United States Environmental Protection Agency | Office Of Water (4203) | EPA 833-R-95-001 October 1995

EPA

Part 503 Implementation Guidance

EXCERPT:
Ch. 5 Surface Disposal

Sec. 5.5-12
Groundwater Protection

- No longer available from EPA - 202/260-7786
- Small Flows Clearinghouse 800/624-8301
  Document WWBKRG50
  ($38.50 as of 2/02)

5. SURFACE DISPOSAL - PART 503 SUBPART C

QUICK REFERENCE INDEX

EXCERPT

- Installation of warning signs such as "Do not enter," "Sewage sludge disposal site, no trespassing," and "Access restricted to authorized personnel only."

The use of natural barriers, such as trees, hedges, embankments, berms and ditches, is not considered adequate access restriction because they can be crossed by pedestrians and off-road vehicles fairly easily. However, natural barriers coupled with warning signs in a remote rural area may be adequate.

At surface disposal sites containing active and/or closed sewage sludge units located in areas with high population densities or sensitive land use practices, several of the above management practices may be necessary. In areas that are less susceptible to public trespass, such as rural areas, warning signs alone may suffice. In areas with a high probability of vehicular traffic across the surface disposal site, measures restricting vehicular traffic must be taken. If a surface disposal site contains only closed sewage sludge units, provision must be made to maintain the access control practices for 3 years from the date that the last active sewage sludge unit on that surface disposal site closes.

Permit Conditions

The regulatory requirement of § 503.24(m) can be embodied in the permit in three ways:

- By using the exact language from Part 503
- By prescribing specific public access controls as permit conditions
- By incorporating a permit condition that requires submission of a plan and schedule for implementation of best management practices to restrict public access.

If the permit writer determines that current access management practices are adequate, she may want to include these management practices in the permit or reference the surface disposal site's design plan or other document where these management practices are described. The permit writer should also include a permit condition requiring the maintenance and upkeep of access restriction measures.

5.5.12 GROUND-WATER PROTECTION

Statement of Regulation

§503.24(n)(1) Sewage sludge placed on an active sewage sludge unit shall not contaminate an aquifer.

§503.24(n)(2) Results of a ground-water monitoring program developed by a qualified ground-water scientist or a certification by a qualified ground-water scientist shall be used to demonstrate that sewage sludge placed on an active sewage sludge unit does not contaminate an aquifer.

Permitting Factors

Part 503 prohibits contamination of an aquifer. The regulation provides for two alternatives for the owner/operator to demonstrate that the aquifer is not contaminated: providing a certification that the sewage sludge being placed on the active sewage sludge unit will not contaminate the aquifer, or performing ground-water monitoring. The certification is not a simple signed statement; rather, it is a

hydrogeologic assessment by a qualified ground-water scientist. Based on the hydrogeology of the site and the design of the surface disposal site, the scientist determines the likelihood of ground-water contamination occurring at the site and then certifies that, based on his/her knowledge of the site, contamination is not likely to occur. The ground-water monitoring alternative, on the other hand, is an actual demonstration that aquifer contamination is not occurring through actual measurement of nitrate in the ground water below the surface disposal site.

> Contaminate an aquifer means to introduce a substance that causes the maximum contaminant level for nitrate in 40 CFR §141.11 to be exceeded in ground water or that causes the existing concentration of nitrate in ground water to increase when the existing concentration of nitrate in the ground water exceeds the maximum contaminant level for nitrate in §141.11. [§503.21(c)]

The permit writer must verify the information submitted to support either option. While verifying information, the permit writer should consider the potential of the site to cause contamination, and the risks to human health and the environment should contamination of the ground water occur.

> Aquifer is a geologic formation, group of geologic formations, or a portion of a geologic formation capable of yielding ground water to wells or springs. [§503.21(b)]

To perform these assessments, the permit writer should obtain appropriate documentation from the owner/operator, and the State and local ground-water protection agencies, to determine if the surface disposal site is located over an aquifer designated for ground-water protection or whether the aquifer is already contaminated. In addition, preliminary design information and site-specific geological information may indicate if the site needs special consideration.

The first assessment should determine the potential of the surface disposal site to cause or contribute to nitrate contamination. This potential will depend on many considerations, such as:

- Age of the surface disposal site or sewage sludge unit
- Site design features (e.g., lined versus unlined)
- Site-specific hydrogeological and meteorological features.

Second, the permit writer should determine the risk to human health and the environment associated with the contamination of an aquifer below the surface disposal site. This assessment should consider the degree of contamination that could occur (i.e., whether the increase in nitrate levels in the aquifer will lead to levels above the maximum contaminant levels [MCLs]). This assessment also should consider the size of the affected community if contamination occurs (i.e., whether the site is located over a sole source aquifer serving a small community or serving several large communities). The permit writer should also determine if any applicable State or locality-specific ground-water protection requirements apply. To do so, the permit writer should consult the following documents, if available:

- State Wellhead Protection Plan
- Comprehensive State Ground-Water Protection Program Plan.

A State Wellhead Protection Plan is a plan that is established under the Wellhead Protection (WHP) Program to protect ground waters that supply wells and well fields contributing drinking water to public water supply systems (SDWA 1986). The Comprehensive State Ground Water Protection Program Plan is developed by States to implement the 1991 EPA Ground-Water Protection Strategy (EPA 1991c). These plans may include information useful to the permit writer, such as:

- Ground-water protection goals
- Identification of ground-water classification systems, special aquifers requiring protection, or priorities for ground-water protection
- Designated wellhead protection areas (WHPA) for each wellhead based on hydrogeologic data, ground-water flow, and aquifer recharge and discharge.

Performing these assessments allows the permit writer to assign the surface disposal site a relative risk factor. However, the permit writer should be aware that the determination of whether a site has a low, medium or high risk factor is a subjective determination. Some States and/or localities may have prioritized areas within their jurisdiction and have actually identified specific criteria on which to base the judgment (e.g., Wellhead Protection Programs or State Ground-Water Protection Programs) while others may not have.

Where the permit writer does not find institutionalized policies on assigning priorities and risks, she may develop a system for assigning the relative risk factors. The system may be based on one of several criteria:

- Quality of ground water beneath the active sewage sludge unit
- Designated uses or potential uses of ground water below the active sewage sludge unit
- Design of the active sewage sludge unit (i.e., lined versus unlined, and stable versus unstable land).

The permit writer may wish to develop the relative risk factor system based on one of these criteria or a combination of all three. For example, using the first criterion, low-risk sites may be identified as sites located over contaminated aquifers. A high-risk site would be located over ground water of exemplary quality. An example using all three criteria would yield low-risk sites where ground waters are contaminated and will never be useable as a drinking water source because of the cost of remediation, and where the sewage sludge unit has a liner and leachate collection system. A high potential risk site would be an unlined site located in an area with known seismic activity and over a high-quality drinking water source that is irreplaceable and ecologically vital.

Based on the relative risk factors assigned to the site, the permit writer can decide if the appropriate measures have been taken. In general, a certification is appropriate for a surface disposal site with low to medium relative risk factors. Ground-water monitoring may be necessary for high-risk surface disposal sites. Both the certification and the ground-water monitoring program must be developed by a qualified ground water scientist. The permit writer should request that information on the qualified ground-water scientist's educational and work experience be submitted along with the certification or ground-water monitoring plan to allow the permit writer to evaluate the scientist's credentials and expertise.

Certification

As mentioned above, the certification alternative is most appropriate for low to medium risk sites. This certification is a hydrogeologic assessment that the aquifer will not be contaminated by sewage sludge placed in the active sewage sludge unit(s). This hydrogeological assessment must be based on site-specific data. The assessment report should:

> A qualified ground-water scientist is an individual with a baccalaureate or post-graduate degree in the natural sciences or engineering who has sufficient training and experience in ground water hydrology and related fields, as may be demonstrated by State registration, professional certification, or completion of accredited university programs, to make sound professional judgments regarding ground water monitoring, pollutant fate and transport, and corrective action. [§503.21(l)]

- Identify regional geologic and hydrogeologic characteristics, such as geologic formations and origins, geomorphology, seismic activity, drainage, surface waters and their quality, soils, aquifer recharge and discharge areas, regional topography, and meteorological and climatological information

- Analyze the effect of site topographic and geomorphic features on the site ground-water hydrology

- Classify and describe site hydrogeological properties, such as aquifer thickness, porosity, texture, hydraulic conductivity, infiltration rates, transmissivity, and structure

- Include structural contour maps and geological sections showing hydrogeology of uppermost aquifer, perched zones, interconnections, and water table elevations

- Characterize ground water, including water levels, flow patterns, flow rates, and water quality.

The complexity of the certification depends on the relative risk factor and on specific site characteristics. For low relative risk sites, the permit writer may require that the certification be based on a hydrogeological assessment prepared from already existing documentation on the hydrogeology of the site and surrounding areas. Such documentation includes historical records (e.g., precipitation or land development), USGS information or State geologic survey maps, Soil Conservation Service reports and maps indicating soil types, studies performed on nearby sites, and geologic logs of existing wells or test borings that have been taken near the site. Ascertaining that the aquifer is not and will not be contaminated would be deduced from this information.

For medium relative risk sites, the permit writer may require that the above existing information on the hydrogeology of the site be verified or supplemented with site-specific, field-collected measurements, such as soil borings, rock corings, material tests, surface geophysical surveys, and hydraulic conductivity measurements. For medium relative risk sites that have existing problems with nitrates, the permit writer may consider requiring in the permit that the certification be based on fate and transport demonstrations, such as:

- Site-specific, field collected measurements, sampling, and analysis of physical, chemical and biological processes affecting nitrate fate and transport

- Nitrate fate and transport predictions that maximize nitrate migration and consider impacts on human health and the environment.

The permit writer could require a one-time monitoring of the aquifer to verify that the active sewage sludge units are not contaminating the aquifer. The permit writer may decide that there are sufficient wells in close proximity to the surface disposal site to provide the needed monitoring information or he may require the construction of wells specifically for this purpose. The monitoring information should be submitted with the certification. The results can be used by the permit writer to determine the need for additional periodic monitoring at that surface disposal site. If wells were constructed for this initial assessment, they can then be used for the required periodic monitoring.

Ground-Water Monitoring

Sites that a permit writer determines have a high relative risk factor may be required to monitor the ground water to demonstrate that the sewage sludge placed on any active sewage sludge units at the surface disposal site does not contaminate an aquifer. Such a demonstration is made by analyzing ground-water samples collected from monitoring wells placed downgradient and comparing the analytical results of the nitrate concentrations to samples taken from wells placed upgradient of the active sewage sludge unit.

Before the permit writer can determine which ground-water monitoring permit conditions to incorporate into the permit, he must have a clear understanding of the hydrogeological conditions at the surface disposal site. This is accomplished by requiring the owner/operator to submit a hydrogeologic report of the disposal site and to develop a ground-water monitoring plan. The permit writer should review and evaluate the hydrogeological report and ground-water monitoring plan. If the owner/operator does not have adequate information or resources to develop such a hydrogeologic report and monitoring plan for the permit application, the permit writer may choose to require the owner/operator to submit all available hydrogeologic information and issue the permit incorporating a compliance schedule for development and implementation of a ground-water monitoring program. The milestones in the compliance schedule could address the development of an adequate hydrogeologic report, completion of a monitoring plan, commencement of monitoring well development, and commencement of monitoring well sampling.

Hydrogeologic Assessment and Ground-Water Monitoring Plan

The permit writer must require that the ground-water monitoring plan be prepared by a qualified ground-water scientist. This plan can then be used by the permit writer to develop permit conditions for periodic ground-water monitoring. At a minimum, the permit writer should require the owner/operator to submit the following information as part of a hydrogeologic study that assesses aquifer contamination:

- A characterization of the site geology and hydrology (hydrogeologic assessment) including seasonal variability in ground-water flow directions and an interpretation of the information and data submitted

- A description of the ground-water monitoring system design and installation for the active sewage sludge unit(s) (including a well location map)

- A discussion of sampling and analytical procedures including statistical methods used
- Results of nitrate-nitrogen analyses of ground-water samples with associated quality assurance/quality control (QA/QC) data.

The permit writer will need to determine whether the ground-water hydrogeologic assessment and monitoring plan is complete and whether the information provided by the owner/operator verifies the absence of aquifer contamination. This type of evaluation requires: (1) a review of the data quality; (2) an understanding of the interpretation of the hydrogeologic and water quality data; and (3) an analysis of whether the data and information submitted fully characterize the potential ground-water impact of placing the sewage sludge on the sewage sludge unit. Finally, the evaluation should also include a comparison of the nitrate-nitrogen levels reported for each ground-water sample to the MCL for nitrate-nitrogen (10 mg/l) to verify the absence of aquifer contamination.

Several other guidance documents published by EPA may be useful to the permit writer in reviewing the ground-water assessment and monitoring plan. These documents are listed in Table 5-6. Much of the information provided in these documents is not duplicated in this document. Instead, only the most important technical considerations that the permit writer must address in a review of a hydrogeologic assessment and ground-water monitoring program are discussed. The following discussion details the type of information that should be included in the hydrogeologic assessment and monitoring plan submitted by the owner/operator.

TABLE 5-6 SUPPORTING DOCUMENTS FOR REVIEW OF GROUND-WATER ASSESSMENT AND MONITORING PLANS

Document Title	Guidance Provided to the Permit Writer
The Ground Water Monitoring Technical Enforcement Guidance Document	Provides technical guidance on the development of ground-water monitoring programs, including site characterization, well design and placement, and well construction
RCRA Comprehensive Ground-Water Monitoring Evaluation	Provides guidance to evaluate the compliance of a ground-water monitoring system
Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities (EPA/530-SW-89-026)	Provides information to review and evaluate ground-water quality data using statistical methods
Procedures Manual for Ground Water Monitoring at Solid Waste Disposal Facilities	Provides guidance for hydrogeologic investigation including characterization of site hydrogeology, design of detection monitoring systems, design and construction of monitoring wells, and sampling and analysis of ground water

Characterization of Site Geology and Hydrology

The permit writer should require that the owner/operator provide data on the site geology and hydrology to identify all potential migration pathways and the target monitoring zones. The collection of subsurface samples, ground water-level measurements, water quality data, aquifer data, meteorological and

climatological data, and descriptions of other site-specific conditions are used to formulate interpretative tools, such as geologic cross sections, isoconcentration maps, water-level contour maps, flow nets, and aquifer characteristics. The final hydrogeologic assessment should identify the spacial variability of geologic units and the seasonal/temporal variability expected to occur in the ground- water flow systems.

The geologic units that compose the targeted monitoring zone must be identified and characterized. It is important to determine how these units may vary spatially and how they are connected hydraulically with surrounding units. The quantity of data required to characterize the target monitoring zone(s) depends on the site's geological complexity. For example, a subsurface environment composed of geologic units that are highly variable and appear to be discontinuous may require considerably more data than a system that is relatively homogeneous and predictable.

Important geologic features that indicate a high degree of variability and irregularity within the subsurface are: fracture zones, solution cavities, pinchout zones (i.e., discontinuous strata across the site), tilted or folded beds, or high hydraulic conductivity zones. These types of geologic features often control the direction and velocity of ground-water flow. For example, since fractures are often preferred pathways for ground water, the orientation of fractures can control the direction of ground-water flow.

Seasonal and temporal variability of ground-water flow directions and ambient ground-water quality must be characterized. The influence of surface water bodies on the ground-water system (e.g., tidal variations and river stage variations) is often an important control on the direction and quality of ground-water flow. Other local influences on ground-water flow that can change seasonally or temporally include on or off-site pumping wells, injection wells, irrigation or agricultural activities, and other land-use activities.

Site conditions may help identify the amount and extent of potential contaminant migration. For example, orientation and dimensions of an active sewage sludge unit will affect the placement of ground-water monitoring wells, and should be evaluated to ensure that all migration pathways are monitored.

The site characterization is adequate when the following conditions are satisfied: (1) the target monitoring zone is identified (usually the uppermost aquifer); (2) the degree of hydrogeologic variability within the targeted monitoring zone is defined; and (3) all potential contaminant migration pathways from the active sewage sludge unit are identified. This information fosters accurate placement of monitoring wells to detect potential contamination.

Description of the Ground-Water Monitoring System

The permit writer should require that the owner/operator provide a well location map as well as information on well installation and construction. Monitoring wells should be placed downgradient of the active sewage sludge unit to intercept ground water that flows beneath the unit. This requires identification of the area of ground-water flow that could interact with potential contaminant migration from the unit. The number of downgradient wells should be sufficient to determine water quality at the point of compliance (i.e., as close to the unit boundary as possible). Typically, at least three downgradient wells are required to monitor the lateral extent of contaminant migration. An upgradient well, which is not influenced by the sewage sludge unit but is within the vicinity to represent background ground water quality, should be part of the ground-water monitoring system. To avoid potential pathways of contamination, an upgradient/background well should be located where it won't be influenced by ground-water mounding beneath the unit.

Monitoring wells should be screened laterally and vertically within the target monitoring zone(s) and be constructed of materials that will not affect the quality of ground-water samples. The owner/operator of the surface disposal site should explain the number and placement of the monitoring wells. After consideration of all migration pathways and the effects of temporal variations on the ground water flow system, additional monitoring wells or alternative monitoring techniques such as vadose zone monitoring or tracer tests may be required. For example, fracture and solution channels in an aquifer (e.g., karst hydrology) may require non-conventional monitoring techniques. In addition, certain subsurface conditions such as multiple aquifers may require additional monitoring for hydrologic interconnectiveness.

Sampling and Analytical Procedures

The permit writer should require that the owner/operator submit a description of all sampling and analytical procedures used to collect the data. The following components of the sampling and analysis program should be addressed in the plan:

- Sample collection, preservation, and handling
- Analytical procedures
- Statistical methods used to assess ground-water monitoring data
- Chain-of-custody procedures
- Field and laboratory quality assurance/quality control procedures.

A representative ground-water sample is collected when the following are ensured: (1) the use of proper well evacuation techniques; (2) sampling equipment and techniques that minimize alteration of the chemical constituents in the ground water; (3) adequate documentation of field activities; and (4) identification and reporting of errors or anomalies. Sample integrity must be maintained through proper sample preservation, handling, and chain-of-custody procedures.

All activities related to characterizing the site hydrogeology, design and installation of ground-water monitoring wells, and sampling and analysis should include a quality assurance/quality control (QA/QC) program. All samples must be evaluated with respect to standard QA/QC procedures and to the specified data quality objectives (i.e., the amount of imprecision and bias that will be tolerated). QA/QC procedures should include the use of standards, laboratory blanks, field and trip blanks, and duplicates. Field QA/QC procedures should include equipment decontamination and chain-of-custody.

The frequency of any initial compliance sampling and number of samples collected should represent any expected seasonal variation in ground-water quality. Typically, at least four rounds of ground-water samples are collected over a course of 1 year to ensure seasonal variability. Statistical procedures are often used to determine the appropriate sampling interval that will reflect site-specific hydrogeologic conditions.

Developing Permit Conditions for Ground-Water Monitoring

Permit conditions for ground-water monitoring are developed according to the complexity of the site, site hydrogeology, and potential and real risks. The variability of sites is so great that it becomes difficult

to provide guidance to the permit writer in developing the ground-water monitoring permit conditions. Appropriate permit conditions could range from simply incorporating the owner/operator's ground-water monitoring plan by reference to developing detailed conditions specifying construction details and statistical procedures. The following discussion provides the minimum information that the permit writer should address in the permit and furnishes guidance on the consideration of more detailed provisions.

If the permit writer determines that the proposed ground-water monitoring plan provides a sound technical basis for detection monitoring, the permit writer may incorporate the plan by reference in the ground-water monitoring section of the permit. If, however, the permit writer determines that the ground-water assessment and monitoring plan is deficient, she may decide to specify the terms and conditions of the monitoring to be performed in the permit. At a minimum, the conditions associated with ground-water monitoring that the permit writer should address in the permit include:

- Frequency of monitoring
- Well location, construction, and maintenance
- Monitoring program and data evaluation
- Reporting and recordkeeping.

Frequency of Periodic Ground-Water Sampling and Analysis

The permit writer should specify an appropriate frequency for sampling and analysis of nitrate in ground water for any active sewage sludge units at the surface disposal site. Monitoring frequency can be influenced by the following factors:

- Rate and direction of the ground-water flow
- Location of the monitoring well
- Trends in the water quality data
- Climatological and meteorological characteristics
- Others (such as the resource value of the aquifer and the fate and transport of the nitrate in ground water).

The permit writer must, therefore, develop a flexible monitoring schedule, allowing for modification based on these factors. Initially, the permit writer may want to base the frequency of monitoring on the ground-water flow rate, location, and climate. However, he may want to modify this provision later, based on the trends in the site's water quality data. Special considerations are warranted for sites where contamination is suspected and the frequencies must be altered for aquifer contamination assessment reasons.

Flow rates are primarily dependent on the aquifer porosity and permeability as well as the hydraulic gradient at the site. The higher the flow rate, the greater the monitoring frequency needed. For sites that are underlain by impervious clay soils, semi-annual or annual monitoring may be sufficient. For

sites that have fracture or solution porosity aquifers, it is possible that nitrogen could migrate from the active sewage sludge unit within weeks or even days. Thus, quarterly or monthly monitoring may be more appropriate.

By considering regional climatological characteristics, the permit writer may obtain information on the fluctuations of leachate development that may occur over the year. This type of information may indicate that, instead of arbitrarily assigning a sampling date every third month (for quarterly monitoring), it would be more appropriate to correlate the sampling period with ground-water recharge periods when leachate generation is greatest.

Frequency of monitoring may also be based on the level of concentration of nitrate found in the ground water and whether the surface disposal site is located over an aquifer used for drinking water or with the potential to be used for drinking water. If the surface disposal site is located over an aquifer used for drinking water, the permit writer may elect to specify, in the permit, trigger-based monitoring such as that used in EPA's Phase II Rule for National Primary Drinking Water Standards. These regulations require that ground-water systems sample for nitrate annually as a baseline frequency. If any sample is greater than or equal to 50 percent of the MCL, this triggers an increase in monitoring frequency to quarterly sampling. If four quarterly samples are shown to be reliably and consistently below the MCL, then the sampling can be again reduced to annually, in which case samples must be taken during the quarter that previously yielded the highest analytical result.

Well Location, Construction and Maintenance

The permit writer should specify, in the permit, the design specifications for the ground-water monitoring system. This monitoring system may be the same system as that provided in the ground-water monitoring plan furnished by the owner/operator. If the permit writer determines that any aspect of the proposed system is deficient, the appropriate design specifications should be included in the permit. At a minimum, the permit writer should specify the design of the monitoring network, including the number, location, and sampling depths of all background and downgradient monitoring wells. This information can be specified through the use of maps and cross-sections. Construction materials and well design should also be specified. This may include as much detail as possible on drilling methods, well casing and materials, well diameter, well intake design, well development procedures, and methods for sealing the annular space.

The spacing and required number of downgradient wells is based on the size of the active sewage sludge unit. However, the permit writer should, at a minimum, require three downgradient wells located as close as possible to the edge of the unit penetrating the entire saturated thickness of the aquifer. The line of wells should not have less than one downgradient well for every 76 meters of frontage (EPA 1980). The permit writer may specify an additional well within the surface disposal site to indicate whether leachate is reaching ground water and to give early warning of potential aquifer contamination. In addition, the permit writer may want to add a provision that any detection of nitrates in the indicator well will trigger the owner/operator to monitor the downgradient wells more frequently.

The number and location of upgradient wells to determine background water quality should be specified based on the variability of the water quality prior to flowing under the site. In many cases, the permit writer may want to require multiple background wells to provide better measurements. However, at a minimum, one must be required. Additionally, the statistical procedure used to determine the presence or absence of contamination may dictate how many wells are needed. Background wells do not

necessarily have to be placed upgradient of the active sewage sludge unit, but the permit writer should review any placement criteria to ensure that the wells are not being influenced by any contamination at the site.

The permit should require that the owner/operator provide appropriate maintenance for the wells. Ground-water monitoring plans should contain a schedule for maintaining the ground-water monitoring system, including replacing or redrilling monitoring wells, replacing seals and caps, repairing or replacing pumps, and any other kinds of general equipment maintenance.

Monitoring Program and Data Evaluations

The permit should specify sample collection, preservation, chain of custody controls, analytical procedures and QA/QC procedures to be used for the ground-water monitoring. The permit writer may also want to specify evacuation techniques to remove stagnant water from the wells prior to sampling. Monitoring wells require sampling at different depths to ensure that the contamination potentially migrating from the site will be intercepted by the wells. The permit writer should specify the amount of sampling and the sampling required in the vertical dimension. The permit writer should be careful when specifying sampling depths to avoid mixing of waters of different quality during sampling. In most cases, sampling of sites on the downgradient boundary requires sampling at the water table and several additional depths.

The sampling and analysis section of the permit should include provisions to measure static water elevations in each well prior to each sampling event. This collection of the water elevation is important in determining if horizontal and vertical flow gradients have changed since the initial hydrogeological characterization (EPA 1992a). Any changes would then require that the owner/operator modify the existing ground-water monitoring system.

The permit writer should also specify that the owner/operator use a statistical procedure that provides a reasonable confidence that the migration of nitrates in amounts that could cause contamination from the active sewage sludge unit into an aquifer is detected. The statistical performance standards will limit the possibility of making false conclusions from the monitoring data (EPA 1992a).

Recordkeeping and Reporting

At a minimum, the permit writer should require that the owner/operator maintain the results of any ground-water monitoring in the operating record during the period the sewage sludge unit is active and for 3 years after the sewage sludge unit closes. At high-risk sites, however, the permit writer may want to require that, in addition, the monitoring results be reported on a periodic basis. In this case, the owner/operator should be required to submit the results to the permitting authority along with an explanation of the sampling and analytical methods used and the statistical methods employed to determine presence or absence of contamination.

At a minimum, reporting should be required for those sites that have trigger-based monitoring requirements or when the owner/operator determines that there is a statistically significant increase above the MCL concentration for nitrates or, if the aquifer is already contaminated, above the existing concentration. In the case of contamination, the owner/operator may be required to submit an application for a permit modification to establish corrective action requirements in the permit.