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TREATING SLUDGE: THE CASE FOR REDUCING THE FEDERAL ROLE

INTRODUCTION

Every year, Americans generate 8.6 million dry metric tons of sludge, the solid product separated from waste water. A stringent federal regulatory structure, coupled with the Reagan Administration's "New Federalism" program, has encouraged many state and local governments to "privatize" their sludge removal process. The private sector thus is being allowed to develop innovative, profitable and environmentally clean methods of treating industrial and municipal wastewater and disposing of this previously wasted commodity.

Budget pressures have pushed cities into innovative processes and uses for sludge. Federal and state sludge treatment laws need to be reexamined from the local perspective--where they have a direct impact--rather than from a national/state macroperspective--where their impact is diluted.

Yet the treatment of wastewater and the disposal of sludge remains among the most perplexing and controversial areas of federal environmental policy. Seventy percent of the Environmental Protection Agency's (EPA) entire 1983-84 budget request consists of wastewater treatment facility construction grant monies.

Moreover, there is a confusing mix of federal laws and regulations that control sludge utilization. Amendments to the 1972 Federal Water Pollution Control Act (PL 92-500) and the 1977 Clean Water Act (PL 95-217) set out the statutory authority for municipal waste treatment plant construction grants. Clean Water Act Amendments in December 1981 did eliminate some of the cost-ineffective criteria which previously had existed and streamlined the grant process. But depending upon the medium (air, land, water) into which the sludge is disposed, there are still several other federal laws that may be applicable. Drying the sludge

through heat application and incineration into the ambient air are both controlled primarily by the Clean Air Act. Ocean dumping by barge falls under the Marine Protection, Research and Sanctuaries Act of 1972. Industrial or municipal sewage discharge directly piped into the ocean, on the other hand, is controlled by the Clean Water Act. All solid waste disposal resulting in land reclamation comes under the domain of the Resource Conservation and Recovery Act, but if toxic elements result, the Toxic Substances Control Act (TOSCA) would be triggered. Many of the means of wastewater and sludge disposal are covered by more than one environmental law, creating a confusing regulatory oversight structure.

Simplifying and streamlining national rules, and returning many statutory and environmental obligations to the states, to spur innovation and privatization, could go a long way toward decentralizing and rationalizing the national environmental oversight function. The benefits of such a policy include a quicker, cheaper and less intensive resolution of environmental problems. The case of sludge is a lesson for a reduced federal role in environmental enforcement.

THE TREATMENT OF SLUDGE

The most common form of pollution control in the United States consists of sewer systems and waste treatment plants. The basic function of a wastewater treatment plant is to speed up artificially the natural processes by which water purifies itself. There are three stages in the treatment of wastes.

In the primary stage, large floating objects, grit and gravel are removed from the sewage and deposited in a landfill. The screened grit-free sewage contains dissolved organic and inorganic matter along with suspended solids. These minute solid particles are removed in a sedimentation tank, where they sink slowly to the bottom of the tank and become raw sludge. The wastewater effluent is then piped out, treated with chlorine to kill bacteria and reduce odors and discharged into a receiving stream or river. The sludge is removed from the tank and stored for further treatment or disposal.

The secondary stage of treatment uses bacteria to remove up to 90 percent of the organic matter in the sewage. Tertiary treatment employs advanced chemical and biological processes such as nitrification, coagulation-sedimentation, absorption, electrodialysis, distillation and reverse osmosis. These processes produce a relatively pollutant-free effluent which can be recycled into the receiving stream.

Sludge Management

The sludge resulting from this treatment can be processed in several ways--including land application, landfilling, incinera-

tion, ocean disposal and "lagooning."[1] As Table I shows, since 1976 there have been significant changes in the methods of disposal.

Table I

Estimated Nationwide Wastewater Sludge Management Methods

Management Method	Percent of Total Volume	
	1976	1981
Land Application	25	42
Landfill	26	15
Incineration	35	27
Ocean Disposal	15	4
Other (lagoons, etc.)	-	12

Source: U.S. EPA, 1982.

Between 1976 and 1981, the use of land application and novel methods such as lagooning more than doubled from 25 percent to 54 percent, while the use of landfills, incineration and ocean disposal markedly decreased. This change was due in the main to the tough regulations in the Clean Air Act, the Clean Water Act, the Resource Conservation and Recovery Act and the Marine Resources, Conservation and Recovery Act.

Another factor was the growing appreciation of sludge as a valuable resource. The combination of budget pressures and strictly enforced federal and state environmental laws has led many local and state governments to experiment with innovative, private sector methods of sludge disposal. These procedures are generally inexpensive, efficient and capable of being operated locally in an environmentally safe manner. In some cases, they even are profitable.

INNOVATIVE USES OF SLUDGE

Direct Land Application

Municipal and some industrial sewage sludge are useful materials for conditioning soils, introducing essential micronutrients and trace elements to the soil, enhancing crop yield, recycling plant nutrients, increasing tillability, waterholding capacity and infiltration and reducing run-off and erosion.

Sludge is used as a soil additive or supplement, rather than a fertilizer, because its nitrogen, phosphate and potash concentrations are generally lower than levels in commercial fertilizers.

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[1] A shallow artificial pool or pond used for wastewater storage.

According to Michael H. Gerardi, Wastewater Manager, Williamsport (PA) Sanitary Authority, "...using sludge as a soil additive can produce fertilizer savings of $20-$40 per acre and, when properly applied, can improve crop yield."[2]

Though beneficial as an additive, sludge can present human, animal, soil and crop risks. If proper precautions are not exercised before application and if the soil concentrations of the components are allowed to build to significant levels, the heavy metals, pesticides, polychlorinated biphenyls (PCBs) and pathogens may accumulate to a degree which makes the soil permanently useless. The higher the mix of industrial waste to municipal waste in the sludge, the greater the chance that the sludge will have high concentrations of heavy metals and therefore be unfit for utilization near humans.

The same laws, regulations and guidelines that apply to landfilling apply to landspreading. The incidence of landfilling has decreased, though, due to possible toxic and hazardous waste seepage into groundwater supplies.

This transfer of power is the result of federal budget cutbacks that have led to lower federal matching contributions to wastewater treatment programs. State and local governments have been forced to realize that if they want to preserve programs they either must increase their own outlays or find less expensive private sector alternatives which meet legal environmental standards authorized by the federal government. The benefit of the private option is that state and local governments have the incentive to meet these goals in the most economical and appropriate way.

Some of the private methods now utilized for sludge include the reclamation of strip-mined land, composting, sod application, and agricultural fertilizers.

Strip-Mine Reclamation

One private concern, Modern Earthline Company (MEC) of Somerset, Pennsylvania, reclaims surface mined land with a product made from Philadelphia's wastewater. This program, begun in 1977, helps preserve the environment while reducing waste disposal costs. Under contract with the city, MEC transports the product from Philadelphia to Somerset, limes the site, applies the product in a layer one and one-half inches thick, then ploughs and seeds the area. The process takes about four weeks for the average site and produces a lush green ground cover within three months. Since 1980, MEC has reclaimed close to 400 hectares per year.

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2 Michael H. Gerardi, "Is Sludge Really Beneficial?" American City and County, July 1981, p. 25.

The new ground cover reduces erosion and groundwater contamination due to acid mine drainage, provides wildlife habitats, protects streams and generally improves the environment. Previously spoiled lands quickly return to production and mining companies can quickly reinvest in new mining projects.

Since strip mining may well account for approximately 70 percent of future coal production, programs such as that practiced by Philadelphia/MEC can and should be utilized by cities. It matches the need for sludge disposal with the goal of reclaiming mined land in an environmentally safe and economically productive manner.

Composting

Philadelphia has developed other innovative techniques to dispose of sludge. The city has contracted with Delchem Services, Inc., a Philadelphia-based distributor of salt and chemicals, to market and distribute composted sewage sludge. Delchem pays the city one dollar a ton for the treated material plus a small percentage of the gross annual revenue earned by the process.

Philadelphia Water Department Director Frank Senske notes that it costs the city $230 per ton to dewater, compost and dispose of sludge. He believes that "The main attraction of [the new] marketing arrangement is the savings in disposal costs of about $50 per ton." Delchem reports that the compost product can save growers 25 to 50 percent compared with commercial fertilizer mixes. If sales measure up to expectations, says a company spokesman, 40,000 tons of the compost will be sold over the next five years. This could save Philadelphia $2 million annually.

Sod Application

At the St. Charles Cemetery in Farmingdale, New York, soil for cemetery sod is manufactured on site with the help of sewage sludge. Don Brandenstein, Chief Engineer for the W.H. Greene Company., notes that "The goal of the current efforts with dewatered sludge is to come up with a system for generating one to two inches of topsoil annually with limited labor and no purchased fertilizers." Many cemeteries use cover crops, such as winter rye and sudan grass, to keep the nitrogen content of the soil high. At St. Charles, however, the crops will be sown, fertilized with sewage sludge and turned under as green manure. The topsoil produced will be harvested and used in sod renovation throughout the cemetery.

Fertilizer

Sludge also can be used for agricultural fertilizer. "The number of Ohio cities spreading part or all of their sludge on nearby farmland now exceeds 80," says Ohio State agronomist Robert H. Miller. He told participants at this year's annual meeting of the American Society of Agronomy that "30 percent of

Ohio's total municipal sludge is now going back on agricultural land."

The results of a three-year EPA-supported Ohio State University study released in March 1982 indicate that using sludge from municipal waste treatment plants rather than chemical fertilizers on certain Ohio farmlands did not cause any obvious health problems. According to Ohio State's Medical Microbiology and Immunology Department, the key to success is to treat the sludge carefully so that it will contain little in the way of noxious odors, and so that the bacterial, parasitic, and viral contents are reduced significantly compared with raw sewage.

Washington, D.C., has explored similar profitable uses for sludge composted with woodchips. Customers include greenhouse growers, landscapers, container plant growers, hospitals, universities and those needing top quality topsoil. The State of Maryland licenses dealers, who pay the state up to $3.50 per cubic yard for the compost. They sell it for $10.00 to $35.00 per cubic yard. At the current price to dealers of $3.50 per cubic yard, the state is recovering its marketing costs and part of its production costs. According to Maryland officials the economics are changing so fast that the day when sludge compost becomes a profitable commodity is not far off. The nation's capitol is proving that sludge may be both environmentally profitable and a moneymaker for cities.

Other Innovative Methods

In 1976, less than one percent of the nation's sludge was disposed of by means other than land application, ocean dumping, landfill or incineration. By 1981, this had increased to 12 percent and is still increasing. New methods include lagooning, aquaculture, the development of an asphalt substitute for construction, and other uses.

Most of the statutory oversight regulations include the current federal regulations plus somewhat more lenient and flexible state and local environmental laws. Under the Reagan Administration the federal government has encouraged, for example, private sector alternatives to previously government funded wastewater treatment services.

Lagooning

Dodge City, Kansas, is building a land application wastewater treatment facility. The water effluent will be collected at the old wastewater treatment plant and then will be pumped into a series of lagoons occupying approximately 90 acres. It will be allowed to treat itself through evaporation and bacterial processes, after which it will be distributed as irrigation water to approximately 2,200 acres of farmland. The unique feature of the operation is that farmers have agreed to return the fresh water currently used for irrigation purposes for use as city drinking water.

They have also agreed to pay the city for the effluent wastewater, since the nitrogen and phosphorous in the water are valuable fertilizers which farmers would otherwise need to purchase. Savings to the city are estimated at between $1 million and $2 million over the next twenty years, compared with a conventional secondary treatment plant.

Aquaculture

Easton, Maryland, which produces almost 1.5 million gallons of wastewater every day, has instituted one of the nation's most successful pilot sludge-aquaculture programs. In 1981, Easton began to experiment with marsh grass as a form of tertiary sludge treatment. Wastewater is held in lagoons, from which an experimental portion is pumped into a "living filter" of locally adapted grasses. Data suggest that some of the deleterous organic compounds have been taken up into the grasses in sufficient quantities to bring the water up to tertiary standard compliance. As the marsh plants mature, they are cut down and used as compost. Supervisors with the Easton Water and Sewer Service estimate that the aquaculture project will save the city close to $100,000 per year, while yielding high quality drinkable water.

Asphalt Substitute

In March, 1982, EPA announced the completion of an environmentally sound research project that found certain types of sludge constituted an acceptable substitute for asphalt. This breakthrough may herald further economies at the local level. The project developed a process to convert sludge into a substance very similar to conventional petroleum asphalt.

Building Bricks

As part of the National Science Foundation's program of developing and encouraging innovative ways to dispose of sewage sludge, Dr. James E. Alleman of the University of Maryland's Civil Engineering Department has been refining a process for making lightweight building bricks from municipal and industrial sludges. With assistance from Maryland Clay Products of Laurel, Maryland, Alleman produced 35,000 "Biobricks" containing various ratios of sludge, shale and clay. These bricks have many advantages over conventional bricks. While their compressive strength (when composed of at least 40 percent sludge) is sufficient to meet American Society for Testing and Materials (ASTM) standards for building bricks, the biobricks have better insulating qualities and a greater aesthetic value due to their rugged appearance. A plan to use 30 tons per day of Bowie, Maryland sludge in this way is now under discussion. Commercial interest in the bricks has been strong.

Fruit Irrigation

A 1982 study by Professor Fouad M. Basiount of the Tuskegee Institute in Alabama found that sewage effluent is a safe source

of irrigation water for fruit production. According to the study, the application of treated effluent to fruit trees has two beneficial effects. First, because of the mineral and organic nutrients present in the sewage effluent it is similar to a combination of irrigation and fertilization. Second, disposing of the wastewater effluent in this manner helps to restore surrounding groundwater reservoirs. The study found that "The use of treated sewage effluent for irrigating citrus trees was safe and without a corollary outbreak of disease. It stated that the use of effluent for fruit tree irrigation would produce economic savings of 25 to 30 percent, and would preserve our natural resources of fresh water."

Forests

A 1979 study conducted at the University of Washington's Pack Demonstration Forest in Seattle tested the effects of heavily treated sludge applications on two coniferous forest soils. The growth in response to the application was dramatic and economically significant. Excessive applications did, however, choke the pores in the surface soil, seriously hampering infiltration and oxygen diffusion, and the survival rate of tree seedlings planted in heavily treated soil was poor. Nevertheless, reports Dr. H. Riekerk of the University of Florida, "It appears that utilization of sewage as a forest soil amendment is quite feasible provided that some limitations are observed. Among these strictures might be the fact that forest soils are usually of low site quality, rather remote from the human food chain and often show large changes in topographic relief."

Oxyozosynthesis

In recent years, a relatively simple system of treating municipal sewage sludge has been perfected. Called Hyperbaric Oxyozosynthesis, this process takes just 90 minutes and turns primary sludge into a residue which burns as easily as wood. The amount of space needed to treat the sewage is cut by roughly 90 percent with energy usage cut by close to half. Oxyozosynthesis involves treating the raw sewage with a small amount of sulphuric acid to reduce its alkalinity, and then bubbling ozone, followed by oxygen, through the sewage. The mixture is pumped out and the substance floating on top is skimmed off and pressed into grey, cardboard-like sheets. This product is free of bacteria, odorless, practically inert, and makes an excellent landfill material. If traces of heavy metals are also removed in the pretreatment process, the final product can be safely burned as a fuel that produces virtually the same amount of heat as wood or soft coal.

THE FEDERAL ROLE

Though well-intentioned, many current federal environmental laws, including those dealing with sludge disposal, are cumbersome,

expensive and environmentally inefficient. They also present obstacles to the innovative and profitable private sector means of dealing with sludge discussed above.

If these economical alternatives are to be pursued on a large scale, the approach to environmental protection in this field must be modified. Once the government has set certain national standards for clean water or solid waste disposal, the states and cities in most cases should determine how these standards are to be applied. Other than providing national standards that are strict but sensitive to cost-benefit considerations, the federal government generally should intervene only in interstate and international pollution matters. Washington should step out of intrastate problems.

As the case of sludge illustrates, innovative and effective solutions to environmental pollution can come from the bottom up, not the top down. States are initiating local solutions to their own local problems, in part because the federal government has a long history of engaging in costly and deleterious delays in developing rules which then ignore local circumstances and opportunities. Noted journalist and futurist John Naisbit, referring to one specific case: "The Environmental Protection Agency took four years, 1976-1980, to write hazardous-waste regulations, plenty of time for organized crime to get into the illegal hazardous-waste disposal business. In the interim, New Jersey, Delaware, and Pennsylvania tightened regulations. Also, ten Eastern states sought a Law Enforcement Assistance Administration grant to share information and chase dumpers across state lines."[3]

Sludge disposal is a lesson of how the federal government need only provide basic oversight and general standards. Sludge is treatable, profitable, and capable of being disposed of in an environmentally safe fashion without federal intervention--indeed, the federal government controls seems to have impeded profitable but safe disposal of the substance.

The current environmental decentralization approach had its genesis in the Carter Administration. Critics of a decentralized environmental policy claim that without the federal government's oversight function, special interests will use their political power to make a mockery of intrastate pollution control. While there has been a long history of special interests seeking to dominate regulatory boards, the antidote to this seems to be either: a) deregulation, when competition is likely to be beneficial to the industry, such as in the case of trucking and airlines, or b) transfer of regulatory functions to lower tiers of government. In the case of wastewater, the greater the number of intrastate oversight functions returned to the states and their sub-units, the greater will be the level of statutory compliance.

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3 John Naisbit, Megatrends (New York: Warner Books, 1982), p. 106.

For years state and local politicians have been able to pass the buck back to Washington for pollution problems ranging from sewage disposal to hazardous waste treatment. They have been able to pretend to show responsibility while in fact turning a blind eye to pollution and the erosion of regulations. Once applicable regulatory responsibilities are shifted back to state and local officials, however, they will have to face up to local environmental problems. If a local government is negligent enough to permit the dumping of hazardous waste, officials should be answerable directly to those affected by the decision. When the federal government makes and enforces the rules, a small community's interest are often lost in the political processes of Washington. On the other hand, the local citizenry ought to be able to decide if they want industrial and economic growth even at the cost of some local pollution.

That every American is entitled to a basic level of environmental quality is a maxim with which there can be no argument. It is the role of the federal government to set broad standards and provide general oversight. In the specific case of sludge disposal, a number of changes should enhance the federal role. Among them:

1. While a small policy office should be retained in Washington, the EPA's sludge disposal experts should be transferred to the individual state environmental oversight agencies. Currently these experts are located in the ten regional headquarters. Their staff salaries and operating expenses should be paid by Wasington for two years. After this, each state would provide funding and would have the right to amend state mandated responsibilities. Most states seem reticent to accept oversight responsibility without having the relevant government experts resident in the state to implement it. This transfer would make clear to the states that the federal government is providing them with the expertise to undertake their new environmental oversight responsibilities. Because there would be no initial cost to the state, the state would have the time to secure its own funding. Also, the federal government would save money on travel of officials located in the states, rather than regional offices. Above all, this reform would get the expertise out in the field where it is needed.

2. The elimination of the federal sewage treatment plant construction grants program should be accelerated. These matching grants have had the effect, in most cases, of simply transferring the proper responsibility of local government to the federal Treasury. If a community wishes to accept the benefits of municipal and industrial growth, it should seek inexpensive and environmentally safe private sector means of disposing of wastewater, rather than depending on "free" federal money for standard plants. The federal government should not continue to bear the burden of poor urban planning.

CONCLUSION

As the scope of the federal government slowly shrinks, and the power and obligations of state and local government expand, these lower levels of government will acquire incentive to experiment with private sector and innovative public methods of dealing with waste products. Measures already undertaken by cities and other local governments in the case of sludge have produced a variety of innovative and environmentally safe methods by which that substance can be controlled, sanitized and disposed of in a fashion which is far more economic than the traditional methods. And yet, it still meets the standards set by federal, state and local environmental laws.

America needs innovative and environmentally safe methods of handling sludge and other waste products. First steps are being taken, but Congress and the Reagan Administration need to push ahead vigorously with the decentralization of rule-making required to foster, instead of impede, this new development. In so doing, they need look only at the innovations in sludge treatment for guidance and encouragement.

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