USE OF WASTEWATER SLUDGE ON HIGHWAY RIGHTS-OF-WAY: PHASE II

by

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SUMMARY

The feasibility of using wastewater sludge on highway rights-of-way as a substitute for fertilizers was evaluated using the following constraints: (1) environmental restrictions; (2) public health restrictions; (3) programs that must be implemented to meet both environmental and public health safeguards; and (4) potential cost savings to the Virginia Department of Highways and Transportation.

Environmental and public health restrictions will require strict control on the kinds of sludges, the sites that can be used and the method of application. The Virginia Department of Highways and Transportation will have to provide an active surveillance program to analyze the sludges used and the groundwater and surface runoff from the areas upon which sludge is applied. Because of the strict controls that will be required by the Virginia Department of Health, the number of sites that will be suitable for sludge application to new construction and existing rights-of-ways will be extremely limited.

The tentative requirements presently being considered by the Virginia Department of Health are so restrictive, and require such extensive monitoring, that the economic benefits to be gained are not sufficient to warrant further study by the Virginia Highway and Transportation Research Council.

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INTRODUCTION

The purpose of the work reported here was to document the expenditures for fertilizers and soil conditioners used in both construction and maintenance by the Virginia Department of Highways and Transportation, and to determine the policies and requirements of the Virginia Department of Health and the Virginia State Water Control Board regarding the land application of wastewater sludges. In addition, based on the Department's expenditures and the regulatory control agencies' requirements, an assessment was made of the feasibility of sludge use on highway rights-of-way and the need for the Research Council to develop the technology for such use.

The work was initiated as a result of rising fertilizer costs (urea aldehyde now costs $1,000 to $2,000 per ton and the Department has ceased using it) and a consideration of the potential for using as fertilizer the large amounts of wastewater sludge being produced by localities.

EXTENT OF THE CURRENT USE OF FERTILIZER AND SOIL CONDITIONERS

Maintenance

The Environmental Quality Division of the Department reported that, based on all maintenance purchase orders for 1974-1975, the total fertilizer costs for the 8 Department districts was $300,000. Because of the economic conditions in 1974-75, this value may not be typical; however, records for the past year indicate that $300,000 to $350,000 per year has been spent to purchase fertilizers.

Construction

Costs for fertilizers and soil conditioners for new construction were obtained from bid tabulations. These tabulations carry line items for seeding, fertilizer, top soil, and lime. Although sludge may be blended with a top soil, it cannot be used as a replacement for it; therefore, the cost

for top soil was not considered. (Top soil costs are approximately as follows: Class "A" — $750 per acre; Class "B" — $1,000 per acre for rural to $2,000 per acre for urban).

Table 1 gives the cost of fertilizers, applied at the site, for new construction included in bid lettings from May 1975 through September 1975. These data indicate that both primary and interstate costs were approximately $3,000 per mile. The uncertainity of the amount of new construction that will be undertaken makes it difficult to calculate an annual cost for it. It would appear that an upper cost limit of $500,000 for new construction may be as good a guess as any. This amount would be equivalent to approximately 100 miles of primary and interstate or 170 miles of secondary roads.

TABLE 1

COSTS FOR FERTILIZER ON NEW CONSTRUCTION — MATERIALS AND APPLICATION

(Based on bids let from May 1975 through September 1975)

Parameter	Primary Roads	Secondary Roads	Interstate Roads
Total fertilizer, tons	52	258	502
Miles of road	6.26	12.14	19.31
Number of interchanges	-	1	-
Total cost, roads	$17,250	$53,335	$112,635
Total cost, interchanges	-	$18,480	-
Other facilities, number	1	1	2
Total cost of other facilities	$ 600	$ 400	$ 6,903

CONTROL OF THE USE OF WASTEWATER SLUDGES BY STATE REGULATORY AGENCIES

Both the State Water Control Board and the Virginia Department of Health were contacted to determine the current and anticipated controls over the land application of wastewater sludges.

During 1975, a task group was formed to advise the Virginia Department of Health on the fundamental issues involved in deciding on whether or not to permit the use of wastewater sludge, how and when it can be used, and the health problems and environmental damage that must be considered. This task group was multidisciplinary and included representation as follows:

Extension Agent (VPI & SU)
Soil Scientists
Virginia Department of Commerce
Virginia Department of Health
Virginia State Water Control Board

The task group has drawn up tentative regulations for controlling the use of sludge, however, these are not currently available as public information. There will be a public hearing on the proposed Health Department regulations sometime this spring. According to representatives of the Health Department who are familiar with the work of the task group, the following items will be covered in the new regulations.

1. Characteristic of sludge to be used: This item will require a continuous, extensive documentation of components that make up the sludge. The sludge analyses will include tests for specific organics and inorganics, including heavy metals. The specific analyses and the frequency of the analyses will be specified. (For use on rights-of-way each load of sludge may have to be analyzed depending upon the location and drainage.) Limitations on specific parameters will likely depend upon locations and intended use.

2. Soil: A minimum soil depth of 2 feet will probably be required. (This would eliminate use of sludge on rights-of-way at a significant number of locations.) An investigation of the soil profile and drainage will be required and application will be limited to certain minimum conditions. There is a high degree of probability that land application will be limited for the most part to plowing into the soil.

3. Classification of sludges: Regulations will classify sludges according to their source and degree of treatment. The metal content as well as other components will probably be used in the classification. In no case will untreated sludge be accepted for use.

4. Knowledge of application rates: Both surface and groundwater contamination must be considered. The likelihood of anaerobic conditions and plant contamination with transmission of toxic substances — either through surface contamination or uptake by the plant — will have to be evaluated.

5. Method of application: No application will be allowed on substantial slopes. Some surface application on flat land may be allowed, but the method most likely to gain acceptance will be plowing into the soil.

6. Permits: Permits will have to be obtained for application at each site and from each source. Some program for plant growth and the water that comes into contact with the sludge will probably be required. Testing of the sludge to be applied will be required on some routine basis.

In general, the Department of Health was not receptive to the idea of using sludges on highway rights-of-way and discouraged pursuits toward the end. The main concerns seemed to be:

1. Health hazards — air, water, vegetation.

2. Limited use due to embankment slopes.

3. Land use area small — requiring significant effort to control and monitor.

4. Surface application — sufficient soil cover and ability to disc into soil.

DISCUSSION

Based on the assumption that regulations along the lines currently being considered by the Virginia Department of Health will be adopted and the data on current fertilizer use by the Department, the potential use of sludge on rights-of-way can be brought into perspective.

The questions that must be explored by the Department are those that deal with the regulatory control of sludge use and the cost effectiveness of using sludge within the regulatory framework. First, based on slope and solid depth requirements, how many areas in the Commonwealth would be available for sludge application? Second, how much would the incentive for sludge use be reduced if it could be applied only by plowing into the soil. Third, how would contract cost change if the contractor must use special equipment for sludge application to a small percentage of the project, i.e., dual equipment for same task. Fourth, how would operation and maintenance costs change in response to the special equipment needs for applying sludge; i.e., would contract application be desirable? Fifth, would a new speciality have to be developed within the Department to monitor sludge quality and discharges from approved sites? Six, aesthetically, what would be the response in populated areas to such things as odors during application or rewetting? Seven, what would be the cost of developing data for each site prior to its acceptance for use? Eight, what would be cost of sludge analyses on a routine bases? In light of the expected regulatory requirements, these questions immediately raise doubt as to the feasibility of sludge use at this time.

It is difficult to make a good assessment of the economic feasibility; however, by making some realistic assumptions, the cost savings can be put into perspective. Assume that only one-half of the highway districts may have a use for sludge due to limiting slopes and soil cover, and that in the one-half that can develop a use for the sludge it can be used on only one-half of the areas receiving fertilizer, then the projected savings for maintenance would be approximately $80,000 per year. Likewise for new construction, a 25 percent utilization would be optimistic and this savings would amount to about $125,000 per year. Therefore, it appears that a very liberal estimate of the reduced fertilizer costs as a result of sludge utilization would be $200,000 per year. These apparent savings must, of course, be compared with the cost for applying the sludge.

The costs of applying sludge involve a front end cost to gear up, a front end cost on each site to be used, and administrative, operation, and maintenance costs in the Central Office and at the district and residency levels. An estimate can be made only by using certain assumptions. Assume that the department will have only four districts that can apply sludge and that manpower requirements for the entire Department will be 2 man-years per district, i.e., a total of 8 persons for the entire Department. Assume these 8 man-years are split with 2 professionals (and/or semiprofessionals) at $16,000 per man-year, and 6 nonprofessionals at $8,000 per man-year. This puts the salary cost at $80,000 per year. (Note: The average annual salary for the Staunton District is approximately $9,000.)

If a conservative 50 percent is added to cover personnel benefits and operation and maintenance, the total operating cost estimate becomes $120,000, (this does not include the costs of site investigations prior to permit issuance, monitoring, or sludge analyses). The capital cost of the equipment for applying the sludge is estimated to be between $25,000 and $50,000 per district. Using this lower estimate and a straight-line depreciation over a period of 5 years, the minimum annual capital cost, not considering amortization, would be $20,000 annually.

Based on the foregoing broad assumptions, it would appear that after adding site investigation cost, site monitoring cost, and sludge analyses cost to the $140,000 estimated annual cost due to operation and maintenance cost and capital cost (without amortization), there would be no net savings in using wastewater sludges. It should be noted that these cost comparisons are intended only to provide a dollar framework that would appear to be realistic. For instance, it is readily apparent that if new construction is not considered, the use of sludge for maintenance of existing vegetation is totally unrealistic.

It must be concluded that at this time it would not be in the best interest of the Department to begin a project for investigating the application of wastewater sludge to rights-of-way. The anticipated acceptability by the regulatory agencies and the marginal savings, if any, indicate that the Department should hold in abeyance all development in this direction until technological developments in sludge utilization are firmly established by others and accepted by the Virginia Department of Health. The Department should take a wait and see attitude so that if wastewater sludge use becomes an acceptable practice it can evaluate how it can best use the developed technology in the framework of acceptable practices. It appears that if political subdivisions in the state move toward land application of sludge, they would have to bear both manpower and equipment costs. If application of sludge to land becomes an economic alternative for sludge disposal, then it can be expected that the economical use of sludge by the Department would require close scrutiny.

It is recommended that the Council routinely follow up land disposal of wastewater sludge technology and the acceptability of disposal techniques to the state regulatory agencies. Once land disposal practices become acceptable, the use of sludge by the Department should be reevaluated. It is not recommended that the Council pioneer efforts into the land application of wastewater sludges.