

EPA POLICY ON LAND TREATMENT AND THE
CLEAN WATER ACT OF 1977

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Prepared for
Environmental Research Information Center

Seminar
Land Treatment of Municipal Wastewater Effluents

June 1979

ENVIRONMENTAL RESEARCH INFORMATION CENTER
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
CINCINNATI, OHIO 45268

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The Journal of the Water Pollution Control Federation represents a major national forum for discussion of significant environmental issues. The July 1973 issue featured "land disposal" and included articles representing the entire spectrum of professional opinion on the topic. That special issue was prompted by over a year of vigorous debate following the Journal editorial of May 1972 which called for "hard technical facts about land disposal," so: "all may evaluate them in their proper perspective." Many hard technical facts about "land disposal," or more correctly land treatment, have been gathered and reported in the technical literature since then. With this new information available the Congress has completed a review and revision of the Federal Water Pollution Control Act of 1972. These revisions, enacted as the Clean Water Act (PL 95-217) in December 1977 strengthened the legislative mandate to consider land treatment as a proven and reliable alternative for management of wastewaters.

This article focuses on Environmental Protection Agency (EPA) Policy and Construction Grants Program Guidance as they relate to the Agency's issuance of the October 1977 Policy Statement on Land Treatment of Municipal Wastewaters. The history of Federal legislation will be recounted to establish a framework for the abrupt change of Federal involvement and posture as of 1972. Emphasis will be placed on the October 1977 EPA Policy Statement on Land Treatment; its relationship to the Clean Water Act; and recent Construction Grants Program guidance on land treatment.

A discussion or evaluation of the rapidly expanding base of hard facts regarding land treatment is beyond the scope of this paper. Perhaps it is time for the Water Pollution Control Federation to again feature "land treatment" with emphasis on the hard facts of performance, reliability, and recycling capabilities in relation to energy requirements and comparative health risks.

Early Federal Legislation

The precursor of all Federal legislation for water pollution control was the River and Harbors Act of 1899 which contained provisions to require permits for discharge of any refuse into navigable waters. Refuse was defined to include industrial pollutants and to cover all foreign substances and pollutants except for municipal sewage. Other Federal legislation pertaining to water pollution abatement includes the Public Health Service Act of 1912, the Oil Pollution Act of 1924, and the Water Pollution Control Act of 1948. Sullivan¹, in tracing the early origins of Federal legislation, noted that the Federal Water Pollution

Control Act of 1956 instituted a grants program containing prohibitions and omissions that were discouraging to land treatment. Land for sewage treatment including land used as a functional element in wastewater treatment was not eligible for grant assistance. Also, there was no encouragement for adoption of treatment concepts that incorporated recycling or reclamation in conjunction with waste treatment.

The Federal Water Pollution Control Act Amendments of 1972² mandated a sweeping Federal-State-local government program to reduce, prevent and eliminate water pollution. This Act contained several provisions directly encouraging land treatment. These included: (1) a mandate for the Administrator of EPA to encourage waste management alternatives that would produce revenues from recycling sewage pollutants for production of agriculture, silviculture, or aquaculture products; (2) a provision that grants made from funds authorized for any fiscal year beginning after June 30, 1974, include consideration of alternative technologies and the works proposed for grant assistance provides for best technology adaptable to recycling or elimination of pollutant discharge; and (3) definition of the land that will be an integral part of the treatment process as an allowable cost while retaining land for construction of conventional plants as a non-allowable cost. The message of the Federal Water Pollution Control Act of 1972 with respect to land treatment was straightforward. Land treatment deserved serious consideration as an alternative that combined effective waste management with recycling and reclamation in revenue producing projects. Land treatment was to be encouraged as EPA implemented the multi-billion dollar program to assist communities with 75 percent Federally funded grants to upgrade existing or construct new waste treatment facilities.

The impact of PL 92-500 on municipal use of land treatment is illustrated in Table 1. There was a dramatic increase in such systems after passage of the law as compared to the preceding four years. However, the increase from 1972 to 1976 was still only equivalent to that realized in the 1940's when there were no Federal encouragements or incentives. Apparently the engineering profession had lost sight of the advantages and benefits of land treatment that were self-evident to many in the 1940's. It was clear that further action was needed and the result has been stronger policy by EPA and additional legislation by Congress. The message that land treatment was to be encouraged is repeated very forcefully in the Clean Water Act of 1977.

The Clean Water Act of 1977

The Clean Water Act³ enacted into law on December 27, 1977, did more than carry a straightforward message that land treatment deserved serious consideration as a viable waste management alternative. This Act provides many financial incentives for innovative and alternative (I/A) approaches to waste management and specifically includes land treatment as an innovative or alternative technology. Among these

incentives for I/A projects are the following: (1) the Federal share of a construction grant may be increased from 75% to 85%; (2) a requirement to spend 2% of allocated funds on increasing the Federal share from 75% to 85% in fiscal years 1979 and 1980 (in 1981 this set-aside increases to 3%); (3) the Federal government may participate with full construction grant funding in projects which are up to 15% more costly than the most cost-effective of the conventional alternatives; and (4) projects which fail to meet design criteria may be eligible for 100% Federal grants for modification or replacement. Obviously, the future holds more promise for expanding use of land treatment for management of municipal wastewaters.

In the words of the Conference Report (House of Representatives, 95th Congress, 1st Session, Report 95-830, page 57), "The Administrator has been provided all the legislative tools needed to require the utilization of such innovative and alternative wastewater treatment processes and techniques." This statement is included in a section of the Conference Report in which the Congressional Conferees chastise wastewater treatment professionals for lack of initiative to implement the intent of the 1972 amendments to redirect waste management toward recycling, reclamation and confined disposal of wastes. The financial incentives of the 1977 Act are offered to underscore the intent of Congress to force utilization of new and better alternatives. It is sobering and thought provoking to ponder the fact that select members of Congress consider the mainstream of our profession so entrenched in a rut that they have used Federal legislation to pry us out.

EPA Policy

The initial statement of EPA policy to reinforce the encouragement of land treatment in accordance with the Federal Water Pollution Control Act Amendments of 1972 came in November 1974. The major thrust of this statement of policy on land treatment was directed to assuring that land treatment be considered as an alternative wastewater management system. The Regional Administrators of EPA were urged to: "ascertain that your regional review of applications for construction of publicly-owned treatment works requires that land application be considered as an alternative waste management system. If it can be demonstrated that land treatment is the most cost-effective alternative, is consistent with the environmental assessment, and in other aspects satisfies applicable tests, the Region should insist that land treatment be used and should refuse to fund projects using other systems of waste treatment."

The EPA Technical Bulletin "Evaluation of Land Application Systems"⁴ was listed as the key document to be used in the review process. The policy statement also called for regional seminars to demonstrate the EPA intent to emphasize consideration of land treatment, and to reacquaint the engineering profession with the technology of land treatment. An even stronger announcement of the Agency policy on encouragement of land

treatment was issued in October 1977.⁵ This policy statement spelled out three major points of emphasis on land treatment of municipal wastewater:

1. The Agency will press vigorously for implementation of land treatment alternatives to reclaim and recycle municipal wastewaters.
2. Rejection of land treatment alternatives shall be supported by a complete justification (reason for rejection shall be well documented in the facilities plan).
3. If the Agency deems the level of preapplication treatment to be unnecessarily stringent, the costs of achieving the excessive level of preapplication treatment will not be considered as eligible for EPA cost sharing when determining the total cost of a project.

The policy statement reiterated the intent of Congress that the Federal Water Pollution Control Act Amendments of 1972 should cause a major shift to recycling and reclamation technologies while stating that the EPA would press vigorously to utilize land treatment. In explaining this position the policy statement notes that land treatment is capable of achieving treatment levels comparable to the best of the advanced wastewater treatment technologies. Land treatment achieves these levels of treatment with a comparatively low energy demand because recovery and beneficial reuse of wastewater nutrients through crop production are an integral part of the process in most instances.

The policy statement also declared that EPA was adopting a requirement to provide complete justification for rejection of land treatment unless the recommended alternative encouraged water conservation, wastewater reclamation or reuse. This declaration came about because land treatment was receiving superficial assessment in development of alternatives in the facility planning process. It was clear to EPA that more encouragement was needed if land application was going to receive indepth assessment as it was compared to conventional treatment.

The third point of major emphasis addressed the level of preapplication treatment of the wastewater to be applied to the land. Public health concerns, and uncertainties from lack of experience were prompting many States to hastily adopt EPA secondary effluent criteria as the minimum level of preapplication treatment for land application. The EPA, knowing that these criteria were established for discharge to surface waters, wanted to encourage establishment of preapplication criteria on a logical evaluation of public health considerations in relation to project objectives. In order to stem the adoption of EPA secondary criteria for discharge as minimum preapplication criteria the EPA took the position

that facilities needed to provide unnecessarily stringent preapplication treatment would not be funded by EPA. The intent of this position was to encourage States to re-examine and to revise the adoption of criteria and so reduce the probability of requiring construction and operation of unnecessary or too costly facilities for preapplication treatment.

The EPA views the October 1977 policy statement as part of a continuing program to achieve the intent of the Congress as established in the Federal Water Pollution Control Act of 1972 and reaffirmed in the Clean Water Act of 1977. In essence it is part of a continuing program to reorient waste management from a program of collection and disposal to a program of collection, recycle, reclamation, and reuse.

EPA Guidance

As discussed by Hais⁶ in a recent paper on Federal guidelines, most of the EPA guidance for the use of land treatment is linked in some way to the Construction Grants Program as established by Section 201 of the Federal Water Pollution Control Act of 1972. Several provisions of Section 201 and some other parts of the Act called for EPA to establish guidance pertaining to land treatment. Section 201 grant applicants were required to evaluate best practicable alternatives that include reclaiming and recycling of water. The legislative history of the 1977 Act and the mandate that the Administrator of EPA encourage revenue producing projects involving agriculture, silviculture, or aquaculture left no doubt that land treatment should be included in the "Best Practicable Waste Treatment Technologies" described pursuant to Section 304 of the 1972 Act.

EPA guidance on land treatment is comprised of many items issued since passage of the 1972 Act. Many technical bulletins have been issued culminating in the "Process Design Manual for Land Treatment of Municipal Wastewater," which was issued concurrently with the October 1977 Policy Statement on Land Treatment. Program guidance (requirements) memoranda have been issued to cover various aspects of the purchase or lease of land. These technical bulletins and Program Requirements Memoranda pertain only to the planning, design, and construction of facilities which receive EPA Construction Grants. Even so, their impact is often comparable to that of nationwide regulations because of the magnitude of the EPA managed Construction Grants Program.

The Best Practicable Waste Treatment Technology (BPWTT) criteria published by EPA in October 1975 contain requirements which for all intents and purposes have the effect of Federal land treatment requirements. The basic thrust of these criteria is to protect groundwater for drinking water purposes.

The criteria for protection of groundwater describe three cases as follows:

CASE I: The groundwater can potentially be used for drinking water supply. In this case the groundwater resulting from the land application of wastewater, including the affected native groundwater, must meet the maximum contaminant levels for inorganic and organic chemicals specified in the National Interim Primary Drinking Water Regulations.

CASE II: The groundwater is presently being used for drinking water supply. In this case, the groundwater must meet the maximum microbiological contaminant levels specified in the National Interim Primary Drinking Water Regulations as well as the levels for chemicals specified in Case I.

CASE III: The groundwater has uses other than drinking water supply. In this case groundwater criteria are to be developed by the EPA Regional Administrator in cooperation with the appropriate State agencies based on the present or potential use of the groundwater.

Land treatment systems having a discharge to a surface water must meet the BPWTT criteria applied to any treatment and discharge system. It is important to note that, in any case, the point at which the wastewater is measured for compliance with the Federal BPWTT criteria is at the point it leaves the land treatment system (i.e., becomes part of the uncontrolled and permanent groundwater or is surface discharged). The wastewater is not required to meet BPWTT surface discharge criteria, which are the EPA secondary treatment requirements, prior to application to the land.

There have been two Program Requirements Memoranda issued to provide guidance on land treatment since the October 1977 Policy Statement by EPA and passage of the Clean Water Act. A Program Requirements Memorandum (PRM No. 78-4) issued on February 17, 1978, spelled out additional guidance on eligibility of land. A broad-based Program Requirements Memorandum (PRM 79-3) issued on November 15, 1978, provides guidance for consistent and indepth coverage of land treatment in facility planning.

Section 212 (2)(A) of the Clean Water Act had been modified to make --- "land used for the storage of treated wastewater in land treatment systems prior to land application" an eligible cost. PRM 78-4⁷ describes two approaches for providing temporary storage that may qualify the land as cost eligible. The first approach is for ponds constructed specifically to meet storage needs. Such ponds should be constructed with maximum depth appropriate for site conditions and with storage volumes commensurate with the discussion of storage in the PA Design Manual on Land Treatment of Municipal Wastewater. The second approach is for ponds which are constructed for combination treatment and storage purposes. Ponds with

a defined storage volume greater than the treatment volume qualify the total land area as eligible. Ponds with a defined storage volume less than the defined treatment volume require eligibility to be prorated as the ratio of the storage volume to the total volume.

The major points made in the EPA Policy Statement issued in October 1977 provided the central basis for the guidance spelled out in PRM 79-3⁸ issued on November 15, 1978. The memorandum expands previous guidance and stipulates what constitutes adequate coverage of land treatment in facility planning for the EPA Construction Grant Program. The PRM establishes the "Process Design Manual for Land Treatment of Municipal Wastewater"⁹ as the principal technical reference for EPA review purposes. In addition, it stipulates that the basis of design for land treatment in the Design Manual will be sideboards for evaluation of designs presented in a facility plan. It further stipulates that costs for land treatment alternatives will be reviewed in relation to the "Costs of Wastewater Treatment by Land Application".¹⁰ Using these two documents as principal resources for technical information, the PRM spells out procedures for addressing planning factors which have historically limited the use of land treatment. The factors identified are (1) overly conservative and, consequently, costly design for slow rate (irrigation) systems, (2) failure to consider rapid infiltration as a proven and reliable land treatment alternative, and (3) provision (as required) of a substantially greater and more costly level of preapplication treatment than is needed to protect public health and ensure design performance. The PRM requires that the coverage of land treatment will include assessment of a slow rate alternative and a rapid infiltration alternative while leaving coverage of overland flow optional at this time. Specific methods are presented for reviewing the procedures used for five design related factors. These factors are site selection, loading rates and land area, preapplication treatment, costs, and environmental effects.

An important point to re-emphasize is EPA's approach to the issuance of design criteria such as these. The Agency recognizes that no single value or even one set of values can be realistically applied to all locations considering the variability across the country in climate, geology, treatment needs and other factors affecting the design of land treatment systems. For this reason the EPA guidelines are varied to suit a number of possible situations and include ranges of values wherever possible. For example, the range of application rates indicated in the PRM varies from 0.6-6 M/yr for slow rate systems to 6-170 M/yr for rapid infiltration systems. Tables 2 and 3 summarize the range of criteria for these important design factors.

This concept of flexibility is particularly important with respect to EPA's position on preapplication treatment requirements. The EPA statements on preapplication treatment have apparently been misconstrued by some who have interpreted them as indicating that the Agency will not support any project which requires secondary treatment prior to application to the land. This is not the case. What the Agency is saying is that the level of

preapplication treatment must be suited to the particular situation. As previously noted, in some cases primary treated or even raw sewage may be acceptable for application to the land, while in other instances treatment beyond that provided by secondary may be necessary. Clearly an arbitrary requirement that all wastewater has to receive secondary treatment prior to land application is not consistent with the Agency's approach. The guidance on preapplication treatment included in the PRM ranges from simple screening or comminution for overland flow in isolated areas with no public access to extensive BOD and suspended solids control with disinfection for slow rate systems in public access areas such as parks and golf courses. Table 4 summarizes EPA guidance for assessing the level of preapplication treatment.

Summary

Federal legislation pertaining to wastewater treatment and the control of pollution therefrom dates back to the Rivers and Harbors Act of 1899. The Federal role in control of water pollution was relatively minor until enactment of the Federal Water Pollution Control Act of 1956. Overall, the early Federal legislation treated pollution abatement as a dominantly local problem and not of national programmatic concern. The 1956 Act signalled the beginning of a national effort which was expanded into a sweeping Federal-State-local government program by the Federal Water Pollution Control Act Amendments of 1972. The intent is to re-direct a treatment and disposal program to an effort which emphasizes recycling, reclamation, and reuse. The Clean Water Act of 1977 re-emphasizes this intent and offers many financial incentives to those who choose to implement innovative or alternative technologies.

EPA policy and guidance specific to land treatment dates from an administrative memorandum issued in November 1974. This memorandum placed EPA on record as preferring land treatment when cost-effective and environmentally acceptable. Many EPA issuances from November 1974 through September of 1977 provided additional guidance and technical information on many aspects of land treatment in relation to the EPA Construction Grants Program. Two EPA actions in October 1977 drew much attention to land treatment as an alternative wastewater management technology. The Administrator of EPA issued a policy statement promising vigorous support of land treatment and a critical assessment of reasons given for rejecting land treatment or requirement of high levels of preapplication treatment. Simultaneously the EPA, in a cooperative effort with the Corps of Engineers and the United States Department of Agriculture, released the "Process Design Manual for Land Treatment of Municipal Wastewater." The EPA has incorporated the basic thrust of the October 1977 policy statement into guidance for the Construction Grants Program. This expanded guidance on coverage of land treatment in facility planning uses the Design Manual as the principal source for technical information. When coupled with the emphasis placed on land treatment as an innovative or alternative technology in the Clean Water Act, this most recent EPA guidance on land treatment should cause major movement toward achieving the recycling, reclamation, and reuse intent of the 1972 and 1977 Acts on control of water pollution.

REFERENCES

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3. Clean Water Act of December 1977, as amended; 33 U.S.C. 466.
4. Evaluation of Land Application Systems, U.S. Environmental Protection Agency, Office of Water Program Operations, March 1975, EPA 430/9-75-001.
5. "Environmental Protection Agency Policy on Land Treatment of Municipal Wastewater," October 3, 1977.
6. Hais, Alan B., "Federal Guidelines for Use of Land Treatment of Wastewater in the United States," Statement of Knowledge in Land Treatment of Wastewater, August 1978, pp. 1-5.
7. "Grant Eligibility of Land Acquired for Storage in Land Treatment Systems," U.S. Environmental Protection Agency, Program Requirements Memorandum No. 78-4, February 1978.
8. "Revision of Agency Guidance for Evaluation of Land Treatment Alternatives Employing Surface Application," U.S. Environmental Protection Agency, Program Requirements Memorandum No. 79-3, November 1978.
9. Process Design Manual for Land Treatment of Municipal Wastewater, U.S. Environmental Protection Agency, Office of Water Program Operations, October 1977, EPA 625/1-77-008.
10. Costs of Wastewater Treatment by Land Application, U.S. Environmental Protection Agency, Office of Water Program Operations, May 1975, EPA 430/9-75-003.

TABLE 1

Municipalities in U.S. Using Land Treatment

Year	Number of Systems	Change
1940	304	
1945	422	+118
1957	461	+ 39
1962	401	- 60
1968	512	+111
1972	571	+ 59
1976	694	+123

TABLE 2

COMPARISON OF DESIGN FEATURES FOR LAND TREATMENT PROCESSES

Feature	Principal processes			Other processes	
	Slow rate	Rapid infiltration	Overland flow	Wetlands	Subsurface
Application techniques	Sprinkler or surface ^a	Usually surface	Sprinkler or surface	Sprinkler or surface	Subsurface piping
Annual application rate, ft	2 to 20	20 to 560	10 to 70	4 to 100	8 to 87
Field area required, acres ^b	56 to 560	2 to 56	16 to 110	11 to 280	13 to 140
Typical weekly application rate, in.	0.5 to 4	4 to 120	2.5 to 6 ^c 6 to 16 ^d	1 to 25	2 to 20
Minimum preapplication treatment provided in United States	Primary sedimentation ^e	Primary sedimentation	Screening and grit removal	Primary sedimentation	Primary sedimentation
Disposition of applied wastewater	Evapotranspiration and percolation	Mainly percolation	Surface runoff and evapotranspiration with some percolation	Evapotranspiration, percolation, and runoff	Percolation with some evapotranspiration
Need for vegetation	Required	Optional	Required	Required	Optional

a. Includes ridge-and-furrow and border strip.

b. Field area in acres not including buffer area, roads, or ditches for 1 Mgal/d (43.8 L/s) flow.

c. Range for application of screened wastewater.

d. Range for application of lagoon and secondary effluent.

e. Depends on the use of the effluent and the type of crop.

1 in. = 2.54 cm

1 ft = 0.305 m

1 acre = 0.405 ha

TABLE 3

COMPARISON OF SITE CHARACTERISTICS FOR LAND TREATMENT PROCESSES

Characteristics	Principal processes			Other processes	
	Slow rate	Rapid infiltration	Overland flow	Wetlands	Subsurface
Slope	Less than 20% on cultivated land; less than 40% on noncultivated land	Not critical; excessive slopes require much earthwork	Finish slopes 2 to 8%	Usually less than 5%	Not critical
Soil permeability	Moderately slow to moderately rapid	Rapid (sands, loamy sands)	Slow (clays, silts, and soils with impermeable barriers)	Slow to moderate	Slow to rapid
Depth to groundwater	2 to 3 ft (minimum)	10 ft (lesser depths are acceptable where underdrainage is provided)	Not critical	Not critical	Not critical
Climatic restrictions	Storage often needed for cold weather and precipitation	None (possibly modify operation in cold weather)	Storage often needed for cold weather	Storage may be needed for cold weather	None

1 ft = 0.305 m

TABLE 4

Guidance for Assessing Level of Preapplication Treatment

- I. Slow-rate Systems (reference sources include Water Quality Criteria 1972, EPA-R3-73-003, Water Quality Criteria EPA 1976, and various state guidelines).
 - A. Primary treatment - acceptable for isolated locations with restricted public access and when limited to crops not for direct human consumption.
 - B. Biological treatment by lagoons or inplant processes plus control of fecal coliform count to less than 1,000 MPN/100 ml acceptable for controlled agricultural irrigation except for human food crops to be eaten raw.
 - C. Biological treatment by lagoons or inplant processes with additional BOD or SS control as needed for aesthetics plus disinfection to log mean of 200/100 ml (EPA fecal coliform criteria for bathing waters) - acceptable for application in public access areas such as parks and golf courses.
- II. Rapid-infiltration Systems
 - A. Primary treatment - acceptable for isolated locations with restricted public access.
 - B. Biological treatment by lagoons or inplant processes - acceptable for urban locations with controlled public access.
- III. Overland-flow Systems
 - A. Screening or comminution - acceptable for isolated sites with no public access.
 - B. Screening or comminution plus aeration to control odors during storage or application - acceptable for urban locations with no public access.