EVALUATION OF LONG TERM LEACHATE MONITORING DATA FROM CLOSED LANDFILLS

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Introduction

Waste Management is studying the affects of leachate quality with different aspects of MSW landfills including time, age of waste, type of cap, liner, climate, design and operational practices. This is a multi-year study and this paper will evaluate the initial results at a few landfills. USEPA in their 10 year review of Subtitle D regulations is investigating if the 30 years of post-closure care is a sufficient time frame for site monitoring. This study hopes to gain additional information to assess if this time frame is adequate and if another performance based criteria based on risks is the proper way to evaluate closed landfills. In review of the historical leachate data closed sites, it was discovered that one of the landfills appears to behave as an "accidental" flushing bioreactor and that the leachate data at other closed landfills appears to have similar trends in organic degradations indicators. Gas data also are reviewed where available.

The "Accidental Bioreactor"

The site is located in the northeast part of the US and was operational from the mid'70's stopped taking waste in 1991 and finalized cap construction in 1993 with a 4 foot thick clay cap with grass vegetation cover. The site has a natural clay liner and constructed as a valley fill. Groundwater inflow into the base of waste from an unconfined aquifer resulted in the installation of a slurry wall and collection drain just downgradient adjacent to the limits of fill. The leachate (groundwater that flowed through the landfill) appears to have similar characteristics to bioreactor landfills described in the literature and waste samples were taken for analyses of degradation and also for geotechnical stability measurements. The leachate quality meets groundwater quality standards (MCLs) for all appendix II compounds analyzed and has very few hazardous constituents detected from the long list of analytes.

Phases of Leachate Degradation

Leachate quality data is evaluated using historical graphs of key indicator parameters (BOD, COD, NH3, pH, and hazardous constituents (heavy metals and VOCs) from the past 8-15 years. The data are reviewed to determine if the stages of waste degradation fit the model presented by Pohland and Harper(1986) showing the five phases of

degradation : initial adjustment, transition, acid formation, methane formation, and final maturation. At some sites, leachate from individual sumps is analyzed where the age of waste is known. These data are graphed to represent "historical" data and graphed from newest to oldest parts of the landfill. Leachate in sites that experienced high infiltration rates appears to have enhanced treatment or biodegradation of the leachate as well as early depletion of methane production. There appears to be a correlation in the downward trend in organic indicators and the downward trend in the hazardous constituents. When the indicators reached "stability" (i.e., an asymptote or BOD/COD ratio of 0.1) there was similar "stability" in the hazardous constituents that declined to levels at or below MCLs for the most recent 10 years of records. These data are similar to sites that recirculate leachate as seen in the presentation by Dr. Jeremy Morris discussing the results of historical (1983-present) leachate monitoring data from one of Delaware Solid Waste Authority's landfills.

Gas Data and Waste Analyses

Gas production peaked after closure and declined to very low levels. The gas was extracted with an active system and was used to convert energy with 2 reciprocating engines. Nine years after the completion of the landfill cap, gas production declined to a level that no longer supported energy recovery and recently was below a level to support a flare. The gas probe data showed no migration and the site was allowed by the local State authority to turn off the active gas collection system and go to passive venting. Waste samples were taken and the analyses shows significant degradation at depths of 20 –30 feet below the top of waste in very low organic matter and very low BMP.

Conclusions

This study supports the previous lab and pilot scale work of the last 30 years that show the in-situ treatment capabilities that MSW landfills can provide for sustained leachate quality enhancement. Although not enough leachate has infiltrated into the landfill to reach field capacity, as in the lab and pilot scale work, it appeared adequate in degrading the lower portion of the landfill. The bottom of the landfill appears to be serving as a "trickling filter" that treats new leachate added by continued recirculation at the upper part of the cell. This was observed by Ham (1982) and cited in Reinhart and Townsend (1997) and Barlaz (2002). This aspect of the study will be discussed further in the presentation.

References

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