Metro Tests Land Disposal Of Sludge

By NEIL PETERSON

The members of this Association are involved with issues that are critically linked with the number one problem we all face today, and that's the energy situation.

From Metro's perspective, as the agency responsible for public transit and water pollution control in King County, Washington, this encompasses two areas:

First is transit. The future importance of transit, with the energy crunch we're facing, is obvious. Among our most important needs is to acquire land for new park-and-ride lots and bus bases, and to get exclusive lanes and high-occupancy vehicle lanes on our highways. As more and more people turn to public transportation, these things will become more critical.

Second is land acquisition for recycling of sewage sludge. As part of our sewage treatment process, we produce 60,000 cubic yards of sludge annually. To conserve and recover energy, as well as enhance our natural resources, we need to find ways to acquire land for disposal and recycling of sludge. And, of course, this must be compatible with other land uses.

These are two concerns that you, as right-of-way agents and land-use professionals, will be dealing with. In this article, I want to address the problem of land disposal of sludge. Sludge disposal and reuse involves energy use and recovery, land acquisition and policies, open space and environmental concerns; things that affect all of us.

First, let me give some background information. As part of Metro's responsibility for water pollution control in the region, we operate and maintain a sewage collection system and five wastewater treatment plants that serve more than 800,000 people in the King County area.

Our annual budget for operation and maintenance costs for the sewage treatment plants, which handle more than 170 million gallons of water per day, is about $7 million. More than $1 million is spent on the processing and offsite handling of sewage sludge.

What is sludge? Sludge is the by-product or residue from the sewage treatment process. When sewage is treated at one of our plants, organic material is collected from the bottom of the sedimentation tanks. This liquid material, only about three percent solid at this point, is sludge.

The sludge is then taken from the sedimentation tanks and sent through anaerobic digesters that essentially "cook" off most of the volatile or odorous portions of the material. From there the digesters produce methane gas that we use to power and heat many of our treatment plant operations. The remaining material is sent through a dewatering process that reduces the liquid content thus increasing the solids level to about 20 percent.

Sludge Disposal And Reuse

From 1966 until 1971 Metro discharged sludge in a three percent solids state from the West Point treatment plant into deep Puget Sound. But in 1971 Metro reached an agreement with the State Department of Ecology and Department of Social and Health Services to stop discharging sludge into the Sound.

Because the disposal and reuse of sludge is a national problem, Congress passed (in 1972) the Clean Water Act. It calls for the elimination of dumping sludge into navigable waters. The Environmental Protection Agency has issued draft guidelines on the land reuse of sludge that also call for the protection of public health, agricultural crops and groundwater supplies. Complying with these Federal guidelines, as you might guess, is difficult.

Metro will handle 60,000 cubic yards of digested, dewatered sludge this year. Next year it will be 75,000 cubic yards. After processing, sludge contains up to 2½ percent nitrogen and consists of mostly organic material. Since it is a potentially valuable material, it makes sense to reuse it and recycle it where possible.

Most smaller municipalities do not have the money for elaborate reuse operations. Larger agencies like Metro, which are already confronted with important concerns over land use and public health, are now having to develop sludge reuse programs that are expensive and at times controversial. Sludge reuse may require the acquisition of extensive amounts of land. And at times it means sludge will be brought closer to the population. What we have is a very tough problem.

For the last several years Metro has been conducting extensive research on different types of sludge use programs. I'd like to break these down into three basic areas: Soil rehabilitation, agricultural or fertilizer use, and energy recovery.

Soil Rehabilitation

This area seems to hold the greatest potential for success, primarily in the area of forest land rehabilitation.

In 1973, Metro and the University of Washington began work on a project at the Pack Forest Research Station near Mt. Rainier. Our original effort at this 2,000-acre site was to experiment with both a three percent solids sludge in an irrigation type experiment and a 20 percent solids sludge in a soil amendment capacity. The clear-cut sites originally chosen for sludge were of such poor soil quality that foresters had experienced a 100 percent mortality rate in their previous reseeding attempts.

Today, seven years later, we have applied 150,000 cubic yards of sludge at the Pack Forest site. We have developed techniques for tilling sludge into the soil, pumping dewatered sludge among thinned timber stands and applying it to steeper slopes than ever before. We have learned what problems arise with sludge handling and have developed some of the most comprehensive soil and groundwater monitoring systems in the country.

While we do have some problems with the sludge applications, it appears that the annual growth rate for the forest land may be increased up to 180 percent. And while

no reforestation projects have ever been as intensive as our Pack Forest work, we believe this use of sludge is feasible on a large scale basis and not just as an experiment.

At Pack Forest we found that various bacteria and chemical components such as heavy metals, which were found to be a limiting factor in agricultural experiments, were simply not a problem in forest soils or in vegetation. The only significant problem we had with offsite effects was the leaching of nitrates in groundwaters at levels equal to or exceeding drinking water standards. We also have had some unexpected effects, including rapid weed growth followed by the appearance of feeding mice, and then deer, that prefer feeding on the sludge-grown trees. But, these problems can be controlled. Today, we are continuing to develop new methods to evaluate the cost and growth benefits and to test new equipment and techniques for forest land applications of sludge. It looks promising for the future.

We have been testing other types of soil rehabilitation efforts at strip mine sites, gravel pits, clear-cut land and landfill sites.

An interesting part of this research has been the use of sludge as a soil enhancer at several parks in the area. We have successfully applied sludge at Myrtle Edwards Park, Gasworks Park, Pier 86 Park, and along Metro's Lake Sammamish pipeline right-of-way. This park enhancement program has worked very well. At these sites we have applied sludge up to 10 inches thick and mixed it with the subsoil. We were able to restore lush green grass at these sites which started out as dredged sand, industrial oil-saturated ground, or areas filled with construction debris.

While these techniques for park land and green belt development have worked well, it is difficult to return to these sites for repeated sludge applications after they are open to the public. It's a shame Metro doesn't still have rights-of-way to the old interurban bus routes in the region that extended from Everett to Tacoma up until the 1940s. We would not only solve some of our "exclusive" transit lane problems, but we could use the adjacent land for sludge developed greenbelts or small parks.

Fertilizer And Agricultural Uses

We have also studied agricultural uses and fertilizer production as part of our sludge research efforts. There have been some programs to heat-dry municipal sludge and use it as a fertilizer. Manufacturing the product, however, requires a lot of energy, even more than sludge incineration, which is highly energy-intensive. Boeing has been researching a solvent-drying method that can produce a 98-percent solid sludge for fertilizer. However, recent testing has shown the product does not add significantly to plant growth.

A more promising area of reuse appears to be composting sludge with sawdust. Three years ago Metro initiated a composting program to find out if we could produce a safe, easy-to-handle, and acceptable landscaping product for home and commercial use. So far it's been very successful. The sludge/sawdust compost, effectively disinfected, can be easily handled. A private firm, in fact, is now marketing the product in King County.

The compost material has also been used at the University of Washington's Arboretum and at the tree nursery at Pack Forest. First results from these projects are very encouraging. Future plans are to test this blend of sawdust and sludge for reseeding clear-cut lands now unable to support trees.

We don't have all the answers on this material, but we think it is good enough that we are recommending contractors use it for work at our transit park-and-ride lots. And we will be approaching other state agencies to encourage the use of this compost for other projects.

Metro has been working with Washington State University also in testing the fertilizer potential of dewatered sludge for agricultural uses. After several years of study in Puyallup, Green River, and Skagitt Valley farmlands, the program has met with limited success. There have been handling problems, especially in some softer soils, and some crop failures along with some successes. Our research seems to indicate that there are some serious handicaps to sludge use on agricultural lands, including effects of heavy metal content on some sludge-fertilized crops.

Silage corn production in Western Washington has benefitted from sludge applications. Nitrate leaching to groundwater was shown to be no greater than that from fertilizers currently used. But again heavy metal content was higher in sludge-treated corn. How the metals would move along in the food chain and affect animal tissue and milk is not known. We have found, though, that adding lime to the soil can cut down on the heavy metal uptake by the crops. We need, again, to continue our testing in this area.

Energy Recovery

Just briefly I'd like to touch on methods for energy recovery from sludge. Three are now feasible. The first is pyrolysis or the incineration of sludge; another is the use of chemicals in a solvent drying process; and a third is the production of methane gas.

The first two methods show a large amount of energy loss in the recovery process and are very costly at this time.

The third method, collecting the methane gas from the sludge, is what we are doing now at our West Point treatment plant. Methane gas from the sludge is collected when the material is biologically "cooked" in our anaerobic digesters. Today we are producing about 1 million cubic feet of methane a day to help run our plant, that's about $3,000 a day in energy value. Added advantages of this process are that it reduces the amount of solids to be handled, removes most of the noxious odors from the sludge, and makes it more attractive for land-use applications.

A Look At The Future

As I've told you, soil rehabilitation, especially forest land projects, mining sites and park land and greenbelt projects, appear to be our most promising land-use possibilities. (*Sludge is one of the most serious residual waste problems we face in the country today.*) We need to look at potential forest land and other areas for possible sludge application. The next step, of course, is to acquire these lands. Our studies have shown that for varying types of sludge uses in upcoming years, Metro will need up to 10,000 acres of land.

How will we solve sludge problems? First, sludge management is part of Met-

ro's 25-year wastewater facility planning program that will determine the nature of our future water pollution control activities in the Puget Sound region. I might add, it is one of our top priorities. Second, we are planning to obtain innovative technology grants from the Environmental Protection Agency for sludge projects.

Third, we need to be concerned about current regulations. Today sludge is classified as a solid waste material, not as a resource. The Environmental Protection Agency is now adopting sludge reuse draft regulations and we are anxiously awaiting the guidelines. We are hoping for some easing of the tight restrictions and support for sludge reuse on land. Otherwise, we are faced with incineration and some landfill alternatives that are expensive and energy wasteful and that do nothing to enhance our natural resources.

But it is understandable why EPA is taking a careful approach to the sludge issue. There are no easy answers. Most important, we must be concerned with public health. And it is a very large problem.

So I believe we need to continue our research efforts and look into acquiring land for forest rehabilitation and park and green belt projects.

What I believe this will involve for us at Metro, and you who are right-of-way and land-use professionals, will cover several areas.

We need to begin looking into acquiring lands, identifying the value of various land areas, finding out how suitable they are for sludge applications and measuring the advantages and disadvantages in particular areas.

We also can work together to achieve some joint-use programs for sludge applications. We need research to determine if sludge applications may be compatible with preserving farmland and wetlands in the country; we must also find out if sludge reuse could be valuable in open space, for preserving corridors or upgrading permanent open space lands. We need to look into the environmental affects and other long-range impacts to see if sludge is consistent with these goals. But joint-use could be something very beneficial to all of us.

There are also several things I believe we can begin doing soon:

- Acquire forest land to encourage tree growth for lumber and even biomass energy production, and to make now unusuable land available for tree growth.
- Use 3-percent solids sludge for a combined irrigator/fertilizer material.
- Develop separated buffer areas of sludge-enhanced forest and greenbelt to help control urban growth.

All of these things I've talked about are key concerns to those of us at Metro and to you who are involved daily with right-of-way issues and land management decisions. But these concerns have a very real connection to our energy problems. And energy is the most crucial matter facing all of us. It will take our cooperation in the coming months and years to find the best answers for the future.

Deadlines For Right Of Way

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