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LOW-COST WASTE-WATER TREATMENT

O U T L I N E

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I INTRODUCTION

Low-cost is a relative term, for in any activity so important to our health, welfare and economy as waste treatment, it really involves low-cost versus benefits received - any cost is not "low" unless it provides facilities that meet required water pollution standards.

With certain exceptions (such as the use of chemicals), waste treatment facilities are normally only man-made structures provided for carrying on natural biological processes. Obviously low-cost treatment must provide a substitute for these man-made structures of concrete, steel and machinery. This paper presents in outline form one approach, using what can be called a "living filter", but in reality the natural earth itself. It could be considered a modern adaptation of a principle practiced for centuries by primitive man.

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Three methods of applying wastes to this "living filter" are discussed. Spray irrigation, overland flow and rapid infiltration ponds. Lagoons are also recognized in the "low-cost" category and often used in pre-treatment for land disposal. By mutual arrangement this phase of the subject will be covered in a separate outline paper by Dr Herbert Preul in this Seminar. Therefore, it is not included in this discussion outline.

Certain discussion topics are common to all three methods. Some apply specifically to each. They have been grouped accordingly. Space permits only the inclusion of salient points.

There is increasingly more literature appearing on these subjects and some references, the bases for this discussion , are included.

II SPRAY IRRIGATION

Spray irrigation is the application of waste effluent by various spray nozzle arrangements and usually with an underdrain tile system. This permits continuous use of system.

1. Phosphorous removal 99 per cent.
2. Heavy metals removal 99 per cent.
3. Requires silt-loam 5 feet deep.
4. Best method for removal of organics 99 per cent (50 overland, 90 pond).
5. Greater possibility of wind transport of pathogens.
6. Effect on outlet watercourse.

III RAPID INFILTRATION PONDS

Waste effluents are applied to the ponds normally for ten to twelve days during which time anaerobic conditions exist. The pond area is then allowed to dry for a short drying cycle (four days, dependent on weather) for oxidation of organic matter and maintenance of rapid infiltration.

1. Phosphorous removal 90 per cent.
2. Heavy metals removal 95 per cent.
3. Application rate 330 feet per year requires sandy gravel - effective lateral distance 200 feet.
4. Most difficult of three to manage and monitor.
5. Relation to ground water recharge and quality.

IV OVERLAND RUNOFF

Overland runoff is the application of waste effluents in trenches to achieve retention and contact time with the soil. Removal of waste-water is achieved by movement of water over the soil surface and through the decaying material - as contrasted with other two methods involving organisms at and below the ground surface.

1. Lower efficiency in phosphates removal (80 per cent).
2. Heavy metals removal (10 - 30 per cent).
3. Low infiltration in clay or clay-loam less than .2 inches per day. Effective travel 150 feet, slope 2 to 6 per cent.
4. Least desirable if wastes contain chlorinated hydrocarbons, oil, etc. (decrease in soil penetration cause).
5. Greater possibility bacteria be carried to receiving waters.
6. Usually least effective method unless top soil has high porosity. Affected also by heavy rains.

V FACTORS COMMON TO ALL THREE METHODS

1. A continuous cover of vegetation necessary to prevent soil erosion and clogging of soil surface.
2. Each system has particular requirements for hydraulic conductivity of soil and chemical properties.
3. Maximum chemical renovation of waste-water is desired with minimum deleterious effect on the soils of the disposal area.
4. Removal of BOD and suspended solids of 99 per cent. Overland runoff expected to have higher total solids.
5. Nitrogen removal 80 per cent - spraying irrigation 80-90.
6. Bacterial removal 99 per cent spray and pond, 90 per cent overland.
7. Bacteria and virus removed 99 per cent spray and pond, 90 per cent overland.
8. Value of surface, aerated lagoons and settling lagoon for pre-treatment.

The foregoing is only intended as a general exposure to these methods. Much data exists regarding the details. However, much study is still needed.

This outline was intended to stimulate discussion and hopefully some pilot studies. From the variables mentioned, especially soils, it is apparent that each site requires careful study and the application of a great knowledge of soil mechanics.

No details are included regarding monetary or social costs. These again are dependent on the site.

ANNEX I

REFERENCES

1. Assessment of the Effectiveness and Effects of Land Disposal Methodologies of Waste-Water Management,
Waste-Water Management Report 72-1,
US Army Corps of Engineers, January 1972.

2. Waste-Water Management by Disposal on Land,
Spcial Report 171
US Army Corps of Engineers, May 1972.

3. Waste-Water Renovation and Conservation,
Penn. State University Study 23,
Pennsylvania State University, USA.