

# **Microbial and Biochemical Characteristics of Freshly Landfilled Waste: Comparisons to Landfilled Wastes of Different Ages**

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## **Abstract**

A cooperative research and development agreement was initiated between U.S. EPA and Waste Management Inc. for a multi-year study of landfill bioreactors at the Outer Loop Landfill in Louisville, KY. As part of the agreement a research project is underway to study the microbiology of waste landfilled for different lengths of time. The objective of the study is to survey microbial and chemical parameters of solid waste before and after conversion to the bioreactor process. The microbiology of municipal solid waste (MSW) of approximately 1 and 3-5 years of age were studied and discussed (Kavanaugh et. al. results to be published). Core samples of the solid waste from surface to approximately 70-80 ft were used in the study.

Two bioreactor processes are being tested for the treatment of MSW at the Outer Loop Landfill. Cells 5 north and south are retrofitted to perform as a facultative landfill bioreactor (FLB). The conversion involves treatment of the leachate ammonia to nitrate and recirculation of the nitrified leachate. Cells 7.4 A and B will be filled and operated as an aerobic-anaerobic landfill bioreactor (AALB). The AALB involves landfilling waste in shallow lifts to promote homogenization of the waste. Provisions for injecting air and extraction of gases will also be made. In addition liquids will be added for increasing moisture content. Solid waste samples landfilled for less than two weeks from the AALB (cells 7.4 A and B) were analyzed for microbial and chemical parameters. Solid waste and biosolids landfilled together were also analyzed. The samples were obtained from 0-3 ft depth. Five representative functional groups of microorganisms: aerobes, anaerobes, denitrifiers, sulfate reducers and methane producers were enumerated. Enumerations were performed using liquid extracts of solid waste. Volatile fatty acid concentrations (VFA) in extracts were also analyzed. The counts of different functional groups from freshly landfilled solid waste samples give an evaluation of the microbial inoculums going into the landfill and show the changes taking place microbially and biochemically shortly after emplacement under the AALB study.

Characteristics of the waste landfilled, changes shortly after landfilling, and the influence of jointly landfilling waste and biosolids will be the focus of the presentation. The changes in waste shortly after landfilling will be compared with changes seen from other disposed waste. The results from the analyses of the samples landfilled for less than two weeks show that production of volatile fatty acids occurs soon after landfilling. Significant amounts of organic acids are produced. The methanogenic

population/activity is influenced by the concentrations of the fatty acids produced during the early decomposition. Counts of aerobes and anaerobes are similar for most of the samples indicating possible facultative nature of the waste even early in the decomposition process. The similarity of the aerobe and anaerobe counts together with the high concentrations of VFAs indicates that fermentation of the freshly landfilled waste occurs within two weeks after being landfilled. This is probably due to high concentrations of readily decomposable material in fresh waste. Appreciable numbers of bacteria capable of denitrification were also recovered. A discussion of the results obtained from this study including influence of biosolids will be presented.

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