

Addressing High Gas Pressure Near the Bottom of Landfills

Ali Khatami, Ph.D., P.E., SCS Engineers

Subtitle D requirements for municipal solid waste (MSW) landfills have been around for more than three decades, and many MSW landfills currently have bottom lining systems that meet the federal and local state rules and regulations. With the bottom lining system geomembrane comes a drainage layer placed directly above the geomembrane to laterally convey leachate reaching the geomembrane to a collection point. The past few decades of advancements in developing new drainage media have led to the use of geocomposites as the primary drainage layer above the bottom lining system geomembrane. However, one needs to be watchful for the free flow of leachate through the thin layer of geocomposite under high gas pressures near the bottom lining system.

Those involved in landfill gas modeling and maintenance of gas collection systems are well aware that gas generation begins relatively quickly after disposal of MSW in landfills, and the gas generation rate is a function of time, with increasing trends over time to a peak and then decreasing from there on. The general perception of landfill professionals is that gas pressures near the bottom of landfill lining system are not a concern, especially after installing gas wells and applying vacuum to the system. However, observations and measurements of gas pressures near the bottom lining system have indicated that landfill professionals should be conscious about landfill gas pressures near the bottom lining system and its impact on the flow of leachate through the geocomposite

drainage layer at the bottom of the landfill.

Take, for example when a new cell is placed in service, and 50 feet of waste is deposited in the new cell. Gas pressure near the bottom lining system can increase to such high levels that when removing the blind flange on the leachate collection pipe cleanout, leachate will eject out of the cleanout riser with significant speed and for a long distance. This situation is indicative of high landfill gas pressures developing near the bottom lining system, extending into the voids of the drainage layer geocomposite where leachate is designed to flow

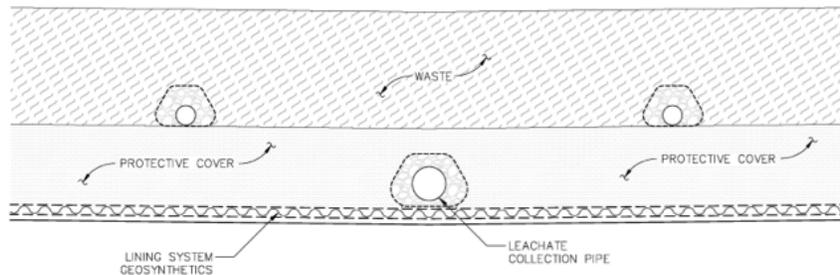


Figure 1 - Pressure relief system near the bottom lining system.

through under gravity freely. The impact of high gas pressures on the free flow of leachate through geocomposite drainage layer will need to be investigated and addressed by solid waste engineers to understand the phenomenon better and devise a means to address the issue.

Short of investigations and clear guidelines for addressing high gas pressure near the bottom lining system, landfill operators can use a gas pressure relief system near the bottom in future new disposal cells. The pressure relief system can simply include a few perforated high density polyethylene pipes laid in parallel directly above the soil layer placed above the bottom lining system drainage layer, as shown in the Figure 1 schematic. The perforated pipes may be embedded in gravel and wrapped in geotextile to prevent intrusion of fine

particles into the pipe.

The pipes are extended to outer limits of the cell and to the top of the perimeter berm where they connect to a vacuum source. These pipes will successfully remove excess gas pressures that may develop near the bottom lining system and prevent adverse impacts of the high pressures on the free flow of leachate through the bottom lining system drainage layer. Constructing this type of gas pressure relief system is typically inexpensive. Landfill operators might consider the benefit of such systems versus their costs and the negative impact that drainage layers might experience in the absence of this design.

The solid waste engineer preparing construction plans of new disposal cells should include in the design the number of perforated

pipes, the spacing of the pipes, and the gravel/geotextile embedment. Installation of the gas pressure relief system is carried out by the cell contractor following completion of the soil layer above the bottom lining system geocomposite drainage layer. Connecting the pipes to a vacuum source is usually the responsibility of the landfill operator, and takes place sometime after placing the cell in service with a specific amount of waste in the cell. The determining factor for the timing of connecting the vacuum source to the system depends on the amount of gas pressure detected in the pipes at the landfill perimeter berm.

Ali Khatami, Ph.D., P.E., is Vice President of SCS Engineers. He may be reached at akhatami@scsengineers.com.