CHAPTER 1

INTRODUCTION

The disposal of solid waste has always consisted of two options, burning and burying. Presently, landfilling is the dominant means of disposing of solid waste. It offers the lowest cost and most easily managed and sited alternative for almost all communities in the United States. Approximately 61 percent of the municipal solid waste generated in the United States in 1995 was placed in municipal solid waste landfills (Franklin Associates, 1996). While recycling will play an increasingly important role in solid waste management, projections indicate that landfilling will account for a significant portion of municipal solid waste disposal long into the future.

Waste degradation is accomplished through a complex sequence of biologically, chemically, and physically mediated events. Gaseous and liquid emissions are the products of these reactions. Micro-organisms, acidogens and methanogens, produce methane, carbon-dioxide, hydrogen gas and other trace gases as they degrade the organic fraction of the waste mass. Volatile materials in the waste mass are transported out of the landfill with this evolving gas stream. Liquid emissions (leachate) are produced as water trickles through the waste mass dissolving soluble components, hydrolyzed materials, and degradation products from the refuse. The long-term potential for production of contaminated gas and leachate from a landfill has resulted in the proposal of federal landfill regulations calling for monitoring of groundwater and landfill gas for 30 years (USEPA, 1988b).

Bioenhanced operation of municipal solid waste (MSW) landfills can accelerate the stabilization of the organic fraction of the waste. Such enhancement promotes biogas energy production while reducing the potential for long-term adverse environmental impacts. Bioenhancement techniques have been investigated at the laboratory scale for many years and have only recently been attempted at full-scale operations. Bioenhancement primarily involves moisture control using leachate recirculation through the landfill, but also may include nutrient and buffer addition, aerobic decomposition within the landfill for temperature control, and MSW composition control. Because leachate recirculation has been found to be the most practical approach to moisture content control, full-scale bioenhancement efforts tend to focus on this technique.

Full-scale site studies of leachate recirculation have identified the following research needs:

- landfill subsidence mitigation,
- long-term performance of landfill bioreactors,
- effect of metals in recirculated leachate on landfill operation, and
- hydrodynamics of leachate routing through the landfill (Reinhart, 1992).

Also, when leachate recirculation devices are designed or operated incorrectly the landfill can develop many hydraulic problems including the propagation of large heads on the liner and the breakout of leachate from the landfill containment system. An understanding of system design requirements will help to minimize problems and promote the successful use of leachate recirculation.

Therefore, the objectives of this research project were to evaluate the effect of leachate recirculation on the moisture saturation levels of the waste in the landfill and determine the steady state area of influence of the horizontal infiltration trench and vertical infiltration well recirculation methodologies. The effects of the hydraulic conductivity of the waste and daily cover, waste heterogeneities and the recirculation rate on moisture routing were assessed.