg DW	100	100	100
Pb	mg/kg DW	300	840	840
Zn	mg/kg DW	2,800	4,000	7,500
Total Solids (TS)	%	90%	10%	3%
Fecal Coliforms	MPN/g DW	< 1,000	< 2,000,000	NR**
Salmonella	MPN/4g DW	< 3	NR	NR
Intestinal Pathogenic Nematodes	Eggs/4g DW	< 1	NR	NR
Enteric Viruses	PFU/4g DW	< 1	NR	NR

*DW = Dry Weight
**NR = No Requirement
MPN = Most Probable Number
PFU = Plack Forming Unit

Table 4: Major wastewater treatment plants in Jordan treatments processes and capacity

No.	Name/Location	Start of Operations	Type of Treatment	Capacity (m^3/day)	Actual Load in 2005 (m^3/day)	Size of Population Served
1	Madaba	1988 upgraded in 2002	Stabilization Ponds until 2002. Activated sludge	7,600	5,500	50,000
2	Wadi Hassan	2001	Activated sludge	1,600	1,100	40,000
3	Aqaba	2005	Activated sludge and Stabilization Ponds	21,000	14,000	70,000
4	As-Samra	2008	Activated sludge	267,000	140,000 **(2008)**	3,000,000
5	Abu-Nuseir	1986	Activated sludge	4,000	2,300	35,000
6	Fuheis	1997	Activated sludge	2,400	1,600	23,000
7	Salt	1982	Activated sludge	7,600	5,200	55,000
8	Central Irbid	1986	Activated sludge	11,023	6,500	70,000
9	Ramtha	2004	Activated sludge	5,400	3,300	40,000
10	Jerash	1985	Activated sludge	3,250	3,600	75,000
11	Wadi Mousa	2000	Activated sludge	3,400	1,200	10,000
12	Kufranjeh	1990	Trickling filter	1,800	2,550	45,000
13	Karak	1988	Trickling filter	1,700	785	60,000
14	Tafilah	1989	Trickling filter	1,600	1,000	12,000
15	Baq'a	1988	Trickling filter	14,090	10,000	250,000
16	Wadi Al-seir	1997	Aerated lagoons	2,700	4,000	*NA

*Not Available

Table 5: Characteristics of Raw Wastewater by Plant

Treatment Plant	Total suspended solids (mg/L)	BOD_5 (mg/L)
Madaba	2,000	1,400
Wadi Hassan	900	850
Aqaba	450	407
As-Samara	682	663
Abu-Nuseir	509	550
Fuheis	600	600
Salt	880	850
Central Irbid	1,008	1,150
Ramtha	700	950
Jerash	1,150	3,600
Wadi Mousa	972	614
Kufranjeh	891	1,150
Karak	750	700
Tafilah	750	800
Baq'a	907	900
Wadi Al-seir	400	600

Table 6: Biosolid generation by plant, treatment and disposal method

Plant	Sludge generated (dry m^3 per year)	Treatment	Disposal method
Madaba	900 dry	Drying beds	Liquid hauled to Ain Ghazal pretreatment station; dried stored on site
Wadi Hassan	7,300 liquid; 730 dry	Drying beds	Alakaider dumping site
Aqaba	1,012 dry	Drying beds	Stored on Site
As-Samara	100,140 dry	Anaerobic digestion and drying beds	Stored on-site
Abu-Nuseir	29,200 liquid	none	Liquid hauled to Ain Ghazal pretreatment station
Fuheis	4,380 liquid; 130 dry	Drying beds	Liquid hauled to Ain Ghazal pretreatment station; dried stored on site
Salt	27,375 liquid; 1,825 dry	Drying beds	Liquid hauled to Ain Ghazal pretreatment station; dried stored on site
Central Irbid	20,000 liquid; 2,500 dry	Anaerobic digestion and drying beds	Alakaider dumping site
Ramtha	5,000 liquid; 500 dry	Drying beds	Alakaider dumping site
Jerash	27,400 liquid; 600 dry	Drying beds	Alakaider dumping site
Wadi Mousa	Not Available	Drying beds	Stored on site
Kufranjeh	11,000 liquid; 700 dry	Drying beds	Alakaider damping site
Karak	1,000 liquid; 500 dry	Drying beds	liquid sludge is currently disposed of at Al-Lajoon treatment plant while dewatered bio-solids at Karak landfill
Tafilah	1,050 liquid; 500 dry	Drying beds	Jarf Al-Daraweesh dumping site
Baq'a	91,250 liquid	none	Hauled to Ain Ghazal pretreatment station
Wadi Al-seir	4,960 dry	Ponds dried every other year to remove accumulation	Stored on site

Appendix A:
Jordanian Standards JS 1145/2006

1. Field of Application:

This standard contains guidelines that must be met for bio-solids produced in wastewater treatment plants in order to be used to improve soil fertility or as organic fertilizer for agricultural purposes or to be disposed of in landfills as stated by the guidelines of this standard.

2. Definitions:

2.1 Sludge : wet or dry solid material produced by wastewater treatment processes before treatment of this sludge.

2.2 Liquid Sludge : wet by-product solid material of wastewater treatment processes that has a total solid content of 50-89%.

2.3 Dewatered Sludge: Dry by-product solid material of wastewater treatment processes that has a total solid content not less than 10%.

2.4 Treated bio-solids : bio-solids treated with one or more of the treatment processes stated by this standard.

2.5 Wastewater : the disposed water produced by domestic uses that may contain liquid industrial wastes that permitted to be disposed in the network as conditioned by formal parties.

2.6 Sludge dry weight: weight of solid material after drying at a temperature (103-105)^{o}C or till a constant weight reached.

2.7 Producer: the party responsible for wastewater treatment and bio-solids production.

2.8 Distributor: the party responsible for distribution and transport of bio-solids to user.

2.9 User: the party that uses the bio-solids.

2.10 Collection: the process of gathering bio-solids after treatment and before use.

2.11 Bio-solids addition to soil: distribution on soil surface or injection beneath soil surface or mixing with soil.

2.12 Fruit Trees: trees produce fruits for human use.

2.13 Field crops: cereals and fodders that harvested once or more in a year.

2.14 Licensing committee: the governmental party that supplies the license to use bio-solids (Ministry of Environment).

2.15 Supervising parties: ministries and official institutions that supervise environmental and health conditions in accordance with current laws and guidelines.

2.16 Landfills: Defined sites by the licensing parties for disposal of solid and liquid wastes.

2.17 First class of bio-solids: Bio-solids that can be used in all fields stated by this standards. The quality and physical, chemical and microbial constitution of such bio-solids fits into the concentrations stated in table (1) of the standard.

2.18 Second class of bio-solids: Bio-solids that can be used for soil modification or to be disposed of in landfills. The quality and physical, chemical and microbial constitution of such bio-solids fits into the concentrations stated in table (1) of the standard.

2.19 Third class of bio-solids: Bio-solids that's permitted to be disposed of in landfills. The quality and physical, chemical and microbial constitution of such bio-solids fits into the concentrations stated in table (1) of the standard.

2.20 Pastures: Lands used for forage crops or trees plantation.

3. Abbreviations

The following abbreviations are applied for the purpose of this standard:

Abbreviation	Symbol
Arsenic	As
Cadmium	Cd
Chromium	Cr
Copper	Cu
Mercury	Hg
Molybdenum	Mo
Nickel	Ni
Lead	Pb
Selenium	Se
Total Fecal Coliform Count	TFCC
Zinc	Zn

4. General Conditions:

4.1 It is prohibited to use the untreated sludge.

4.2 It is not permitted for any party or person to use bio-solids unless the guidelines of this standards are met.

4.3 Bio-solids laboratory tests requested by the licensing committee or supervising parties should be carried out by an accredited party.

4.4 The user should get the official licenses from licensing committee at the Ministry of Environment and should supply all needed information including bio-solid addition site, nearby water resources, soil quality and crops to be planted. The licenses should be modified every two years and the supervising parties have the right to modify or cancel any license in the case of infringements.

4.5 The producer shall keep a special register for a period not less than five years, the register shall contain information about the quality and quantity of produced bio-solids and the treatment processes to be displayed when needed.

4.6 The user should provide guiding signs at the bio-solids reuse site.

4.7 If required, bio-solids shall be gathered and stored on covered land with lined bottom and sides and in a way that its quality will not be affected and for a period not more than three years.

4.8 It's prohibited to store bio-solids near wadis, areas exposed to floods , irrigation channels, water bodies and sites diversely affect surface water and groundwater.

4.9 Bio-solids is added during January and December for productive trees and during September and October for field crops and pastures, the addition process shall take place within one week before planting for irrigated areas.

4.10 It is not permitted to add bio-solids for lands planted with vegetables, also for parks, house gardens, green flats, and near residential areas. Also it is prohibited to add bio-solids for areas planted with root crops such as carrot, potato, radish or any other crops eaten cooked or uncooked.

4.11 The safety, healthy and environmental conditions shall be met for bio-solids transport process:

- Transport vehicles shall hold obvious signs.
- Leakage from Transport vehicles is prohibited.
- It shall be kept clean.
- Transported bio-solids should be covered.

4.12 The addition process should be homogenous; within the amounts needed and the existed elements and nutrients covered by this standard.

- Addition process for irrigated land is carried out along planting lines, bio-solids is mixed with surface soil (10-20cm), there are no specific addition period but the addition process shall be carried out within a week before planting.

- For rainy land bio-solids is added before precipitation period (starting October) and mixed with surface soil, land slope shall be less than 5%.

- For pastures -as above- but cultivation shall be in contours, bio-solids is mixed with surface soil.

4.13 Bio-solids addition rate depends on nutrients in soil and other elements covered in this standards:

- The maximum nutrients and elements concentrations stated by this standard shall not be exceeded.
- The used shall investigate the nutrients concentrations in soil and crops need before application.

4.14 Supervising parties have the right to carry out needed laboratory tests for crops produced with bio-solids addition to insure safety of the product and general health and environmental conditions.

4.15 The producer shall provide a management plane for the supervising parties.

4.16 It's prohibited to dispose bio-solids in water bodies, wadis, groundwater recharge areas, wastewater networks with the exception of wastewater treatment plants receiving wastes from septic tanks.

4.17 For bio-solids filled in buckets for trading purposes, the approval from supervising parties is needed, in this case (US EPA) guidelines or any other guidelines are helpful.

4.18 In order to use bio-solids for other purposes other than that stated by this standard, technical studies and licenses are needed.

5. Health and Environmental Guidelines:

5.1 Its prohibited to use bio-solids in such away that this will diversely affect the quality of groundwater or surface water including streams, water harvesting projects and areas exposed to floods .

5.2 Supervising parties have the right to state other restrictions other than that stated by this standards in special cases in order to conserve the environment and to keep human safety.

5.3 Health and safety conditions should be kept for persons who are exposed to work with bio-solids.

5.4 The user and producer comply with health requirements, periodic inoculation for workers and providing that for supervising parties when requested.

5.5 Vector attraction shall be taken in consideration while gathering and using of bio-solids.

5.6 Bio-solids shall be mixed with soil in a period not more than two days after addition.

5.7 Bio-solids shall not be added to lands with a slope more than 15%.

5.8 In the case of sludge addition near to residential areas, the addition sites should be 250 m far away.

5.9 It is prohibited to consume fallen fruits in lands exposed to bio-solids addition.

5.10 It is prohibited to use lands with bio-solids addition for pasturing purposes before two months of addition.

5.11 It is requested to use warning signs for sights with bio-solids application in order to warn from entering these sites.

5.12 Mechanical methods may be used in bio-solids addition whenever possible.

6. Technical Conditions:

6.1 Sludge must be treated before use with treatment methods stated by this standard.

6.2 Bio-solids to be disposed at landfills shall comply with the guidelines of this standard.

6.3 Soil characteristics should be identified before the first time of bio-solids addition.

6.4 For the purposes of this standard, bio-solids is classified into three classes, first, second and third class.

- First class bio-solids is used for agricultural purposes in modifying soil characteristics.
- Second class bio-solids is used to modify soil characteristics only.
- It is permitted to dispose bio-solids of the first, second or third class in landfills.

6.5 It is prohibited to add bio-solids to soil at a rate beyond 6 ton/ha per a year.

6.6 Tables (1) and (2) show the maximum permitted concentrations in bio-solids in addition to maximum annual rates and accumulation limits for elements

Table 1

Parameter	Unit	Concentration/ Bio-solids Class		
		Third Class	First Class	Second Class
As	mg/kg Dry Weight	41	75	75
Cd	mg/kg Dry Weight	40	40	85
Cr	mg/kg Dry Weight	900	900	3000
Cu	mg/kg Dry Weight	1500	3000	4300
Hg	mg/kg Dry Weight	17	57	57
Mo	mg/kg Dry Weight	75	75	75
Ni	mg/kg Dry Weight	300	400	420
Se	mg/kg Dry Weight	100	100	100
Pb	mg/kg Dry Weight	300	840	840
Zn	mg/kg Dry Weight	2800	4000	7500
TFCC	MPN/g CFU/g	1000	2,000,000	-
Salmonella	mg/kg Dry Weight	3	-	-
Helmenths eggs	mg/kg Dry Weight	1	-	-
Viruses	mg/kg Dry Weight	1	-	-

Table(2): Maximum Annual Rates and Accumulation

As	1	20
Cd	1	20
Cr	25	500
Cu	35	700
Hg	0.85	17
Mo	0.9	18
Ni	5	100
Se	2	40
Pb	11	220
Zn	50	1000

7. Quality Control:

7.1 Collected bio-solids samples must be representative for the quantity to be used.

7.2 Sampling devices must be clean and made from none polluting material, for biology and microbiology tests sampling and incubation devices must be sterilized.

7.3 Sampling and samples incubation, transfer and analysis shall be carried out as stated by standard methods for the examination of water and wastewater reference (United states Health Association & the Federal American Society of Water Research) or any other accredited analysis methods for example the USEPA Bio-solids sampling and analysis guide.

7.4 Needed laboratory analyses for bio-solids samples must be carried out in accredited technical laboratories and approved by supervising parties.

7.5 Supervising parties have the right to analyze soil, bio-solids and crops and with the frequency wanted.

7.6 The frequency of sampling and chemical, biological and microbiological Analysis are as shown in table (3) below.

Table(3): Frequency of analysis based on produced bio-solids amounts.

BIO-SOLIDS PRODUCED AMOUNT (TON/YEAR)	FREQUENCY OF ANALYSIS (ONCE A YEAR)
Less than 300	once every one year
300-1500	once every 3months
1500-15000	once every 2 month**s**
more than 15000	once a month

8. Quality Control

Bio-solids user, through qualified laboratories, is requested to collect three samples of bio-solids and analyses them to insure its quality and complying with the standards. The average of the three samples is used for classification purposes.

9. Bio-solids Treatment Levels:

First Level:

- Fermentation: sludge is stored in containers or landfilled at a temperature of 20^{o}C for 60 days or at 40^{o}C for 15 days.

- Thermal drying: sludge is dried by direct or indirect contact with hot gases to reach moisture content of 15% or less and a temperature of 80^{o}C.

- Air drying: sludge is let to filtrate or to dry in sand basins so that the depth of sludge is not more than 25 cm, sludge must be kept in the basins for at least 45 days during April to October, solids content must reach at least 85%.

- Thermal aerobic digestion: sludge is mixed in an aerobic environment for 10 days at (55-60) ^{o}C solid content must reach at least 38%.

- Other methods able to reach treatment levels such of the above methods.

Second Level:

- Aerobic digestion: sludge is mixed in an aerobic environment for a period of 40 days at 20^{o}C, solids content must reach 38% at least.

- Air drying: sludge is let to filtrate or to dry in sand basins so that he depth of sludge is not more than 25 cm, sludge must be kept in the basins for at least 30 days, solids content must reach 60% at least.

- Anaerobic digestion: this method is carried out by incubation of sludge in an anaerobic environment for 15 days at 35-55^{o}C or for 60 days at 20^{o}C, solids content must reach 38% at least.

- Other methods able to reach treatment levels such of the above methods.

Third Level:

- Sludge thickening to a solid content of 3%.
- Other methods able to reach treatment levels such of the above methods.

References:

-Syrian Standard Guidlies for Bio-solids Reuse, 2002.

-USEPA Guidelines part (503).

-Australian Standard Guidelines for Bio-solids Reuse , 1997.

-Obreza T, Conner G. The Basics of Bio-solids Application to Land in Florida. University of Florida & Institute of Food and Agricultural Sciences. 2003.

-Stehouwer R. Land Application of Sewage Sludge in Pennsylvania. Pennsylvania State University.1999.

-Indiana Administrative Code (IAC) No. 327. Land Application of Bio-solids, Industrial Wastes Product and Pollutant Bearing Water. Indiana Department of Environment and Management & Indiana Water Pollution Control Association. 2003.

-The Code of Virginia 12 VAC 5-585-10. Virginia Department of Health . 1997.

-Guidelines for the Utilization of Bio-solids and Other Wastes on Agricultural Land. Ministry of Agriculture, Food and Rural Affairs (OMAFRA). Ontario, 1996.

-Usage of Sludge Regulations, Israel Ministry of Environment. 2004.

Appendix B:
U.S. EPA PART 503 Rule

Standards for the Use or Disposal of Sewage Sludge

Electronic Code of Federal Regulations
e-CFR™

e-CFR Data is current as of July 15, 2010

Title 40: Protection of Environment

Browse Previous

PART 503—STANDARDS FOR THE USE OR DISPOSAL OF SEWAGE SLUDGE

Section Contents

Authority: Sections 405 (d) and (e) of the Clean Water Act, as amended by Pub. L. 95–217, sec. 54(d), 91 Stat. 1591 (33 U.S.C. 1345 (d) and (e)); and Pub. L. 100–4, title IV, sec. 406 (a), (b), 101 Stat., 71, 72 (33 U.S.C. 1251 *et seq.*).

Source: 58 FR 9387, Feb. 19, 1993, unless otherwise noted.

Subpart A—General Provisions

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§ 503.1 Purpose and applicability.

top

(a) *Purpose.* (1) This part establishes standards, which consist of general requirements, pollutant limits, management practices, and operational standards, for the final use or disposal of sewage sludge generated during the treatment of domestic sewage in a treatment works. Standards are included in this part for sewage sludge applied to the land, placed on a surface disposal site, or fired in a sewage sludge incinerator. Also included in this part are pathogen and alternative vector attraction reduction requirements for sewage sludge applied to the land or placed on a surface disposal site.

(2) In addition, the standards in this part include the frequency of monitoring and recordkeeping requirements when sewage sludge is applied to the land, placed on a surface disposal site, or fired in a sewage sludge incinerator. Also included in this part are reporting requirements for Class I sludge management facilities, publicly owned treatment works (POTWs) with a design flow rate equal to or greater than one million gallons per day, and POTWs that serve 10,000 people or more.

(b) *Applicability.* (1) This part applies to any person who prepares sewage sludge, applies sewage sludge to the land, or fires sewage sludge in a sewage sludge incinerator and to the owner/operator of a surface disposal site.

(2) This part applies to sewage sludge applied to the land, placed on a surface disposal site, or fired in a sewage sludge incinerator.

(3) This part applies to the exit gas from a sewage sludge incinerator stack.

(4) This part applies to land where sewage sludge is applied, to a surface disposal site, and to a sewage sludge incinerator.

§ 503.2 Compliance period.

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(a) Compliance with the standards in this part shall be achieved as expeditiously as practicable, but in no case later than February 19, 1994. When compliance with the standards requires construction of new pollution control facilities, compliance with the standards shall be achieved as expeditiously as practicable, but in no case later than February 19, 1995.

(b) The requirements for frequency of monitoring, recordkeeping, and reporting in this part for total hydrocarbons in the exit gas from a sewage sludge incinerator are effective February 19, 1994 or, if compliance with the operational standard for total hydrocarbons in this part requires the construction of new pollution control facilities, February 19, 1995.

(c) All other requirements for frequency of monitoring, recordkeeping, and reporting in this part are effective on July 20, 1993.

(d) Unless otherwise specified in subpart E, compliance with the requirements in §§503.41(c) through (r), 503.43(c), (d) and (e), 503.45(a)(1), (b) through (f), 503.46(a)(1), (a)(3), and (c), and 503.47(f) that were revised on September 3, 1999 shall be achieved as expeditiously as practicable, but in no case later than September 5, 2000. When new pollution control facilities must be constructed to comply with the revised requirements in subpart E, compliance with the revised requirements shall be achieved as expeditiously as practicable but no later than September 4, 2001.

[58 FR 9387, Feb. 19, 1993, as amended at 64 FR 42568, Aug. 4, 1999]

§ 503.3 Permits and direct enforceability.

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(a) Permits. The requirements in this part may be implemented through a permit:

(1) Issued to a “treatment works treating domestic sewage”, as defined in 40 CFR 122.2, in accordance with 40 CFR parts 122 and 124 by EPA or by a State that has a State sludge management program approved by EPA in accordance with 40 CFR part 123 or 40 CFR part 501 or

(2) Issued under subtitle C of the Solid Waste Disposal Act; part C of the Safe Drinking Water Act; the Marine Protection, Research, and Sanctuaries Act of 1972; or the Clean Air Act. “Treatment works treating domestic sewage” shall submit a permit application in accordance with either 40 CFR 122.21 or an approved State program.

(b) Direct enforceability. No person shall use or dispose of sewage sludge through any practice for which requirements are established in this part except in accordance with such requirements.

§ 503.4 Relationship to other regulations.

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Disposal of sewage sludge in a municipal solid waste landfill unit, as defined in 40 CFR 258.2, that complies with the requirements in 40 CFR part 258 constitutes compliance with section 405(d) of the CWA. Any person who prepares sewage sludge that is disposed in a municipal solid waste landfill unit shall ensure that the sewage sludge meets the requirements in 40 CFR part 258 concerning the quality of materials disposed in a municipal solid waste landfill unit.

§ 503.5 Additional or more stringent requirements.

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(a) On a case-by-case basis, the permitting authority may impose requirements for the use or disposal of sewage sludge in addition to or more stringent than the requirements in this part when necessary to protect public health and the environment from any adverse effect of a pollutant in the sewage sludge.

(b) Nothing in this part precludes a State or political subdivision thereof or interstate agency from imposing requirements for the use or disposal of sewage sludge more stringent than the requirements in this part or from imposing additional requirements for the use or disposal of sewage sludge.

§ 503.6 Exclusions.

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(a) *Treatment processes.* This part does not establish requirements for processes used to treat domestic sewage or for processes used to treat sewage sludge prior to final use or disposal, except as provided in §503.32 and §503.33.

(b) *Selection of a use or disposal practice.* This part does not require the selection of a sewage sludge use or disposal practice. The determination of the manner in which sewage sludge is used or disposed is a local determination.

(c) *Co-firing of sewage sludge.* This part does not establish requirements for sewage sludge co-fired in an incinerator with other wastes or for the incinerator in which sewage sludge and other wastes are co-fired. Other wastes do not include auxiliary fuel, as defined in 40 CFR 503.41(b), fired in a sewage sludge incinerator.

(d) *Sludge generated at an industrial facility.* This part does not establish requirements for the use or disposal of sludge generated at an industrial facility during the treatment of industrial wastewater, including sewage sludge generated during the treatment of industrial wastewater combined with domestic sewage.

(e) *Hazardous sewage sludge.* This part does not establish requirements for the use or disposal of sewage sludge determined to be hazardous in accordance with 40 CFR part 261.

(f) *Sewage sludge with high PCB concentration.* This part does not establish requirements for the use or disposal of sewage sludge with a concentration of polychlorinated biphenyls (PCBs) equal to or greater than 50 milligrams per kilogram of total solids (dry weight basis).

(g) *Incinerator ash.* This part does not establish requirements for the use or disposal of ash generated during the firing of sewage sludge in a sewage sludge incinerator.

(h) *Grit and screenings.* This part does not establish requirements for the use or disposal of grit (e.g., sand, gravel, cinders, or other materials with a high specific gravity) or screenings (e.g., relatively large materials such as rags) generated during preliminary treatment of domestic sewage in a treatment works.

(i) *Drinking water treatment sludge.* This part does not establish requirements for the use or disposal of sludge generated during the treatment of either surface water or ground water used for drinking water.

(j) *Commercial and industrial septage.* This part does not establish requirements for the use or disposal of commercial septage, industrial septage, a mixture of domestic septage and commercial septage, or a mixture of domestic septage and industrial septage.

§ 503.7 Requirement for a person who prepares sewage sludge.

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Any person who prepares sewage sludge shall ensure that the applicable requirements in this part are met when the sewage sludge is applied to the land, placed on a surface disposal site, or fired in a sewage sludge incinerator.

§ 503.8 Sampling and analysis.

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(a) *Sampling.* Representative samples of sewage sludge that is applied to the land, placed on a surface disposal site, or fired in a sewage sludge incinerator shall be collected and analyzed.

(b) *Methods* . The materials listed below are incorporated by reference in this part. These incorporations by reference were approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. The materials are incorporated as they exist on the date of approval, and notice of any change in these materials will be published in theFederal Register.They are available for inspection at the HQ Water Docket Center, EPA/DC, EPA West, Room B102, 1301 Constitution Ave., NW., Washington, DC, and at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202–741–6030, or go to: *http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html.* Copies may be obtained from the standard producer or publisher listed in the regulation. The methods in the materials listed below (or in 40 CFR Part 136) shall be used to analyze samples of sewage sludge.

(1) *Enteric viruses.* ASTM Designation: D 4994–89, “Standard Practice for Recovery of Viruses From Wastewater Sludges”, 1992 Annual Book of ASTM Standards: Section 11—Water and Environmental Technology, ASTM, 1916 Race Street, Philadelphia, PA 19103–1187.

(2) *Fecal coliform.* Part 9221 E. or Part 9222 D., “Standard Methods for the Examination of Water and Wastewater”, 18th Edition, 1992, American Public Health Association, 1015 15th Street, NW., Washington, DC 20005.

(3) *Helminth ova.* Yanko, W.A., “Occurrence of Pathogens in Distribution and Marketing Municipal Sludges”, EPA 600/1–87–014, 1987. National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161 (PB 88–154273/AS).

(4) *Inorganic pollutants.* “Test Methods for Evaluating Solid Waste, Physical/Chemical Methods”, EPA Publication SW–846, Second Edition (1982) with Updates I (April 1984) and II (April 1985) and Third Edition (November 1986) with Revision I (December 1987). Second Edition and Updates I and II are available from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161 (PB–87–120–291). Third Edition and Revision I are available from Superintendent of Documents, Government Printing Office, 941 North Capitol Street, NE., Washington, DC 20002 (Document Number 955–001–00000–1).

(5) *Salmonella sp. bacteria.* Part 9260 D., “Standard Methods for the Examination of Water and Wastewater”, 18th Edition, 1992, American Public Health Association, 1015 15th Street, NW., Washington, DC 20005; or

Kenner, B.A. and H.P. Clark, "Detection and enumeration of *Salmonella* and *Pseudomonas aeruginosa* ", Journal of the Water Pollution Control Federation, Vol. 46, no. 9, September 1974, pp. 2163–2171. Water Environment Federation, 601 Wythe Street, Alexandria, Virginia 22314.

(6) *Specific oxygen uptake rate.* Part 2710 B., "Standard Methods for the Examination of Water and Wastewater", 18th Edition, 1992, American Public Health Association, 1015 15th Street, NW., Washington, DC 20005.

(7) *Total, fixed, and volatile solids.* Part 2540 G., "Standard Methods for the Examination of Water and Wastewater", 18th Edition, 1992, American Public Health Association, 1015 15th Street, NW., Washington, DC 20005.

[58 FR 9387, Feb. 19, 1993, as amended at 69 FR 18803, Apr. 9, 2004; 72 FR 14233, Mar. 26, 2007]

§ 503.9 General definitions.

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(a) *Apply sewage sludge or sewage sludge applied to the land* means land application of sewage sludge.

(b) *Base flood* is a flood that has a one percent chance of occurring in any given year (*i.e.* , a flood with a magnitude equalled once in 100 years).

(c) *Class I sludge management facility* is any publicly owned treatment works (POTW), as defined in 40 CFR 501.2, required to have an approved pretreatment program under 40 CFR 403.8(a) (including any POTW located in a State that has elected to assume local program responsibilities pursuant to 40 CFR 403.10(e)) and any treatment works treating domestic sewage, as defined in 40 CFR 122.2, classified as a Class I sludge management facility by the EPA Regional Administrator, or, in the case of approved State programs, the Regional Administrator in conjunction with the State Director, because of the potential for its sewage sludge use or disposal practice to affect public health and the environment adversely.

(d) *Cover crop* is a small grain crop, such as oats, wheat, or barley, not grown for harvest.

(e) *CWA* means the Clean Water Act (formerly referred to as either the Federal Water Pollution Act or the Federal Water Pollution Control Act Amendments of 1972), Public Law 92–500, as amended by Public Law 95–217, Public Law 95–576, Public Law 96–483, Public Law 97–117, and Public Law 100–4.

(f) *Domestic septage* is either liquid or solid material removed from a septic tank, cesspool, portable toilet, Type III marine sanitation device, or similar treatment works that receives only domestic sewage. Domestic septage does not include liquid or solid material removed from a septic tank, cesspool, or similar treatment works that receives either commercial wastewater or industrial wastewater and does not include grease removed from a grease trap at a restaurant.

(g) *Domestic sewage* is waste and wastewater from humans or household operations that is discharged to or otherwise enters a treatment works.

(h) *Dry weight basis* means calculated on the basis of having been dried at 105 degrees Celsius until reaching a constant mass (*i.e.* , essentially 100 percent solids content).

(i) *EPA* means the United States Environmental Protection Agency.

(j) *Feed crops* are crops produced primarily for consumption by animals.

(k) *Fiber crops* are crops such as flax and cotton.

(l) *Food crops* are crops consumed by humans. These include, but are not limited to, fruits, vegetables, and tobacco.

(m) *Ground water* is water below the land surface in the saturated zone.

(n) *Industrial wastewater* is wastewater generated in a commercial or industrial process.

(o) *Municipality* means a city, town, borough, county, parish, district, association, or other public body (including an intermunicipal Agency of two or more of the foregoing entities) created by or under State law; an Indian tribe or an authorized Indian tribal organization having jurisdiction over sewage sludge management; or a designated and approved management Agency under section 208 of the CWA, as amended. The definition includes a special district created under State law, such as a water district, sewer district, sanitary district, utility district, drainage district, or similar entity, or an integrated waste management facility as defined in section 201(e) of the CWA, as amended, that has as one of its principal responsibilities the treatment, transport, use, or disposal of sewage sludge.

(p) *Permitting authority* is either EPA or a State with an EPA-approved sludge management program.

(q) *Person* is an individual, association, partnership, corporation, municipality, State or Federal agency, or an agent or employee thereof.

(r) *Person who prepares sewage sludge* is either the person who generates sewage sludge during the treatment of domestic sewage in a treatment works or the person who derives a material from sewage sludge.

(s) *Place sewage sludge or sewage sludge placed* means disposal of sewage sludge on a surface disposal site.

(t) *Pollutant* is an organic substance, an inorganic substance, a combination of organic and inorganic substances, or a pathogenic organism that, after discharge and upon exposure, ingestion, inhalation, or assimilation into an organism either directly from the environment or indirectly by ingestion through the food chain, could, on the basis of information available to the Administrator of EPA, cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunction in reproduction), or physical deformations in either organisms or offspring of the organisms.

(u) *Pollutant limit* is a numerical value that describes the amount of a pollutant allowed per unit amount of sewage sludge (e.g., milligrams per kilogram of total solids); the amount of a pollutant that can be applied to a unit area of land (e.g., kilograms per hectare); or the volume of a material that can be applied to a unit area of land (e.g., gallons per acre).

(v) *Runoff* is rainwater, leachate, or other liquid that drains overland on any part of a land surface and runs off of the land surface.

(w) *Sewage sludge* is solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a treatment works. Sewage sludge includes, but is not limited to, domestic septage; scum or solids removed in primary, secondary, or advanced wastewater treatment processes; and a material derived from sewage sludge. Sewage sludge does not include ash generated during the firing of sewage sludge in a sewage sludge incinerator or grit and screenings generated during preliminary treatment of domestic sewage in a treatment works.

(x) *State* is one of the United States of America, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Trust Territory of the Pacific Islands, the Commonwealth of the Northern Mariana Islands, and an Indian Tribe eligible for treatment as a State pursuant to regulations promulgated under the authority of section 518(e) of the CWA.

(y) *Store or storage of sewage sludge* is the placement of sewage sludge on land on which the sewage sludge remains for two years or less. This does not include the placement of sewage sludge on land for treatment.

(z) *Treat or treatment of sewage sludge* is the preparation of sewage sludge for final use or disposal. This includes, but is not limited to, thickening, stabilization, and dewatering of sewage sludge. This does not include storage of sewage sludge.

(aa) *Treatment works* is either a federally owned, publicly owned, or privately owned device or system used to treat (including recycle and reclaim) either domestic sewage or a combination of domestic sewage and industrial waste of a liquid nature.

(bb) *Wetlands* means those areas that are inundated or saturated by surface water or ground water at a frequency and duration to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Subpart B—Land Application

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§ 503.10 Applicability.

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(a) This subpart applies to any person who prepares sewage sludge that is applied to the land, to any person who applies sewage sludge to the land, to sewage sludge applied to the land, and to the land on which sewage sludge is applied.

(b)(1) *Bulk sewage sludge.* The general requirements in §503.12 and the management practices in §503.14 do not apply when bulk sewage sludge is applied to the land if the bulk sewage sludge meets the ceiling concentrations in Table 1 of §503.13 and the pollutant concentrations in Table 3 of §503.13; the Class A pathogen requirements in §503.32(a); and one of the vector attraction reduction requirements in §503.33(b)(1) through (b)(8).

(2) The Regional Administrator of EPA or, in the case of a State with an approved sludge management program, the State Director, may apply any or all of the general requirements in §503.12 and the management practices in §503.14 to the bulk sewage sludge in §503.10(b)(1) on a case-by-case basis after determining that the general requirements or management practices are needed to protect public health and the environment from any reasonably anticipated adverse effect that may occur from any pollutant in the bulk sewage sludge.

(c)(1) The general requirements in §503.12 and the management practices in §503.14 do not apply when a bulk material derived from sewage sludge is applied to the land if the derived bulk material meets the ceiling concentrations in Table 1 of §503.13 and the pollutant concentrations in Table 3 of §503.13; the Class A pathogen requirements in §503.32(a); and one of the vector attraction reduction requirements in §503.33(b)(1) through (b)(8).

(2) The Regional Administrator of EPA or, in the case of a State with an approved sludge management program, the State Director, may apply any or all of the general requirements in §503.12 or the management practices in §503.14 to the bulk material in §503.10(c)(1) on a case-by-case basis after determining that the general requirements or management practices are needed to protect public health and the environment from any reasonably anticipated adverse effect that may occur from any pollutant in the bulk sewage sludge.

(d) The requirements in this subpart do not apply when a bulk material derived from sewage sludge is applied to the land if the sewage sludge from which the bulk material is derived meets the ceiling concentrations in Table 1 of §503.13 and the pollutant concentrations in Table 3 of §503.13; the Class A pathogen requirements in §503.32(a); and one of the vector attraction reduction requirements in §503.33(b)(1) through (b)(8).

(e) Sewage sludge sold or given away in a bag or other container for application to the land. The general requirements in §503.12 and the management practices in §503.14 do not apply when sewage sludge is sold or given away in a bag or other container for application to the

land if the sewage sludge sold or given away in a bag or other container for application to the land meets the ceiling concentrations in Table 1 of §503.13 and the pollutant concentrations in Table 3 of §503.13; the Class A pathogen requirements in §503.32(a); and one of the vector attraction reduction requirements in §503.33(b)(1) through (b)(8).

(f) The general requirements in §503.12 and the management practices in §503.14 do not apply when a material derived from sewage sludge is sold or given away in a bag or other container for application to the land if the derived material meets the ceiling concentrations in Table 1 of §503.13 and the pollutant concentrations in Table 3 of §503.13; the Class A pathogen requirements in §503.32(a); and one of the vector attraction reduction requirements in §503.33(b)(1) through (b)(8).

(g) The requirements in this subpart do not apply when a material derived from sewage sludge is sold or given away in a bag or other container for application to the land if the sewage sludge from which the material is derived meets the ceiling concentrations in Table 1 of §503.13 and the pollutant concentrations in Table 3 of §503.13; the Class A pathogen requirements in §503.32(a); and one of the vector attraction reduction requirements in §503.33 (b)(1) through (b)(8).

[58 FR 9387, Feb. 19, 1993, as amended at 64 FR 42568, Aug. 4, 1999]

§ 503.11 Special definitions.

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(a) *Agricultural land* is land on which a food crop, a feed crop, or a fiber crop is grown. This includes range land and land used as pasture.

(b) *Agronomic rate* is the whole sludge application rate (dry weight basis) designed:

(1) To provide the amount of nitrogen needed by the food crop, feed crop, fiber crop, cover crop, or vegetation grown on the land; and

(2) To minimize the amount of nitrogen in the sewage sludge that passes below the root zone of the crop or vegetation grown on the land to the ground water.

(c) *Annual pollutant loading rate* is the maximum amount of a pollutant that can be applied to a unit area of land during a 365 day period.

(d) *Annual whole sludge application rate* is the maximum amount of sewage sludge (dry weight basis) that can be applied to a unit area of land during a 365 day period.

(e) *Bulk sewage sludge* is sewage sludge that is not sold or given away in a bag or other container for application to the land.

(f) *Cumulative pollutant loading rate* is the maximum amount of an inorganic pollutant that can be applied to an area of land.

(g) *Forest* is a tract of land thick with trees and underbrush.

(h) *Land application* is the spraying or spreading of sewage sludge onto the land surface; the injection of sewage sludge below the land surface; or the incorporation of sewage sludge into the soil so that the sewage sludge can either condition the soil or fertilize crops or vegetation grown in the soil.

(i) *Monthly average* is the arithmetic mean of all measurements taken during the month.

(j) *Other container* is either an open or closed receptacle. This includes, but is not limited to, a bucket, a box, a carton, and a vehicle or trailer with a load capacity of one metric ton or less.

(k) *Pasture* is land on which animals feed directly on feed crops such as legumes, grasses, grain stubble, or stover.

(l) *Public contact site* is land with a high potential for contact by the public. This includes, but is not limited to, public parks, ball fields, cemeteries, plant nurseries, turf farms, and golf courses.

(m) *Range land* is open land with indigenous vegetation.

(n) *Reclamation site* is drastically disturbed land that is reclaimed using sewage sludge. This includes, but is not limited to, strip mines and construction sites.

§ 503.12 General requirements.

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(a) No person shall apply sewage sludge to the land except in accordance with the requirements in this subpart.

(b) No person shall apply bulk sewage sludge subject to the cumulative pollutant loading rates in §503.13(b)(2) to agricultural land, forest, a public contact site, or a reclamation site if any of the cumulative pollutant loading rates in §503.13(b)(2) has been reached.

(c) No person shall apply domestic septage to agricultural land, forest, or a reclamation site during a 365 day period if the annual application

rate in §503.13(c) has been reached during that period.

(d) The person who prepares bulk sewage sludge that is applied to agricultural land, forest, a public contact site, or a reclamation site shall provide the person who applies the bulk sewage sludge written notification of the concentration of total nitrogen (as N on a dry weight basis) in the bulk sewage sludge.

(e)(1) The person who applies sewage sludge to the land shall obtain information needed to comply with the requirements in this subpart.

(2)(i) Before bulk sewage sludge subject to the cumulative pollutant loading rates in §503.13(b)(2) is applied to the land, the person who proposes to apply the bulk sewage sludge shall contact the permitting authority for the State in which the bulk sewage sludge will be applied to determine whether bulk sewage sludge subject to the cumulative pollutant loading rates in §503.13(b)(2) has been applied to the site since July 20, 1993.

(ii) If bulk sewage sludge subject to the cumulative pollutant loading rates in §503.13(b)(2) has not been applied to the site since July 20, 1993, the cumulative amount for each pollutant listed in Table 2 of §503.13 may be applied to the site in accordance with §503.13(a)(2)(i).

(iii) If bulk sewage sludge subject to the cumulative pollutant loading rates in §503.13(b)(2) has been applied to the site since July 20, 1993, and the cumulative amount of each pollutant applied to the site in the bulk sewage sludge since that date is known, the cumulative amount of each pollutant applied to the site shall be used to determine the additional amount of each pollutant that can be applied to the site in accordance with §503.13(a)(2)(i).

(iv) If bulk sewage sludge subject to the cumulative pollutant loading rates in §503.13(b)(2) has been applied to the site since July 20, 1993, and the cumulative amount of each pollutant applied to the site in the bulk sewage sludge since that date is not known, an additional amount of each pollutant shall not be applied to the site in accordance with §503.13(a)(2)(i).

(f) When a person who prepares bulk sewage sludge provides the bulk sewage sludge to a person who applies the bulk sewage sludge to the land, the person who prepares the bulk sewage sludge shall provide the person who applies the sewage sludge notice and necessary information to comply with the requirements in this subpart.

(g) When a person who prepares sewage sludge provides the sewage sludge to another person who prepares the sewage sludge, the person who provides the sewage sludge shall provide the person who receives the sewage sludge notice and necessary information to comply with the requirements in this subpart.

(h) The person who applies bulk sewage sludge to the land shall provide the owner or lease holder of the land on which the bulk sewage sludge is applied notice and necessary information to comply with the requirements in this subpart.

(i) Any person who prepares bulk sewage sludge that is applied to land in a State other than the State in which the bulk sewage sludge is prepared shall provide written notice, prior to the initial application of bulk sewage sludge to the land application site by the applier, to the permitting authority for the State in which the bulk sewage sludge is proposed to be applied. The notice shall include:

(1) The location, by either street address or latitude and longitude, of each land application site.

(2) The approximate time period bulk sewage sludge will be applied to the site.

(3) The name, address, telephone number, and National Pollutant Discharge Elimination System permit number (if appropriate) for the person who prepares the bulk sewage sludge.

(4) The name, address, telephone number, and National Pollutant Discharge Elimination System permit number (if appropriate) for the person who will apply the bulk sewage sludge.

(j) Any person who applies bulk sewage sludge subject to the cumulative pollutant loading rates in §503.13(b)(2) to the land shall provide written notice, prior to the initial application of bulk sewage sludge to a land application site by the applier, to the permitting authority for the State in which the bulk sewage sludge will be applied and the permitting authority shall retain and provide access to the notice. The notice shall include:

(1) The location, by either street address or latitude and longitude, of the land application site.

(2) The name, address, telephone number, and National Pollutant Discharge Elimination System permit number (if appropriate) of the person who will apply the bulk sewage sludge.

§ 503.13 Pollutant limits.

top

(a) *Sewage sludge.* (1) Bulk sewage sludge or sewage sludge sold or given away in a bag or other container shall not be applied to the land if the concentration of any pollutant in the sewage sludge exceeds the ceiling concentration for the pollutant in Table 1 of §503.13.

(2) If bulk sewage sludge is applied to agricultural land, forest, a public contact site, or a reclamation site, either:

(i) The cumulative loading rate for each pollutant shall not exceed the cumulative pollutant loading rate for the pollutant in Table 2 of §503.13; or

(ii) The concentration of each pollutant in the sewage sludge shall not exceed the concentration for the pollutant in Table 3 of §503.13.

(3) If bulk sewage sludge is applied to a lawn or a home garden, the concentration of each pollutant in the sewage sludge shall not exceed the concentration for the pollutant in Table 3 of §503.13.

(4) If sewage sludge is sold or given away in a bag or other container for application to the land, either:

(i) The concentration of each pollutant in the sewage sludge shall not exceed the concentration for the pollutant in Table 3 of §503.13; or

(ii) The product of the concentration of each pollutant in the sewage sludge and the annual whole sludge application rate for the sewage sludge shall not cause the annual pollutant loading rate for the pollutant in Table 4 of §503.13 to be exceeded. The procedure used to determine the annual whole sludge application rate is presented in appendix A of this part.

(b) *Pollutant concentrations and loading rates—sewage sludge* —(1) *Ceiling concentrations.*

Table 1 of §503.13—Ceiling Concentrations

Pollutant	Ceiling concentration (milligrams per kilogram)[1]
Arsenic	75
Cadmium	85
Copper	4300
Lead	840
Mercury	57
Molybdenum	75
Nickel	420
Selenium	100
Zinc	7500

[1]Dry weight basis.

(2) *Cumulative pollutant loading rates.*

Table 2 of §503.13—Cumulative Pollutant Loading Rates

Pollutant	Cumulative pollutant loading rate (kilograms per hectare)
Arsenic	41

Cadmium	39
Copper	1500
Lead	300
Mercury	17
Nickel	420
Selenium	100
Zinc	2800

(3) *Pollutant concentrations.*

Table 3 of §503.13—Pollutant Concentrations

Pollutant	**Monthly average concentration (milligrams per kilogram)[1]**
Arsenic	41
Cadmium	39
Copper	1500
Lead	300
Mercury	17
Nickel	420
Selenium	100
Zinc	2800

[1]Dry weight basis.

(4) *Annual pollutant loading rates.*

Table 4 of §503.13—Annual Pollutant Loading Rates

Pollutant	Annual pollutant loading rate (kilograms per hectare per 365 day period)
Arsenic	2.0
Cadmium	1.9
Copper	75
Lead	15
Mercury	0.85
Nickel	21
Selenium	5.0
Zinc	140

(c) *Domestic septage.* The annual application rate for domestic septage applied to agricultural land, forest, or a reclamation site shall not exceed the annual application rate calculated using equation (1).

$$AAR = \frac{N}{0.0026} \qquad Eq.\ (1)$$

Where:

AAR=Annual application rate in gallons per acre per 365 day period.

N=Amount of nitrogen in pounds per acre per 365 day period needed by the crop or vegetation grown on the land.

[58 FR 9387, Feb. 19, 1993, as amended at 58 FR 9099, Feb. 25, 1994; 60 FR 54769, Oct. 25, 1995]

§ 503.14 Management practices.

top

(a) Bulk sewage sludge shall not be applied to the land if it is likely to adversely affect a threatened or endangered species listed under section 4 of the Endangered Species Act or its designated critical habitat.

(b) Bulk sewage sludge shall not be applied to agricultural land, forest, a public contact site, or a reclamation site that is flooded, frozen, or snow-covered so that the bulk sewage sludge enters a wetland or other waters of the United States, as defined in 40 CFR 122.2, except as provided in a permit issued pursuant to section 402 or 404 of the CWA.

(c) Bulk sewage sludge shall not be applied to agricultural land, forest, or a reclamation site that is 10 meters or less from waters of the United

States, as defined in 40 CFR 122.2, unless otherwise specified by the permitting authority.

(d) Bulk sewage sludge shall be applied to agricultural land, forest, a public contact site, or a reclamation site at a whole sludge application rate that is equal to or less than the agronomic rate for the bulk sewage sludge, unless, in the case of a reclamation site, otherwise specified by the permitting authority.

(e) Either a label shall be affixed to the bag or other container in which sewage sludge that is sold or given away for application to the land, or an information sheet shall be provided to the person who receives sewage sludge sold or given away in an other container for application to the land. The label or information sheet shall contain the following information:

(1) The name and address of the person who prepared the sewage sludge that is sold or given away in a bag or other container for application to the land.

(2) A statement that application of the sewage sludge to the land is prohibited except in accordance with the instructions on the label or information sheet.

(3) The annual whole sludge application rate for the sewage sludge that does not cause any of the annual pollutant loading rates in Table 4 of §503.13 to be exceeded.

§ 503.15 Operational standards—pathogens and vector attraction reduction.

top

(a) *Pathogens—sewage sludge.* (1) The Class A pathogen requirements in §503.32(a) or the Class B pathogen requirements and site restrictions in §503.32(b) shall be met when bulk sewage sludge is applied to agricultural land, forest, a public contact site, or a reclamation site.

(2) The Class A pathogen requirements in §503.32(a) shall be met when bulk sewage sludge is applied to a lawn or a home garden.

(3) The Class A pathogen requirements in §503.32(a) shall be met when sewage sludge is sold or given away in a bag or other container for application to the land.

(b) *Pathogens—domestic septage.* The requirements in either §503.32 (c)(1) or (c)(2) shall be met when domestic septage is applied to agricultural land, forest, or a reclamation site.

(c) *Vector attraction reduction—sewage sludge.* (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.

(d) *Vector attraction reduction—domestic septage.* The vector attraction reduction requirements in §503.33(b)(9), (b)(10), or (b)(12) shall be met when domestic septage is applied to agricultural land, forest, or a reclamation site.

§ 503.16 Frequency of monitoring.

top

(a) *Sewage sludge.* (1) The frequency of monitoring for the pollutants listed in Table 1, Table 2, Table 3 and Table 4 of §503.13; the pathogen density requirements in §503.32(a) and §503.32(b)(2); and the vector attraction reduction requirements in §503.33 (b)(1) through (b)(4) and §503.33 (b)(7) through (b)(8) shall be the frequency in Table 1 of §503.16.

Table 1 of §503.16—Frequency of Monitoring—Land Application

Amount of sewage sludge[1](metric tons per 365 day period)	Frequency
Greater than zero but less than 290	Once per year.

Equal to or greater than 290 but less than 1,500	Once per quarter (four times per year).
Equal to or greater than 1,500 but less than 15,000	Once per 60 days (six times per year).
Equal to or greater than 15,000	Once per month (12 times per year).

[1]Either the amount of bulk sewage sludge applied to the land or the amount of sewage sludge prepared for sale or give-away in a bag or other container for application to the land (dry weight basis).

(2) After the sewage sludge has been monitored for two years at the frequency in Table 1 of §503.16, the permitting authority may reduce the frequency of monitoring for pollutant concentrations and for the pathogen density requirements in §503.32(a)(5)(ii) and (a)(5)(iii).

(b) *Domestic septage.* If either the pathogen requirements in §503.32(c)(2) or the vector attraction reduction requirements in §503.33(b)(12) are met when domestic septage is applied to agricultural land, forest, or a reclamation site, each container of domestic septage applied to the land shall be monitored for compliance with those requirements.

(Approved by the Office of Management and Budget under control number 2040–0157)

[58 FR 9387, Feb. 19, 1993, as amended at 64 FR 42569, Aug. 4, 1999]

§ 503.17 Recordkeeping.

top

(a) *Sewage sludge.* (1) The person who prepares the sewage sludge in §503.10(b)(1) or (e) shall develop the following information and shall retain the information for five years:

(i) The concentration of each pollutant listed in Table 3 of §503.13 in the sewage sludge.

(ii) The following certification statement:

I certify, under penalty of law, that the information that will be used to determine compliance with the Class A pathogen requirements in §503.32(a) and the vector attraction reduction requirement in [insert one of the vector attraction reduction requirements in §503.33(b)(1) through §503.33(b)(8)] was prepared under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate this information. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment.

(iii) A description of how the Class A pathogen requirements in §503.32(a) are met.

(iv) A description of how one of the vector attraction reduction requirements in §503.33 (b)(1) through (b)(8) is met.

(2) The person who derives the material in §503.10 (c)(1) or (f) shall develop the following information and shall retain the information for five years:

(i) The concentration of each pollutant listed in Table 3 of §503.13 in the material.

(ii) The following certification statement:

I certify, under penalty of law, that the information that will be used to determine compliance with the Class A pathogen requirements in §503.32(a) and the vector attraction reduction requirement in (insert one of the vector attraction reduction requirements in §503.33(b)(1) through (b)(8)) was prepared under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate this

information. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment.

(iii) A description of how the Class A pathogen requirements in §503.32(a) are met.

(iv) A description of how one of the vector attraction reduction requirements in §503.33 (b)(1) through (b)(8) is met.

(3) If the pollutant concentrations in §503.13(b)(3), the Class A pathogen requirements in §503.32(a), and the vector attraction reduction requirements in either §503.33 (b)(9) or (b)(10) are met when bulk sewage sludge is applied to agricultural land, forest, a public contact site, or a reclamation site:

(i) The person who prepares the bulk sewage sludge shall develop the following information and shall retain the information for five years.

(A) The concentration of each pollutant listed in Table 3 of §503.13 in the bulk sewage sludge.

(B) The following certification statement:

I certify, under penalty of law, that the information that will be used to determine compliance with the Class A pathogen requirements in §503.32(a) was prepared under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate this information. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment.

(C) A description of how the pathogen requirements in §503.32(a) are met.

(ii) The person who applies the bulk sewage sludge shall develop the following information and shall retain the information for five years.

(A) The following certification statement:

I certify, under penalty of law, that the information that will be used to determine compliance with the management practices in §503.14 and the vector attraction reduction requirement in (insert either §503.33(b)(9) or (b)(10)) was prepared under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate this information. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment.

(B) A description of how the management practices in §503.14 are met for each site on which bulk sewage sludge is applied.

(C) A description of how the vector attraction reduction requirements in either §503.33(b)(9) or (b)(10) are met for each site on which bulk sewage sludge is applied.

(4) If the pollutant concentrations in §503.13(b)(3) and the Class B pathogen requirements in §503.32(b) are met when bulk sewage sludge is applied to agricultural land, forest, a public contact site, or a reclamation site:

(i) The person who prepares the bulk sewage sludge shall develop the following information and shall retain the information for five years:

(A) The concentration of each pollutant listed in Table 3 of §503.13 in the bulk sewage sludge.

(B) The following certification statement:

I certify, under penalty of law, that the information that will be used to determine compliance with the Class B pathogen requirements in §503.32(b) and the vector attraction reduction requirement in (insert one of the vector attraction reduction requirements in §503.33(b)(1) through (b)(8)if one of those requirements is met) was prepared under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate this information. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment.

(C) A description of how the Class B pathogen requirements in §503.32(b) are met.

(D) When one of the vector attraction reduction requirements in §503.33 (b)(1) through (b)(8) is met, a description of how the vector attraction reduction requirement is met.

(ii) The person who applies the bulk sewage sludge shall develop the following information and shall retain the information for five years.

(A) The following certification statement:

I certify, under penalty of law, that the information that will be used to determine compliance with the management practices in §503.14, the site restrictions in §503.32(b)(5), and the vector attraction reduction requirement in (insert either §503.33(b)(9) or (b)(10) if one of those requirements is met) was prepared for each site on which bulk sewage sludge is applied under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate this information. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment.

(B) A description of how the management practices in §503.14 are met for each site on which bulk sewage sludge is applied.

(C) A description of how the site restrictions in §503.32(b)(5) are met for each site on which bulk sewage sludge is applied.

(D) When the vector attraction reduction requirement in either §503.33 (b)(9) or (b)(10) is met, a description of how the vector attraction reduction requirement is met.

(E) The date bulk sewage sludge is applied to each site.

(5) If the requirements in §503.13(a)(2)(i) are met when bulk sewage sludge is applied to agricultural land, forest, a public contact site, or a reclamation site:

(i) The person who prepares the bulk sewage sludge shall develop the following information and shall retain the information for five years.

(A) The concentration of each pollutant listed in Table 1 of §503.13 in the bulk sewage sludge.

(B) The following certification statement:

I certify, under penalty of law, that the information that will be used to determine compliance with the pathogen requirements in (insert either §503.32(a) or §503.32(b)) and the vector attraction reduction requirement in (insert one of the vector attraction reduction requirements in §503.33(b)(1) through (b)(8) if one of those requirements is met) was prepared under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate this information. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment.

(C) A description of how the pathogen requirements in either §503.32 (a) or (b) are met.

(D) When one of the vector attraction requirements in §503.33 (b)(1) through (b)(8) is met, a description of how the vector attraction requirement is met.

(ii) The person who applies the bulk sewage sludge shall develop the following information, retain the information in §503.17 (a)(5)(ii)(A) through (a)(5)(ii)(G) indefinitely, and retain the information in §503.17 (a)(5)(ii)(H) through (a)(5)(ii)(M) for five years.

(A) The location, by either street address or latitude and longitude, of each site on which bulk sewage sludge is applied.

(B) The number of hectares in each site on which bulk sewage sludge is applied.

(C) The date bulk sewage sludge is applied to each site.

(D) The cumulative amount of each pollutant (*i.e.* , kilograms) listed in Table 2 of §503.13 in the bulk sewage sludge applied to each site, including the amount in §503.12(e)(2)(iii).

(E) The amount of sewage sludge (*i.e.* , metric tons) applied to each site.

(F) The following certification statement:

I certify, under penalty of law, that the information that will be used to determine compliance with the requirement to obtain information in §503.12(e)(2) was prepared for each site on which bulk sewage sludge was applied under my direction and supervision in accordance

with the system designed to ensure that qualified personnel properly gather and evaluate this information. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment.

(G) A description of how the requirements to obtain information in §503.12(e)(2) are met.

(H) The following certification statement:

I certify, under penalty of law, that the information that will be used to determine compliance with the management practices in §503.14 was prepared for each site on which bulk sewage sludge was applied under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate this information. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment.

(I) A description of how the management practices in §503.14 are met for each site on which bulk sewage sludge is applied.

(J) The following certification statement when the bulk sewage sludge meets the Class B pathogen requirements in §503.32(b):

I certify, under penalty of law, that the information that will be used to determine compliance with the site restrictions in §503.32(b)(5) for each site on which Class B sewage sludge was applied was prepared under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate this information. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment.

(K) A description of how the site restrictions in §503.32(b)(5) are met for each site on which Class B bulk sewage sludge is applied.

(L) The following certification statement when the vector attraction reduction requirement in either §503.33(b)(9) or (b)(10) is met:

I certify, under penalty of law, that the information that will be used to determine compliance with the vector attraction reduction requirement in (insert either §503.33(b)(9) or §503.33(b)(10)) was prepared under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate this information. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment.

(M) If the vector attraction reduction requirements in either §503.33 (b)(9) or (b)(10) are met, a description of how the requirements are met.

(6) If the requirements in §503.13(a)(4)(ii) are met when sewage sludge is sold or given away in a bag or other container for application to the land, the person who prepares the sewage sludge that is sold or given away in a bag or other container shall develop the following information and shall retain the information for five years:

(i) The annual whole sludge application rate for the sewage sludge that does not cause the annual pollutant loading rates in Table 4 of §503.13 to be exceeded.

(ii) The concentration of each pollutant listed in Table 4 of §503.13 in the sewage sludge.

(iii) The following certification statement:

I certify, under penalty of law, that the information that will be used to determine compliance with the management practice in §503.14(e), the Class A pathogen requirement in §503.32(a), and the vector attraction reduction requirement in (insert one of the vector attraction reduction requirements in §503.33(b)(1) through §503.33(b)(8)) was prepared under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate this information. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment.

(iv) A description of how the Class A pathogen requirements in §503.32(a) are met.

(v) A description of how one of the vector attraction requirements in §503.33 (b)(1) through (b)(8) is met.

(b) *Domestic septage.* When domestic septage is applied to agricultural land, forest, or a reclamation site, the person who applies the domestic septage shall develop the following information and shall retain the information for five years:

(1) The location, by either street address or latitude and longitude, of each site on which domestic septage is applied.

(2) The number of acres in each site on which domestic septage is applied.

(3) The date domestic septage is applied to each site.

(4) The nitrogen requirement for the crop or vegetation grown on each site during a 365 day period.

(5) The rate, in gallons per acre per 365 day period, at which domestic septage is applied to each site.

(6) The following certification statement:

I certify, under penalty of law, that the information that will be used to determine compliance with the pathogen requirements (insert either §503.32(c)(1) or §503.32(c)(2)) and the vector attraction reduction requirement in [insert §503.33(b)(9), 503.33(b)(10), or §503.33(b)(12)] was prepared under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate this information. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment.

(7) A description of how the pathogen requirements in either §503.32(c)(1) or (c)(2) are met.

(8) A description of how the vector attraction reduction requirements in §503.33 (b)(9), (b)(10), or (b)(12) are met.

(Approved by the Office of Management and Budget under control number 2040–0157)

[58 FR 9387, Feb. 19, 1993, as amended at 64 FR 42569, Aug. 4, 1999]

§ 503.18 Reporting.

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(a) Class I sludge management facilities, POTWs (as defined in 40 CFR 501.2) with a design flow rate equal to or greater than one million gallons per day, and POTWs that serve 10,000 people or more shall submit the following information to the permitting authority:

(1) The information in §503.17(a), except the information in §503.17 (a)(3)(ii), (a)(4)(ii) and in (a)(5)(ii), for the appropriate requirements on February 19 of each year.

(2) The information in §503.17(a)(5)(ii)(A) through (a)(5)(ii)(G) on February 19th of each year when 90 percent or more of any of the cumulative pollutant loading rates in Table 2 of §503.13 is reached at a land application site.

(Approved by the Office of Management and Budget under control number 2040–0157)

[58 FR 9387, Feb. 19, 1993, as amended at 64 FR 42570, Aug. 4, 1999]

Subpart C—Surface Disposal

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§ 503.20 Applicability.

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(a) This subpart applies to any person who prepares sewage sludge that is placed on a surface disposal site, to the owner/operator of a surface disposal site, to sewage sludge placed on a surface disposal site, and to a surface disposal site.

(b) This subpart does not apply to sewage sludge stored on the land or to the land on which sewage sludge is stored. It also does not apply to sewage sludge that remains on the land for longer than two years when the person who prepares the sewage sludge demonstrates that the land on which the sewage sludge remains is not an active sewage sludge unit. The demonstration shall include the following information, which shall be retained by the person who prepares the sewage sludge for the period that the sewage sludge remains on the land:

(1) The name and address of the person who prepares the sewage sludge.

(2) The name and address of the person who either owns the land or leases the land.

(3) The location, by either street address or latitude and longitude, of the land.

(4) An explanation of why sewage sludge needs to remain on the land for longer than two years prior to final use or disposal.

(5) The approximate time period when the sewage sludge will be used or disposed.

(c) This subpart does not apply to sewage sludge treated on the land or to the land on which sewage sludge is treated.

§ 503.21 Special definitions.

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(a) *Active sewage sludge unit* is a sewage sludge unit that has not closed.

(b) *Aquifer* is a geologic formation, group of geologic formations, or a portion of a geologic formation capable of yielding ground water to wells or springs.

(c) *Contaminate an aquifer* means to introduce a substance that causes the maximum contaminant level for nitrate in 40 CFR 141.62(b) to be exceeded in the ground water or that causes the existing concentration of nitrate in ground water to increase when the existing concentration of nitrate in the ground water exceeds the maximum contaminant level for nitrate in 40 CFR 141.62(b).

(d) *Cover* is soil or other material used to cover sewage sludge placed on an active sewage sludge unit.

(e) *Displacement* is the relative movement of any two sides of a fault measured in any direction.

(f) *Fault* is a fracture or zone of fractures in any materials along which strata on one side are displaced with respect to strata on the other side.

(g) *Final cover* is the last layer of soil or other material placed on a sewage sludge unit at closure.

(h) *Holocene time* is the most recent epoch of the Quaternary period, extending from the end of the Pleistocene epoch to the present.

(i) *Leachate collection system* is a system or device installed immediately above a liner that is designed, constructed, maintained, and operated to collect and remove leachate from a sewage sludge unit.

(j) *Liner* is soil or synthetic material that has a hydraulic conductivity of 1×10^{-7}centimeters per second or less.

(k) *Lower explosive limit for methane gas* is the lowest percentage of methane gas in air, by volume, that propagates a flame at 25 degrees Celsius and atmospheric pressure.

(l) *Qualified ground-water scientist* is an individual with a baccalaureate or post-graduate degree in the natural sciences or engineering who has sufficient training and experience in ground-water hydrology and related fields, as may be demonstrated by State registration, professional certification, or completion of accredited university programs, to make sound professional judgments regarding ground-water monitoring, pollutant fate and transport, and corrective action.

(m) *Seismic impact zone* is an area that has a 10 percent or greater probability that the horizontal ground level acceleration of the rock in the area exceeds 0.10 gravity once in 250 years.

(n) *Sewage sludge unit* is land on which only sewage sludge is placed for final disposal. This does not include land on which sewage sludge is either stored or treated. Land does not include waters of the United States, as defined in 40 CFR 122.2.

(o) *Sewage sludge unit boundary* is the outermost perimeter of an active sewage sludge unit.

(p) *Surface disposal site* is an area of land that contains one or more active sewage sludge units.

(q) *Unstable area* is land subject to natural or human-induced forces that may damage the structural components of an active sewage sludge unit. This includes, but is not limited to, land on which the soils are subject to mass movement.

[58 FR 9387, Feb. 19, 1993, as amended at 64 FR 42570, Aug. 4, 1999]

§ 503.22 General requirements.

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(a) No person shall place sewage sludge on an active sewage sludge unit unless the requirements in this subpart are met.

(b) An active sewage sludge unit located within 60 meters of a fault that has displacement in Holocene time; located in an unstable area; or located in a wetland, except as provided in a permit issued pursuant to either section 402 or 404 of the CWA, shall close by March 22, 1994, unless, in the case of an active sewage sludge unit located within 60 meters of a fault that has displacement in Holocene time, otherwise specified by the permitting authority.

(c) The owner/operator of an active sewage sludge unit shall submit a written closure and post closure plan to the permitting authority 180 days prior to the date that the active sewage sludge unit closes. The plan shall describe how the sewage sludge unit will be closed and, at a minimum, shall include:

(1) A discussion of how the leachate collection system will be operated and maintained for three years after the sewage sludge unit closes if the sewage sludge unit has a liner and leachate collection system.

(2) A description of the system used to monitor for methane gas in the air in any structures within the surface disposal site and in the air at the property line of the surface disposal site, as required in §503.24(j)(2).

(3) A discussion of how public access to the surface disposal site will be restricted for three years after the last sewage sludge unit in the surface disposal site closes.

(d) The owner of a surface disposal site shall provide written notification to the subsequent owner of the site that sewage sludge was placed on the land.

[58 FR 9387, Feb. 19, 1993, as amended at 64 FR 42570, Aug. 4, 1999]

§ 503.23 Pollutant limits (other than domestic septage).

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(a) Active sewage sludge unit without a liner and leachate collection system.

(1) Except as provided in §503.23 (a)(2) and (b), the concentration of each pollutant listed in Table 1 of §503.23 in sewage sludge placed on an active sewage sludge unit shall not exceed the concentration for the pollutant in Table 1 of §503.23.

Table 1 of §503.23—Pollutant Concentrations—Active Sewage Sludge Unit Without a Liner and Leachate Collection

Pollutant	Concentration (milligrams per kilograms[1])
Arsenic	73
Chromium	600
Nickel	420

[1]Dry weight basis.

(2) Except as provided in §503.23(b), the concentration of each pollutant listed in Table 1 of §503.23 in sewage sludge placed on an active sewage sludge unit whose boundary is less than 150 meters from the property line of the surface disposal site shall not exceed the concentration determined using the following procedure.

(i) The actual distance from the active sewage sludge unit boundary to the property line of the surface disposal site shall be determined.

(ii) The concentration of each pollutant listed in Table 2 of §503.23 in the sewage sludge shall not exceed the concentration in Table 2 of §503.23 that corresponds to the actual distance in §503.23(a)(2)(i).

Table 2 of §503.23—Pollutant Concentrations—Active Sewage Sludge Unit Without a Liner and Leachate Collection System That Has a Unit Boundary to Property Line Distance Less Than 150 Meters

Unit boundary to property line	Pollutant concentration[1]

Distance (meters)	Arsenic (mg/kg)	Chromium (mg/kg)	Nickel (mg/kg)
0 to less than 25	30	200	210
25 to less than 50	34	220	240
50 to less than 75	39	260	270
75 to less than 100	46	300	320
100 to less than 125	53	360	390
125 to less than 150	62	450	420

[1]Dry weight basis.

(b) Active sewage sludge unit without a liner and leachate collection system—site-specific limits.

(1) At the time of permit application, the owner/operator of a surface disposal site may request site-specific pollutant limits in accordance with §503.23(b)(2) for an active sewage sludge unit without a liner and leachate collection system when the existing values for site parameters specified by the permitting authority are different from the values for those parameters used to develop the pollutant limits in Table 1 of §503.23 and when the permitting authority determines that site-specific pollutant limits are appropriate for the active sewage sludge unit.

(2) The concentration of each pollutant listed in Table 1 of §503.23 in sewage sludge placed on an active sewage sludge unit without a liner and leachate collection system shall not exceed either the concentration for the pollutant determined during a site-specific assessment, as specified by the permitting authority, or the existing concentration of the pollutant in the sewage sludge, whichever is lower.

§ 503.24 Management practices.

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(a) Sewage sludge shall not be placed on an active sewage sludge unit if it is likely to adversely affect a threatened or endangered species listed under section 4 of the Endangered Species Act or its designated critical habitat.

(b) An active sewage sludge unit shall not restrict the flow of a base flood.

(c) When a surface disposal site is located in a seismic impact zone, an active sewage sludge unit shall be designed to withstand the maximum recorded horizontal ground level acceleration.

(d) An active sewage sludge unit shall be located 60 meters or more from a fault that has displacement in Holocene time, unless otherwise specified by the permitting authority.

(e) An active sewage sludge unit shall not be located in an unstable area.

(f) An active sewage sludge unit shall not be located in a wetland, except as provided in a permit issued pursuant to section 402 or 404 of the CWA.

(g)(1) Run-off from an active sewage sludge unit shall be collected and shall be disposed in accordance with National Pollutant Discharge Elimination System permit requirements and any other applicable requirements.

(2) The run-off collection system for an active sewage sludge unit shall have the capacity to handle run-off from a 24-hour, 25-year storm event.

(h) The leachate collection system for an active sewage sludge unit that has a liner and leachate collection system shall be operated and maintained during the period the sewage sludge unit is active and for three years after the sewage sludge unit closes.

(i) Leachate from an active sewage sludge unit that has a liner and leachate collection system shall be collected and shall be disposed in accordance with the applicable requirements during the period the sewage sludge unit is active and for three years after the sewage sludge unit closes.

(j)(1) When a cover is placed on an active sewage sludge unit, the concentration of methane gas in air in any structure within the surface disposal site shall not exceed 25 percent of the lower explosive limit for methane gas during the period that the sewage sludge unit is active and the concentration of methane gas in air at the property line of the surface disposal site shall not exceed the lower explosive limit for methane gas during the period that the sewage sludge unit is active.

(2) When a final cover is placed on a sewage sludge unit at closure, the concentration of methane gas in air in any structure within the surface disposal site shall not exceed 25 percent of the lower explosive limit for methane gas for three years after the sewage sludge unit closes and the concentration of methane gas in air at the property line of the surface disposal site shall not exceed the lower explosive limit for methane gas for three years after the sewage sludge unit closes, unless otherwise specified by the permitting authority.

(k) A food crop, a feed crop, or a fiber crop shall not be grown on an active sewage sludge unit, unless the owner/operator of the surface disposal site demonstrates to the permitting authority that through management practices public health and the environment are protected from any reasonably anticipated adverse effects of pollutants in sewage sludge when crops are grown.

(l) Animals shall not be grazed on an active sewage sludge unit, unless the owner/operator of the surface disposal site demonstrates to the permitting authority that through management practices public health and the environment are protected from any reasonably anticipated adverse effects of pollutants in sewage sludge when animals are grazed.

(m) Public access to a surface disposal site shall be restricted for the period that the surface disposal site contains an active sewage sludge unit and for three years after the last active sewage sludge unit in the surface disposal site closes.

(n)(1) Sewage sludge placed on an active sewage sludge unit shall not contaminate an aquifer.

(2) Results of a ground-water monitoring program developed by a qualified ground-water scientist or a certification by a qualified ground-water scientist shall be used to demonstrate that sewage sludge placed on an active sewage sludge unit does not contaminate an aquifer.

§ 503.25 Operational standards—pathogens and vector attraction reduction.

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(a) *Pathogens—sewage sludge (other than domestic septage).* The Class A pathogens requirements in §503.32(a) or one of the Class B pathogen requirements in §503.32 (b)(2) through (b)(4) shall be met when sewage sludge is placed on an active sewage sludge unit, unless the vector attraction reduction requirement in §503.33(b)(11) is met.

(b) *Vector attraction reduction—sewage sludge (other than domestic septage).* One of the vector attraction reduction requirements in §503.33 (b)(1) through (b)(11) shall be met when sewage sludge is placed on an active sewage sludge unit.

(c) *Vector attraction reduction—domestic septage.* One of the vector attraction reduction requirement in §503.33 (b)(9) through (b)(12) shall be met when domestic septage is placed on an active sewage sludge unit.

§ 503.26 Frequency of monitoring.

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(a) *Sewage sludge (other than domestic septage).* (1) The frequency of monitoring for the pollutants in Tables 1 and 2 of §503.23; the pathogen density requirements in §503.32(a) and in §503.32(b)(2); and the vector attraction reduction requirements in §503.33(b)(1) through (b)(4) and §503.33(b)(7) through (b)(8) for sewage sludge placed on an active sewage sludge unit shall be the frequency in Table 1 of §503.26.

Table 1 of §503.26—Frequency of Monitoring—Surface Disposal

Amount of sewage sludge[1] (metric tons per 365 day period)	**Frequency**
Greater than zero but less than 290	Once per year.
Equal to or greater than 290 but less than 1,500	Once per quarter (four times per year).

Equal to or greater than 1,500 but less than 15,000	Once per 60 days (six times per year).
Equal to or greater than 15,000	Once per month (12 times per year).

[1]Amount of sewage sludge placed on an active sewage sludge unit (dry weight basis).

(2) After the sewage sludge has been monitored for two years at the frequency in Table 1 of this section, the permitting authority may reduce the frequency of monitoring for pollutant concentrations and for the pathogen density requirements in §503.32(a)(5)(ii) and (a)(5)(iii).

(b) *Domestic septage.* If the vector attraction reduction requirements in §503.33(b)(12) are met when domestic septage is placed on an active sewage sludge unit, each container of domestic septage shall be monitored for compliance with those requirements.

(c) *Air.* Air in structures within a surface disposal site and at the property line of the surface disposal site shall be monitored continuously for methane gas during the period that the surface disposal site contains an active sewage sludge unit on which the sewage sludge is covered and for three years after a sewage sludge unit closes when a final cover is placed on the sewage sludge.

(Approved by the Office of Management and Budget under control number 2040–0157)

[58 FR 9387, Feb. 19, 1993, as amended at 64 FR 42570, Aug. 4, 1999]

§ 503.27 Recordkeeping.

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(a) When sewage sludge (other than domestic septage) is placed on an active sewage sludge unit:

(1) The person who prepares the sewage sludge shall develop the following information and shall retain the information for five years.

(i) The concentration of each pollutant listed in Table 1 of §503.23 in the sewage sludge when the pollutant concentrations in Table 1 of §503.23 are met.

(ii) The following certification statement:

I certify, under penalty of law, that the information that will be used to determine compliance with the pathogen requirements in (insert §503.32(a), §503.32(b)(2), §503.32(b)(3), or §503.32(b)(4) when one of those requirements is met) and the vector attraction reduction requirement in (insert one of the vector attraction reduction requirements in §503.33 (b)(1) through (b)(8) if one of those requirements is met) was prepared under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate this information. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment.

(iii) A description of how the pathogen requirements in §503.32 (a), (b)(2), (b)(3), or (b)(4) are met when one of those requirements is met.

(iv) A description of how one of the vector attraction reduction requirements in §503.33 (b)(1) through (b)(8) is met when one of those requirements is met.

(2) The owner/operator of the surface disposal site, shall develop the following information and shall retain that information for five years.

(i) The concentration of each pollutant listed in Table 2 of §503.23 in the sewage sludge when the pollutant concentrations in Table 2 of §503.23 are met or when site-specific pollutant limits in §503.23(b) are met.

(ii) The following certification statement:

I certify, under penalty of law, that the information that will be used to determine compliance with the management practices in §503.24 and the vector attraction reduction requirement in (insert one of the requirements in §503.33(b)(9) through §503.33(b)(11) if one of those requirements is met) was prepared under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate this

information. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment.

(iii) A description of how the management practices in §503.24 are met.

(iv) A description of how the vector attraction reduction requirements in §503.33 (b)(9) through (b)(11) are met if one of those requirements is met.

(b) When domestic septage is placed on a surface disposal site:

(1) If the vector attraction reduction requirements in §503.33(b)(12) are met, the person who places the domestic septage on the surface disposal site shall develop the following information and shall retain the information for five years:

(i) The following certification statement:

I certify, under penalty of law, that the information that will be used to determine compliance with the vector attraction reduction requirements in §503.33(b)(12) was prepared under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate this information. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment.

(ii) A description of how the vector attraction reduction requirements in §503.33(b)(12) are met.

(2) The owner/operator of the surface disposal site shall develop the following information and shall retain that information for five years:

(i) The following certification statement:

I certify, under penalty of law, that the information that will be used to determine compliance with the management practices in §503.24 and the vector attraction reduction requirements in (insert §503.33(b)(9) through §503.33(b)(11) if one of those requirements is met) was prepared under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate this information. I am aware that there are significant penalties for false certification including the possibility of fine or imprisonment.

(ii) A description of how the management practices in §503.24 are met.

(iii) A description how the vector attraction reduction requirements in §503.33(b)(9) through §503.33(b)(11) are met if one of those requirements is met.

(Approved by the Office of Management and Budget under control number 2040–0157)

[58 FR 9387, Feb. 19, 1993, as amended at 64 FR 42571, Aug. 4, 1999]

§ 503.28 Reporting.

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Class I sludge management facilities, POTWs (as defined in 40 CFR 501.2) with a design flow rate equal to or greater than one million gallons per day, and POTWs that serve 10,000 people or more shall submit the information in §503.27(a) to the permitting authority on February 19 of each year.

(Approved by the Office of Management and Budget under control number 2040–0157)

Subpart D—Pathogens and Vector Attraction Reduction

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§ 503.30 Scope.

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(a) This subpart contains the requirements for a sewage sludge to be classified either Class A or Class B with respect to pathogens.

(b) This subpart contains the site restrictions for land on which a Class B sewage sludge is applied.

(c) This subpart contains the pathogen requirements for domestic septage applied to agricultural land, forest, or a reclamation site.

(d) This subpart contains alternative vector attraction reduction requirements for sewage sludge that is applied to the land or placed on a surface disposal site.

§ 503.31 Special definitions.

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(a) *Aerobic digestion* is the biochemical decomposition of organic matter in sewage sludge into carbon dioxide and water by microorganisms in the presence of air.

(b) *Anaerobic digestion* is the biochemical decomposition of organic matter in sewage sludge into methane gas and carbon dioxide by microorganisms in the absence of air.

(c) *Density of microorganisms* is the number of microorganisms per unit mass of total solids (dry weight) in the sewage sludge.

(d) *Land with a high potential for public exposure* is land that the public uses frequently. This includes, but is not limited to, a public contact site and a reclamation site located in a populated area (e.g, a construction site located in a city).

(e) *Land with a low potential for public exposure* is land that the public uses infrequently. This includes, but is not limited to, agricultural land, forest, and a reclamation site located in an unpopulated area (e.g., a strip mine located in a rural area).

(f) *Pathogenic organisms* are disease-causing organisms. These include, but are not limited to, certain bacteria, protozoa, viruses, and viable helminth ova.

(g) *pH* means the logarithm of the reciprocal of the hydrogen ion concentration measured at 25 °Centigrade or measured at another temperature and then converted to an equivalent value at 25 °Centigrade.

(h) *Specific oxygen uptake rate (SOUR)* is the mass of oxygen consumed per unit time per unit mass of total solids (dry weight basis) in the sewage sludge.

(i) *Total solids* are the materials in sewage sludge that remain as residue when the sewage sludge is dried at 103 to 105 degrees Celsius.

(j) *Unstabilized solids* are organic materials in sewage sludge that have not been treated in either an aerobic or anaerobic treatment process.

(k) *Vector attraction* is the characteristic of sewage sludge that attracts rodents, flies, mosquitos, or other organisms capable of transporting infectious agents.

(l) *Volatile solids* is the amount of the total solids in sewage sludge lost when the sewage sludge is combusted at 550 degrees Celsius in the presence of excess air.

[58 FR 9387, Feb. 19, 1993, as amended at 64 FR 42571, Aug. 4, 1999]

§ 503.32 Pathogens.

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(a) *Sewage sludge—Class A.* (1) The requirement in §503.32(a)(2) and the requirements in either §503.32(a)(3), (a)(4), (a)(5), (a)(6), (a)(7), or (a)(8) shall be met for a sewage sludge to be classified Class A with respect to pathogens.

(2) The Class A pathogen requirements in §503.32 (a)(3) through (a)(8) shall be met either prior to meeting or at the same time the vector attraction reduction requirements in §503.33, except the vector attraction reduction requirements in §503.33 (b)(6) through (b)(8), are met.

(3) *Class A—Alternative 1.* (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 give 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) The temperature of the sewage sludge that is used or disposed shall be maintained at a specific value for a period of time.

(A) When the percent solids of the sewage sludge is seven percent or higher, the temperature of the sewage sludge shall be 50 degrees Celsius or higher; the time period shall be 20 minutes or longer; and the temperature and time period shall be determined using equation (2), except when small particles of sewage sludge are heated by either warmed gases or an immiscible liquid.

$$D = \frac{131,700,000}{10^{0.1400t}} \qquad Eq.\ (2)$$

Where,

D=time in days.

t=temperature in degrees Celsius.

(B) When the percent solids of the sewage sludge is seven percent or higher and small particles of sewage sludge are heated by either warmed gases or an immiscible liquid, the temperature of the sewage sludge shall be 50 degrees Celsius or higher; the time period shall be 15 seconds or longer; and the temperature and time period shall be determined using equation (2).

(C) When the percent solids of the sewage sludge is less than seven percent and the time period is at least 15 seconds, but less than 30 minutes, the temperature and time period shall be determined using equation (2).

(D) When the percent solids of the sewage sludge is less than seven percent; the temperature of the sewage sludge is 50 degrees Celsius or higher; and the time period is 30 minutes or longer, the temperature and time period shall be determined using equation (3).

$$D = \frac{50,070,000}{10^{0.1400t}} \qquad Eq.\ (3)$$

Where,

D=time in days.

t=temperature in degrees Celsius.

(4) *Class A—Alternative 2.* (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 give 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)(A) The pH of the sewage sludge that is used or disposed shall be raised to above 12 and shall remain above 12 for 72 hours.

(B) The temperature of the sewage sludge shall be above 52 degrees Celsius for 12 hours or longer during the period that the pH of the sewage sludge is above 12.

(C) At the end of the 72 hour period during which the pH of the sewage sludge is above 12, the sewage sludge shall be air dried to achieve a percent solids in the sewage sludge greater than 50 percent.

(5) *Class A—Alternative 3.* (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 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 give 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)(A) The sewage sludge shall be analyzed prior to pathogen treatment to determine whether the sewage sludge contains enteric viruses.

(B) When the density of enteric viruses in the sewage sludge prior to pathogen treatment is less than one Plaque-forming Unit per four grams of total solids (dry weight basis), the sewage sludge is Class A with respect to enteric viruses until the next monitoring episode for the sewage sludge.

(C) When the density of enteric viruses in the sewage sludge prior to pathogen treatment is equal to or greater than one Plaque-forming Unit per four grams of total solids (dry weight basis), the sewage sludge is Class A with respect to enteric viruses when the density of enteric viruses in the sewage sludge after pathogen treatment is less than one Plaque-forming Unit per four grams of total solids (dry weight basis) and when the values or ranges of values for the operating parameters for the pathogen treatment process that produces the sewage sludge that meets the enteric virus density requirement are documented.

(D) After the enteric virus reduction in paragraph (a)(5)(ii)(C) of this section is demonstrated for the pathogen treatment process, the sewage sludge continues to be Class A with respect to enteric viruses when the values for the pathogen treatment process operating parameters are consistent with the values or ranges of values documented in paragraph (a)(5)(ii)(C) of this section.

(iii)(A) The sewage sludge shall be analyzed prior to pathogen treatment to determine whether the sewage sludge contains viable helminth ova.

(B) When the density of viable helminth ova in the sewage sludge prior to pathogen treatment is less than one per four grams of total solids (dry weight basis), the sewage sludge is Class A with respect to viable helminth ova until the next monitoring episode for the sewage sludge.

(C) When the density of viable helminth ova in the sewage sludge prior to pathogen treatment is equal to or greater than one per four grams of total solids (dry weight basis), the sewage sludge is Class A with respect to viable helminth ova when the density of viable helminth ova in the sewage sludge after pathogen treatment is less than one per four grams of total solids (dry weight basis) and when the values or ranges of values for the operating parameters for the pathogen treatment process that produces the sewage sludge that meets the viable helminth ova density requirement are documented.

(D) After the viable helminth ova reduction in paragraph (a)(5)(iii)(C) of this section is demonstrated for the pathogen treatment process, the sewage sludge continues to be Class A with respect to viable helminth ova when the values for the pathogen treatment process operating parameters are consistent with the values or ranges of values documented in paragraph (a)(5)(iii)(C) of this section.

(6) *Class A—Alternative 4.* (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 give 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) The density of enteric viruses in the sewage sludge shall be less than one Plaque-forming Unit 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 give 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), unless otherwise specified by the permitting authority.

(iii) The density of viable helminth ova in the sewage sludge shall be less than one 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 give 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), unless otherwise specified by the permitting authority.

(7) *Class A—Alternative 5.* (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 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 representative samples of the sewage sludge that is used or disposed shall be collected.

(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 grazed 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.

[58 FR 9387, Feb. 19, 1993, as amended at 64 FR 42571, Aug. 4, 1999]

§ 503.33 Vector attraction reduction.

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(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 septage) is placed on an active sewage sludge unit.

(5) One of the vector attraction reduction requirements in §503.33 (b)(9), (b)(10), or (b)(12) shall be met when domestic septage is applied to agricultural land, forest, or a reclamation site and one of the vector attraction reduction requirements in §503.33 (b)(9) through (b)(12) shall be met when domestic septage is placed on an active sewage sludge unit.

(b)(1) The mass of volatile solids in the sewage sludge shall be reduced by a minimum of 38 percent (see calculation procedures in “Environmental Regulations and Technology—Control of Pathogens and Vector Attraction in Sewage Sludge”, EPA–625/R–92/013, 1992, U.S. Environmental Protection Agency, Cincinnati, Ohio 45268).

(2) When the 38 percent volatile solids reduction requirement in §503.33(b)(1) cannot be met for an anaerobically digested sewage sludge, vector attraction reduction can be demonstrated by digesting a portion of the previously digested sewage sludge anaerobically in the laboratory in a bench-scale unit for 40 additional days at a temperature between 30 and 37 degrees Celsius. When at the end of the 40 days, the volatile solids in the sewage sludge at the beginning of that period is reduced by less than 17 percent, vector attraction reduction is achieved.

(3) When the 38 percent volatile solids reduction requirement in §503.33(b)(1) cannot be met for an aerobically digested sewage sludge, vector attraction reduction can be demonstrated by digesting a portion of the previously digested sewage sludge that has a percent solids of two percent or less aerobically in the laboratory in a bench-scale unit for 30 additional days at 20 degrees Celsius. When at the end of the 30 days, the volatile solids in the sewage sludge at the beginning of that period is reduced by less than 15 percent, vector attraction reduction is achieved.

(4) The specific oxygen uptake rate (SOUR) for sewage sludge treated in an aerobic process shall be equal to or less than 1.5 milligrams of oxygen per hour per gram of total solids (dry weight basis) at a temperature of 20 degrees Celsius.

(5) Sewage sludge shall be treated in an aerobic process for 14 days or longer. During that time, the temperature of the sewage sludge shall be higher than 40 degrees Celsius and the average temperature of the sewage sludge shall be higher than 45 degrees Celsius.

(6) The pH of sewage sludge shall be raised to 12 or higher by alkali addition and, without the addition of more alkali, shall remain at 12 or higher for two hours and then at 11.5 or higher for an additional 22 hours.

(7) The percent solids of sewage sludge that does not contain unstabilized solids generated in a primary wastewater treatment process shall be equal to or greater than 75 percent based on the moisture content and total solids prior to mixing with other materials.

(8) The percent solids of sewage sludge that contains unstabilized solids generated in a primary wastewater treatment process shall be equal to or greater than 90 percent based on the moisture content and total solids prior to mixing with other materials.

(9)(i) Sewage sludge shall be injected below the surface of the land.

(ii) No significant amount of the sewage sludge shall be present on the land surface within one hour after the sewage sludge is injected.

(iii) When the sewage sludge that is injected below the surface of the land is Class A with respect to pathogens, the sewage sludge shall be injected below the land surface within eight hours after being discharged from the pathogen treatment process.

(10)(i) Sewage sludge applied to the land surface or placed on an active sewage sludge unit shall be incorporated into the soil within six hours after application to or placement on the land, unless otherwise specified by the permitting authority.

(ii) When sewage sludge that is incorporated into the soil is Class A with respect to pathogens, the sewage sludge shall be applied to or placed on the land within eight hours after being discharged from the pathogen treatment process.

(11) Sewage sludge placed on an active sewage sludge unit shall be covered with soil or other material at the end of each operating day.

(12) The pH of domestic septage 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.

[58 FR 9387, Feb. 19, 1993, as amended at 64 FR 42571, Aug. 4, 1999]

Subpart E—Incineration

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§ 503.40 Applicability.

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(a) This subpart applies to a person who fires sewage sludge in a sewage sludge incinerator, to a sewage sludge incinerator, and to sewage sludge fired in a sewage sludge incinerator.

(b) This subpart applies to the exit gas from a sewage sludge incinerator stack.

(c) The management practice in §503.45(a), the frequency of monitoring requirement for total hydrocarbon concentration in §503.46(b) and the recordkeeping requirements for total hydrocarbon concentration in §503.47(c) and (n) do not apply if the following conditions are met:

(1) The exit gas from a sewage sludge incinerator stack is monitored continuously for carbon monoxide.

(2) The monthly average concentration of carbon monoxide in the exit gas from a sewage sludge incinerator stack, corrected for zero percent moisture and to seven percent oxygen, does not exceed 100 parts per million on a volumetric basis.

(3) The person who fires sewage sludge in a sewage sludge incinerator retains the following information for five years:

(i) The carbon monoxide concentrations in the exit gas; and

(ii) A calibration and maintenance log for the instrument used to measure the carbon monoxide concentration.

(4) Class I sludge management facilities, POTWs (as defined in 40 CFR 501.2) with a design flow rate equal to or greater than one million gallons per day, and POTWs that serve a population of 10,000 people or greater submit the monthly average carbon monoxide concentrations in the exit gas to the permitting authority on February 19 of each year.

[58 FR 9387, Feb. 19, 1993, as amended at 59 FR 9099, Feb. 25, 1994]

§ 503.41 Special definitions.

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(a) *Air pollution control device* is one or more processes used to treat the exit gas from a sewage sludge incinerator stack.

(b) *Auxiliary fuel* is fuel used to augment the fuel value of sewage sludge. This includes, but is not limited to, natural gas, fuel oil, coal, gas generated during anaerobic digestion of sewage sludge, and municipal solid waste (not to exceed 30 percent of the dry weight of sewage sludge and auxiliary fuel together). Hazardous wastes are not auxiliary fuel.

(c) *Average daily concentration* is the arithmetic mean of the concentration of a pollutant in milligrams per kilogram of sewage sludge (dry weight basis) in the samples collected and analyzed in a month.

(d) *Control efficiency* is the mass of a pollutant in the sewage sludge fed to an incinerator minus the mass of that pollutant in the exit gas from the incinerator stack divided by the mass of the pollutant in the sewage sludge fed to the incinerator.

(e) *Dispersion factor* is the ratio of the increase in the ground level ambient air concentration for a pollutant at or beyond the property line of

the site where the sewage sludge incinerator is located to the mass emission rate for the pollutant from the incinerator stack.

(f) *Fluidized bed incinerator* is an enclosed device in which organic matter and inorganic matter in sewage sludge are combusted in a bed of particles suspended in the combustion chamber gas.

(g) *Hourly average* is the arithmetic mean of all measurements, taken during an hour. At least two measurements must be taken during the hour.

(h) *Incineration* is the combustion of organic matter and inorganic matter in sewage sludge by high temperatures in an enclosed device.

(i) *Incinerator operating combustion temperature* is the arithmetic mean of the temperature readings in the hottest zone of the furnace recorded in a day (24 hours) when the temperature is averaged and recorded at least hourly during the hours the incinerator operates in a day.

(j) *Monthly average* is the arithmetic mean of the hourly averages for the hours a sewage sludge incinerator operates during the month.

(k) *Performance test combustion temperature* is the arithmetic mean of the average combustion temperature in the hottest zone of the furnace for each of the runs in a performance test.

(l) *Risk specific concentration* is the allowable increase in the average daily ground level ambient air concentration for a pollutant from the incineration of sewage sludge at or beyond the property line of the site where the sewage sludge incinerator is located.

(m) *Sewage sludge feed rate* is either the average daily amount of sewage sludge fired in all sewage sludge incinerators within the property line of the site where the sewage sludge incinerators are located for the number of days in a 365 day period that each sewage sludge incinerator operates, or the average daily design capacity for all sewage sludge incinerators within the property line of the site where the sewage sludge incinerators are located.

(n) *Sewage sludge incinerator* is an enclosed device in which only sewage sludge and auxiliary fuel are fired.

(o) *Stack height* is the difference between the elevation of the top of a sewage sludge incinerator stack and the elevation of the ground at the base of the stack when the difference is equal to or less than 65 meters. When the difference is greater than 65 meters, stack height is the creditable stack height determined in accordance with 40 CFR 51.100 (ii).

(p) *Total hydrocarbons* means the organic compounds in the exit gas from a sewage sludge incinerator stack measured using a flame ionization detection instrument referenced to propane.

(q) *Wet electrostatic precipitator* is an air pollution control device that uses both electrical forces and water to remove pollutants in the exit gas from a sewage sludge incinerator stack.

(r) *Wet scrubber* is an air pollution control device that uses water to remove pollutants in the exit gas from a sewage sludge incinerator stack.

[58 FR 9387, Feb. 19, 1993, as amended at 64 FR 42571, Aug. 4, 1999]

§ 503.42 General requirements.

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No person shall fire sewage sludge in a sewage sludge incinerator except in compliance with the requirements in this subpart.

§ 503.43 Pollutant limits.

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(a) Firing of sewage sludge in a sewage sludge incinerator shall not violate the requirements in the National Emission Standard for Beryllium in subpart C of 40 CFR part 61.

(b) Firing of sewage sludge in a sewage sludge incinerator shall not violate the requirements in the National Emission Standard for Mercury in subpart E of 40 CFR part 61.

(c) *Pollutant limit—lead.* (1) The average daily concentration for lead in sewage sludge fed to a sewage sludge incinerator shall not exceed the concentration calculated using Equation (4).

$$C = \frac{0.1 \times NAAQS \times 86,400}{DF \times (1 - CE) \times SF} \qquad \text{Eq. (4)}$$

Where:

C = Average daily concentration of lead in sewage sludge.

NAAQS = National Ambient Air Quality Standard for lead in micrograms per cubic meter.

DF = Dispersion factor in micrograms per cubic meter per gram per second.

CE = Sewage sludge incinerator control efficiency for lead in hundredths.

SF = Sewage sludge feed rate in metric tons per day (dry weight basis).

(2) The dispersion factor (DF) in equation (4) shall be determined from an air dispersion model in accordance with §503.43(e).

(i) When the sewage sludge stack height is 65 meters or less, the actual sewage sludge incinerator stack height shall be used in the air dispersion model to determine the dispersion factor (DF) for equation (4).

(ii) When the sewage sludge incinerator stack height exceeds 65 meters, the creditable stack height shall be determined in accordance with 40 CFR 51.100(ii) and the creditable stack height shall be used in the air dispersion model to determine the dispersion factor (DF) for equation (4).

(3) The control efficiency (CE) for equation (4) shall be determined from a performance test of the sewage sludge incinerator in accordance with §503.43(e).

(d) *Pollutant limit—arsenic, cadmium, chromium, and nickel.* (1) The average daily concentration for arsenic, cadmium, chromium, and nickel in sewage sludge fed to a sewage sludge incinerator each shall not exceed the concentration calculated using equation (5).

$$C = \frac{RSC \times 86,400}{DF \times (1 - CE) \times SF} \qquad \text{Eq. (5)}$$

Where:

C = Average daily concentration of arsenic, cadmium, chromium, or nickel in sewage sludge.

CE = Sewage sludge incinerator control efficiency for arsenic, cadmium, chromium, or nickel in hundredths.

DF = Dispersion factor in micrograms per cubic meter per gram per second.

RSC = Risk specific concentration for arsenic, cadmium, chromium, or nickel in micrograms per cubic meter.

SF = Sewage sludge feed rate in metric tons per day (dry weight basis).

(2) The risk specific concentrations for arsenic, cadmium, and nickel used in equation (5) shall be obtained from Table 1 of §503.43.

Table 1 of §503.43—Risk Specific Concentration for Arsenic, Cadmium, and Nickel

Pollutant	Risk specific concentration (micrograms per cubic meter)
Arsenic	0.023
Cadmium	0.057

Nickel	2.0

(3) The risk specific concentration for chromium used in equation (5) shall be obtained from Table 2 of §503.43 or shall be calculated using equation (6).

Table 2 of §503.43—Risk Specific Concentration For Chromium

Type of Incinerator	Risk specific concentration (micrograms per cubic meter)
Fluidized bed with wet scrubber	0.65
Fluidized bed with wet scrubber and wet electrostatic precipitator	0.23
Other types with wet scrubber	0.064
Other types with wet scrubber and wet electrostatic precipitator	0.016

$$RSC = \frac{0.0085}{r} \qquad \text{Eq. (6)}$$

Where:

RSC=risk specific concentration for chromium in micrograms per cubic meter used in equation (5).

r=decimal fraction of the hexavalent chromium concentration in the total chromium concentration measured in the exit gas from the sewage sludge incinerator stack in hundredths.

(4) The dispersion factor (DF) in equation (5) shall be determined from an air dispersion model in accordance with §503.43(e).

(i) When the sewage sludge incinerator stack height is equal to or less than 65 meters, the actual sewage sludge incinerator stack height shall be used in the air dispersion model to determine the dispersion factor (DF) for equation (5).

(ii) When the sewage sludge incinerator stack height is greater than 65 meters, the creditable stack height shall be determined in accordance with 40 CFR 51.100(ii) and the creditable stack height shall be used in the air dispersion model to determine the dispersion factor (DF) for equation (5).

(5) The control efficiency (CE) for equation (5) shall be determined from a performance test of the sewage sludge incinerator in accordance with §503.43(e).

(e) *Air dispersion modeling and performance testing.* (1) The air dispersion model used to determine the dispersion factor in §503.43 (c)(2) and (d)(4) shall be appropriate for the geographical, physical, and population characteristics at the sewage sludge incinerator site. The performance test used to determine the control efficiencies in §503.43 (c)(3) and (d)(5) shall be appropriate for the type of sewage sludge incinerator.

(2) For air dispersion modeling initiated after September 3, 1999, the modeling results shall be submitted to the permitting authority 30 days after completion of the modeling. In addition to the modeling results, the submission shall include a description of the air dispersion model and the values used for the model parameters.

(3) The following procedures, at a minimum, shall apply in conducting performance tests to determine the control efficiencies in §503.43(c)(3) and (d)(5) after September 3, 1999:

(i) The performance test shall be conducted under representative sewage sludge incinerator conditions at the highest expected sewage sludge feed rate within the design capacity of the sewage sludge incinerator.

(ii) The permitting authority shall be notified at least 30 days prior to any performance test so the permitting authority may have the opportunity to observe the test. The notice shall include a test protocol with incinerator operating conditions and a list of test methods to be used.

(iii) Each performance test shall consist of three separate runs using the applicable test method. The control efficiency for a pollutant shall be the arithmetic mean of the control efficiencies for the pollutant from the three runs.

(4) The pollutant limits in §503.43 (c) and (d) of this section shall be submitted to the permitting authority no later than 30 days after completion of the air dispersion modeling and performance test.

(5) Significant changes in geographic or physical characteristics at the incinerator site or in incinerator operating conditions require new air dispersion modeling or performance testing to determine a new dispersion factor or a new control efficiency that will be used to calculate revised pollutant limits.

[58 FR 9387, Feb. 19, 1993, as amended at 64 FR 42572, Aug. 4, 1999]

§ 503.44 Operational standard—total hydrocarbons.

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(a) The total hydrocarbons concentration in the exit gas from a sewage sludge incinerator shall be corrected for zero percent moisture by multiplying the measured total hydrocarbons concentration by the correction factor calculated using equation (7).

$$\text{Correction factor (percent moisture)} = \frac{1}{(1-X)} \qquad Eq.\ (7)$$

Where:

X=decimal fraction of the percent moisture in the sewage sludge incinerator exit gas in hundredths.

(b) The total hydrocarbons concentration in the exit gas from a sewage sludge incinerator shall be corrected to seven percent oxygen by multiplying the measured total hydrocarbons concentration by the correction factor calculated using equation (8).

$$\text{Correction factor (oxygen)} = \frac{14}{(21-Y)} \qquad Eq.\ (8)$$

Where:

Y=Percent oxygen concentration in the sewage sludge incinerator stack exit gas (dry volume/dry volume).

(c) The monthly average concentration for total hydrocarbons in the exit gas from a sewage sludge incinerator stack, corrected for zero percent moisture using the correction factor from equation (7) and to seven percent oxygen using the correction factor from equation (8), shall not exceed 100 parts per million on a volumetric basis when measured using the instrument required by §503.45(a).

§ 503.45 Management practices.

top

(a)(1) An instrument that continuously measures and records the total hydrocarbons concentration in the sewage sludge incinerator stack exit gas shall be installed, calibrated, operated, and maintained for a sewage sludge incinerator.

(2) The total hydrocarbons instrument shall employ a flame ionization detector; shall have a heated sampling line maintained at a temperature of 150 degrees Celsius or higher at all times; and shall be calibrated at least once every 24-hour operating period using propane.

(b) An instrument that continuously measures and records the oxygen concentration in the sewage sludge incinerator stack exit gas shall be installed, calibrated, operated, and maintained for a sewage sludge incinerator.

(c) An instrument that continuously measures and records information used to determine the moisture content in the sewage sludge incinerator stack exit gas shall be installed, calibrated, operated, and maintained for a sewage sludge incinerator.

(d) An instrument that continuously measures and records combustion temperatures shall be installed, calibrated, operated, and maintained for a sewage sludge incinerator.

(e) Operation of a sewage sludge incinerator shall not cause the operating combustion temperature for the sewage sludge incinerator to exceed the performance test combustion temperature by more than 20 percent.

(f) An air pollution control device shall be appropriate for the type of sewage sludge incinerator and the operating parameters for the air pollution control device shall be adequate to indicate proper performance of the air pollution control device. For sewage sludge incinerators subject to the requirements in subpart O of 40 CFR part 60, operation of the air pollution control device shall not violate the requirements for the air pollution control device in subpart O of 40 CFR part 60. For all other sewage sludge incinerators, operation of the air pollution control device shall not cause a significant exceedance of the average value for the air pollution control device operating parameters from the performance test required by §503.43 (c)(3) and (d)(5).

(g) Sewage sludge shall not be fired in a sewage sludge incinerator if it is likely to adversely affect a threatened or endangered species listed under section 4 of the Endangered Species Act or its designated critical habitat.

(h) The instruments required in §503.45(a)–(d) shall be appropriate for the type of sewage sludge incinerator.

[58 FR 9387, Feb. 19, 1993, as amended at 64 FR 42573, Aug. 4, 1999]

§ 503.46 Frequency of monitoring.

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(a) *Sewage sludge.* (1) The frequency of monitoring for beryllium shall be as required in subpart C of 40 CFR part 61, and for mercury as required in subpart E of 40 CFR part 61.

(2) The frequency of monitoring for arsenic, cadmium, chromium, lead, and nickel in sewage sludge fed to a sewage sludge incinerator shall be the frequency in Table 1 of §503.46.

Table 1 of §503.46—Frequency of Monitoring—Incineration

Amount of sewage sludge[1] (metric tons per 365 day period)	Frequency
Greater than zero but less than 290	Once per year.
Equal to or greater than 290 but less than 1,500	Once per quarter (four times per year).
Equal to or greater than 1,500 but less than 15,000	Once per 60 days (six times per year).
Equal to or greater than 15,000	Once per month (12 times per year).

[1]Amount of sewage sludge fired in a sewage sludge incinerator (dry weight basis).

(3) After the sewage sludge has been monitored for two years at the frequency in Table 1 of §503.46, the permitting authority may reduce the frequency of monitoring for arsenic, cadmium, chromium, lead, and nickel.

(b) *Total hydrocarbons, oxygen concentration, information to determine moisture content, and combustion temperatures.* The total hydrocarbons concentration and oxygen concentration in the exit gas from a sewage sludge incinerator stack, the information used to measure moisture content in the exit gas, and the combustion temperatures for the sewage sludge incinerator shall be monitored continuously.

(c) *Air pollution control device operating parameters.* For sewage sludge incinerators subject to the requirements in subpart O of 40 CFR part 60, the frequency of monitoring for the appropriate air pollution control device operating parameters shall be the frequency of monitoring in subpart O of 40 CFR part 60. For all other sewage sludge incinerators, the appropriate air pollution control device operating parameters shall be at least daily.

(Approved by the Office of Management and Budget under control number 2040–0157)

[58 FR 9387, Feb. 19, 1993, as amended at 64 FR 42573, Aug. 4, 1999]

§ 503.47 Recordkeeping.

top

(a) The person who fires sewage sludge in a sewage sludge incinerator shall develop the information in §503.47(b) through §503.47(n) and shall retain that information for five years.

(b) The concentration of lead, arsenic, cadmium, chromium, and nickel in the sewage sludge fed to the sewage sludge incinerator.

(c) The total hydrocarbons concentrations in the exit gas from the sewage sludge incinerator stack.

(d) Information that indicates the requirements in the National Emission Standard for beryllium in subpart C of 40 CFR part 61 are met.

(e) Information that indicates the requirements in the National Emission Standard for mercury in subpart E of 40 CFR part 61 are met.

(f) The operating combustion temperatures for the sewage sludge incinerator.

(g) Values for the air pollution control device operating parameters.

(h) The oxygen concentration and information used to measure moisture content in the exit gas from the sewage sludge incinerator stack.

(i) The sewage sludge feed rate.

(j) The stack height for the sewage sludge incinerator.

(k) The dispersion factor for the site where the sewage sludge incinerator is located.

(l) The control efficiency for lead, arsenic, cadmium, chromium, and nickel for each sewage sludge incinerator.

(m) The risk specific concentration for chromium calculated using equation (6), if applicable.

(n) A calibration and maintenance log for the instruments used to measure the total hydrocarbons concentration and oxygen concentration in the exit gas from the sewage sludge incinerator stack, the information needed to determine moisture content in the exit gas, and the combustion temperatures.

(Approved by the Office of Management and Budget under control number 2040–0157)

[58 FR 9387, Feb. 19, 1993, as amended at 64 FR 42573, Aug. 4, 1999]

§ 503.48 Reporting.

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Class I sludge management facilities, POTWs (as defined in 40 CFR 501.2) with a design flow rate equal to or greater than one million gallons per day, and POTWs that serve a population of 10,000 people or greater shall submit the information in §503.47(b) through §503.47(h) to the permitting authority on February 19 of each year.

(Approved by the Office of Management and Budget under control number 2040–0157)

Appendix A to Part 503—Procedure To Determine the Annual Whole Sludge Application Rate for a Sewage Sludge

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Section 503.13(a)(4)(ii) requires that the product of the concentration for each pollutant listed in Table 4 of §503.13 in sewage sludge sold or given away in a bag or other container for application to the land and the annual whole sludge application rate (AWSAR) for the sewage sludge not cause the annual pollutant loading rate for the pollutant in Table 4 of §503.13 to be exceeded. This appendix contains the

procedure used to determine the AWSAR for a sewage sludge that does not cause the annual pollutant loading rates in Table 4 of §503.13 to be exceeded.

The relationship between the annual pollutant loading rate (APLR) for a pollutant and the annual whole sludge application rate (AWSAR) for 1a sewage sludge is shown in equation (1).

$$APLR = C \times AWSAR \times 0.001 \qquad (1)$$

Where:

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 rearranged into equation (2):

$$AWSAR = \frac{APLR}{C \times 0.001} \qquad (2)$$

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

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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 ^{60} Cobalt and ^{137} Cesium, at dosages of at least 1.0 megarad at room temperature (ca. 20 °Celsius).

7. Pasteurization—The temperature of the sewage sludge is maintained at 70 degrees Celsius or higher for 30 minutes or longer.

[58 FR 9387, Feb. 19, 1993, as amended at 64 FR 42573, Aug. 4, 1999]