ATTACHMENT 22

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Process Design Manual

Surface Disposal of Sewage Sludge and Domestic Septage

U.S. Environmental Protection Agency
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4.2.1.5 Protection of Surface Water—Collection of Runoff and Leachate

Runoff is rain water or other liquid that drains over the land and runs off the land surface. Part 503 requires that runoff from an active sewage sludge unit be collected and disposed according to permit requirements of the National Pollutant Discharge Elimination System and any other applicable requirements.

Leachate is fluid from excess moisture in sewage sludge or from rain water percolating down from the land surface through an active sewage sludge unit. If an active sewage sludge unit has a liner and leachate collection system, Part 503 requires that leachate be collected and disposed according to applicable requirements. These include NPDES permit requirements for leachate discharged as a point source to surface water. The system must be operated in accordance with applicable requirements while the unit is active and for 3 years after it closes (or longer if required by the permitting authority).

In view of these requirements, selection of a site on or near surface water can compound design and operational difficulties and increase the difficulty in securing permits. This should be considered during the selection process. As part of the site selection process, existing surface water bodies and drainage on or near proposed sites should be mapped and their current and future use considered.

4.2.1.6 Protection of Ground Water

One of the Part 503 management practices requires that sewage sludge placed on an active sewage sludge unit not contaminate an aquifer. An aquifer is an area below the ground that can yield water in large enough quantities to supply wells or springs. "Contaminating an aquifer" in this instance means introducing a substance that can cause the level of nitrate in ground water to increase above a certain amount. Under this management practice nitrate-nitrogen levels in ground water must not exceed the MCL of 10 mg/liter or must not increase the existing concentration of nitrate-nitrogen in ground water if that concentration exceeds the MCL. Pollutants in sewage sludge other than nitrate are addressed by pollutant limits (see Section 3.4.2).

Part 503 also requires proof that the sewage sludge placed on an active sewage sludge unit is not contaminating an aquifer. This proof must be either (1) the results of a ground-water monitoring program developed by a qualified ground-water scientist, or (2) certification by a ground-water scientist that ground water will not be contaminated by the placement of sewage sludge on the active sewage sludge unit. The certification option usually is obtainable only if the unit has a liner and leachate collection system because it can be difficult to certify that ground water will not be contaminated in the absence of a liner, unless ground water is very deep and protected by a natural clay layer.

Assessment of local aquifers is an essential step in helping to ensure that an active sewage sludge unit will not contaminate an aquifer. Data collected should include:

- Depth to ground water (including historical highs and lows).
- Hydraulic gradient.
- Existing ground-water quality.
- Current and projected ground-water use.
- The location of primary recharge zones.

Sludge should not be placed where there is a potential for direct contact with the ground-water table. Also, major recharge zones should be eliminated from consideration, particularly sole source aquifers. As much distance as possible should be maintained between the bottom of the fill and the highest known level of ground water.

The structural and mineralogical characteristics (with respect to nitrate-nitrogen) of any nearby aquifers should be delineated so that the potential for contamination can be accurately assessed. Any faults, major fractures, and joint sets in the vicinity of an active sewage sludge unit should be identified. Karst terrains and other solutional formations should be avoided. In general, limestone, dolomite, and heavily fractured crystalline rock are less desirable than consolidated sedimentary bedrock and unconsolidated alluvial and other unconsolidated formation.

Ground-Water Data Sources

Sources of data on ground-water quality and movement include the U.S Geological Survey "Ground-water Data Network," local well drillers, state geological surveys, state health departments, other state environmental and regulatory agencies, and samplings from nearby wells. The USGS also publishes an annual report entitled "Ground-water Levels in the United States" in the Water-Supply Paper Series. The data for this paper are derived from some 3,500 observation wells located across the nation.

On-site Drilling

If necessary, further background information on ground-water elevations, fluctuations, and quality and on the hydraulic gradient should be collected by performing on-site drilling. The hydraulic gradient is equivalent to the slope of the ground-water table (or, for an artesian aquifer, the slope of the piezometric surface). Data on the hydraulic gradient helps ascertain the rate and amount of ground-water movement and whether hydraulic connections to surrounding aquifers exist.

The direction of ground-water flow (and thus of the hydraulic gradient) can be determined by noting the depth to ground water in nearby wells or borings, calculating the elevation of the ground water, and drawing contour lines that connect wells of equal ground-water elevations. At least three wells (and normally more) are needed to determine the direction of ground-water flow. Usually large units, units with complex hydrogeology, and/or relatively flat units require more borings than small units. An experienced hydrogeologist should participate in the research and exploratory drilling to interpret field data. He or she can recommend the number, location, and type of exploratory wells needed. Table 4-2 summarizes the methods for collecting data from the subsurface and the type of information available from the methods.

4.2.2 Part 258

The 40 CFR Part 258 regulations promulgated in 1991 under the authority of RCRA Subtitle D establish minimum national siting requirements for municipal solid waste (MSW) landfills, including MSW landfills where sewage sludge is codisposed with household waste. Most states have already implemented stricter landfill

Table 4-2. Summary of Methods for Collecting Data from the Subsurface (U.S. EPA, 1994)

Method	Properties	Comments
Vertical Variations		
Drill logs	Changes in lithology Aquifer thickness Confining bed thickness Layers of high/low hydraulic conductivity Variations in primary porosity (based on material description)	Basic source for geologic cross sections. Descriptions prepared by geologist preferred over those by well drillers. Continuous core samples provided more accurate descriptions.
Electric logs	Changes in lithology Changes in water quality Strike and dip (dipmeter)	Require uncased hole and fluid-filled borehole.
Nuclear logs	Changes in lithology Changes in porosity (gamma-gamma)	Suitable for all borehole condition (cased, uncased, dry, and fluid-filled).
Acoustic and seismic logs	Changes in lithology Changes in porosity Fracture characterization Strike and dip (acoustic televiewer)	Requires uncased or steel cased hole, and fluid-filled hole.
Other logs	Secondary porosity (caliper, television/photography) Variations in permeability (fluid-temperature, flowmeters, single borehole tracing)	Require open, fluid-filled borehole. Relatively inexpensive and easy to use.
Packer Tests	Hydraulic conductivity	Single packer tests used during drilling; double-packer tests after hole completed.
Surface geophysics	Changes in lithology (resistivity, EMI, TDEM, seismic refraction)	Requires use of vertical sounding methods for electrical and electromagnetic methods.
Lateral Variations		
Potentiometric maps	Changes in hydraulic conductivity	Based on interpretation of the shape and spacing of equipotential contours.
Hydrochemical maps	Changes in water chemistry	Requires careful sampling, preservation and analysis to make sure samples are representative.
Tracer tests	Time of travel between points.	Requires injection point and one or more downgradient collection points. Essential for mapping of flow in karst.
Geologic maps and cross-sections	Changes in formation thickness Structural features, faults	Result from correlation features observed at the surface and in boreholes.
Isopach maps	Variations in aquifer and confining layer thickness.	Distinctive strata with large areal extent required.
Geologic structure maps	Stratigraphic and structural boundary conditions affecting aquifers.	See Table 5-6.
Surface geophysics	Changes in lithology (seismic) Structural features (seismic, GPR, gravity) Changes in water quality/ contaminant plume detection (ER, EMI, GPR).	Interpretations require verification using subsurface borehole data.

U.S. Environnmental Protection Agency (EPA), 1994. Ground Water and Wellhead Protection. EPA/625/R-94/001. Available from CERI.