Potential Problems with MSW Landfill Leachate Recirculation

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Editor: The July/August issue of Solid Waste Technologies published an article by L. Miller and others (Townsend et al., 1994) on MSW landfill leachate recycle. It discussed some of the potential benefits of introducing MSW landfill leachate back into a landfill, directed toward reducing the long-term risks associated with landfills. The article focused on the results of a research project being conducted by the University of Florida and Alachua County, FL in which MSW landfill leachate is being re-introduced into a County landfill for the purpose of creating a "bioreactor" in the landfill. Claimed as benefits of that activity were increased rate of landfill gas production and reduction of the long-term problems associated with "dry tomb" landfilling.

We have been involved in the review of MSW landfill leachate recycle for the past decade (e.g., Lee et al., 1985; 1986; Lee and Jones, 1990; Lee and Jones-Lee, 1993; 1994a,b,c) and wish to provide the following summary comments regarding potential benefits, limitations, and problems with MSW landfill leachate recirculation as described in Miller's article.

Since the rate of "stabilization" of a landfill (the biochemical conversion (fermentation) of fermentable organics to produce CH_4 and $C0_2$) is dependent on the amount of moisture in the landfill, leachate recirculation in an otherwise "dry tomb" landfill can accelerate that rate. However, neither the stabilization of fermentable organics nor the process of recirculation of leachate eliminates many of the hazardous and otherwise deleterious components of the buried residues or eliminates the significant threat of leachate that will subsequently be generated, to public health, groundwater resources, and the environment. After gas production has essentially ceased in a leachate-recirculation landfill, the landfill would be considered "stabilized" and recirculation would be terminated, but the materials in the landfill would still contain hazardous and otherwise deleterious components. Subsequent introduction of water into that landfill, such as that which will be expected to eventually occur at some time in perpetuity with any Subtitle D-type "dry tomb" landfill, will leach those components; that leachate will eventually breach the liner system and be available to pollute groundwater hydraulically connected to the landfill.

The threat posed by leachate depends on the types and concentrations of hazardous and otherwise deleterious components in the leachate. The process of fermentation acts on certain "biodegradable" organics, but not on many of the "hazardous" and otherwise deleterious organic and inorganic components (e.g., salts and some heavy metals) of the buried wastes that eventually leach from the wastes and leak from the landfill. The recirculation of leachate with its myriad conventional, non-conventional, and Priority pollutants does not create a waste residue that will no longer leach hazardous and otherwise deleterious contaminants. While the percent reduction in certain components of leachate may be considerable and their concentrations noticeably lower after leachate recycle, hazardous and otherwise deleterious measured

contaminants and non-conventional pollutants in the leachate produced after the recycle period would still be sufficiently potent to adversely affect groundwater quality and public health. Without proper consideration of the limitations of leachate recirculation, the "treatment" of wastes with leachate recirculation creates a false sense of security about the future "safety" of the landfill.

Leachate recycle must be followed by sufficient clean-water washing (leaching) of the fermented residues to remove the leachable components of fermented wastes that represent long-term threats to public health and groundwater quality.

By increasing the rate of fermentation, leachate recirculation will shorten the period of time during which "landfill gas" ($C0_2$ and CH_4) is produced; the release of those landfill gases could be expected to augment the emission of other hazardous and otherwise deleterious gases that emanate from the buried MSW during the period of fermentation. However, the impact of leachate-recycle-enhanced fermentation on the rate of release from the landfill of hazardous and otherwise deleterious gases that are not a product of fermentation has not been well-investigated.

The MSW should be shredded prior to placement in the landfill. Shredding of the waste will allow better contact of the recirculated leachate with organic wastes that were discarded to the MSW landfill in plastic bags. Without proper shredding, the presence of such bags will greatly prolong the time that landfill gas formation can and will occur in a leachate-recirculation landfill.

As typically practiced today in either unlined or composite-lined landfills of the Subtitle D type (including the Alachua County Landfill), leachate recirculation significantly enhances the threat of groundwater pollution by landfill leachate because of the increased hydraulic loading (introduction of liquid) to the landfill. This problem is being recognized in landfills at which recirculation has been practiced and has resulted in the termination of the procedure at some. Neither existing landfills, nor the Subtitle D-type "dry tomb" landfills were in general designed to accommodate the additional hydraulic loading from leachate recycle.

We recommend against the practice of leachate recirculation in Subtitle D landfills that only have a single-composite liner and that rely on groundwater monitoring at the point of compliance for detection of landfill liner leakage. This is because of the significant leachate-containment limitations of such a system that will increase the potential for groundwater pollution, and because of the significant inadequacies of the monitoring systems commonly incorporated into Subtitle D-type single-composite-lined landfills for detection of leakage and groundwater pollution.

We recommend that MSW landfill leachate recirculation be practiced only: in landfills that include a double-composite liner in which the lower composite liner is used as a full-landfill-area pan lysimeter leak detection system for the upper composite liner, and in which the MSW has been shredded, and if followed by clean-water washing of the fermented MSW residues to leach the wastes.

Additional information on this topic is available from the authors.

References

Lee, G. F., and Jones, R. A., "Managed Fermentation and Leaching: An Alternative to MSW Landfills," BioCycle 31(5) :78-80,83 (1990).

Lee, G. F., and Jones-Lee, A., "Landfills and Groundwater Pollution Issues: 'Dry Tomb' vs F/L Wet-Cell Landfills, " IN: Proceedings of IAWQ Sardinia '93 IV International Landfill Symposium, Sardinia, Italy, pp.1787-1796, October (1993).

Lee, G. F., and Jones-Lee, A., "Impact of Municipal and Industrial Non-Hazardous Waste Landfills on Public Health and the Environment: An Overview," Report of G. Fred Lee & Associates, El Macero, CA, prepared for California Environmental Protection Agency's Comparative Risk Project, May (1994).

Lee, G. F., and Jones-Lee, A., "MSW Landfill Leachate Recycle and Groundwater Quality Protection," Submitted to Journal Waste Management & Research, June (1994).

Lee, G. F., and Jones-Lee, A., "Advantages and Limitations of Leachate Recycle in MSW Landfills," Accepted for publication in a condensed form in World Waste, July (1994).

Lee, G. F., Jones, R. A., and Ray, C., "Review of the Efficacy of Sanitary Landfill Leachate Recycle as a Means of Leachate Treatment and Landfill Stabilization," Report to the US Army Construction Engineering Research Laboratory, Champaign, IL, November (1985).

Lee, G. F., Jones R. A., and Ray, C., "Sanitary Landfill Leachate Recycle," BioCycle 27:36-38 (1986).

Townsend, T., Miller, L., Bishop, R., and Carter, J., "Combining Systems for Leachate Recirculation and Landfill Gas Collection," Solid Waste Technologies 8(4)18-24 (1994).