

WEST VIRGINIA
SECRETARY OF STATE
KEN HECHLER
ADMINISTRATIVE LAW DIVISION

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OFFICE OF WEST VIRGINIA
SECRETARY OF STATE

**NOTICE OF AGENCY APPROVAL OF A PROPOSED RULE
AND
FILING WITH THE LEGISLATIVE RULE-MAKING REVIEW COMMITTEE**

WV Division of Environmental Protection
AGENCY: Water Resources & Solid Waste Management TITLE NUMBER: 47

CITE AUTHORITY WV Code 22-1-3; 22-1-3a- 22-1A; and 22-15-20(b)

AMENDMENT TO AN EXISTING RULE: YES NO

IF YES, SERIES NUMBER OF RULE BEING AMENDED: 38D

TITLE OF RULE BEING AMENDED: Sewage Sludge Management Rule

IF NO, SERIES NUMBER OF NEW RULE BEING PROPOSED: N/A

TITLE OF RULE BEING PROPOSED: N/A

THE ABOVE PROPOSED LEGISLATIVE RULE HAVING GONE TO A PUBLIC HEARING OR A PUBLIC COMMENT PERIOD IS HEREBY APPROVED BY THE PROMULGATING AGENCY FOR FILING WITH THE SECRETARY OF STATE AND THE LEGISLATIVE RULE MAKING REVIEW COMMITTEE FOR THEIR REVIEW.

Roger T. Hall
Roger T. Hall

27-80



BUREAU OF ENVIRONMENT
10 McJunkin Road
Nitro, WV 25143-2506

GASTON CAPERTON
GOVERNOR

LAIDLEY ELI MCCOY, PH.D.
COMMISSIONER

June 23, 1995

Ms. Judy Cooper
Director, Administrative Law Division
Secretary of State's Office
Building 1, Suite 157K
Charleston, West Virginia 25305

RE: 47 CSR 38D - "Sewage Sludge Management Rule"

Dear Ms. Cooper:

This is to advise you that I am giving approval for the filing of the above-captioned rule as agency approval of a proposed rule and filing with the Legislative Rule-Making Review Committee.

Your cooperation in this regard is very much appreciated. If you have any questions or require additional information, please feel free to contact Roger T. Hall at 759-0515.

Sincerely yours,

A handwritten signature in cursive script, appearing to read "Laidley Eli McCoy".

Laidley Eli McCoy, Ph.D.
Director

LEM;RTH:cc

Attachment

LEGISLATIVE RULE

47 CSR 38D

DIVISION OF ENVIRONMENTAL PROTECTION

WATER RESOURCES AND SOLID WASTE MANAGEMENT

STATEMENT OF CIRCUMSTANCES REQUIRING THE RULE AMENDMENT

Pursuant to West Virginia Code 22-15-20 (b), the Division of Environmental Protection promulgated an emergency rule which governed the land application of sewage sludge. Legislative rule 47 CSR 38D was subsequently filed on May 13, 1994 and became effective on June 1, 1994. Both rules contained maximum allowable soil concentration standards for various metals (arsenic, lead, zinc, etc.). These standards are contained in Table 3 of the existing rule.

Because of the emergency nature of the rule, as declared by the Legislature, there was virtually no time to develop a sound technical and scientific foundation for establishing the soil concentration standards. During the ensuing period of time since promulgating the rule, it has been determined through scientific sampling and analysis that many native soils throughout the state exhibit naturally-occurring levels of metals which exceed the standards established in Table 3.

The results of these determinations are that lands containing these naturally-occurring metals preclude the land application of sewage sludge. This poses a serious health and economic problem for Publicly Owned Treatment Works (POTW's) which are primarily municipal sewage treatment plants. These facilities are forced to either store the sewage sludge on site or dispose of it in permitted landfills. The stored sludge must be composted and carefully monitored by the POTW and poses an ever-present potential for health risks. This is an expansive process for which POTW's are not well trained or prepared to implement. Landfilling is even more expensive because of the mandatory tipping fees. This additional cost will eventually be passed on to the public in the form of higher sewage and water bills.

In view of the inappropriateness of the soil concentration standards and the health and monetary considerations, the Division of Environmental Protection must amend Table 3 to reflect soil concentration levels which are based on sound technical and scientific data. Collection and analysis of such data will require several months. In the interim, the division is compelled to lift the requirements of Table 3 to avert any economic and health risk to the public.

APPENDIX B

FISCAL NOTE FOR PROPOSED RULES

Rule Title: Sewage Sludge Management Rule

Type of Rule: **Legislative** **Interpretive** **Procedural**

Agency Division of Environmental Protection

Address 10 McJunkin Road
Nitro, West Virginia 25143

1. Effect of Proposed Rule

	ANNUAL		FISCAL YEAR		
	INCREASE	DECREASE	CURRENT	NEXT	HEREAFTER
ESTIMATED TOTAL COST	\$ -0-	\$ -0-	\$ -0-	\$ -0-	\$ -0-
PERSONAL SERVICES	-0-	-0-	-0-	-0-	-0-
CURRENT EXPENSE	-0-	-0-	-0-	-0-	-0-
REPAIRS & ALTERNATIONS	-0-	-0-	-0-	-0-	-0-
EQUIPMENT	-0-	-0-	-0-	-0-	-0-
OTHER	-0-	-0-	-0-	-0-	-0-

2. Explanation of above estimates:

The proposed rule will not result in any increase or decrease in cost or revenue to the state.

3. Objectives of these rules:

The proposed rule will in effect amend existing 47CSR38D by making the definition of "Solid Waste" identical to the definition which appears at WV Code 22-15-2(27) and deletes Table 3 (Maximum Allowable Soil Concentrations) and any reference to Table 3 from the existing rule.

Rule Title: Sewage Sludge Management Rule

4. Explanation of Overall Economic Impact of Proposed Rule.

A. Economic Impact on State Government.

None

B. Economic Impact on Political Subdivisions; Specific Industries; Specific groups of Citizens.

The proposed rule will remove an unachievable restriction on the land application of sewage sludge for Publicly Owned Treatment Works (Sewage Treatment Plants); thereby saving these facilities substantial costs of storage or landfilling which would eventually be passed on to the public.

C. Economic Impact on Citizens/Public at Large.

The proposed rule will reduce the cost of sewage sludge disposal to Publicly Owned Treatment Works (Sewage Treatment Plants) which would ultimately be passed on to the public.

Date: March 20, 1995

Signature of Agency Head or Authorized Representative

Roger T. Hall
Roger T. Hall

DATE: June 23, 1995

TO: LEGISLATIVE RULE-MAKING REVIEW COMMITTEE

FROM: WV Division Environmental Protection/Water Resources & Solid Waste Management

LEGISLATIVE RULE TITLE: Sewage Sludge Management Rule

1. Authorizing statute(s) citation WV Code 22-1-3; 22-1-3a; 22-1A;
and 22-15-20(b)

2. a. Date filed in State Register with Notice of Hearing
March 22, 1995

b. What other notice, including advertising, did you give
of the hearing?

Wire Service Bulletin to over 100 news media outlets
statewide

c. Date of Hearing(s) April 14, 1995

d. Attach list of persons who appeared at hearing,
comments received, amendments, reasons for amendments.

Attached No comments received

e. Date you filed in State Register the agency approved
proposed Legislative Rule following public hearing:
(be exact)

June 23, 1995

f. Name and phone number(s) of agency person(s) to
contact for additional information:

Roger T. Hall, Assistant to Director

3. If the statute under which you promulgated the submitted rules requires certain findings and determinations to be made as a condition precedent to their promulgation:

a. Give the date upon which you filed in the State Register a notice of the time and place of a hearing for the taking of evidence and a general description of the issues to be decided.

N/A

b. Date of hearing: N/A

c. On what date did you file in the State Register the findings and determinations required together with the reasons therefor?

N/A

d. Attach findings and determinations and reasons:

Attached N/A

LEGISLATIVE RULE

DIVISION OF ENVIRONMENTAL PROTECTION WATER RESOURCES AND SOLID WASTE MANAGEMENT

SEWAGE SLUDGE MANAGEMENT RULE

47 CSR 38D

SUMMARY

The rule amends existing 47 CSR 38D by making the definition of "Solid Waste" consistent with the definition in West Virginia Code 22-15.

The existing rule is further amended by deleting Table 3 (Maximum Allowable Soil Concentrations) and any references to Table 3. The subject table sets standards which are more restrictive than natural concentrations in native soils, which in effect precludes the land application of sewage sludge for Publicly Owned Treatment Works (Sewage Treatment Plants). The standards were set without the benefit of adequate technical and scientific foundation, and were not intended by the Code and the existing rule to prohibit land application practices.

A number of "clean up" amendments are also made by the rule.

FILED

TITLE 47
LEGISLATIVE RULES
DIVISION OF ENVIRONMENTAL PROTECTION
WATER RESOURCES AND SOLID WASTE MANAGEMENT

JUN 22 3 09 PM '95

OFFICE OF WEST VIRGINIA
SECRETARY OF STATE

SERIES 38D
SEWAGE SLUDGE MANAGEMENT RULE

§47-38D-1. GENERAL.

1.1. Scope and Purpose. -- This legislative rule establishes requirements for the permitting siting, bonding, installation, establishment, construction, modification, and operation of any facility that generates, processes, recycles and/or disposes of sewage sludge by whatever means, including, but not limited to, land application, composting, incineration, mixed waste composting, or any other method of handling sewage sludge within the state. This rule applies to any person who owns or operates a sewage sludge facility or who is responsible for the processing or disposal of sewage sludge.

1.2. Authority. -- W. Va. Code ~~§20-5F-2b(b)~~ §22-1-3, §22-1-3a, 22-1A, and §22-15-20(b)

1.3. Filing Date. -- ~~May 13, 1994.~~

1.4. Effective Date. -- ~~June 1, 1994.~~

1.5. Incorporation by Reference. -- Whenever federal or state statutes or regulations are incorporated into this rule by reference, the reference is to the statute or regulation in effect on the effective date of this rule.

§47-38D-2. DEFINITIONS.

The following definitions shall apply to this rule unless otherwise specified herein:

2.1. "Agronomic rate" means the whole sewage sludge application rate, by dry weight, designed: (1) To provide the amount of nitrogen needed by the food crop, feed crop, fiber crop, cover crop or vegetation on the land; and (2) To minimize the amount of nitrogen in sewage sludge that passes below the root zone of the crop or vegetation grown on the land to the ground water.

2.2. "Applicant" means the person applying for a commercial solid waste facility permit or similar renewal permit and any person related to such person by virtue of common ownership, common management or family relationships as the Director of the Division may specify, including the following: spouses, parents, children and siblings.

2.3. "Approved solid waste facility" means a solid waste facility or practice which has a valid permit under W. Va. Code ~~§20-5F~~ §22-15.

2.4. "Backhauling" means the practice of using the same container to transport solid waste and to transport any substance or material used as food by humans, animals raised for human consumption or reusable item which may be refilled with any substance or material used as food by humans.

2.5. "Bulking Agent" means materials such as yard waste, wood chips, leaves and other living or dead plant tissues approved by the Chief as suitable to promote the passage of air through a static pile or windrow.

2.6. "Chief" means the Chief of the Office of Waste Management of the Division.

2.7. "Commercial recycler" means any person, corporation or business entity whose operation involves the mechanical separation of materials for the purpose of reselling or recycling at least seventy percent (70%) by weight of the materials coming into the commercial recycling facility.

2.8. "Commercial solid waste facility" means any solid waste facility which accepts solid waste generated by sources other than the owner or operator of the facility and shall not include an approved solid waste facility owned and operated by a person for the sole purpose of disposing of solid wastes created by that person or such person and other persons on a cost-sharing or nonprofit basis and shall not include land upon which reused or recycled materials are legitimately applied for structural fill, road base, mine reclamation and similar applications.

2.9. "Composting" means the aerobic, thermophilic decomposition of natural constituents of solid waste to produce a stable, humus-like material.

2.10. "Composting facility" means any solid waste facility processing solid waste by composting, including sludge composting, organic waste or yard waste composting, but does not include a facility for composting solid waste that is located at the site where the waste was generated.

2.11. "Curing area" means an area where organic material that has undergone the rapid initial stage of decomposition is further stabilized into a humus-like material.

2.12. "Director" means the Director of the Division.

2.13. "Distributor" is a person who prepares the product for distribution and marketing and is responsible for distributing and marketing the product.

2.14. "Division" means the Division of Environmental Protection.

2.15. "Domestic septage" means either liquid or solid material (septage) 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.

2.16. "Energy recovery incinerator" means any solid waste facility at which solid waste is incinerated with the intention of using the resulting energy for the generation of steam, electricity or any other use not specified herein.

2.17. "Importer" means any person receiving sewage sludge from any source whatsoever for the purpose of processing.

2.18. "Incineration technologies" means any technology that uses controlled flame combustion to thermally break down solid waste, including refuse-derived fuel, to an ash residue that contains little or no combustible materials, regardless of whether the purpose is

processing, disposal, electric or steam generation or any other method by which solid waste is incinerated.

2.19. "Incinerator" means an enclosed device using controlled flame combustion to thermally break down solid waste, including refuse-derived fuel, to an ash residue that contains little or no combustible materials.

2.20. "Landfill" means any solid waste facility for the disposal of solid waste on land. Such facility is situated, for purposes of W. Va. Code ~~§20-5F~~ §22-15, in the county where the majority of the spatial area of such facility is located.

2.21. "Materials recovery facility" means any solid waste facility at which source-separated materials or materials recovered through a mixed waste processing facility are manually or mechanically shredded or separated for purposes of reuse and recycling, but does not include a composting facility.

2.22. "Mixed solid waste" means solid waste from which materials sought to be reused or recycled have not been source-separated from general solid waste.

2.23. "Mixed waste processing facility" means any solid waste facility at which materials are recovered from mixed solid waste through manual or mechanical means for purposes of reuse, recycling or composting.

2.24. "Municipal solid waste incineration" means the burning of any solid waste collected by any municipal or residential solid waste disposal company.

2.25. "Open dump" means any solid waste disposal which does not have a permit under W. Va. Code ~~§20-5F~~ §22-15, or is in violation of state law, or where solid waste is disposed in a manner that does not protect the environment.

2.26. "Person" or "persons" mean any industrial user, public or private corporation, institution, association, firm or company organized or existing under the laws of this or any other state or country; state of West Virginia; governmental agency, including federal facilities; political subdivision; county commission; municipal corporation; industry; sanitary district; public service district; drainage district; soil conservation district; watershed improvement district; partnership trust; estate; person or individual; group of persons or individuals acting individually or as a group; or any legal entity whatever.

2.27. "Producer" means any person producing sewage sludge at a publicly owned treatment works (POTW).

2.28. "Publicly owned treatment works" or "POTW" means any device or system used in the conveyance and/or treatment (including recycling and reclamation) of municipal sewage or industrial waste of a liquid nature which is owned by a state or municipality as defined by section 502 (4) of the Clean Water Act, any other treatment works treating domestic sewage (TWTDS), or wastewater treatment device or system, regardless of ownership (including federal facilities) used in the storage, treatment, recycling and reclamation of municipal or domestic sewage.

2.29. "Recycling facility" means any solid waste facility for the purpose of recycling at which neither land disposal nor biological, chemical or thermal transformation of solid waste occurs: Provided, That mixed waste recovery facilities, sludge processing facilities and composting facilities are not considered recycling facilities nor considered to be reusing or recycling solid waste within the meaning of W. Va. Code ~~§§20-9 and 21~~ §§22C-4 and 20-11.

2.30. "Representative sample" means a sample collected from a population or whole that exhibits the average or typical properties of the larger population or whole.

2.31. "Sewage sludge" means 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."

2.32. "Sewage sludge processing facility" is a solid waste facility that processes sewage sludge for land application, incineration or disposal at an approved landfill. Such processes include, but are not limited to, composting, lime stabilization, thermophilic digestion and anaerobic digestion.

2.33. "Sludge" means any solid, semisolid, residue or precipitate, separated from or created by a municipal, commercial or industrial waste treatment plant, water supply treatment plant or air pollution control facility or any other such waste having similar origin.

2.34. "Solid waste" means any garbage, paper, litter, refuse, cans, bottles, waste processed for the express purpose of incineration; sludge from a waste treatment plant, water supply treatment plant or air pollution control facility; and other discarded materials, including offensive or unsightly matter, solid, liquid, semisolid or contained liquid or gaseous material resulting from industrial, commercial, mining or community activities but does not include solid or dissolved material in sewage or solid or dissolved materials in irrigation return flows or industrial discharges which are point sources and have permits under W. Va. Code §20-5A §22-11, or source, special nuclear or by-product material as defined by the Atomic Energy Act of 1949, as amended, including any nuclear or by-product material considered by federal standards to be below regulatory concern, or a hazardous waste either identified or listed under W. Va. Code §20-5E §22-18, or refuse, slurry, overburden or other wastes or material resulting from coal-fired electric power or steam generation, the exploration, development, production, storage and recovery of coal, oil, and gas and other mineral resources placed or disposed of at a facility which is regulated under W. Va. Code §§22-2, §22-3, §22-4, §22-6, §22-7, §22-8, §22-9, §22-10, §22A, §22C-2, §22C-7, §22C-8, and §22C-9 22A, or 22B, so long as such placement or disposal is in conformance with a permit issued pursuant to such provisions of this code. chapters.

2.35. "Solid waste disposal" means the practice of disposing of solid waste including placing, depositing, dumping or throwing or causing to be placed, deposited, dumped or thrown any solid waste.

2.36. "Solid waste disposal shed" means the geographical area which the solid waste management board designates and files in the state register pursuant to W. Va. Code §16-26-8 §22C-3-9.

2.37. "Solid waste facility" means any system, facility, land contiguous land, improvements on the land, structures or other appurtenances or methods used for processing, recycling or disposing of solid waste, including landfills, transfer stations, materials recovery facilities, mixed waste processing facilities, sewage sludge processing facilities, composting facilities and other such facilities not herein specified but not including land upon which sewage sludge is applied in accordance with W. Va. Code §20-5F-2b §22-15-20. Such facility shall be deemed to be situated, for purposes of this rule, in the county where the majority of the spatial area of such facility is located: Provided, That a salvage yard licensed and regulated pursuant to the terms of W. Va. Code §17-23, is not a solid waste facility.

2.38. "Source separated materials" means materials separated from general solid waste at the point of origin for the purpose of reuse and recycling but does not mean sewage sludge.

2.39. "Source separated organic waste" means readily degradable organic material such as food waste, yard waste and wood waste, except pressure-treated wood waste, which is collected separately from the mixed solid waste stream. It does not include sewage sludge or domestic septage.

2.40. "Stabilization" means the decomposition of organic material to the point where it neither reheats when wetted nor gives off offensive odors and does not include pathogens, toxins or vectors in excess of Federal regulations 40 CFR 503.

§47-38D-3: STANDARDS FOR USE, DISPOSAL AND PROCESSING OF SEWAGE SLUDGE.

3.1. Incorporation of Federal Regulations. -- Federal regulations 40 CFR 503, excluding sections 503.10(b)(1) and 503.20 through 503.29 inclusive, in effect on the effective date this rule, are hereby fully incorporated and implemented as a part of these sewage sludge management regulations promulgated under the authority of W. Va. Code ~~§20-5F-2b~~ §22-15-20. Provided, That in instances where similar provisions exist, the more stringent requirements (state or federal) shall apply.

3.2. Sewage Sludge Land Application Siting Restrictions and Location Standards

3.2.1 Sludge will not be applied to land that meets any of the following conditions:

3.2.1.a. Land that is frozen, snow-covered, or known to be flooded on a regular basis unless the applicant can demonstrate to the Director that the land application will not cause runoff into streams or wetlands.

3.2.1.b. Land within 50 feet of surface water to include streams, springs, ponds, wetlands, or other collection points for surface water.

3.2.1.c. Land within 200 feet of drinking water supply wells or other personal water supply.

3.2.1.d. Land within 200 feet of an occupied dwelling.

3.2.1.e. Land within 50 feet of a federal or state highway.

3.2.1.f. Land within 100 feet of an adjacent property owner's property line.

3.2.1.g. Land from which drainage leads into a sinkhole.

3.2.1.h. Land that has been tested and determined to have a pH of less than 6.2, unless the pH is adjusted to 6.2 or greater.

3.2.1.i. Land that has a slope greater than 15%.

3.2.1.j. Land that has a seasonal high groundwater table less than 2 feet from the surface.

3.2.1.k. Land that has less than 6 inches of soil over bedrock or an impervious pan.

3.2.1.l. Land containing soil with surface permeability of less than 0.6 inches/hour or greater than 6 inches/hour.

3.2.2. No person or entity shall be allowed to apply sewage sludge to land in a manner that will result in exceeding the maximum soil concentration for arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, and zinc. ~~as listed in Table 3 of this rule and the soil testing requirements of this rule.~~

3.2.2.a. The director shall assign an individual and lifetime loading rate for each land application site by considering background soil concentrations, and maximum allowable pollutant concentrations as per Table 1 ~~and per Table 3~~ of this rule, and cumulative loading rates as per Federal Regulations 40 CFR Part 503, Sections 503.13.a2i and 503.13.b2 except as provided for in 3.2.2.b.

3.2.2.b. If circumstances at sewage sludge processing facilities result in short term excursions of Table 1 criteria, the Director may develop temporary loading rates, for a period not to exceed six months, based on the provisional limitations of Table 2 of this rule.

3.2.3. No land, except a solid waste facility, shall be allowed to accept or store so much sewage sludge as to exceed the agronomic rate or a rate of fifteen dry ton per acre per year, whichever is less. Provided, That up to twenty-five dry tons per acre per year may be applied in the reclamation of surface mine land.

3.2.4. No person shall be allowed to store sewage sludge at a land application site for a period longer than one week; except, storage shall be allowed for no longer than three months where provisions, approved by the Chief of the Office of Water Resources of the Division, have been made to prevent leachate runoff into surface or groundwater. Septage storage shall only be allowed in-tank and for no more than three days, or as otherwise authorized by the Chief of the Office of Water Resources of the Division.

3.2.5. No person shall be allowed to land apply sludge except during the hours of daylight.

3.3. Sewage Sludge Processing Facility Operational and Design Requirements.

3.3.1. Sewage sludge processing facilities must adhere to the following requirements:

3.3.1.a. Areas used for processing, curing and storage of raw materials, intermediate and final products, loading and unloading areas, impoundments, pipelines, ditches, pumps and drums, sumps and tanks, must be designed, constructed and operated to prevent release of contaminants to the groundwater and surface water. Storage of finished products from the facility shall be limited to one year.

3.3.1.b. The facility must be designed and operated to control vectors and odors.

3.3.1.c. The facility must not be operated or constructed within the one hundred year flood plain unless provisions have been made to prevent the encroachment of flood waters upon the facility.

3.3.1.d. All land areas within the boundaries of a sewage sludge processing facility upon which sewage sludge, intermediate or final products come in direct contact with the land surface must be protected in accordance with the Groundwater Protection Act, W. Va. Code §20-5M §22-12 and the rules promulgated thereunder.

3.4. Leachate Management Requirements.

3.4.1. Any liquid which comes in contact with sewage sludge at a sewage sludge processing facility must be handled as leachate and is subject to the requirements of W. Va. Code §§20-5A and 5M §§22-11 and 12, and the rules promulgated thereunder.

3.5. Storm Water Requirements.

3.5.1. Storm water drainage must be directed around and away from the operating area. All storm water must be collected and discharged in compliance with State Water Quality Standards and the permit issued by the Office of Water Resources of the Division.

3.6. Landfill Disposal of Sewage Sludge. -- Sewage sludge disposed at a landfill shall contain at least twenty percent (20%) solids by weight. This requirement may be met by adding or blending sand, sawdust, lime, or soil. Alternative sludge disposal methods can be utilized upon obtaining prior written approval from the Chief.

3.6.1. Sewage sludge may not represent more than twenty-five percent (25%) by weight of the total weight of waste disposed of at the landfill on any working day.

§47-38D-4. PERMITS REQUIRED.

4.1. Applicability.

4.1.1. No person may construct or operate a sewage sludge processing facility (including mixed waste composting facilities which utilize sewage sludge) or a commercial solid waste facility which processes or handles sewage sludge or materials derived from sewage sludge without first obtaining a solid waste facility permit; Provided, That land upon which sewage sludge is applied is not a solid waste facility.

4.1.2. On and after the effective date of this rule, all permitted facilities shall submit an application to modify such permit.

4.1.3. No person may land apply sewage sludge without first obtaining a land application permit; provided, That land application permit requirements may be incorporated into a modification of a facility's WV/NPDES permit required under W. Va. Code §20-5A §22-11.

4.1.4. For those publicly owned treatment works (POTW's) which produce sewage sludge and are regulated by the Division pursuant to an WV/NPDES permit required under W. Va. Code §20-5A §22-11 a sewage sludge processing facility modification will be obtained by the applicant as a part of the existing WV/NPDES permit and shall include a sewage sludge management plan approved by the Chief of the Office of Water Resources of the Division.

4.1.5. Facilities which are surface disposal sites as defined in 40 CFR 503, Subpart C, are hereby defined as "landfills" and must meet all requirements of 47 CSR 38 applicable to landfills.

4.1.6. Permits issued under paragraph 4.1.1 of this rule, shall be subject to the provisions of 47 CSR 38, section 3 (excluding the provisions for Liner Requirements) and the closure requirements of 47 CSR 38, section 6.

4.1.7. Permits issued under paragraph 4.1.4. of this rule, shall be subject to the permit issuance procedures, procedures for permit modifications, suspension and revocation, procedures for transfer of permits, and the procedures for permit appeals of ~~46-CSR-2~~ 47 CSR 10 and are not subject to the procedures outlined in 4.1.5, 4.1.6. and 4.1.8 of this rule.

4.1.8. Permits issued under paragraph 4.1.5, of this rule, shall be subject to the procedures of 47 CSR 38 section 3 and the closure requirements of 47 CSR 38 section 6.

4.1.9 Permits issued under paragraph 4.1.3 of this rule except for land application modifications made in WV/NPDES permits under paragraph 4.1.4 of this rule shall be subject to the permit issuance procedures (subsections 3.17 through 3.29 inclusive) of 47 CSR 38 and are not subject to the procedures outlined in paragraphs 4.1.5, 4.1.6 and 4.1.8 of this rule.

4.2. General, Processing Facility, and Land Application Permit Requirements -- Persons required to obtain a permit pursuant to this rule must provide the following information, in the form and manner prescribed by the Chief of the Office of Waste Management or the Office of Water Resources of the Division as appropriate. The form may require information in addition to that required by this subsection.

4.2.1. Permit Application General Requirements -- All applicants must provide the following information:

- 4.2.1.a. The name, address, and location of the facility;
- 4.2.1.b. A description of the activities conducted or to be conducted by the applicant;
- 4.2.1.c. The operator's and owner's name, address, telephone number, ownership status, and status as a federal, state, private, public or other entity;
- 4.2.1.d. Other environmental permits issued by any local, state or federal agency;
- 4.2.1.e. A description of the specific source(s) of sewage sludge;
- 4.2.1.f. The amount of sewage sludge actually generated or imported;
- 4.2.1.g. The content of heavy metals, pathogens, toxins or vectors and moisture (percent solids) present in the sewage sludge;
- 4.2.1.h. Each location that the sewage sludge is stored, land applied or otherwise disposed of; the amount so stored, land applied or otherwise disposed of; and the capacity of that location to accept sewage sludge;

4.2.1.i. Information relative to the quality of the sewage sludge(s) or product(s) derived from sewage sludge as required by 40 CFR 503, and

4.2.1.j. A detailed design and a description of the method to collect and control leachate and surface water runoff, including the method for treatment and disposal of leachate generated.

4.2.2. Sewage Sludge Processing Facility Permit Requirements.--All applicants for permits for sewage sludge processing facilities, except facilities located at the site where sewage sludge is generated, must submit the following additional information:

4.2.2.a. An engineering report to construct must contain, at a minimum, the following:

4.2.2.a.A. A regional map, or maps, (of appropriate scale) that delineate the entire service area of the proposed facility (both existing and proposed); existing and proposed collection, processing, and disposal operations; the location of the closest population centers; and the transportation systems including highways, airports, railways and waterways;

4.2.2.a.B. A vicinity map (minimum scale of 1"=2000') that delineates the area within one mile of the facility boundaries, zoning and land use, residences, surface waters, access roads, bridges, railroads, airports, historic sites, and other existing and proposed man-made or natural features relating to the project;

4.2.2.a.C. A site plan (minimum scale of 1"=200' with five foot contour intervals) that delineates property boundaries, the location of existing and proposed soil boring, monitoring wells, buildings and appurtenances, fences, gates, roads, parking areas, drainage, culverts, storage facilities or areas, loading areas; existing and proposed elevation contours and direction of prevailing winds; and the location of residences, potable wells, surface water bodies, and drainage swales located within the site and in the site plan area; and

4.2.2.a.D. A map indicating wetlands and flood plains within 1,000 feet of the site, if any.

4.2.2.b. A description of the operation of the facility, detailed engineering plans and specifications for the entire facility, must be submitted by the applicant including at a minimum:

4.2.2.b.A. A schedule of operation, including the days and hours that the facility will be open, preparations before opening, and procedures followed after closing for the day;

4.2.2.b.B. Anticipated daily traffic flow to and from the facility, including the number of trips by private or public collection vehicles, and the quantity of material contained in each vehicle;

4.2.2.b.C. The procedure for unloading trucks (including frequency, rate, and method);

4.2.2.b.D. Special precautions or procedures for operation during wind, heavy rain, snow, and freezing conditions;

4.2.2.b.E. A description of the ultimate use for the finished compost or other product, method for removal from the site, and a plan for use or disposal of those finished products that cannot be used in the expected manner due to poor quality or change in market conditions;

4.2.2.b.F. A (description) copy of the label or other information source, by the distributor, that outlines the type of waste the compost product was derived from, a list of any restrictions on use, and recommended safe uses and application rates;

4.2.2.b.G. Identification of the personnel required to operate and maintain the facility and their job descriptions/responsibilities;

4.2.2.b.H. A detailed description of the source, and anticipated quality, and quantity of any bulking agent to be used in the process; and

4.2.2.b.I. A detailed description of the quantity, quality and specific source of the sewage sludge received or anticipated to be received.

4.2.2.c. The permit application must contain an operating engineering report which must include, at a minimum, the following:

4.2.2.c.A. Detailed engineering plans and specifications for the entire sewage sludge processing facility, including manufacturer's performance data for the selected equipment;

4.2.2.c.B. Contingency plans detailing corrective (or remedial) action to be taken in the event of equipment breakdown; air pollution (odors); unacceptable waste delivered to the facility; groundwater contamination; spills; and undesirable conditions such as fires, dust, noise, vectors, lack of a market for the compost product and unusual traffic conditions; and

4.2.2.c.C. An Operation and Maintenance manual.--The manual must contain general design information, detailed operational information and instructions. In addition, the manual must list the specific procedures used or to be used in monitoring, sampling and analyzing sewage sludge and the finished product, and record keeping requirements.

4.2.2.d. A description of the design of the facility, including:

4.2.2.d.A. The type, size, and associated detention times of equipment used in the handling, processing, and storage of sewage sludge;

4.2.2.d.B. The method of measuring, shredding, mixing, and proportioning input materials;

4.2.2.d.C. A description and sizing of the storage facilities for amendment, bulking agent, and finished product;

4.2.2.d.D. The separation, processing, storage, and ultimate disposal of materials that cannot be composted, if applicable;

4.2.2.d.E. The location of all temperature and any other type of monitoring points, and the frequency of monitoring;

4.2.2.d.F. A process flow diagram of the entire process, including all major equipment and flow streams. The flow streams must indicate the quantity of material on a wet weight, dry weight, and volumetric basis;

4.2.2.d.G. The aeration capacity of the system;

4.2.2.d.H. The method of supplying and regulating airflow;

4.2.2.d.I. The expected mass balance through the composting system;

4.2.2.d.J. A description of how the (temperature) monitoring equipment will ensure that facility qualifies as a process to further reduce pathogens, toxins, heavy metals and/or vectors; and

4.2.2.d.K. If applicable, a description of the air emission collection and control technologies.

4.2.3. Land Application Permit Requirement.--Persons performing land application of sewage sludge or materials derived from sewage sludge must submit the following information to the Chief of the Office of Water Resources of the Division in addition to that required under section 4.2.1. of this rule

4.2.3.a. Soil analysis for all land application sites including but not limited to pH, potassium, phosphorus, nitrogen, all metals listed in Table 1 of this rule and any additional chemical analysis required by the Director;

4.2.3.b. Information relative to the nitrogen content of the sludge(s) or product(s) derived from sewage sludge to be land applied;

4.2.3.c. A soils map with application sites clearly defined;

4.2.3.d. An agreement between the preparer of sewage sludge(s) or material(s) derived from sewage sludge, the applicer, and the owner of the land application site indicating each party's concurrence with the application, and certifying that each will comply with applicable requirements of 40 CFR 503 and this rule;

4.2.3.e. A description of existing and future uses of the land application site;

4.2.3.f. Information relative to past application(s) of sewage sludge or material(s) derived from sewage sludge as necessary to comply with 40 CFR 503.12 and this rule;

4.2.3.g. Information relative to past fertilizer applications to the site;

4.2.3.h. In addition to the chemical analyses required in paragraph 4.2.1 of this rule, any additional chemical analyses of sewage sludge(s) or material(s) derived from sewage sludge, requested by the Chief of the Office of Water Resources of the Division, including, but not limited to sodium, chloride, fluoride, calcium and sulfates;

application; 4.2.3.i. A description of the methods to be used for land

to the site; 4.2.3.j. A description of the methods for transportation of sludge

4.2.3.k. For sewage sludge or material derived from sewage sludge, which has been imported, a copy of the POTW's NPDES permit;

4.2.3.l. For sewage sludge or material derived from sewage sludge, which has been imported, information relative to the significant industrial users of the POTW from which the sludge or material originated;

4.2.3.m. For sewage sludge or material derived from sewage sludge, which has been imported, a description of the methods by which pathogen control and vector attraction reduction are being achieved; and

4.2.3.n. A description of the methods to be utilized to adjust and maintain the soil to a minimum pH of 6.2 for at least 5 years from the date of application.

§47-38D-5. GENERAL, PROCESSING FACILITY, AND LAND APPLICATION PERMIT REQUIREMENTS.

5.1. Permit General Requirements.-- All permits issued pursuant to this rule shall contain the following:

5.1.1. Any requirement of 40 CFR 503, including but not limited to:

5.1.1.a. Limitations on the concentrations of pollutants (heavy metals), toxins, vectors and pathogens in the sewage sludge or sewage sludge products;

5.1.1.b. Requirements relative to monitoring sewage sludge and sewage sludge product quality and reporting the results of those analyses for pH, percent solids, organic nitrogen, potassium, phosphorus, calcium, magnesium, total nitrogen, ammonia nitrogen, pathogen test results, vector attraction verification; and all heavy metals listed in Table 1 of this rule except that the frequency of monitoring shall be as described in Appendix A of this rule ;

5.1.1.c. Requirements relative to reporting and certification;

5.1.1.d. Requirement to pay fees as identified in section 6 of this rule;

5.1.1.e. Requirements for the proper collection, control and disposal of leachate and stormwater runoff for the protection of ground and surface waters;

5.1.1.f. Requirements to retain records for the facility for a minimum of five years;

5.1.1.g. Requirements to monitor and report monthly to the Division the quantity of sewage sludge produced or imported and the specific source of the sewage sludge produced or imported;

5.1.1.h. Requirements not to exceed a commercial solid waste facility's tonnage limits, where applicable;

5.1.1.i. Requirements to provide copies of monthly reports to the county or regional solid waste authority in which the facility or land application site(s) is located;

5.1.1.j. Any other requirements, including additional monitoring, determined to be necessary by the Director to insure compliance with state and federal regulations;

5.2. Processing Facility Permit Requirements.-- In addition to the requirements of subsection 5.1. of this rule, any solid waste facility permit issued to a sewage sludge processing facility, pursuant to the sewage sludge regulations, must contain the following:

5.2.1. Operational requirements relative to pathogen control in accordance with 40 CFR 503.32 and its Appendix B;

5.2.2. Operational requirements relative to vector attraction reduction in accordance with 40 CFR 503.33;

5.2.3. Requirements to routinely monitor and report information relative to the quality of raw materials used in the sewage sludge processing facility including but not limited to: sewage sludge, bulking agents, and kiln dust; except that the frequency of monitoring shall be as described in Appendix A of this rule;

5.2.4. Limitations for the pollutant concentrations of the end product of the sewage sludge processing facility;

5.2.5. Labeling requirements as per 40 CFR 503.14.e., if applicable;

5.2.6. Requirements for the implementation of practices to prevent the contamination of ground and surface waters, including liners if necessary; and

5.2.7. For commercial sewage sludge processing facilities, requirements for reporting in accordance with subsection 4.12 of the Solid Waste Management Regulations (47 CSR.38);

5.3. Land Application Permit Requirements.-- In addition to the requirements of subsection 5.1 of this rule, any land application permit issued pursuant to the sewage sludge regulations shall contain the following:

5.3.1. Requirements delineating the sites for which land application is approved;

5.3.2. Limitations on the maximum amount of sewage sludge allowed to be land applied;

5.3.3. Requirements implementing the siting restrictions and location standards of subsection 3.2 of this rule;

5.3.4. Requirements limiting the types of crops that may be grown on land used for application of sewage sludge and the time between application of sewage sludge and the harvesting of crops, in accordance with 40 CFR 503.32(b);

5.3.5. Restrictions on animal grazing and public access, in accordance with 40 CFR 503.32(b); and

5.3.6. Applicable vector attraction reduction requirements of 40 CFR 503.33; and

5.3.7. Applicable pathogen reduction requirements of 40 CFR 503.32 and its Appendix B.

§47-38D-6. FEE AND BONDING REQUIREMENTS

6.1. Applicability.-- Any producer or importer of sewage sludge for land application shall be subject to non-refundable fees, as described herein, which shall be used to cover the costs of the sewage sludge management program. The fees established herein in paragraphs 6.4.1 and 6.4.2 of this rule shall be assessed on forms prescribed by the Chief of the Office of Water Resources of the Division and shall be paid to said chief quarterly.

6.2. Water Quality Management Fund.-- Fees collected for land application shall be deposited in the special revenue fund designated the "Water Quality Management Fund" established under the provisions of W.Va. Code §-20-5A-6a §22-11-10 except as otherwise specified herein.

6.3. Bonding.-- The Director may require a surety bond, deposit or similar instrument in an amount sufficient to cover the cost of future environmental remediation from producers and importers of sewage.

6.4. Fee Assessments

6.4.1. Producers and importers of sewage sludge or material derived from sewage sludge for land application shall be assessed a sewage sludge management program fee calculated as \$5.00 per actual ton of sludge times the proportion of solids in the sludge for sludge with maximum metals concentrations not exceeding those listed in Table 1 of this rule.

6.4.2. All sewage sludge placed in, or upon, or used by a solid waste facility or processed or handled, pursuant to a permit issued by the Division, shall be subject to the same tipping and other fees as levied on the disposal of solid waste under W. Va. code §-20 §22; Provided, That no such fees, excepting assessment fees required by this section, shall be levied upon the application of sewage sludge to land outside a solid waste facility in accordance with the statute and this rule.

6.4.3. Fees generated pursuant to paragraph 6.4.1 shall be reviewed periodically by the Director and shall be adjusted as necessary to assure that total collections shall not exceed \$200,000 per year.

APPENDIX A

FREQUENCY OF MONITORING

AMOUNT OF SEWAGE SLUDGE RECEIVED (actual dry tons per 365 day period)	FREQUENCY OF MONITORING
Greater than zero but less than 290	once every 6 months
Equal to or greater than 290 but less than 1,500	once per quarter (4 times per year)
Equal to or greater than 1,500 but less 15,000	once per month (12 times per year)
Equal to or greater than 15,000	once per week

TABLE 1
**MAXIMUM CONCENTRATION OF METALS IN SEWAGE SLUDGE
 FOR LAND APPLICATION**

Metal	Concentration (mg/kg)
Arsenic	41
Cadmium	10
Chromium	1000
Copper	1000
Lead	250
Mercury	10
Molybdenum	18
Nickel	200
Selenium	36
Zinc	2500

TABLE 2
**PROVISIONAL MAXIMUM CONCENTRATION OF METALS IN SEWAGE SLUDGE
 FOR PRODUCERS NOT MEETING TABLE 1 CRITERIA**

Metal	Concentration (mg/kg)
Arsenic	75
Cadmium	85
Chromium	3000
Copper	4300
Lead	840
Mercury	57
Molybdenum	75
Nickel	420
Selenium	100
Zinc	7500

TABLE-3

MAXIMUM-ALLOWABLE-SOIL-CONCENTRATIONS

Metal	Concentration (mg/kg)
Arsenic	5.7
Cadmium	1.4
Chromium	140.0
Copper	140.0
Lead	35.0
Mercury	2.0
Molybdenum	2.5
Nickel	28.0
Selenium	5.0
Zinc	350.0

§503.1 Purpose and applicability.

(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.

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§503.2 Compliance period.

(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.

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§503.3 Permits and direct enforceability.

(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.

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§503.4 Relationship to other regulations.

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.

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§503.5 Additional or more stringent requirements.

(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.

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§503.6 Exclusions.

(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.

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§503.7 Requirement for a person who prepares sewage sludge.

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.

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§503.8 Sampling and analysis

(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 USC 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 the Federal Register. They are available for inspection at the Office of the Federal Register, 7th Floor, suite 700, 800 North Capitol Street, NW., Washington, DC, and at the Office of Water Docket, room L-102, U.S. Environmental Protection Agency, 401 M Street, SW., Washington, DC. Copies may be obtained from the standard producer or publisher listed in the regulation. Methods in the materials listed below 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.

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§503.9 General definitions

(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

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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 m

eans 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.

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Subpart B--Land Application

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503.10 Applicability.

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

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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 pollutant concentrations in 503.13(b) (3), 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 pollutant concentrations in 503.13(b) (3), 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 pollutant concentrations in §503.13(b)(3), 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 pollutant concentrations in §503.13(b)(3), 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 pollutant concentrations in §503.13(b)(3), 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 pollutant concentrations in §503.13(b)(3), 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 pollutant concentrations in §503.13(b) (3), 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).

>

§503.11 Special definitions

(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.

(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.

(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.....	
Cadmium.....	
Chromium.....	

Copper.....	43
Lead.....	8
Mercury.....	
Molybdenum.....	
Nickel.....	4
Selenium.....	1
Zinc.....	75

<FN1> Dry weight basis.

(2) Cumulative pollutant loading rates.

Table 2 of § 503.13.--Cumulative Pollutant Loading Rates
 Cumulative pollutant loading rate
 (kilograms per hectare)

Pollutant	
Arsenic.....	
Cadmium.....	
Chromium.....	30
Copper.....	15
Lead.....	3
Mercury.....	
Nickel.....	4
Selenium.....	1
Zinc.....	28

[§503.13(b) (2) Table 2 amended at 59 FR 9098, Feb. 25, 1994]

(3) Pollutant concentrations.

Table 3 of § 503.13.--Pollutant Concentrations
 Monthly average concentrations
 (milligrams per kilogram)†1

Pollutant	
Arsenic.....	
Cadmium.....	
Chromium.....	12
Copper.....	15
Lead.....	3
Mercury.....	
Nickel.....	4
Selenium.....	

Zinc.....

28.

<FN1> Dry weight basis.

[§503.13(b)(3) Table 3 amended at 59 FR 9098, Feb. 25, 1994]

(4) Annual pollutant loading rates.

Table 4 of § 503.13.--Annual Pollutant Loading Rates

Pollutant	Annual pollutant loading rate (kilograms per hectare per 365 da period)
Arsenic.....	2
Cadmium.....	1
Chromium.....	1
Copper.....	
Lead.....	
Mercury.....	0.
Nickel.....	
Selenium.....	5
Zinc.....	1

[§503.13(b)(4) Table 4 amended at 59 FR 9098, Feb. 25, 1994]

(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).

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

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.

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§503.14 Management practices.

(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.

(a) Pathogens--sewage sludge.

(1) The Class A pathogen requirements in §503.32(a) or the
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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.

(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 in §503.32(b) (2) through (b) (4); and the vector attraction reduction requirements §503.33 (b) (1) through §503.33 (b) (8) shall be the frequency in Table 1 of §503.16.

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)

<FN1>Either the amount of bulk sewage sludge applied to the land or the amount of sewage sludge received by a person who prepares sewage sludge that is sold or given 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), but in no case shall the frequency of monitoring be less than once per year when sewage sludge is applied to the land.

(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)

> §503.17 Recordkeeping.
>

(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 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)] have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the pathogen requirements and vector attraction reduction requirements have been met. 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 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)] have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the pathogen requirements and the vector attraction reduction requirements have been met. 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 pathogen requirements in §503.32(a) have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the pathogen requirements have been met. 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 management practices in §503.14 and the vector attraction reduction requirement in [insert either §503.33 (b) (9) or (b) (10)] have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the management practices and vector attraction reduction requirements have been met. I am aware that there are significant penalties for false certification including 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 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] have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the pathogen requirements [and vector attraction reduction requirements if applicable] have been met. 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 management practices in §503.14, the site restrictions in §503.32(b)(5), and the vector attraction reduction requirements in [insert either §503.33 (b)(9) or (b)(10), if one of those requirements is met] have been met for each site on which bulk sewage sludge is applied. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the management practices and site restrictions [and the vector attraction reduction

requirements if applicable] have been met. 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.

(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 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] have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the pathogen requirements [and vector attraction reduction requirements] have been met. 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 and time 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 requirements to obtain information in §503.12(e) (2) have been met for each site on which bulk sewage sludge is applied. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the requirements to obtain information have been met. I am aware that there are significant penalties for false certification including 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 management practices in §503.14 have been met for each site on which bulk sewage sludge is applied. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the management practices have been met. I am aware that there are significant penalties for false certification including 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 site restrictions in §503.32(b)(5) have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the site restrictions have been met. I am aware that there are significant penalties for false certification including 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 vector attraction reduction requirement in [insert either §503.33(b)(9) or §503.33(b)(10)] has been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the vector attraction reduction requirement has been met. 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 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 (b)(8)] have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the management practice, pathogen requirements, and vector attraction reduction requirements have been met. 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 and time 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 pathogen requirements in [insert either §503.32(c)(1) or §503.32(c)(2)] and the vector attraction reduction requirements in [insert §503.33(b)(9), §503.33(b)(10), or §503.33(b)(12)] have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the pathogen requirements and vector attraction reduction requirements have been met. 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 §503.33 (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)

>
§503.18 Reporting.

(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 [insert the month and day from the date of publication of this rule] 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 site.

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

Division of **E**nvironmental **P**rotection

Public Hearing: TITLE 40 CFR 503 - Sludge Standards Time/Date: 4/14/95 9 A.M.

NAME	ADDRESS	COMMENT	
		YES	NO
Jimmie Pennings	Rt 1 Beverly W Va (City of Gratton) Rye		
Frank White	Box 718, Richwood, WV 26261		
ROBERT CRITES	Box 719, Richwood, WV 26261		
Terry Honaker	PO Box 998 Bluefield WV (South Bd.)	✓	
Norris Kantor	PO Box 757 Bluefield W Va 24701	✓	
JIM WESOLOWSKI	BOX 3066 BLUEWELL STATION BLUEFIELD 24701	✓	
Ray D. Dyer	P.O. BOX 998 BLUEFIELD WV SOUTHWESTERN Bd BRANCH	✓	
David A. Sutherland	PO Box 352 Augusta, WV 26704	✓	⊙
Charles R. Williams	P.O. Box 998, Bluefield, WV 24701	✓	
Steve A. Whitman	P.O. Box 1245 Oak Hill W Va. 25961		✓
Jim Kotcon	Rt. 12 Box 400 Morgantown WV 26505	✓	
Penny McNeil	Rt 2 Box 73 Riverview WV 26578		
JAMES SUMMERS	Rt 1, Box 5 Frametown, WV 26623		✓
RAY LOVEJOY	1058 Agricultural Science Building P.O. Box 6108 Morgantown WV 26506-1058		
BARRY KEMERER	P.O. Box 7027 CHAS. 25356	✓	

Division of **E**nvironmental **P**rotection

Public Hearing: Title 40 CFR 503 - Sludge Standards Time/Date: 4/14/95 9 A.M.

NAME	ADDRESS	COMMENT	
		YES	NO
Steve Goffin	34 W. Main St. White Sulphur Springs WV 24986	✓	
David Pennington	P.O. Box 1245 Oak Hill WV		✓
Nathaniel Rodriguez	P.O. Box 109B Rt. 1, Rivesville 26588	✓	
Wayne Bookley	P.O. Box 245 Greenup WV 26026	✓	
Susan G. Stenberg	P.O. Box 109B Rivesville WV 26588	✓	
Pam Waight	900 Pike Street, Shenandoah WV 26431	✓	
Mary Boone	125 19th St, Parkersburg WV 26104		
Clarence Cox	125 19th St Parkersburg WV 26101	✓	
Bill Brannon	1201 Geary St. Ches 25311 - OWR		✓
Tom Sowers	" " " "		✓
Low Test Recorder	P.O. Box 438 Mason, W Va 25260		✓
Fred Taylor Mayor	P.O. Box 438 Mason WV 25260		✓
Danny Lewis	Nitre Sanitary Body Nitro WV 25143		✓
Bryant Newell	1615 Washington St E. Ches WV 25311		✓
Dark Hanson	P.O. Box 113 Kilmath WV 25859	✓	

Division of **E**nvironmental **P**rotection

Public Hearing: TITLE 40 CFR 503 - Sludge Standards Time/Date: 4/14/95 9A.

NAME	ADDRESS	COMMENT	
		YES	NO
JAMES M. Cox	P.O. Box 700 WASHINGTON, WV 26181	X	
Conna Stephens	15 Riverside Glen Winfield WV 25213		X
Jim Besley	PO Box 350 Tad WV 25201-0350	X	
Robert R. Bell	State Rt. 1. Box 155A Tokinville WV 25202		
DAN HALLORAN	CHAS. SHAN. BD		X
Tom Negele	HC 75 BOX 324 CHLOE, WV 25235	X	
JERRY KELLEY	House of Delegates - 13th Dist		X
Clifton Branning	WV DEP CWR		
Dwight W. Roggi	Berdley PSD		X
Steve LeRosa	Summersville W. Va. Municipal League	✓	
Bob Hillman	" " CITY		X
Claude H. Butler	" " CITY	X	
MILT SEBERT	MARTINSBURG WV PSD		
John Wiseman	1101 Maple Lane, Tornado WV		
Ken Ward	Chas. Gazette		X

Division of **E**nvironmental **P**rotection

Public Hearing: Title 40 CFR 503 - Sludge Standards Time/Date: 4/14/95 9A

NAME	ADDRESS	COMMENT	
		YES	NO
LISA Dooley	1620 Kan Blvd E. Ches WV 25311	✓	
John H. Anderson	400 Fleming Ravenswood WV 26064		✓
Nelson Robinson	2210 Washington St East 25311		✓
Karl Ellis	2067 main street Culloden WV 25310		✓
Norm Sloanster	charleston		✓
Kevin A. Deane	151 Mt Hope WV	X	
Douglas R. Arns	PO Box 1428 Fairmont WV 26555	X	
Arlene Bonitt	P.O. Box 1488, St. Albans, W. VA 25177	X	
Martha Huffman	1136 - 4 th St. New Martinsville WV 26155	X	
Shirley Mullett	Rt 1 Box 19 " " "	X	
HL Weiss	RDC Box 146 " " "		✓

Public Hearing
Title 40CFR503 - Sludge Standards
April 14, 1995

BRIAN FARKAS: The purpose of today's public hearing is to receive your comments on proposed changes to standards for the use or disposal of sewage sludge. We have sign-in sheets in the back. Again, if you need to sign in, please do. These sheets are very important to us. We use them not only to determine who was here today, but then also to use if you have any comments you would like to make during the hearing. We use these sheets to call off your name. There are a lot of people who have indicated the desire to speak and because of that, we're going to limit comments to about five minutes apiece. So if we can just keep our comments to five minutes. Of course, as people are speaking, please be courteous- one speaker at a time. A couple of housekeeping rules. Because there are a lot of people here. The emergency exits to this building. There is an exit, you walk out this door and immediately make a left, there is an emergency exit here. There is also an emergency exit the way you came in, if you came in from the front doors, so you have two ways to go. If some time during the hearing you need to use the restroom, if you go down this main hallway from where you came, the first hallway to your left before you go down the steps there are men's and women's bathrooms there.

My name again is Brian Farkas, and I am based in Nitro. My telephone number is 759-0515, if anyone would like to get in touch with me after the hearing. With us today are, to my very far right, I guess your left, is Eli McCoy.

Eli is the Deputy Director of the Division of Environmental Protection. His telephone number is 759-0515. Next to Eli is Clifton Browning from our Office of Water Resources. Clifton, I guess, would be our Sludge Management Expert within the agency. His number is 558-2108. If you are out of the local dialing area because of changes with C and P Telephone, or whatever phone system, you must dial 304.

We're going to conduct today's hearing in three sections. The first section of today's hearing is a brief explanation of why we're here today, the reason why we filed emergency rules on the sludge regulations. After that, we will open it up to receive your comments. At that time, we are just receiving your comments and if you have any questions to us please hold them because the third section of the hearing we will then close out the formal hearing and open up a question and answer session with you. So if you have any questions please hold them and we will try to get to them at the third section of the hearing. And with that, oh wait, one other thing before I finish. When we filed the regulations, there was a computer glitch with margins and some of the values, I believe we're on page thirteen, were not in the regulation, they dropped off. I do have corrected versions of that. I have eight copies here today. If you would like a copy before you leave today, please let me know and I'll try and get that done, and if I can't do it before you leave, then give me your address and I'll be more than happy to send you one. And now, Eli McCoy.

ELI MCCOY: Thank you, Brian. I, too, will be brief. We're here today to hold the public hearing that's required on emergency rule CSR37-38D. Those are the

Sewage Sludge Management Regulations that were promulgated pursuant to Senate Bill 288. The emergency regs have been filed with the Secretary of State's Office and a corresponding set of regulations have been filed with the Legislative Rule Making Review Committee. We are filing these regs because as we have begun to implement the program and we've received soils dated back from throughout the state, we've seen that some of the background levels of the materials that are listed in Table 3 in the regulations, are being exceeded by natural background, and it's precluding the application of any material, or the use of that material. So, the effect of the changes that we have filed are twofold. One, we've removed Table 3, those maximum soil concentration values. Those are out of that regulation as it's proposed. And secondly, there are some minor semantic changes, and a few typo corrections that were discovered. The gist of what's in there in terms of change is the removal of Table 3. With that, we can get started.

UNIDENTIFIED MAN: Can you speak a little louder, please?

MCCOY: I'm through...

FARKAS: Did you hear that?

MCCOY: Did you want me to go back over it?

FARKAS: Did you hear everything that was said? Do you need to have him repeat any section of that? It's important, because if you didn't hear it, we'll repeat it....No? okay. Okay, at this time, I'm going to call your name based on the list that we have. It isn't in any order, so please come up front, state your name for the record and who you're representing, and then please limit your comments to five

minutes. The first speaker is Terry Honaker.

TERRY HONAKER: I'm Terry Honaker. I'm the Manager of the Sanitary Board in Bluefield. I'm here to speak on behalf of the emergency rule. Treatment of waste water has gotten highly technical. And as most of you in the room know, this process gets harder and harder every year. It seems that the senators up there have become the experts now instead of us. And they see fit just to make rule changes without any advice. He published numerous articles in the paper. It says here, McNoughton set the standards based on EPA recommendations. These standards weren't based on EPA recommendations. If they were, they'd be the 503 regs. EPA doesn't recommend you go beyond that. It says, in his article, the levels were set with the benefit of technical, scientific information. If you can sit and drink a beer on a Monday afternoon, in two hours do what EPA took sixteen years to do, well then that's highly technical. I'm to tell you that Table 3 has nothing to do with the sludge, it has to do with the soil only. If the soil can't pass the test, what are you going to do? You can't even put fertilizer on it. They're saying that the metal uptake in the soil is already higher than what the sludge will allow you to put on it. That's the reason the emergency rule's here to take Table 3 out. It has nothing to do with sludge, it deals with soils only. We have some technical people with us that will give you the background on this.

Thank you.

FARKAS: The next person is Norris Kantor.

NORRIS KANTOR: I'm the attorney for the Sanitary Board of the City of Bluefield, and I will be followed by some of our technical people, but we want to make it

clear that the existing rule basically precludes the land application of sludge in West Virginia. There is no scientific basis for that rule, and there were no studies to justify the validity of the rule.

EPA studied land applications of sludge for at least ten to sixteen years and developed their 503 regulations, and the West Virginia table for maximum concentration of metals in sewage sludge is the same as EPA 503 table for pollutant concentrations. The West Virginia table for provisional concentration of metals in sewage sludge is the same as the EPA 503 ceiling concentrations. The West Virginia table for maximum background concentration of metals in soil where sludge may be land applied, which is the subject of the emergency rule, has no corresponding 503 EPA regulation, and anyone who says it does is either deliberately or mistakenly misleading the public, the Legislature, and the Secretary of State. In fact, the West Virginia table for maximum background concentration of metal in soil where sludge may be applied, and the subject of this emergency rule, was adopted without benefit of any responsible or reliable scientific study. Unfortunately, DEP was misled by the proposers of the rule and allowed the rule to be passed into law. However, after considerable study and practical application, DEP realized it had been misled and further realized that application of the rule would preclude the use of sludge in West Virginia and would unduly and unjustifiably penalize West Virginia Sanitary Boards and Public Service Districts. DEP further recognized that a serious scientific study should be undertaken at West Virginia University, or elsewhere, to evaluate the rule and to determine if there was, in fact, any scientific justification for the rule. Thus, DEP

wrote the emergency rule which is before you, filed it with the Secretary of State, and in effect, is recommending its implementation.

The existing rule is severely penalizing every West Virginia Sanitary Board and Public Service District. It has made the land application of sludge an impossibility in West Virginia at an enormous, unnecessary cost to the citizens of the state. As an example: in Bluefield the cost will go, under the existing rule, from five dollars per ton disposal cost to at least two hundred and fifty dollars per ton, or a hundred and sixty-eight thousand dollar per year increase in cost. That's in Bluefield. You can imagine what it's going to do in the larger communities.

The table we are seeking to have removed by the emergency rule is not a table that applies to the quality of the sludge and will not inhibit the introduction of out of state sludge to either landfills or land application. The table under consideration, when tested by DEP in twenty-two counties, found that the natural soil background metals, which is what Mr. McCoy just told you, concentration already exceeded the limits imposed by the table. Thus, you cannot use sludge in those counties for land application. The alternative is to either ship the sludge out of the state, or to go to a public landfill and there dispose of the sludge at an extreme cost, bearing in mind the landfills are not obligated to take the sludge. Thus, the Sanitary Boards and the Public Service Districts can and will be faced with both an intolerable and unsolvable problem unless the emergency rule is adopted. It is our request that that emergency rule be adopted.

FARKAS: Thank you. Jim Wenzeldowski.

JIM WESOLOWSKI: Wesolowski.

FARKAS: Wesolowski. I'm sorry.

WESOLOWSKI: My name is Jim Wesolowski. I'm on the Management Committee for the Rural Water Association and today I'm speaking on behalf of the West Virginia Rural Water Association. The West Virginia Rural Water Association is supporting the implementation of the emergency rule as proposed by DEP. The West Virginia Rural Water Association has an active membership in excess of two hundred utilities that represent populations of ten thousand or less. The POTW membership produces a highly regulated, safe and beneficially reusable biosolid product. Our member POTW's generate approximately seventeen thousand five hundred tons of biosolids or sludge, whichever word you prefer to use, annually.

The intent of the legislators in 1994, in our opinion, was to implement sewage sludge management rules that would provide regulations to allow the beneficial reuse of municipal sludges for land application and insure that the regulations would provide for a well managed and strictly enforced program. Sadly, the 1994 legislation provided regulations that have virtually eliminated the practice of beneficial reuse of biosolids for land application. We believe that the metal levels concentration in this legislation as stated in Table 3 were established outside the intent of the majority of responsible legislators. It is a sad commentary that one or two uninformed and mean-spirited legislators would irresponsibly set limits that make land application illegal in this state.

Contrary to the opinions generated in much of our news media stories recently, which would make us all believe that the water environment operators

and managers in this state are plunderers of Mother Earth, we feel it's quite the contrary. The vast majority of operators and managers in the State of West Virginia are highly trained, highly skilled professionals that have been environmentally sensitive for over a decade. This legislation will set us back many years.

Many of us recall when the Land Application Program began its initial control of the POTW's. We have witnessed a continuing improvement in the quality of our streams and groundwater supplies because of this program. We have witnessed the joy of farmers that have turned unusable farm land into highly productive agricultural fields through the beneficial reuse of biosolids. We have also reviewed pilot program projects in the state that reveal tremendous potential for the revegetation of savage stripmine land. And now we are witnessing the demise of this program because our legislators have made dirt illegal in West Virginia. It is obvious that the sponsor of this rule did not intend to be known as the individual who made dirt illegal, but that's exactly what's happened. We believe that this is irresponsible government and that the emergency rules must be promulgated to continue an excellent program and allow the sludge management enforcement officers the opportunity to develop analytical data for future legislative review.

We have nine points now, if the emergency rules are not allowed we anticipate the current law as it exists today will result in: 1) approximately six hundred thousand dollars in tipping fees for landfill use will impact the POTW's that are members of West Virginia Rural Water Association; 2) that the cost of

thickening agents for the members of West Virginia Rural Water Association will exceed a hundred and seventy-five thousand dollars annually; 3) additional transportation cost will increase dramatically to move the product to the landfill. Many POTW's land apply within two to three miles of their facility. There are cases where many of the facilities will have to drive fifty miles or more one way; 4) there will be unnecessary accounting fees and this is an unknown factor. When these new fees are incurred by the POTW's they will have to pass this on to their customer base. They can only do that through a PSD in West Virginia. They have to hire an accountant, then they present that before the Public Service Commission. So the accounting fees is an unknown factor. We anticipate that being in the thousands of dollars statewide. These tariff increases will be added to the customer's monthly bill. We anticipate that the accumulative annual rate impact will exceed a whopping one million dollars to the rural water member customers; 6) we feel that this excess cost because of poor legislation will cause the customers of our systems to seek retaliation and retribution at the polls. We'd hate to see that happen; 7) the landfills by current law cannot accept sewage sludge in excess of twenty-five percent of the total daily landfill weight. This will turn away many producers and double the cost of transportation. There's no way for us to know if the landfill has already accepted twenty-five percent of the weight by volume for that particular day. You're playing a crapshoot. You'll drive fifty miles to a landfill, find out they've already accepted twenty-five percent, and you have to drive back again. [Just one more minute. Thirty seconds.] 8) many POTW's will become frustrated with the accumulated higher

levels of solids in their treatment process which will ultimately be lost to the streams of West Virginia. The years of progressively cleaning up our waterways will immediately be at risk under the current law. We urge that this be passed. Let's keep the environmental process working. Let's keep the streams clean, and let's keep working with the DEP to maintain a useful and beneficial reuse of biosolids in West Virginia. Thank you.

FARKAS: There are a couple of seats that have been brought in the room. There are three seats here. There are two seats right up front if you'd like to come in and sit down. There's some space over here next to the wall if you'd wanna [inaudible] don't be bashful now, just come up and sit down so you won't have to stand against the wall. Next person who signed up is Ron Dodson.

RON DODSON: I'm Ron Dodson from Bluefield, West Virginia. I'm also employed by the Sanitary Board of Bluefield. Part of my job with the Sanitary Board of Bluefield is seeing that our plants operate as cost effectively as possible. With the implementation of the sludge rules, if we are forced to go to landfills, then we'll have to seek other ways to reduce our cost to make up for the additional cost of going to landfills, and this will result in us not treating our sludge as well as we do to apply it for land application. The regs involving sludge that sits in landfills are not as stringent as the regs for sludge that is applied to land. So instead of lime stabilization, vector attraction, we even do pathogen removal. All this will cease. Okay, we'll just get our sludge to that twenty percent level and send it out regardless of what's in it because the rules don't apply to landfills.

Even if the landfill accepts twenty-five percent of the volume in sludge, this

is going to reduce our landfill capacity by twenty-five percent. I mean, West Virginia has a difficult time now getting their landfills approved. If you build a landfill and the lifespan is currently a hundred years, if they start taking additional twenty-five percent of their volume in sludge, then they're gonna lose twenty-five years on the lifespan at the landfills. So, you're also gonna cause a landfill problem in the state. If we don't treat our sludge as well as we do now for land application, then the leech egg problem in landfills is gonna increase. So this is just not a land application/sludge problem. It's a solid waste problem for the whole state.

I think you should consider adopting this emergency rule, not only just for Sanitary Boards, but for all the solid waste handlers that have to try and make this a safe and aesthetic place to live. Thank you very much.

FARKAS: Thank you. The next person, Donald Sutherland.

DAVID SUTHERLAND: David Sutherland.

FARKAS: David. I'm sorry.

SUTHERLAND: I'd like to save the rustic humor and the pseudo-legal remarks until later. Let me see what the other people say, I may have nothing to say, if I may.

FARKAS: Okay, so right now we'll say no and then later on we'll open it up to [inaudible], okay? Charles Via.

CHARLES VIA: That's Via.

FARKAS: Via. Via.

VIA: Hello, I'm Charlie Via with the Sanitary Board of Bluefield. I'm not gonna stand up here and talk too long. My colleagues, they pretty well said everything that

needs to be said, except for one thing they may have left out. About a year and a half ago, Clifton and I sat down and went over these regs and the soil concentration tables at that time. I pretty well made the statement then, and he'll agree with me, that this would happen. It did. The background metals are too high in the state according to the tables. What we really need is just the time to come up with something that is workable; that will beneficially profit the state. The farmers will be able to use the sludge. It won't put a hardship on all the people in this state that has a fixed income.

Also, by doing this, we're gonna prevent one other thing that I can see happening in the future. If we continue to have a hardship on these smaller communities, instead of seeing the environment better, the water get cleaner, we're gonna see it reverse itself. There's gonna be a lot of accidental upsets in our plants. The streams are gonna be high, and just all of a sudden, you know, for some reason, the solids that were in the plant that would have went on to the fields hits the streams. You know, these things happen. Because communities just can't afford to go on with this. You know, we're looking at probably anywhere from a six to a ten percent rate increase to cover this. We've got a lot of folks that are on fixed incomes, that are unemployed, that are on welfare. They can't afford to pay for this.

The farmers. You know, I've seen two to three times the hay production increased on each one of them. There's never been a problem with land application of sludge. It's been done for years. Everybody's cleaned out a barn. I used to do it when I was a kid. That's land application of sludge, in another way.

The Chinese, how many centuries have they flooded their rice patties. That's land application of sludge.

This is protected. This is by regulation, by federal regulations. This has been tested. The EPA, you know, set these regulations that they said where you could land apply sludge to a field for a hundred years before you reach the cumulative loading.

You know, all we're asking for is time and maybe, you know I would like to make a further recommendation that there be advisory boards set up across the state for people to review these regulations. To give their input to this. You know, the people that actually have to use these regulations and actually have the knowledge and the background to implement it and to make a fair recommendation.

But I would like to say that what has happened, it's the right way to go at it and I would recommend that these regulations be adopted and I thank you.

FARKAS: Thank you. Jim Kotcon.

JIM KOTCON: My name is James Kotcon. I'm the State Government Program's Chair for the West Virginia Sierra Club. This is probably the fifth hearing in the last three years where I've testified on the issue of sewage sludge and management and I have to admit that I don't think I've ever heard more misinformation and incorrect statements than I've heard this morning.

The Sierra Club supports the beneficial use of biosolids and municipal waste where it can be done in an environmentally safe manner. I think we would also support some of the technical changes in the addition of the pathogen

reduction requirements that were implemented in this proposed rule. I disagree, however, that this is an emergency. I do not believe that this particular rule should be done as an emergency rule or should it be promulgated outside of the normal legislative process. There are several reasons for suggesting that.

First, the conclusion that the levels of heavy metals found in the soils in some of the fields in the state are quote naturally occurring has not been documented in any way, shape or form. Heavy metals tend to accumulate in the soil and build up and persist for extremely long periods of time. There is no basis for concluding that because an area is heavy woods today, that fifty or a hundred years ago it was not the source of significant industrial activity that might have resulted from that contamination.

Secondly, irregardless of whether the heavy metal concentrations are due to background sources, are naturally occurring, or because of human induced contamination, the source of those metals is not relevant to the question of whether it is safe to add additional metals. If heavy metals exceed a safe standard, putting more heavy metals onto the site will not result in a safe situation.

And it is irresponsible to suggest that simply because we have found some problem sites we should abolish the table and turn our head the other way and stick our head in the sand or wherever else you might want to put it and pretend that this problem doesn't exist. The only justifiable basis for adjusting these regulations is if, in fact, there is serious, quantifiable, well documented risk assessment to show that the particular levels in Table 3 are more stringent than are necessary to protect the environment or human health or to maintain

agricultural productivity. To my knowledge, there has been no such risk assessment conducted based on the levels of metals in soil.

The intent of these rules was to assure that West Virginia could continue to apply sewage sludge and other biosolids to lands in an environmentally safe method and to assure that the soils in West Virginia's farms and countryside would not exceed safe levels. That is the requirement of the law. That is a requirement that the Legislature has upheld several times, and to automatically and blindly and irresponsibly, I might add, take the situation where there are some fields that exceed the standards as a justification for abolishing the standards altogether is I think, foolish. I think it's irresponsible and I assure you it is illegal.

I would suggest that DEP should withdraw this proposed emergency rule. I would suggest that we go back to the drawing board and identify some scientifically valid approaches for assessing which risks are real and for determining what are safe levels in soil. If in fact the level for arsenic is more stringent than is necessary, there are ways of adjusting that. We could look at other types of monitoring, bio assays, or leech egg tests for the soils to determine what is safe levels. We could look at a more in-depth risk assessment approach. We could look at other types of approaches. I have here a fairly thick file of scientific literature that I have started to accumulate and I'm going to be submitting more detailed comments later on. But I urge that this emergency rule be withdrawn and that we start looking at a reasonable basis for rule making rather than this approach.

UNIDENTIFIED VOICE: ...confidential

FARKAS: Thank you. One comment- today is a public hearing on the fourteenth. But the public comment period on this proposed change ends on April twenty-fourth. And, so if you have anything that you want to submit today entered in writing, you can give that to me, but if you want to submit some comments based on what you heard today you have until April twenty-fourth to do that and to do that you would send it to Roger Hall, 10 McJunkin Road, Nitro, West Virginia 25143, and I will repeat that address later on. Next person to speak is Barry, I'm sorry, Kemerer, is that it?

BARRY KEMERER: Kemerer.

FARKAS: Kemerer.

KEMERER: That's a tough act to follow, talking about misinformation. Whew.

UNIDENTIFIED MAN: I'd like to submit my speech to the department.

KEMERER: My name is Barry Kemerer. I'm President of the West Virginia Pollution Control Association. Our membership incorporates three hundred members. To suggest that our position is a head in the sand position in itself is irresponsible. But be that as it may, I'd like to give the Association's position on this matter. Our membership is composed of professionals that deal with the design, the operation, administration and all various aspects of the waste water industry. Our association believes, now as it did in 1994 when the Sewage Sludge Management Regulations were first passed into law, that these regulations would be impractical, if not impossible to comply with. These concerns and fears are now becoming readily apparent. The sludge management regulations impose limits on West Virginia soil that are technically unsound and have little, if any, scientific basis.

Members of our organization have accumulated data and supplied such to the DEP showing that the values in Table 3 concerning background metal concentrations cannot be met even in soils that have never been treated with sewage sludge. Some data has even shown that soils have been previously treated with sewage sludge have lower metal concentrations after they have been land applied than before application.

The State of West Virginia annually produces some three hundred and eighty-eight million pounds of domestic sewage sludge. This material, if not land applied, would have to be land filled. According to our estimates, it would cost the voters of the State of West Virginia approximately eight million dollars a year. This would also consume a great deal of space in our few remaining existing permanent landfills, a commodity that is fast becoming very expensive and scarce. This is also contrary to the well publicized concept of recycling and waste minimization. The economic gain of the farmers and others who utilize this resource as a fertilizer and soil conditioner would also be lost. Annually, this economic gain is estimated to be three point three million dollars.

Our association believes that existing federal 503 regulations are more than adequate to regulate the practice of land application in our great State of West Virginia and encourage their adoption in whole. We support the passage of the emergency sewage sludge regulations and encourage the DEP to develop ecologically sound and scientifically defensible rules and regulations along with the guidelines of 503. Our association also believes the passage of the emergency rules is only the first step towards this goal and encourage and supports any and

all efforts that will correct, no matter how well intentioned, the misguided and uninformed efforts of the past. Thank you.

FARKAS: Thank you. Steven Godfry.

STEVE GODFRY: Yes. I'm Steve Godfry, the Interim Plant Manager at White Sulphur Springs. Just a couple remarks. We've estimated that our landfill tipping fees will go from less than one percent to more than twenty percent of our total operational budget if the emergency rules are not adopted. And also, I don't think I've heard anyone mention, I can see the logic of adopting a ceiling on land application for metals, and I can see the logic on doing a background check for metals so you'll know how much you start with. But I fail to see the logic on not being able to land apply because your soil levels are lower than the maximum level you're allowed to start with, where you're allowed to attain. I'm not very good at public speaking. But as long as your background soil levels are below your maximum limit, I don't see why you're not allowed to land apply. We're in favor of the emergency rules.

FARKAS: Cathy Rodriguez.

CATHY RODRIGUEZ: My name is Catherine Rodriguez. I am President of the Concerned Citizens of the Environment. It's an environmental group in Marion County. I am speaking in opposition to the proposed change of eliminating Table 3. I feel that there is not an emergency. Why did not the director come before the legislative session and ask for this change in a democratic way so that the people can have a voice in what they're saying? Right now, we have an appointed official saying what goes on at the State and has bypassed, in my feeling, the

legislative process.

Now it's my understanding from documents that I have seen that you have known about this from at least November twenty-second, and probably before that time. To me, that would have given you enough time to go before the legislature and ask for this relief if that's what you needed. Don't go behind our backs. And that's what I think you are doing to the citizens of this state. Take the time to do it right. Take the time to do the research that is needed. There is a problem. One of our group has talked to Ray Lovejoy in Morgantown, and has stated there is a problem. Okay? Don't wanna put any financial burden on anybody in this state, but please, do the research that's needed before you do this.

Outside of my comments, would like to say that this room is filled, and that's great. This room would be filled even more if this date were not chosen. April fourteenth, Good Friday. How many people in Marion County, I could have had a busload of people down here, except it was Good Friday. People had already made arrangements for family outings and to be away from this, or they had commitments. I have a commitment. I have people coming in from New York this afternoon, but I'm down here, because that's how important I think it is. Maybe the State wasn't that inappropriate, because two thousand years ago a man was betrayed for thirty pieces of silver. And I think that David Callaghan is betraying the people of the state for thirty pieces of silver. Thank you.

FARKAS: Thank you. I'm sorry, it looks like Clade Deakley. [Stun]. Leak. Did someone come with Miss Rodriguez and sign in right after her? I can't read the writing. Is it Bleakley? Leakley? Cleakley?

UNIDENTIFIED VOICE: Coakley?

FARKAS: Coakley? Is that an O? Is that it? Doyle Coakley?

DOYLE COAKLEY: It might be.

FARKAS: Okay. I'm sorry, sir, I couldn't, it looked like C-E and E-L and, sorry.

COAKLEY: My name is Doyle Coakley, and I'm from Webster County. And the things I'm hearing here today and what's led up to it, well, it's kinda like a dog and pony show. The real reason for wanting to do away with Table 3 is it restricts where and how much sludge can be applied to a given parcel of land. In this case, stripmined land. And by restricting the amounts of sludge that can be applied, Table 3 also restricts the profits available to sludge haulers and sludge appliers. Maybe too much.

At a sludge symposium by the West Virginia University Extension Service on July 7, 1992, held at Ripley, West Virginia, a Miss Anne Carcoff- I believe I'm pronouncing that right, and she might be here today- of the US EPA said that because of the enormous problem of disposing of sewage sludge from the eastern seaboard, the EPA decided that the safest and most affordable way to handle the problem for now was to use it for land reclamation on strip jobs. She made three points pretty clear. The decision to bring it here has already been made. And two, we can't stop it. And three, we can control how it is used up to a point. Mr. McCoy was at that symposium with me. Table 3 of the Sewage Sludge Management Rule does control where and how much sludge can be applied anywhere. Like I said, maybe too well, maybe it needs to be changed. But if any changes need to be made, any changes in the Sewage Sludge Management Rule,

especially in Table 3, it should be done in the State Legislature, and not by an agency that has proven to be a lapdog for mining industry and solid waste companies.

FARKAS: Thank you.

COAKLEY: I'm sure you don't like what I said but I'll give you a copy of it anyway.

FARKAS: Well, more than happy to take it.

UNIDENTIFIED WOMAN: I liked it.

UNIDENTIFIED MAN: [inaudible response]

FARKAS: Another Miss Rodriguez.

RICHARD RODRIGUEZ: Richard?

FARKAS: Richard Rodriguez? Okay.

RODRIGUEZ: My name's Richard Rodriguez. My wife, Cathy, spoke earlier. Of course, we're opposed to this. Table 3 was put in there for a very good reason. Somebody mentioned Don McNoughton, like he didn't know what he was talking about. This Dr. McNoughton, chemical engineer, very intelligent person, by the way. They didn't come around with these regulations arbitrarily. West Virginians care about West Virginia. We passed three hundred million dollars to clean up West Virginia, for sewage and water. That means we care. I'm a landowner. Two of my brothers and I, we have over two hundred acres. I'm a coal miner, also. I don't live in a dream world. We have to, you guys talk about spending money, a couple thousand dollars here and there. It's not coming out of your pocket. It's coming out of the taxpayer's pocket. So, we're gonna end up with a West Virginia that's gonna be a dump if these tables are thrown out. And they

said legislators came up with these rules and regulations and we just can't arbitrarily throw them out because we can't meet the regulations. Thank you.

FARKAS: Thank you. Pam Wright? No? Decided not to? Okay.

[END OF TAPE - BEGINNING OF NEXT SIDE STARTS WITH UNIDENTIFIED SPEAKER'S COMMENTS. CLARENCE COX IS LISTED NEXT ON SIGN IN SHEET.]

UNIDENTIFIED SPEAKER (CLARENCE COX?): It's obvious the primary subject today is Table 3. How did we get Table 3? Pretty clear that it's the brainchild of Senator McNoughton. Why did we get Table 3? It most likely involves certain activities related to a particular landfill in Brook County. Who benefits from Table 3? Should be clear by now that landfill operators stand to gain a significant increase in business and income if Table 3 is enforced. Who pays for Table 3? Citizens throughout West Virginia pay dearly for Table 3. Parkersburg alone will incur additional landfill costs approaching a hundred fifty thousand dollars per year at current rates. Also, landowners in our area lose the advantage of a great source of nutrients for their soil which also helps to improve the soil's ability to retain moisture. The value of sewage sludge to farmers is approximately eighty dollars per acre according to the local Cooperative Extension agents in Wood County. How valid is Table 3? When forest soils undisturbed for decades in some of the most remote areas of the state are too polluted with metals according to Table 3 to permit application of sludge, one must doubt the validity of Table 3. When one or more metal concentrations in Table 3 is at or below the minimum detection limits of common lab techniques, one has serious doubt as to the worth

of Table 3.

Has anyone addressed in a scientific matter the subject of metal concentrations in soil used for sludge application? Federal 503 Sludge Regulations take into account background levels of metals in soil. These regulations were adopted as a result of an extreme effort by sincere, qualified and experienced people with a wide variety of skills and interests. The validity of Federal 503 regulations far surpasses Mr. McNoughton's Table 3. What should happen to Table 3? It should be eliminated. Table 3 clearly is not based upon actual field data. It is a serious and expensive theoretical miscalculation. Table 3 is a double whammy, so to speak. State sludge regulations will still include Table 1, which limits the concentrations of metals and sludge applied to land. Concentrations included in Table 1 are lower than those in the Federal regulations, providing an extra measure of protection without Table 3.

One last comment relates to the irony of this situation. On the one hand we have the State Legislature demanding that we not waste valuable organic matter and landfill space by landfilling leaves and grass. Then with Table 3 we are forced to cease proven beneficial use of organic sewage sludge and to dispose of sludge in landfills at a cost much higher than land application. Allow reason and sound judgement to prevail. Approve the Amendment of Sludge Management Rules proposed by the DEP.

FARKAS: Thank you. Derek Hanson. Okay, no comment?

DEREK HANSON: [Response inaudible.]

FARKAS: James Cox?

JAMES COX: Well, just reiterate his comments [inaudible].

FARKAS: Jim Graley?

[conversation between audience members]

JIM GRALEY: Good morning, ladies and gentlemen. My name is Jim Graley. I'm the General Manager of Malden Public Service District. I've been in this business some twenty some years. I was land applying sludge before there was a regulation. On strip mines for beneficial reuse. I have seen gobpiles on stripmines that wouldn't grow anything. It was too hot to grow. Ph of the soil less than two. I've seen a rebalance of the soil come back from beneficial reuse of sludge. I've seen trees grow where nothing would grow before.

This past year, we had a little problem on a gobpile that we were doing reclamation. The problem was that we had grass as tall as I am and we couldn't get our trucks into the field because grass would grow up in around the, and get tangled in the dryshaft and pull the universals out of the truck.

Now, I'm not saying that there is not a need for regulation. But I have reviewed the sludge regulations. I have looked at these in detail. I have discussed them with DEP and I have been at the public hearings and I have been at the Legislature when these regulations were negotiated and put together. Background checks - nobody knew at that time. Senator McNoughton, he had a valid point, but I think the point is mute at this point. I think that we ought to adopt what the 503 guidelines are. Keep in mind that even though that we adopt this change, okay? That the state regulation overall is still four times tougher to meet on the limits, or four times more stringent than what the EPA standards is.

Now I know Anne Carcoff at EPA. And I know some of the problems that she faced in getting the EPA guidelines passed through on a national level. I know that everybody, every environmental group, every industrial group, every person, had input to that process. I also understand that it is very important that we reach a place in our society that cost of service does not bankrupt the household. The cost of service to the customer.

Now, I have been doing this for well over twenty years. I have yet to have a fatality. I have yet to have an environmental concern in relationship to these issues. Dr. McCoy, Mr. Clifton Browning, they are fair but they are also heavy handed. Because it's a double whammy on the POTW's in this state. Ya know, if we don't meet the sludge regs, we're gonna violate in the treatment plant. Well, it's twenty-five thousand dollars a day and a year in jail for offense for an operator to willingly violate an MPDS permit. That's the standard set that as an operator within this state has to live with, day in and day out. I see no other person in this state stepping forth and putting their livelihood, their personal livelihood, on the line every day. From that I can say accept DEP's proposed change and from that I'd say we need to get on with work. Thank you.

FARKAS: Tom Degen. Roger Hall is now joining us.

TOM DEGEN: My name is Tom Degen. I'm on the Board of Directors of the West Virginia Environmental Council. I would also like to add I've done quite a bit of farming work. I farm now. My concern with this rule is that it's been at the federal level and at the state level. It's approached from a waste management point of view. Let's get rid of our sludge. We gotta get rid of it cheaply. Oh,

let's land apply it. The 503 rule does not address concentrations of pollutants in soil, only in sludge. There's nobody out there looking after soil health. And it has not been proven yet that the 503 regs, these numbers that they have, are gonna be protective of soil health, because those levels have not been reached yet in soils.

I think it's very important that we act to protect soil health. I've got quite a bit of literature here I'm gonna submit with my comments. I don't feel that there's an emergency. There are options. Granted, there's some extra cost involved. But we have to keep in mind here that if we destroy crop land there's gonna be a heck of a lot more cost to the taxpayers, citizens, public health and safety than there is in what I calculated to be about fifty cents a month extra to the household if this has to be land applied.

Now if the Table 3 levels are not doing the job, if they're too restrictive, I think we need to do some studies to check that out. Even when they were doing the 503 rule, like I say, nobody has paid enough attention to soil health. It may be that we need to do some studies. But it needs to be done by a much broader variety of disciplines than waste management people. We need farmers. We need soil scientists. We need plant scientists. We gotta look at the soil that the sludge is going on. And while we may amend the Table 3, I don't believe the agency has the authority to delete Table 3, because that would pull the legs right out from under the code where it says maximum soil concentrations may not be exceeded. If we remove the table, there's no numbers to give maximum. It completely undoes that provision of the code. I don't believe the agency has the authority to

do that. Thank you.

FARKAS: Next speaker is Steve LeRose.

STEVE LEROSE: Well, I'm here today on behalf of the City of Summersville, and the West Virginia Municipal League. It is with great interest that I hear, we're on behalf of the DEP. We think that they are an agency that has studied these rules. They are trying to defend the people of West Virginia. Not only us in the sludge business, but the citizens of West Virginia, because yes, it is an emergency. When you take the amount of cost that these rules are gonna stick on the people of West Virginia, your fifty cents, sir, is wrong. And I think what we gotta do, maybe in the DEP, is allow us in the sludge business to take the Sierra Club and all those people, and let them solve their sewage problems by stopping their sewers up. Let them worry with getting rid of it.

Ya know, Summersville, they say it's fifty cents, Summersville put a plant in, three million dollar project, two or three years ago we opened it up under the existing laws. Then we changed the law last year, where we land apply liquid sludge. We put two percent, two percent of our sludge is solids, the rest is liquids. We spread that out over our- we have a farmer here today to testify to what that's done to his farm- well we spread that over an area and we put it out, instead of stacking it up and letting them spread themselves, we spread it in a manner that's safe to the environment. We've been checked by DEP several times. We are inside the guidelines. But if we have to go to take it to the landfill, we'll have to go to a twenty percent solids. That's still eighty percent water we're gonna be charged for. We'd have to spend over five hundred thousand dollars

just to get it up to the twenty percent. It's a lot more than fifty cents. It's taxes on the people of West Virginia.

We have to stop taxing our people. You say, study it. Well, let's study it, but not tax until we find out what the problem is and we have studied it and studied ourselves. It's time that Senator McNoughton tell the truth. The reason he put these rules in- and yes, he's a doctor. A doctor sits there with pencil that studies the chemical solutions but doesn't get out and do the practical study. He was worried about someone coming into his county and bringing out of state sludge. Well, they tried to put a fee on us last year, it would've cost Summersville thirty-five thousand dollars, to stop that. Well they couldn't do it that way. So they put these figures in Table 3. Well, it's gonna stop twenty-two counties now. We don't know how many counties it's gonna be, because we haven't got the reports back from the rest of the counties. They're gonna stick it into the landfills. We can't afford it. It's time that the radicals stop pushing things down our throats and let us run this state in an efficient economical way and a safe way.

We have a lake up there. I'm not gonna pollute that lake. Like I said, we could, nighttime, when Clifton's not watching, we could turn the valve full and throw it all out- cut our cost. We're not gonna do that. Because my kids and the constituents in my community go in that lake. We, in the sludge business, are here to protect the people of West Virginia.

Now, just because you're mad that you don't want someone bringing something out of state, don't destroy the whole State of West Virginia. That's what this is about. About people who are out trying to scare the public that we're

trying to do something unsafe. These men are dedicated. That's their job. They were given that job. They studied it. Become doctors. Become the people that we trusted to run the DEP. Now we let legislators and senators, for political reasons, pass laws that are meant for one reason, for political gain.

UNIDENTIFIED VOICE: That's right.

LEROSE: Now these men have a job to do and they're not here politically or not 'cause if someone changes next year, they're still gonna be there, protecting the people of West Virginia. And yeah, we're here to support you. And the city. And the other cities in West Virginia are behind you a hundred percent.

FARKAS: Claude Butler.

CLAUDE BUTLER: My name's Claude Butler and I'm the person Steve was talking about that they've been spreading it on my farm up there. I'm with the DEP, too. But if you'd come up here and see what this has done to my place. And they took soil samples before they dumped it. Ah, they didn't dump it, they spread it. They took soil samples before they spread it. They come up and take soil samples every time we get one place fixed, they take soil samples and see what's going on the next time. I've had no problem with it. The only thing that they won't do is spread it where I want it. I want the whole thing covered and they stay away from the boundary lines and the creeks and all that stuff. So I'm gonna have to buy lime and fertilizer unless I can talk Steve into getting me some, to build up the outer edges. It's gonna cost me money. This way it's not costing me nothing. And I like it. And you're all doing a good job.

FARKAS: Eloise Wisman.

ELOISE WISMAN: May I speak from back here? I have a broken leg and I can't get up there. I really didn't come here prepared to speak today, but I do want to say that I cannot speak for the metal content of the ground now or of the metal content that is in the sludge that is being dumped. But I can only speak for our condition that I am very familiar with. I am from Tornado, West Virginia, down in Kanawha County, and the land that is adjoining to the street that I live on is being dumped on right now by the City of St. Albans. I do not know how often the DEP comes out. I do know that we have called them repeatedly. Some of the people on our street have even called. We do not have public sewage. But we're taking everybody else's. We have thought that our septic system was going bad and it was not from the septic system. It was from the sludge that the city dumped on us.

My neighbor, who is with me today, they came to talk to us at his property, that they needed to dump it into our two yards. It's gross. There is a rule about that. I don't know how close to our house it was, as I say it now [inaudible], but I do know that on that property there has been condoms found, there have been plastic applicators, Tampax applicators. You can't tell me that's healthy. There have been flies so bad on the houses that one man, well, couldn't even go in his back door. He had to go around to the front of his house around the other side to get into his home. The smell is so bad that we can't have cookouts at our places.

I'm not speaking against the extra dumping of the metal because as I say I am not familiar with the [inaudible] contents. I have seen no regulation or no

information on the metal content for Kanawha County. I have seen some from the other counties, Wood County, I think, and other parts of the state, but I do question and also, the area that I am in is in the Coal River [Chad] area. The part of the land that the dumping is being dumped on, plus, and I'm wondering if this is an emergency approval without giving it some extra thought and without reviewing some of the properties that this is being dumped on. I am wondering how relaxed that this is going to be, and I recommend as Miss Rodriguez said, that this be given extra time. I do not recommend that it's an emergency ruling.

FARKAS: Thank you. The next person to speak is Larry Vernati.

LARRY VERNATI: My name is Larry Vernati, and Miss Eloise is the one that she said that I was the neighbor that flies were so bad on one side of my house I could not go in it. I had to go around the house. The smell is so bad. I moved out here three years ago from Chicago. I was born here, but I left here when I was ten. I came back. I've seen stuff in Chicago you would not believe. I came back here. I felt this was a beautiful place. But what I've seen now, I'd like to move outta here. This is disgusting to smell the condoms that goes down the streams and the [sutch] trucks. Over there on Coal River Road, there's a gentleman said that his, whose got his farm, and he said that the trucks don't want to get too close to the streams. Well, I've seen the trucks go up by the Coal River Road River and wash their trucks out. And where'd this stuff go? Where does it go? Thank you.

FARKAS: Lisa Dooley.

LISA DOOLEY: My name's Lisa Dooley. I'm the Executive Director of the West Virginia Municipal League, and I'm here representing the two hundred and thirty-

three municipalities across the State of West Virginia. There's a critical need for the emergency rules for an environmentally safe and economically achievable process of the land application of the sewage sludge. Table 3 existing in rule forty-seven will be responsible for real environmental hazards, the loss of municipal and pre-treatment plant jobs, and irrational and unnecessary tax increases to the citizens of this state.

Quoting the Office of Water's Administrator in a 1994 release, "for too many years we were simply throwing the resource away, creating contamination problems in other media in the process. The negative public perception comes from the not too distant memories of raw waste water being dumped into our rivers. Existing scientific evidence shows that the safest way to deal with biosolids is to use them beneficially on the land. The area of most concern to the EPA officials were that some states may impose more restrictive requirements than those required under Part 503, and that such excessively strict limits could constrain the beneficial use of these biosolids." As prophetic as it sounded, West Virginia is now one of a handful of states listed as using these stricter requirements.

A few of the interesting reworked environmental laws include the Clean Water Act. As it was put into effect, part of the testing requirements are the testing for a specific pesticide used exclusively by pineapple growers in Hawaii. While this should be a requirement for regions surrounding the use, the act was passed which blanketed municipalities in the farthest regions of the East Coast. Why? Because it was the quick solution to a local problem. It's effects were not

studied to carefully consider the burden it placed upon local governments, nor the testing vital in protecting the environment. Local governments who could not be contaminated were instead forced to pass the cost to a truly unnecessary [tax] to their citizens. Sounds absurd, doesn't it?

In West Virginia, the maximum allowable content of zinc in our drinking water is twenty-two times greater than the maximum allowable content to be discharged into streams. In other words, it's okay to drink it, but to discharge it into the streams is pollution. When we start reworking state environmental regulations over the federal environmental regulations to deal with local problems, we see enormous statewide problems emerge. Table 3, as it exists, does not regulate the sludge, nor does it keep out of state sludge from being brought into West Virginia. Table 3 regulates the soil and, as written, certifies that the entire state is an environmental disaster based on naturally occurring levels. We need corrections to these absurdities.

Our efforts to resolve this problem- and we have tried to resolve this problem- have been sidetracked by a few. In the meantime, every municipality and every citizen in this state are at risk. The so called facts that we have seen in the media are a reminder of the games that are played in this state. Scare tactics of environmental hazards and discrediting a director and a department for acting in the best public interest grab the headlines. Our cities are not asking for weaker rules, nor do they want to allow poisons to be released into the environment. They are asking for rules and regulations which have been scientifically studied and formulated. The EPA spent sixteen years working on the 503 tables. Why is

West Virginia replacing this research with soil concentration standards which were developed without the scientific foundation used by the federal government?

Why does West Virginia again need to reinvent the wheel?

If the rules remain unchanged, cities are told the choice is to landfill. The landfills are under no obligation to store these biosolids. What then? What does one do with the sludge? Store it? If it's stored, there is the environmental hazard, the real environmental threat to our streams, ground water, and water supply from untreated, untested sludge. This rule allows for nothing more but a step back to a past of environmental indifference, instead of a scientifically proven, safe, and the most beneficial use of these biosolids.

In conclusion, the emergency that exists is not the threat to municipal government, it is the immediate threat to the citizens of this state. West Virginia citizens deserve to be protected from being forced backward. Cities cannot bear the burden of an additional two and a half million dollars annually. The citizens have demanded that the increase stop and the belts of government at all levels be tightened. They are demanding that the laws which are written to protect them are based on sound facts and full consideration of the impact each will have upon them. If city budgets are strapped with existing unfunded mandates, this additional cost will be labeled as a tax increase from the State. Or, the cities will be left with one more choice- to cut the essential services provided. Which will go first? Police? Fire? How effective is a budget set at a local level when checks in excess of two million dollars in the form of needless landfilling are being written on a state level? We urge the amendment to the existing rules.

FARKAS: Kim, I'm sorry I can't read the last name.

KIM DEANE: How about Deane?

FARKAS: Excuse me?

DEANE: Deane.

FARKAS: Are you from Mount Hope?

DEANE: Yes.

FARKAS: Then that's you.

DEANE: I also am not a whole lot on public speaking. I didn't have a lot of time to prepare some nice statements, 'cause I was busy doing my job, keeping the sewer out of the creek. My community is a very small community. I have only about five hundred and thirty-nine customers. I live in an economically depressed area. If we have to stop land application of sludge, I've heard a lot of big figures mentioned in the room about how it's gonna affect people all over the state. I can't speak to that. I can speak to my community. We recently had a new sewage facility built about three years ago. It's a good facility. It's a well operated plant. We had to have a rate increase, of course, at that time to compensate for the new construction and pay for the operation of the treatment of the sewage. If we have to go to landfills right now, we're looking at our current sludge production rate of a cost on the year of about twenty-two thousand dollars a year. Our customers are paying right now an average of twenty-five to thirty dollars a month for sewer bill. If we have to do that, we're gonna kick up another twelve dollars approximately a month on each person's bill. I don't know how much money you people make, but we can't afford it. The people in our

community can't afford it.

Somebody previously mentioned that they passed three hundred million dollars to pay for the cleanup of sewage in the state, and that's good, but is that money gonna pay for disposal of sludge in landfills? I don't think though. It's gonna build the plants that are gonna produce it. So we're gonna produce more sludge all over the state. But it's not gonna pay for putting it in a landfill. We're gonna jack rates. That's what we're gonna do.

Another person mentioned that there was three point three million dollars estimated saved by farmers in fertilizer cost a year through land application of sludge. If we stop that, they're gonna have to pay for that fertilizer. How many farmers are we gonna put out of business? How many farmers can we keep in business because we're putting sludge on their property and increasing productivity of their land?

I've heard a lot of people say well, let's take some time and let's wait and study this situation. What am I gonna do with my sludge while I'm waiting on everybody to study? Am I gonna just keep on piling it up and piling it up? I gotta do something with it, ya know, and I can't afford to go to landfill with it. So, ya know, there is something needs to be done.

I don't understand why the State superseded the federal reg. I know we don't have a lot of faith in our government, maybe. Maybe we do, but if the fed established a reg and we established a more stringent one, and now we've got a problem, why don't we just fall back on the federal reg until such time as this study that everybody wants to do is done? A lot of people can apply under the

federal reg but can't apply under the current state reg. So why don't we do that? If all the plants are gonna go to landfills, and this is gonna exceed the acceptance limits of the landfills, and we're gonna build more plants with this three hundred million dollars, we're gonna produce more sludge, and we can't put it in landfills, so as somebody said we're gonna have to take it out of state. And, it's gonna be a lot of money. Also, about the state reg, I believe there's twenty-two or twenty-eight counties in the state that the metals limits in the land already exceeds the limits. If that's a hazard, what are we gonna do with that land? We gonna strip it up and take it to the landfill? Or we gonna build machines that go in and strip these metals out of the earth and run 'em across these farms? Clean 'em up for these guys? Or what? That's all I have to say. Thank you.

FARKAS: Thank you. Douglas Amos.

DOUGLAS AMOS: Thank you. My name's Douglas Amos. I'm with the Fairmont Sanitary Board where I've been Superintendent for the last seven years. I'm here also today, Mr. Tom Ervcart, General Manager of the Morgantown Utility Board also asked me to make comments and to read a letter which I'll submit to you. I'll take care of his letter first there.

It says in 1994, the West Virginia Legislature passed a law regulating the beneficial use of sewage sludge. This law established limits for the background soil concentrations prior to any land application of sewage sludge. These limits imposed on the native West Virginia soil were arbitrarily set with little or no scientific basis and are not as purported by some to be EPA recommended values. These arbitrary limits are commonly referred to as the Table 3 in the Sewage

Sludge Management Regulations and from there, as well as in the letter that we'll submit to you from the Sanitary Board, there's pretty much the same rhetoric that we've heard from my constituents.

We've heard each point to be made. You know, there is a problem. We do need to address it. One thing that I haven't heard brought up that I'd like to say is, in Fairmont, we're one of the larger producers of sewage sludge in the state. We produce about four hundred wet tons a month of sewage sludge. We've been land applying for nine years. I've never had a single problem with any of my users in Fairmont. The farmers love it. It's beneficial to the farmers. I've not heard anybody say, ya know, we've had a problem with this farm. We've had soil contamination that's documented, ya know, in this county or that county because of the application of sewage sludge. We've not heard anybody get up here and give a documented problem and like Jim Graley, I think, said he'd been doing this for twenty years. You know, we've had some odor problems, and I see the lady raising her hand back up there. I know you all had some problems, but I'm speaking in generally, do you have a health hazard there?

WISMAN?: Yes.

AMOS: Is that documented? I mean, is there...

UNIDENTIFIED MAN: ...dirty diapers.

AMOS: Is there a health hazard there? What I'm saying is, we've had no documented problems with any of our users. No, there are regulations on where you're supposed to stay away from the boundaries of neighboring farmers and so on and so forth. That's up to us in the industry to be sure that we go according to the

regulations and to be sure that we're good neighbors to the farmers of the people of the farmers that we're applying to that we're good neighbors to their neighbors as well. And I think by and large, ya know, the POTW operators across this state are. Now there are a minority. In any organization that you look at, you're gonna be able to point the finger at a minority of people who has done something wrong. But I believe that my constituents across this state are professional people who want to do things right. We live here. We eat here. We work here. We're just as concerned about the environment as anybody in here from the Sierra Club or any other environmental organization. Ya know, we're committed to the environment. And like Mr. Graley said, every day we get up and go and we're committed to protecting the environment in West Virginia. That's the way, that's, ya know, somebody said about Dr. McNoughton. Nobody brought up how about Dr. McCoy? That's Dr. McCoy, too. And these individuals up here who are also committed to protecting our environment. And in short I'd just like to submit these letters from the Fairmont Sanitary Board and the Morgantown Utility Board and we would like to urge that Table 3 be removed. Thank you for your time.

FARKAS: Eddie Bassett.

UNIDENTIFIED MAN: I was seated with Miss Wisman and she has comments.

FARKAS: Ma'am. Ma'am. If you... after the hearing is over. Thank you.

EDDIE BASSETT: My college professor always told me that a picture is worth a thousand words.

FARKAS: That microphone's not on.

BASSETT: How come?

FARKAS: This one's not.

BASSETT: Why I can spit out on these [inaudible] Anyway, when I was a kid growing up and I was ten years old. [You see...inaudible] I was moving the St. Albans sludge in the basement of my house when I was a kid. And the reason we moved that was 'cause every time the rains came and the sanitary sewers flooded, and the storm cellars flooded, I got that word sludge in our basement, okay? I had to move the sludge. And I land applied it out in the front of the house on the field out there, and I also mixed a little bit of lime with it to keep the smell down. Miss Wisman, I've never had a call from you folks out there. If you would've

WISMAN: [inaudible] I called three times.

BASSETT: Excuse me, I have not. Been there nine years. If you'd called me, I'd be up. Mr. Covert, I'm sure, would positively be up. But let me assure you that I will be up. We'll come on out to see ya, okay?

My problem becomes is I support this rule on this sludge because I think we need it and I think it needs to be done. The problem becomes is it becomes like solid waste. Solid waste in St. Albans, started out this past year, we start out at twenty-seven dollars, okay? We went to thirty-five dollars, okay? We went to forty-seven dollars. Now where do we go from there? My problem becomes is nobody gives me an answer to my solution of my problem. My problem is what are we gonna do with the sludge, not a year from now. Five years from now where're we going to? Now has anybody got that solution? And that becomes a problem we need to look at.

We need to relax these rules. We need to come up with a theory as to

where we're gonna go 'cause we have people we respond to. We have constituents we respond to. And let me assure you, when I get my sanitary bill, I go in and tell 'em I'm the mayor, and you know what they tell me? They want the payment. When I go in there and tell 'em I'm the mayor and I want this paid to my water bill, they tell me they want the payment. We're not any different than you. We're still taxpayers and we have to pay the taxes. And my taxes go to Washington just as well as the next guy does. And they don't relieve me of any exoneration because I'm the mayor of anything else, but I agree with Steve LeRose, even though we're on different parties, that we have to answer to the taxpayers and we have to answer to the voters. And unless we're responsibly sound, we have troubles.

And Dr. McCoy comes to visit me and fines me because I like the paying fines, he says, but do you think I want the rivers dirty? Do you think I want the streams dirty? Absolutely not. For the simple reason that the future generations we have to take care of. The kids today are twenty-five percent of today but they're one hundred percent of tomorrow and we need to take care of those kids. And there's an old statement goes but I ain't, believe it or not, I care, I care about what happens to the lands of the State of West Virginia. So that's my spot, thank you, and I'll write you a letter about it.

FARKAS: Thank you. Martha Huffman.

MARTHA HUFFMAN: First of all, aside from all the other comments that were here I'd like to set the record straight on Senator Dr. Don McNoughton. He was not just a senator out there doing something for political gain. He has been a member

of the New Martinsville Water and Sewer Board for over twenty years. The city of New Martinsville used to land apply sewage sludge but due to odor problems and due to heavy metal contamination they stopped it.

Now, second off I'd like to agree with Mrs. Rodriguez and what she was saying. I am not happy to be here today. I'd like to say I am but I'd be lying through my teeth. I'd much rather be at home dying Easter eggs with my children. The preposterous timing of this whole hearing and the whole politics of having this hearing, believe me this is a political hearing, this is not a public hearing. The politics of having this hearing on Good Friday shows that we're trying to crucify justice here in West Virginia. Because each and every one of you POTW people that are here realize that this bill was before the legislature and it was killed deader than hell because the people of West Virginia did not want it passed. But now that the legislature is gone home, here, behind closed doors, on Good Friday, we sit here and we try and bury the problem.

Now I'm not going to sit there and deny that perhaps the DEP has done overkill which they have done in the past. In doing their background analysis of the existing soils, of the heavy metal content and the numbers that are in Table 3. But the numbers from Table 3 did not come up out of thin air. This is not someone's imagination. These tables came from the surrounding states that are facing similar problems. New York. New Jersey. Pennsylvania. Places that are coping with copious amounts of sewage sludge being land applied at enormous rates. So what did they do? They did the sane and sensible thing and they sat there and limited the quantities. You can't say it can't be done. They were trying

to do a rational and sane limiting of the quantities. So what I propose as a reasonable solution here is something that's already contained within the provisions of the sludge regulations as they exist right now.

If you, if for any reason the contamination of the soil and the contamination of what the land application's gonna be, there are provisions for a variance for three quarters of the year, that you can sit there and get by. Well we've got at least three quarters of a year before the Legislature comes back and reconvenes. Let's do this rationally. If the numbers in Table 3 need to be readjusted, go ahead. But I have one thing to say. There is no emergency right now. You have the provision of the variance for at least three quarters of the year. Use that variance until we can sit down and rationally study this.

Now, once again the DEP has fabricated a nonexistent emergency to weaken sewage sludge regs that were discussed for over a year. Every person in this room, every person of this state, had opportunities [ad] nauseam. I am so sick and tired of going to public hearing I could throw up. Indeed this same change is before the legislature this year and our elected officials saw no emergency. The bill died because the people of West Virginia told their elected officials they did not want a change and there was no emergency. My purpose for being here today, one more time, is to say there is no emergency. Do not change. Don't drop Table 3.

So here we have a proposed so called emergency rule that flies in the face of the legislative mandate 22-15-20(b)(6) that says that no [persody] or entity be allowed to apply sewage sludge to land in a manner that will result in exceeding

maximum soil concentration for all pollutants including but not limited to arsenic, cadmium, chromium, copper and zinc. This portion of the code mandates that Table 3 has to exist. You can jack with the numbers but you can't eliminate the need for the table unless you want to fly in the face of the law. By eliminating Table 3, the DEP effectively proposes to break the law, this has been mandated by the State. [END OF TAPE] I say there is no emergency. Don't change the rule.

The State of New York has gone one step further. During their 1993-94 Legislative Session, their Assembly passed, they passed Assembly Bill 6171 that prohibits land application of sewage sludge on agricultural land in order to protect a valuable, nonrenewable natural resource. I recently learned of alleged reports of sludge from POTW's that were receiving untreated poultry sludge being directly applied to land where livestock graze. The livestock allegedly died from arsenic poisoning. If the DEP pursues in pushing weakening of the rules and regulations, documentation of aspergillus, which is an airborne pathogen, and other airborne diseases that are caused by sewage sludge can be provided to strengthen the rules and regulations. Again, I say, there is no emergency. We can go either way with this, guys. But don't change the rule.

In eliminating Table 3, the DEP would allow contaminated soils to be even more contaminated. This could potentially result in the contamination of groundwater and surface water. This negate the rule's claim that there would be no adverse impact on property owners, and talk to the people in St. Albans who think there's no adverse affect on property owners for land application of sewage sludge.

Again, I say, there is no emergency. Don't change the rule. As West Virginians we can be proud of West Virginia's solid waste and sewage sludge legislation that is a model for our nation. Let's maintain the gains and not go backwards. There is no emergency, don't change the rule. Thank you.

FARKAS: Shirley Mullett.

SHIRLEY MULLETT: I didn't really come to speak, but I feel like I want to get a few things off my chest. I did come down to the legislation when the sludge rules and regs were being discussed, and I was told that it was dead, don't worry about it. I said, well, those dead things sometimes raise their head again. And I was told no, it's not gonna happen. Now a year after the sludge rules and regs had been passed, I find that the legislation was gonna fail to do it so let's circumvent the legislation and do it like we do a lot of other things. I don't think it's fair to West Virginians. I'm not a POTW. I understand that they have a problem. They want to get rid of their sludge and they have a problem with economics. I don't think that we can take a chance on the welfare of West Virginians to try to make it cheaper, and I think that the people of West Virginia should have a chance to pay more if that's what they're willing to do.

I'm willing to pay more to make sure that our water is safe. I'm willing to pay more to make sure that the soil that vegetables are grown in are not contaminated. You talk about the testing. It seems like nobody really knows, but even with the Drug Administration, they don't rush out and let somebody take the drugs until they've been thoroughly tested. West Virginia ground levels, if they're contaminated already, we have to consider that.

Now if sludge is good, and you want to put sludge on it, I know that there's a lot of nitrogen and stuff that the plants use. But along with that there's a lot of heavy metals that can affect our children's future. You keep hearing about children having high level of lead and you wonder where it's all coming from. This arsenic thing, I don't know a whole lot about that, but I'm concerned about it and I think that we don't need to drop everything down to the federal 503's that are supposed to be so protective, when we know that they've been watered down from what they originally were meant to be. If you look around and you look at what Canada and some of the other, Netherlands, they're concerned and they seem to be more concerned. They're more stringent than we are.

West Virginians have a right to be protected and we have a right to go through the legislation. And even though we sometimes worry about that. I think that we need to do it the right way. I don't think we need to come in from the back door and try to do it that way.

And I want to see our soil safe. I can tell you when I go to the store, and I pick up a piece of vegetable. I'm not always, and, I'm not always looking for the one that's the biggest and the brightest. I often take potatoes that have sprouts, not the ones that've been treated. If I see an apple or another vegetable that's got a hole in it where the bugs have been eating it, sometimes I feel like, well, maybe that one's safer. Why wouldn't the bug survive in the other one?

Now, the sludge, you spread the sludge and you take a picture and you see the pretty green foliage that's growing because of the nitrogen stuff. But you have

to consider that you're getting a lot of metals in the municipal sludge. Everybody keeps talking about the high metal content in the soil but I don't hear anyone talking about cleaning up the sludge. Maybe it's necessary for us to do more pretreatment or maybe it's necessary for us to separate some of the industries that are causing high contamination. If the sewage sludge turns out that it is good for agriculture, or for reclaiming mining areas, let's at least limit it to those areas where the background plus the sewage sludge is at a safe limit. And if you have to clean up the sludge, clean up the sludge. And if the soil's already too high, it's already contaminated. You wonder why it's already contaminated, and let's not add to it. You don't want to flush West Virginia down the sewer, too.

FARKAS: Barry Milam.

BARRY MILAM: I don't wish to comment.

FARKAS: Raymond Peak. You have a question mark whether you wanted to comment.

RAYMOND PEAK: I think everything's been said [inaudible].

FARKAS: Do you, are you going to make a comment, sir? If you are, then I'd appreciate if you could come up here so I can record it.

PEAK: You might not want to record it.

FARKAS: That's okay, we'll...

PEAK: I'd like to preface my couple remarks with a little story. There's a little boy came home, twelve years old, and asked his mother, he said, "How old are you?" His mother said, "That's one thing you never ask a lady." The little boy came back later and he said, "How much do you weigh?". She said, "That's the second thing you never ask a lady." Came back in a little while and he said,

``Mother, how come you and Daddy got a divorce?" And she said, ``Well, when you're fifteen I'll explain that to you." So the little boy went back to school and was talking to some of his buddies and he said, ``Hey, all you have to do is look at her driver's license." And said, ``You sneak in her pocketbook and get her driver's license and you'll find out everything you wanna know." So, the little boy did. So he walked in the next day and he said, ``Hey, Mom. I know how old you are." And she said, ``How old?" He said, ``You're thirty-nine." ``How did you know that?" He said, ``That's nothing." He said, ``I know how much you weigh." She said, ``How much do I weigh?" He said, ``A hundred and twenty-nine." He said, ``Well, I know why you and Dad got a divorce." She said, ``Why?" And he said, ``Cause you got an F in sex." [laughter from audience]

Now, this is the same thing that we're going through today.

FARKAS: I'm glad we have that on tape. [laughter from audience]

PEAK: You know, it's misinformation and one group here saying this, this, and this.

And you got another group saying this, this, and this. And we don't have the real facts on everything. The only thing facts we have is, in my city, we don't have any problem with the land application because the land we put it on, the metals are not high. I don't know, and maybe some of the other counties need to bring a suit, with it being Good Friday, against God, I guess, because there's too much metal in their land. I don't think there's been too many plants up in those wooded areas.

I also think that we need to use good common sense. We gotta take care of our people. Our people can only pay so much. We were paying twenty

dollars a ton to dispose of our sludge. If we- we're land applying it now- if we took it tomorrow, it would cost us forty-three dollars. Our people can't afford that. Everybody says Teays Valley's rich, but in Hurricane we're not all rich. I was a school teacher all my life, in addition to being mayor. And I didn't make that kind of money. We've got to use good sense. Let common sense prevail. Let's put this, pass these regulations, the emergency regulations, and give us time to work this out and then we'll all work on the problem as we have in other things in West Virginia. West Virginians are not dumb. We're smart people. And it just takes time to get it done and we'll do it right if we're given the time. Let's change these regulations and I don't think you sold us out for thirty pieces of silver, either. Thank you.

FARKAS: Dwayne Ernest. No? That concluded the list of people who indicated the desire to speak. For those people who would like to make a comment at this time, if you will raise your hand. When you come up to the microphone and give your name, then we'll proceed. Sir.

DAVID SUTHERLAND: Yeah, David Sutherland. I was on the list; I deferred. I hoped I wouldn't have to speak, but,

FARKAS: Remember, five minutes

SUTHERLAND: it looks like I ought to. Yes, sir, I have that in mind. Okay. And I can't give you everything that's in this book here this morning. I'm from Augusta, in the County of Hampshire, about two hundred and fifty miles from here. And I'm here individually. I didn't ask any people back there to sign onto this stuff. For me, it's technically complicated. Perfectly clear, that y'all are asking we throw

out the baby? with the bath.

We've got a statute says you're supposed to control cumulative pollutant [levels] with workable figures. And yet the people here, I've seen where the last time same witnesses, same testifying, the whole thing, before the law was passed, saying you shouldn't do that. There's a reason for that. The sewer treatment operators here today are proud of their [output] and they're doing everything they're supposed to as far as 503 goes, and it's irritating to have it turn out a field they've picked out doesn't pass the test.

Now, I hear about the Summersville plant, it touches me. We got the [Romley] plant up there about the same. Far as I know they haven't done any harm, and I'd like to see it a long run. That the people that've been spreading this stuff on the farms in the area can go on doing it, where it doesn't do any harm.

I am a little surprised at the enthusiasm for the federal level here. I'm not gonna descend to this rustic humor, but I'm gonna pull something out of what I read in here about the way they did these federal regulations. They assumed that a seven year old child would eat two-tenths of a gram of sludge per day and they tested to see if the child would be hurt if she ate that two-tenths of a gram every day right along. And that's the way they set the health limits in this stuff. Now I suppose these learned scientists that you all are [putting your hand on the line] scientist, if they were here they could tell me, why the kid would eat the sludge in the first place? But on the other hand, if she ate the first two-tenths of a gram and keep eating it, she probably likes it, and wouldn't she eat more as the days go

by? I don't think there's any magic in these federal regs.

The main thing, as somebody here said was, they had to get rid of the sludge from up the East Coast somewhere. It was all piling up and they provided regulations to put some kind of limit on that sludge. Notice, I'll make a little sense here for a minute. Under the federal regs, the history of the land you're putting it on begins on July 20, 1993. It doesn't matter how bad it was or how much stuff was in the ground, that's okay. The operators, I take it, could figure back to July 20, 1993 and what had been put out and you can keep piling it on that place however poison it is and however poison it's gonna get. Now, from the federal point of view, as I read these regulations- that's all I know about them, what I read- is that they were strictly limiting their controls to the plant operator. They left it to a landowner to protect his own land. Alright, that's fine. Maybe they were thinking of places like Kansas where there's lots of land, and a lot of land down in Texas. You can spread this stuff for, ya know, a whole lot of [inaudible]. West Virginia has very little arable land and our legislature has seen fit to try to protect that land. And how come you have to protect it? Well, I've got a study here which I assume will be turned into you by somebody.

The problem is the occasional farmer that's down on his luck. And he's willing to sacrifice his land here and now for some cash and, as the learned people say, cut his children off at the ankles. We've got one of those up in Hampshire County. Right now he wants to contract to take an estimated seventy-eight tons per hour of materials from Baltimore and dump it. I think that the land's too low lying for that. And if he thinks of sludge, he's gonna be putting sludge on there.

And the heck with the inheritance reg, just pile it up. I think these regulations are aimed at people like that, the occasional bad actor down on his luck [inaudible] found a couple more around the county. This isn't a typical farmer that really worries about these things, but the one that's ready to go out of farming anyway. And finishes it out with a cash lot so he can retire to Miami and Lord knows what'll happen to his boys. The State has seen fit and it's in the law, that cumulative pollutant concentrations be figured starting at, some of you all admit, starting by testing what's in there already. Now, you've got field reports which your [inaudible] lady was good enough to send down here. And what they recommended was a review of the limits. Now I can't say whether the data you have is solid or whether it's something in the lab reports built up the arsenic, that'd be up to the people in charge of this thing, but, the statute says to set reasonable limits. If you've got the background to do it, go ahead and make room for Summersville and the other plants here that apparently aren't doing any harm. But the idea of protecting the soil as well as checking the [output] from the plant is a critical one, yet the law says you aren't supposed to lose it. I don't know how you're proposing to make this regulation good anyhow, but in any case, it's a bad idea.

Let's see. Oh yeah, it's not that this stuff isn't entirely free of risk. I had a report from Virginia Polytechnic and they were very proud of all the grass they were growing on the reclaimed land, but then it comes along down, it says of course we wouldn't confess we have milk cows graze in this stuff. We couldn't have beef cows eat it 'cause it might have bad stuff in there. But, most of the

faculty at Cornell made a report adverse to spreading this stuff on agricultural land in the great State of New York, where most of this stuff comes from. And they were worried about- ah, I won't bother to look it up- but it had to do with male fertility and female gestation. You don't wanna let this stuff build up in the soil to the point where we start having problems like they had out in Vietnam. That's what this is about. I can't tell you whether you've got a solid basis now or whether you'll have to accumulate more data around the state. I haven't got any figures from Hampshire, either. The plant is paying no attention to you. Or, we've got good soil up there; it's very acid. I don't know. Maybe you need to check the rest of the state before you change these things.

Ya oughta comply with the legislative requirement. Stick with the legislative law. We don't need to re-debate the debate the Legislature had, that oughta be over. But I hope within the fullness of time we can put a ceiling over some of these plants.

Now, they're talking about emergency. One thing nobody's mentioned is the possibility of composting this stuff and waiting until it dries up, put it in bags, put it [inaudible] state so that people put it on their lawns. That would be a very desirable endpoint in this stuff. Maybe it's too complicated, ya can't do it, I don't know, I'm not in the business. But I don't think, ya know, the idea we're conjuring up an emergency out of a few, like Chicken Little. Where the little nut fell down, and she said, ``Oh, the sky is falling!" I think this oughta be addressed in a reasonable basis. Put a ceiling over reasonable soils, so that they can go on disposing of it through land application. But don't throw out the baby with the

bath. Thanks.

FARKAS: Thank you. Anybody else who has not signed up, but they'd like to speak?

Please, give your name.

UNIDENTIFIED MAN: Yes.

FARKAS: Please give your name.

UNIDENTIFIED MAN: ... briefly

HERB ICE: My name is Herb Ice. I'm a private citizen, [I] live in Tyler County. I was gonna make, I'll make written comments. I didn't think my ideas were that novel, but I have three things I haven't heard mentioned here. I missed the first part of the meeting.

Number one, Table 3 doesn't preclude the deposition of sludge on all land in West Virginia, just some of it. So, my first question is, what percentage of land are we talking about, that's going to be excluded from the deposition of sludge? I don't mean on a county by county basis, either, where the statisticians can play their little games. I mean, on an acreage basis. What percent of the acres of West Virginia are so high in these contaminant metals that you cannot apply sludge to them? That's number one.

Number two, it's been pointed out that the Table 3 was based on values garnered from surrounding states that have that type of protection for their own land. Now, when the West Virginia Department of Commerce goes out and tries to entice industry into this state, one of the arguments they use for putting a plant in West Virginia is that we're within five hundred miles of fifty percent of the population of the United States. We're also within five hundred miles of fifty

percent of the sludge and solid waste in the United States, so keep that in mind. If you monkey around with Table 3 and throw away your protection, what you're gonna do, is you're gonna encourage these surrounding states which have the more stringent regulations. That sludge is gonna come pouring into West Virginia. And all these people here that are so concerned about their little water [waste] treatment plants, little I mean by comparison. I'll venture to say that for every ton of domestically produced sludge that's deposited in the state that's high in metals and things like that, you're gonna have ten tons of imported sludge. So if you weaken, if you do something drastic to Table 3, keep in mind, you're not just helping yourselves, you're helping all the neighboring states to come in and take advantage of that. So think about that.

And my last comment is, if we are gonna tinker with Table 3, let's do it on a considered basis. It's not an emergency. We have time. Let's do it by an impartial group. I don't have that much confidence in the DEP. I'll say that. The management of DEP. Down there in [Tyler and Webster] County over the past seven years we've had a lot of bad experiences with the Solid Waste Management Group as far as policing local landfills. So, if Table 3's going to be changed in any way, it should be done by impartial people over a period of time through the legislative process. This is not an emergency that has to be settled now. Thank you.

FARKAS: Would you like to make a comment?

MEL BIRCH: My name is Mel Birch and I live in Tornado, where we have one of the local problems, and maybe that is just local, but I'd like to say this. I did not

come with the idea of talking today. I wanted to see how [a plant], and I realize that some of our areas that the bigger cities have got problems, but what happens to us folks that live out of town, is we're the ones that end up suffering for your problems. We get it dumped in our area and it lowers our quality of life that some of us moved out there for. I know there's a cost associated with it and ya gotta weigh those cost and the benefits and everything. I kinda got a question, it may sound a little bit facetious to you, but if this stuff is so safe, then why don't you take it home and dump it on your own yards instead of bringing it out in our area and dumping it on us?

And again, just to kind of sum up, I don't think that it's, it's something that we've gotta look at and see what we can do. But I don't think relaxing the standards may be the right answer.

FARKAS: Thank you, sir.

FRANK WHITE: My name's Frank White and I'm from the city of Richwood. I've worked in wastewater for fifteen years. We have land applied sludge for many years and to my knowledge we've never had a problem. I don't know how many places in the state are having problems with metals in the soil but I also do not know what kind of research went into setting those levels by the Legislature. I'm a member of our local City Council and if the State Legislature is anything like our City Council, most of the time they don't know what they're doing anyhow. I would certainly think that suspending this rule until research can be done to assure that nobody is gonna hurt anything by disposing of their sludge would not be a problem. I think the DEP, for the most part, does a good job. And I'm not

saying that so they don't come up and jump on me. But I don't think that a bureaucrat is anything but a bureaucrat. I mean, they don't have the technical expertise to make decisions other than on information they're given. Now if they're given [all the] information, they make quality decisions. So, I would be in favor of suspending the rule.

FARKAS: Thank you. Okay. Miss Wisman, did you want to add or...

WISMAN: Yes. Yes, I did. Something that I didn't get to tell to the gentleman talking about the health hazard. One of the things that did happen to us was they dumped the sludge. Four days later the people came in to mow the house and in less than two weeks the [hay itself] with the condoms and the applicators and sat down and told the department that [infested] their animals. This is a health hazard. When someone came out from the DEP to check it he said yes, he's been over it. There had been found about eight or nine or ten, I believe, applicators he told me. [inaudible] this man. As I said, the problem has been is that they have been put down into the ground with machinery or [bailed into the house.] And this is what does concern me about the relaxation of some of the rules. If this is happening now, what will happen when the [inaudible].

FARKAS: Thank you, Miss Wisman. Do you...

UNIDENTIFIED MAN: I just wanna ask a question...

FARKAS: ...oh, can you wait until, do you have a question about this?

UNIDENTIFIED MAN: Yes.

FARKAS: Okay. We, at the end of this period, we'll open it up to question and answer, okay? Let's just get through the public hearing and then we'll open it up for

question and answers. If there is nobody else who would like to put a comment on the record, then I'm going to close the Public Hearing. Okay? In closing the hearing let me tell you that copies of the tape, we've been taping your comments. Those are available. It's a tape and a half so it'd be ten bucks. If you'd like a copy of that, you can contact me at the end of the hearing or you can send me a note. My name again is Brian Farkas. The address here is 10 McJunkin Road, Nitro, WV 25143. The comment period does end on April the twenty-fourth so if you'd like to put some written comments, submit written comments to the agency based on what you've heard today or want to do some additional research and send some technical information to us you have until April the twenty-fourth to do that. With one more comment, again, when the regulations were filed, there was a margin glitch on printing and some of the values, I believe it was on page thirteen, were dropped off the one that was filed. I do have copies of the corrected version up here. If you would like a copy of it, I'd be more than happy to make that available to you. And with that, if nobody else wants to make a comment on the record, I will then close this, yes, Mr. [inaudible]

MAN: Yes, one comment I'd like to add is that these pretreatment plants applying the sludge to the farmer's land. When it does become contaminated, who's liable?

FARKAS: Okay, let's...

MAN: ...who does the farmer turn to? The State? Or the ...

FARKAS: Can we, let's address that, but let's address that after we close this public hearing out. It's a good question and we will address that question. So let me close the hearing and then we'll go into the informal, then we'll go into the

question and answer period. Okay?

(MCCOY?): Could I just interrupt one thing before we get going? Clifton has a previous engagement and if we've got technical questions about some of those application regs and some of those sorts of things, I'd prefer that those might be asked first while Clifton is here. We also have James Summers in the back, who does the inspections work and visits the sites as well as the representative from the Extension Service, he coordinates it, and I can't remember his name...

UNIDENTIFIED MAN: ...Ray Lovejoy

MCCOY: Ray Lovejoy. So if perhaps James and Ray could come up and between us we could answer those questions.

FARKAS: Okay, so I'm going to turn off the tape recorder now, unless Mr. Sutherland [inaudible]

(SUTHERLAND?): ...my company

UNIDENTIFIED MAN: I didn't know you had a job.

(SUTHERLAND?): ...incorporated the federal regulations, has instructions on how to make your computer show certain tables. Are those figures of any use in regulating this material? We've filled in the blanks where they didn't get the last two digits

FARKAS: Okay, well let me...

(SUTHERLAND?): What about those...

FARKAS: We'll address that, let me, I don't know the answer to that right now. Let me just, let me just close the public hearing unless somebody else wants to put a record on it, comment on the record. No? okay.

[END OF TAPE]

**RESPONSE TO PUBLIC COMMENTS
SEWAGE SLUDGE MANAGEMENT RULE
TITLE 47, SERIES 38D**

BACKGROUND

The announcement of a public hearing and public comment period for the amendment to CSR 47 - 38D was filed with the Secretary of State's Office on March 22, 1995. On April 14, 1995, a public hearing was held at the Division of Environmental Protection's Headquarters' Office in Nitro, West Virginia to receive written and/or oral comments concerning the proposed amendment to the subject rule for land application of sewage sludge. The reason for the amendment is based on technical problems noted during the first year of implementation of the Sludge Management Act. During this initiation period the agency determined that a rule amendment was necessary, because analytical reports of metals concentrations in soils indicated that many soils in their natural state could not meet the minimum standards for land application of sewage sludge. Because this result was totally unexpected and was effectively precluding the land application option, the rule amendment was filed as both an "emergency" rule and a "legislative" rule. The "emergency" rule was determined not to satisfy the requirements of an emergency and was therefore not approved by the Secretary of State's Office, and has since been withdrawn.

The public hearing and concurrent public comment period offered the opportunity for comment on both rules which differed only in terms of the filing process. All comments received were individually reviewed and classified as to general themes. The following responses were prepared.

PUBLIC COMMENTARY

Comment:

1. Many commentators expressed concern that the agency was proposing to relax requirements related to pollutant levels in the sewage sludge as reflected in Table 1 of the rule.

Response:

The agency is not proposing to amend Table 1 requirements. The amendment in question relates to soil concentration levels for those metals which are contained in Table 3. Information generated over the course of the first year of implementation of Table 3 has made it increasingly apparent that the soil limits contained in Table 3 will severely restrict, if not

prohibit in many areas of the state, land application of sewage sludge. The agency does not support a practice that will adversely impact the environment; however, the agency does have concerns about the establishment of soil concentration limits that appear to have been developed arbitrarily and without adequate scientific research. The result of the agency's one year of experience is that natural soil concentration levels already exceed Table 3 levels. The proposed rule amendment addresses the problem by eliminating Table 3 and using the cumulative loading rate concept established by federal regulations.

The cumulative loading rate process uses background concentrations of soils to establish an accurate lifetime loading rate without eliminating use of the site due to natural background levels. Also, by factoring the background soil concentrations into the lifetime loading rates, the rule addressed the intent of the law, Chapter 22-15-20(b)(6).

Comment:

2. Many commentors expressed grave concern that the amendment would result in relaxed standards for sewage sludge disposal and encourage dumping of out-of-state sewage sludge in West Virginia.

Response:

West Virginia's sludge regulations contain the strictest sludge limits in the country, and are intended to eliminate the possibility of West Virginia becoming a "dumping ground" for contaminated sludge from large eastern cities. This concern, expressed by many commentors, is not well founded and is not germane to the proposed rule amendment.

Comment:

3. Support for the rule changes were expressed in comments relating to the economic burden to municipalities that would occur if land application sites were not available due to soil concentration limitations.

Response:

The agency recognizes that land application is a much more cost effective disposal option than paying landfill rates; however, the agency did not base the proposed amendment on adverse financial impacts on municipalities. Sewage sludge, if properly treated and processed, is an effective, low cost soil amendment which has significant potential for beneficial use.

Experience in West Virginia and other states show this option to be safe to human health if properly applied, and that disposal of processed sewage sludge in landfills is an unnecessary waste of a natural resource and results in the consumption of limits violation capacity of the landfill which is contrary to the concept of proper landfill management.

Comment:

4. Several commentators suggested that a review of existing scientific data addressing safe levels of metals in soils should be conducted or that a research effort should be initiated by the agency to determine appropriate safe levels.

Response:

Discussions with West Virginia University's School of Agriculture revealed that no such relevant data exists on West Virginia soils, but that there is an interest in proposing and conducting a study to determine appropriate soil characteristics and capacities. The agency is concerned, however, that such a research project cannot be adequately funded by the existing fees and would need additional funding to support such a study.

FURTHER ACTION

The rule will now be submitted for review by the Legislative Rule-Making Review Committee and the 1996 West Virginia Legislature. If there are any further questions or need for more clarification on any issue discussed during the public hearing and comment period, any interested person may write or call the Office of Waste Management at 304-759-5929.

ENVIRONMENTAL ISSUES

Toxic Metal Accumulation from Agricultural Use of Sludge: Are USEPA Regulations Protective?

M. B. McBride*

ABSTRACT

The new USEPA regulations for the use of sewage sludges will permit concentrations of particular toxic metals to increase locally on agricultural land by a factor of a hundred or more above present soil concentrations. Short-term field experiments have shown that the adsorptive properties of sludges themselves often prevent excessive uptake of many of these metals into crops, a protection attributable largely to the added organic matter. This protection cannot be considered to be permanent or effective for all toxic metals, as indicated by data from old sludged sites. Differences in degree of protection are evident for greenhouse and field experiments, largely attributable to different rooting patterns and degree of sludge mixing in these two situations. The USEPA reliance on field data for metal uptake by corn (*Zea mays* L.) has led to an underestimation of phytotoxicity thresholds applicable to a wider range of crops, in part because corn is able to root deeply and is metal-tolerant. Also, the decision to use 50% yield reduction and plant top (rather than root) concentrations of heavy metals as phytotoxicity indicators may have obscured incipient toxicity. Long-term field observations (several decades) often show that sludge-applied metals can remain sufficiently available, even in nonacid soils when total metal concentrations are below the proposed EPA limits, to harm sensitive crops and microbes. It is concluded that the ultimate impact of toxic metals from sewage sludges at levels approaching the proposed USEPA limits on various soil-crop systems is potentially harmful.

THE LEVELS OF a number of heavy metals are increasing slowly in agricultural soils due to atmospheric deposition, additives in animal feeds, and commercial fertilizer use (Andersson, 1992; Billet et al., 1991; Jones, 1991). Although widespread increases of metals such as Cd, Hg, and Pb on agricultural soils in Europe have been estimated to be on the order of 10 to 15% since the turn of the century, these increases are small compared with the potential localized increases from sewage sludge use in agriculture.

Soils amended with municipal sewage sludges will be permitted (by the USEPA Clean Water Act 503 Regulations; USEPA, 1993) to accumulate metals such as Cr, Cd, Cu, Pb, Hg, Ni, Se, and Zn to levels from 10 to >100 times the present background concentrations of these metals in most soils. The comparison in Table 1 shows the USEPA Regulations to be very permissive for most metals by international standards. Defenders of the 503 Regulations believe that sludge-amended soils

maintain an ability to immobilize toxic metals in nonavailable forms. Indeed, Chaney and Ryan (1993) have stated that "all evidence available indicates that the specific metal adsorption capacity added with sludge will persist as long as the heavy metals of concern persist in the soil." These scientists reject the argument that the slow mineralization of organic matter in sludge could release metals into more soluble forms, often termed the sludge time bomb hypothesis. Instead, they argue that the residuum of sludge decomposition can perpetually maintain heavy metal solubilities at very low levels. This could be termed the sludge protection hypothesis. The field observation that "plant uptake reaches a maximum as sludge application increases" (Ryan and Chaney, 1993) is used to support this hypothesis. Based on this reasoning, even if sludge were applied to soil for a sufficiently long time to convert the surface soil almost completely into sludge residue, the uptake of trace elements would be, at worst, a linear function of cumulative sludge application, because the sludge itself is adding adsorptive capacity to the soil. Thus, heavy metal availability or solubility in sludge-amended soils would depend linearly on the total heavy metal content of the soil, as illustrated by curve a of Fig. 1. Because uptake of metals into plants often becomes less efficient at higher metal loadings in soil, Curve b has been proposed to describe this saturation effect. On the other hand, because soils have a finite capacity to immobilize metals by adsorption or precipitation reactions, without the protective effect of the sorptive materials in the sludge itself, a Langmuir-type relationship (Curve c, Fig. 1) would be expected. This is the relationship found for metals added to soils in the soluble salt form (Hendrickson and Corey, 1981). Given the serious consequences of a response similar to Curve c for heavy metal additions on crop quality and yield, it is essential to know whether the added protective effect of the sludge residue arises from the organic or inorganic materials, because much of the added organic matter eventually decomposes. Nevertheless, there is evidence that a fraction of the organic matter resists decomposition, and could provide protection against metal uptake for decades. Inorganic residues in sludge most likely to provide long-term retentive capacity for some heavy metals are phosphates, silicates, and Fe, Al, and Mn oxides. Although carbonates and sulfides may exist in

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Abbreviations: EDTA, ethylenediaminetetraacetic acid; CEC, cation-exchange capacity; DTPA, diethylenetriaminepentaacetic acid; PT_{50} , phytotoxicity threshold; LOAEL, lowest observed adverse effect level.

ushed by the USEPA-503 regulations, compared with other standards.† The international standards are based on total metal content in soil, including background level.

Metal	USEPA-503	N.E.‡	Germany	Netherlands§	Ontario
As	41	—	—	60 (100)	14
Cd	39	5	6	10 (40)	1.6
Co	—	—	—	100 (600)	30
Cr	3000	500	200	500 (1600)	210
Cu	1500	125	200	200 (1000)	150
Hg	17	—	4	4.0 (20)	0.8
Mn	18	—	—	80 (400)	4
Ni	420	50	100	200 (1000)	32
Pb	300	500	200	300 (1200)	90
Se	100	—	—	—	2.4
Zn	2800	250	600	1000 (6000)	330

† For direct comparison, standards based on mg/kg units have been converted to kg/ha using a factor of 2. The exact conversion depends on soil density and depth of sludge mixing.

‡ Data from Northeastern U.S. Regional Research, 1985.

§ The values are considered to represent moderate soil contamination requiring additional study, while those in parentheses are considered to represent a serious threat to humans or the environment.

sludges, they cannot be assumed to persist in most soils, and their dissolution could increase heavy metal solubility over time. For this reason, the chemical nature of sludges needs to be better described before predictions about long-term fate of heavy metals are possible.

Research funding has been of such a nature that long-term research on the behavior of sludge-applied metals in soils has been hampered. Consequently the USEPA had the difficult task of developing a risk-analysis for land use of sewage sludge, in which it was necessary to extrapolate from short-term experiments at relatively low metal loadings to long-term with higher metal loadings. The USEPA-503 heavy metal loading limits, listed in Table 1, have not been reached (except in a few cases for a few metals) in field experiments, and it remains to be proven that they are safe. The important question that needs an answer before the USEPA limits can be considered environmentally and agriculturally acceptable is: What happens to toxic metals over the very long-term following the cessation of sludge application? It is generally agreed that the organic matter level in the soil must eventually return to a value not much greater than that of the original soil. The half-life of organic decomposition has been estimated to be ≈ 10 yr (Bell et al., 1991), but this may be an overestimate of decomposition rate over a period of several decades (Terry et al., 1979).

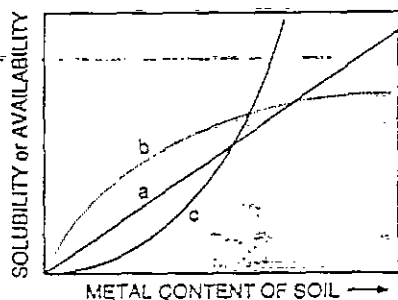


Fig. 1. Possible trends in heavy metal solubility (or plant availability) as a function of metal content of soils. These trends represent (a) the constant partitioning model, (b) the solubility limit (saturation) model, and (c) the Langmuir sorption model.

Nevertheless, part of the metal-complexing capacity of the soil is gradually lost over several decades. The sludge protection hypothesis requires that the inorganic materials (phosphates, Fe and Al oxides, and silicates) in the sludge either adsorb or precipitate the toxic elements so that metal availability will remain low or further decrease in the long term. Although many soil scientists believe that soil chemistry is also very important in controlling the solubility of trace elements in the long-term, the USEPA 503 Regulations pay no heed to the characteristics of the soil, other than to recommend that the pH be maintained at 6.5 or higher. Thus, the USEPA 503 regulations are rationalized on the basis of the efficacy of permanent materials in sludges for metal immobilization. Our purpose is to analyze existing evidence and determine whether there is convincing support for the hypothesis that the sorptive capacity of sludges is sufficient to prevent heavy metals from impairing crop productivity or quality over the long-term.

PROBLEMS IN QUANTIFYING SLUDGE PROTECTION

It is important to recognize that, since much of the information on metal availability in sludge-treated soils is obtained indirectly by measuring the metal content of plant tops, a plateau in metal uptake as a function of total metal content in the soil does not necessarily mean that Curve b (Fig. 1) describes metal availability to roots (or soil microbes). There may not be a strong correlation between metal solubility (or availability to roots) and the concentration in the tops. This depends on the many factors affecting translocation, including species and cultivar of plant, environmental conditions, and competing ions. One could easily conclude that the soil is providing protection against metal uptake at high loadings of the metal in the soil when uptake is in fact being suppressed by changes in the translocating efficiency of the plant. Although the edible portion of the plant may contain acceptably low concentrations of toxic metals in either case, the true extent of metal bioavailability and toxicity to roots and soil microbes could be underestimated.

Evidence for metal solubility or availability increasing according to Curve c is seen where metals have been added as soluble (or insoluble) salts to soils. Although such metals show some tendency to diminish in bioavailability with time, experience with Cu salts accumulated in orchards, vineyards, and other agricultural sites suggests that total soil Cu in the range of several hundred milligrams per kilogram causes phytotoxicity in some crops (Merry et al., 1986a; Lexmond, 1980), but not in all (Payne et al., 1988). As the concentration of Cu in orchard soils increases with time from cumulative application, a larger fraction of the total Cu can be extracted by ethylenediaminetetraacetic acid (EDTA) (Dickinson et al., 1988), suggesting adherence of Cu availability to Curve c (Fig. 1). Similarly, as the level of Pb in soil is increased by pollution from inorganic solids, it becomes increasingly extractable by mild chemical treatments (Nicklow et al., 1981; Stiles et al., 1993). It appears, from these studies of long-polluted soils that decades or

Even centuries of aging metal pollutants added in inorganic form to soils is insufficient to convert them to nonavailable forms. Consequently, the USEPA heavy metal limits for sludge application (which would permit, i.e., ≈ 750 mg Cu/kg soil) can be considered generally safe only if materials in the sewage sludge itself permanently immobilize most of the metals. Organic matter in the sludge is probably critical in metal immobilization for years or decades, but cannot be regarded permanent in the soil. This leaves the inorganic constituents of sludge to provide protection against metal uptake by crops.

Certain points of general consensus seem to have been reached from short- and medium-term field studies of sludge application. Availability of sludge-borne metals to plants is generally the highest immediately following application of sludge to soil, diminishing thereafter (Bidwell and Dowdy, 1987; Chang et al., 1987a; Hinesly et al., 1979). The cause of the initially high bioavailability may be, at least in part, rapid organic matter decomposition that produces soluble organic carriers of metals (Alloway and Jackson, 1991; Chaney and Ryan, 1993; Minnich et al., 1987). Organic matter appears to have quite different roles in controlling trace metal uptake by plants, depending upon whether it is soluble (fulvic acid) or insoluble (humic acid). Insoluble organic matter very effectively inhibits uptake of metal cations such as Cu^{2+} , which bind strongly with organic matter and are thereby prevented from diffusing to roots. Conversely, soluble organics raise the carrying capacity of soil solutions for Cu^{2+} and other metal cations at any particular pH by forming soluble metal-organic complexes (McBride, 1994). Because the plant is able to extract trace metals from these complexes once they diffuse to the root (Nor and Cheng, 1986), the high level of soluble organics found in soils recently amended with sludge could promote absorption of trace metals by roots. With time, organic decomposition rates and levels of soluble organics diminish, total dissolved metals presumably stabilize at lower values, and bioavailability is reduced.

Higher initial bioavailability in some field experiments may result from incomplete initial mixing of sludge with soil. Sludge particles may only slowly reach equilibrium with the soil matrix, so the impact of soil adsorptive properties on metal solubility may be gradual. It needs to be stressed, however, that this decreasing metal availability, often described as being longterm, is most pronounced in the first few years after ceasing sludge application, and has generally been based on experiments in which the soils have been monitored for no more than about six years following the cessation of sludge application.

REANALYSIS OF THE STUDY OF MAHLER ET AL., 1987

Chaney and Ryan (1993) reference the study of Mahler et al. (1987) as evidence supporting the sludge protection hypothesis. In that study, 12 soils with relatively long histories of sludge application (5–30 years), along with the unsludged control soils, were amended with Cd (as CdSO_4) at the levels of 0, 5, and 10 mg Cd/kg soil. The

sludged soils then contained Cd from two sources: old Cd from the earlier sludge applications, and new Cd from the added CdSO_4 . The unsludged control soils contained no Cd from sludge, and generally <1.0 mg/kg of native Cd. The exception to this was the Salinas (fine-loamy, mixed, thermic Pachic Haploxeroll) soil from California, which naturally contained 4.2 mg Cd/kg. Swiss chard (*Beta vulgaris* subsp. *cicla* (L.) Koch) and corn were grown in these soils in growth chambers with and without lime addition (1% CaCO_3 , w/w). Plant tops were harvested after 5 wk of growth and analyzed for Cd content.

Although this experiment is unrealistic in the sense that Cd added to fields from sludge is initially in the sludge matrix rather than a salt form, it is still useful in establishing whether aged soils containing sludge residue possess a higher capacity to immobilize Cd against plant uptake relative to unsludged soil. Despite the claim of Chaney and Ryan (1993) that the Mahler et al. (1987) study demonstrates "the persistence of the sludge effect on metal sorption," no clear answer is evident from the study. Although a number of the soils did show a positive effect of previous sludge addition on limiting plant uptake of newly added Cd salts, this was not generally the case. Soils such as the Congaree (fine-loamy, mixed, nonacid, thermic Typic Udifluent) and Ross (fine-loamy, mixed, mesic Cumulic Hapludoll), which had markedly higher organic matter content than the control soils due to sludge addition, showed substantially lower Cd uptake into both corn (Fig. 2 and 3) and Swiss chard (data not shown). On the other hand, soils having low organic matter content (evidently due to sludge decomposition), despite having received substantial sludge applications, revealed no significant advantage of sludge addition in limiting Cd uptake by the two crops. This is quite evident for the sludged Pembroke (fine-silty, mixed, mesic Mollic Paleudalf) and Burkhardt (sandy, mixed, mesic Typic Hapludoll) soils (Fig. 2), reported to contain 2.3 and 2.1% C, respectively, not much higher than the same soils in the unsludged condition. The Blount (fine, illitic, mesic Aeric Ochraqualf) and Russell (fine-silty, mixed, mesic Typic Hapludalf) soils, that had received high Cd loadings (≈ 200 and 70% of the USEPA limit of 39 kg/ha) from sludge addition, also failed to show a convincing sludge protection effect (Fig. 3). In these soils, the sludge Cd was sufficiently available that, even if no additional Cd salts were added to the soil, Cd levels in the crops greatly exceeded levels in the crops grown on the unsludged soils. With 5 mg/kg, and sometimes 10 mg/kg, Cd added as salts, the sludged soils still allowed greater uptake of Cd than the unsludged soils. The one soil with a naturally high level of Cd, Salinas, also failed to show the protective effect of sludge treatment (Fig. 3). The remaining soils usually showed inconsistent results as illustrated by the Del Rey soil (Fig. 2). Although the Cd concentrations are plotted for corn only in Fig. 2 and 3, a fairly similar pattern was observed for Swiss chard.

How then did the authors reach the conclusion that the sludge provides a protective effect? It is based on the argument that the Cd increase in plants in response

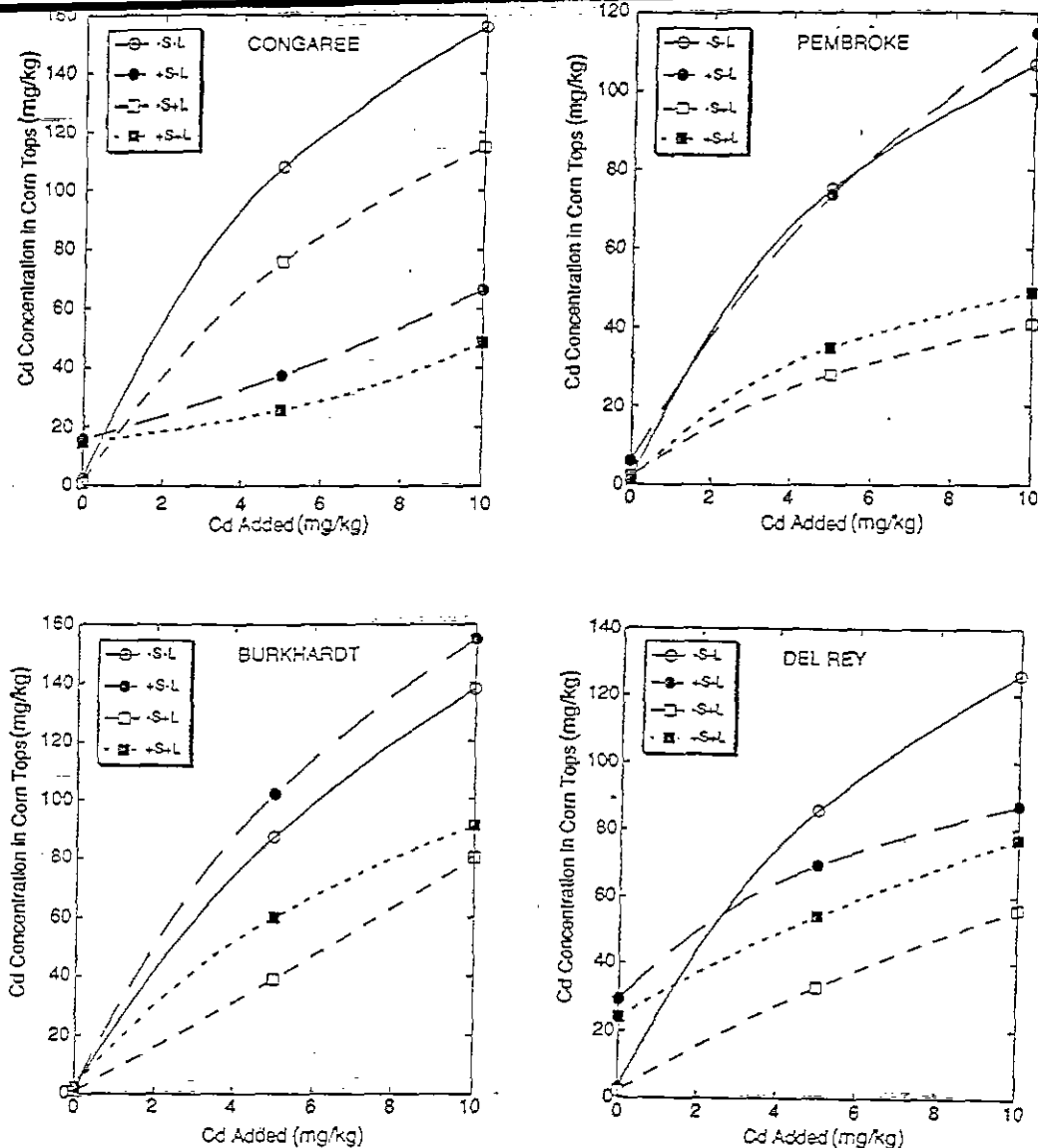


Fig. 2. Concentration of Cd in corn tops (mg Cd/kg dry tissue) after growing in the Congaree, Pembroke, Burkhardt, and Del Rey soils with and without sludge (+S, -S) and lime (+L, -L), and with increasing levels of soluble Cd (CdSO_4) added. Data in this and subsequent figures taken from Mahler et al. (1987).

to added Cd salt was less for the sludged soils than for the control soils (Mahler et al., 1987). This can be seen in the tendency for the response curves for sludged soils in Fig. 2 and 3 to have lower slopes than the curves for the corresponding control soils. A soil-by-soil comparison, however, suggests that the cause of the lower slopes may be the adsorptive capacity of organic matter. The clearly protective effect of sludge against Cd uptake from the Congaree soils (Fig. 2) can be attributed to the very large difference in organic matter content between the sludged (23% C) and control (1.3% C) soils. The nonprotective effect of sludge for the Pembroke and Burkhardt (Fig. 2) may be due to the rather small difference in organic matter content in these soils. The Pembroke contained 2.3% C (sludged) and 1.8% C (unsludged),

while the Burkhardt contained 2.1% C (sludged) and 1.5% C (unsludged). The Blount and Russell, heavily loaded with Cd from sludge applications, showed some protection against Cd uptake (based upon slopes of the response curves in Fig. 3), but this may have been due at least in part to a substantially higher organic matter content in the sludged soils. The Blount contained 3.5% C (sludged) and 2.5% C (unsludged), while the Russell contained 3.2% C (sludged) and 1.9% C (unsludged). The sludged Salinas soil had very little more organic matter (3.0% C) than the unsludged Salinas (2.7% C), perhaps explaining the lack of a protective effect of sludge in this soil (Fig. 3).

It appears from this analysis of the data of Mahler et al. (1987) that a stronger case can be made for the

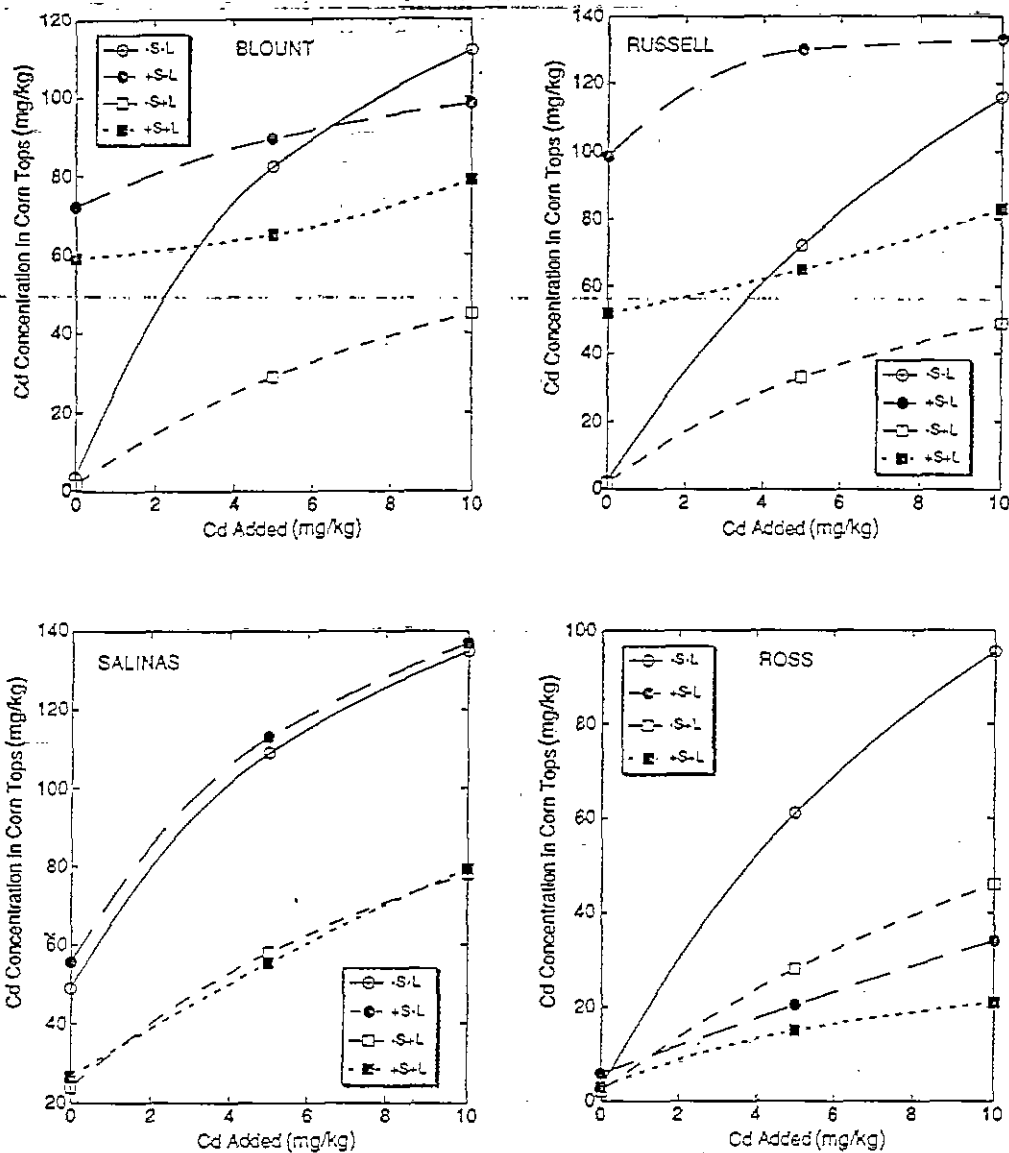


Fig. 3. Concentration of Cd in corn tops (mg Cd/kg dry tissue) after growing in the Blount, Russell, Salinas, and Ross soils with and without sludge (+S, -S) and lime (+L, -L), and with increasing levels of soluble Cd (CdSO_4) added.

protective effect of *organic matter* as opposed to that of the inorganic constituents of sludge. In fact, the importance of organic matter in limiting Cd availability is suggested by the relationships plotted from the Mahler et al. (1987) data in Fig. 4 and 5. In these Figures, a correlation is shown between Cd uptake from all the sludged soils (with no Cd salts added) and the soil Cd to soil organic carbon (Cd/C) ratio. There is a tendency for soils with low Cd/C ratios to limit plant uptake relative to soils with higher Cd/C ratios. While this is not conclusive proof that organic matter is critical to limiting availability of Cd in soils with histories of sludge application, there is little in the Mahler et al. (1987) data to suggest that inorganic materials have a dominant role in controlling Cd availability. It should be noted also that the behavior of two of the most Cd-polluted soils,

Blount and Russell, largely determines the steepness of the best-fit curves in Fig. 4 and 5. Thus, the mathematically described relationship between Cd uptake and Cd/C ratio based on this study is very uncertain. Since the Blount soil had a higher pH and cation-exchange capacity (CEC) than the Russell soil, even after sludge addition, adsorption reactions in the Blount soil may have reduced Cd uptake.

In summary, the data from the Mahler et al. (1987) study fail to support the sludge protection hypothesis, because those sludge-amended soils that had lost most of the added organic matter due to decomposition generally permitted greater Cd uptake than those that still retained considerably higher levels of organic matter. The study does, however, support the USEPA position that sludge quality (i.e., Cd concentration in sludge) must be consid-

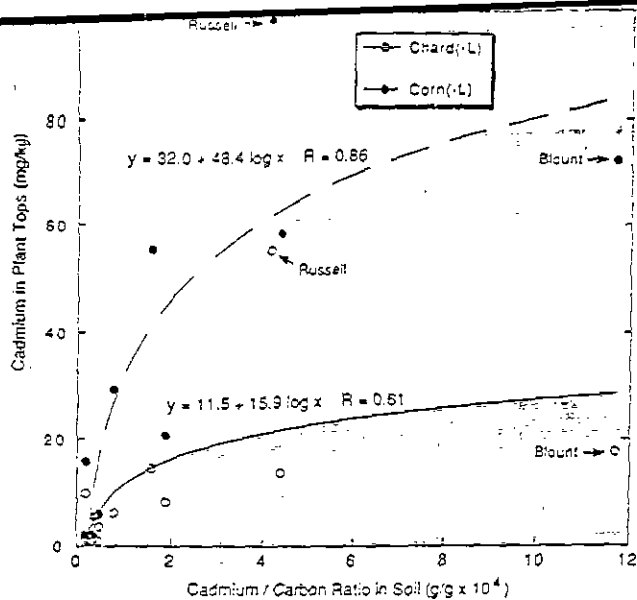


Fig. 4. Concentration of Cd in Swiss chard and corn tops (mg Cd/kg dry tissue) after growing in 12 different soils with 5 to 30 yr histories of sludge application, reported as a function of the total soil Cd to total organic C ratio. This figure is based on the data of Mahler et al. (1987) in which no soluble Cd had been added to the unlimed soils.

ered as well as total metal loading limits, since the Cd/C ratio is an important parameter. As sludged soils age, the ratio of heavy metals to organic matter increases, and Fig. 4 and 5 predict plant uptake of Cd to increase in response to this change. While inorganic residues in the sludge persist, their effectiveness as adsorbates for heavy metals must depend on the chemistry of the specific mineral material in sludges. Iron salts, Al salts, Ca oxides, and other materials have been used in processing sludges, but most research fails to consider the macrochemical composition of the sludge when assessing trace metal solubility. It is unrealistic to expect that the chemical behavior of trace metals in sludges would not be affected by the types of sorptive minerals present (oxides of Fe and Al, carbonates, or phosphates); however, there is no allowance made for this in the USEPA regulations.

An additional note in reference to the analysis of slopes of Cd uptake response curves, as done by Mahler et al. (1987), is warranted. In general, uptake of Cd and other metals by plant tops does not occur in *linear* response to concentration (or activity) of the metal in solution, except at a low range of concentration. This has been illustrated for Cd by various studies, including the hydroponic experiments of Jarvis et al. (1976) on ryegrass (*Lolium multiflorum* Lam.), where the Cd concentration in both the plant tops and roots increased curvilinearly. That is, the efficiency of metal uptake by many plant species tends to diminish at higher soil solution concentrations of the metal, particularly as the threshold of toxicity for that metal is approached. Many of the sludge-treated soils of the Mahler et al. (1987) study provided high baseline uptake of Cd before any addition of Cd salts. Thus, plants grown on such soils may have been

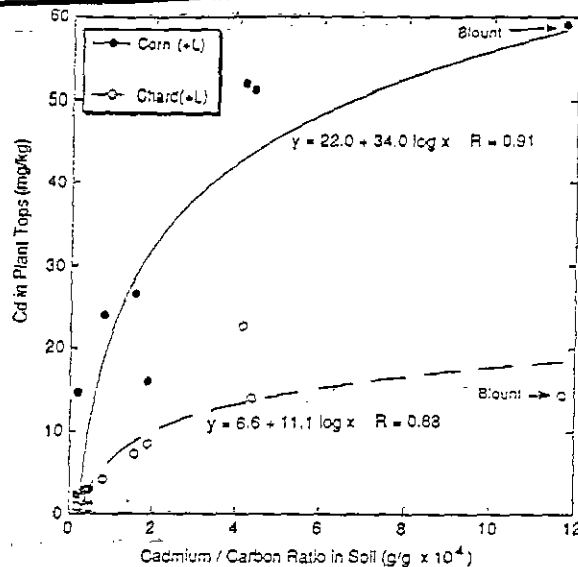


Fig. 5. Concentration of Cd in Swiss chard and corn tops (mg Cd/kg dry tissue) after growing in 12 different soils with 5 to 30 yr histories of sludge application, reported as a function of the total soil Cd to total organic C ratio. This figure is based on the data of Mahler et al. (1987) in which no soluble Cd had been added to the limed soils.

on the flatter upper portion of the response curve even before Cd salt addition. Their uptake of additional Cd is unlikely to be as efficient as that for plants grown on unsludged soils that are relatively free of Cd. Some sludges supply large amounts of several potentially toxic metals such as Cu, Zn, and Ni, to soils simultaneously and these are likely to alter Cd uptake response curves by competition and other effects (Choudhary et al., 1993). Because heavy metal toxicity to roots can be somewhat additive and even synergistic when several metals are present (Hassett et al., 1976; Wallace and Berry, 1989), soils approaching the USEPA limits for several of the phytotoxic elements may show yield reductions at lower concentrations than expected if a single element is at an elevated concentration. For this reason, there has been debate about the extent to which the phytotoxic effects of metals such as Zn, Cu, and Ni are additive and whether individual metal limits should be lowered to reflect this additivity (Sanders et al., 1986; Davis and Carlton-Smith, 1984). Antagonism between potentially toxic metals such as Cd and micronutrients such as Zn, Mn, and Cu can reduce root and top growth as well as micronutrient content in the plants (Jalil et al., 1993). Symptoms of Mn deficiency, for example, are observed in some old sludge sites (Trocmé et al., 1950). It cannot be ruled out that such deficiencies are caused by excesses of metals such as Zn or Cu, since these metals are higher in the tissues of chlorotic plants from these sites (Leeper, 1978).

HEAVY METAL AVAILABILITY ESTIMATED BY MULTI-YEAR FIELD STUDIES

Field studies are sometimes interpreted to support the sludge protection hypothesis. If the hypothesis is correct,

as application of sludge continued from year to year, the levels of heavy metals in tissues of indicator crops might increase in the first few years, but then would level off or decrease in later years as metals are gradually converted into less soluble (nonavailable) forms. In many cases, however, the overall pattern is one of uptake in response to cumulative loading of Cd in the soil. For example, the data of Chang et al. (1987b) show that, for radish (*Raphanus sativus* L.) and Swiss chard leaves, tissue Cd concentration tends to increase yearly with each sludge application, although there is considerable year-to-year variability. Other field studies have shown evidence of Cd and Zn accumulation in plant leaf tissues in approximate proportion to total cumulative loading of these metals in the soil from sludges (Hinesly et al., 1984; Vlamis et al., 1985; Kiemnec et al., 1990; Davis, 1984). This relationship is, however, much less evident in grain tissues of the same crops because of the tendency of plants to exclude these metals from the grain. The relationship for Cd appears to be most pronounced for sludges of relatively high Cd content (Vlamis et al., 1985) and for soil with low organic matter (Hinesly et al., 1984), again suggesting the importance of organic matter in suppressing Cd uptake. A field study using a low Cd sludge (7.6 mg Cd/kg) failed to show Cd concentrations in snap beans (*Phaseolus vulgaris* L.) to increase in proportion to total cumulative loading of Cd in the soil (Dowdy et al., 1978), although Zn and Cu in the leaf tissue did increase with cumulative loading of these metals. In some field experiments, there is a stronger statistical relationship of Cd uptake in crops to the amount of Cd added in the most recent sludge application than to the cumulative Cd loading (Hinesly et al., 1977; Webber and Beauchamp, 1979). This has been taken as evidence for residual sludge protection, but can perhaps be attributed to slow equilibration of sludge with the soil matrix, especially if sludge mixing in the field is initially incomplete. Discrete sludge particles can be observed in soils for years after initial application, and it is possible that the solubility of metals within these particles is not controlled by pH and other chemical properties of the soil for some time. As the soil-sludge system approaches equilibrium, heavy metal solubility should diminish if the soil is strongly adsorptive. It must be emphasized that most of the field studies described here spanned 3 to 7 yr, with only one study exceeding a decade.

COMPARISON OF GREENHOUSE AND FIELD EXPERIMENTS

Greenhouse experiments, in which sludge mixing with soil is generally more thorough and plant roots are restricted in pots to the volume of soil containing the sludge, more convincingly show a relation of metal uptake to total metal content of soil than do field experiments (Kuo et al., 1985). While pot studies generally overestimate metal phytoavailability found under field conditions, the reason for this discrepancy has not been clearly established. Climatic differences (temperature, humidity, and light quality and intensity) are suspected (de Vries and

Tiller, 1978), but rooting pattern seems to be most critical. Experiments with Swiss chard grown outside the greenhouse in pots under field conditions have shown a strong relation of Cd and Zn in leaf tissue to total Cd and Zn content of the soil (Kuo et al., 1985), suggesting that climatic factors in themselves do not explain the differences observed between greenhouse and field experiments. While several other variables, such as differences in rhizosphere effects and fertilizer distribution in field and pot experiments need to be considered (Chaney and Ryan, 1993), the reason (or reasons) for the difference in apparent availability of metals in pot and field experiments remains open to question. Although the USEPA Regulations for heavy metals are based on the premise that only field experimental results are relevant in establishing the permitted metal loading rates, field experiments usually represent a poorly controlled situation of soil-sludge mixing, climate and root distribution in the soil. In fact, those who conducted field experiments with deep-rooting crops such as corn are aware that most of the mature root system may occupy a volume of soil that contains none of the applied sludge (Hinesly et al., 1977). Even for relatively shallow rooted plants, avoidance of toxic metals in the sludge-treated surface layer of soil could explain the relative lack of metal uptake in some field experiments (de Vries and Tiller, 1978). Thus, metal uptake in field experiments depends strongly on variables in addition to the inherent chemical lability or solubility of the metals in the soil, and consequently shows a high degree of unexplained variability. Although the results from these experiments represent reality for the plant-soil systems studied, extrapolation of such metal uptake data to other soils, crops, and climates would be risky, since it could underestimate metal uptake. For example, as sludge is applied repeatedly with cultivation, the metals are worked deeper into the soil, and avoidance of metals by less deep-rooted crops could diminish with time. The data used to generate the USEPA regulations are based heavily on results from field studies of corn, and metal avoidance may be an important factor in interpreting uptake data for this crop. This means, however, that very different metal uptake behavior may be seen in crops with shallower rooting systems.

Plant tissue concentrations of heavy metals are sometimes stated to have no correlation (to a statistically significant degree) with extractable or total heavy metals in the soil (Hinesly et al., 1984; Chang et al., 1992), probably due in part to uncontrolled factors in field experiments. A lack of statistical significance in a correlation between variables does not, however, prove that the variables are not related: it means that the apparently random variability in the data is too great to prove or disprove the existence of a correlation with an arbitrarily chosen degree of certainty. Since agronomists typically choose a confidence level of 95% to test significance, this means that there is a high chance of a Type II statistical error; that is, accepting the false null hypothesis that there is no correlation between the variables. Consequently, it is likely that many field experiments, which have failed to show at the 95% confidence level a correla-

tion between the concentration (or extractability) of heavy metals in soils and the uptake of these metals by plants, have resulted in the rejection of a correct hypothesis that such a correlation does exist. One example of this use of statistics is a field study of Cd and Zn uptake from sewage sludge by corn (Hinesly et al., 1984). Although a tendency for Cd in corn leaves to increase with cumulative Cd in the soil was indicated by the best-fit linear regression of the data, this trend was not significant at the 95% level of confidence and it was concluded by the authors that repeated sludge applications to the soil did not cause concentrations of Cd in corn leaves to increase. There is a strong possibility that this conclusion is incorrect, that is, that the hypothesis of no correlation between total soil Cd and Cd in corn leaves is invalid.

Field studies of metal uptake by particular crops have generally been conducted in an empirical manner, frustrating efforts to generalize observations from one particular sludge-crop-soil system to another. Relatively little has been learned from field studies about fundamental processes that determine solubility and chemical form of the heavy metals in the sludge and soil, or uptake into roots and translocation into tops of plants. Yield is commonly used as the index of toxicity for metals, but Beckett and Davis (1977) have argued that because yield is affected by many factors, the onset of a metal toxicity can be obscured by variables that tend to increase yield. For sludge, these variables include micronutrients and the effects of organic matter on soil physical structure and water holding capacity. These additional variables can only be accounted for in those sludge experiments where the control treatment uses a low-metal sludge for yield comparison.

Because of the inherent variability of field data, the present USEPA limits on Cd loading in soil, for example, are based on field data in which the ratio of Cd uptake to metal content in soil ranges across about four orders of magnitude. Since a single-point estimate of this ratio was used in the USEPA risk-assessment analysis, it fails to factor in the uncertainty of the data (Stern, 1993).

CHANGES IN HEAVY METAL SOLUBILITY AND AVAILABILITY FOLLOWING THE CESSATION OF SLUDGE APPLICATION

In relatively short-term experiments where the annual sludge application was terminated, Cd uptake by corn was shown to decrease for several successive crops, then level off and hold steady for ≈ 3 yr (Bidwell and Dowdy, 1987). In beans, uptake of Zn and Cu was found to remain elevated for the 4 yr during which the crops were monitored following cessation of sludge application (Dowdy et al., 1978). For 3 yr following the cessation of sludge application on a calcareous soil, Webber and Beauchamp (1979) noted no real change in Cd uptake by corn. Davis (1984) noted a decrease in Cd uptake by ryegrass for 3 yr following a single sludge application, followed by a small rebound in the fourth year.

The review of Alloway and Jackson (1991) addresses the important issue of long-term changes in bioavailability of heavy metals in sludge-amended soils. In some

longer-term sludge experiments (in which the loadings of phytotoxic metals were well below the USEPA-503 limits), there was little or no evidence of a long-term decline in either heavy metal uptake by plants or metal extractability by reagents such as EDTA or acetic acid (Berrow and Burridge, 1981; Leriche, 1968). McGrath (1987) noted that most studies of trends in metal availability following the termination of sludge application observed availability to remain fairly constant. Sauerbeck and Styperek (1986) noted a tendency for heavy metal availability to decrease with time in some sites for certain crops, but the trend was inconsistent. Even for studies in which sludge application had ceased >20 yr earlier, almost 30% of the organic matter from the sludge remained in the soil (McGrath and Cegarra, 1992). The possible role of residual organic matter in maintaining heavy metals in a relatively nonavailable form for a long time may have to be considered, since Terry et al. (1979) found that $>50\%$ of sludge organic matter was resistant to decomposition. It is possible that some of this resistance is provided by the toxic effects of heavy metals on microbes, although this does not seem to be the case for Cu, at least in the early stages of sludge decomposition (Minnich and McBride, 1986).

In the long-term market garden experiment at Woburn, England, which spanned an interval of time from the 1940s to the 1980s, during which time sludge was applied only before 1962, the CaCl_2 -exchangeable Cd in the soil changed little from the early 1950s to the early 1980s, remaining much higher than exchangeable Cd in the control soils (fertilizer-treated, without sludge) over the entire interval investigated (McGrath and Cegarra, 1992). Similarly, the extractability by EDTA of Cu, Pb, Zn, Ni, and Cr changed little following the termination of sludge application, and the sludge-amended soil generally had a much higher percentage of heavy metals in EDTA-extractable form than the unsludged (control) soil. This evidence suggests a fairly stable situation, in which the loss of a large fraction of added organic matter has not substantially altered the chemical forms of metals in the soil. It is possible that inorganic materials in the sludge are limiting metal uptake, but the properties of the soil, which was maintained at a pH of 6.5 by liming, may have had a strong influence on metal solubility on the long time scale of this experiment.

Although none of the studies reported here provide clear evidence for increased availability of heavy metals with time following the cessation of sludge application, neither do they indicate that most soils are able to gradually convert a large portion of the added heavy metals to insoluble, unavailable forms, even when they are applied at concentrations well below the USEPA-503 limits.

Field experiments are unable to discern the relative importance of organic and inorganic constituents in sludge with respect to limiting heavy metal availability. Certainly, inorganic materials added to soils can immobilize heavy metals in relatively insoluble forms (Mench et al., 1994). Phosphates or carbonates in sludges are expected to adsorb or precipitate Pb and Cd, while Fe and Al oxides are known to have a strong tendency to

adsorb metals such as Cu, Pb, and Zn. These mechanisms are, however, highly selective, competitive, and pH dependent, and do not necessarily reduce solubility sufficiently to markedly lower plant availability. Manganese oxides appear to be much more effective in reducing bioavailability of metals than phosphates, carbonates or Fe oxides (Mench et al., 1994). Because the inorganic solids initially present in sludges are at least partially noncrystalline (Baldwin et al., 1983), they may age to more crystalline phases in the soil, ejecting coprecipitated metals that are not of proper radius and charge to be accommodated by the crystal lattice (McBride, 1978, 1989). Thus coprecipitated heavy metals may actually be concentrated at surfaces, not buried within structures. The high degree of extractability of Pb, Cu, Zn, and Cd by EDTA in old sludge sites and orchard soils (Merry et al., 1986a; Dickinson et al., 1988; McGrath and Cegarra, 1992) suggests that many of the heavy metals have a limited ability to diffuse or coprecipitate into soil minerals over a period of decades. In fact, a large part of these metals is probably associated with organic matter in the sludge (Baldwin et al., 1983). Thus, even over relatively long periods of time, a large fraction of certain heavy metals from sludges remain in potentially plant-accessible forms. Bell et al. (1991) found that about the same fraction (50%) of Cd in a soil was extractable with diethylenetriaminepentaacetic acid (DTPA) whether the Cd had been added in sludge, or as CdCl₂ salt. Since the Cd had been applied ≈ 9 yr earlier, this observation contradicts both the sludge protection hypothesis and the argument that reversion of Cd to less plant-available forms occurs. Similarly a high degree of extractability of Cd from old sludge sites by EDTA has been measured (McGrath and Cegarra, 1992). In fact, numerous pot and field studies have shown a highly significant correlations between EDTA, DTPA, or CaCl₂-extractable Cd, Zn, Cu, Ni, and uptake of these metals into the tops of a number of crops (Sanders et al., 1986; Lee et al., 1983; Hooda and Alloway, 1994; Kuo et al., 1985; Latterell et al., 1978; Barbarick and Workman, 1987; Bidwell and Dowdy, 1987; Minnich et al., 1987). Metals extracted by the chelating agents, DTPA and EDTA, are largely in exchangeable, organically-complexed, and carbonate forms, and tend to correlate with metal uptake by plants (Latterell et al., 1978; Walsh et al., 1972). It has been cautioned, however, that it should not be too readily assumed that these chelating agents actually measure availability (Tiller and Merry, 1981; Beckett et al., 1983). For example, while DTPA extractability of Pb and Cu may increase with increasing soil pH, plant uptake sometimes decreases (Merry et al., 1986b). Also, decreases in plant uptake of Cd have been noted in successive years of cropping on sludged soils despite steady levels of DTPA-extractable Cd (Bidwell and Dowdy, 1987). Since there is a tendency for DTPA-extractable heavy metals to increase with metals concentration in the soil, and for uptake in crops to increase in response to increased metals in the soil, the correlation between DTPA-extractable metals and plant uptake may in some cases be fortuitous (O'Connor, 1988; Beckett et al., 1983). It should be stressed, however, that avail-

ability of metals is best measured from contents of these metals in root rather than tops. Since DTPA extractability can be a better predictor of metal content in roots than plant tops (Minnich et al., 1987), its usefulness for testing heavy metal availability may be to some degree underestimated because of the tendency of most studies to use metal levels in plant tops.

The most convincing evidence that sludge-applied metals can remain labile and therefore plant-available is found for Cd. In isotope exchange studies, Lloyd et al. (1981) found almost all of the Cd in a long-term sludge site to be in the labile form. Another experiment on the isotopic exchangeability of Cd in soils treated with sludge in 1976 showed a marked increase in Cd lability from 1976 to 1993 (Xia et al., 1993), although part of this increase may have been due to the downward drift in pH at the site. Alloway (1990) reported that a sludge-amended sandy soil (pH 6.4) in southwestern France, which had reached a low level of organic matter (1.8%), had a very high Cd solubility (>3% of total soil Cd soluble in water). Alloway noted that no such trend toward increased solubility was seen in a sludge site in England nearly 30 yr after cessation of sludge application, but indicated that this may have been due to the difference in climate and its effect on organic matter decomposition.

EVIDENCE FOR LONG-TERM LOSS OF HEAVY METALS FROM FIELD SITES

For most of the heavy metals of concern, the experimental evidence in the field suggests that there is relatively little movement of sludge-applied metals below the surface soil, even over periods of several decades (Alloway and Jackson, 1991; Dowdy and Volle, 1983). In some of the longer-term field experiments, however, evidence for metal percolation, perhaps facilitated by mobile colloidal particles or soluble anionic and uncharged complexes of inorganic or organic ligands, has been found. In one case, downward migration was observed 7 yr after sludge application, where both organic matter and soluble Cu and Zn were higher at the 40 to 60-cm depth in the sludge-treated than in the untreated soil (Campbell and Beckett, 1988). In acid soils, the movement of Zn to a depth of 60 to 90 cm was observed following 6 yr of sludge application (Robertson et al., 1982). Dowdy et al. (1993) noted that, while most of the monitored trace metals did not migrate below 30-cm depth after 19 yr of sludge application, Cr and Cu were increased in the subsoil (below 45 cm). Both of these metals have a high affinity for organic matter, suggesting that movement was caused by the leaching of soluble or colloidal organics. In general, however, unless soils are coarse-textured or very acid, the mobile fraction of most sludge-applied metals is small, at least as long as organic matter from the sludge persists. Nevertheless, even if a very small fraction of a highly toxic element, such as Hg, is converted into a more mobile or volatile form, as may be the case for conversion of the immobile Hg²⁺ ion to methylmercury or Hg⁰ (Steinnes, 1990), the risk to groundwater and the environment could be significant.

Over very long time periods, with continued applica-

tion of sludge, the effect of slow metal movement to greater depths in the soil (by leaching, bioturbation, or deep tilling) is likely to increase metal uptake by deep-rooted crops because avoidance by deep roots is no longer possible. Support for the sludge protection hypothesis has been based in part on measured gradual reductions in Cd uptake by successive crops over extended periods of time. This special attention given to Cd behavior is a consequence of the element's relatively high mobility (compared with Cu and Pb) and phytoavailability in soil, and its high toxicity to animals and humans. However, it has generally been assumed in interpreting the time-related reduction in Cd bioavailability that all of the added Cd has remained within the rooting zone during the period of study. This is expected to be the case as long as soil pH is maintained at 6.5 or higher, but the Cd²⁺ ion in acid soils is mobile (Brams and Anthony, 1988; Tyler and McBride, 1982). There is limited evidence that Cd in sludge applications is lost from surface soils in field experiments (Davis, 1984). Bell et al. (1991) noted that their Cd mass balance on field plots, which had been treated with either Cd salt or Cd in sludge form, accounted for only ≈ 50% of the total applied Cd in both treatments. These soils were somewhat acid (below pH 6.0) and had received the Cd treatments ≈ 8 yr earlier. McGrath and Lane (1989) also noted loss of heavy metals from sludged field plots over long periods of time. In some of these field studies, apparent heavy metal loss may have been due to dilution into subsoil by deep cultivation or lateral movement into adjacent plots by repeated cultivation. Indications of the latter process are seen, for example, in the control (no sludge) plot data of McGrath and Cegarra (1992) and Chang et al. (1987b), in which soil exchangeable Cd and plant tissue Cd, respectively, were seen to increase over a period of years. If high-sludge plots gradually contaminate adjacent low-sludge (or control) plots, a bias results in comparing relative uptake of heavy metals by sludge-treated and untreated soil. For example, many agricultural soils have low native levels of Cd (most New York State mineral soils that have been analyzed have no more than ≈ 0.15 mg/kg total Cd). If a sludge containing 30 mg/kg Cd (dry weight basis) is applied at a rate of 10 metric tons/ha/yr, this would add ≈ 0.15 mg/kg annually to this total. Consequently, one year of addition of the sludge would double the total Cd in the soil, and a decade of sludge application would increase total Cd by a factor of 10. Furthermore, the Cd (and a number of the other heavy metals) added in sludge is typically found to be more easily extracted chemically from the soil than the native Cd (McGrath and Cegarra, 1992), suggesting that it also is more bioavailable than natural Cd. Thus, movement of a relatively small fraction of soil from sludge-treated to control plots by cultivation, erosion, or other processes could raise the bioavailable Cd in the control plots substantially. This is important if plant uptake data are interpreted on the basis of comparison with uptake from control plots.

PHYTOTOXICITY IN SLUDGE-AMENDED SOILS

If metals can become more soluble as organic matter decays, one would expect numerous reported instances of losses in soil productivity at old sludge sites. There are few well-documented cases, however, in which the organic matter from sludge application on soil has had time to decompose sufficiently to create clearly identifiable metal toxicity problems. Leeper (1978) described three cases of long-term application of sewage on land-sewage farms near the cities of Paris, Berlin, and Melbourne. He argued that two of these three cases (Paris and Melbourne) provided favorable evidence for sewage application to land. Leeper acknowledged, however, that a severe micronutrient imbalance had developed in crops of the Paris farm, attributed to Mn depletion in the soil due to chemical reduction and leaching by excessive sewage application (Trocmé et al., 1950). Although this problem could be corrected by foliar application of Mn, the fact that the least healthy plants had higher tissue concentrations of Zn and Cu could mean some involvement of these metals in the micronutrient imbalance. High levels of heavy metals in sludge can cause tissue levels of Mn to decrease (de Haan, 1975). The second favorable case, Melbourne, while having received liquid raw sewage since 1893, had accumulated metals far below the concentration limits of the USEPA Regulations, and can not be judged a test of the safety of metal applications at the levels to be permitted under the USEPA-503 Regulations. The third case, Berlin, showed chlorosis in crops on those sites with higher Cu and Zn in the soil (Leeper, 1978). Since all of these sewage farms had greatly elevated levels of organic matter in the soil at the time of study, the sludge time bomb hypothesis can only be tested a long time following the termination of sludge application at these sites. Furthermore, these were not experiments based on well-controlled treatments, but rather investigations of problems with soil fertility that developed on sewage farms. They are useful to the extent that they show that heavy sewage or sludge applications can produce micronutrient imbalances in crops. Such imbalances could arise from the complex interaction among several trace metals at the root or within the plant (Wallace and Berry, 1989).

The most critical soil parameter that indicates whether that soil has exceeded the threshold of metal phytotoxicity for any particular crop is not the total heavy metal content, but the activity of the free metal cation in soil solution. Free metal cations are generally more toxic than the same metals in soluble complexed forms, although soluble metal-fulvic acid complexes are probably plant-available (Nor and Cheng, 1986). Unfortunately, few estimates of heavy metal activities have been made in aged sludge-treated sites. Several activity measurements have, however, been made in more freshly prepared soil-sludge mixtures. In a study of beans grown in sludge-treated soils, Minnich et al. (1987) found that a Cu²⁺ activity higher than 10⁻⁷ resulted in elevated concentrations of Cu in plant tissues. No more than 300 mg Cu/kg soil was present in the soil-sludge mixtures. Fujii et

al. (1983), using a chelate addition method, estimated free Zn^{2+} , Cu^{2+} , and Ni^{2+} activities at $\approx 2 \times 10^{-6}$, 2×10^{-9} , and 6×10^{-9} in a sludge-treated soil (pH 6.2) containing ≈ 210 , 94, and 196 mg/kg of these metals, respectively. Campbell and Beckett (1988) reported marked increases in soil solution concentrations of Zn and Cu in a nonacid soil that had been amended 7 yr earlier with sewage sludge, despite the fact that the Zn and Cu loadings were well below the USEPA-503 limits.

McBride and coworkers (1994, unpublished data) have measured Cu and Zn solubility in a nonacid soil treated with sludge almost 20 yr earlier, to give Cu and Zn loadings of 21 and 974 kg/ha, respectively. These solubilities, measured by anodic stripping voltammetry (soil pH ≈ 6.9), were 5×10^{-6} M and 3×10^{-5} M, respectively, and represent total soluble concentration. For comparison, free Cu^{2+} activity and total soluble Cu in uncontaminated soils have been estimated around 10^{-10} to 10^{-12} (Sanders, 1982; McBride, 1994, unpublished data), and 10^{-6} to 10^{-8} M (McBride, 1981; Sanders, 1982; Kabata-Pendias and Pendias, 1984), respectively. Comparable activity and total solubility values for Zn in uncontaminated soils tend to be somewhat higher than those for Cu.

It appears from these few measurements that substantial increases in activity and solubility of phytotoxic metals can persist long after sludge additions (within the USEPA 503 metal limits), but research is needed to establish whether these increases would cause reductions in soil productivity for a wide variety of crops. Furthermore, long-term research is needed to determine if the solubility or activity of these metals changes significantly as sludges further decompose in the soil. There is some circumstantial evidence that this may occur even when low-metal sludges decompose. At an old site of sludge dumping in Pennsylvania, the soil has been reported to be toxic to plant life (D. Baker, 1993, personal communication), despite analytical data to show that the sludge had heavy metal concentrations well below the USEPA maximum concentrations for land-applied sludges. At this site, the organic content of the sludge has been largely lost, presumably by decades of decomposition. The present total metal content of the soil is below (or near, for Cu) the limits set by the USEPA-503 Regulations, with Cd = 12, Cr = 312, Cu = 805, Pb = 129, Ni = 144, Zn = 636 mg/kg, and the pH is 6.3. These metal levels do, however, exceed the recommended maxima for Zn, Cu and Ni based upon studies of phytotoxicity in several crops (Williams, 1983; McGrath and Smith, 1990; Kiekens, 1990). Williams (1983) has recommended that total concentrations of Zn, Cu, and Ni in sludge-treated soils should not exceed ≈ 275 , 110, and 85 mg/kg, respectively, in order to protect more sensitive crops. Davis and Carlton-Smith (1984) have suggested maxima ≈ 300 , 100, and 200 mg/kg for Zn, Cu, and Ni in soils at pH 7. The phytotoxicity of Ni appears to be particularly sensitive to soil pH, and it tends to become more toxic than Cu in acid soils.

Numerous other experiments indicate that the USEPA-503 metal limits for phytotoxic metals (Table 1) are too high for many crops. Pot experiments with nonacid soils

show phytotoxic effects from Zn, Cu, and Ni at much lower metal concentrations than permitted by the USEPA-503 regulations (Sanders et al., 1987). Yield reductions at Cu, Zn, and Ni concentrations in nonacid soils far below the USEPA-503 limits have been observed in sludge field experiments, particularly with dicotyledonous crops (Lübben et al., 1991; Williams et al., 1986; Siegenthaler and Stauffer, 1991; Sauerbeck and Styperek, 1986). Similarly, experience with pig manure application indicates that additions of Cu to nonacid soils in excess of ≈ 300 kg/ha can be toxic for some crops (Unwin, 1981; Coppener, 1981). Lexmond (1981) has argued that HNO_3 -extractable Cu should not exceed 30 mg/kg for each percentage of organic matter in slightly acid soils in order to avoid toxicity to crop plants. This guideline is based on the observation that the Cu/C ratio seems to exert control over Cu solubility (or Cu^{2+} activity). Consequently, the absolute amount of Cu added to soils in sludge influences plant availability less than the concentration in the sludge, because of the protective effect of the sludge. This concept has been verified in pot experiments with beans (Minnich et al., 1987), where a given amount of Cu added to soil in sludge resulted in less plant uptake if the Cu was diluted in a larger amount of sludge. The importance of metal concentration in sludge has been incorporated into the USEPA-503 regulations, which place limits on acceptable concentrations for sludges to be used agriculturally. However, because much of the protective effect may come from organic matter, as suggested by the importance assigned to the Cu/C ratio in limiting bioavailability, it cannot be assumed that protection will persist at a high level for the long term.

The USEPA-503 regulations define the phytotoxicity threshold (PT_{50}) as the plant top tissue concentration that results in 50% yield (vegetative growth of shoots) reduction for plants grown in solution culture. The USEPA chose 40 mg/kg as the PT_{50} for Cu, basing this value on the solution culture corn study of Lexmond and van der Vorm (1981). That study, however, demonstrated large effects of soluble Cu on root surface area and Fe and PO_4 uptake at shoot Cu concentrations well below 40 mg/kg. Lexmond and van der Vorm (1981) concluded that "the use of dry matter production as the measure of root growth can thus obscure an inhibition of growth." They demonstrated that Cu toxicity is initially manifested as inhibition of fine root growth without any notable reduction in root weight. At higher Cu concentration, root weight is reduced, but shoot growth is not immediately inhibited. Ultimately, shoot growth is retarded, but at this advanced stage of toxicity, shoot concentrations of Cu actually level off or diminish as the toxic level of Cu appears to impair translocation of Cu from roots.

A similar complex response to a phytotoxic metal may explain the puzzling data presented by the USEPA (USEPA, 1992), in which the probability of exceeding the PT_{50} level for Zn and Ni in corn shoots is shown to decrease once a certain loading of the respective metal in the soil is exceeded. This led the USEPA to the conclusion that "as cumulative loadings (of nickel) in-

crease, the probabilities of nickel concentrations in corn leaf exceeding the PT_{50} decrease" (emphasis added). This conclusion makes sense only if plant functions such as translocation have been impaired by the metal or if roots have avoided phytotoxic regions of the soil.

The effects of incipient phytotoxicity on root surface area and function may influence top growth much less in short-term solution culture experiments than in longer-term field experiments, where root surface area is critical for the plant to obtain sufficient water and nutrients to thrive. Furthermore, yield as defined by short-term vegetative growth in plants may not predict harvestable yield in the agronomic sense, and could underestimate the degree to which crop production is affected by metal toxicity over a full growing season.

In summary, the USEPA has selected LOAEL (lowest observed adverse effect level) values for Cu and Zn that are difficult to defend scientifically. The PT_{50} of 40 mg/kg for corn shoots does not agree with the upper critical level for toxicity of 21 mg/kg or less reported by MacNicol and Beckett (1985). Similarly, the PT_{50} for Zn in corn shoots of 1975 mg/kg is much higher than the 200 mg/kg critical level from other studies (MacNicol and Beckett, 1985). In part, the very high PT_{50} values used in the USEPA-503 regulations arise from the decision to set the LOAEL at 50% yield reduction, whereas the upper critical levels of MacNicol and Beckett (1985) are based on 10% yield reduction. Also, corn is generally more tolerant of phytotoxic metals than most dicotyledonous plants. Even so, it is difficult to find support for the USEPA position that these tissue concentrations of Cu and Zn represent the lowest observed adverse effect level.

Based on field and greenhouse studies with a range of crops in neutral and slightly acid soils, then, the USEPA-503 metal loading limits for the phytotoxic metals, Cu, Zn, and Ni (Table 1) are too high. As there is reason to believe that the toxic effects of these elements can be additive to some degree (Coppenet, 1981; Beckett, 1981; Davis and Carlton-Smith, 1984), soils loaded near the limits for all three metals would be even more likely to manifest toxicity. The USEPA limits may be biased by a heavy reliance on data from corn (maize) yields in the field (USEPA, 1992), as corn is one of the least sensitive crops to Cu and Zn toxicity (Lübben et al., 1991). Furthermore, USEPA apparently employed an extrapolation to determine the level of phytotoxic metal that would have to be added to soil in order to produce a tissue metal level causing yield reduction. This was necessary because few soils have received sufficient sludge to approach, for example, the 2800 kg/ha limiting value for Zn (see Table 1). Consequently, the effect of this soil concentration of Zn on yield has not actually been field-tested. Perhaps certain types of soils (e.g., calcareous ones) with certain crops (e.g., corn) can tolerate concentrations of toxic metals approaching the USEPA-503 limits without substantial yield reduction, but most studies with a range of crops in slightly acid to neutral soils do not support these limits.

SUMMARY

The long-term consequences of the application of metal-laden sewage sludges at the loadings permitted by the USEPA-503 regulations are still unknown. While there is no doubt that sludges initially provide a strong protection against metal uptake by plants, it is likely that the nature of the major inorganic constituents in sludges (Fe, Al, Ca, or P) as well as the native properties of the soil receiving the sludge will ultimately exert greater control over the solubility of toxic elements as organic matter decays to low levels. Nevertheless, the USEPA-503 regulations make no allowance for differences in soil and sludge chemistry, and are based on the argument that the inorganic constituents of all sludge materials will permanently retain potentially toxic metals in insoluble forms. The available evidence suggests that organic matter is more effective than these inorganic constituents in keeping Cd unavailable. Although certain phytotoxic metals such as Cu and Ni are bonded more strongly than Cd by inorganic phases, these metals may nevertheless inhibit microbial activity and plant growth at soil concentrations below those permitted by the USEPA-503 regulations.

Leeper (1978) noted that "it is no light matter to decide to multiply the naturally occurring burden of heavy metals in soils by a factor of 3 to 4," and yet the USEPA-503 regulations permit very much larger increases than this for a number of toxic elements. Because no soils known to this author have been simultaneously loaded with several of the heavy metals at the limits set by the USEPA-503 regulations, predictions of no adverse effects on crops are evidently extrapolations that remain to be tested. These predictions also assume that the protective effect of the sludge does not diminish with time. The inorganic solids in soils with properties most conducive to the permanent burial of high levels of initially available heavy metals are manganese oxides (Leeper, 1978). Because these are minor minerals in most soils, their capacity to adsorb or coprecipitate heavy metals is limited. Other solids tend to be too soluble or weatherable in the long term (e.g., carbonates) or are unable to accommodate many of the heavy metal cations in their structure (e.g., Fe oxides). Phosphates may have a significant role in coprecipitating Cd and Pb, but the effectiveness of this mechanism in lowering bioavailability of these heavy metals has not been established.

Most of the agriculturally productive soils in this country are presently in use; food production cannot simply be relocated if existing farm land is degraded. Our best agricultural soils need to have their productivity and crop quality protected, not for 10, 20, or even 100 yr, but in perpetuity. To this end, a cautious approach to the application of toxic metals in sludges to agricultural soils would be prudent.

REFERENCES

- Alloway, B. 1990. Cadmium, p. 100-124. In B.J. Alloway (ed.) Heavy metals in soils. Blackie, Glasgow.
- Alloway, B.J., and A.P. Jackson. 1991. The behaviour of heavy metals in sewage-sludge amended soils. Sci. Total Environ. 100: 151-176.

- Andersson, A. 1992. Trace elements in agricultural soils. Fluxes, balances and background values. Swedish Environmental Protection Agency Rep. 4077. Solna, Sweden.
- Baldwin, A., T.A. Brown, P.H.T. Becken, and G.E.P. Elliot. 1983. The forms of combination of Cu and Zn in digested sewage sludge. *Water Res.* 17:1935-1944.
- Barbarick, K.A., and S.M. Workman. 1987. Ammonium bicarbonate-DTPA and DTPA extractions of sludge-amended soils. *J. Environ. Qual.* 16:125-130.
- Becken, P. 1981. Copper in sludge—are the toxic effects of copper and other heavy metals additive? p. 204-215. *In* P. L'Hermite and J. Dehandtschutter (eds.) *Copper in Animal Wastes and Sewage Sludge*. D. Reidel, Dordrecht.
- Becken, P.H.T., and R.D. Davis. 1977. Upper critical levels of toxic elements in plants. *New Phytol.* 79:95-106.
- Beckett, P.H.T., E. Warr, and R.D. Davis. 1983. Cu and Zn in soils treated with sewage sludge: their 'extractability' to reagents compared with their 'availability' to plants. *Plant Soil.* 70:3-14.
- Bell, P.F., B.R. James, and R.L. Chaney. 1991. Heavy metal extractability in long-term sewage sludge and metal salt-amended soils. *J. Environ. Qual.* 20:481-486.
- Berrow, M.L., and J.C. Burridge. 1981. Persistence of metals in available form in sewage sludge treated soils under field conditions. p. 202-204 *In* Proc. Int. Conf. Heavy Metals in the Environment, Amsterdam. 1981. CEP Consultants, Edinburgh.
- Bidwell, A.M., and R.H. Dowdy. 1987. Cadmium and zinc availability to corn following termination of sewage sludge applications. *J. Environ. Qual.* 16:438-442.
- Billet, M.F., E.A. Fitzpatrick, and M.S. Cresser. 1991. Long-term changes in the copper, lead, and zinc content of forest soil organic horizons from north-east Scotland. *Water Air Soil Pollut.* 59:179-192.
- Brams, E., and W. Anthony. 1988. Residual cadmium in a soil profile and accumulation in wheat grain. *Plant Soil* 109:3-8.
- Campbell, D.J., and P.H.T. Becken. 1988. The soil solution in a soil treated with digested sewage sludge. *J. Soil Sci.* 39:283-298.
- Chaney, R.L., and J.A. Ryan. 1993. Heavy metals and toxic organic pollutants in MSW-composts: Research results on phytoavailability, bioavailability, fate, etc. p. 451-506. *In* H.A.J. Hottink and H.M. Keener (ed.) *Science and engineering of composting: design, environmental, microbiological and utilization aspects*. Renaissance Publ., Worthington, Ohio.
- Chang, A.C., T.C. Granato, and A.L. Page. 1992. A methodology for establishing phytotoxicity criteria for chromium, copper, nickel and zinc in agricultural land application of municipal sewage sludges. *J. Environ. Qual.* 21:521-536.
- Chang, A.C., J.D. Hinesly, T.E. Bates, H.E. Doner, R.H. Dowdy, and J.A. Ryan. 1987a. Effects of long-term sludge application on accumulation of trace elements by crops. p. 53-66. *In* A.L. Page et al. (ed.) *Land application of sludge: Food chain implications*. Lewis Publ., Chelsea, MI.
- Chang, A.C., A.L. Page, and J.E. Wermicke. 1987b. Long-term sludge application on cadmium and zinc accumulation in Swiss chard and radish. *J. Environ. Qual.* 16:217-221.
- Choudhary, M., L.D. Bailey, and C.A. Grant. 1993. Effect of Zn application on Cd concentration in durum wheat (*Triticum turgidum* L. var *durum*) as affected by soil temperature and growth stages. p. 27. *In* Agronomy abstracts. ASA, Madison, WI.
- Coppenet, M. 1981. Copper accumulation in Brittany soils through enriched pig slurry: Phytotoxic risks. p. 154-161. *In* P. L'Hermite and J. Dehandtschutter (ed.) *Copper in animal wastes and sewage sludge*. D. Reidel, Dordrecht.
- Davis, R.D. 1984. Cadmium—a complex environmental problem: II. Cadmium in sludges used as fertilizers. *Experientia* 40:117-126.
- Davis, R.D., and C.H. Carlson-Smith. 1984. An investigation into the phytotoxicity of zinc, copper and nickel using sewage sludge of controlled metal content. *Environ. Pollut. ser. B* 8:163-185.
- de Haan, S. 1975. Land application of liquid municipal wastewater sludges. *J. Water Pollut. Control Fed.* 47:2707-2710.
- de Vries, M.P.C., and K.G. Tiller. 1978. Sewage sludge as a soil amendment, with special reference to Cd, Cu, Mn, Ni, Pb and Zn—comparison of results from experiments conducted inside and outside a glasshouse. *Environ. Pollut.* 16:231-240.
- Dickinson, N.M., N.W. Lepp, and G.J.K. Surtan. 1988. Further studies on copper accumulation in Kenyan *Coffea arabica* plantations. *Agric. Ecosyst. Environ.* 21:181-190.
- Dowdy, R.H., C.E. Clapp, D.R. Linden, T.R. Halbach, and R.C. Polta. 1993. Partitioning of applied sludge-borne trace metals within a watershed cropped with corn continuously for 19 years. p. 314. *In* Agronomy abstracts, ASA, Madison, WI.
- Dowdy, R.H., W.E. Larson, J.M. Titrud, and J.J. Latterell. 1978. Growth and metal uptake of snap beans grown on sewage sludge-amended soil: a four-year field study. *J. Environ. Qual.* 7:252-257.
- Dowdy, R.H., and V.V. Volle. 1983. Movement of heavy metals in soils. p. 229-240. *In* D.W. Nelson et al. (ed.) *Chemical mobility and reactivity in soil systems*. SSSA Spec. Publ. 11. SSSA and ASA, Madison, WI.
- Fujii, R., L.L. Hendrickson, and R.B. Corey. 1983. Ionic activities of trace metals in sludge-amended soils. *Sci. Total Environ.* 28:179-190.
- Hassett, J.J., J.E. Müller, and D.E. Koeppe. 1976. Interaction of lead and cadmium on maize root growth and uptake of lead and cadmium by roots. *Environ. Pollut.* 11:297-302.
- Hendrickson, L.L., and R.B. Corey. 1981. Effect of equilibrium metal concentrations on apparent selectivity coefficients of soil complexes. *Soil Sci.* 131:163-171.
- Hinesly, T.D., R.L. Jones, E.L. Ziegler, and J.J. Tyler. 1977. Effects of annual and accumulative applications of sewage sludge on assimilation of zinc and cadmium by corn (*Zea mays* L.). *Environ. Sci. Technol.* 11:182-188.
- Hinesly, T.D., K.E. Redborg, R.I. Pietz, and E.L. Ziegler. 1984. Cadmium and zinc uptake by corn (*Zea mays* L.) with repeated applications of sewage sludge. *J. Agric. Food Chem.* 32:155-163.
- Hinesly, T.D., E.L. Ziegler, and G.L. Barret. 1979. Residual effects of irrigating corn with digested sewage sludge. *J. Environ. Qual.* 8:35-38.
- Hooda, P.S., and B.J. Alloway. 1994. The plant availability and DTPA extractability of trace metals in sludge-amended soils. *Sci. Total Environ.* 149:39-51.
- Jalil, A., F. Selles, and J.M. Clarke. 1993. Effect of cadmium on the growth and nutrient uptake of durum wheat. p. 36. *In* Agronomy abstracts. ASA, Madison, WI.
- Jarvis, S.C., L.H.P. Jones, and M.J. Hopper. 1976. Cadmium uptake from solution by plants and its transport from roots to shoots. *Plant Soil* 44:179-191.
- Jones, K.C. 1991. Contamination trends in soils and crops. *Environ. Pollut.* 69:311-326.
- Kabata-Pendias, A., and H. Pendias. 1984. Trace elements in soils and plants. CRC Press, Boca Raton, FL.
- Kiekens, L. 1990. Zinc. p. 261-279. *In* B.J. Alloway (ed.) *Heavy metals in soils*. Blackie, Glasgow.
- Klemenc, G.L., D.D. Hemphill, M. Hickey, T.L. Jackson, and V.V. Volk. 1990. Sweet corn yield and tissue metal concentration after seven years of sewage sludge applications. *J. Prod. Agric.* 3:232-237.
- Kuo, S., E.J. Jellum, and A.S. Baker. 1985. Effects of soil type, liming, and sludge application on zinc and cadmium availability to Swiss chard. *Soil Sci.* 139:122-130.
- Latterell, J.J., R.H. Dowdy, and W.E. Larson. 1978. Correlation of extractable metals and metal uptake of snap beans grown on soil amended with sewage sludge. *J. Environ. Qual.* 7:435-440.
- Lee, C.R., B.L. Folsom, and D.J. Bates. 1983. Prediction of plant uptake of toxic metals using a modified DTPA soil extraction. *Sci. Total Environ.* 28:191-202.
- Leeper, G.W. 1978. *Managing the heavy metals on the land*. Marcel Dekker, New York.
- Leriche, H.H. 1968. Metal contamination of soil in the Woburn Market-Garden experiment resulting from the application of sewage sludge. *J. Agric. Sci. (Cambridge)* 71:205-208.
- Lexmond, Th.M. 1980. The effects of soil pH on copper toxicity to forage maize grown under field conditions. *Neth. J. Agric. Sci.* 28:164-183.
- Lexmond, Th.M. 1981. A contribution to the establishment of safe copper levels in soil. p. 162-183. *In* P. L'Hermite and J. Dehandtschutter (ed.) *Copper in animal wastes and sewage sludge*. D. Reidel, Dordrecht.
- Lexmond, Th.M., and P.D.J. van der Vorm. 1981. The effect of pH

- on copper toxicity to hydroponically grown maize. *Neth. J. Agric. Sci.* 29:217-238.
- Lloyd, C.A., R.L. Chaney, and P.J. Mastradone. 1981. Labile cadmium in soils of long-term sludge utilization farms. p. 29. *In* Agronomy abstracts. ASA, Madison, WI.
- Lübben, S., E. Rietz, and D. Sauerbeck. 1991. Metal uptake and crop growth on sewage sludge field trials with heavy metal contents near the recommended limit values. p. 535-543. *In* P. L'Hermite (ed.) Treatment and use of sewage sludge and liquid agricultural wastes. Elsevier, New York.
- MacNicol, R.D., and P.H.T. Beckett. 1985. Critical tissue concentrations of potentially toxic elements. *Plant Soil* 85:107-129.
- Mahler, R.J., J.A. Ryan, and T. Reed. 1987. Cadmium sulfate application to sludge-amended soils I. Effect on yield and cadmium availability to plants. *Sci. Total Environ.* 67:117-131.
- McBride, M.B. 1978. Retention of Cu^{2+} , Ca^{2+} , Mg^{2+} and Mn^{2+} by amorphous alumina. *Soil Sci. Soc. Am. J.* 42:27-31.
- McBride, M.B. 1981. Forms and distribution of copper in solid and solution phases of soil. p. 25-45. *In* J.F. Loneragan et al. (ed.) Copper in soils and plants. Academic Press, New York.
- McBride, M.B. 1989. Reactions controlling heavy metal solubility in soils. *Adv. Soil Sci.* 10:1-56.
- McBride, M.B. 1994. Environmental chemistry of soils. Oxford Univ. Press, New York.
- McGrath, S.P. 1987. Long-term studies of metal transfers following application of sewage sludge. p. 301-317. *In* P.J. Coughrey, M.H. Martin and M.H. Unsworth (ed.) Pollutant transport and fate in ecosystems. Blackwell Scientific Publ., Oxford.
- McGrath, S.P., and J. Cegarra. 1992. Chemical extractability of heavy metals during and after long-term applications of sewage sludge to soil. *J. Soil Sci.* 43:313-321.
- McGrath, S.P., and P.W. Lane. 1989. An explanation for the apparent losses of metals in a long-term experiment with sewage sludge. *Environ. Pollut.* 60:235-256.
- McGrath, S.P., and S. Smith. 1990. Chromium and nickel. p. 125-150. *In* B.J. Alloway (ed.) Heavy metals in soils. Blackie, Glasgow.
- Mench, M.J., V.L. Didier, M. Löffler, A. Gomez, and P. Masson. 1994. A mimicked in-situ remediation study of metal-contaminated soils with emphasis on cadmium and lead. *J. Environ. Qual.* 23:58-63.
- Merry, R.H., K.G. Tiller, and A.M. Alston. 1986a. The effects of contamination of soil with copper, lead and arsenic on the growth and composition of plants: I. Effects of season, genotype, soil temperature and fertilizers. *Plant Soil* 91:115-128.
- Merry, R.H., K.G. Tiller, and A.M. Alston. 1986b. The effects of soil contamination with copper, lead and arsenic on the growth and composition of plants: II. Effects of source of contamination, varying soil pH and prior waterlogging. *Plant Soil* 95:255-269.
- Minnich, M.M., and M.B. McBride. 1986. Effect of copper activity on carbon and nitrogen mineralization in field-aged copper-enriched soils. *Plant Soil* 91:231-240.
- Minnich, M.M., M.B. McBride, and R.L. Chaney. 1987. Copper activity in soil solution: II. Relation to copper accumulation in young snapbeans. *Soil Sci. Soc. Am. J.* 51:573-578.
- Nicklow, C.W., W.A. Norvell, and J. Spitzer. 1981. Predicting total soil lead from an acetic acid-sodium acetate buffered solution. *Commun. Soil Sci. Plant Anal.* 12:239-245.
- Nor, Y.M., and H.H. Cheng. 1986. Chemical speciation and bioavailability of copper: uptake and accumulation by *Eichornia*. *Environ. Toxicol. Chem.* 5:941-947.
- Northeastern U.S. Regional Research. 1985. Criteria and recommendations for land application of sludges in the Northeast. U.S. Regional Research Bull. 851. Pennsylvania State Univ., University Park.
- O'Connor, G.A. 1988. Use and misuse of the DTPA soil test. *J. Environ. Qual.* 17:715-718.
- Payne, G.G., D.C. Martens, C. Winarko, and N.F. Perera. 1988. Form and availability of copper and zinc following long-term copper sulfate and zinc sulfate applications. *J. Environ. Qual.* 17:707-711.
- Robertson, W.K., M.C. Lutrick, and T.L. Yuan. 1982. Heavy applications of liquid-digested sludge on three ultisols: I. Effects on soil chemistry. *J. Environ. Qual.* 11:278-282.
- Ryan, J.A., and R.L. Chaney. 1993. Regulation of municipal sewage sludge under the clean water act section 503: a model for exposure and risk assessment for MSW-compost. p. 422-450. *In* H.A.J. Holtink and H.M. Keener (ed.) Science and engineering of composting: Design, environmental, microbiological and utilization aspects. Renaissance Publ., Worthington, OH.
- Sanders, J.R. 1982. The effect of pH upon the copper and cupric ion concentrations in soil solutions. *J. Soil Sci.* 33:679-689.
- Sanders, J.R., S.P. McGrath, and T. McM. Adams. 1986. Zinc, copper and nickel concentrations in ryegrass grown on sewage sludge-contaminated soils of different pH. *J. Sci. Food Agric.* 37:961-968.
- Sanders, J.R., S.P. McGrath, and T. McM. Adams. 1987. Zinc, copper and nickel concentrations in soil extracts and crops grown on four soils treated with metal-loaded sewage sludges. *Environ. Pollut.* 44:193-210.
- Sauerbeck, D.R., and P. Styperek. 1986. Long-term effects of contaminations. p. 318-325. *In* P. L'Hermite (ed.) Processing and use of organic sludge and liquid agricultural wastes. D. Reidel, Dordrecht.
- Siegenthaler, A.F., and W. Stauffer. 1991. Environmental effects of longterm slurry and sewage sludge application: reasons and measures. p. 82-89. *In* P. L'Hermite (ed.) Treatment and use of sewage sludge and liquid agricultural wastes. Elsevier, New York.
- Steinnes, E. 1990. Mercury. p. 222-236. *In* B.J. Alloway (ed.) Heavy metals in soils. Blackie, Glasgow.
- Stern, A.H. 1993. Monte Carlo analysis of the USEPA model of human exposure to cadmium in sewage sludge through consumption of garden crops. *J. Exposure Anal. Environ. Epidemiol.* 3:449-469.
- Stiles, C.A., J.E. Foss, and R.J. Lewis. 1993. Lead fractions in soil samples from Hadrian's Villa, Italy. p. 305. *In* Agronomy abstracts. ASA, Madison, WI.
- Terry, R.E., D.W. Nelson, and L.E. Sommers. 1979. Carbon cycling during sewage sludge decomposition in soils. *Soil Sci. Soc. Am. J.* 43:494-499.
- Tiller, K.G., and R.H. Merry. 1981. Copper pollution of agricultural soils. p. 119-137. *In* J.F. Loneragan et al. (ed.) Copper in Soils and Plants. Academic Press, New York.
- Trocme, S., G. Barbier, and J. Chabannes. 1950. Chlorosis, caused by lack of manganese, of crops irrigated with filtered water from Paris sewers (In French). *Ann. Agron.* 1:663-685.
- Tyler, L.D., and M.B. McBride. 1982. Mobility and extractability of cadmium, copper, nickel and zinc in organic and mineral soil columns. *Soil Sci.* 124:198-205.
- Unwin, R.J. 1981. The application of copper in sewage sludge and pig manure to agricultural land in England and Wales. p. 102-116. *In* P. L'Hermite and J. Dehandtshuter (ed.) Copper in animal wastes and sewage sludge. D. Reidel, Dordrecht.
- U.S. Environmental Protection Agency. 1993. Clean water act. Section 503. Vol. 58. No. 32. USEPA, Washington, DC.
- USEPA. 1992. Technical support document for land application of sewage sludge. Vol. I. USEPA 822/R-93-001a and Vol. II. EPA 822/R-93-001b. USEPA, Washington, DC.
- Viamis, J., D.E. Williams, J.E. Corey, A.L. Page, and T.J. Ganje. 1985. Zinc and cadmium uptake by barley in field plots fertilized seven years with urban and suburban sludge. *Soil Sci.* 139:81-87.
- Wallace, A., and W.L. Berry. 1989. Dose-response curves for zinc, cadmium, and nickel in combinations of one, two or three. *Soil Sci.* 147:401-410.
- Walsh, L.M., W.H. Erhardt, and H.D. Seibel. 1972. Copper toxicity in snapbeans (*Phaseolus vulgaris* L.). *J. Environ. Qual.* 1:197-200.
- Webber, L.R., and E.G. Beauchamp. 1979. Cadmium concentration and distribution in corn (*Zea mays* L.) grown on a calcareous soil for three years after three annual sludge applications. *J. Environ. Sci. Health B14(5):459-474.*
- Williams, J.H. 1983. Zinc, copper and nickel—suggested safe limits in sewage sludge treated soils. p. 82-90. *In* R.D. Davis et al. (ed.) Environmental effects of organic and inorganic contaminants in sewage sludge. D. Reidel, Dordrecht.
- Williams, J.H., K.A. Smith, and J.R. Jones. 1986. Varietal tolerance in cereals to metal contamination in a sewage treated soil. p. 537-542. *In* P. L'Hermite (ed.) Processing and use of organic sludge and liquid agricultural wastes. D. Reidel, Dordrecht, Holland.
- Xia, K., P.A. Helmke, and T.S. Morris. 1993. Concentrations of isotopically exchangeable zinc and cadmium in soils. p. 238. *In* Agronomy abstracts. ASA, Madison, WI.

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Comparison of United States, Dutch, German and Canadian Compost Quality Standards

mg/kg dry weight

UNITED STATES COMPOST QUALITY STANDARDS

	ARSENIC	BORON	CADMIUM	CHROMIUM	COBALT	COPPER	LEAD	MERCURY	MOLYBDENUM	NICKEL	SELENIUM	ZINC
Arizona	-	-	10	1000	-	450	250	10	-	50	-	900
Florida	-	-	15	-	-	450	500	-	-	50	-	900
Iowa	-	-	4.4	-	-	450	500	-	-	125	125	-
Maine	-	-	10	1000	1000	1000	700	10	-	200	-	2000
Massachusetts	-	300	2	1000	-	1000	300	10	10	200	-	2500
Minnesota	-	-	10	1000	-	500	500	5	-	100	-	1000
New Hampshire	-	-	10	1000	-	1000	500	10	-	200	-	2500
New York	-	-	10	1000	-	1000	250	10	-	200	-	2500
North Carolina	-	-	10	1000	-	800	250	10	-	200	-	1000
Pennsylvania	-	-	-	1000	-	1000	1000	10	-	200	-	2500
Vermont	-	-	10	1000	-	1000	250	10	-	200	-	2500
Stds. For CWA 503 High Quality Sludges/Sludge Composts	41	-	39	1200	-	1500	300	17	13	420	36	2800
CWA 503 Ceiling Concentrations	75	-	85	3000	-	4300	800	57	75	420	100	7500

DUTCH COMPOST SLUDGE QUALITY STANDARDS

Compost until 12/31/94	25	-	2	200	-	300	200	2	-	50	-	900
Clean Compost Until 12/31/94	15	-	1	70	-	90	120	0.7	-	20	-	280
Compost After 1/1/95	15	-	1	50	-	60	100	0.3	-	20	-	200
Very Clean Compost After 1/1/95	5	-	0.7	50	-	25	65	0.2	-	10	-	75
Sludge	15	-	1.25	350	-	75	100	0.75	-	30	-	300

GERMAN COMPOST & SLUDGE QUALITY STANDARDS

Compost	-	-	1.5	100	-	100	150	1.0	-	50	-	400
Sludge	-	-	1-1.5	10	-	6	100	1.0	-	5	-	150-200

CANADIAN COMPOST QUALITY STANDARDS

Ontario	10	-	3	50	25	60	150	0.15	2	60	2	500
British Columbia	13	-	2.6	210	-	100	150	.8	-	50	-	500
National Guideline on Compost	13	-	2.6	210	26	120	83	0.83	7	32	2.6	315

UNITED STATES

"The United States Environmental Protection Agency (USEPA) has no plans, at present, to develop standards for composts derived from municipal solid waste (MSW). However, the Agency has indicated that such standards ultimately will be established utilizing risk assessment methodology similar to that developed for the Clean Water Act, Section 503 Sludge Regulations (CWA 503 Regulations) promulgated in November, 1992. The CWA 503 Regulations concern the use or disposition of sewage sludge and sludge products, including composts derived from sludge alone or in admixture with MSW. Unrestricted use of such materials is permitted if they meet quality sludge specifications for metals concentrations, pathogen reduction, and vector (disease-carrying animals, such as rodents and vermin) attraction prevention. According to USEPA, the standards for metals concentrations in sludge set forth in the CWA 503 Regulations should be acceptable for MSW compost products...USEPA has characterized the approach used to develop the Regulations as science-based 'reasonable-risk' methodology. Underlying it are the following assumptions: that change in soil is inevitable; that safety factors can be mathematically predicted with certainty utilizing existing scientific data; and that currently available scientific information is sufficient to set standards ensuring no harm to human health or the environment. While acknowledging that neither the dynamics of contaminant and soil interaction, nor ecological risks are well understood, EPA has concluded that, '...there are virtually no effects when sludge is disposed of on the land or used as a soil conditioner or fertilizer in compliance with...[CWA 503]...rules.' And that, '...MSW composts and sewage sludge can provide significant benefit to sustainable agriculture; compost utilization can safely continue for an indefinite period without risk to agriculture or the environment.' The U.S. standards are permissive compared ... particularly [with] those of The Netherlands and the Canadian Province of Ontario."

THE NETHERLANDS

"The Netherlands were the first of the European Community (EC) members to develop standards for soil quality conservation under their Soil Protection Act of 1987. Guided by the principle of 'good stewardship,' or sustainability, of the land, compost quality standards were calculated to reverse presently occurring accumulation of pollutants in soil by preventing their addition in amounts greater than are acceptably removed via leaching and plant uptake. *Acceptable* leaching means no addition of contaminants to ground water beyond current mean values, and *acceptable* plant uptake is defined by food quality standards. Central to the Dutch concept of good stewardship is maintenance of land use options for future generations through preservation of *essential soil functions* - such things as recreation, water filtering, plant growth, crop production, and the cycling of carbon, nitrogen and sulfur. In order to establish scientifically-based soil quality standards, the Dutch Government requires more research-derived information than presently exists. In the meantime, the stringent Dutch compost quality standards are meant to guard, or allow for timely repair of, *soil multifunctionality*, feared threatened by the current rate of heavy metals accumulation in soil. Since protection of essential soil functions is thought to rely on the eventual elimination of *all* sources of soil contamination, fertilizers and diffuse atmospheric deposition are also targeted for regulation."

* * *

"The following [is a] statement by U.S. Government scientists involved in the development of CWA 503 Regulations '...just because lower concentrations of metal residue can be reached in MSW composts [through source separation of organic waste] doesn't mean that they have to be attained to make utilization of MSW compost on cropland a valuable practice of sustainable agriculture.' The marked contrast between EPA's conception of agricultural sustainability and that of the Dutch is striking."

ONTARIO, CANADA

"Ontario has issued interim *guidelines* for compost production and use. The guidelines contain metals standards, based on concentrations in rural 'background' -defined as non-point-source-contaminated- Ontario soils. These levels are thought to provide an appropriate foundation for compost quality standards, pending additional research-based information. An element in this decision is the desire to leave open the possibility for future agricultural use of nonagricultural lands. Ontario standards assume minimal metals leaching and plant uptake, and a compost application rate of 100 tons per hectare every five years for 55 years before relatively conservative maximum allowable metals concentrations in soil are reached. Neal Ahlberg, of the Ontario Ministry of Environment and Energy's Waste Reduction Office, has been involved in the ongoing process of standards development. 'For us deciding on standards was different than choosing acceptable levels for cleaning up already contaminated lands,' he said. 'We did not want to set limits for how much we could dirty-up clean lands.'... Risk assessment was not utilized for establishing Ontario's standards. 'The problem with risk assessment is that there are too many unknowns. To us, it seems a bit dangerous; our knowledge is too limited. There are many differences of opinion, even among experts. And there are historical examples of significant harm caused by insufficient knowledge,' said Dr. Lambert Otten, former member of two Canadian standards-development advisory bodies..."

* * *

"Results from pilot projects in Ontario indicate that composts produced from source-separated food and yard wastes are able to comply with the contaminant limits in the Guidelines. Several Ontario municipalities are planning composting projects based on source-separated organic materials from residential, commercial and industrial sources..." "Ontario's Guidelines for Compost Production and Use," by Neal Ahlberg

WASTE NOT # 241. A publication of *Work on Waste USA*, published 48 times a year. Annual rates are: Groups & Non-Profits \$50; Students & Seniors \$35; Individual \$40; Consultants & For-Profits \$125; Canadian \$US50; Overseas \$65. Editors: Ellen & Paul Connett, 82 Judson Street, Canton, NY 13617. Tel: 315-379-9200. Fax: 315-379-0448.

POTENTIAL IMPACT OF CURRENT LANGUAGE IN SLUDGE LAW

Land application of sewage sludge has been recognized by the federal government and the State of West Virginia as a viable disposal/reuse option which is environmentally sound and beneficial. The current statute includes a provision intended to limit long term accumulation of certain metals in those soils receiving sludge amendments. During the last year as municipalities have collected the information necessary to begin implementing the law, soils samples in many West Virginia counties indicate that natural levels for several metals exceed the targets established by the regulations. Those targets were not scientifically defensible, but at the time, it was determined that safeguards be developed and that target levels in soils be established for long term environmental protection.

While that concern is still valid, the current language in the law and the limits in the regulations have in effect prohibited land application in at least 28 counties in West Virginia where soils data have been collected. (See attached map) In those counties, facilities will not be allowed to land apply sludge. Municipalities will be forced to dispose of their sludge in landfills, if landfills are available to accept it. The difference in cost between land application and landfill disposal in those counties will be borne by the municipality and the citizens. Approximately 60,000 tons of sludge is generated by the municipalities in these counties. At \$30 to \$40 per ton it would cost them between \$1.8 and \$2.4 million to dispose of this sludge in landfills. Land application fees for that same sludge would cost \$60,000.

Municipalities must have access to environmentally acceptable and economically achievable disposal options. Without such options, sludges may end up in streams or in areas where significant environmental harm may occur.

In order for the current sludge management activities related to land application of sewage sludge to continue effectively and with minimal impact to the environment, the statute must be amended.

DIVISION OF ENVIRONMENTAL PROTECTION

Soil Sample Results

County	As	Cd	Cr	Cu	Pb	Hg	Mo	Ni	Se	Zn	Method
Grant	3.9		80		18.4	0.1		40	2.9		SW-846
Greenbrier	2.2		13	25	12.1	0.1	0.25	25	0.5	30	CFR-136
Hardy	7.6	0.4	40	25	15.9	0.3		45	1.2	115	CFR-136
Jefferson	9.9		255		23.4	0.1		160	8.7		SW-846
Jefferson	15		340		23.8	0.1		150	1.7		SW-846
Jefferson	6.1		375		23.9	0.2		175			SW-846
Lewis	16.6	0.4	60	35	30.4	0.1	0.8	55	4.3	110	CFR-136
Mercer	3.1		30	25	18.3	0.1		10	0.5	105	CFR-136
Mercer	5.8		13	15	13	0.1		10	2.2	60	CFR-136
Mercer	3.2		13	15	10.6	0.3		10	0.5	55	CFR-136
Mineral	18		290		18	0.1		100	1.8		SW-846
Morgan	10.7		105		17.3	0.1		50	1.1		SW-846
Pocahontas	7.4		60	15	17.8	0.1		40	0.5	55	CFR-136
Putnam	16.2		60	30	43.5	0.2	0.25	50	1.5	120	CFR-136
Putnam	6.7	0.1	55	15	20.2	0.1	1.4	55	0.5	60	CFR-136
Putnam	4.6		50	25	15.6	0.2		50	0.5	60	CFR-136
Wood	6.4		50	30	17	0.2		50	0.5	115	CFR-136
Wood	9.4	0.3	55	20	29.7	0.1	0.7	30	1.5	90	CFR-136
Wood	14.6	0.3	80	20	25.9	0.1	0.6	35	0.5	85	CFR-136
Wood	8.5	0.1	13	15	23.7	0.1	0.5	20	0.5	75	CFR-136
Wood	10.4	0.4	13	25	30.3	0.1	1.1	30	0.5	90	CFR-136
Wood	4.7	0.2	45	5	19.4	0.1	0.7	20	0.5	55	CFR-136
Wood	11.7	0.1	45	25	25.8	0.1	1.2	45	0.5	85	CFR-136
Wood	10.8	0.1	75	25	27.4	0.1	0.6	45	0.5	80	CFR-136
Wood	9.8	0.2	55	25	26.5	0.1	2.2	35	0.5	90	CFR-136
Wood	11.2	0.2	85	30	27.9	0.1	1.1	45	0.5	95	CFR-136
Wood	16.7	0.3	115	45	39	0.1	3	45	0.5	115	CFR-136
Wood	4.2	0.1	75	15	24.5	0.1	0.25	20	0.5	60	CFR-136
Wood	6.2	0.2	80		25.5	0.1	0.5	10	0.5	45	CFR-136
Wood	6.2	0.3	40	15	21.8	0.1	0.25	10	0.5	75	CFR-136
Wood	8.8	0.3	75	25	33.3	0.1	0.25	30	0.5	85	CFR-136
Average	8.923	0.235	88.39	22.71	23.22	0.126	0.824	48.23	1.23	80.4	
Maximum	18	0.4	375	45	43.5	0.3	3	175	8.7	120	
Minimum	2.2	0.1	13	5	10.6	0.1	0.25	10	0.5	30	
State Limit	5.7	1.4	140	140	35	2	2.5	28	5	350	

Blank Spaces Indicate No Sample Results Available.

When values reported from the laboratory are below the minimum detection limit, one half of the detection limit value is used for averaging purpose. These values are italicized.



DIVISION OF ENVIRONMENTAL PROTECTION
1201 Greenbrier Street
Charleston, WV 25311-1088

GASTON CAPERTON
GOVERNOR

DAVID C. GALLAGHAN
DIRECTOR

TO: Doug Brown
FROM: Clifton Browning

Here are the counties that we would like to have colored:

Brooke, Tyler, Wood, Jackson, Mason, Putnam, Wayne, McDowell,
Wyoming, Raleigh, Mercer, Summers, Monroe, Greenbrier, Pocohantas,
Lewis, Monongalia, Preston, Grant, Hardy, Mineral, Morgan, Taylor
and Jefferson.

We would like to have it titled:

COUNTIES VIOLATING MAXIMUM SOIL CONCENTRATIONS FOR METALS

We need approximately 50 copies. I can pick them up if they can not
be sent to us by Monday AM. Thanks

Clifton Browning

COPYIES
not [unclear]

Senate Bill 0007

STATE OF NEW YORK

6171

1993-1994 Regular Sessions

IN ASSEMBLY

March 18, 1993

Introduced by M. of A. PARMENT -- read once and referred to the Committee on Agriculture

AN ACT to amend the agriculture and markets law, in relation to the application of certain wastes within agricultural districts

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

1 Section 1. Legislative intent. The legislature hereby declares that
 2 agricultural lands are irreplaceable state assets. This declaration
 3 recognizes the importance of a healthy and viable agriculture to a
 4 prosperous state economy. It is further declared that the state must explore
 5 ways to sustain the state's valuable farm economy and the land
 6 base associated with it. Implicit in this policy is the need to preserve
 7 and protect the soil which is literally the foundation of New York
 8 state's most important industry. Since a federal ban recently went into
 9 effect prohibiting the disposal of sludges in the ocean, land applica-
 10 tion of sludges has been increasing. Utilization of sludges on agri-
 11 cultural land poses a number of problems. The presence of heavy metals
 12 and other substances in sludges can reduce soil productivity and crop
 13 production, and adversely affect animal health. Therefore, it is the de-
 14 clared policy of the state to protect land used in agricultural produc-
 15 tion located within an agricultural district, or land receiving an agri-
 16 cultural assessment from the potentially harmful effects of the land ap-
 17 plication of sludge, septage, or sewage sludge as defined herein.

18 § 2. Paragraph i of subdivision 4 of section 305 of the agriculture
 19 and markets law is relettered paragraph j and a new paragraph i is added
 20 to read as follows:

Fed

21 i. Notwithstanding any other provision of law to the contrary, no sep-
 22 tage, sewage sludge or other sludge or composted solid waste products
 23 made from septage, sewage sludge or other sludge, shall be applied upon

EXPLANATION--Matter in italics (underscored) is new; matter in brackets [] is old law to be omitted.

LBD07105-05-3

A. 6171

2

1 land used in agricultural production located within an agricultural dis-
2 trict, or upon land receiving an agricultural assessment pursuant to
3 this article. Nothing contained herein, however, shall be deemed to pro-
4 hibit such continued application on land where such application is
5 lawfully made prior to the effective date of this paragraph. For pur-
6 poses of this paragraph:

7 "Sludge" means any solid, semisolid or liquid waste generated from a
8 wastewater treatment plant, water supply treatment plant, or air pollu-
9 tion control facility but does not include the treated effluent from a
10 wastewater treatment plant, or the food processing wastes generated from
11 a food processing establishment licensed pursuant to the provisions of
12 article twenty-C of this chapter,

13 "Septage" means the contents of a septic tank, cesspool, or other in-
14 dividual sewage treatment facility which receives domestic sewage
15 wastes, and

16 "Sewage sludge" means the accumulated semisolids or solids resulting
17 from treatment of wastewaters from publicly or privately owned or oper-
18 ated sewage treatment plants.

19 § 3. This act shall take effect immediately.

April 11, 1995
Tom Degen
HC 75 Box 324
Chloe, WV 25235

Division of Environmental Protection
Offices of Water Resources & Waste Management
10 McJunkin Rd.
Nitro, WV 25143
Attn: Roger Hall

Dear Mr. Hall,

The Sewage Sludge Management Act states in §22-15-20(b)(6):

“That no person or entity be allowed to apply sewage sludge to land in a manner that will result in exceeding the maximum soil concentration for all pollutants, including, but not limited to, arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium and zinc;”

The language of §22-15-20(b)(6) reflects the concern that the West Virginia Legislature has for soil as a valuable resource. The Federal 503 rule regulates the concentrations of pollutants in *sewage sludge*, but does not have any provisions to check concentrations of these pollutants in *the soil itself* either before, during or after sludge application. This is a significant omission, because it is not yet proven that the pollution concentrations allowed under the 503 rule are environmentally and agriculturally safe. “Chief among the pitfalls of sludge application to agricultural lands is the long-term effects of trace contaminants on the soil and groundwater. There is a general scarcity of scientific research on the long-term (20 years +) effects of trace metals. . .” (Mazzocchi). “The USEPA-503 heavy metal loading limits . . . have not been reached . . . in field experiments, and it remains to be proven that they are safe. The important question that needs an answer before the USEPA limits can be considered environmentally and agriculturally acceptable is: What happens to toxic metals over the very long-term following the cessation of sludge application?” (McBride). That this is a concern of the legislature is not surprising, it is shared by many, from soil scientists and farmers, to lending institutions and governments. Many other nations, provinces and states have adopted standards that are more stringent than those in the 503 rule (Connett)(McBride). The New York State Assembly introduced a bill that stated, in part: “. . . no septage, sewage sludge, . . . shall be applied upon land used in agricultural production . . .” (New York). New Jersey food processors will not process vegetable or animal products produced on land that has ever received applications of waste products (Blew). Del Monte Corporation has banned the use of sludge on any land used for growing its food crops (Babish, et al). The Farm Credit Bank of Springfield has concluded that “. . . the bank would not recommend the application of sewage sludge on agricultural land mortgaged to Farm Credit without proper contractual indemnification underwritten by a financially responsible party.” (Farm Credit Bank).

The West Virginia Legislature has acted to protect its soils by requiring, among

other things, that maximum *soil* concentrations for pollutants are not exceeded. There is a sheet filed with the rule entitled SUMMARY. In this sheet, the statement is made that "The standards were . . . not intended by the Code and the existing rule to prohibit land application practices." That the agency would make such a statement demonstrates that it has completely failed to grasp the intent of the legislature to protect our soil resources. The standards were indeed intended to prohibit land application practices where such practices would ". . . result in exceeding the maximum soil concentration for . . . pollutants . . ." It is disturbing to note that the agency wants to change the rule rather than enforce it. Removing Table 3 would *create* an emergency by allowing soils already excessively high in metals to receive more.

The fact that there are soils in West Virginia that exceed these concentrations does indeed raise questions, the most significant of which may be "why are these concentrations present, how did these soils get these concentrations?" The DEP study by James Summers falls far short of proving that these are "naturally occurring levels". With all due respect to Mr. Summers, such a study should utilize the expertise of a much wider range of disciplines and perspectives than the offices of water resources and waste management can provide. Soil scientists, toxicologists, plant scientists, the department of agriculture, farmers, environmental groups, representatives from the financial community, the Soil Conservation Service, the US Economic and Geologic Survey, as well as the Office of Waste Management, should all be involved in determining if we have soil health problems.

If a thorough study of West Virginia soils shows that we do have soil health problems, then increasing the amount of pollutants that we allow to be land applied in sewage sludge will only exacerbate the problem. If such a study shows that the levels of metals that the agency has presented are not indicative of soil or plant health problems, then Table 3 could be revised, but in the meantime, the agency has not established that an emergency exists. Publicly Owned Treatment Works (POTW's), or any other entity, are not prohibited or prevented from properly managing sewage sludge, there are options available to them besides land applying sludge to soils that have high metal contents. The agency mentions two of these options, landfilling and composting on site, in the one-page Factors Constituting an Emergency that it filed with the amendment. A third option that comes to mind quite readily is simply land applying sewage sludge to soils that are not excessively high in metals. Since there are approved alternatives available to the POTWs, it can hardly be claimed that there is an immediate threat to the public peace, health, safety or welfare.

I have obtained some material that the agency used to arrive at its conclusion that there is an emergency. The material is confusing, in that it is stated that ". . . at least 28 counties in West Virginia . . ." have been affected. It is further stated that approximately 60,000 tons of sludge is generated in these 28 counties and that at \$30 to \$40 per ton, it would cost between \$1.8 and 2.4 million to dispose of that sludge in landfills. Nowhere in the material are all 28 counties named. Soil sample results are given for only eleven counties, and a list of 24 counties is given elsewhere. Working with such inconsistent information is difficult at best, but if one uses the figure of \$1.8 and \$2.4 million to dispose of 60,000 tons of sludge, and divides it by the population for the 24 counties that are listed (using 1990 census figures as presented in the West

Virginia Solid Waste Management Plan prepared by the Solid Waste Management Board), the figure of \$2.35 to \$3.13 per person is arrived at. Assuming 2.5 people per household (a figure typical for WV), one arrives at a cost per household per year of between \$5.88 and \$7.83. It should be noted that there are four counties worth of population not figured into this equation since four of the 28 counties that produce the 60,000 tons of sludge are not named. It would perhaps be more accurate to use one half the state population, since 28 is roughly one half of the 55 counties in West Virginia. In that case, the cost per household would be between \$5.03 and \$6.70 per year, or between \$.42 and \$.56 per month. This hardly amounts to "substantial harm to the public interest", one of the three factors mentioned in §29A-3-15(f) as constituting an emergency. The agency has also not mentioned which of these counties may have already been landfilling sludge anyway, in which case there would be no additional cost to continue the practice.

The claim is made in Factors Constituting an Emergency that composting sludge "... poses an ever-present potential for health risks." While the environmental community feels there is evidence of health risks from LARGE composting operations, say facilities that handle multiple thousands of tons per month, neither the agency or the environmental community has presented any evidence that the composting of 60,000 tons per year scattered over 28 counties, presents a health threat. The 503 rule that is incorporated into this very rule lists composting as one of the several acceptable Processes to Further Reduce Pathogens that can be used to produce Class A sludge. It is ludicrous for the agency to claim that a process that its own rule specifically lists as a means to make sewage sludge safe is "an ever present health risk", considering the apparently small scale of operations that are being referred to here.

It is further claimed that composting is an "expansive" process. I have to assume that this is a typographical error, and what is meant is "expensive". While in-vessel composting can be quite expensive, static pile or open windrow composting is technologically quite simple. In fact, static pile and open windrow composting may well be two of the least expensive methods mentioned in the rule. At any rate, the agency has presented no data to show that composting is more expensive than any other approved method of treating sewage sludge, or that it is expensive to the point of causing "substantial harm to the public interest."

Concerning the proposed change to the definition of "solid waste", it would be consistent with the Code if the definition was verbatim from §22-15-2. As it is presented in the proposed amendment, the date of the Atomic Energy Act is not consistent with the Code, and while the meaning of the rest of it is consistent, not all of the wording is the same as that in the Code presently.

I appreciate the opportunity to comment on this rule.

Sincerely,

Tom Degen, member
Board of Directors
WV Environmental Council

References

- Mazzocchi, Susan. Editorial in Composting Frontiers. Volume II, Issue 1, Autumn 1993.
- McBride, M.B. Environmental Issues, Toxic Metal Accumulation from Agricultural Use of Sludge: Are USEPA Regulations Protective? Journal of Environmental Quality, 24:5-18, 1995.
- Connett, Dr. Paul. Waste Not #241. July 1993.
- New York. State of New York 6171, 1993-1994 Regular Session, In Assembly, March 18, 1993.
- Blew, R. Denny. Interview with R. Denny Blew. Composting Frontiers. Volume II, Issue 1, Autumn 1993.
- Babish, J.G.; Lisk, D.J.; Stoewsand, G.S.; Wilkinson, C. Organic Toxicants and Pathogens in Sewage Sludge and Their Environmental Effects. Special Report No. 42. Subcommittee on Organics in Sludge of Cornell University's College of Agriculture and Life Sciences. December 1981.
- Farm Credit Bank of Springfield. Background Statement, The Position of the Springfield Farm Credit Bank on the Application of Sewage Sludge to Agricultural Land. Composting Frontiers. Volume II, Issue 1, Autumn 1993.
- Solid Waste Management Board. West Virginia Solid Waste Management Plan. January, 1994.

WEST VIRGINIA WATER POLLUTION CONTROL ASSOCIATION

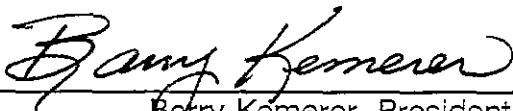
P.O. BOX 5262
CHARLESTON, WEST VIRGINIA 25361

Comments of the WPCA Interim Emergency Rule - Sewage Sludge Management Regulations

The WPCA is an organization of professionals that is primarily concerned with wastewater. The membership is composed of professionals concerning the design, operation, administration and all other various aspects of the wastewater industry. The WPCA believes now as it did back in 1994 when the sewage sludge management regulations were first passed into law that these regulations would be impractical if not impossible to comply with. These fears and concerns are now becoming readily apparent. The sewage sludge management regulations impose limits on the native West Virginia Soil that are technically unsound and have little if any scientific basis. Members of our organization have accumulated data and supplied such to the DEP showing that the values in Table 3, background metal concentrations cannot be met even in soils that have never been treated with sewage sludge. Some data has even shown that soils that have been previously treated with sewage sludge have lower metal concentrations after they have been land applied than before application.

The state of West Virginia annually produces an estimated 388 million pounds of domestic sewage sludge. This material if not land applied would have to be landfilled. This would cost the Voters of West Virginia 7.76 million dollars a year. This would also consume a great deal of space in our few remaining existing permitted landfills, a commodity that is fast becoming very expensive and scarce. This is also contrary to the well publicized concept of recycling and waste minimization. The economic gain of the Farmers and others who utilize this resource as a fertilizer and soil conditioner would also be lost. Annually this economic gain is estimated to be 3.30 million dollars.

The Association believes the existing Federal 503 regulations are more than adequate to regulate the practice of land application in the GREAT STATE of WEST VIRGINIA and encourage their adoption in whole. We support the passage of the emergency sewage sludge regulations and encourage the DEP to develop ecologically sound and scientifically defensible rules and regulations, along the guidelines of the 503 regulations, for the land application of treated sewage sludge. The WPCA also believes that the passage of the Emergency rules is only the first step toward this goal and encourage and supports any and all efforts that will correct, no matter how well intentioned, the misguided and uninformed efforts of the past.



Barry Kemerer, President

April 13, 1995

Roger T. Hall
Division of Environmental Protection
10 McJunkin Road
Nitro, WV 25143

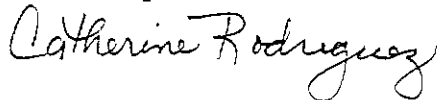
Dear Mr. Hall:

This letter is in opposition to the proposed change of Rule 47CRS38D eliminating Table 3. The Director is claiming an emergency. If this is so why did he not go before the legislature. There are documents dating back to November 22, 1994. From this it seems that there was time to go before the legislature and get relief. Circumventing the legislative process is not the way win citizens confidence.

A member of the Concerned Citizens of the Environment spoke with Ray Lovejoy on April 11, 1995 and he stated there was a problem but to completely eliminate Table 3 may not be the answer. West Virginia has 60 different types of soil and research needs to be done to find the correct solution to this problem. By eliminating Table 3 you are throwing the baby out with the bath water.

Please take the time to find the right solution to this problem and don't take the away the citizens' constitutional right to pass laws through the legislative process.

Sincerely,



Catherine Rodriguez, President
Concerned Citizens of the Environment
Rt.1, Box 109B
Rivesville, WV 26588
304-278-7668

DOYLE COAKLEY
P.O. BOX 245
COWEN, WV 26206
APRIL 14, 1995

THIS HEARING WOULD BE BETTER NAMED IF YOU JUST CALLED IT "A DOG AND PONY SHOW".

THE REAL REASON FOR WANTING TO DO AWAY WITH TABLE 3 IS IT RESTRICTS WHERE AND HOW MUCH SLUDGE CAN BE APPLIED ON A GIVEN PARCEL OF LAND.

IN THIS CASE, STRIP MINED LAND AND BY RESTRICTING THE AMOUNTS OF SLUDGE THAT CAN BE APPLIED TABLE 3 ALSO RESTRICTS THE PROFITS AVAILABLE TO THE SLUDGE HAULERS AND SLUDGE APPLIERS.

AT A SLUDGE SYMPOSIUM BY THE WVU EXTENSION SERVICE ON JULY 7, 1992 HELD AT RIPLEY, WV A MS ANN KARKOFF OF THE US EPA SAID THAT BECAUSE OF THE ENORMOUS PROBLEM OF DISPOSING OF SEWAGE SLUDGE FROM THE EASTERN SEABOARD THE EPA HAD DECIDED THAT THE SAFEST AND MOST AFFORDABLE WAY TO HANDLE THE PROBLEM, FOR NOW, WAS TO USE IT FOR LAND RECLAMATION ON STRIP MINES.

SHE MADE THREE POINTS REAL CLEAR, 1= THE DECISION TO BRING IT HERE HAS ALREADY BEEN MADE. 2= WE CAN'T STOP IT. 3= BUT WE CAN CONTROL HOW IT IS USED, UP TO A POINT.

TABLE 3 OF THE SEWAGE SLUDGE MANAGEMENT RULE DOES CONTROL WHERE AND HOW MUCH SLUDGE CAN BE APPLIED ANYWHERE.

IF ANY CHANGES NEED TO BE MADE IN THE SEWAGE SLUDGE MANAGEMENT RULE, ESPECIALLY IN TABLE 3, IT SHOULD BE DONE IN THE STATE LEGISLATURE AND NOT BY AN AGENCY THAT HAS PROVEN TO BE A LAPP DOG FOR MINING, INDUSTRY AND SOLID WASTE COMPANIES.



SIERRA CLUB

WEST VIRGINIA CHAPTER

April 13, 1995

P.O. Box 4142
Morgantown, WV 26504

Roger Hall
WV-DEP
10 McJunkin Road
Nitro, WV 25143

Dear Mr. Hall:

Please consider these comments regarding the proposed amendment to the Sewage Sludge Management Rule. I urge that the proposed emergency rule amendment be withdrawn. It violates the intent of state law, it increases the risk of potential soil pollution by heavy metals and other contaminants in sewage sludge applied to lands in West Virginia, and most importantly, no emergency exists to justify an emergency rule amendment.

The finding that certain potential land application sites in West Virginia exceed the maximum allowable soil concentrations for heavy metals established in Table 3 does not provide a basis for abolishing the Table. If anything, it provides evidence that the rule is working as intended. I am unaware of any evidence or any serious investigation to assure that the metal levels found are "naturally occurring". Even if these levels are naturally occurring, this still does not provide a logical scientific basis for INCREASING the metals levels in these soils.

The intent of the rules is to assure levels of metals in soils remain adequate to assure human health and environmental safety, and that the agricultural productivity of the soils is maintained. The only logical basis for increasing the standards is if a thorough risk assessment assures us that the levels can be increased without jeopardizing these values. No such analysis has been conducted, so no basis exists for allowing metals concentrations in soils to exceed the legislatively promulgated standards.

In June of 1993, when these rules were first proposed, we suggested that "Categories of sludges should be established based on contaminant levels" and that "The cleanest category of sludge would have contaminant levels equivalent to background soil levels and would be available for unrestricted use..." "Sludges in this category, by their very nature would be exempted from lifetime loading restrictions and other rules and could be distributed essentially as fertilizer. This minimal regulatory burden would encourage POTWs to clean up their sludge, thereby reducing the overall pollution load to the environment." If these recommendations had been adopted then, the rule change we are facing today might have been unnecessary.

"Not blind opposition to progress, but opposition to blind progress."

Certainly, some adjustment of the standards in Table 3 may be needed, but abolishing those standards is unwarranted and without a legal foundation. Furthermore, to attempt to eliminate the soil standards under the guise of an emergency is sheer foolishness. The only basis for such an emergency appears to be the increased cost of sludge disposal. Yet these costs amount to only pennies per household per day, hardly an economic emergency. The basis for the emergency appears to be that the rule is working as it was originally intended. Fields with excessively high metals levels won't have even higher levels of metals added to them, hardly an emergency. In fact, eliminating the soils standards may actually create the real emergency in the form of toxic contaminants added to soils at unsafe levels.

Several methods to identify appropriate soil metals standards should be evaluated. DEP may be able to estimate the risk from metals in soil from EPA's "Technical support document for land application of sewage sludge" however it should be noted that that document applies to sludge, not to soil. For example, the rate of soil ingestion by a child is typically estimated at 5 to 10 grams per day, while the EPA document estimates a sludge ingestion rate of only 0.2 grams per day. Thus safe soil levels would be proportionately lower than the safe sludge levels for a particular metal. DEP could establish an interim method by identifying typical background concentrations from uncontaminated sites, although care must be taken to assure that sites are really uncontaminated. Sites that are deep woods today may have been the center of significant industrial activity 50 or 100 years ago. DEP could determine metal availability through leaching assays and through bioassays with indicator plants. This approach would more accurately determine the ecological risk, and would be independent of the variability in metal-holding capacity among soils. Other monitoring approaches or scientifically valid standard setting methods could be devised. In the meantime, DEP should abandon its attempt to delete the standards set in Table 3 and should work to protect the West Virginia's environment and its people and it should do so in a manner consistent with the law.

In 1993 we wrote that these rules without heavy metal analyses "virtually guarantee that lifetime loading rates will result in metal concentrations exceeding safe limits. The rules should be intended to prevent, rather than guarantee this result." Sludge application can have beneficial results, but the emphasis should be on maintaining safe and productive agricultural soils. West Virginia agriculture cannot afford to risk a tainted reputation for its agricultural products, nor can local municipalities afford the liability of trying to reclaim farmland contaminated by heavy metals. Soil testing was recognized by the Legislature as the only practical way to assure that we can have both the benefits of sludge application to land and assure a healthy productive agricultural industry.

Detailed comments will be forthcoming on the technical deficiencies of the proposal, as well as suggestions for remedying the rules. In the meantime, I urge DEP to withdraw the proposed emergency amendment.

Sincerely,



James Kotcon

State Government Programs Chair

3029 Greenbag Road • Post Office Box 852 • Morgantown, WV 26507-0852 • 304-292-8443 • Fax 304-292-1526

April 12, 1995

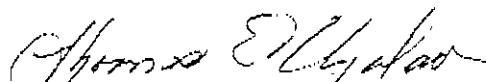
Morgantown Utility Board Comments on:
Interim Emergency Rule - Sewage Sludge Management Regulations

In 1994 the West Virginia legislature passed a law regulating the beneficial use of sewage sludge. This law established limits for background soil concentrations prior to any land application of sewage sludge. These limits imposed on the native West Virginia soil were arbitrarily set with little or no scientific basis, and are not as purported by some to be EPA recommended values. These arbitrary limits are commonly referred to as Table 3 in the sewage sludge management regulations. The limits, taken as they now exist, would make it almost impossible for anyone to land apply sewage sludge, regardless of how clean or how low any metal concentration in the sludge was. These regulations impose unattainable limits for the land application of sewage sludge, a practice that is both ecologically and economically beneficial and is encouraged by the Federal Environmental Protection Agency. Land application of sewage sludge does increase crop yields such as cattle corn, and hay without the use of chemical fertilizers while building up and replacing the soil with a much needed organic base. Land application has been extensively studied by West Virginia University and is supported by the University extension service and local county extension agents. The beneficial use of treated sewage sludge provides a large economic benefit to local farmers. In Monongalia County alone this is estimated to be \$100,000 per year.

The proposed interim rules would allow the ecologically desirable practice of land application to continue in accordance with the already established, well researched and scientifically sound Federal Regulations as stipulated in 40 CFR Part 503 while allowing the State DEP the time required to research, develop and implement sound and defensible land application criteria. The failure to enact these emergency rules would have a severe economic impact on most municipal wastewater treatment plants in the state of West Virginia. The Morgantown Utility Board alone land applies 11.62 million pounds of high quality treated sewage sludge a year. This amount if not land applied would have to be discarded and placed into a DEP approved and permitted landfill. This alone would cost our customers, an additional \$233,000 dollars a year just in disposal cost and tipping fees. This would be a waste of a valuable asset and use valuable landfill space that is fast becoming a very rare and costly commodity. The Morgantown Utility Board fully endorses the passage of the interim emergency rules concerning the Sewage Sludge Management Regulations and agrees with the DEP's desire to develop sound and scientifically defensible standards for the beneficial reuse of treated sewage sludge.

Respectfully submitted,

MORGANTOWN UTILITY BOARD



Thomas E. Urquhart
General Manager

Sanitary Sewer Board
City of Fairmont
P.O. Box 1428
Fairmont, WV 26555-1428

COPY

Phone (304) 366-0540
Fax (304) 366-6242

March 21, 1995

The Honorable Ken Hechler
Secretary of State
State of West Virginia
Building 1, Suite 157 K
1900 Kanawha Boulevard, East
Charleston, West Virginia 25305-0770

Dear Mr. Secretary:

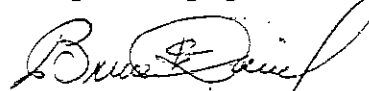
The Sanitary Sewer Board of the City of Fairmont voted at their regular meeting of today to support the emergency rules filed by the Division of Environmental Protection concerning the State Regulations for the use and disposal of municipal wastewater sludge.

More specifically, the regulations amended by this emergency rule would delete Table 3 (Maximum Background Concentration of Metals in Soil Where Sewage Sludge May Be Land Applied), and incorporates the essence of the Federal 40CFR 503 Regulations. This change will correct technical errors in the existing regulations in that Table 3 did not account for the naturally occurring metal concentrations in native soil that had never been treated with sewage sludge.

The Sanitary Sewer Board of the City of Fairmont currently land applies sewage sludge on land in our area. If we are forced to dispose of sewage sludge at landfills, our rate payers would incur \$160,000 annually in additional costs. Also, a valuable soil amendment would be wasted and precious landfill space would be unnecessarily wasted.

Our Board asks that you sign these emergency rules.

Very truly yours,



Bruce McDaniel
Utility Manager

cc: D. Amos
D. Sago
Board Members

10,000 14,000 19,000

Genevieve "Penny" McGill
Route 1, Box 73
Rivesville, WV 26588

Home Phone: (304) 278-7550

April 02, 1995

Judy Cooper
Director of Administrative Law Division
Secretary of State Office
Building 1, Suite 157-K
1900 Kanawha Blvd., East
Charleston, West Virginia 25305

Dear Ms. Cooper:

WHEN DOES "NO" MEAN "NO?" HOW MANY WAYS MUST WE SAY "NO" TO THE ILLEGAL SLUDGING OF WEST VIRGINIA BEFORE OUR REPRESENTATIVES IN CHARLESTON UNDERSTAND "NO" MEANS "NO?"

In the pursuit of justice, I am writing this letter to protest the Division of Environmental Protection's use of emergency rule; to circumvent the legislative process, to enact laws they could not otherwise achieve! This letter of protest is in response to the DEP proposed changes to State regulated hazardous substance. Published in the Times-West Virginian, Sunday, March 26, 1995 edition. The published change (emergency rules) eliminates limits on how much arsenic, mercury and similar hazardous materials that can be in sewage sludge dumped and how much can accumulate in the soil were sludge is dumped.

I do not have a problem and do not feel there is a problem with treatment plant storage or land-filling of West Virginia's sewage sludge caused by State Legislated Environmental Standards. I do not feel DEP implied increase of public sewage cost reflects/justifies emergency rules and I question DEP motives for so-called emergency rule!

The public response, "NO," to lowering state sewage sludge regulations defeated three-Senate Bills (S.B. 528, S.B. 533, S.B. 539) February 20, 1995, sponsored by and died in the Department of Natural Resource Committee. By ignoring the public's outcry "NO" to lowering regulations, I feel the DEP emergency rules creates favoritism/financial gain for one group intent upon establishing West Virginia as a wholesale marketplace to dump their illegal sludge. Now we write to the Secretary of State Office, Director of Administrative Law Division, to echo "NO" to the illegal sludging of WV and trust that our demand for justice will be heard!

Genevieve "Penny" McGill

Route 1, Box 73
Rivesville, WV 26588

Home Phone: (304) 278-7550

Page 2
DEP Emergency Rules
April 02, 1995

It is my opinion the DEP proposed rules create an emergency by illegal sludging of West Virginia (contamination of ground water, wells, etc., cumulative loading of heavy metals in the soil rendering it useless for future crop use; adversely effecting plant and animal life; all of which, will ultimately contaminate the food chain!) I think the DEP created illegal sludge emergency will increase not decrease public sewage cost and will jeopardies the health and safety of West Virginia for generations to come!

I feel the only West Virginia Environmental Emergency is caused by those in defeat refusing to take "NO" for an answer, without legislative process, imposing their own laws upon the people of West Virginia!

In the name of justice, I condemn the DEP Emergency Rules as an abuse of power that weakens the very foundation of the office they have sworn to uphold; and as an act of betrayal of the people of West Virginia, for whom, their appointed office was entrusted by the Governor of West Virginia.

Sincerely,

Genevieve McGill

cc: The Honorable Gaston Caperton
Governor of West Virginia

David Calaghan
Director, Division of Environmental Protection

W.V. DEP

comments on emergency Rule
Change Sludge Land Application
1-304-759-0526

4/15/95

In reviewing the report by DEP inspector Summers that preceded the proposed emergency rule change in sewage sludge land application rates, I cannot see that the DEP has substantiated the need for or the emergency nature of the proposed change.

One of the primary tenants of the change is that background or "naturally" occurring levels of certain metals in soil, especially arsenic, are higher than expected. This should be a crisis in itself. Acceptable levels of metals in soil have been established in prior regulations. The fact that some areas already exceed these levels only reinforces the need for controls. These levels were assumed to be naturally occurring.

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DIRECTOR'S OFFICE

APR 17 1995

WV DIVISION OF
ENVIRONMENTAL PROTECTION

herbicide or sludge use were ruled out by DEP staff. In my own country, Handy, the only listed sample was from fields owned by a local poultry processor.

However, were those levels naturally

occurring? Since arsenic is a common

feed additive in poultry production

and since elevated soil arsenic levels

have been a problem in other poultry

areas, perhaps these results are

from poultry waste disposal. Are

there other countries out there that

just might defy this background level

theory? Throwing out maximums

certainly assumes the degradation of

our soils with these toxic and

carcinogenic substances and is yet

another attempt to throw safety and

good sense out the window. It is time
the DEP stops caving in to short term
special interests and realizes they are
trying to mortgage our future with
too much sludge.

Margaret C. James DUM

Resource Alliance

HC 67 Box 279a

Mathias, WV 26812

304-897-6048

(MARGARET C JAMES DUM)

Brooke County Solid Waste Authority

P.O. Box 50
Wellsburg, WV 26070
(304) 737-0780
FAX (304) 737-0781

April 11, 1995

Mr. Roger T. Hall
Division of Environmental Protection
Office of Water Resources &
Solid Waste Management
10 McJunkin Rd
Nitro, WV 25143

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DIRECTOR'S OFFICE
APR 14 1995
WV DIVISION OF
ENVIRONMENTAL PROTECTION

Re: Emergency Rule 47 CSR 38D
Sewage Sludge Management Rules

Dear Mr. Hall:

The Board of the Brooke County Solid Waste Authority at its March 28, 1995, regular meeting voted unanimously to advise the Department of Environmental Protection that weakening the sewage sludge management rules with the proposed amendment to the existing rule, 47 CSR 38D, is wrong. Therefore, please note of record the Brooke County Solid Waste Authority's opposition to the Emergency Rule filed on March 29, 1995, under the Notices of March 20.

West Virginia industry has been forced to reduce their fugitive emissions of heavy metals into our environment for obviously good reason. This proposed amendment will allow these same heavy metals to be land applied at a greater rate than is now permitted and will thus result in a leaching into the West Virginia water table, streams and rivers at an increased rate and create a need for more expensive water purification equipment. The purported "fact" that many native soils already naturally exceed the existing Table 3 standards is certainly no reason to increasingly add to those levels. If the Division of Environmental Protection is truly committed to the proper management of our water resources, it should not be a proponent of increasing the risks to those resources and neither the Division nor anyone else should advocate permitting these increased risks to occur indirectly when industry and others are not permitted to introduce these hazards directly.

The existing Solid Waste Management Regulations already condone the disposal of out of state garbage in West Virginia. This proposed amendment will open the door further for out of state sewage sludge to be brought to West Virginia and add to the potential contamination of our resources. If, as the Division states, "collection and analysis of such data will require several

Reduce, Reuse, Recycle



Roger T. Hall
Page 2
April 11, 1995

months", obviously there has not yet been any analysis made of the impact of loosening the land application restrictions on the environmental aspects of West Virginia citizens and it cannot be seen how, in good conscience, the Division can assert that "the emergency rules have no affect on the rights of private property owners" -- notwithstanding any other considerations, there must be a potential affect on those large number of persons utilizing private water wells.

While land application of sewage sludge may be a good thing, too much of a good thing is harmful. Moderation is acceptable but excess is morally and legally unacceptable and, without a full analysis of the long-term risks to our resources and the health of our citizens, the State of West Virginia must no longer be a party to any contamination process. And this is true even on a short term basis for far too often have we all experienced the extreme difficulty in having a regulation or standard changed once it has been put into effect.

The Board notes that the same proposal as sought by this "Emergency Rule" was placed before the Legislature and, despite apparent concerted effects by its proponents, the legislation was not acted upon. Again, this seems to be an effort to do indirectly through the appointive state officials what the proponents were unable to accomplish directly through the elected legislators which is not the manner by which we believe our systems of government is meant to work.

We are also reminded that the original Solid Waste Management Regulations as submitted on July 8, 1993, contained references to the Federal Rules, 40 CFR, Part 503, but that the existing Regulations filed after what is recalled to have been extensive comment on and withdrawal of the first proposed Regulation, then incorporated a provision "That in instances where similar provisions exist, the more stringent requirements (state or federal) shall apply." (47 SCR 38D - 3.1) It is apparent everyone previously had the benefit of Table 3 now sought to be eliminated and Part 503 for comparative purposes and, after due deliberation, chose to utilize Table 3. Now it seems that the results of that deliberation are sought to immediately reversed simply by the purported "emergency" rule process.

Roger T. Hall
Page 3
April 11, 1995

All in all, this proposed amendment shows on its face a lack of concern by the Division of Environmental Protection about the long term risks and, in the view of the Brooke County Solid Waste Authority, it is ill-advised. It is therefore requested that it be withdrawn by the Division and/or rejected by the Secretary of State.

Very truly yours,



Silvio Paesani, Chairman
Brooke County Solid Waste Authority

cc: Honorable Gaston Caperton
Governor of the State of West Virginia
State Capital Building
Charleston, WV 25305

Honorable Ken Hechler
Secretary of State
Suite 157k
State Capital Building
Charleston, WV 25305

Max Robertson
Division of Environmental
Protection
1356 Hansford, Str
Charleston, WV 25301

West Virginia Legislature
Legislative Rule Making Review Committee
Room M 152
State Capital Bldg
Charleston, WV 25305

Lisa Dooley
WV Municipal League
1620 Kanawha Blvd., East
Charleston, WV 25311

David C. Callahan, Commissioner
Bureau of Environment
10 McJunkin Rd
Nitro, WV 25343-2506

WV House of Delegates
Attn: House Clerk
Room 212 Main Bldg Complex
Capital Bldg 1
Charleston, WV 25305

Darrell McGraw, Attorney General
Office of the Attorney General
State of West Virginia
State Capital Bldg
Charleston, WV 25305

WV Senate
Attn: Senate Clerk
Room 211 Main Bldg Complex
Capital Bldg 1
Charleston, WV 25305

Charles Town Wastewater Treatment Plant

Route 9 East PC Box 359

Charles Town, WV 25414

304-725-8179

April 11, 1995

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DIRECTOR'S OFFICE

APR 17 1995

WV DIVISION OF
ENVIRONMENTAL PROTECTION

Mr. Roger Hall
Special Assist. to the Director
10 McJunkin Road
Nitro, WV 25143

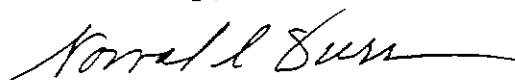
Dear Mr. Hall,

The City of Charles Town and the City's Wastewater Treatment Plant would like to address the Interim Emergency Rule-Sewage Sludge Management Regulations. We are currently land applying our sludge at a local farm that has been farmed since the late 1700's. The soil analysis has shown that the soil is above the arsenic, nickel and molybdenum levels allowed under the sludge management program. If the current levels are not changed, and brought up to the Federal Government levels, the costs for operating our treatment plant will be enormous.

Our plant is currently generating approx. 800 wet tons of sludge a year. The sludge has an average of 21% dry solids coming off our belt press and we lime stabilize. We deliver the sludge to the farm in our own truck, six wet tons, about three to four loads a week. Currently we pay the farm \$100 a truck load, approx. \$13,500 per year. If we were forced to go to a land fill, closest one is 24 miles, the tipping fee is \$38.75 per ton. Totaling \$31,000 yearly, not counting the labor and wear on the vehicle. We were also advised by the land fill they would only accept a max. of three loads a week. What would happen to the rest of the sludge?

Please address this problem immediately, we do not want to have to pass any more charges on to the local community.

Sincerely,



Norval C. Furr
WWTP Superintendent

DATE: April 14, 1995
TO: DEP/OWR&SW
10 McJunkin Rd.
Nitro, WV 25143
Attn: Roger T. Hall

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DIRECTOR'S OFFICE

APR 17 1995

WV DIVISION OF
ENVIRONMENTAL PROTECTION

The Honorable Ken Hechler
Secretary of State
Building 1, Suite 157K
Charleston, WV 25305
Attn: Judy Cooper

FROM: Sue Maguire
Rt. 1-Bx. 48
Auburn, WV 26325

RE: Comment on Title 47, Series 38D
Sewage Sludge Management Rule

I have served on SWICC and was Coordinator for the Ritchie Co. SWA for the past four years. Much time has already been spent on formulating the existing sewage sludge rule. These regulations help protect all West Virginians. There was ample time to develop scientific foundation for establishing the soil concentration standards. In fact, DEP never wanted to establish a concentration other than federal limits. These are inadequate. Table 3 should be kept in these regulations as it is based on sound scientific data. POTW'S should consider composting sludge or perform pre-treatments to make the levels of toxins acceptable for land application. Composting regulations are in place and more municipalities or counties will be establishing facilities to deal with yardwaste that will be banned from WV landfills. WV has all but completed the process of having only lined, safe landfills for waste disposal. Sludge that can't be land applied under Table 3 belongs in a landfill. It should not be put on land to pollute the environment. Proper handling of this toxic material should be a priority over any other considerations for the welfare of all.

The legislature felt no need to change the rule during the session that just ended, and DEP has no justification for any emergency now. Situations are the same now as when the current rule was written, went through the public input process and then past by the legislature.

Thank you for attention to this matter.

CITY OF BUCKHANNON

WEST VIRGINIA
26201

70 E. MAIN STREET
BUCKHANNON, WV 26201

TELEPHONE
(304) 472-1651
TDD # (304) 472-9550
FAX # (304) 472-4620

April 18, 1995

Mr Roger Hall
Division of Environmental Protection
10 McJunkin Road
Nitro, WV 25143

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DIRECTOR'S OFFICE

APR 20 1995

WV DIVISION OF
ENVIRONMENTAL PROTECTION

Dear Mr Hall:

This letter is being sent in response to the news release we received regarding the proposed modification to the sewage sludge management regulations. We strongly support the proposed modification.

The City of Buckhannon owns and operates a sewage treatment plant. Sludge disposal is a major element on the operation of this facility. Current operating procedures are to haul dried sludge to nearby farmland for land application disposal. During 1994, 2400 tons of dried sludge (approximately 12% solids) were hauled away from the plant at an estimated cost of \$4,400.

Tests performed on soil from farmland near the sewage treatment plant show results that are higher than permitted limits particularly for zinc and arsenic. If these limits are maintained, it seems unlikely that land application would remain a viable option for sludge disposal.

The only remaining alternative for sludge disposal would be landfilling. Cost to haul dried sludge to the nearest landfill and to pay the tipping fee would have been \$115,000 for 1994.

This change would be a \$110,600 increase. Since the plant operating budget (personnel, operation, maintenance, & power) is only \$183,500, it would be impossible to support this additional cost without a major rate increase.

Buckhannon - The promise of tomorrow with the dignity of yesterday



We believe that land application of sewage sludge is a wise use of a valuable resource. Sludge from our plant is high quality and soil conditions in Upshur County have shown no reason to be of concern. It will be a very unwise waste of a valuable soil amendment resource and financial resources to landfill the sludge.

We strongly support the emergency rules to amend the regulations.

Very truly yours

Samuel S Ludlow

Samuel S Ludlow PE
Sewer Superintendent

cc: Senator Ross
Delegate Riggs
Mayor Gum
Burl Long

WATER RESOURCES
PROGRAM MANAGEMENT

APR 25 1995

RECEIVED

Genevieve "Penny" McGill

Route 1, Box 73
Rivesville, WV 26588

Home Phone: (304) 278-7550

April 02, 1995

Judy Cooper
Director of Administrative Law Division
Secretary of State Office
Building 1, Suite 157-K
1900 Kanawha Blvd., East
Charleston, West Virginia 25305

Dear Ms. Cooper:

WHEN DOES "NO" MEAN "NO?" HOW MANY WAYS MUST WE SAY "NO" TO THE ILLEGAL SLUDGING OF WEST VIRGINIA BEFORE OUR REPRESENTATIVES IN CHARLESTON UNDERSTAND "NO" MEANS "NO?"

In the pursuit of justice, I am writing this letter to protest the Division of Environmental Protection's use of emergency rule; to circumvent the legislative process, to enact laws they could not otherwise achieve! This letter of protest is in response to the DEP proposed changes to State regulated hazardous substance. Published in the Times-West Virginian, Sunday, March 26, 1995 edition. The published change (emergency rules) eliminates limits on how much arsenic, mercury and similar hazardous materials that can be in sewage sludge dumped and how much can accumulate in the soil were sludge is dumped.

I do not have a problem and do not feel there is a problem with treatment plant storage or land-filling of West Virginia's sewage sludge caused by State Legislated Environmental Standards. I do not feel DEP implied increase of public sewage cost reflects/justifies emergency rules and I question DEP motives for so-called emergency rule!

The public response, "NO," to lowering state sewage sludge regulations defeated three-Senate Bills (S.B. 528, S.B. 533, S.B. 539) February 20, 1995, sponsored by and died in the Department of Natural Resource Committee. By ignoring the public's outcry "NO" to lowering regulations, I feel the DEP emergency rules creates favoritism/financial gain for one group intent upon establishing West Virginia as a wholesale marketplace to dump their illegal sludge. Now we write to the Secretary of State Office, Director of Administrative Law Division, to echo "NO" to the illegal sludging of WV and trust that our demand for justice will be heard!

Genevieve "Penny" McGill

Route 1, Box 73
Rivesville, WV 26588

Home Phone: (304) 278-7550

Page 2
DEP Emergency Rules
April 02, 1995

It is my opinion the DEP proposed rules create an emergency by illegal sludging of West Virginia (contamination of ground water, wells, etc., cumulative loading of heavy metals in the soil rendering it useless for future crop use; adversely effecting plant and animal life; all of which, will ultimately contaminate the food chain!) I think the DEP created illegal sludge emergency will increase not decrease public sewage cost and will jeopardies the health and safety of West Virginia for generations to come!

I feel the only West Virginia Environmental Emergency is caused by those in defeat refusing to take "NO" for an answer, without legislative process, imposing their own laws upon the people of West Virginia!

In the name of justice, I condemn the DEP Emergency Rules as an abuse of power that weakens the very foundation of the office they have sworn to uphold; and as an act of betrayal of the people of West Virginia, for whom, their appointed office was entrusted by the Governor of West Virginia.

Sincerely,

Genevieve E. McGill

Genevieve McGill

cc: The Honorable Gaston Caperton
Governor of West Virginia

David Calaghan ✓
Director, Division of Environmental Protection

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APR 11 1995

Division of Environmental Protection

RECEIVED
APR 7 1995

Division of Environmental Protection
Office of Waste Management

COMMENTARY AT PUBLIC HEARING

TO: Division of Environmental Protection

FROM: West Virginia Rural Water Association
James Wesolowski, Management Committee

SUBJECT: Emergency Rule, 47 CSR 38D
Sewage Sludge Management Rule

DATE: April 14, 1995, 9:00 A.M.

The West Virginia Rural Water Association has an active membership in excess of 200 utilities in the State of West Virginia. The POTW membership produces a highly regulated, safe and beneficially reusable biosolid product. Our member POTW's generate approximately 17,500 tons of biosolids annually. The intent of the Legislators in 1994, was to implement Sewage Sludge Management Rules that would provide regulations to allow the beneficial reuse of municipal sludges for land application and insure that the regulations would provide for a well managed, strictly enforced program.

Sadly, the 1994 Legislation provided regulations that have virtually eliminated the practice of beneficial reuse of biosolids for land application. We believe that the Metal Levels Concentrations in this legislation, as stated in Table 3, were established outside the intent of the majority of responsible Legislators. It is a sad commentary, that one or two uninformed and mean spirited elected officials would irresponsibly set limits that make land application illegal in this state.

Contrary to opinions generated in the news media, which would make us believe that all Water Environment Facility Operators and Managers in West Virginia are plunderers of Mother Earth, we are to the contrary. The vast majority of Operators and Managers are highly trained and skilled professionals that have been environmentally sensitive for a over a decade.

This legislation will set us back many years. Many of us recall when the land application program began its initial control of the POTW's. We have witnessed a continued improvement in the quality of our streams and ground water supplies because of this program. We have witnessed the joy of farmers that have turned unusable farmland into highly productive agricultural fields through the beneficial reuse of biosolids application under the direction and enforcement of the DEP. We have also reviewed pilot projects that revealed tremendous potential for the revegetation of savaged strip mine land. AND NOW WE ARE WITNESSING THE DEMISE OF THIS PROGRAM, BECAUSE OUR LEGISLATORS HAVE MADE "DIRT" ILLEGAL IN THIS STATE. It is obvious that the sponsor of this Rule did not intend to be known as the individual who made "DIRT" illegal in at least 28 counties of this State, but that's exactly what happened.

We believe this is irresponsible government and that EMERGENCY RULES must be promulgated to continue an excellent program and allow the Sludge Management Enforcement Officers the opportunity to develop analytical data for future legislative review.

If the EMERGENCY RULES are not allowed, we anticipate that the current law will result in:

1. Approximately \$600,000 in tipping fees for landfill use will impact the POTW's that are members of WVRWA.
2. The cost of thickening agents for our members will exceed \$175,000 annually.
3. Additional transportation costs will increase dramatically to move the product to the landfill. Some POTW's land apply within 2 to 3 miles of their facility and will be forced to travel 50 miles or more.
4. There will be unnecessary accounting fees incurred to file tariff increases with the Public Service Commission.
5. The tariff increases will be added to the customers monthly bill. We anticipate that the accumulative annual rate impact will exceed a whopping \$1 million for Rural Water Member customers.
6. The Customers of the Rural Water Members will seek retribution at the polls.
7. The landfills, by current law, cannot accept sewage sludge in excess of 25% of the total daily landfill weight. This will turn away producers and double costs of transportation.
8. Many POTW's will become frustrated and begin to accumulate higher levels of solids in their treatment process, which will ultimately be lost to the streams of West Virginia.
9. Years of the progressive cleansing of our waterways will be immediately at risk because of the current law.

In conclusion, we urge the implementation of the Emergency Rule. We urge the environmentally conscious citizens to put aside personal grievances with the DEP and envision the realistic impact of this issue, which is immediate unrealistically high and unnecessary RATE INCREASES and most dramatically, the WHOLESAL DEGRADATION OF OUR WATERWAYS.

We all want a safe and clean environment and I believe we should all work together scientifically to achieve that goal. Slamming the gate shut won't resolve this issue. Pass the Emergency Rule. The sludge will always be produced and I, personally, want to know where it's going and want to know that it is being regulated with cooperative efforts of producers, enforcers and environmentalists.

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MAY 02 1995

WATER RESOURCES
PROGRAM MANAGEMENT

3

Bluewell Public Service District

P. O. Box 3066, Bluewell Station

BLUEFIELD, WV 24701

(304) 589-3470

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DIRECTOR'S OFFICE

APR 27 1995

April 22, 1995

**WV DIVISION OF
ENVIRONMENTAL PROTECTION**

Roger T. Hall
Division of Environmental Protection
Solid Waste Management
#10 McJunkin Road
Nitro, West Virginia 25143

Re: Interim Emergency Rule - Sewage
Sludge Management Regulations

Dear Mr. Hall:

The West Virginia Rural Water Association presented Public Comment at the hearing on April 14, 1995. We have enclosed a copy of the commentary presented at that hearing.

During the public hearing, several environmental groups and citizens made comments that were not accurate or incomplete. We offer the following comments:

1. Jim Kotcon, lobbyist for the WV Sierra Club, indicated that before eliminating table Three, the DEP should investigate the source of the high levels of heavy metals. He stated that the the heavy metals exceed safe levels as outlined in table 3.

WVRWA believes that the DEP should be allowed to determine the the application of beneficial biosolids on a case by case basis. The standards established in Table 3 were set without benefit of adequate and scientific foundation and are not scientifically defensible. The DEP should be given authority to accumulate data with the assistance of the University of West Virginia technical advisors. If heavy metals in Table 3 do not appear in municipal biosolids, it would still be illegal to apply the biosolids to those fields that have naturally occurring levels in excess of Table 3. Application of such biosolids would certainly not contribute to any unsafe condition.

2. Cathy Rodriguez, Concerned Citizens of the Environment, stated that the proposed rule changes should go before the legislature, not through the use of Emergency Rules.

WVRWA worked with the WV Municipal League to draft a bill this session to amend the current rules. The Muncipal League introduced the bill this past session and it was not placed on the agenda to be addressed by the legislators. We believe that

the necessary votes were in place to pass the bill; however, Senator Dittmar, Chair of Natural Resources, declined to bring the bill out of committee. Committee Chairs possess extraordinary powers and we believe that the use of Emergency Rules are the appropriate mechanism to balance that power.

3. Tom Deegan, WV Environmental Council, stated that the additional cost to rate payers was insignificant and average cost per rate payer would not exceed fifty cents per household per month.

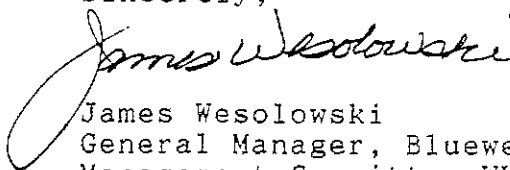
WVRWA believes that the average cost per household is an inappropriate barometer to measure the financial impact. The customers of systems that are not currently impacted by the rule would not have any increase; conversely, the customers of Bluefield Sanitary Board would see monthly increases in excess of \$2.30 to cover landfill costs. This is significant.

While this Emergency Rule is a volatile issue, the WVRWA believes that, the recognition by the federal government and the State of West Virginia that the land application of biosolids as a viable disposal/reuse option, should be paramount in the decision to approve the Emergency Rule.

Public Owned Treatment Works must have access to environmentally acceptable and economically achievable disposal options. Without such options, biosolids may end up in streams or in areas where significant environmental harm may occur.

In order for the current sludge management activities related to land application of biosolids to continue effectively and with minimal impact to the environment, the statute must be amended.

Sincerely,



James Wesolowski
General Manager, Bluewell PSD
Management Committee WVRWA

Route 2 Box 168
Rivesville, WV 26588
April 21, 1995

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APR 26 1995

WV DIVISION OF
ENVIRONMENTAL PROTECTION

Mr. Roger T. Hall
Division of Environmental Protection
10 McJunkin Road
Nitro, WV 25143

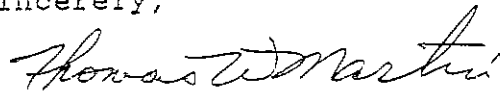
Dear Mr. Hall,

Please do not allow the sewage sludge regulations to be weakened. These standards were passed by the Legislature to protect our fields and streams from heavy metal contamination.

Other states, such as New York, New Jersey, Maryland and Pennsylvania, have seen the dangers of heavy metal contamination and passed stringent laws to protect themselves. They are now looking elsewhere for a cheap and ready dumping ground.

Please do not allow this to happen. Our lives, our health, our future and our children depend upon the regulations.

Sincerely,



Thomas W. Martin

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WV DIVISION

ENVIRONMENTAL PROTECTION

Mr. Roger T. Hall
Division of Environmental Protection
10 McJunkin Road
Nitro, WV 25143

April 21, 1995

Dear Mr. Hall,

2
This letter is to protest weakening the 'Sewage Sludge' regulations through an 'emergency' rule change, eliminating Table 3 and all reference to Table 3 in 47 CSR 38D. Just weeks ago West Virginia citizens screamed enmasse through the legislature to defend the sludge regulations because they are confident these laws offer excellent protection against contamination and exploitation. This rule change effort is a violation of citizens voting rights.

Rather than negate an exemplary background soil concentration limit standard, leaving no guideline and opening to door to disaster, the DEP should take the time, this time, to do a comprehensive soil type research study. Each year for the last several years sewage sludge has been a problem issue. I encourage this agency to sponsor and conduct a research project which will provide the "scientific analysis" needed to implement viable solutions, perhaps soil zones or selective concentration adjustments per soil type. Perhaps a risk assessment should have been done on sludge years ago. If these things take time, then let's start now. Then, this information if presented during the Legislative session, would allow public perusal.

Whereas several areas of the state which showed naturally occurring higher limits of certain metals still had survey places which met the level requirements, these areas are under no emergency. Under 29A-3-15(g) of the State Administrative Act, actually finding out the law works does not constitute need for an emergency change and the DEP should not bow to pollution threats but take a firm stand to fine violators. What solutions or input, other than veiled threats, kill the law, slam Sen. Macnaughton, have the various POTWs, Rural Water Assoc. and Municipal League contributed to this problem?

Allowing additional pollution is never the right answer, it's just the easy one.

Sincerely,

Donna S. Hartley

Mrs. Donna S. Hartley
Rt. 2 Box 169A
Rivesville, WV 26588
278-5120

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ENVIRONMENTAL PROTECTION



*WEST VIRGINIA
SOLID WASTE
MANAGEMENT
PLAN*

*Prepared by:
Solid Waste
Management
Board*

*GASTON CAPERTON
GOVERNOR*

*Department of Commerce, Labor
and Environmental Resources*

January 1994

TABLE 2-1
SOLID WASTE MANAGEMENT BOARD
WASTESHED POPULATION PROJECTIONS

COUNTY	1990 CENSUS	PROJECTED POPULATION					
		1995	2000	2005	2010	2015	2020
WASTESHED "A"							
Brooke	26,992	26,392	25,891	25,561	25,361	25,248	25,198
Hancock	35,233	33,862	32,575	31,431	30,518	29,804	29,226
Marshall	37,356	36,610	35,893	35,267	34,815	34,534	34,310
Ohio	50,871	49,374	48,109	47,226	46,692	46,324	46,030
Tyler	9,796	9,841	9,935	10,024	10,134	10,230	10,308
Wetzel	19,258	19,155	19,042	18,928	18,861	18,832	18,798
TOTALS	179,506	175,234	171,445	168,437	166,381	164,972	163,870
WASTESHED "B"							
Barbour	15,699	16,190	16,637	17,059	17,452	17,797	18,096
Braxton	12,998	13,123	13,259	13,393	13,547	13,718	13,885
Clay	9,983	9,965	9,921	9,944	9,996	10,050	10,077
Doddridge	6,994	7,238	7,414	7,553	7,667	7,772	7,869
Gilmer	7,669	7,458	7,307	7,239	7,270	7,318	7,380
Harrison	69,371	67,255	65,572	64,364	63,626	63,183	62,821
Lewis	17,223	17,055	16,904	16,811	16,735	16,667	16,615
Marion	57,249	54,781	52,647	50,991	49,740	48,728	47,856
Monongalia	75,509	77,641	79,327	81,766	83,923	85,358	86,244
Preston	29,037	29,324	29,522	29,639	29,713	29,748	29,736
Randolph	27,803	28,252	28,582	28,953	29,353	29,738	30,050
Taylor	15,144	15,325	15,458	15,591	15,707	15,858	15,983
Tucker	7,728	7,616	7,513	7,445	7,390	7,365	7,350
Upshur	22,867	23,393	23,845	24,311	24,781	25,192	25,512
TOTALS	375,274	374,616	373,908	375,064	376,900	378,492	379,474
WASTESHED "C"							
Jackson	25,938	26,537	26,993	27,365	27,691	27,973	28,185
Pleasants	7,546	7,732	7,847	7,948	8,045	8,127	8,198
Ritchie	10,233	10,031	9,864	9,735	9,669	9,653	9,632
Wirt	5,192	5,527	5,824	6,106	6,338	6,547	6,718
Wood	86,915	87,360	87,534	87,661	87,925	88,250	88,508
TOTALS	135,824	137,187	138,062	138,815	139,668	140,550	141,241

TABLE 2-1 (CONTINUED)

COUNTY	1990 CENSUS	PROJECTED POPULATION					
		1995	2000	2005	2010	2015	2020
WASTESHED "E"							
Grant	10,428	10,758	11,075	11,389	11,693	11,998	12,265
Hampshire	16,498	17,772	18,896	19,880	20,756	21,523	22,170
Hardy	10,977	11,339	11,680	12,046	12,427	12,798	13,115
Mineral	26,697	26,828	26,991	27,148	27,297	27,437	27,534
Pendleton	8,054	8,224	8,372	8,496	8,579	8,642	8,683
Berkeley	59,253	64,962	70,150	74,958	79,440	83,547	87,082
Jefferson	35,926	39,163	42,137	44,831	47,178	49,120	50,671
Morgan	12,128	12,701	13,215	13,662	14,084	14,489	14,853
TOTALS	179,961	191,747	202,516	212,410	221,454	229,554	236,373
WASTESHED "F"							
Greenbrier	34,693	34,928	35,134	35,369	35,671	35,999	36,285
Nicholas	26,775	26,840	26,899	26,849	26,877	26,935	26,952
Pocahontas	9,008	9,359	9,595	9,801	10,019	10,243	10,440
Webster	10,729	10,679	10,709	10,769	10,852	10,945	11,029
TOTALS	81,205	81,806	82,277	82,788	83,419	84,122	84,706
WASTESHED "G"							
Fayette	47,952	46,416	45,236	44,571	44,273	44,098	43,909
McDowell	35,233	31,914	29,136	26,903	25,112	23,651	22,471
Mercer	64,980	64,448	63,969	63,639	63,510	63,523	63,569
Mingo	33,739	32,994	32,446	32,055	31,739	31,444	31,117
Monroe	12,406	12,725	13,008	13,287	13,539	13,767	13,968
Raleigh	76,819	76,206	75,622	75,161	74,827	74,662	74,532
Summers	14,204	14,365	14,507	14,659	14,864	15,156	15,457
Wyoming	28,990	27,696	26,450	25,342	24,376	23,545	22,788
TOTALS	314,323	306,764	300,374	295,617	292,240	289,846	287,811
WASTESHED "H"							
Boone	25,870	25,130	24,408	23,777	23,192	22,645	22,116
Cabell	96,827	95,739	95,085	95,130	95,499	95,896	96,138
Calhoun	7,885	7,876	7,836	7,794	7,784	7,784	7,768
Kanawha	207,619	203,614	199,639	196,228	193,742	192,015	190,697
Lincoln	21,382	21,631	21,882	22,119	22,364	22,543	22,672
Logan	43,032	41,059	39,337	37,786	36,444	35,330	34,359
Mason	25,178	25,353	25,375	25,349	25,343	25,330	25,301
Putnam	42,835	45,452	47,577	49,263	50,685	51,961	53,009
Roane	15,120	15,429	15,686	16,018	16,428	16,781	17,025
Wayne	41,636	41,593	41,465	41,374	41,399	41,480	41,512
TOTALS	527,384	522,876	518,290	514,838	512,880	511,765	510,597
WV TOTALS	1,793,477	1,790,230	1,786,872	1,787,969	1,792,942	1,799,301	1,804,072

Organic Toxicants and Pathogens in Sewage Sludge and Their Environmental Effects

J.G. BABISH, D.J. LISK, G.S. STOEWSAND, and C. WILKINSON

CONSIDERATIONS

In discussing the possible hazards of using sewage sludge on land, it is critical that certain facts be clearly stated.

1. Ninety per cent of the total mass of sludge generated in New York State is produced in cities. This is also the sludge which is most contaminated from industrial users. Land area near cities where sludge can be applied is greatly limited. Since trucking costs are very expensive, the rate of application is high in order to dispose of the mass of sludge being continually produced. Also, rates of application of 50 to 100 tons per acre are required in order to observe any noticeable improvement in soil physical structure when applied to clayey or other poorly structured soils. Thus, increasing potential benefits from sludge application by increasing the rate of application necessarily increases the risk.

2. Municipal sludges represent the solidified mass of all of the waste products of industrial and domestic users. Typically, more than 100 to 200 industries may flush wastes into a single treatment plant. Therefore, literally thousands of chemicals may be present in a single sludge. Numerous metabolites and degradation products of these compounds formed during sewage treatment will also be present. These can be either more or less toxic than the parent compound. The final hazard from sludge use, therefore, will be determined by the additive, synergistic, and antagonistic effects of all of these, depending on relative exposure levels.

It is not surprising that the nation's largest food processor, Del Monte Corporation, has banned the use of sludge on any land used for growing its food crops (47).

TOXIC ORGANIC COMPOUNDS IN SLUDGE

Organic compounds in sludges, with particular reference to the health risks associated with land application of municipal sludges, have been reviewed by Kover (36), Dacre (15,16), Kowal and Pahren (37), Pahren, et al (51), and briefly by Connery (13).

Polychlorinated biphenyls (PCBs) have demonstrated both acute and chronic toxicity. Acute symptoms in humans include eye discharge and swelling of upper eyelids, acne-form eruption, and pigmentations of the skin (27). The demonstrated chronic toxicities of PCBs include carcinogenicity (46), teratogenicity (42), and chromosomal alterations (53). The prevalence of PCBs in sludge is well documented. Furr et al (26) found PCBs in concentrations up to 23 ppm in all sludges from 18 American cities. PCBs have been found in municipal sludges of Canadian cities (39). Tucker et al (60) found that the stability of PCB isomers in sludge is directly proportional to their degree of chlorination. The related polyhalogenated biphenyl compounds and their levels found in sludges in various areas of the United States are shown in Table 1. These are average values, e.g. the range in the Midwest was 240 to 1,700 ppm with an average value of 765 ppm.

Table 1.—Polyhalogenated compounds in municipal sewage sludge in the United States.

Compound	State	ppm(dry matter)	Reference
PCBs	Mass.	10.8	(22)
PCBs	Wisc.	20-79	(20)
PCBs	Midwest	765	(6)
PBBs	N.J.	21	(17)

Many organochlorine insecticides occur in sludges. DDT was banned by the Environmental Protection Agency in 1973, aldrin/dieldrin in 1974, and Chlordane in 1975. Table 2 indicates levels of these insecticides present in sludges.

Table 2.—Organochlorine insecticides in municipal sewage sludge.

Insecticide	Country	ppm(dry weight)	Reference
DDT	USA	0.35	(23)
DDD	USA	0.25	(23)
Dieldrin	Netherlands	7.5	(19)
Dieldrin	USA	0.31	(26)
Aldrin	USA	16.2	(23)
Chlordane	USA	16.0	(23)

Other chlorinated compounds have been identified in

sewage sludge by Erikson and Pellizzari (25). The origins and toxic properties of these individual compounds are not well known. Dacre (15) has identified additional chlorinated compounds in wastewater, and it is almost certain that many of these highly toxic, including potentially carcinogenic, compounds will be concentrated in municipal sludges (Table 3).

Table 3.—Chlorinated compounds found in sewage sludge and those probably present in sewage sludge.

Compounds Found	Probably Present
Dichlorobenzene	Endrin
Trichlorobenzene	Heptachlor
Tetrachlorobenzene	Endosulfan
Chloroaniline	Kepon
Dichloroaniline	Lindane (gamma BHC)
Dichloronaphthalene	2,4,-Dichlorophenoxyacetic Acid
Tetrachloronaphthalene	2,4,5-Trichlorophenoxyacetic Acid
Trichlorophenol	Dioxins
Chlorobiphenyl	Pentachlorophenol
Dichlorobiphenyl	
Trichlorobiphenyl	
Tetrachlorobiphenyl	
Pentachlorobiphenyl	

Polynuclear aromatic compounds (PAH) have been identified in sludge (48). The compounds include fluoranthrene, benzo(b)fluoranthrene, benzo(k)fluoranthrene, benzo(a)pyrene, benzo(ghi)perylene, and indeno(1,2,3,c,d)pyrene at concentrations of 90 to 1,600 ppb. Additionally, a number of PAH have been observed in municipal sewage sludge including two proven carcinogens, benzo(a)pyrene and benzo(a)fluoranthrene (Table 4) (29).

Table 4.—Polynuclear aromatic hydrocarbons in municipal sewage sludge.

Compound	ppb (mean of 5 sludge samples)
Chrysenes	3.6
Benzo(b)fluoranthene	3.2
Benzo(k)fluoranthene	.
Benzo(a)pyrene	1.7
Perylene	0.5
Dibenz(a,j)anthracene	0.26
Indeno(1,2,3,c,d)pyrene	1.34

Petroleum hydrocarbons, possibly resulting from industrial cutting oils, have been found in sludge (40). Such petroleum hydrocarbons would be expected to be herbicidal since waste oil has long been used as a spray for control of unwanted plant growth along roadways. Phytotoxic effects in plants grown on sludge-amended soils have been observed by various investigators. Up to 180 ppm of the flame retardant pentabromotoluene has been found in sewage sludge (41).

Trimethylamine in sewage is converted to the potent carcinogen dimethylnitrosamine (2,3). Dimethylnitrosamine formed in soil to which dimethylamine and nitrite were added, but only when organic matter was present (43). Dimethylnitrosamine and diethylnitrosamine continue to volatilize from soils for several weeks following incorporation (49). The half-life of these compounds in soil is about 3 weeks (50).

PATHOGENIC BACTERIA AND VIRUSES IN SLUDGE

A number of pathogenic micro-organisms have been found in sewage sludges. Dudley et al (21) found bacteria among the following genera in Texas sludges: *Staphylococcus*, *Clostridium*, *Mycobacterium*, *Klebsiella*, and *Enterogacteriaceae*. *Salmonella* species were found in 68 to 96 per cent of sludges sampled in England (35). Poliovirus was found in sludges in Sweden (7). Non-vaccinal strains of polio virus and various other enteroviruses were found in sludge from Laval, Canada (52). Viral transport to groundwater at a wastewater land application site has been recently reported (44).

EFFECTS OF ORGANIC CONSTITUENTS IN SLUDGES ON THE ENVIRONMENT

Land application of sewage wastewater reportedly can result in the passage of detectable concentrations of many of the synthetic compounds to the groundwater (59). In sandy or gravelly soils, the possibility of the movement of dimethyl or dipropylnitrosamine into groundwater is real (18,56). The movement of pathogenic bacteria and viruses downward through soil from applied sewage wastewater and rainfall and their survival time in soils does not rule out a potential hazard from this source (9,21,38,58).

CONTAMINATION OF PLANTS AND ANIMALS BY TOXIC ORGANICS IN SLUDGE APPLIED TO SOIL

PCBs in sludges applied to soils have been reported to cause plant contamination. The plants involved were corn and grass (14), soybeans (61), and spruce trees (45). Contamination of carrots grown in PCB-treated soil (34) as well as corn and golden rod (10) have been found. Fries (25) has stated that plants do not translocate many PCBs from the soil, but plants become contaminated by volatilization of these compounds.

Although PCB residues found in plants usually are not large, as little as 5 ppb of such fat soluble chlorinated compounds in the diets of dairy cows rapidly show detectable levels in milk (30). The more highly chlorinated PCBs found in sludge are most apt to be excreted in milk since they are more stable and also more fat soluble. The more highly chlorinated PCBs are also much more efficient in induction of hepatic microsomal mixed-function oxidases in animals (11,27).

Crops grown on sludge-amended soils are probably contaminated by sludge which becomes occluded or absorbed owing to splashing by rain and deposition of PCBs which vaporize from the soil surface (10,24). The danger of PCB contamination of animals allowed to graze on sludge-amended soil is considerable (51). Cows which have been autopsied typically exhibit a layer of soil several centimeters deep in their abomasum. This occurs because plant roots with absorbed soil particles are torn loose dur-

ing grazing. Also, swine allowed to forage in sludge treated areas can expect to uproot the surface and ingest sludge-amended soil.

Cabbage grown on sludge alone was fed to sheep and guinea pigs. PCBs were elevated 275 per cent in the cabbage and significantly increased in the livers of guinea pigs. In addition, induction of intestinal and hepatic microsomal enzymes was observed in the guinea pigs as compared to corresponding control animals fed soil grown cabbage (4,32). Histopathologic lesions (swollen mitochondria, cell necrosis) were observed in the livers of sheep fed sludge-grown corn silage (33,57) and induction of hepatic microsomal mixed-function oxidases occurred in mice fed sludge-grown lettuce (12).

In a study on the mutagenicity of New York State sewage sludges, it was determined that 50 per cent of the sludges demonstrated a mutagenic response in the *Salmonella/mammalian-microsome* assay. Using the same test, other researchers have presented similar findings for sludges from Chicago (61). More than 80 per cent of the positive responses required metabolic activation, indicating the effect was due to environmentally inert compounds which exert their biological effect when undergoing biotransformation.

Under agricultural or laboratory conditions, sludge induced both point mutations and cytogenic aberrations in plant systems (54). *Zea mays* (homozygous for wx-90) grown in maximum treatment plots (equivalent to 21 MT/ha dry sludge) had a 10-fold increase in reversion frequency over controls. Dilutions of liquid sludge also induced a dose-dependent increase of micronuclei in *Tradescantia*.

Rats fed diets containing cabbage or red beets grown on sludge-amended soil exhibited detectable mutagenic activity in the urine. This activity was observed only in the presence of a metabolic activation system (8).

The demonstrated carcinogen, dimethylnitrosamine, which can form in sludge, has also been shown to be absorbed by spinach and lettuce (18).

Finally, there may be risks to individuals applying sludge to soil or cultivating such soils when PCB contamination of sludge is high. PCB levels in the serum of sludge applicators markedly increased, with a concomitant increase in their plasma triglyceride levels indicating altered lipid metabolism (5).

SUMMARY AND RECOMMENDATIONS

In general, the characteristics of organic compounds in sludge as noted by Dacre (15) are:

1. Very low water solubility.
2. Do not degrade readily—long half life in soils.
3. High lipid affinity—bioaccumulates in tissue.
4. Compounds may translocate in the food chain.
5. Many compounds are known carcinogens.

It is known that native soil biota degrade chemicals. However, certain molecules have structures that are never

encountered in natural products. This is a cause for concern (31). Application of any level of sludge to soils is a definite risk since sludge is so variable in make-up and since few toxicological and/or in-depth analytical studies have been done on the extremely complex soil-plant-consumer (animal/human) relationship.

The disposal of sewage sludges on land which currently or in the foreseeable future grows crops for human or animal consumption is not justified at the present time. There are many economic, environmental, and health uncertainties associated with agricultural use of sludges, and sufficient data are not available to engineer safe systems. Who is willing to assume the responsibility for possible future health consequences? Furthermore, other viable disposal methods such as incineration, landfilling, land reclamation, and spreading on parks and forests do exist. As long as such alternatives are available, or until such time as it is shown that agricultural use involves less risks to the environment and health than these other alternatives, we feel that it should be the general policy of the State of New York to discourage and prohibit, if possible, application of sewage sludges to agricultural land. Sludge can be disposed of by incineration using combustible urban refuse (paper, cardboard) as the fuel to dry and ignite the sludge. This method greatly reduces the need for fossil fuels. The city of Duluth, Minnesota now disposes of its sludge in this manner. Also, hundreds of other fossil fuel-fired incinerators are presently in use for sludge disposal.

LITERATURE CITED

1. Ames, B. N., J. McCann, and E. Yamaski. 1975. Methods for detecting carcinogens and mutagens with the *Salmonella/mammalian-microsome* mutagenicity test. *Mutation Res.* 31:347-364.
2. Ayanaba, A. and M. Alexander. 1974. Transformations of methylamines and formation of a hazardous product, dimethylnitrosamine, in samples of treated sewage and lake water. *J. Environ. Qual.* 3:83-89.
3. Ayanaba, A., W. Verstraete, and M. Alexander. 1973. Possible microbial contribution to nitrosamine formation in sewage and soil. *J. Natl. Cancer Inst.* 50:811-813.
4. Babish, J. G., G. S. Stoewsand, A. K. Furr, T. F. Parkinson, C. A. Bache, W. H. Gutenmann, P. C. Wszolek, and D. J. Lisk. 1979. Elemental and polychlorinated biphenyl content of tissues and intestinal aryl hydrocarbon hydroxylase activity of guinea pigs fed cabbage grown on municipal sewage sludge. *J. Agr. Food Chem.* 27:399-402.
5. Baker, E. L., P. J. Landrigan, C. J. Glueck, M. M. Zack, Jr., J. A. Liddle, V. W. Burse, W. J. Housworth, and L. L. Needham. 1980. Metabolic consequences of exposure of PCBs in sewage sludge. *Am. J. Epidem.* 112:553-563.

6. Bergh, A. K. and R. S. Peoples. 1977. Distribution of polychlorinated biphenyls in a municipal wastewater treatment plant and environs. *Sci. Total Environ.* 8:197-204.
7. Bottiger, M. 1978. Isolation of viruses from sewage, with special regard to poliovirus. *Bul. World Health Organization.* 56:937-943.
8. Boyd, J. N., G. S. Stoewsand, J. G. Babish, J. N. Telford, and D. J. Lisk. In Press. 1982. Safety evaluation studies of vegetables cultured on municipal sewage sludge-amended soil. *Arch. Environ. Contam. and Toxicol.*
9. Brown, K. W., S. G. Jones, and K. C. Donnelly. 1980. The influence of simulated rainfall on residual bacteria and virus on grass treated with sewage sludge. *J. Environ. Qual.* 9:261-265.
10. Buckley, E. H. 1979. Differential uptake of airborne PCBs by plants. 56th Ann. Rpt., Boyce Thompson Institute for Plant Research at Cornell Univ., p. 6.
11. Bunyan, P. J. and J. M. J. Page. 1978. Polychlorinated biphenyls. The effect of structure on the induction of quail hepatic microsomal enzymes. *Tox. Appl. Pharm.* 43:507-518.
12. Chaney, R. L., G. S. Stoewsand, C. A. Bache, and D. J. Lisk. 1978. Cadmium deposition and hepatic microsomal induction in mice fed lettuce grown on municipal sludge amended soil. *J. Agr. Food Chem* 26:992-994.
13. Connery, J. L. 1979. Health implications of sludge disposal alternatives: ocean disposal, incineration, land application, and land filling. *In: Workshop on the health and legal implications of sewage sludge composting.* Vol. 2, Position Papers, Chap. 9. Energy Resources, Co., Inc., Cambridge, MA.
14. Curry, N. A. 1977. PCBs in the environment. *Clearwaters New York State Water Pollution Control Assoc.* 7:6-8.
15. Dacre, J. C. 1980. Potential health hazards of toxic organic residues in sludge-health risks of land application. Eds. G. Britton, B. L. Damon, G. T. Edds, and J. M. Davidson. *Ann Arbor Science Publ., Inc., Ann Arbor, MI.* pp. 85-102.
16. Dacre, J. C. 1978. The potential health hazards and risk assessment of toxic organic chemicals in municipal wastewaters and sludges with special reference to their effects on the food chain. *In: Proc. Conf. on Risk Assessment and Health Effects of Land Application of Municipal Wastewaters and Sludges.* San Antonio, TX.
17. DeCarlo, V. J. 1979. Studies on brominated chemicals in the environment. *Ann. N. Y. Acad. Sci.* 320:678-681.
18. Dean-Raymond, D. and M. Alexander. 1976. Plant uptake and leaching of dimethylnitrosamine. *Nature.* 262:394-396.
19. deHaan, F. A. M. 1977. The effects of long-term accumulation of heavy metals and selected compounds in municipal wastewater on soil. *In: Wastewater Renovation and Reuse.* Vol. 3., D'Itri Ed. Marcel Dekker, Inc., New York, Chap. 9.
20. Dube, D. J., G. D. Veith, and G. F. Lee. 1974. Polychlorinated biphenyls in treatment plant effluents. *J. Water Pollut. Control Fed.* 46:966-972.
21. Dudley, D. J., M. N. Guentzel, M. J. Ibarra, B. E. Moore, and B. P. Sagik. 1980. Enumeration of potentially pathogenic bacteria from sewage sludges. *Appl. Environ. Microbiol.* 39:118-126.
22. Erickson, M. D. and E. D. Pellizzari. 1979. Analysis of municipal sewage sludge samples by GC/MS computer for polychlorinated biphenyls and other chlorinated organics. *Bul. Environ. Contam. Toxicol.* 22:688-694.
23. Farrell, J. B. and B. V. Salotto. 1973. The effect of incineration on metals, pesticides, and PCBs in sewage sludge. *In: Proc. of a National Symposium on Ultimate Disposal of Wastewaters and Their Residuals.* McJunkin and Visilind, Eds. Water Resources Research Inst., Raleigh, NC.
24. Fries, G. F. 1981. An assessment of potential residues in animal products from application of sewage sludge containing PCBs to agricultural land. In press. *J. Environ. Qual.*
25. Fries, G. F. 1980. An assessment of potential residues in animal products from application of sewage sludge containing polychlorinated biphenyls to agricultural land. *In: Sludge-Health Risks of Land Application.* Eds. G. Bitton, G. L. Damon, G. T. Edds, and J. M. Davidson. *Ann Arbor Science Publishers, Inc., Ann Arbor, MI.* pp. 348-349.
26. Furr, A. K., A. W. Lawrence, S. S. C. Tong, M. C. Grandolfo, R. A. Hofstader, C. A. Bache, W. H. Gutenmann, and D. J. Lisk. 1976. Multielement and chlorinated hydrocarbons analysis of municipal sewage sludges of American cities. *Environ. Sci. Technol.* 10:683-687.
27. Goldstein, J. A. 1979. The structure-activity relationships of halogenated biphenyls as enzyme inducers. *Ann. N. Y. Acad. Sci.* 320:164-178.
28. Goto, M. and K. Higuchi. 1969. The symptomatology of Yusho (chlorobiphenyl poisoning) in dermatology. *Fujioka Acta Med.* 60:409.
29. Grimmer, G., H. Böhnke, and H. Browitzky. 1978. Profile-analysis of polycyclic aromatic hydrocarbons in sewage sludge by gas chromatography. *Fresenius Z. Anal. Chem.* 289:91-95.
30. Hardee, D. D., W. H. Gutenmann, G. I. Keenan, G. G. Gyrisco, D. J. Lisk, F. H. Fox, G. W. Trimmerger, and R. F. Holland. 1964. Residues of heptachlor epoxide and telodrin in milk from cows fed part per billion insecticide levels. *J. Econ. Entomol.* 57:404-407.
31. Hartenstein, R. 1981. Sludge decomposition and stabilization. *Science.* 212:743-749.
32. Haschek, W. M., A. K. Furr, T. F. Parkinson, C. L. Heffron, T. Reid, C. A. Bache, P. C. Wszolek, W. H. Gutenmann, and D. J. Lisk. 1979. Element and PCB deposition and effects in sheep fed cabbage grown on municipal sludge. *Cornell Vet.* 69:302-314.

33. Heffron, C. L., J. T. Reid, D. C. Elfving, G. S. Stoewsand, W. M. Haschek, J. N. Telford, A. K. Furr, T. F. Parkinson, C. A. Bache, W. H. Gutenmann, P. C. Wszolek, and D. J. Lisk. 1980. Cadmium and zinc in growing sheep fed silage corn grown on municipal sludge-amended soil. *J. Agr. Food Chem.* 28:58-61.
34. Iwata, J. and F. A. Gunther. 1976. Translocation of the PCB aroclor 1254 from soil into carrots under field conditions. *Arch. Environ. Contam. Toxicol.* 4:44-59.
35. Jones, P. W., L. M. Reeison, V. H. Lewin, and D. L. Redhead. 1980. The occurrence and significance to animal health of salmonellas in sewage and sewage sludges. *J. Hyg. Camb.* 84:47-61.
36. Kover, F. D. 1976. Considerations relating to toxic substances in the applications of municipal sludge to cropland pastureland (a background summary). EPA 560/8-76-004. EPA, Washington, D. C.
37. Kowal, N. E. and H. R. Pahren. Health effects associated with wastewater treatment and disposal. *J. Water Pollut. Control Fed.* 51:1301-1315.
38. Lance, J. C. and C. P. Gerba. 1980. Poliovirus movement during high rate land filtration of sewage water. *J. Environ. Qual.* 9:31-34.
39. Lawrence, J. and H. M. Tosine. 1977. PCB concentration in sewage and sludges of some waste treatment plants in southern Ontario. *Bul. Environ. Contam. Toxicol.* 17:49-56.
40. Liu, D. 1980. Fate of petroleum hydrocarbons in sewage sludge after land disposal. *Bul. Environ. Contam. Toxicol.* 25:616-622.
41. Mattsson, P. E., A. Norstrom, and C. Rappe. 1975. Identification of the flame retardant pentabromotoluene in sewage sludge. *J. Chrom.* 111:209-213.
42. Miller, R. W. 1971. Cola-colored babies. Chlorobiphenyl poisoning in Japan. *Teratology.* 4:211-212.
43. Mills, A. L. and M. Alexander. 1976. Factors affecting dimethylnitrosamine formation in samples of soil and water. *J. Environ. Qual.* 5:437-440.
44. Moore, B. E., P. B. Sagik, and C. A. Sorber. 1981. Viral transport to ground water at a wastewater land application site. *J. Water Pollut. Control Fed.* 53:1492-1502.
45. Moza, P. N., I. Scheunert, W. Klein, and F. Korte. 1979. Long-term uptake of lower PCBs and their conversion products by spruce trees (*Picea Abies*) from soil treated with sewage sludge. *Chemosphere.* 6:373-375.
46. National Institute for Occupational Safety and Health. 1976. Suspected Carcinogens, 2nd ed. p. 188. Cincinnati, Ohio.
47. Newkumet, C. 1980. The Del Monte decision: Banning crops grown in sludge-amended soils. *Sludge.* Sept.-Oct. pp. 18-21.
48. Nicholls, T. P., R. Perry, and J. N. Lester. 1979. The influence of heat treatment on metallic and polynuclear aromatic hydrocarbon content of sewage sludge. *Science Total Environ.* 12:137-150.
49. Oliver, J. E. 1979. Volatilization of some herbicide related nitrosamines from soils. *J. Environ. Qual.* 8:596-601.
50. Oliver, J. E., P. C. Kearney, and A. Kontson. 1979. Degradation of herbicide-related nitrosamines in aerobic soils. *J. Agr. Food Chem.* 27:887-891.
51. Pahren, H. R., J. B. Lucas, J. A. Ryan, and G. K. Dotson. 1979. Health risks associated with land application of municipal sludge. *J. Water Pollut. Control Fed.* 51:2588-2601.
52. Payment, P., Y. Larose, and M. Trudel. 1979. Polioviruses and other enteroviruses in urban sewage from Laval (Canada): presence of non-vacinal strains of poliovirus. *Can. J. Microbiol.* 25:1305-1309.
53. Peakall, D. B., J. L. Lincer, and S. E. Bloom. 1972. Embryonic mortality and chromosomal alterations caused by Aroclor 1254 in ring doves. *Environ. Health Perspectives.* 1:103-104.
54. Plewa, M. J., E. D. Wagner, S. Wood, and P. K. Hopke. 1981. Mutagenicity of Chicago sewage sludge in *Zea mays* and *Tradescantia paludosa*. Abstract 12th Annual Mtg. Environ. Mut. Soc.
55. San, R. H. C., H. F. Stich, A. B. Acton, and L. Maus. 1981. Human sewage: A source of environmental mutagens? Abstract 12th Annual Mtg. Environ. Mut. Soc.
56. Saunders, D. G., J. W. Mosier, J. E. Gray, and A. Loh. 1979. Distribution, movement, and dissipation of N-nitrosodipropylamine in soil. *J. Agr. Food Chem.* 27:584-589.
57. Stoewsand, G. S., J. T. Reid, W. M. Haschek, J. N. Telford, and D. J. Lisk. 1980. Hepatic changes in lambs fed corn silage grown on municipal sludge amended soil. In: *Sludge-Health Risks of Land Application*. Eds. G. Britton, B. L. Damon, G. T. Edds, and J. M. Davidson. Ann Arbor Science Publ., Inc., Ann Arbor, Mi. p. 359.
58. Temple, K. L., A. K. Camper, and G. A. McFeters. 1980. Survival of two enterobacteria in feces buried in soil under field conditions. *Appl. Environ. Microbiol.* 40:794-797.
59. Tomson, M. B., J. Dauchy, S. Hutchins, C. Curran, C. J. Cook, and C. H. Ward. 1981. Groundwater contamination by trace level organics from a rapid infiltration site. *Water Res.* 15:1109-1116.
60. Tucker, E. S., V. W. Saeger, and O. Hicks. 1975. Activated sludge primary biodegradation of PCBs. *Bul. Environ. Contam. Toxicol.* 14:705-713.
61. Weaver, D. L., P. K. Hopke, J. B. Johnston, and M. J. Plewa. 1981. Mutagenicity of Chicago municipal sewage sludge in the *Salmonella*/microsome reverse mutation test. Abstract 12th Annual Mtg. Environ. Mut. Soc.
62. Weber, J. B. and E. Mrozek, Jr. 1979. PCBs: phytotoxicity, absorption, and translocation by plants and inactivation by activated carbon. *Bul. Environ. Contam. Toxicol.* 23:412-417.

This report was prepared by a Subcommittee on Organics in Sludge of Cornell University's College of Agriculture and Life Sciences. Members of the Subcommittee are: J. G. Babish, Department of Preventive Medicine, New York State College of Veterinary Medicine; D. J. Lisk, Toxic Chemicals Laboratory; G. S. Stoewsand, Department of Food Science and Technology, New York State Agricultural Experiment Station, Geneva; and C. Wilkinson, Director, Institute of Comparative and Environmental Toxicology.

COMPOSTING FRONTIERS

Providing Direction
on Composting for
Waste Management

Volume II, Issue 1
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The year-old USEPA (United States Environmental Protection Agency) CWA 503 Regulations governing the use and disposition of sewage sludge and sludge products [For an analysis of the USEPA CWA 503 Regulations see COMPOSTING FRONTIERS, Volume I, Issue 3.] have caused controversy within a variety of sectors across the United States, from university-based soil scientists to farmers; from lending institutions to state governments. In almost every quarter, awareness is growing of the problems and uncertainty inherent in assessing their short- and long-term implications, no less in establishing appropriate monitoring, oversight, and enforcement programs to ensure compliance with them.

The 1991 ban on ocean dumping, added to sludge disposal exigencies arising from widespread opposition to incineration, declining landfill space, and the high costs of transportation and appropriate landfilling, lent immediacy to an already urgent need for alternative sludge disposal. Thus, it is within an atmosphere of intense political and economic pressure that scientists, agricultural associations, farmers, and lending institutions, among others, are grappling with questions arising from possibly conflicting societal goals: "beneficial use," through land-application, of sewage sludge and other wastes, and protection of public health and the environment, including irreplaceable United States farmland.

Considering those involved in this effort, it may seem surprising, though it is certainly logical, that perhaps the earliest, most effective, and least ambiguous public exposition of the issue has come from the Farm Credit Bank of Springfield, the Northeast region's largest agricultural lender.

Foreseeing the possibility of such heavy fines and clean-up costs for sludge-caused contamination of farmland that farmers would abandon their farms and leave lenders liable, and seeking to protect its mortgage investments in tens of thousands of acres of New England, New York and New Jersey farmland, the Farm Credit Bank issued a sludge

application "policy," effective October 20, 1993. One intent of the policy is to alert the community at large - and the agricultural community, especially - to the uncertain affects and potential societal costs of agricultural sludge-application. Another is to shift long-term liability from farmers - and their lenders - to the sludge-generating community at large by requiring that landowners wishing to spread sludge obtain insured indemnification agreements from sludge generators.

The Farm Credit Bank anticipates that liability might stem from a variety of causes, including new information leading to establishment of additional standards and existing ones being made stricter; the spreading of contaminated sludge received from unscrupulous disposal contractors; financial losses arising from unfavorable public perception regarding produce grown on sludge-amended land, and damage to property value near sludge application sites; and environmental degradation from improper sludge application, or adherence to existing national and state sludge regulations that ignore site particularity.

An August 1992 Farm Credit Bank of Springfield report, *Land Application of Municipal Sludge: Impact on Springfield District Farm Credit*, by John A. Detweiler, states that, "Chief among the pitfalls of sludge application to agricultural lands are the long-term effects of trace contaminants on the soil and groundwater. There is a general scarcity of scientific research on the long-term (20 years +) effects of trace metals.... [Should metals be found to pose health risks at lower levels than initially thought, stricter sludge regulations could be enacted, raising the risk of noncompliance for farmers with long-standing sludge spreading practices.

"There is reason to believe that the... EPA regulations are not based on exhaustive scientific research. The Agency has clearly stated that multi-year sludge applications were not used to determine loading rates ..., potentially underestimating the effects of metals over long periods of time.

"Farmers must also assess the risk from sludge deriva-

COMPOSTING FRONTIERS

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tives or products that have been chemically altered, typically treated with lime, and marketed as a fertilizer. Drawbacks to using these sludge by-products include that, unlike commercial fertilizer, ingredients are not guaranteed. Sample tests of large batch quantities have shown that nutrients can vary by batch. In addition, because such sludge derivatives are regulated as compost, not sludge, application rates are less stringent in some states, allowing for the remote possibility that metals could eventually exceed cumulative loading limits for sludge."

It is too early to judge what overall affect Farm Credit Bank's policy will have. It is thought unlikely that municipalities would enter into indemnity agreements, or be able to afford to insure them. It is also unlikely that private insurers, who presently provide \$1- to perhaps \$10 million in coverage to some sludge-product vendors, would be able to provide enough insurance to back such agreements. Thus, if Farm Credit's policy provokes similar action by other lenders, as some believe it will, it could effectively argue against sludge application to northeastern agricultural land, unless some mechanism for liability apportionment is found.

According to Dennis Connolly, of Johnson and Higgins, one of the eight or so largest insurance brokers in the United States, "There are an increasing number of insurance policies available in the environmental area. Almost all environmental policies are *claims-made* policies, whereby a claim can be made only during the policy period. Yet, a characteristic of environmental liability is that damages and hazards are often discovered a long time later. Insurance companies can't take the risk that laws and science might change, leading to claims in the future.

"Significant members of the insurance industry feel that the industry has been severely, if not fatally, harmed by environmental liability. Insurers are insuring for the future. At present, we have a Draconian liability system in which environmental liability standards are almost absolute. A safe harbor to operate in would be a system where there would be no liability when actions complied with existing state-of-the-art. However, liability definition would have to be changed through state and federal legislation and it is highly unlikely that this will occur.

"In terms of sludge-related liability, the tightest sludge standards in the world wouldn't be insurable. If society has decided that sludge should be put on land, then society must accept the risks. Insurance companies can't handle them."¹

Ellen Gulbinsky, Executive Director of the Association

of Environmental Authorities, comprised of New Jersey agencies with responsibility for water and sewage treatment, and solid waste and sludge management, feels frustrated that, "lending institutions are throwing up roadblocks to agricultural sludge application. The Authorities feel that they have increased the quality of their sludges. Yet, obstacles render New Jersey's 'beneficial use' policy a policy in word only.

"Aside from financing and insurance being a great deterrent, canneries won't accept vegetables grown on sludge-amended land. They are afraid of a renegade virus or pathogen. Since New Jersey's policy was put into effect, more sludge is being sent out of state to be landfilled or used for land reclamation than ever before.

"Sewage authorities are not liable for contamination caused by land-application of sludge. New Jersey law places cradle to grave responsibility for environmental contamination on the sludge producer, the homeowner/municipality. And farmers should be responsible for protecting the lands they own by seeing to it that sludge application is done properly."²

An additional threat to farmland anticipated by the Farm Credit Bank is that financially-strapped farmers might opt for short-term monetary gain over long-term agricultural sustainability. Again, from the 1992 report: "Currently, most sludge spread on Northeast Farmland offers the farmer little to no financial reward.... However, as municipal sludge becomes more difficult to dispose of, financial incentives are likely to increase. This trend is supported by municipal sludge disposal practices in New Jersey where farmers can earn significant income from applying sludge to their land ... as high as \$800 per acre per year.... Indeed, such high compensation may justify spreading sludge on farmland and offset the long-term risks involved.

"... farmers also benefit from reduced fertilizer expenses on cropland, often placed at around \$50-70 per acre for corn.... this compensation, both direct and indirect, is attractive for farmers ... [as] ... an easy way to improve net income. These lucrative opportunities are limited ... to a minority of farmers in the northeastern district, primarily in New Jersey."

Some farmers would be interested in becoming sewage sludge brokers, according to Richard S. Brown, a retired farmer/landowner in Burlington County, New Jersey. He sees nothing wrong with that, because he believes that, "the majority of sewage plants are producing product acceptable for land application, which, if done well, would solve a statewide problem while benefiting agriculture. It's New Jersey's waste product. I don't go along with dumping

my trash in someone else's backyard. It doesn't belong in a landfill. If it will benefit mankind, then I think farmers should take it. I firmly believe it can be made safer than a lot of fertilizing products, including animal wastes and chemicals.

"But there is still the liability question. Not too long ago, farmers suggested the creation of a statewide insurance fund from a small tax on every ton of sludge to be used. The agricultural community feels that it is already taking a beating in overregulation. Guidelines, monitoring and enforcement are matters for state and federal agencies to solve."³

While seeking to improve farmers' understanding of the risks associated with agricultural sludge application, Farm Credit Bank realizes that open discouragement of it could create conflict between farmers, like Richard Brown, and their lenders in states whose environmental authorities support the practice. Indeed, Jack Batchellor, of Garden State Farm Credit Bank, in Bridgeton, New Jersey, said that his lending institution which has been "here the longest and is in it for the long haul, prefers to take a low-key approach.

"We placed the news release on Farm Credit's sludge application policy in a local paper probably not read by too many farmers. And we are not planning to notify farmers about it because we don't want to be perceived as being on the 'cutting edge' by farmers who want to take sludge. We're trying to educate farmers to accurately assess the risk involved, to be financially sound. We want them to be pushing for indemnification agreements, to start moving in that direction. But do we want to deny farmers mortgages because they're putting sludge on their land? No."⁴

The attitude in New York State is quite different. According to Dennis Rapp, New York State Deputy Commissioner of Agriculture, and former Director of Policy for the New York State Department of Conservation, "The informal position of the New York State Department of Agriculture and Markets is that although there are some benefits to farmers from using sludge as a soil amendment, beneficial use is very marginal.

"The New York State Department of Agriculture and Markets is considering issuing an advisory to farmers. We are concerned about application rates. Most farmers don't have scientific or technical training. Application is imperfect. Though some farmers have been trained at land grant colleges, their practices are often at odds with their training. The vast majority of farmers have not had land-grant-college training. Capital-intensive farming leads to using whatever chemicals give the greatest crop yield.

Thus, farmers tend to follow directions provided by the chemical industry.

"There are many unanswered questions about the land application of sludge which create uncertainty and thus, controversy. In order to approve of sludge application to farmland, there would have to be some assurance that the risk is practically zero. New York State will not allow sludge application to food-crop land; it will be applied only to feed-crop land, which comprises about 65% of all New York agricultural land."

Mr. Rapp is concerned that the USEPA CWA 503 Regulations, which he says are based on research under Western and Midwestern climatic soil conditions, are not safe for New York State conditions. He worries about heavy metals build-up in soil, and about the relationship between soil acidity and heavy metals adsorption. The USEPA CWA 503 Regulations assume that farmers will take care of soil pH as part of normal farming practice. However, a survey conducted by the New York State Department of Agriculture and Markets found that fewer than 30% of farmers test their soil.⁵

Farm Credit Bank has taken the lead in exploring avenues for limiting, managing and sharing liability. Some of the questions it raises regarding limiting liability are, What precautions should be taken in applying the current USEPA CWA 503 regulations? How should appropriate application be geared to particular sites, particular soils, particular regions, taking into account soil background contaminant and nutrient levels, and site-specific conservation requirements? What mechanisms need to be established for nutrient management? How should monitoring and record-keeping be accomplished, and by whom? How can application oversight be accomplished, and by whom? What standardized testing protocols should be utilized? How can these be made uniform nationwide so that sludge is not transported across state lines simply to avoid stringent testing? How will all of the above be financed?

The Bank also has questions concerning managing and sharing liability, including, Who should bear liability? How might liability be apportioned under various arrangements? What liability-sharing mechanisms exist or might be developed? In the absence of risk predictability, can such mechanisms be established now? What should the time frame for liability be? and, In terms of liability, how should contamination be measured now and in the future? Considering government's commitment to the "beneficial use" of sludge and sludge products, might legislation be created granting liability exemption for contamination

arising from compliance with regulations in existence at the time of sludge generation/application?

The questions raised by the Farm Credit Bank illustrate the complexities of the issue and the overwhelming difficulties in limiting, no less in fairly apportioning risk liability stemming from sludge-related damages. The only way to minimize sludge-related risk is through redoubling efforts to reduce sources of sludge contamination. Yet, although significant progress has already been made, the relative permissiveness of the United States metals standards is discouraging additional efforts to clean up sludges and sludge-derived products. In fact, the standards are being used to justify lessening efforts, or not making any at all, to improve product quality.

Focus on liability, at this time, implies acceptance of probable sludge-caused damage. The question of liability aside, current controversy among scientists is a warning against reliance upon the USEPA CWA 503 regulations to protect irreplaceable farmland. Considering what is at stake, we ought not to ignore it.

- Susan Mazzocchi
Editor

References

1. Telephone conversation, November 18, 1993.
2. Telephone conversation, November 1, 1993.
3. Telephone conversation, November 3, 1993.
4. Telephone conversation, October 30, 1993.
5. Telephone conversation, October 28, 1993.

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INTERVIEW WITH R. DENNY BLEW

Chief Operating Officer, Centerton Nursery, Inc.

Citizen Advisor, New Jersey Center for

Agricultural Molecular Biology

President of the Cumberland County Board of Agriculture

Founder & Chairman, Eastern Container Association of Nurserymen

May 12, 1992

What is the potential agricultural market in New Jersey for absorption of waste-derived soil amendment products?

RDB: According to the latest figures – tempered with some professional opinion – of total New Jersey agricultural land, soil amendment products could be used on approximately 779,250 acres. Of this, 450,000 acres are in vegetable, fruit, grain and hay production; 29,250 acres in nursery, greenhouse and sod production; 300,000 acres in forest, pasture, fallow, or in a transitional stage. This acreage is spread among eight thousand farm owners with operations ranging in size from two to two thousand acres, the average being about one hundred. Approximately 500,000 acres – fruit, grain, vegetable, hay, and pasture land – are food-chain related, 279,250 acres are not.

Please tell me a little bit about the nursery industry.

RDB: Although nursery production represents only 3.7% farmland usage, it generates one third of all New Jersey cash farm receipts (\$217 million). New Jersey's nursery industry today is largely a non-food-chain business. Of the 29,250 acres in the nursery industry, 17,000 are nursery stock, 12,000 are devoted to sod production, and the remaining 250 are in short-term greenhouse production of herbaceous annuals and holiday crops.

Nursery stock production itself is divided into two major categories – container production and field production – each of which can be broken down into numerous niches. Container production, a relatively young industry only twenty-five years old, is a very high front-end investment business. It is also high risk and extremely intensive.

Modern container production facilities utilize only man-made "soil" mixes and new soil is created for each new crop. This is also true for greenhouse production. The industry still has a multitude of unanswered questions. Unexplained – many times, positive – phenomena are commonplace: extended flowering periods, two- to seven times growth rates, lack of pH significance, etc.

How does this compare with field nursery production?

RDB: Field production is a traditional form of farming. It

began as a commercial business 200 years ago, supplying fruit tree seedlings to orchards. Although there have been advances, field production technology has changed very little over the years. Comparatively, it is a lower investment, lower risk business.

Crops are grown in our typical New Jersey inorganic, mineral soils. Due to this and a number of other factors, growth is decidedly slower and more predictable in field than in container culture. Only in rare instances, are soil conditioners such as peat moss, leaf or wood compost used.

How much waste-derived amendment could the nursery production industry consume?

RDB: My rough estimate of soilless mix usage in New Jersey is 556,000 cubic yards per year. If New Jersey container growers were to replace one of the soilless mix's major components, representing 40% of the mix, it would consume a total of 222,000 cubic yards of material annually.

The remaining nursery industry in field- and sod production, with a combined acreage of 27,000, could use 1.8 million cubic yards of a solid-waste-derived amendment, assuming an annual application rate of one-half inch, or 67 cubic yards per acre. This field facet of the industry cares much less about time and space than do container growers, and, given proof of performance and believable economics, is a potentially large user of such material. However, I would guess that to capture a significant portion of this market would require a price of \$6 or less per yard, delivered (one half the price of peat). A \$3 pricetag would increase this market many-fold.

Sludge is produced every day of the year. Would there be unlimited capacity for its use as a soil amendment on non-nursery field crops?

RDB: Yes, if the price were right and it were free of contaminants. Because organic matter content in New Jersey soils is extremely low, about 2%, there's a lot of room for improvement. In addition, depletion of the soil is a problem both in field nursery and sod production because of the unavoidable removal of a certain amount of soil with each harvest, and because of natural erosion from wind and runoff.

However, because of the large quantities of conditioners that would be needed to affect the tremendous area of any given parcel of soil, cost could be a prohibiting factor.

If sludge-derived compost were found suitable, would farmers expect to purchase it, receive it cost-free, or be paid to take it?

RDB: In traditional farming it would be difficult for farmers to pay very much because they're in economically dire straits right now; their margin of profit is very slim. If cost is a large factor in nursery field production, which generates a few thousand dollars per acre, can you imagine what that factor must be for the green bean grower who grosses \$500 to \$600 per acre? Or wheat, which brings \$150 to \$200 per acre?

If the amendment were in the form of compost and relatively contaminant-free, it could give tremendous benefit to the farming community by improving crop production. Right now, to a large degree, we're using various kinds of fertilizers. We used to use manures. Most of it came from dairy farms with cows, pigs and chickens. That's a tough business, a segment of our agricultural heritage which has been all but driven out of the state by regulation and taxes. So now we use ground-cover fertilizers and chemical fertilizers, as well as peat moss, mainly from Canada.

However, although an appropriate waste compost might enhance their soils, most traditional farming operations are in no position to pay for something they've done without, and can live without indefinitely.

Would sludge be utilized as a fertilizer, an organic amendment, or both?

RDB: If it's a fertilizer, you're going to apply it when you think you need it and that would depend on the crop grown, the area of the country, and a lot of other things. If it's to be used as an organic amendment to build soil value, it doesn't matter when it's applied.

Then I suppose the question is, is sludge unavoidably a fertilizer?

RDB: I don't think we know. If it were to be used as a fertilizer it would depend on nutrient content. One of things that's restricting us from calling it a fertilizer *per se* is that most of it contains undesirable contaminants - heavy metals and mineral concentrations that are too high for growing some varieties of plants. Depending on source, location of the sampling area and time of day, there might be any number of contaminants.

What are the farm community's greatest concerns about government's encouragement of "beneficial use" of sludge?

RDB: We are concerned about the product's short-term safety for the people who handle and work with it, and its long-term safety in terms of groundwater protection. In addition, we are concerned about whether or not we're being given correct information. We fear having to face legal and financial problems as a result of misguidance.

For instance, numerous financial lending institutions require affidavits from sellers assuring buyers that the land they are about to purchase has never - I repeat *never* - had waste products applied to it. If we don't sign the affidavit, we can't sell our property. If we have used sludge, we must assume total responsibility for any problems this may cause down the line. For whatever reason, the waste products are viewed as a potential source of controversy in both food-chain and non-food-chain applications.

How do you feel about utilizing a waste-derived soil amendment?

RDB: At Centerton Nursery, we grow plants in containers. If we could get the performance we get right now and the price were in line, we would purchase it. The finest quality soilless ingredients usually comprise less than 7% of total production costs, so mix costs are a secondary or tertiary consideration for us. The hidden, and by far the greatest, cost in this industry is the use of space over a given period of time. Therefore, top performance is the brawny #1 factor. Under no circumstances would we at Centerton sacrifice performance for savings on soil amendments - even if the amendments were free.

What kinds of things do you grow?

RDB: All kinds of ornamental plants. We wholesale to retailers, to nurseries, to people who sell flowering plants. Even with that kind of business there is concern about phytotoxics. We are not a monoculture type of operation. To survive today's marketplace our farm must grow hundreds of varieties, many of which have different requirements, different sensitivities. Even with class A sludge it would be a big conversion for us, which would require research.

We would need to know the percentages of all the minerals and nutrients we'd use in our mix, aside from what's in the sludge, because we'd have to make adjustments. The nutrients come in different forms, different size molecules and we would have to understand about the forms of the nutrients. We would want Rutgers University to do this research; their research determined the mixes we now use.

What kinds of mixes are currently used for container production in the nursery industry?

RDB: Typical soilless mixes for container production would consist of 40% stick-free peat moss, 40% vermiculite (popcorn size) and 20% #2 washed sand. Another, cheaper and more popular mix is 40% peat moss, 40% composted pine bark, and 20% construction sand. At Centerton we use the former. Some of the qualities we looked for in designing this mix were:

- high performance growth media (peat is excellent)
- sterile ingredients free of weeds, insects and diseases
- high cation exchange capacity
- low initial nutrient value
- low toxins
- high buffering capacity
- high water retention and oxygen content
- predictable results
- absolute consistency; uniformity from pot to pot, crop to crop
- amenability to mechanical mixing and potting
- ballast with minimal drainage reduction
- good soilless-to-soil interface for consumer ease

Would it make any difference to you if the compost were derived from municipal solid waste?

RDB: Not if we could get a standardized product, uniform and consistent from batch to batch, year after year. The presence of heavy metals, incomplete pasteurization and intermediate compounds from anaerobic activities render compost too capricious for widespread agricultural use.

The viability of waste compost as an amendment comes down to local situations and specific markets. With most current municipal solid waste composting processes there's too much inconsistency from batch to batch. Test results vary from processor to processor, location to location within the mass, and hour to hour within a given location. This makes it simply too difficult to deal with the products.

When the product funnels down to one micro-seedling or the toxin analysis in one slice of tomato, we cannot speculate, philosophize or offer principles without applications. The potential use of it comes down to quality. What's in it? What's in each batch of it? And would that analysis be consistent with what one might find in any mere handful of it? The products will not be marketable until those questions can be answered.

Forcing agriculture to deal with a dynamic waste-derived compost product is the same as telling Coca-Cola that it must process soft drinks in randomly shaped bottles and fluctuating syrup concentrations. It isn't practical, it doesn't conform to successful business management; and it

makes the product undesirable.

What type of soil amendment would you want to use?

RDB: I would prefer compost because it would be pasteurized. Compost could be used as a soil amendment in both soil and soilless mixes. However, it must be a consistent, fully pasteurized, aerobic compost, free of contaminants, with mineral and metals levels that are safe to use on a wide array of food, feed, fiber and ornamental crops.

Accepted, economically successful production practices are not easily altered at the expense of risk. So, we're awaiting product improvement and research data on performance, as well as acknowledgement of a problem which exists.

What problem is that?

RDB: The New Jersey agricultural community has been told by the New Jersey Department of Environmental Protection and Energy (NJDEPE) that we must take sludge. Right now there are battles in this area of the county. Sludge processors in cooperation with powerful government agencies are attempting to forcefeed waste products to agricultural communities. There is growing public perception of this as collusive.

Sludge processors have had some success at marketing their product for use in New Jersey. Sludge companies and haulers, who need to get rid of the material, are going to landowners and offering them money to put sludge on their land. There are some who are trying to make this illegal. Others believe that sludge is a natural product which should be land applied.

Why is it a problem that farmers accept sludge for money?

RDB: We have reason to suspect that, unfortunately, some distribution companies are offering money to financially-strapped, desperate landowners, who are applying the materials at higher — perhaps many times higher — than recommended levels. The thing that scares me is that they have gone to farmers, who have financial problems, and paid them more money to take tonnage to put on their ground than their crops would bring in.

These farmers have cut their own children off at the ankles because they're not going to be able to get money from the bank to continue to farm the land. And they're not going to be able to sell that land. So they've written off the farm.

We don't really know if the material is okay, and whether or not this will lead to detrimental environmental effects

down the road. It might threaten groundwater, or future crops, or animals.

This exercise in greed will eventually haunt the waste management industry as a whole.

Can you give me a recent example of this kind of thing?

RDB: We just had an open public township meeting on this subject. We had a farmer in the township who wanted to apply large quantities of sludge from Philadelphia, and some concerned citizens wanted to prevent it. The local board of health has the power to give or withhold approval. In this case, the local board of health refused to approve the application. Then NJDEPE came in with an injunction prohibiting the county from preventing the sludge application.

They can force us to take it. They can pay the farmer to take it. But they will not accept responsibility down the road. They will not say that if something happens, they will accept the financial risk. Who pays for the land when you can't sell it?

You said that you are awaiting research data on performance. What kind of research and by whom?

RDB: In order to prove that waste-derived products are usable in the agriculture-related industries, extensive research must be conducted by our state universities. If the research proves that use of the product is feasible, it is imperative that an endorsement from the university accompany that proof.

Each of our state universities should also establish best management practices and parameters based upon the specific sources of the wastes from which the amendments are derived, as well as upon local site conditions.

Research should cover the following critical areas:

- the products' physical characteristics – particle size(s), structural makeup, variability within lots and from lot to lot, weight, physical shrinkage and settling, oxygenation properties, water-holding capacity, etc.
- the products' chemical makeup – toxins, heavy metals, CEC, nutrient levels, variability of these within lot and from lot to lot, etc.
- the products' other characteristics – pathogens for plants, animals and humans, undesirables such as weeds and weed seeds, insects in any stage of life cycle, etc.
- testing product performance compared to existing agricultural practices in all facets of food-chain and non-food-chain industries – container nursery and field

nursery/sod cultures, vegetable/fruit production and animal/animal by-product production. Performance testing should be carried out in the controlled environment of the university laboratory and field situation, then eventually as university-directed experimentation out in the private sector.

Isn't there a problem with food processors accepting food grown on sludge-amended land?

RDB: Most New Jersey food processors are stating forcefully that they will not process vegetable or animal products produced on land that has ever received applications of waste products. They want farmers to sign affidavits saying they will not use and have *never* used sludge or waste products on food-bearing land. Requirement of the word, 'never,' is kind of scary.

Food processors fear that consumers will have the mental association – Flush the toilet; the bean crop should be real tasty this year! When a product is derived from sewage sludge or some other waste, there is an image problem to be overcome when it's associated with the food chain. Whether or not these concerns are legitimate, they are powerful deterrents to using waste products.

The processors also fear potential liability from the ramifications of some hazardous compound in the parts per trillion range being detected later on. What if someone said to them, "I ate your spinach last year and my wife had a miscarriage."?

But we have that problem right now. Lead arsenate on citrus crops. Nitrates in spinach and cranberries.

RDB: But we're talking about a new product now whose standards are based on cost-benefit – my rear end vs the environment.

Government appears to be saying that it will redefine contamination.

RDB: They've passed regulations before and then they come back – the pesticide thing is a perfect example. They said, "Use it the way we say and you will have no problems." The farmers did and then they changed the regulations.

Agriculture needs a formal assurance from government, just as we have for pesticide use, that government will accept responsibility for their recommendation and encouragement to us to use these kinds of products. We need assurance that we would not incur liability if the products were used in accordance with governmental recommendations.

Considering waste management imperatives, what is the level of trust within the farm community in governmental advice, governmental standards for product quality and application, and government-funded research?

RDB: There's diminished confidence right now. One of the reasons is that while agriculture is admonished to use sludge and accept the liability, government, itself, really has not embraced the product through its deliberate, publicized use on federal, state and municipal properties and projects. So what they're saying is, "This is fine to use, but not on national or state forests." They're going to have to put their money where their mouth is.

And by the way, by 'publicize,' we don't mean the use of such statements as, "recycled materials used." We mean that they should tell it like it is, in the same way we'd be required to notify our neighbors. It should be a billboard that might say something like "COMPOSTED SEWAGE SLUDGE USED ON THIS PROJECT!"

If the government issued standards, would you have any means of assessing them? [The United States Environmental Protection Agency issued sludge quality standards in November, 1992. See *COMPOSTING FRONTIERS*, Volume 1, Issue 3.]

RDB: We'd compare them to data on what we're using right now. In terms of heavy metals, there's data on what different plant species can tolerate. We really do need standards and some type of control. For instance, there's the potential for contaminant spikes in sewage plants in industrial areas, perhaps caused by periodic surges of contaminants when a machine is flushed out.

Once the product quality issue is straightened out, we

would take the products if we had a reason to. We're willing to contribute towards recycling, but we cannot risk losing our livelihood to do that.

With confidence in government running low, whose advice do you trust?

RDB: The New Jersey agricultural community is very close to Rutgers Cooperative Extension Service. They are very grassroots, working with us all the time, and they are very close to the State Department of Agriculture. So they watch the watchdog, the watchdog being megagovernment with a problem on their hands right now that they've got to get rid of. The university really has a tremendous responsibility.

What would convince you that the forthcoming EPA and State standards will be okay?

RDB: Unbiased university research. And constant analysis to assure consistency. But they say that this is not economically feasible. Beneficial use of sludge should be a societal goal, but right now we have a problem with a lot of our sludges. I think we really have to know what we're doing. We have a lot of unanswered questions.

It would be great to gain the benefits of a waste-derived compost, but not if it means degrading prime land or contaminating the food chain. We're concerned about the safety of our families, employees and consumers. And we need assurance that future generations will want to use this land. Our concern is for the long-term because farming is a family business that gets handed down from generation to generation.

For further information, contact R. Denny Blew, Centerton Nursery, Inc., R.D. #5, Box 498B, Route 553, Bridgeton-Centerton Road, Bridgeton, New Jersey 08302-9343. Phone (609) 455-0926.

FARM CREDIT BANK OF SPRINGFIELD SPRINGFIELD BANK FOR COOPERATIVES

NEWS RELEASE

For Immediate Release
October 20, 1993

Farm Credit Announces Policy Regarding Use of Municipal Sewage Sludge on Farmland

Now that the U.S. Environmental Protection Agency has banned the ocean dumping of municipal sewage sludge, communities are looking for alternative disposal methods. High among the options is agricultural land, where sludge can be a valuable soil amendment and source of nutrients.

With that in mind, the Farm Credit Bank of Springfield, a major farm lender in the Northeastern U.S., has announced a policy on the application of sewage sludge to land where the bank holds a mortgage.

According to Roger Allbee, a vice president at the bank, "Clearly, the goal of nutrient recycling on farm land is worthwhile. We confirmed this by conducting our own studies, and by hiring an independent consultant to evaluate current literature regarding the practice.

"However, the way in which the practice is implemented can be of concern to the farmer, abutters, local communities, lenders and consumers.

"By adopting a formal policy, our board of directors wants to ensure that landowners who hold mortgages with Farm Credit weigh the potential benefits against short- and long-term risks, and then only use sludge of

appropriate quality and apply it according to an acceptable management plan."

Allbee said that, while EPA regulations include strict application and testing guidelines, they do not limit the environmental liability of even the most prudent farmers. Lenders could be at risk, too, Allbee added.

"If crops, livestock, and the land itself are damaged, destroyed or devalued," said Allbee, "a farmer's income and assets will be affected, perhaps leaving the farmer with few financial resources. Both the farmer and the lender could be exposed to potential losses. Obviously, we don't want that to happen."

Allbee explained that Farm Credit's new policy for its mortgage customers, effective October 20, 1993, has four key points, outlined in the Background Statement which follows.

Allbee summed up the policy announcement by saying, "Farm Credit believes that the interest of farmers, the bank and local communities are best served by the bank's support of careful stewardship of land and water resources. The policy helps ensure the achievement of this objective."

BACKGROUND STATEMENT

The Position of the Springfield Farm Credit Bank on the Application of Sewage Sludge to Agricultural Land

The U.S. Environmental Protection Agency's prohibition of ocean dumping of municipal sewage sludge has forced communities to look more closely at land disposal. Consequently, many communities in the Northeast are evaluating land-based options, including the application of sewage to agricultural land.

The Farm Credit Bank of Springfield is a major lender to agricultural businesses in the Northeast and holds mortgages on tens of thousands of acres of agricultural land in New England, New York and New Jersey. Thus, the bank has a vested interest in the short- and long-term effects of sewage disposal on farmland.

Farm Credit Bank has always supported the proper stewardship of land and water resources through the appropriate handling of potential contaminants. Our borrowers' interests and the bank's own financial well-being are best served by this position.

Recently, the management of the Farm Credit Bank of Springfield completed a study to assess the benefits and risks associated with the land application of sewage sludge. The first phase of the study involved an extensive literature search and consultations with knowledgeable professionals. The bank compiled its initial findings in a research report, *Land Application of Municipal Sludge: Impact on Springfield*

District Farm Credit, which is available upon request.

To date, it is apparent that there are still many unanswered questions and differences of expert opinion regarding the advantages, disadvantages and costs concerning the long-term effects of land application.

For example, the EPA has adopted regulations on land application designed to promote maximum benefit to farmers and minimal risk to the environment. The EPA has directed that sludge must be of the highest quality from known sources, properly tested and applied according to acceptable agronomic rates. The EPA also notes that improper handling, testing or application could expose farmers, and in turn, their lenders, to the risk of liability for damages and cleanup.

However, while EPA regulations include enforcement measures regarding testing and application of sludge, they do not limit the environmental liability of prudent farmers and lenders who accept sludge in good faith and follow optimum land management practices. Thus, if application results in damage to crops, livestock and the land itself, a farmer may be exposed to serious financial loss.

Farm Credit believes that prudent farmers (and their lenders) who accept high-quality sludge and apply it according to accepted agronomic rates should be protected from liability.

Thus, following our investigation, Farm Credit Bank recommends that anyone wishing to apply sewage sludge on land where the bank holds a mortgage should proceed cautiously.

Based on our findings, our most significant conclusion is that the bank would not recommend the application of sewage sludge on agricultural land mortgaged to Farm Credit without proper contractual indemnification underwritten by a financially responsible party.

With this in mind, the Farm Credit Bank has adopted

the following four-point policy:

- Before applying sewage sludge, farmers should become familiar with safe application procedures, understand risks, and become acquainted with EPA and state regulations and related land management practices as recommended by state universities.
- Farmers should follow prudent land management practices, such as the use of high-quality sludge from reliable sources, the performance of regular testing, and conformance to standards of composition and purity. Farmers should apply sludge according to agronomic standards and be sensitive to the implications of marketing products grown on sludge-amended soils. Farmers must also take appropriate steps to ensure the safety of individuals who have access to the land.
- Farmers should protect themselves from the risks outside their control by securing an indemnification agreement with the sludge generator, underwritten by an appropriate private or public insurer.
- Borrowers requesting permission to apply sludge or sludge-derived materials on land mortgaged to Farm Credit must demonstrate to the bank that they have taken the steps described above as a condition to receiving the lender's permission.

Farm Credit recognizes that scientific investigation continues on the long-term benefits of sludge application to agricultural land. The bank has noticed a particular need for investigation regarding the interaction among sludge, soil chemistry, and crop production under conditions unique to the Northeastern United States.

For this reason, bank management will evaluate its policy on an ongoing basis to promote the best interests of borrowers and Farm Credit cooperatives, and to ensure that the bank's policies do not jeopardize the productivity of the land.

The Farm Credit Bank of Springfield has held a closed symposium on this issue for about thirty participants, including representatives of state and federal government, university-based scientists, insurance experts, farm organization leaders, sludge industry officials, and environmentalists.

For further information on the Farm Credit Bank's sludge application policy contact Mr. Roger N. Allbee, Vice President, Farm Credit Bank of Springfield, Post Office Box 141, Springfield, Massachusetts 01102. Phone: (413) 786-7600.

RISKS ARISING FROM LAND APPLICATION OF SEWAGE SLUDGE ON NORTHEASTERN FARMLAND

Report to the Springfield District Farm Credit Council

*Dr. Charles M. Benbrook
Benbrook Consulting Services
June 25, 1993 Version
[Abridged and Edited]*

Application of sludge, and sludge-based products on agricultural land links rural and urban America in new ways. There is much to be gained and lost on both sides of the transaction. Society's challenge is to capture the benefits while minimizing risks and assuring that the costs remain predictable, affordable, and equitably shared.

Summary and Conclusions

Risk, its size and management, is the key cost factor facing the Farm Credit System. The evaluation of risks arising from the application of sewage sludge to farmland is enormously complex. The variables are many and often unpredictable, both on the farm and in the waste stream and treatment/composting processes. Farmers cannot predict when heavy spring rains will cause flooding; a municipal waste water treatment manager cannot anticipate a chemical spill inside a local manufacturing facility and the resultant spike in the concentration of some chemical moving through the plant and then onto the land. Yet both events occur periodically, and damaging consequences may follow, particularly when such events overlap, as they sometimes will.

The Bottom Line

My basic conclusion is two-fold: most sewage sludge can be recycled safely on agricultural land, but in the real world, some of it won't be. Rapid growth in the percentage of sludge applied to land is contemplated, indeed encouraged by USEPA in its new regulations. Such expansion, especially if carried out hurriedly, will broaden the risk profile and raise the odds that unforeseen problems will surface.

Problems may arise as a result of economic incentives structured by regulations, or by inadvertent error and/or technical surprises. The Northeast is more vulnerable than the rest of the country for reasons noted below. Yet the factors giving rise to the region's vulnerability have not been adequately addressed by the scientific community or by government agencies, who, despite lingering concerns, have become spirited advocates of land application.

Some argue that concerns expressed in the Northeast are unfounded in light of years of experience with land application of sludge in other regions of the country. I disagree, especially if state regulations through the region are relaxed in accordance with EPA's recently issued Clean Water Act, Section 503 Sludge Regulations (CWA 503 Regulations). Circumstances differ markedly in much of the Northeast. The ratio of the volume of sludge to cultivated land differs at least tenfold; most Northeastern soils are acidic, enhancing the prospect that heavy metals may be more available than in other parts of the country; the topography is rolling, and patterns of cropping and livestock land uses are more variable; and community expectations differ.

Advocates argue that, "done wisely," potential problems with land application can be largely avoided, or, in any event, be detected and dealt with before serious harm is done. Technically such proponents are on solid ground; institutionally they are not. The rush to move ahead with large scale land application is likely to get ahead of efforts to establish the technical and institutional building blocks essential to assure that sludges are applied safely in the real world.

A critically important question is how much confidence to place in government's ability, through research, regulations and compliance activities, to assure that reality approaches the technological and managerial state of the art upon which safety judgements are based. While the answer varies markedly across the region, rapid growth in the volume of sludge applied to land, coupled with challenges inherent in implementing USEPA's new CWA 503 Regulations, are likely to overwhelm most state government agencies responsible for controlling potential risks associated with land application. This is why many people are now pushing for what amounts to the deregulation of "clean" sludges and sludge-based products.

The Costs of Uncertainty

The major issue the agricultural community and the

Farm Credit System must confront is the magnitude and distribution of costs associated with the management of risk arising from land application of sludge. Such costs may eventually include:

- monitoring of land and sludge quality, and associated technical assistance needed to assure application of sludge in accordance with recommended practices;
- restrictions on when and how land can be used following sludge applications;
- the undermining of agricultural markets or land values, or future restrictions on land use due to health scares;
- higher insurance premiums and/or limitations on the scope of coverage;
- higher interest rates to secure capital and service loans;
- government regulatory, reporting, and associated compliance costs;

RISKS FROM LAND APPLICATION OF SLUDGE

There is strong evidence that recycling sludge on land can deliver significant environmental and economic gains *relative* to other disposal options. The risks associated with land application are different from those arising from incineration and landfill disposal. Those who face the risks and bear the costs of dealing with them also differ, as do the technologies and processes needed to monitor and control risks. The nature and level of risk will also vary markedly according to the quality of the sludge or sludge-based product. The institutions and regulations needed to assure that land application is carried out safely are markedly different, and in many respects more complex and costly than those needed to control incineration or landfill operations.

Heavy Metals

Soil contamination with heavy metals remains a legitimate concern despite encouraging progress in cleaning up sludge. Problems may arise from four interrelated factors, each of which is addressed in more detail later. They are:

- Sludges in the Northeast contain widely variable levels of heavy metals; in general, sludges from urban/industrial areas contain higher and more variable levels of metals than sludges from smaller cities and rural areas.
- There is much uncertainty over the bioavailability of metals to various crops and grazing livestock, and to the environment through runoff and leaching.

- litigation expenses in the event of nuisance or other lawsuits.

Such costs are now modest, generally on the order of \$10.00 to \$25.00 per acre treated with sludge at an agronomic rate. But these costs are bound to rise as sludge is used more intensively, and as USEPA's new regulations take effect. Costs will rise over time as a function of actual and perceived levels of risk. The degree of public attention paid to the ongoing controversy over land application of sludge will be an important variable driving costs, as will the scope and degree of disagreement among scientists over risks.

Still, per-ton costs are likely to remain modest compared to alternative disposal options. Strong economic pressures are building to accommodate land application of sludge; it's not a matter of whether, but of how fast, where, and under what conditions it will occur.

- Significant downward adjustments may be necessary in estimating safe levels for humans and livestock as states and the USEPA adopt more sophisticated risk assessment methodologies, and as toxicologists gain better insight into hazards associated with low-level exposures; developmental effects facing pregnant women and children, and male reproductive system effects are emerging as areas of particular concern.
- Laws and policies leading to the estimation of safe levels may become more prudent.

Variability in Metal Levels. New York's Legislative Commission on Solid Waste Management recently carried out an assessment of New York Department of Environmental Conservation (DEC) sludge quality data collected from twenty-three Publicly Owned Treatment Works (POTW's) in seven regions from October, 1991, through late 1992. The data, as follows, show that some sludges contain clearly worrisome levels of metals, and that the degree of variability is significant.

Cadmium. CWA 503 Maximum Allowed Level for High Quality Sludge, 39 ppm; New York Class I (proposed), 10 ppm; Massachusetts Class I, 2 ppm. Of the 23 POTW's tested, twenty had cadmium levels below 10 ppm; the other three had much higher levels: 106 ppm, 18.6, and 15.1 ppm.

Zinc. CWA 503, 2,800 ppm; New York and Massa-

achusetts Class I, 2,500 ppm. Ten POTW's had zinc levels below 1,000 ppm, but four were above 2,500 ppm; the highest levels were 7,488 ppm and 4,886 ppm.

Copper. CWA 503, 1,500 ppm; New York and Massachusetts Class I, 1,000 ppm. Fifteen of 23 POTW's had copper levels below 1,000 ppm; two had much higher levels, 4,475 ppm and 2,299 ppm.

Molybdenum. CWA 503, 18 ppm; New York Class I, 35 ppm. Thirteen POTW's were below 12 ppm, but seven exceeded USEPA's standard with levels of 117 ppm, 86 ppm, 36 ppm, 25.9 ppm, 20.3 ppm, 19.3 ppm, and 18.2 ppm.

Bioavailability and Environmental Fate. Heavy metals in soil, from whatever source, are more bioavailable to plants and the environment at lower pH levels. Soils in much of the Northeast test well below 6.0 pH; corn and other crop yields do not respond to liming above pH levels around 5.2 to 5.5. Yet the difference between 5.2 and 6.0 is often significant relative to the availability of heavy metals.

Based on careful studies with lime-stabilized sludges using the N-Viro process, available zinc can fall from 8.25 mg/liter at pH 5.55 to 0.3 mg/l at pH 7.5; chromium can fall from 0.57 mg/l at pH 5.4 to 0.17 at pH 6.2; and nickel can fall from 2.9 mg/l at pH 5.5 to 1.31 at pH 7.0. Other metals – copper and lead, for example – are less sensitive to pH levels.

Northeastern field topography and variable soil types, to a greater extent than those of other regions, can also affect the distribution of metal concentrations. Sloping land, coupled with surface runoff and subsurface lateral flows may tend to concentrate metals in low-lying parts of fields. This is likely to be a particular problem with grazing land on which sludge-based products are surface applied; surface water runoff from pastures onto low-lying fields may also expose cattle to dangerous pathogen levels in freshly-applied sludge.

Potential heavy metal risk in the Northeast is, therefore, more sensitive to cropping system design and management practices than in regions with more homogeneous, generally level fields/soils. Accordingly, worst-case scenarios not plausible in other regions warrant attention in the Northeastern region, until there is a reasonable basis to conclude that mechanisms have been put in place, and will be adhered to, which render the scenarios implausible.

Significant institutional challenges must be faced in devising such mechanisms: assuring that desirable soil pH levels will be maintained for many years after sludge

application has ceased; maintaining and assuring access to accurate records regarding metal levels and past application rates; enforcing compliance with land-use restrictions and precautions many years after application has stopped; and dividing the near-term and long-run costs and liability exposure inherent in land application.

Safety Standards. On June 28, 1993, the National Academy of Sciences (NAS) released the long-awaited report on pesticides in the diets of infants and children. This report recommends major changes in the way dietary exposure to pesticides is estimated for the purposes of setting "safe" pesticide-residue tolerance levels. USEPA is expected to act quickly to adopt the Academy's suggestions, and not just in the pesticide program. The new exposure assessment methodology will undoubtedly be used to reassess tolerable levels of metal and chemical contaminants in other media, including sludges.

In general, the NAS recommendations are likely to lead to a two- to ten-fold increase in exposure estimates among certain population subgroups. As a result, there would have to be proportional tightening of levels considered "safe." In addition, new studies on developmental and reproductive system effects are very likely to result in upward adjustment of heavy metal risk profiles, at least for a few compounds – mercury, lead, and cadmium among them. Thus, stricter standards for at least some metals can be expected in the next two- to ten years.

Uncertainty over standards dictates considerable near-term prudence in estimating "safe" sludge application rates. Consider the possible outcome of tightened standards utilizing current recommended rates of application of N-Viro soil from the Syracuse, New York, plant run by Waste Stream Environmental, Inc. (WSE). Under current metal standards and recommended application rates, WSE has calculated that forty applications, or ten wet tons per acre can be made on a given field, based on the cumulative loading limit for copper, present in the product at 160 ppm. If new information lowered the acceptable standard for copper ten-fold, the cumulative loading limit for copper could be reached in as few as four years. Recall that some New York sludges tested by DEC have copper levels more than 25 times that level.

Another reason that the loading limit might be reached sooner than expected, is that there are other probable routes through which copper is reaching Northeastern croplands. For example, copper contamination of European soils from the spreading of hog manure has recently become a major concern. Yet, all of EPA's estimates of safe, cumulative

heavy metal loading limits rest upon the assumption that sludges are the sole source of the metal, and that baseline levels are the same as background levels. Both assumptions are likely to often prove faulty. Thus, fields receiving sludges should be assessed first to determine baseline levels, and greater attention should be directed toward quantifying other sources of metals, especially cadmium in commercial fertilizers.

Laws and Policy. Standards are subject to adjustment when new information becomes available, or when policies change. Current heavy metals standards are intended to avoid appreciable risk using best available risk assessment methods and data. These standards are then used to calculate acceptable cumulative loadings.

There are many different ways to set "safe" limits; none can be proven inherently correct. Other countries favor a non-degradation standard, resulting in far stricter standards than USEPA's risk assessment-based method. As better data on exposure and toxicity emerge, the gap between today's risk assessment-based standards and non-degradation standards will narrow for many metals. Political pressure — already evident in New York — may increase to move toward a nondegradation standard. Public debate on this issue will lead to more scrutiny of actual metal levels in agricultural soils, and more careful assessment of how land application of sludge has affected levels. Data will be collected to provide perspective, and some lands are likely to be found to exceed acceptable levels, particularly if standards are tightened. As a result, the public may call upon regulators to place restrictions on future agricultural use or other development of such lands.

In sum, there is great variability in the levels of metals in sludge, considerable uncertainty as to their bioavailability and environmental fate, and many reasons to expect new science and/or changes in policy to result in more stringent standards for at least some contaminants. Moreover, these sources of uncertainty may well prove at least additive in characterizing worst-case scenarios.

Bacteria, Pathogens and Viruses

Disease-causing organisms in sewage sludge pose acute risks to both humans and animals. The greatest risk arises from those organisms that can regrow in sludge after treatment and prior to land application, specifically bacteria like salmonella, campylobacter, and shigella. Viruses and protozoa of concern do not survive outside a mammalian host, and hence find sludge a very hostile environment.

Bacterial hazard is a function of the quality and method

of treatment. Lime-stabilized sludge-based soil amendments are virtually free of viable salmonella, and the levels of other pathogens are reduced far below standards applicable to Class A sludges. Properly composted sludge is nearly pathogen-free with no pathogen regrowth. However, pathogen levels in liquid sludges and composts produced in improperly-controlled systems can pose significant risks, especially in the case of bacteria that can rapidly regrow.

The new USEPA rule also contains a curious provision allowing POTW's the option of reporting pathogen levels for multiple species, in effect, allowing them to choose to only report a species meeting the standard. For example, if a partially stabilized sludge product fails to meet the Class A standard for salmonella, but meets it for *E. coli*, the POTW can report only the latter and retain Class A designation. This provision may well need to be reexamined.

Pathogen testing methods are sometimes difficult and can be costly. USEPA concludes that, "Monitoring sewage sludge on a regular basis to determine the types and densities of pathogenic bacteria present is desirable but impractical." There is, moreover, considerable uncertainty over how frequently tests for pathogens must be conducted. Currently, USEPA requires that tests be carried out monthly in large POTW's, and only once a year in small plants. Yet, for a sludge-based product to be sold as a High Quality product, USEPA requires monitoring for salmonella or *E. coli* "every load."

Guidance has not yet been given whether "every load" means every one-ton pickup load, every twenty-ton truck-load, or every shipment to a farm, which could mean 1,000 tons, figuring treatment of 100 acres at 10 tons per acre. The difference in cost is sizeable, since just an *E. coli* screen costs about \$80 per sample, and a thorough screen involving pH, nutrient and metal levels, and other pathogens costs about \$250 per sample. An expenditure of \$250 to test sludge product quality spread over a 1,000-ton delivery is affordable at \$0.25 per ton, but would be prohibitive for a one-acre application at ten tons per acre, or \$25 per ton.

Use of improperly-treated sludges, or sludge-based products on pastures should raise concerns throughout the dairy-producing regions of the Northeast. European studies cited by the USEPA in the pathogen Technical Support Document point to serious risk of salmonellosis in dairy and beef cattle from sludge application on pastures. For this reason, Germany and Switzerland require disinfection of any sludge applied to pasture. But USEPA concludes that the adverse European findings reflect very

high salmonella population levels not indicative of United States circumstances and practices, as long as sludge is processed to reduce fecal indicator densities to 2,000,000 CFU (colony forming units) or MPN (Most Probable Number) per gram, and cows are not allowed to graze on affected pastures for one month following application.

The one-month grazing restriction is critical, since viable salmonella populations decline sharply once sludge is land-applied. USEPA estimates that 99% die off within thirty days. But if within a month of application rain washes surface-applied sludge, or sludge-based products from one pasture down onto a bottom-land field where cows are grazing, or fences break, or a gate is left open by mistake, cattle may be at risk for exposure.

Water Contamination

Commercial fertilizer, pesticides, and animal manures are important sources of water pollution throughout the Northeast. Limits are bound to be placed on routine land application of sludges, driven by concerns about heavy metals. It is hard to imagine sewage sludge accounting for more than a small fraction of the soil nutrients available from all sources within a watershed. For this reason, efforts to reduce agricultural N and P losses to water should be directed toward development of farm-specific nutrient management plans and practices; nutrients from sludges should clearly be considered in the course of developing such plans, but the principal focus should be on the major sources of nutrients - fertilizer, animal manure, and legume nitrogen fixation.

Certain circumstances may increase the seriousness of sludge-related risks from heavy metal contamination of groundwater. Under current regulations, a POTW dependent upon land application, or land application contractors can minimize costs by applying the heaviest possible rates of application on each acre, by working out agreements

with farmers nearest to the plant, and developing ongoing relationships with customers, so that N and P, or soil-liming needs are met each year by sludge-based products. Such patterns of application would tend to gradually raise heavy metal levels across a significant portion of the land base within certain watersheds. Accordingly, it is possible that cumulative loading limits for sludge will be reached on much of the land within a watershed within the same five-to-ten-year period. Such an area might then be abandoned as a large-scale sludge receiving area.

As long as soil pH levels are maintained at or above 6.0 on lands treated with sludge, most of the metals present presumably would remain tied up. But if changes in the farm economy, unusual weather, changes in land use, or some other factor were to create a set of circumstances leading to declining pH levels, a flush of metals could be released from the soil across a wide area within a few years. Such an event could conceivably elevate levels in drinking water in certain localized regions, creating a serious dilemma for both individuals and communities.

Nuisance Suits

Nuisance lawsuits brought against landowners and sludge applicators are likely to allege offensive odors, water contamination, and perhaps, in some cases, human health problems or adverse impacts on pets or livestock. Certain lawyers specialize in locating possibly aggrieved parties, such as anyone living next to, or downstream from a field on which sludge has been applied. Sometimes a "guilty" verdict accompanied by a significant monetary settlement in a well-publicized case in one part of the country will generate literally hundreds of "copy-cat" law-suits in other areas. Even when defendants feel complaints are spurious, settlements of \$5- to \$15 thousand are common, because the costs of mounting a credible, science-based defense in court would be much higher, with no guarantee against an adverse judgement.

LIMITING RISKS AND EQUITABLY SHARING COSTS: OPTIONS FOR THE FARM CREDIT SYSTEM

Beyond adopting a "Just Say No" policy, agricultural lenders can influence how and where sludge is applied to agricultural land only indirectly. Yet they may end up incurring sizeable costs as a consequence. For this reason, it is appropriate for the Farm Credit System to monitor developments in both the regulatory and scientific communities. In addition, before the new USEPA regulations spur a significant increase in the volume of sludge land applied, the Farm Credit System should assess more thoroughly the

range of options lenders could pursue to protect their - and agriculture's - interests.

Careful attention to this issue is particularly important now, as states begin the process of implementing USEPA's new Section 503 Regulations. These long-awaited regulations are clearly designed to encourage land application of sludge, by lessening regulatory hurdles and relaxing certain key standards, most notably allowable cadmium loadings and levels.

Following is a summary of what lenders can and should do, if, and where, it is judged that stronger steps are needed to assure that the long-term productivity of agricultural land is not compromised in the rush to reduce near-term sewage waste-disposal costs.

Stay Abreast of Changing Regulations and the Comparative Economics of Alternative Disposal Options

Reliance on land application is bound to grow, and rapidly in some regions. The greatest hazards will arise in communities where a large new facility is built, all of a sudden creating the need to land-apply thousands of tons of sludge-based products per year. Once such a plant starts up, the products will have to be moved, sometimes in the absence of much local experience or appreciation of the possible hazards, or of how to minimize them. That's why the Farm Credit System, within each region, should continuously assess how changing regulations and policies, and the economics of disposal, affect the methods that will be used when sludge is land applied, and the cost of land application relative to other disposal options — especially when there is a major change in a community's or region's method of disposal, or when large volumes of sludge are shipped into a region from another.

Diligence is in order because while lenders have a twenty-, thirty-, or forty-year interest in a piece of land, land-application decisions are driven by short-run, inter-related financial and waste management concerns.

Low-Key Farm Credit System Responses

Lenders need policies governing how they will evaluate and act upon environmental and other hazards that may affect the long-term value of a farm. Certain provisions and/or policies should be invoked when setting the terms and contract provisions associated with a new mortgage. Related provisions should be developed to use in the case of refinancing actions, foreclosures, and/or in the context of annual loan performance reviews. The goal should be development of credible, technically- and economically-sound, risk-based capital investment standards, which will serve Farm Credit System associations, their borrowers and investors, and the communities in which the system is active.

Public policies will affect directly the Farm Credit System's exposure to risk. For this reason the system needs to assess emerging policies in order to assure that risks generated by society at large are not disproportionately concentrated in agricultural communities. In the case of land application of sewage sludge, the System should assess, and when judged necessary, pursue the following policies:

- **Avoid high-risk scenarios** by placing a moratorium on all sludge application on dairy farms and fruit and vegetable operations until more research and analysis can be completed, and until liability and related issues can be more thoroughly addressed, or by restricting application to only those landowners and operators who agree to follow necessary conservation, nutrient balancing, and related management practices.
- **Adopt prudent regulatory standards and compliance provisions until scientific uncertainty is narrowed** (also allowing time for public confidence to grow). Support continuation of state standards more stringent than USEPA's Section 503 regulations, as well as policies requiring annual permits for all applications of sludge over five or ten tons.

Require government permitting authorities to carry out baseline monitoring prior to land application; prohibit application where problems are already apparent; monitor changes in metal levels every two years following sludge application, to assure that levels are not rising faster than expected; and take appropriate steps where they are found to be higher, or rising faster than deemed acceptable.

- **Set conditions for new loans.** *At a minimum*, add provisions to mortgages requiring lender notification prior to land application; and a baseline characterization of soil properties — pH, nutrient and heavy metal levels — to assure that the soil is not already partially contaminated; and, if certain critical levels are exceeded, either prohibiting land application or allowing it only under carefully defined circumstances.

A reasonable, readily-defended policy might state that the Farm Credit System discourages any agricultural management practice that may result in the buildup of heavy metals or other toxic contaminants beyond one-half the level currently considered acceptable by USEPA. To translate such a policy into operational practice, mortgage contracts could contain a provision requiring those wanting to land-apply sludge to produce credible evidence showing that existing, baseline soil contaminant levels are less than 50% of the maximum allowed, and that, at the proposed rate of application, if continued over the life of the loan sought, levels would not exceed the 50%-of-the-maximum-allowed goal.

- **Test for soil contaminants when contemplating foreclosure** on a property on which sludge has been applied. The lender should retain the right to secure

from an independent expert an up-to-date soil test showing key contaminant levels. This allows the lender to make an informed judgement regarding whether foreclosure or some other kind of action should proceed, or whether liability issues for soil contamination need to be resolved first.

Under a *more aggressive policy*, a lender might attach additional clauses to mortgage contract provisions, or impose a more conservative goal in terms of requiring contaminant levels to be much lower than those now judged safe by USEPA. A risk-averse association might choose limits 25%, or even 10% of the CWA 503 standards.

Additional provisions could strive to encourage prudent decision-making regarding where sludge is applied, as well as adherence to best management practices when actually testing and applying sludge. Types of actions that would minimize risks are requiring periodic sampling and reporting of contaminant levels following a few years of application; and insisting that soil testing be carried out, and sludge-management plans developed and put in place by certified, independent crop- and environmental consultants.

Other actions, which would vest the risk of contamination on those generating it, rather than allowing it to be attached, *de facto*, to the land, and to lenders, are insisting on an indemnification clause in contracts between sludge generators and landowners, protecting both the lender and farmer in the event of losses from sludge application or legal actions from aggrieved neighbors; and requiring that a sludge generator and/or applier post a bond in the name of the lender/borrower, to be held until a loan is paid off.

The purpose of the bond would be to assure that there is a source of capital that can be tapped easily in the event of a loss, even if such a loss occurs several years after the sludge is applied, and possibly years after the business responsible for generating the sludge has ceased operations. The size of the bond should be sufficient to cover any increases in annual operating expenses (maintaining pH levels, for example); and/or any loss in per-acre value as a result of restrictions that might be placed on future land use. Such loss could exceed the agricultural value of land if a parcel of farmland is condemned for development uses because of excessive contaminant levels.

A third set of provisions could alter the cost of borrowing as a function of the degree of risk a given borrower accepts as a result of carrying out certain risky practices or behaviors. Lenders may have to cover some portion of a landowner's legal fees, or assume responsibility for the costs of maintaining soil pH at required levels. In the event of a

sizeable judgement, a lender might conceivably have to cover part of the liability, or would, at a minimum, incur legal fees defending against such a motion before a court. Insurance premiums may rise over time. To cover such costs, the minimum level of equity in a property could be adjusted based on whether or not a borrower wishes to retain the option of land applying sludge in the future, or costs to borrowers wishing to land apply sludge could be made higher, perhaps by higher interest rates.

Restricting land that has received sludge to the production of cash grain crops, or other nonfood crop uses, would markedly undermine agricultural land values. Food, milk, for example, produced on sludge-amended land may be shunned by buyers or consumers as a result of concern about sludge-associated risks, even if groundless.

A number of realistic contingency plans must be developed, and funded up front, through binding legal instruments, so that they can be implemented when necessary. Examples of the kinds of scenarios such plans would cover are: a POTW or sludge-based product manufacturer ceases business or engages in fraudulent record-keeping or financial practices; a farm runs into disrepair during litigation over a will; a community-based activist group sues a plant and all landholders receiving sludge; a major contamination incident is caused by illegal dumping of toxic wastes into the waste stream.

Ideally, the cost of capitalizing these contingencies should be covered as part of the initial transaction when a farmer agrees to land-apply sludge or a sludge-based product. Clearly, such provisions and related costs will vary in accord with the quality of the sludge, or sludge-based product, and how much is applied on a given piece of land.

Assuring Technical Competence

Safe application of sludge to farmland will require a high degree of foresight and technical competence. Careful attention to detail must be maintained in running equipment and monitoring processes. Applicable rules must be adhered to; credible monitoring programs must be developed and used to assure compliance with standards. A high degree of professional ethics must pervade the process in order to win and sustain public confidence.

The Farm Credit System is not in a position to directly influence the level, quality, or nature of professional certification that might be adopted through the sewage sludge treatment and land application industries. But the lending community, as well as insurance providers, surely should continuously monitor such developments to deter-

mine how much confidence can and should be placed in the integrity of the system, since a financial institution's risk profile is a direct function of how carefully and wisely land application is carried out in practice.

Many details need to be assessed on an ongoing basis. Equipment must be routinely checked for proper calibration; laboratories doing tests need to be certified, and participate in appropriate QA/QC (quality assurance/quality control) programs whereby samples are checked by other laboratories; and new test methods and equipment should be carefully appraised and calibrated prior to widespread use.

The importance of an initial screen of soil nutrient and contaminant levels was stressed above. Such a screen should establish a set of baseline indicators, from which changes can be monitored over time. It would also provide the data needed to set agronomic rates. Similar tests should be required perhaps every two years for the first four to ten applications, to check heavy metal, pH, and soil nutrient levels. Deviation from expected and desirable levels can then be corrected before a possibly serious problem materializes. The screens should be undertaken by trained, certified and independent professionals; the cost of these screens should be covered by the sludge generator or applicator.

Trouble-shooting capacity should be built into the process in several ways. Periodic, unannounced sampling should be done of sludge, and sludge-based products at all stages in the process to assure that records match reality. In addition, regulatory agencies should require the prompt reporting of any unexpected laboratory finding — for example, a cadmium level above 80 ppm (twice EPA's allowable level) — to the permitting agency so that steps may be taken to determine to the point source of the contaminant.

Applied research and demonstration plots should be operated by universities throughout the region, to continuously test actual levels of contaminants in the environment and the performance of different sludge treatment and application methods. Such data are essential in improving the accuracy of risk assessment methods which will, in turn, narrow the range and reduce the cost of dealing with uncertainty.

Equitable Sharing of Risks

Basic fairness requires that the generator of a risk should remain responsible for liability exposure related to it. New

legal instruments and financial mechanisms will be needed to assure that landowners and lenders are held harmless in the event of lost land value, fees or fines, or legal judgments brought on account of land application of sludge.

Such instruments, as noted above, might include model insurance policy contracts and coverages, special provisions in land contracts, indemnification funds, the posting of bonds, and/or the imposition of fees on each ton of sludge land applied, to capitalize a state-run fund for needed research, monitoring system performance, and underwriting the cost of liability insurance.

Dealing with indirect threats to the financial integrity of a region's farming economy will be more difficult. Such threats could arise from the collapse of consumer confidence in food products grown or processed in a region, or in an area's safety or quality of life. The role and responsibilities of government in protecting against such problems is clear, yet government's capacity to respond if some unforeseen problem arises is uncertain, at best.

Research and public education can help limit this source of risk. It is worth keeping in mind, however, that research is also likely to sharpen society's ability to delineate acceptable from unacceptable risks. Occasionally, new information will tip the scales so that once acceptable risks become unacceptable. This will no doubt happen with some sludge contaminants and affect some land on which sludge has been applied.

As cooperatives, Farm Credit System associations have to be sensitive to costs imposed by certain borrowers or practices on the financial health of institutions within the system, as well as the system as a whole. The health of the system influences the cost of capital and level of service that can be provided to all members. Hence, the need for a policy governing land application of sludge, and related sources of environmental risks is not likely to disappear.

Certain additional investments in technical competence and knowledge will have to be made in order for the land application of sludge in the Northeast to be done safely. It is unclear who will make the initial investment and who will cover the cost of routine monitoring and oversight. A process of negotiation is needed to settle the division of costs and benefits, and to more clearly specify individual and lender rights. The role of government also needs to be much more thoroughly articulated. What could be viewed as a new social contract may evolve from this process, establishing an urban-rural partnership that strengthens all communities within the region at the expense of none.

**MARCH 30, 1993 LETTER TO MR. FRANCIS SERBENT
ADMINISTRATIVE LAW JUDGE
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
OFFICE OF HEARINGS**

*On the letterhead of Cornell University
College of Agriculture and Life Sciences
Department of Soil, Crop and Atmospheric Sciences*

Dear Mr. Serbent:

The undersigned ask that the following scientific facts, scientific judgements, and resultant implications be considered when formulating the final NYCRR Part 360, Subpart 360-4 Land Application and Other Sewage Sludge Management Facilities, and Subpart 360-5, Composting and Other Distribution and Marketing Facilities.

From the standpoint of beneficial use, State 360 regulations should not restrict use of the best ("Grade A") sludges when applied to the soils least influenced by sludges, and when growing crops least likely to be influenced by constituents in sludges, and when used by growers and land-owners who, after an informed decision-making process, have decided that application is an appropriate land management practice. Our purpose is to protect the soil resources of New York, while at the same time establishing conditions under which present-day sludges and composts can safely be added to soils.

We understand that the recently promulgated EPA 503 regulations are the result of extensive health and environmental risk analysis by respected soil and plant scientists and that these rules will be used as a basis for the new 360's. We applaud both EPA and DEC for supporting nutrient recycling by land application through the formation of regulations protective of the environment, agriculture and the consumer.

We differ with USEPA on at least two counts. The first is that the field plot data base is strongly biased towards the midwest and western soils and cropping systems. Acidic rainfall and naturally falling soil pH values in the east are not taken into account. It is gratifying that the proposed NYS Cd limit remains at 25 mg/kg [*Editor's note: Class II sludge; Class I is 10 mg/kg.*], for the above reasons. But is this low enough to protect the environment and human health when sludge applications stop and soil pH control ceases? We're not certain that it does. The problem of perpetual pH control remains with us.

Secondly, potential toxicity of organic chemicals is not

included in the regulations. Cornell toxicologists are not satisfied that this risk can be dismissed in the short term for sludge-treated soils, food crops, and grazing animals. To protect farm families, rural populations, and the consumer, we suggest that crops for direct human consumption (fresh vegetables, fruits, potatoes and wheat) not be grown on recently sludge-amended land.

Statements of Scientific and Land Management Facts

- Copper, zinc, cadmium and several other metals will remain in soils for decades; for all practical purposes any additions must be considered permanent and any restrictions these additions place on the soil are permanent, such as pH maintenance to prevent metal movement into the food chain, or leaching into water sources.
- Copper and zinc are essential for plants and animals but yields of crops are reduced by excessive additions of these metals as well as by nickel and chromium. Growth of some non-crop plants is not reduced by the same excessive (for crops) levels.
- Cadmium is a non-essential element which accumulates in the liver and kidneys from food; excessive accumulations lead to dysfunction of these organs in humans and beneficial wildlife.
- The controversy arises over what is excessive.
- The probability of adverse effects on crop growth and animal health from these elements increases as soils become coarser-textured, and the pH and organic matter decreases.
- The identity of only a very short list of the toxicants in sludge and sludge products are known. They include metals (Cd, Pb, Hg, Ni, Cr, Cu, Zn), PCB's, dioxins, nitrosamine, polycyclic aromatics, solvents, asbestos, cutting oils, flame retardants, organotins, and other halogenated industrial compounds.
- Unlike metals and asbestos, organic molecules have a finite residence time in the soil, but we don't know what it is in most cases. Their impact on crop production and consumer safety is unknown. However, empirically there

have been few reported problems from organics in field situations.

- Soil and water conservation practices and other BMP's (Best Management Practices) are required on sludge-amended cropland to prevent runoff, erosion, and surface and groundwater pollution.

Issues of Concern

- In New York we have such a small area of prime agricultural land that supports a large proportion of our viable agricultural industry, that we cannot afford to place restrictions on its use by applying sludge.

- In New York we raise a bewildering array of crops with widely different tolerance to excesses of copper and zinc (e.g. twelve varieties of snap beans often raised on acid sandy soils). *In addition, EPA's maximum metal concentrations in sludge for Zn, Cu, Cr, and Ni were set for 50% crop growth reduction in the early stages of growth. [Italics added.]* This is not a viable option for growers. We recommend limits which under certain conditions produce a maximum of 10% yield reduction. Limits would be those in NE Bulletin 851 [*Northeast Regional Research Bulletin, published by Pennsylvania State University Department of Agriculture*], i.e. 2500, 1000, 1000, and 20 mg/kg dry weight for Zn, Cu, Cr and Ni, respectively.

- In New York most edible-crop farm income is derived from milk, vegetables, fruit and wheat, all of which are directly consumed by people; we must maintain consumer confidence in these products by erring on the safe side in setting guidelines, at least for the time being.

- In the absence of a geographically large production and marketing system, much of our New York State product is consumed locally, and hence any dilution factor in processing associated with a wide commodity acquisition system may be small.

- Many soils in New York were very acid in their native state and only periodic additions of lime maintain the pH above about 5.0 to 5.2. Maintenance of soil pH is a necessary condition during the period when the land is being used for land spreading to reduce mobility of metals and therefore becomes a permanent requirement.

- The sludges will maintain the organic matter content during the period of application; this may mask the effects of excessive amounts of metals. Once applications of or-

ganic matter cease, the organic matter will decrease causing an increase in metal mobility so that crop yields and quality are reduced in the long run. This situation would be especially troublesome in the absence of long-term pH control.

- The adverse effects of cadmium on health are cumulative and hence more evident as people age. Will our understanding of what constitutes safe, lifetime cumulative loads remain the same as now? If the recommended limit is reduced at some future period then we may find many of our soils will have restricted usage because of the permanent nature of the cadmium amendments. We recommend the sludge content limit be at least as low as 25 mg/kg (dry weight).

- The control of inputs into the sewage stream must continue. Currently septage and landfill leachate are inputs which are difficult to control. On-site pretreatment by industry must continue to be required.

- One scenario under which the EPA 503 regulations would probably be acceptable with few of the above troublesome caveats is the following: application to land owned by the sewage treatment works and dedicated to growing corn for grain under best management practices. Forest and other non-cropland applications would be acceptable, assuming appropriate non-point source controls for water quality protection, and that pH control continues in some way after applications cease.

In the case of unrestricted use on agricultural land, we feel stricter, more conservative standards should apply, as outlined above for pH control and Cd levels, especially. Monitoring of the sludge product quality, tonnage delivered and applied, and soil testing must be continued and enforced vigorously.

Signed:

Dave Allee, Professor

Murray McBride, Professor

Tom Richard, Senior Extension Associate

Don Lisk, Professor

John Peverly, Professor

Dave Pimentel, Professor

Stu Klausner, Sr. Extension Associate

Kenn Cobb, Sr. Extension Associate

Doug Haith, Professor

COMMENTS BY DR. MURRAY B. MC BRIDE

*Department of Soil, Crop and Atmospheric Sciences
College of Agriculture and Life Sciences, Cornell University
A signer of the Above Letter*

During a Telephone Conversation, November 10, 1993

"Is it realistic that we could manage to utilize sludge safely? I'm kind of doubtful for the following reasons. First, cadmium levels, for example, depend on the source of the sewage. Monitoring at the treatment plant might be done a few times a year at most. Yet heavy metal levels can vary; there is some variability — sometimes extreme variability — due to spikes. So we don't know the quality of sludge being trucked, and I understand that there is no plan for monitoring at the farm location, truckload by truckload.

"Second, we can't be sure that farmers will follow best management practices. Some ignore them. When we look at the pH of New York State farm soils submitted to the Cornell University testing laboratory, we find that about one quarter are below pH 5.5 — on the other hand, if the pH gets too high, this can make some metals more soluble. In addition, I don't think that loading limits will be followed rigorously in the field, given the practical problems of spreading these materials.

[Editor's Note: In a written statement titled, Why National Regulations are not Appropriate for New York, D.R. Bouldin and W.S. Reid, of the Department of Soil, Crop and Atmospheric Sciences, Cornell University, stated, "Despite what Ryan and Chaney imply, many crops in New York do not respond to soil pH above about 5.2 (e.g. corn). On the order of 500 to 1000 pounds of limestone are required to maintain soils at about 6 and even more is required to maintain soil pH at 6.5. Farmers lime periodically, and during the intervals between lime applications the pH will drift downward toward 5.0. Thus there are large areas of crop land in New York devoted to profitable crop production with a pH less than 5.5. This means sludge applications in New York should consider the experimental data where soil pH was less than 5.5, not an average of experiments at all soils pH values.]*

"Heavy metals affect soil microbes. They modify the microbial population. Heavy metals particularly affect nitrogen-fixing microbes, preventing nitrogen fixation. The USEPA data supporting the heavy metal loading limits are not that long-term. What they are extrapolating from is usually no more than three- to five years of application, then perhaps a few years' resting period. The validity of such extrapolation is questionable. The tendency of metal availability to drop then stabilizes. The important question

is, will you be in a worse or better condition after one hundred years?

"Long-term binding for the toxic elements has not been proven. EPA assumes that soil has no role to play. Organic matter in sludge has a half-life of about ten years. Because organic matter decays away, you can't rely on it to persistently bind metals. Copper and zinc are plant-toxic at high levels and make soil less productive. Over time, heavy metals buildup may cause soil to become unproductive.

"The question to ask of the Ryan/Chaney approach is why would you condemn soil to twenty years? What do you do then? Behind the USEPA CWA 503 regulations is the sort of thinking that has gotten many businesses into trouble; in other words, thinking in terms of five- to ten- years. For heavy metals you must think in terms of several hundred years or perpetuity, if you're going to protect productivity of the land.

"It is my guess that there is little prime farmland to open up; so we cannot afford to diminish the productivity of the prime farmland that we have. If we were talking about spreading sludge out over the country, that would be one thing, but a relatively small number of farms will, likely, take most of it.

"The CWA 503 Regulations do not allow for changing agricultural land use. For example, if sludge is applied at rates not suitable to food crops, this reduces the profitability of the land. What if, in the future, a different crop becomes more profitable to the farmer? Perhaps he will do what he wants. This could bring heavy metals into the food chain.

"In any case, there are not too many agricultural uses for sludge in New York State. New York State agriculture is very different from agriculture in the Midwest, where, in some states, two crops, corn and soybeans, take up most of the acreage. These crops provide several protection barriers in terms of cadmium translocation from the root to the edible parts of the plant. It is of concern that the yearly uptake by some crops of cadmium, one of the most toxic of the heavy metals, seems to increase more or less in proportion to the cumulative loading of sludge (and cadmium) in the

soil over extended periods of annual sludge applications. The numbers EPA used for the risk assessment on which the cadmium standard is based can be questioned. It is important to note that, generally, metal uptake efficiencies of plants in eastern soils is greater than in many western soils.

"Some people like to point out that chemical fertilizers add cadmium to soil too. However, at about 100 lbs/acre/year, annual phosphate loading is small and you may have about 100 years of application to reach the same level you would get with sludge in a few years, figuring sludge-loading in tens of tons/acre/year. Nevertheless, if their cadmium levels are relatively high, phosphate fertilizers may need to be regulated in some way. Incidentally, in terms of the agronomic rate, if you apply sludge for nitrogen use, you get too much phosphorus for the crop to utilize.

"In New York State, dairy farming takes up 70-80% of the entire agricultural acreage. Farmers have more nitrogen, in the form of manure, than they can handle. A major dairy farmer has already been sued for nitrate pollution. For beneficial sludge application, you need cropland where no manure is used.

"In any case, dairy farming is the worst scenario for

sludge application. Cattle ingest soil. Rain may not wash sludge off pastures, and sometimes farmers don't observe the waiting period between sludge application and grazing. In addition, we need to know more about resistant organics that survive sewage treatment processes, like PCB's, which concentrate in body fat. Some of these chemicals are mutagenic or carcinogenic.

"Mercury volatilization is another issue. There is some research showing that it is measurable in sludge-treated soils.

"There is no doubt that the chemistry of sludge-metal-soil systems is dynamic, extremely complex and site-specific, and no one should claim to understand them to a degree sufficient to make predictions of metal availability on a time scale of decades to centuries and at a particular location. There is also no doubt that few, if any, field experiments have been conducted over the time interval necessary to resolve questions having to do with heavy metals soil loading.

"To protect our productive agricultural lands and the public health, it would be prudent at this time to consider the application of metal-contaminated sludges to farmland an undesirable practice."

*James A. Ryan, USEPA Risk Reduction Engineering Laboratory / Rufus L. Chaney, USDA Agricultural Research Service, Environmental Chemistry Laboratory in their paper, *Regulation of Municipal Sewage Sludge under the Clean Water Act Section 503: A Model for Exposure and Risk Assessment for MSW-Compost*. See *COMPOSTING FRONTIERS*, Volume I, Issue 3.

167 off from areas above and adjacent to the fill shall be di-
168 verted into properly designed and constructed stabilized
169 diversion channels which have been designed using best
170 current technology to safely pass the peak runoff from a
171 100 year, 24 hour precipitation event. The channel shall
172 be designed and constructed to ensure stability of the fill,
173 control erosion, and minimize water infiltration into the
174 fill."

175 (g) The legislative rules filed in the state register on
176 the twenty-sixth day of July, one thousand nine hundred
177 ninety-five, authorized under the authority of section four,
178 article twenty-one, chapter twenty-two of this code, modi-
179 fied by the division of environmental protection to meet
180 the objections of the legislative rule-making review com-
181 mittee and refiled in the state register on the fourteenth
182 day of December, one thousand nine hundred ninety-five,
183 relating to the division of environmental protection
184 (coalbed methane wells, 38CSR23), are authorized.

185 (h) The legislative rules filed in the state register on
186 the twenty-third day of November, one thousand nine
187 hundred ninety-four, authorized under the authority of
188 section eight, article eleven, chapter twenty of this code,
189 modified by the division of environmental protection to
190 meet the objections of the legislative rule-making review
191 committee and refiled in the state register on the twentieth
192 day of December, one thousand nine hundred ninety-five,
193 relating to the division of environmental protection (waste
194 tire management, 47CSR38G), are authorized.

195 (i) The legislative rules filed in the state register on the
196 twenty-second day of June, one thousand nine hundred
197 ninety-five, authorized under the authority of section
198 twenty, article fifteen, chapter twenty-two of this code,
199 modified by the division of environmental protection to
200 meet the objections of the legislative rule-making review
201 committee and refiled in the state register on the
202 twenty-second day of December, one thousand nine hun-
203 dred ninety-five, relating to the division of environmental
204 protection (~~sewage sludge management, 47CSR38D~~), are
205 authorized with the amendments set forth below:

206 On page seven, section 3.2.2. by striking out the words

207 "Table 3 of this rule will automatically be repealed and
208 replaced with Table 3A of this rule on December 31, 1997
209 unless this provision is modified prior to that date.";

210 And,

211 On page seven, section 3.2.2, after the word "rule." by
212 inserting the following: The director is authorized until
213 Dec. 31, 1999 to issue variances to this section to allow
214 land application to soils which exceed the maximum soil
215 concentrations of metals listed in Table 3 where soil analy-
216 ses demonstrate that other soil factors, including but not
217 limited to, soil pH, cation exchange capacity, organic mat-
218 ter content, or clay content, will limit mobility and avail-
219 ability of the metals. No later than June 30, 1999, the
220 director shall propose revisions to Table 3 to adequately
221 protect soil quality, human health and the environment'.

222 And,

223 On page 20, by striking the following from table 3:
224 "NOTE: Table 3 of this rule will automatically be re-
225 pealed and replaced with Table 3A of this rule on Decem-
226 ber 31, 1997 unless the provision of paragraph 3.2.2 of
227 this rule is modified prior to that date.",

228 And,

229 On page 21, by striking out all of Table 3A.

230 (j) The legislative rules filed in the state register on the
231 thirty-first day of July, one thousand nine hundred
232 ninety-five, authorized under the authority of section four,
233 article five, chapter twenty-two of this code, relating to the
234 division of environmental protection (to prevent and con-
235 trol of air pollution from the emission of volatile organic
236 compounds, 45CSR21), are authorized with the following
237 amendment:

238 "On pages 170 and 171, by striking out section 40 in
239 its entirety and inserting in lieu thereof a new section 40,
240 to read as follows:

**§45-21-40. Other Facilities that Emit Volatile Organic Com-
pound (VOC).**

WEST VIRGINIA
SECRETARY OF STATE
KEN HECHLER
ADMINISTRATIVE LAW DIVISION
Form #4

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DEC 22 10 13 AM '95

OFFICE OF WEST VIRGINIA
SECRETARY OF STATE

NOTICE OF RULE MODIFICATION OF A PROPOSED RULE

AGENCY: West Virginia Division of Environmental Protection, Office of Water Resources TITLE NUMBER: 47

CITE AUTHORITY § 22-15-20(b)

AMENDMENT TO AN EXISTING RULE: YES NO

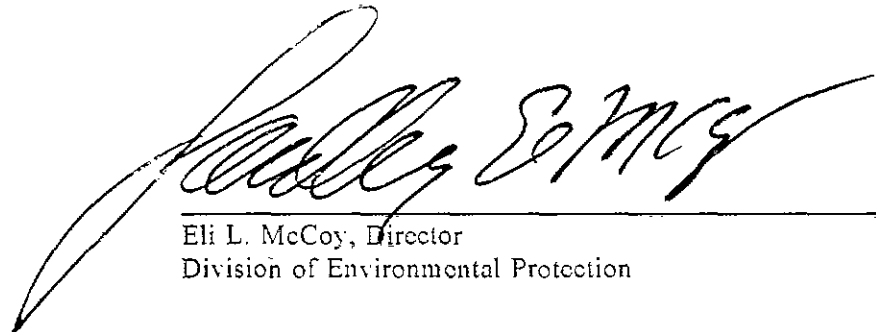
IF YES, SERIES NUMBER OF RULE BEING AMENDED: 38D

TITLE OF RULE BEING AMENDED: Sewage Sludge Management Regulations

IF NO, SERIES NUMBER OF RULE BEING PROPOSED: _____

TITLE OF RULE BEING PROPOSED: _____

THE ABOVE PROPOSED LEGISLATIVE RULE, FOLLOWING REVIEW BY THE LEGISLATIVE RULE-MAKING REVIEW COMMITTEE IS HEREBY MODIFIED AS A RESULT OF REVIEW AND COMMENT BY THE LEGISLATIVE RULE-MAKING REVIEW COMMITTEE. THE ATTACHED MODIFICATIONS ARE FILED WITH THE SECRETARY OF STATE.



Eli L. McCoy, Director
Division of Environmental Protection

6-40

FILED

TITLE 47
LEGISLATIVE RULES
DIVISION OF ENVIRONMENTAL PROTECTION

DEC 22 10 13 AM '95

OFFICE OF WEST VIRGINIA
SECRETARY OF STATE

SERIES 38D
SEWAGE SLUDGE MANAGEMENT REGULATIONS

§47-38D-1. GENERAL.

1.1. Scope and Purpose. -- This legislative rule establishes requirements for the permitting siting, bonding, installation, establishment, construction, modification, and operation of any facility that generates, processes, recycles and/or disposes of sewage sludge by whatever means, including, but not limited to, land application, composting, incineration, mixed waste composting, or any other method of handling sewage sludge within the state. This rule applies to any person who owns or operates a sewage sludge facility or who is responsible for the processing or disposal of sewage sludge.

1.2. Authority. -- W. Va. Code ~~§20-5F-2b(b)~~ §22-15-20(b)

1.3. Filing Date. -- ~~May 13, 1994.~~

1.4. Effective Date. -- ~~June 1, 1994.~~

1.5. Incorporation by Reference. -- Whenever federal or state statutes or regulations are incorporated into this rule by reference, the reference is to the statute or regulation in effect on the effective date of this rule.

§47-38D-2. DEFINITIONS.

The following definitions shall apply to this rule unless otherwise specified herein:

2.1. "Agronomic rate" means the whole sewage sludge application rate, by dry weight, designed: (1) To provide the amount of nitrogen needed by the food crop, feed crop, fiber crop, cover crop or vegetation on the land; and (2) To minimize the amount of nitrogen in sewage sludge that passes below the root zone of the crop or vegetation grown on the land to the ground water.

2.2. "Applicant" means the person applying for a commercial solid waste facility permit or similar renewal permit and any person related to such person by virtue of common ownership, common management or family relationships as the Director of the Division may specify, including the following: spouses, parents, children and siblings.

2.3. "Approved solid waste facility" means a solid waste facility or practice which has a valid permit under W. Va. Code ~~§20-5F~~ §22-15.

2.4. "Backhauling" means the practice of using the same container to transport solid waste and to transport any substance or material used as food by humans, animals raised for human consumption or reusable item which may be refilled with any substance or material used as food by humans.

2.5. "Bulking Agent" means materials such as yard waste, wood chips, leaves and other living or dead plant tissues approved by the Chief as suitable to promote the passage of air through a static pile or windrow.

2.6. "Chief" means the Chief of the Office of Waste Management of the Division.

2.7. "Commercial recycler" means any person, corporation or business entity whose operation involves the mechanical separation of materials for the purpose of reselling or recycling at least seventy percent (70%) by weight of the materials coming into the commercial recycling facility.

2.8. "Commercial solid waste facility" means any solid waste facility which accepts solid waste generated by sources other than the owner or operator of the facility and shall not include an approved solid waste facility owned and operated by a person for the sole purpose of disposing of solid wastes created by that person or such person and other persons on a cost-sharing or nonprofit basis and shall not include land upon which reused or recycled materials are legitimately applied for structural fill, road base, mine reclamation and similar applications.

2.9. "Composting" means the aerobic, thermophilic decomposition of natural constituents of solid waste to produce a stable, humus-like material.

2.10. "Composting facility" means any solid waste facility processing solid waste by composting, including sludge composting, organic waste or yard waste composting, but does not include a facility for composting solid waste that is located at the site where the waste was generated.

2.11. "Curing area" means an area where organic material that has undergone the rapid initial stage of decomposition is further stabilized into a humus-like material.

2.12. "Director" means the Director of the Division.

2.13. "Distributor" is a person who prepares the product for distribution and marketing and is responsible for distributing and marketing the product.

2.14. "Division" means the Division of Environmental Protection.

2.15. "Domestic septage" means either liquid or solid material (septage) 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.

2.16. "Energy recovery incinerator" means any solid waste facility at which solid waste is incinerated with the intention of using the resulting energy for the generation of steam, electricity or any other use not specified herein.

2.17. "Importer" means any person receiving sewage sludge from any source whatsoever for the purpose of processing .

2.18. "Incineration technologies" means any technology that uses controlled flame combustion to thermally break down solid waste, including refuse-derived fuel, to an ash residue that contains little or no combustible materials, regardless of whether the purpose is processing, disposal, electric or steam generation or any other method by which solid waste is incinerated.

2.19. "Incinerator" means an enclosed device using controlled flame combustion to thermally break down solid waste, including refuse-derived fuel, to an ash residue that contains little or no combustible materials.

2.20. "Landfill" means any solid waste facility for the disposal of solid waste on land. Such facility is situated, for purposes of W. Va. Code ~~§20-5F~~ §22-15, in the county where the majority of the spatial area of such facility is located.

2.21. "Materials recovery facility" means any solid waste facility at which source-separated materials or materials recovered through a mixed waste processing facility are manually or mechanically shredded or separated for purposes of reuse and recycling, but does not include a composting facility.

2.22. "Mixed solid waste" means solid waste from which materials sought to be reused or recycled have not been source-separated from general solid waste.

2.23. "Mixed waste processing facility" means any solid waste facility at which materials are recovered from mixed solid waste through manual or mechanical means for purposes of reuse, recycling or composting.

2.24. "Municipal solid waste incineration" means the burning of any solid waste collected by any municipal or residential solid waste disposal company.

2.25. "Open dump" means any solid waste disposal which does not have a permit under W. Va. Code ~~§20-5F~~ §22-15, or is in violation of state law, or where solid waste is disposed in

a manner that does not protect the environment.

2.26. "Person" or "persons" mean any industrial user, public or private corporation, institution, association, firm or company organized or existing under the laws of this or any other state or country; state of West Virginia; governmental agency, including federal facilities; political subdivision; county commission; municipal corporation; industry; sanitary district; public service district; drainage district; soil conservation district; watershed improvement district; partnership trust; estate; person or individual; group of persons or individuals acting individually or as a group; or any legal entity whatever.

2.27. "Producer" means any person producing sewage sludge at a publicly owned treatment works (POTW).

2.28. "Publicly owned treatment works" or "POTW" means any device or system used in the conveyance and/or treatment (including recycling and reclamation) of municipal sewage or industrial waste of a liquid nature which is owned by a state or municipality as defined by section 502 (4) of the Clean Water Act, any other treatment works treating domestic sewage (TWTDS), or wastewater treatment device or system, regardless of ownership (including federal facilities) used in the storage, treatment, recycling and reclamation of municipal or domestic sewage.

2.29. "Recycling facility" means any solid waste facility for the purpose of recycling at which neither land disposal nor biological, chemical or thermal transformation of solid waste occurs: Provided, That mixed waste recovery facilities, sludge processing facilities and composting facilities are not considered recycling facilities nor considered to be reusing or recycling solid waste within the meaning of W. Va. Code ~~§§20-9 and 11~~ §§22C-4 and 20-11.

2.30. "Representative sample" means a sample collected from a population or whole that exhibits the average or typical properties of the larger population or whole.

2.31. "Sewage sludge" means 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."

2.32. "Sewage sludge processing facility" is a solid waste facility that processes sewage sludge for land application, incineration or disposal at an approved landfill. Such processes include, but are not limited to, composting, lime stabilization, thermophilic digestion and anaerobic digestion.

2.33. "Sludge" means any solid, semisolid, residue or precipitate, separated from or created by a municipal, commercial or industrial waste treatment plant, water supply treatment plant or air pollution control facility or any other such waste having similar origin.

2.34. "Solid waste" means any garbage, paper, litter, refuse, cans, bottles, waste processed for the express purpose of incineration; sludge from a waste treatment plant, water supply treatment plant or air pollution control facility; and other discarded materials, including offensive or unsightly matter, solid, liquid, semisolid or contained liquid or gaseous material resulting from industrial, commercial, mining or community activities but does not include solid or dissolved material in sewage or solid or dissolved materials in irrigation return flows or industrial discharges which are point sources and have permits under W. Va. Code ~~§20-5A~~ §22-11-1 et seq., or source, special nuclear or by-product material as defined by the Atomic Energy Act of 1954, as amended, including any nuclear or by-product material considered by federal standards to be below regulatory concern, or a hazardous waste either identified or listed under W. Va. Code ~~§20-5E~~ §22-18-1 et seq., or refuse, slurry, overburden or other wastes or material resulting from coal-fired electric power or steam generation, the exploration, development, production, storage and recovery of coal, oil, and gas and other mineral resources placed or disposed of at a facility which is regulated under W. Va. Code ~~§§22, 22A, or 22B,~~ §22-2-1 et seq., §22-3-1 et seq., §22-4-1 et seq., §22-6-1 et seq., §22-7-1 et seq., §22-8-1 et seq., §22-9-1 et seq. or §22-10-1 et seq. so long as such placement or disposal is in conformance with a permit issued pursuant to such chapters.

2.35. "Solid waste disposal" means the practice of disposing of solid waste including placing, depositing, dumping or throwing or causing to be placed, deposited, dumped or thrown any solid waste.

2.36. "Solid waste disposal shed" means the geographical area which the solid waste management board designates and files in the state register pursuant to W. Va. Code ~~§16-26-8~~ §22C-3-9.

2.37. "Solid waste facility" means any system, facility, land contiguous land, improvements on the land, structures or other appurtenances or methods used for processing, recycling or disposing of solid waste, including landfills, transfer stations, materials recovery facilities, mixed waste processing facilities, sewage sludge processing facilities, composting facilities and other such facilities not herein specified but not including land upon which sewage sludge is applied in accordance with W. Va. Code ~~§20-5F-2b~~ §22-15-20. Such facility shall be deemed to be situated, for purposes of this rule, in the county where the majority of the spatial area of such facility is located: Provided, That a salvage yard licensed and regulated pursuant to the terms of W. Va. Code §17-23, is not a solid waste facility.

2.38. "Source separated materials" means materials separated from general solid waste at the point of origin for the purpose of reuse and recycling but does not mean sewage sludge.

2.39. "Source separated organic waste" means readily degradable organic material such as food waste, yard waste and wood waste, except pressure-treated wood waste, which is collected separately from the mixed solid waste stream. It does not include sewage sludge or domestic septage.

2.40. "Stabilization" means the decomposition of organic material to the point where it neither reheats when wetted nor gives off offensive odors and does not include pathogens, toxins or vectors in excess of Federal regulations 40 CFR 503.

§47-38D-3. STANDARDS FOR USE, DISPOSAL AND PROCESSING OF SEWAGE SLUDGE.

3.1. Incorporation of Federal Regulations. -- Federal regulations 40 CFR 503, excluding sections 503.10(b)(1) and 503.20 through 503.29 inclusive, in effect on the effective date this rule, are hereby fully incorporated and implemented as a part of these sewage sludge management regulations promulgated under the authority of W. Va. Code ~~§20-5F-2b~~ §22-15-20. Provided, That in instances where similar provisions exist, the more stringent requirements (state or federal) shall apply.

3.2. Sewage Sludge Land Application Siting Restrictions and Location Standards.

3.2.1. Sludge will not be applied to land that meets any of the following conditions:

3.2.1.a. Land that is frozen, snow-covered, or known to be flooded on a regular basis unless the applicant can demonstrate to the Director that the land application will not cause runoff into streams or wetlands.

3.2.1.b. Land within 50 feet of surface water to include streams, springs, ponds, wetlands, or other collection points for surface water.

3.2.1.c. Land within 200 feet of drinking water supply wells or other personal water supply.

3.2.1.d. Land within 200 feet of an occupied dwelling.

3.2.1.e. Land within 50 feet of a federal or state highway.

3.2.1.f. Land within 100 feet of an adjacent property owner's property line.

3.2.1.g. Land from which drainage leads into a sinkhole.

3.2.1.h. Land that has been tested and determined to have a pH of less than 6.2, unless the pH is adjusted to 6.2 or greater.

3.2.1.i. Land that has a slope greater than 15%.

3.2.1.j. Land that has a seasonal high groundwater table less than

2 feet from the surface.

3.2.1.k. Land that has less than 6 inches of soil over bedrock or an impervious pan.

3.2.1.l. Land containing soil with surface permeability of less than 0.6 inches/hour or greater than 6 inches/hour.

3.2.2. No person or entity shall be allowed to apply sewage sludge to land in a manner that will result in exceeding the maximum soil concentration for arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, and zinc as listed in Table 3 of this rule and the soil testing requirements of this rule. Table 3 of this rule will automatically be repealed and replaced with Table 3A of this rule on December 31, 1997 unless this provision is modified prior to that date.

3.2.2.a. The director shall assign an individual and lifetime loading rate for each land application site by considering background soil concentrations, and maximum allowable pollutant concentrations as per Table 1 and per Table 3 of this rule.

3.2.2.b. If circumstances at sewage sludge processing facilities result in short term excursions of Table 1 criteria, the Director may develop temporary loading rates, for a period not to exceed six months, based on the provisional limitations of Table 2 of this rule.

3.2.3. No land, except a solid waste facility, shall be allowed to accept or store so much sewage sludge as to exceed the agronomic rate or a rate of fifteen dry ton- per acre per year, whichever is less. Provided, That up to twenty-five dry tons per acre per year may be applied in the reclamation of surface mine land.

3.2.4. No person shall be allowed to store sewage sludge at a land application site for a period longer than one week; except, storage shall be allowed for no longer than three months where provisions, approved by the Chief of the Office of Water Resources of the Division, have been made to prevent leachate runoff into surface or groundwater. Septage storage shall only be allowed in-tank and for no more than three days, or as otherwise authorized by the Chief of the Office of Water Resources of the Division.

3.2.5. No person shall be allowed to land apply sludge except during the hours of daylight.

3.3. Sewage Sludge Processing Facility Operational and Design Requirements.

3.3.1. Sewage sludge processing facilities must adhere to the following requirements:

3.3.1.a. Areas used for processing, curing and storage of raw

materials, intermediate and final products, loading and unloading areas, impoundments, pipelines, ditches, pumps and drums, sumps and tanks, must be designed, constructed and operated to prevent release of contaminants to the groundwater and surface water. Storage of finished products from the facility shall be limited to one year.

3.3.1.b. The facility must be designed and operated to control vectors and odors.

3.3.1.c. The facility must not be operated or constructed within the one hundred year flood plain unless provisions have been made to prevent the encroachment of flood waters upon the facility.

3.3.1.d. All land areas within the boundaries of a sewage sludge processing facility upon which sewage sludge, intermediate or final products come in direct contact with the land surface must be protected in accordance with the Groundwater Protection Act, W. Va. Code ~~§20-5M~~ §22-12 and the rules promulgated thereunder.

3.4. Leachate Management Requirements.

3.4.1. Any liquid which comes in contact with sewage sludge at a sewage sludge processing facility must be handled as leachate and is subject to the requirements of W. Va. Code ~~§§20-5A and 5M~~ §§22-11 and 12, and the rules promulgated thereunder.

3.5. Storm Water Requirements.

3.5.1. Storm water drainage must be directed around and away from the operating area. All storm water must be collected and discharged in compliance with State Water Quality Standards and the permit issued by the Office of Water Resources of the Division.

3.6. Landfill Disposal of Sewage Sludge. -- Sewage sludge disposed at a landfill shall contain at least twenty percent (20%) solids by weight. This requirement may be met by adding or blending sand, sawdust, lime, or soil. Alternative sludge disposal methods can be utilized upon obtaining prior written approval from the Chief.

3.6.1. Sewage sludge may not represent more than twenty-five percent (25%) by weight of the total weight of waste disposed of at the landfill on any working day.

§47-38D-4. PERMITS REQUIRED.

4.1. Applicability.

4.1.1. No person may construct or operate a sewage sludge processing facility (including mixed waste composting facilities which utilize sewage sludge) or a commercial solid waste facility which processes or handles sewage sludge or materials derived from sewage sludge

without first obtaining a solid waste facility permit; Provided, That land upon which sewage sludge is applied is not a solid waste facility.

4.1.2. On and after the effective date of this rule, all permitted facilities shall submit an application to modify such permit.

4.1.3. No person may land apply sewage sludge without first obtaining a land application permit; provided, That land application permit requirements may be incorporated into a modification of a facility's WV/NPDES permit required under W. Va. Code ~~§20-5A~~ §22-11.

4.1.4. For those publicly owned treatment works (POTW's) which produce sewage sludge and are regulated by the Division pursuant to an WV/NPDES permit required under W. Va. Code ~~§20-5A~~ §22-11 a sewage sludge processing facility modification will be obtained by the applicant as a part of the existing WV/NPDES permit and shall include a sewage sludge management plan approved by the Chief of the Office of Water Resources of the Division.

4.1.5. Facilities which are surface disposal sites as defined in 40 CFR 503, Subpart C, are hereby defined as "landfills" and must meet all requirements of 47 CSR 38 applicable to landfills.

4.1.6. Permits issued under paragraph 4.1.1 of this rule, shall be subject to the provisions of 47 CSR 38, section 3 (excluding the provisions for Liner Requirements) and the closure requirements of 47 CSR 38, section 6.

4.1.7. Permits issued under paragraph 4.1.4. of this rule, shall be subject to the permit issuance procedures, procedures for permit modifications, suspension and revocation, procedures for transfer of permits, and the procedures for permit appeals of ~~46 CSR-2~~ 47 CSR 10 and are not subject to the procedures outlined in 4.1.5, 4.1.6. and 4.1.8 of this rule.

4.1.8. Permits issued under paragraph 4.1.5, of this rule, shall be subject to the procedures of 47 CSR 38 section 3 and the closure requirements of 47 CSR 38 section 6.

4.1.9 Permits issued under paragraph 4.1.3 of this rule except for land application modifications made in WV/NPDES permits under paragraph 4.1.4 of this rule shall be subject to the permit issuance procedures (subsections 3.17 through 3.29 inclusive) of 47 CSR 38 and are not subject to the procedures outlined in paragraphs 4.1.5, 4.1.6 and 4.1.8 of this rule.

4.2. General, Processing Facility, and Land Application Permit Requirements.--Persons required to obtain a permit pursuant to this rule must provide the following information, in the form and manner prescribed by the Chief of the Office of Waste Management or the Office of Water Resources of the Division as appropriate. The form may require information in addition to that required by this subsection.

4.2.1. Permit Application General Requirements. All applicants must provide the

following information:

- 4.2.1.a. The name, address, and location of the facility;
- 4.2.1.b. A description of the activities conducted or to be conducted by the applicant;
- 4.2.1.c. The operator's and owner's name, address, telephone number, ownership status, and status as a federal, state, private, public or other entity;
- 4.2.1.d. Other environmental permits issued by any local, state or federal agency;
- 4.2.1.e. A description of the specific source(s) of sewage sludge;
- 4.2.1.f. The amount of sewage sludge actually generated or imported;
- 4.2.1.g. The content of heavy metals, pathogens, toxins or vectors and moisture (percent solids) present in the sewage sludge;
- 4.2.1.h. Each location that the sewage sludge is stored, land applied or otherwise disposed of, the amount so stored, land applied or otherwise disposed of; and the capacity of that location to accept sewage sludge;
- 4.2.1.i. Information relative to the quality of the sewage sludge(s) or product(s) derived from sewage sludge as required by 40 CFR 503, and
- 4.2.1.j. A detailed design and a description of the method to collect and control leachate and surface water runoff, including the method for treatment and disposal of leachate generated.

4.2.2. Sewage Sludge Processing Facility Permit Requirements.--All applicants for permits for sewage sludge processing facilities, except facilities located at the site where sewage sludge is generated, must submit the following additional information:

4.2.2.a. An engineering report to construct must contain, at a minimum, the following:

4.2.2.a.A. A regional map, or maps, (of appropriate scale) that delineate the entire service area of the proposed facility (both existing and proposed); existing and proposed collection, processing, and disposal operations; the location of the closest population centers; and the transportation systems including highways, airports, railways and waterways;

4.2.2.a.B. A vicinity map (minimum scale of 1"=2000') that delineates the area within one mile of the facility boundaries, zoning and land use, residences, surface waters, access roads, bridges, railroads, airports, historic sites, and other existing and proposed man-made or natural features relating to the project;

4.2.2.a.C. A site plan (minimum scale of 1"=200' with five foot contour intervals) that delineates property boundaries, the location of existing and proposed soil boring, monitoring wells, buildings and appurtenances, fences, gates, roads, parking areas, drainage, culverts, storage facilities or areas, loading areas; existing and proposed elevation contours and direction of prevailing winds; and the location of residences, potable wells, surface water bodies, and drainage swales located within the site and in the site plan area; and

4.2.2.a.D. A map indicating wetlands and flood plains within 1,000 feet of the site, if any.

4.2.2.b. A description of the operation of the facility, detailed engineering plans and specifications for the entire facility, must be submitted by the applicant including at a minimum:

4.2.2.b.A. A schedule of operation, including the days and hours that the facility will be open, preparations before opening, and procedures followed after closing for the day;

4.2.2.b.B. Anticipated daily traffic flow to and from the facility, including the number of trips by private or public collection vehicles, and the quantity of material contained in each vehicle;

4.2.2.b.C. The procedure for unloading trucks (including frequency, rate, and method);

4.2.2.b.D. Special precautions or procedures for operation during wind, heavy rain, snow, and freezing conditions;

4.2.2.b.E. A description of the ultimate use for the finished compost or other product, method for removal from the site, and a plan for use or disposal of those finished products that cannot be used in the expected manner due to poor quality or change in market conditions;

4.2.2.b.F. A (description) copy of the label or other information source, by the distributor, that outlines the type of waste the compost product was derived from, a list of any restrictions on use, and recommended safe uses and application rates;

4.2.2.b.G. Identification of the personnel required to operate and maintain the facility and their job descriptions/responsibilities;

4.2.2.b.H. A detailed description of the source, and anticipated quality, and quantity of any bulking agent to be used in the process; and

4.2.2.b.I. A detailed description of the quantity, quality and specific source of the sewage sludge received or anticipated to be received.

4.2.2.c. The permit application must contain an operating engineering report which must include, at a minimum, the following:

4.2.2.c.A. Detailed engineering plans and specifications for the entire sewage sludge processing facility, including manufacturer's performance data for the selected equipment;

4.2.2.c.B. Contingency plans detailing corrective (or remedial) action to be taken in the event of equipment breakdown; air pollution (odors), unacceptable waste delivered to the facility; groundwater contamination; spills; and undesirable conditions such as fires, dust, noise, vectors, lack of a market for the compost product and unusual traffic conditions; and

4.2.2.c.C. An Operation and Maintenance manual.--The manual must contain general design information, detailed operational information and instructions. In addition, the manual must list the specific procedures used or to be used in monitoring, sampling and analyzing sewage sludge and the finished product, and record keeping requirements.

4.2.2.d. A description of the design of the facility, including:

4.2.2.d.A. The type, size, and associated detention times of equipment used in the handling, processing, and storage of sewage sludge;

4.2.2.d.B. The method of measuring, shredding, mixing, and proportioning input materials;

4.2.2.d.C. A description and sizing of the storage facilities for amendment, bulking agent, and finished product;

4.2.2.d.D. The separation, processing, storage, and ultimate disposal of materials that cannot be composted, if applicable;

4.2.2.d.E. The location of all temperature and any other type of monitoring points, and the frequency of monitoring;

4.2.2.d.F. A process flow diagram of the entire process, including all major equipment and flow streams. The flow streams must indicate the quantity of material on a wet weight, dry weight, and volumetric basis;

- 4.2.2.d.G. The aeration capacity of the system;
- 4.2.2.d.H. The method of supplying and regulating airflow;
- 4.2.2.d.I. The expected mass balance through the composting system;
- 4.2.2.d.J. A description of how the (temperature) monitoring equipment will ensure that facility qualifies as a process to further reduce pathogens, toxins, heavy metals and/or vectors; and
- 4.2.2.d.K. If applicable, a description of the air emission collection and control technologies.

4.2.3. Land Application Permit Requirement.--Persons performing land application of sewage sludge or materials derived from sewage sludge must submit the following information to the Chief of the Office of Water Resources of the Division in addition to that required under section 4.2.1. of this rule

- 4.2.3.a. Soil analysis for all land application sites including but not limited to pH, potassium, phosphorus, nitrogen, all metals listed in Table 1 of this rule and any additional chemical analysis required by the Director;
- 4.2.3.b. Information relative to the nitrogen content of the sludge(s) or product(s) derived from sewage sludge to be land applied;
- 4.2.3.c. A soils map with application sites clearly defined;
- 4.2.3.d. An agreement between the preparer of sewage sludge(s) or material(s) derived from sewage sludge, the applier, and the owner of the land application site indicating each party's concurrence with the application, and certifying that each will comply with applicable requirements of 40 CFR 503 and this rule;
- 4.2.3.e. A description of existing and future uses of the land application site;
- 4.2.3.f. Information relative to past application(s) of sewage sludge or material(s) derived from sewage sludge as necessary to comply with 40 CFR 503.12 and this rule;
- 4.2.3.g. Information relative to past fertilizer applications to the site;
- 4.2.3.h. In addition to the chemical analyses required in paragraph 4.2.1 of this rule, any additional chemical analyses of sewage sludge(s) or material(s) derived

from sewage sludge, requested by the Chief of the Office of Water Resources of the Division, including, but not limited to sodium, chloride, fluoride, calcium and sulfates;

4.2.3.i. A description of the methods to be used for land application;

4.2.3.j. A description of the methods for transportation of sludge to the site;

4.2.3.k. For sewage sludge or material derived from sewage sludge, which has been imported, a copy of the POTW's NPDES permit;

4.2.3.l. For sewage sludge or material derived from sewage sludge, which has been imported, information relative to the significant industrial users of the POTW from which the sludge or material originated;

4.2.3.m. For sewage sludge or material derived from sewage sludge, which has been imported, a description of the methods by which pathogen control and vector attraction reduction are being achieved; and

4.2.3.n. A description of the methods to be utilized to adjust and maintain the soil to a minimum pH of 6.2 for at least 5 years from the date of application.

§47-38D-5. GENERAL, PROCESSING FACILITY, AND LAND APPLICATION PERMIT REQUIREMENTS.

5.1. Permit General Requirements.--All permits issued pursuant to this rule shall contain the following:

5.1.1. Any requirement of 40 CFR 503, including but not limited to:

5.1.1.a. Limitations on the concentrations of pollutants (heavy metals), toxins, vectors and pathogens in the sewage sludge or sewage sludge products;

5.1.1.b. Requirements relative to monitoring sewage sludge and sewage sludge product quality and reporting the results of those analyses for pH, percent solids, organic nitrogen, potassium, phosphorus, calcium, magnesium, total nitrogen, ammonia nitrogen, pathogen test results, vector attraction verification; and all heavy metals listed in Table I of this rule except that the frequency of monitoring shall be as described in Appendix A of this rule ;

5.1.1.c. Requirements relative to reporting and certification;

5.1.1.d. Requirement to pay fees as identified in section 6 of this rule;

5.1.1.e. Requirements for the proper collection, control and disposal of leachate and stormwater runoff for the protection of ground and surface waters;

5.1.1.f. Requirements to retain records for the facility for a minimum of five years;

5.1.1.g. Requirements to monitor and report monthly to the Division the quantity of sewage sludge produced or imported and the specific source of the sewage sludge produced or imported;

5.1.1.h. Requirements not to exceed a commercial solid waste facility's tonnage limits, where applicable;

5.1.1.i. Requirements to provide copies of monthly reports to the county or regional solid waste authority in which the facility or land application site(s) is located;

5.1.1.j. Any other requirements, including additional monitoring, determined to be necessary by the Director to insure compliance with state and federal regulations;

5.2. Processing Facility Permit Requirements.--In addition to the requirements of subsection 5.1. of this rule, any solid waste facility permit issued to a sewage sludge processing facility, pursuant to the sewage sludge regulations, must contain the following:

5.2.1. Operational requirements relative to pathogen control in accordance with 40 CFR 503.32 and its Appendix B;

5.2.2. Operational requirements relative to vector attraction reduction in accordance with 40 CFR 503.33;

5.2.3. Requirements to routinely monitor and report information relative to the quality of raw materials used in the sewage sludge processing facility including but not limited to: sewage sludge, bulking agents, and kiln dust; except that the frequency of monitoring shall be as described in Appendix A of this rule;

5.2.4. Limitations for the pollutant concentrations of the end product of the sewage sludge processing facility;

5.2.5. Labeling requirements as per 40 CFR 503.14.e., if applicable;

5.2.6. Requirements for the implementation of practices to prevent the contamination of ground and surface waters, including liners if necessary; and

5.2.7. For commercial sewage sludge processing facilities, requirements for

reporting in accordance with subsection 4.12 of the Solid Waste Management Regulations (47 CSR.38);

5.3. Land Application Permit Requirements.--In addition to the requirements of subsection 5.1 of this rule, any land application permit issued pursuant to the sewage sludge regulations shall contain the following:

5.3.1. Requirements delineating the sites for which land application is approved;

5.3.2. Limitations on the maximum amount of sewage sludge allowed to be land applied;

5.3.3. Requirements implementing the siting restrictions and location standards of subsection 3.2 of this rule;

5.3.4. Requirements limiting the types of crops that may be grown on land used for application of sewage sludge and the time between application of sewage sludge and the harvesting of crops, in accordance with 40 CFR 503.32(b);

5.3.5. Restrictions on animal grazing and public access, in accordance with 40 CFR 503.32(b); and

5.3.6. Applicable vector attraction reduction requirements of 40 CFR 503.33; and

5.3.7. Applicable pathogen reduction requirements of 40 CFR 503.32 and its Appendix B.

§47-38D-6. FEE AND BONDING REQUIREMENTS

6.1. Applicability.--Any producer or importer of sewage sludge for land application shall be subject to non-refundable fees, as described herein, which shall be used to cover the costs of the sewage sludge management program. The fees established herein in paragraphs 6.4.1 and 6.4.2 of this rule shall be assessed on forms prescribed by the Chief of the Office of Water Resources of the Division and shall be paid to said chief quarterly.

6.2. Water Quality Management Fund. Fees collected for land application shall be deposited in the special revenue fund designated the "Water Quality Management Fund" established under the provisions of W.Va. Code ~~§ 20-5A-6a~~ §22-11-10 except as otherwise specified herein.

6.3. Bonding--The Director may require a surety bond, deposit or similar instrument in an amount sufficient to cover the cost of future environmental remediation from producers and importers of sewage.

6.4. Fee Assessments.

6.4.1. Producers and importers of sewage sludge or material derived from sewage sludge for land application shall be assessed a sewage sludge management program fee calculated as \$5.00 per actual ton of sludge times the proportion of solids in the sludge for sludge with maximum metals concentrations not exceeding those listed in Table 1 of this rule.

6.4.2. All sewage sludge placed in, or upon, or used by a solid waste facility or processed or handled, pursuant to a permit issued by the Division, shall be subject to the same tipping and other fees as levied on the disposal of solid waste under W. Va. code § ~~20~~ 22; Provided, That no such fees, excepting assessment fees required by this section, shall be levied upon the application of sewage sludge to land outside a solid waste facility in accordance with the statute and this rule.

6.4.3. Fees generated pursuant to paragraph 6.4.1 shall be reviewed periodically by the Director and shall be adjusted as necessary to assure that total collections shall not exceed \$200,000 per year.

APPENDIX A

FREQUENCY OF MONITORING

<u>AMOUNT OF SEWAGE SLUDGE RECEIVED</u> (actual dry tons per 365 day period)	<u>FREQUENCY</u> <u>OF MONITORING</u>
Greater than zero but less than 290	once every 6 months
Equal to or greater than 290 but less than 1,500	once per quarter (4 times per year)
Equal to or greater than 1,500 but less 15,000	once per month (12 times per year)
Equal to or greater than 15,000	once per week

TABLE 1
MAXIMUM CONCENTRATION OF METALS IN SEWAGE SLUDGE
FOR LAND APPLICATION

Metal	Concentration (mg/kg)
Arsenic	41
Cadmium	10
Chromium	1000
Copper	1000
Lead	250
Mercury	10
Molybdenum	18
Nickel	200
Selenium	36
Zinc	2500

TABLE 2
PROVISIONAL MAXIMUM CONCENTRATION OF METALS IN SEWAGE SLUDGE
FOR PRODUCERS NOT MEETING TABLE 1 CRITERIA

Metal	Concentration (mg/kg)
Arsenic	75
Cadmium	85
Chromium	3000
Copper	4300
Lead	840
Mercury	57
Molybdenum	75
Nickel	420
Selenium	100
Zinc	7500

TABLE 3

MAXIMUM ALLOWABLE SOIL CONCENTRATIONS

<u>Metal</u>	<u>Concentration (mg/kg)</u>
<u>Arsenic</u>	<u>18.0</u>
<u>Cadmium</u>	<u>5.0</u>
<u>Chromium</u>	<u>300.0</u>
<u>Copper</u>	<u>300.0</u>
<u>Lead</u>	<u>70.0</u>
<u>Mercury</u>	<u>2.0</u>
<u>Molybdenum</u>	<u>4.0</u>
<u>Nickel</u>	<u>74.0</u>
<u>Selenium</u>	<u>7.0</u>
<u>Zinc</u>	<u>500.0</u>

NOTE: Table 3 of this rule will automatically be repealed and replaced with Table 3A of this rule on December 31, 1997 unless the provision of paragraph 3.2.2 of this rule is modified prior to that date.

TABLE 3A

MAXIMUM ALLOWABLE SOIL CONCENTRATIONS

Metal	Concentration (mg/kg)
Arsenic	5.7
Cadmium	1.4
Chromium	140.0
Copper	140.0
Lead	35.0
Mercury	2.0
Molybdenum	2.5
Nickel	28.0
Selenium	5.0
Zinc	350.0