

Methane Recovery

Methane is produced in a landfill when anaerobic methane-producing bacteria are active. This condition may be reached in 6 months to 5 years depending on the landfill. Acidic conditions inhibit growth of methane-producing bacteria; alkaline conditions have the opposite effect. Methane production is quite variable depending on the amount and type of decomposable material in the landfill, moisture content, temperature, and resulting rate of microbial decomposition under anaerobic conditions. One estimate is a maximum gas production of 0.18 l/kg per day, or 5.4 l/kg dry weight per day; the effective life of a landfill for gas extraction at a rate of 20 ml/kg dry weight per day is approximately 17 years.⁴¹ In another study, a rate of gas generation (CO₂ and CH₄) of 3.1 to 37 l/kg per year during the more active period of methane production, on the order of 10 years, was considered reasonable. This involved municipal refuse as received, with methane production at about 55 percent of the total gas.⁴²

Methane is odorless, has a heat value of about 500 Btu/ft³ compared to 1000 Btu for commercial gas, has a specific gravity less than air, and is nearly insoluble in water. The gases from landfills, after anaerobic conditions have been established, are quite variable, ranging from 50 to 60 percent methane and 40 to 50 percent carbon dioxide. Included are small amounts of nitrogen, oxygen, water, mercaptans (very odorous), and hydrocarbons. Hydrogen sulfide may also be released if large amounts of sulfates are in the landfill. Vinyl chloride, benzene, and other toxics in trace amounts may also be produced by the action of bacteria on chlorinated solvents deposited in the fill. The presence of oxygen and nitrogen with methane gas would indicate the entrance of air into the landfill.⁴³ This may be due to the rate at which methane is being withdrawn which, if not controlled to reduce or eliminate the entrance of oxygen and nitrogen, would slow down or stop methane production. In the early stages the landfill gases are primarily carbon dioxide with some methane. The carbon dioxide is heavier than air and can dissolve in water to form carbonic acid, which is corrosive to minerals with which it comes into contact. Mercaptans, carbon dioxide, and water are usually extracted to upgrade the methane to "pipeline quality." Removal of carbon dioxide may improve Btu content to 900 or 1000 Btu/ft³.⁴⁴ Methane as it comes from a landfill is often very corrosive. Deep landfills, 30 ft or deeper, and 30 acres or more in area with a good cover are better methane producers. The life of such a landfill in California is estimated at 12 to 20 years.⁴⁵ Actually, gas will be generated as long as biodegradable material remains and is primarily dependent on precipitation, infiltration, and moisture content. Gas can be extracted using plastic tube wells in each cell with perforations or well screens toward the bottom connected to a controlled vacuum pump,^{46, 47} or a series of covered horizontal gravel trenches connected to a pipe collection system.⁴³ See Figures 5-8 and 5-9. The gas may be used for heating and generating electricity.