Missouri Department of Natural Resources

Design and Construction of Landfill Gas Monitoring Wells

Solid Waste Management Program fact sheet 1/2007

Overview

This document was prepared by the Missouri Department of Natural Resources' Solid Waste Management Program (SWMP) to provide guidance for the proper design and construction of gas monitoring wells to comply with the quarterly monitoring required by 10 CSR 80-3.010(14) and 10 CSR 80-4.010(14).

Well Designs

Proper design and construction of gas monitoring wells is critical in obtaining true soil gas concentrations. All wells should be designed to minimize air intrusion into the system so accurate soil gas samples can be collected. All monitoring wells that are deeper than 10 feet are regulated by the department's Division of Geology and Land Survey (DGLS) and must be installed by a certified well driller. For further information on this subject, call (573) 368-2100.

SWMP recommends the following well designs:

- Code Well - This design meets current well drilling codes required by 10 CSR 23-4. Refer to figure 1, which illustrates major components.

- Micro Well - This design is not permitted under current well drilling codes but permission to install this type of well can be obtained through the department's Division of Geology and Land Survey. Refer to figure 2, which illustrates major components.

- Spike Probe - This is not actually a monitoring well by definition since its use is confined to a maximum of 10 feet below ground surface. For this reason no variance is required from DGLS. Refer to figure 3, which illustrates major components.

Well Selection and Location

The location of gas monitoring wells should be based on a characterization of geologic and hydrologic conditions at the landfill site and on the adjacent land uses, which must be approved by the Solid Waste Management Program.

This technical bulletin discusses factors that should be considered before selecting a certain type of well for installation.

For landfills applying for a disposal area permit, and existing landfills with gas migration problems, in-ground monitoring for gas migration must be performed using gas monitoring wells. Spike probes may be used where shallow groundwater, approximately 10 feet or less below the surface, prevents construction of a drilled well. The SWMP does not consider bar punch testing for shallow soil migration to be an effective monitoring method for other than instantaneous monitoring to evaluate the extent of shallow lateral gas migration.

Subsurface monitoring for methane should be conducted around the perimeter of the disposal area. The point of compliance for regulatory limits of methane migration is at the landfill property boundary. However, at sites where the edge of the fill area is far from the property boundary, additional gas monitoring locations may be chosen to provide early detection so that corrective action can be taken to prevent gas migration from the landfill property.

Monitoring wells should be located along the property boundary in areas where gas migration is most likely to occur or to become a threat to the public or the environment. These wells should be located in critical areas such as between the landfill and adjacent buildings, groves of trees and sand or gravel bedded utility lines. Wells should be screened across geologic features that would be likely to transmit gas (sand seams, fracture zones, karst features, mine shafts, etc.). Monitoring locations should be spaced 100 to 500 feet apart, with the spacing dependent on the permeability of the ground (the more permeable, the closer the spacing) and on the number of nearby features that could be potentially damaged. Gas monitoring wells should not be placed directly opposite gas extraction wells on the fill area; monitoring wells may give a falsely low reading if they are in the zone of influence of the extraction well. Monitoring may not be necessary for areas where the potential for gas migration is low. For example, a stream or a valley may form a natural cutoff to prevent the flow of gas through the ground.

Monitoring wells should be designed to monitor unsaturated soil and rock down to an elevation equal to the bottom elevation of the landfill. Wells can be designed with a single riser perforated from just below the well seal to the bottom of the well, or can consist of a well cluster with each riser monitoring a different depth. Well clusters are valuable for detecting gas migration through separate distinct permeable zones.

Gas monitoring wells must be designed to prevent intrusion of atmospheric air into the wells at all times; the cap should have a valved sampling port for the direct attachment of the gas sampling instrument, so that samples may be drawn directly from the well.

Conclusions

All wells should be designed to minimize air intrusion into the system, which can dilute the sample, making it unrepresentative. Selection of well designs should be based upon what zones are to be monitored. Code and Micro wells work best for monitoring screened intervals more than 10 feet below the ground surface. Spike Probe wells work best in monitoring zones that are 10 feet or less below the ground surface.

References

Farquhar, Grahame, *Monitoring and Controlling Methane Gas Migration*, course notes presented at April 1993 Sanitary Landfill Design and Management training, offered by the University of Wisconsin, Madison, College of Engineering.

Missouri Department of Natural Resources, Flood Grant Team, *An Analysis of Landfill Gas Monitoring Well Design and Construction*.

For more information

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Figure 1

Typical Code Well

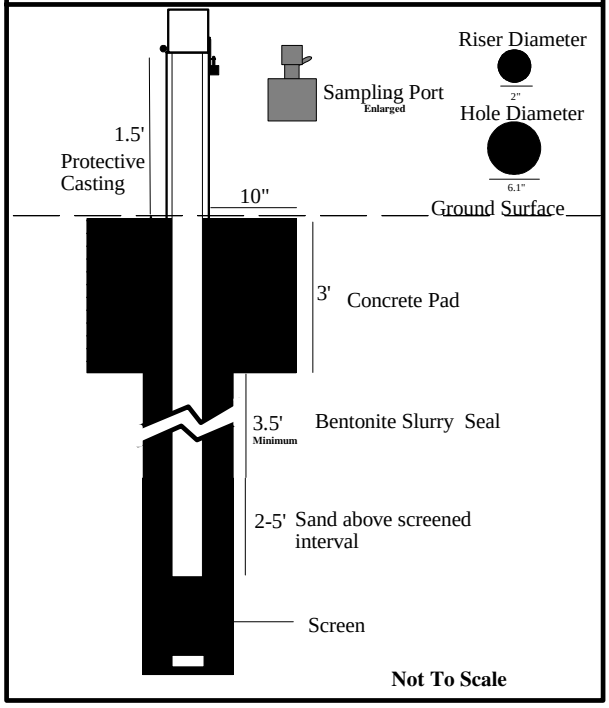


Figure 2

Typical Micro Well

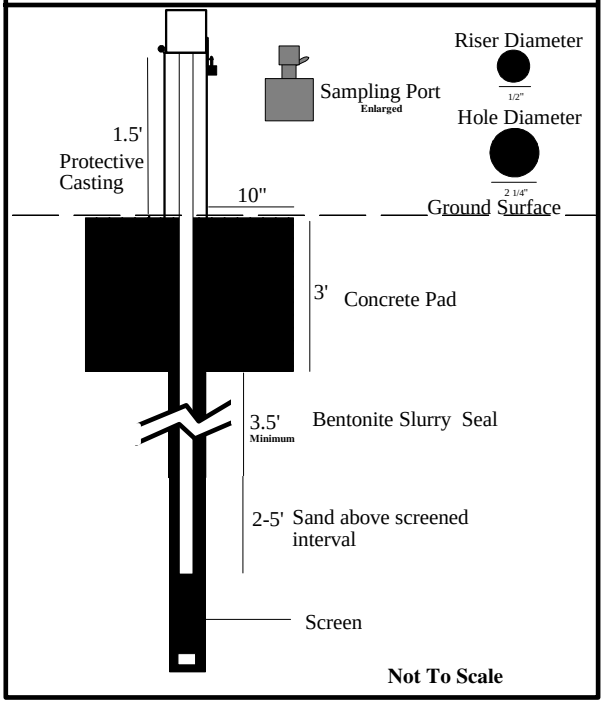
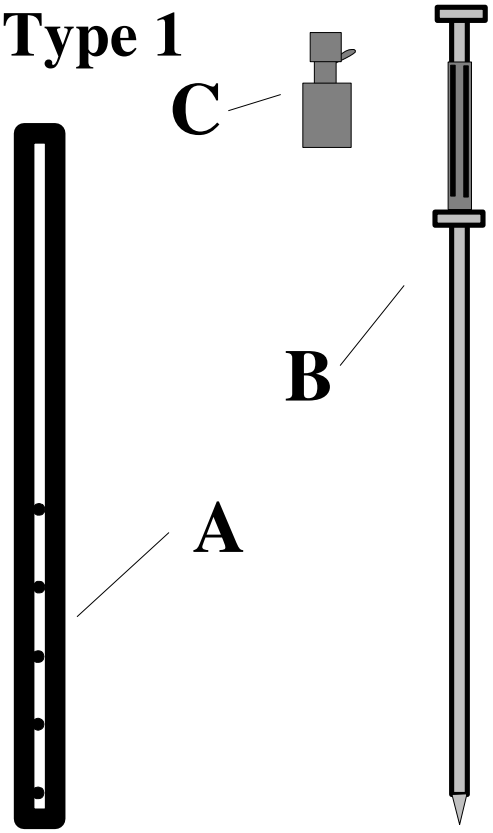


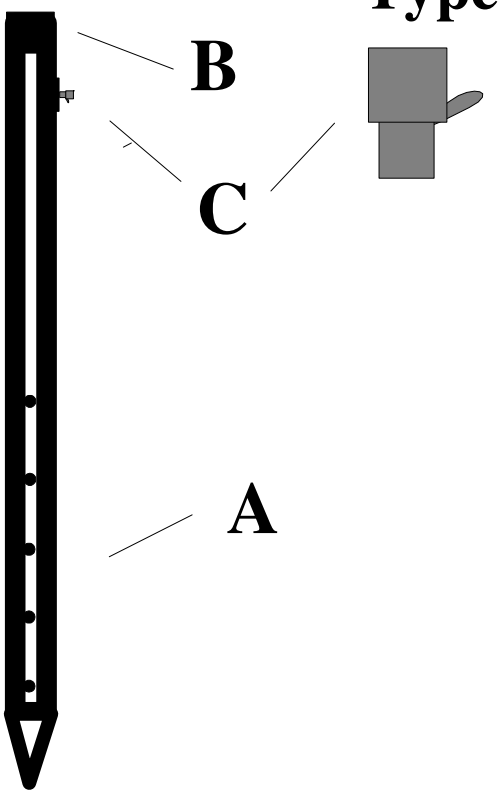
Figure 3
Spike Probe

Type 1



Part A Probe collector - materials copper, steel or galvanized pipe. Holes drilled into pipe to within 1-2' of ground surface point.
Part B Hammer Driver - made of steel in which handle slides on rod to drive point into ground.
Part C Sample Port - made of numerous types; however, must be a compression fitting which remains closed after being disconnected.
Instructions for Use- Insert Part B into Part A. Then using the hammer driver pound Part B into the sellected sampling location. Be sure that the last set of holes on the Probe are at least 1' below ground surface. Install Part C onto Part A securly. Recommend solder or using a hot glue gun to insure air tight seal. Wait at least 1hour before attempting to sample.

Type 2



Part A Probe collector - materials steel or galvanized pipe. Holes drilled into pipe to within 1-2' of ground surface point.
Part B Hammer Cap - made of steel and is use to driving point.
Part C Sample Port - made of numerous types; however, must be a compression fitting which remains closed after being disconnected.
Instructions for Use- Screw Part B onto Part A. Then either hammer or push against Part B until probe is at proper debth. Be sure that the last set of holes on the Probe are at least 1' below ground surface. Install Part C onto Part A securly. Recommend threaded connections to insure air tight seal. Wait at least 1 hour before attempting to sample.