

February 1988

# HAZARDOUS WASTE

## Groundwater Conditions at Many Land Disposal Facilities Remain Uncertain



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United States  
General Accounting Office  
Washington, D.C. 20548

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**Resources, Community, and  
Economic Development Division**

B-226799

February 18, 1988

The Honorable John D. Dingell  
Chairman, Subcommittee on Oversight  
and Investigations  
Committee on Energy and Commerce  
House of Representatives

The Honorable Thomas A. Luken  
Chairman, Subcommittee on  
Transportation, Tourism and  
Hazardous Materials  
Committee on Energy and Commerce  
House of Representatives

The Honorable James J. Florio  
House of Representatives

In accordance with your March 7, 1986, letter, and subsequent discussions with your offices, this is our report on problems EPA and the states are experiencing in obtaining and using hazardous waste facility groundwater monitoring data, and the actions being taken to address such problems. This report and an earlier report, Hazardous Waste: Information on EPA's Proposal to Delete Chemicals from Groundwater Monitoring (GAO/RCED-87-132FS, May 19, 1987), complete our work on this assignment.

As arranged with your offices, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of this letter. At that time, we will send copies to interested parties and make copies available to others upon request.

This work was performed under the general direction of Hugh J. Wessinger, Senior Associate Director. Major contributors are listed in appendix II.

J. Dexter Peach  
Assistant Comptroller General

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# Executive Summary

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## Purpose

Historically, land disposal has been one of the least expensive and heavily used methods for disposing of hazardous wastes. However, in recent years many land disposal facilities have been found to be leaking hazardous substances into the groundwater, a major source of drinking water for many parts of the nation. Because of rising concern that the nation's groundwater resources are becoming contaminated, EPA is placing increased emphasis on the adequacy of land disposal facility groundwater monitoring systems to detect leakage of wastes and provide the basic information needed for designing corrective measures to remove unacceptable levels of groundwater contaminants.

Two subcommittees of the House Committee on Energy and Commerce asked GAO to review the Environmental Protection Agency's (EPA) hazardous waste groundwater monitoring program mandated under the Resource Conservation and Recovery Act of 1976 (RCRA) to determine (1) whether EPA and state permit writers and enforcement officials have had problems in obtaining and using groundwater monitoring data to perform their regulatory responsibilities and, if so, why such problems have occurred, and (2) the extent of EPA actions to address these problems.

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## Background

RCRA regulations promulgated in 1980 emphasized that all operating land disposal facilities be issued permits as quickly as possible. But before receiving permits, facilities were required to install groundwater monitoring systems and collect site-specific data on groundwater conditions. This data was to be used by EPA and the states in making decisions to issue permits to facilities and, if necessary, in requiring facility owner/operators to correct unacceptable contaminant conditions. Because of delays in the permit process, the Congress, in the 1984 RCRA amendments, mandated that facilities planning to continue operating certify compliance with certain RCRA regulatory requirements and apply for operating permits by November 1985 and that permits be issued by November 1988. As of October 9, 1987, 324 facilities were seeking operating permits and about 1,350 had elected to close. Closing facilities remain subject to RCRA groundwater regulations until it is determined that they no longer represent a potential threat to the environment.

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## Results in Brief

Groundwater monitoring data being submitted to EPA and state regulatory officials has varied considerably in terms of completeness and quality and generally has been less than adequate for regulatory decision-making. These problems have occurred because EPA has not established

a system of internal controls to ensure that owner/operator-provided data is of known and acceptable quality and is adequate for the decisions at hand. Because of the delays in obtaining better information, permits have been finalized on only about 34 percent of the 324 operating land disposal facilities nationwide. In the meantime, groundwater conditions at many land disposal facilities remain uncertain, and there is little assurance they are being operated in an environmentally safe manner.

EPA has efforts underway to improve its groundwater monitoring program. Key to these efforts is the establishment of data quality objectives, which should clarify to the regulated community what information is needed for decision-making. These objectives also represent the cornerstone of a developing system of internal controls over the program. EPA is in the initial stages of developing data quality objectives; however, this effort is receiving low priority.

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## Principal Findings

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### Groundwater Program Goals

In 1982 EPA established three groundwater monitoring goals for facilities to achieve prior to being issued operating permits. Thirty-nine of 50 land disposal facilities GAO reviewed in EPA regions III (Philadelphia) and IV (Atlanta) had not developed sufficient groundwater information to demonstrate that they had achieved these goals. Of these 39 facilities, 6 had yet to meet the first goal of determining whether or not the facility was leaking contaminants into the groundwater, and 31 leaking facilities had yet to meet the second goal of determining the extent, rate, and magnitude of the contamination at their facilities. Delays in achieving these goals have delayed the issuance of operating permits—which were initially to have been completed in 1983-84.

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### Data Quality Objectives

Data quality objectives, according to EPA, are explicit statements that describe the type, amount, and quality of data needed to support and defend environmental regulatory decisions. In GAO's view they also represent basic internal control objectives for ensuring that agency program goals are met. Although required for all EPA regulatory programs since 1979, RCRA program managers did not begin to focus on developing data quality objectives for the groundwater monitoring program until 1986. Program officials initially believed that owner/operators would provide the necessary data to support regulatory decisions. However, in

many cases, this expectation has not been met. Consequently, EPA has required owner/operators to gather and provide additional information, which, in turn, has delayed permit decisions.

In 1986 RCRA program managers began examining new strategies for improving the quality of groundwater monitoring data. Estimates for the options considered—which focused on both the development of data quality objectives and the design of a quality assurance/quality control program—ran as high as \$3.25 million with \$1.7 million being the recommended funding option. After internal EPA review, funding for these initiatives has been set at about \$270,000 for fiscal year 1988 with about \$140,000 slated for data quality objective development and training. Data quality objective efforts are included in the third level of three levels of funding priorities.

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### Technical Guidance and Regulatory Requirements

A January 1986 task force report recommended 17 actions designed to improve the RCRA groundwater monitoring program, including the need to develop technical guidance for designing, constructing, and operating groundwater monitoring systems and to require, through regulations, that owner/operators adhere to such technical requirements. One completed initiative in response to the task force recommendations is the issuance of technical guidance for permit writers to use in reviewing groundwater monitoring systems. However, no new requirements have been placed on the regulated community. GAO believes that specific technical requirements would provide effective internal control techniques to ensure that RCRA groundwater monitoring program goals are met. Such techniques, however, should be linked to the data quality objectives established for the program.

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### Quality Assurance and Quality Control Mechanisms

EPA has established few quality assurance and quality control mechanisms to ensure the integrity of owner/operator-provided groundwater data. Currently, no comprehensive program exists for independently verifying owner/operator-supplied data. As indicated previously, along with data quality objectives, EPA has identified a need for improved quality assurance/quality control mechanisms. Current plans call for about \$130,000 annually for this program. As with technical standards and regulatory requirements, quality assurance/quality control mechanisms are effective internal control techniques for ensuring that program objectives are met, and should be linked to the data quality objectives established for the program.

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## Internal Controls

The Federal Managers' Financial Integrity Act requires each federal agency to annually assess and report to the Congress and the President on material weaknesses in its internal control systems. GAO believes the absence of an effective internal control system, although it has not been reported as such, is the fundamental reason EPA has been delayed in meeting its groundwater monitoring program objectives. The groundwater monitoring program should have been reported as a material weakness in the RCRA program.

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## Recommendations

GAO recommends that the Administrator, EPA, develop data quality objectives for the RCRA groundwater monitoring program specifying the type, amount, and quality of data needed for regulatory decision-making. Once established, these objectives should be used to develop specific regulatory requirements and quality assurance/quality control mechanisms for the groundwater monitoring program.

Once implemented, these recommended actions should provide a basic system of internal controls on which EPA can build to ensure that owner/operator-supplied data is appropriate for regulatory decision-making. GAO further recommends that until these actions are taken, the Administrator should report the absence of an internal control system in the RCRA groundwater monitoring program as a material weakness in the agency's annual Federal Managers' Financial Integrity Act report to the President and the Congress.

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## Agency Comments

The views of agency officials responsible for the RCRA groundwater monitoring program were sought during the review and are incorporated in the report as appropriate. However, as requested by the subcommittees' offices, GAO did not obtain official agency comments on this report.

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**Abbreviations**

EPA	Environmental Protection Agency
GAO	General Accounting Office
HSWA	Hazardous and Solid Waste Amendments of 1984
OSW	Office of Solid Waste
QAMS	Quality Assurance Management Staff
RCED	Resources, Community, and Economic Development Division
RCRA	Resource Conservation and Recovery Act

# Introduction

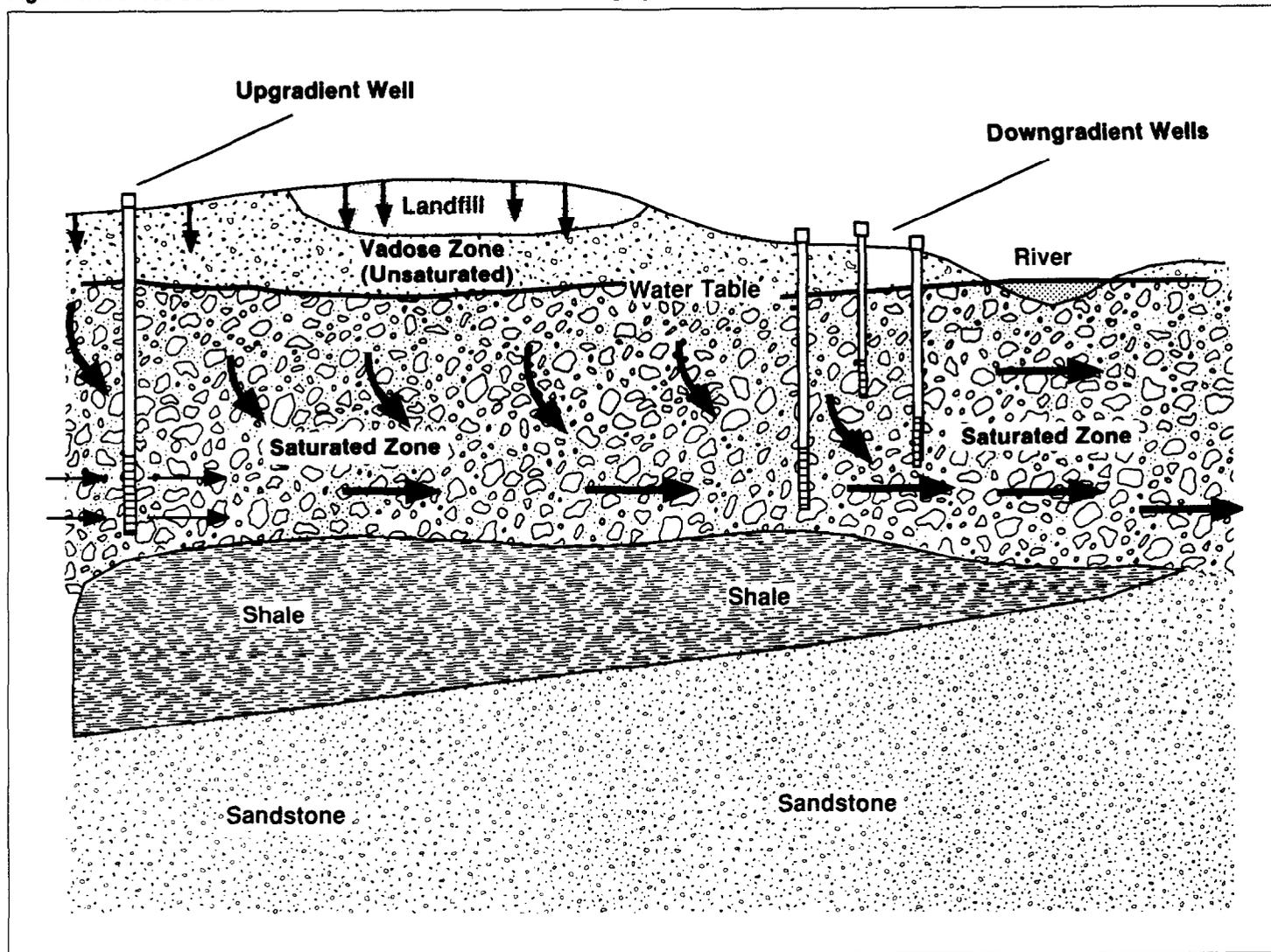
Groundwater is the source of drinking water for about one half of the nation's population and, once contaminated, it can lead to cancer and other adverse human health effects. According to the Environmental Protection Agency (EPA), the nation's consumption of groundwater is on the rise, yet growing evidence suggests that this resource is becoming increasingly contaminated. Once groundwater is contaminated, cleanup is difficult to achieve, can cost millions, and takes many years. Under some conditions it may not be possible to restore groundwater to its original quality.

## Need for Groundwater Monitoring

A major threat to groundwater contamination is from hazardous waste land disposal facilities. As constructed and managed in the past, many hazardous waste land disposal facilities did not minimize the leakage or release of pollutants and contaminants into the underlying and surrounding groundwater. Through enactment of the Resource Conservation and Recovery Act (RCRA), the Congress sought to impose, among other things, strict regulatory controls over hazardous waste land disposal facilities to minimize their potential adverse environmental impacts. One important RCRA control is the requirement that owner/operators monitor the groundwater underlying their facilities to detect contamination. This requirement applies to any land disposal facility that has ever been regulated under RCRA regardless of whether it is currently operating, closed, or in the process of closing. Closed facilities must generally monitor their groundwater for 30 years after they cease operating. For both operating and closed hazardous waste land disposal facilities in the United States today, unless granted a waiver, this means they must install a groundwater monitoring system similar to that shown in figures 1.1 and 1.2.

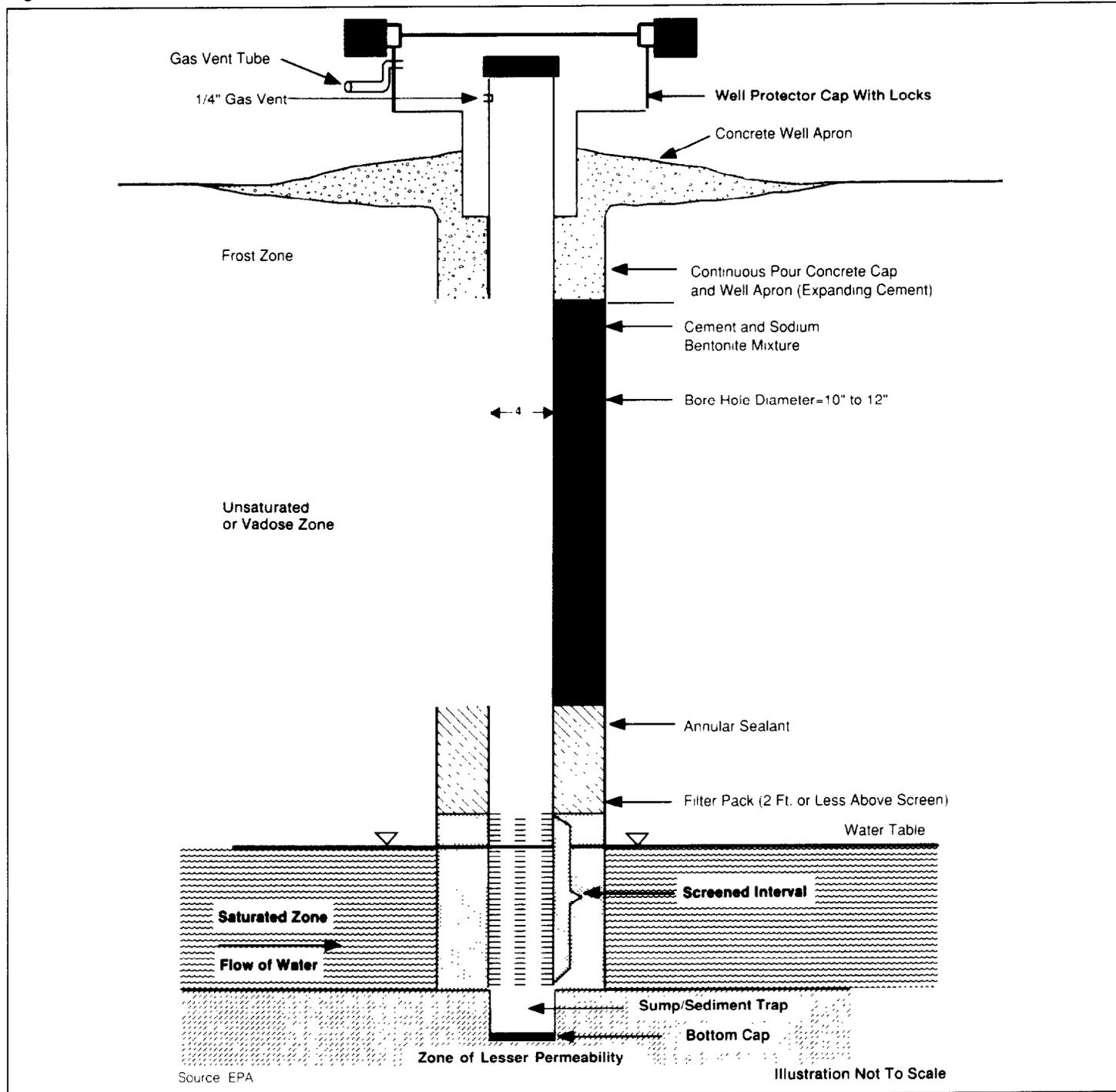
As shown in figure 1.1, groundwater generally flows in a downgradient direction. A monitoring system normally consists of one or more upgradient wells, often referred to as background wells, to determine the quality of the groundwater before it gets to a facility, and three or more downgradient wells to detect any contamination entering the groundwater as it passes under or by the facility. A cross-sectional view of a groundwater monitoring well is shown in figure 1.2. Facilities must periodically collect and analyze groundwater samples from wells such as these to detect and monitor any leakage or release of hazardous waste. Should comparisons of groundwater conditions between the upgradient and downgradient wells confirm contamination, additional assessments

Figure 1.1: Cross Section of a Minimal Groundwater Monitoring System



to determine the extent of groundwater contamination—referred to as assessment monitoring—and follow-on corrective actions may be required.

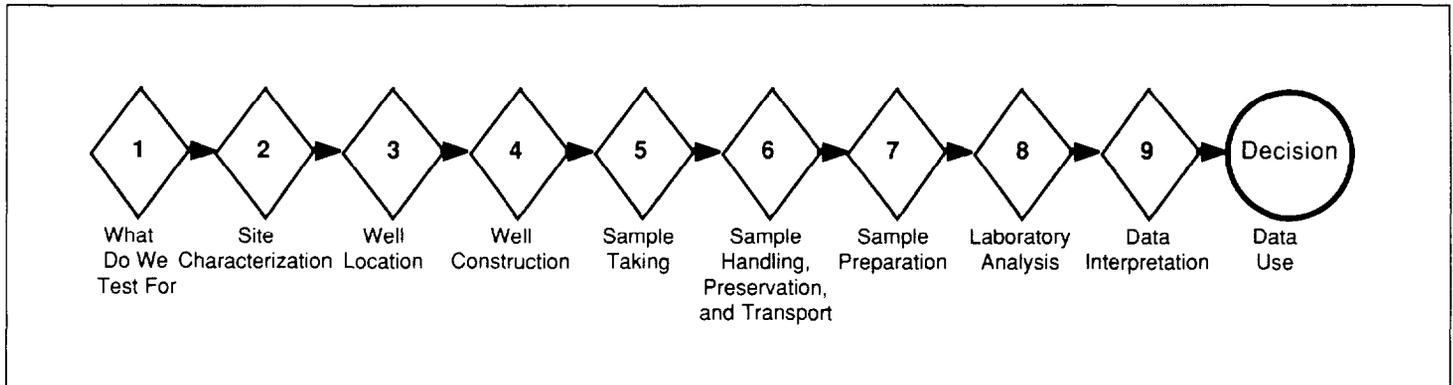
Figure 1.2: Cross Section of a Groundwater Monitoring Well



## Critical Steps in the Process for Obtaining Groundwater Monitoring Data

Nine critical steps should be taken in collecting groundwater monitoring data before the data should be used in making regulatory decisions. (See fig. 1.3.) GAO developed these nine steps in an effort to simplify and categorize the multitude of activities involved in collecting groundwater data. Although they are not a formal model, EPA officials agreed that these steps present a fair framework for discussing groundwater monitoring activities.

Figure 1.3: Critical Steps in the Process for Collecting Groundwater Monitoring Data



Within the nine-step process, EPA specifies which contaminants are to be tested for at facilities (step 1). However, it is the owner/operator who must design and install a groundwater monitoring system and periodically perform the appropriate groundwater sampling and analysis. For example, first the owner/operator must determine the flow rate and direction of groundwater underlying the facility (step 2). This allows the owner/operator to determine where appropriate monitoring wells should be located (step 3). After well locations are chosen, the wells must be properly installed using equipment and techniques that provide for groundwater samples to be taken without the well's design or construction adversely affecting samples (step 4). Sample taking (step 5) involves extracting groundwater samples from the well in a manner that does not compromise the integrity of the sample. Sample handling, preservation, and transport (step 6) are the procedures used to package, preserve, and move the sample from the facility to a testing laboratory, again stressing sample integrity. Once received at the laboratory, lab technicians prepare the sample for analysis (step 7). The sample is then analyzed to determine its chemical makeup (step 8). Once the results of the analysis have been obtained, the data from upgradient and

downgradient wells is compared to determine whether contamination is indicated or has increased in severity (step 9). Sample results are reported to EPA or authorized states so that permit, cleanup, and other regulatory decisions can be made.

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## EPA, State, and Owner/Operator Roles in Implementing the Groundwater Monitoring Program

EPA is responsible for establishing the groundwater monitoring requirements and ensuring that they are implemented. EPA also enforces compliance with program requirements in states not authorized by EPA to conduct their own hazardous waste program. EPA has authorized most states (42), however, to administer their own hazardous waste program. States receive authorization by demonstrating that their program requirements are equivalent to EPA's. Once authorized, a state assumes the responsibility of implementing program requirements, such as issuing permits to facilities, conducting inspections, and taking enforcement actions to ensure compliance with established groundwater monitoring requirements.

Owner/operators are responsible not only for installing monitoring systems and periodically providing groundwater information to EPA and/or authorized states but also, in cases of leakage in which the groundwater protection standard is exceeded, for assessing the extent of the problem and rectifying the environmental degradation caused by the facility. This may involve curtailing or preventing any further leakage and removing contaminants from the groundwater, a process referred to as corrective action. The facilities may also be required to cease operation and close. Decisions regarding the actions to be taken and the evaluation of their effectiveness are critically dependent on the groundwater information and analytical measurements supplied by the facility owner/operator. Therefore, the owner/operators' ability to obtain and maintain accurate, reliable data is very important to the accomplishment of EPA's program goals. EPA and the states also perform oversight monitoring of these facilities to ensure proper groundwater monitoring activities.

Facilities that were operating on or before November 19, 1980, are allowed, under RCRA interim status regulatory provisions, to continue operating until their application for an operating permit can be reviewed and approved or denied by EPA or the states. Facilities constructed after this date are to obtain a permit prior to construction. Interim status was designed to provide facilities with the opportunity to develop the data necessary to support a permit decision while continuing to operate. Normally, the groundwater monitoring requirements are much more stringent for facilities with permits than for facilities operating under

interim status requirements. Similarly, groundwater monitoring requirements for facilities that have closed are generally more stringent than interim status requirements in that these facilities must obtain post-closure permits.

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## Objectives, Scope, and Methodology

By letter dated March 7, 1986, the Subcommittee on Oversight and Investigations and the Subcommittee on Transportation, Tourism, and Hazardous Materials, both of the House Committee on Energy and Commerce, requested that we evaluate certain aspects of EPA's groundwater monitoring requirements applicable to hazardous waste disposal facilities regulated under RCRA.<sup>1</sup> One concern that the subcommittees centered on was the difficulties EPA and the states may be experiencing in obtaining usable groundwater data from owner/operators of land disposal facilities.<sup>2</sup>

In accordance with the request letter and subsequent discussions with the subcommittees' offices, we reviewed EPA, state, and owner/operator systems for collecting accurate, reliable, and useful groundwater data measurements at RCRA facilities. Specifically, our objectives were to determine

- whether users of RCRA groundwater data, such as EPA and state permit writers and enforcement officials, are having problems in obtaining and using needed groundwater monitoring data in fulfilling their regulatory responsibilities and, if so, why such problems are occurring; and
- the extent of any ongoing or planned actions to address these problems.

To accomplish these objectives and in accordance with agreements with the chairmen's offices, we performed work at EPA headquarters, two EPA regional offices, two authorized states, and three EPA laboratories. These locations are shown in table 1.1. At the EPA headquarters level, we also contacted officials of EPA's Hazardous Waste Groundwater Task Force. The task force was established in January 1985 to review the RCRA groundwater monitoring program; identify any significant groundwater

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<sup>1</sup>Prior to the 100th Congress, the Subcommittee on Transportation, Tourism, and Hazardous Materials was called the Subcommittee on Commerce, Transportation, and Tourism. The name was changed—but not the jurisdiction for environmental matters—by the 100th Congress. As agreed with the new subcommittee chairman's office, this report is also being addressed to Congressman James J. Florio, the prior subcommittee chairman.

<sup>2</sup>The Subcommittees also asked us to review EPA's proposal to delete certain chemicals from mandatory groundwater monitoring. We reported on this issue in *Hazardous Waste: Information on EPA's Proposal to Delete Chemicals From Groundwater Monitoring* (GAO/RCED-87-132FS, May 19, 1987).

management, technical, and compliance problems inhibiting the achievement of program goals; and make recommendations for improvements.

**Table 1.1: EPA Offices and States Included in GAO's Review**

<b>EPA headquarters</b>		
Office of Solid Waste and Emergency Response		
Office of Research and Development		
Office of Acid Deposition, Environmental Monitoring, and Quality Assurance		
Hazardous Waste Groundwater Task Force		
Office of Groundwater Protection		
<b>EPA regions</b>		
<b>Regional office</b>	<b>Laboratory</b>	<b>State</b>
EPA Region III, Philadelphia, PA	EPA Environmental Services Division Laboratories, Wheeling, WV and Annapolis, MD	Virginia
EPA Region IV, Atlanta, GA <sup>a</sup>	EPA Environmental Services Division Laboratory, Athens, GA	North Carolina

<sup>a</sup>We gave particular emphasis to region IV's handling of land disposal facilities in Alabama since this was the only state of the 14 states in the two regions in which EPA was fully responsible for the RCRA groundwater monitoring program—Alabama was a nonunauthorized state during the course of our review.

Our scope was limited to these locations because of EPA's recognition of problems in the groundwater monitoring program and the EPA Hazardous Waste Groundwater Task Force's assessment that RCRA groundwater monitoring problems are systemic in nature. According to EPA headquarters program officials, some of the most knowledgeable individuals responsible for overseeing the RCRA owner/operator groundwater monitoring program in the fields of hydrogeology, sampling, laboratory analysis, and quality assurance are located in the regions, laboratories, and states included in our review. As of October 9, 1987, the two regions we visited oversaw a total of 484 of the 1,671 identified land disposal facilities, or about 29 percent of the facilities nationwide.<sup>3</sup> Because our review focused on problems experienced by EPA and state regulatory officials, we did not solicit data from individual owner/operators of RCRA facilities.

<sup>3</sup>Under the 1984 RCRA amendments, hazardous waste land disposal facilities operating under interim status regulations were required to (1) certify compliance with RCRA groundwater monitoring and financial liability requirements and (2) apply for an operating permit by November 8, 1985, in order to continue operating. Facilities not meeting these requirements were to cease operating and close. On November 8, 1985, 543 of the 1,538 land disposal facilities nationwide took action to continue operating—995 indicated they would close. Since November 1985, these numbers have continually changed either because additional facilities decided to close, or additional facilities have been added to the universe that EPA was not aware of as of November 8, 1985.

To address the first objective, we interviewed RCRA program officials in the above regions, states, laboratories, and EPA headquarters offices to determine what problems, if any, they were having in obtaining and using groundwater information and the cause of any such problems. Using a structured interview format, we received input from selected EPA regional and state regulatory officials regarding (1) problems they had experienced in obtaining and using groundwater monitoring data, (2) why they believed such problems had occurred, and (3) their opinions on what actions should be taken to address these problems. Again, these individuals were identified to us by EPA regional and state environmental officials as being the most knowledgeable regulatory officials on groundwater monitoring issues in the EPA regional offices and states included in our review.

We also obtained and reviewed documents, where possible, describing such problems. We examined EPA regional and state files and records for 50, or 59 percent, of 85 land disposal facilities in Alabama, North Carolina, and Virginia. Our selection of facilities was coordinated with EPA and state officials to identify sites where (1) groundwater monitoring data had been required to be obtained for 1 or more years, (2) important environmental and human health protection decisions had been or would soon be made using owner/operator-developed groundwater monitoring data, and (3) if possible, one or more in-depth evaluations of the owner/operator's groundwater monitoring system adequacy had been independently performed.

To address the second objective, EPA's ongoing and planned actions to correct its groundwater problems, we interviewed EPA headquarters and regional program officials and obtained documents, where possible, describing (1) EPA's identification and recognition of program problems, (2) suggested remedies, including costs and milestones for completion, and (3) the status of actions as of September 1987, the end of our field work. We gave particular attention to the actions in response to the findings and recommendations of EPA's Hazardous Waste Groundwater Task Force. Where we identified other areas of concern, we inquired as to whether any of EPA's currently suggested remedies would correct or mitigate these areas of concern and, if not, what the agency proposed to do about them and when action might be forthcoming.

Our work was conducted from August 1986 through September 1987. For analytical purposes, we used EPA and state data reflecting the status of land disposal facilities during this time frame unless otherwise specified in the body of this report. Although we did not comprehensively

review EPA's system of internal controls over its groundwater monitoring program, we did review the EPA Administrator's fiscal year 1985 and 1986 Federal Managers' Financial Integrity Act reports for previously reported internal control weaknesses in the RCRA groundwater monitoring program. The views of EPA officials responsible for the RCRA groundwater monitoring program were sought during our review and are incorporated into the report where appropriate. However, as requested by the subcommittees' offices, we did not obtain official agency comments on a draft of this report. Except as noted above, we performed our review in accordance with generally accepted government auditing standards.

# EPA Has Experienced Delays in Achieving Its Groundwater Monitoring Goals

EPA has experienced delays in achieving its goal of being able to assess the groundwater conditions and prescribe necessary corrective actions to abate groundwater contamination at hazardous waste land disposal facilities. Originally, EPA believed that sufficient hydrogeological and groundwater data would exist to achieve this goal within 2 to 3 years of promulgating its initial groundwater regulatory requirements in 1980. According to EPA's agenda, once these assessments were completed and corrective actions identified, facilities would be issued operating permits, which would establish specific requirements and conditions that the facility would have to adhere to in order to continue operating as a land disposal facility. However, groundwater monitoring has turned out to be more technically complex and time consuming than EPA initially envisioned.

Our review of 50 land disposal facilities in EPA regions III and IV shows that EPA has not been able to achieve its original goals. We found that for 78 percent of the facilities reviewed, groundwater contaminant conditions had not been assessed to the extent necessary for EPA or state regulatory officials to issue or deny operating permits. EPA's national statistics reflect a similar status, as only about 34 percent of the facilities needing permits by November 1988 have had final decisions made on their permit applications. Our review of 7 issued permits of the 50 sites reviewed also indicates that permit issuance does not necessarily mean that groundwater assessments have been completed. For one of the seven facilities holding permits that we reviewed, basic groundwater data was missing at the time the operating permit was issued.

Delays in assessing groundwater conditions have delayed permit and cleanup actions. Past GAO reports and EPA studies have pinpointed owner/operator noncompliance with groundwater regulatory requirements as a factor adversely affecting groundwater program progress. This review indicates that a larger problem affecting program progress today is the lack of clarity and specificity regarding the type, amount, and quality of groundwater information needed from facility owner/operators to make permit and other regulatory decisions. Imprecise data requirements have resulted in groundwater monitoring data frequently being submitted to EPA and state regulatory officials that varies considerably in terms of completeness and quality. Rather than rely on this data, permit writers have generally required that additional groundwater information be collected and provided before making final permit decisions, often causing owner/operators to expand and upgrade their groundwater monitoring systems and gather additional data.

## Goals of the RCRA Groundwater Monitoring Program

EPA promulgated initial RCRA groundwater monitoring requirements in 1980 and, according to RCRA program managers, envisioned issuing permits to all land disposal facilities within 2 to 3 years after promulgating final regulations. EPA believed that by that time sufficient hydrogeological and monitoring information would exist for formal EPA or state review and approval of land disposal permits. Under the initial requirements, by November 1981 existing land disposal facility owner/operators were to have groundwater monitoring wells installed and begin collecting groundwater data while operating under interim status permits. This data was then to be used in formulating applications for formal operating permits. EPA and state permit staffs were to review this information as part of their evaluations of owner/operator permit application submissions and either issue or deny final permits.

EPA anticipated issuing final regulations governing permit issuance to and operation of land disposal facilities shortly after issuing the 1980 interim status regulations. However, because of the complexities involved in designing and installing groundwater monitoring systems, EPA was not able to issue the final regulations as soon as planned. This delay resulted in a court order under which EPA was directed to issue regulations by February 1, 1982. EPA issued the regulations on July 26, 1982, but indicated that the regulations were not as specific as the agency would like. EPA characterized the regulations as being performance-based and stated that at least an additional 18 months of effort would be required to make them more technically specific. EPA officials told us they had planned to work on the regulations to make them more specific, but, because of staffing constraints and other priorities, they were unable to revisit the regulations until 1986.

With the promulgation of the July 1982 regulations, EPA established three groundwater program goals for facilities to achieve prior to receiving permits.<sup>1</sup> These goals were to be pursued as expeditiously as possible in order to obtain a body of data to measure the impacts and trends that a facility's disposal operations might be having on the groundwater. The three goals were to

1. Determine whether the facility is leaking contaminants.
2. Assess the rate, extent, and magnitude of any leaks.

<sup>1</sup>The regulations established a three-stage program that facilities had to address prior to receiving a permit. Although not explicitly stated as such in the regulations, we have characterized the results of each of the three stages as program goals. EPA headquarters officials agreed that this is a reasonable and appropriate characterization.

3. Design any needed corrective action measures to abate groundwater contamination.

In connection with the corrective action goal, implementing and assessing the effectiveness of the chosen corrective measures was to be accomplished after the permit was issued and in accordance with the corrective action compliance schedule provided in the permits.

These same requirements also apply to facilities denied permits or those choosing not to continue operations as hazardous waste disposal facilities. Closing facilities, if not clean closed by removing all waste and contaminated soil, must apply for a post-closure permit describing, among other things, the corrective actions the facility owner/operator will take to abate any contamination present and to monitor the facility for leakage for up to 30 years. Thus, these same goals must be satisfied at all land disposal facilities that are unable to or do not desire to clean close. According to the former Head of EPA's Hazardous Waste Groundwater Task Force, closing facilities may be environmentally equivalent to, or possibly worse than, facilities applying for and receiving permits. We were told that owner/operators have, in many cases, decided that the cost to bring the facilities into full compliance with regulatory requirements in order to continue operating is more than the cost to close the facility. In addition, 770 of the initial 995 facilities that did not certify on November 8, 1985, did not certify because they could not meet interim status groundwater monitoring requirements described below.

Concerned with EPA's slowness in issuing permits to facilities and that facilities were not complying with interim status regulatory requirements, the Congress, in amending RCRA in 1984, mandated that all land disposal facilities, under threat of criminal sanctions, certify compliance with the basic interim status program requirements and apply for an operating permit by November 1985—and obtain a permit by November 1988. Other amendments to RCRA in 1984 expanded the groundwater monitoring regulatory requirements, which owner/operators of land disposal facilities had to address in their permit applications.

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## Delays in Achieving RCRA Groundwater Program Goals

The permit process has taken longer than EPA initially envisioned. Our review found that many owner/operators still have not determined whether their facilities are leaking; assessed the rate, extent, and magnitude of contaminant migration; or designed corrective actions—the three pre-permit goals EPA established for the groundwater monitoring program. Our review of information provided by EPA regional and state

**Chapter 2**  
**EPA Has Experienced Delays in Achieving Its**  
**Groundwater Monitoring Goals**

RCRA officials regarding the status of 50 land disposal facilities we reviewed in EPA regions III and IV showed that most facilities had not yet achieved EPA's three RCRA groundwater program goals needed to approve or deny operating permits or issue post-closure permits. For example, as shown in table 2.1, 6 of the 50 facilities we reviewed (about 12 percent) had not achieved the first groundwater program goal of determining whether contaminant leakage is occurring at the facility. Of the 39 facilities at which leakage had been confirmed (no leakage was found at 5 facilities), 31 had not achieved the second program goal of determining the rate, extent, and magnitude of contamination. Only 6 of the 39 facilities with confirmed leakage had met the third program goal of designing a corrective action plan. In total, 39 of the 50 facilities (78 percent) had not achieved the three goals of the groundwater monitoring program at the time of our review (the 6 facilities that had not met the first goal, plus the 31 facilities that had not met the second goal, plus the 2 facilities that had not met the third goal).

According to the EPA headquarters groundwater officials, accomplishing the third goal alone can easily take 6 to 12 months to complete. As we will discuss later in this chapter, on June 22, 1987, EPA amended its permit regulations to allow completion of the third groundwater goal to be performed after permit issuance.

**Table 2.1: Status of Facilities in Meeting Groundwater Monitoring Requirements for RCRA Permits**

	Alabama	North Carolina	Virginia	Total
<b>Total number of facilities</b>	<b>18</b>	<b>10</b>	<b>22</b>	<b>50</b>
<b>Goal no. 1: Determine if Contaminant Leakage Exists</b>				
Facilities not leaking	4	0	1	5
Facilities with confirmed leakage	13	9	17	39
Facilities yet to meet goal no. 1	1	1	4	6
<b>Goal no. 2: Determine Rate, Extent, and Magnitude of Contamination</b>				
Facilities with confirmed leakage	13	9	17	39
Facilities that have met goal no. 2	5	3	0	8
Facilities with leakage yet to meet goal no. 2	8	6	17	31
<b>Goal no. 3: Design a Corrective Action Plan</b>				
Facilities that have met goal no. 2	5	3	0	8
Facilities that have met goal no. 3	4	2	0	6
Facilities that have met goal no. 2 but have not met goal no. 3	1	1	0	2

Note: The status of these facilities was provided to us by EPA or state regulatory officials and reflects the conditions at the facilities during the period of March to June 1987.

EPA's national statistics as of October 1987 showed a similar status. For example, final action had been taken on only 109 of 324 facilities, or

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about 34 percent of those facilities desiring land disposal operating permits. Sixty-three facilities had received approval to operate in accordance with the permit conditions and 46 had permits denied. Regional distribution of the final decisions is shown in table 2.2.

**Table 2.2: Status of Actions on Operating Facility Permit Applications as of October 1987**

	EPA region										Total
	I	II	III	IV	V	VI	VII	VIII	IX	X	
Number of facilities	3	20	37	49	51	110	6	17	19	12	324
<b>Permit action complete</b>											
Permits issued	1	2	7	26	9	15	0	1	1	1	63
Permits denied	0	6	12	6	2	15	1	3	1	0	46
<b>Total</b>	<b>1</b>	<b>8</b>	<b>19</b>	<b>32</b>	<b>11</b>	<b>30</b>	<b>1</b>	<b>4</b>	<b>2</b>	<b>1</b>	<b>109</b>

Another 51 facilities were far enough along in the permit process to have their final permit (26) or notice of permit denial (25) under preparation. Of the approximately 1,170 closed or closing disposal facilities nationwide requiring post-closure permits, only 12 had been granted post-closure permits as of October 1987.<sup>2</sup> According to RCRA program officials, unanswered questions regarding groundwater conditions are the primary factors affecting permit decisions at many facilities.

The issuance of a permit, however, does not necessarily mean the facility has fully met EPA's established groundwater goals. For example, our review of the groundwater monitoring records for the seven facilities holding permits in our review indicated that one facility was issued a permit without satisfying the three groundwater program goals established in 1980. In this case, basic data needed to evaluate site conditions was missing. A discussion of this permit follows.

- One region IV land disposal facility's permit was approved without having an adequate upgradient, or background, monitoring well. The regulations require basic background groundwater data to be obtained prior to permit issuance. While this facility had installed what it believed to be a properly located background well, an inspection found that this well was in fact downgradient. Thus the groundwater information collected from this well could not be used in establishing the condition of the groundwater before it reached the facility. Region IV approved the facility's permit in September 1986 knowing that the background well was

<sup>2</sup>Of the approximately 1,350 closing facilities as of October 9, 1987, 179 had clean closed and thus did not require a post-closure permit.

inadequate. Under the conditions of the permit, basic background data was scheduled to be collected under a 10-week accelerated monitoring effort after permit issuance. Region IV officials pointed out that this facility is not as environmentally sensitive as many others, since it only operates a neutralization impoundment for acidic hazardous wastes. According to region IV records, however, this site has been showing evidence of groundwater contamination since May 1986.

According to the acting head of EPA's Hazardous Waste Groundwater Task Force, the task force has also found that, nationwide, facilities have made limited progress in accomplishing the RCRA groundwater monitoring goals. For example, he told us in May 1987 that most of the approximately 50 facilities the task force had evaluated had not collected sufficient groundwater information to make informed permit and corrective action decisions.

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## Delays in Meeting Groundwater Monitoring Goals Have Delayed Permit Activities and Corrective Actions

As discussed earlier, although EPA initially envisioned that permit decisions would be made on existing land disposal facilities during 1982 and 1983, relatively few facilities (about 34 percent) had been issued or denied operating permits as of October 1987. These delays in meeting the groundwater monitoring goals have also led to delays in permit actions and in initiating corrective actions at land disposal facilities. In view of these delays, EPA issued a Federal Register notice on June 22, 1987, deferring fulfillment of the third groundwater goal (designing an effective corrective action or cleanup plan) until after permit issuance. According to the Groundwater Section Chief, Special Wastes Branch, EPA recognizes that requiring all owner/operators to fully complete the third groundwater program goal before permit issuance could result in further permit delays and the possibility that many land disposal facilities may not have final actions taken on their permit applications by November 1988. According to the former Groundwater Task Force Head, the proposal recognizes the task force's findings, issued in January 1986, that the existing program has been seriously hampered by regulatory, technical, scientific, training, and administrative problems, many of which will not be remedied in time to significantly improve owner/operator data collection activities for the November 1988 deadline. With this change EPA program officials believe they will issue permits to the remaining facilities by the November 1988 deadline.<sup>3</sup>

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<sup>3</sup>EPA reported the need for improved procedures to implement the corrective action program as a material internal control weakness in the RCRA program in the agency's December 1985 and December 1986 Federal Managers' Financial Integrity Act reports to the President and the Congress.

The former head of the Groundwater Monitoring Task Force stated that, in his opinion, issuing permits to facilities without full information concerning their impact on groundwater conditions could be done since environmental benefits can be achieved beyond just a better groundwater monitoring system by going ahead with the issuance of site-specific permits to land disposal facilities. However, he said that in such cases, the public should be aware that it may not be receiving the degree of health protection it once thought it would by virtue of a land disposal permit being issued to a facility. He also noted that, in his opinion, permits may have to be reopened frequently during the first 5 years after issuance in order to require that individual facilities provide assurance of the appropriate level of health protection.

The EPA region III and region IV RCRA branch chiefs, and the directors of the North Carolina and Virginia hazardous waste programs generally agreed with the task force director's assessment of the situation. For example, the EPA region IV RCRA Branch Chief told us he would not want to see permit issuance slowed because land disposal facilities had not met the three goals. He emphasized, however, that compliance schedules should be incorporated into each permit. For example, permits can include specific requirements for owner/operators that are not covered in the existing interim status regulations. Facility-specific permit requirements are more easily enforceable than requirements in the interim status regulations. In his opinion these site-specific permits are still tremendous improvements in environmental protection. He said that permits may have to be reopened at a later date, which is an additional operational and administrative cost that he recognizes EPA regions and states will have to bear. In his opinion, the environmental benefits and easier enforcement will far outweigh these costs. He did recognize that further delays in meeting these goals produces similar delays in corrective actions during which time contamination may be spreading and increasing eventual cleanup costs.

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## Reasons for Delays in Achieving Groundwater Monitoring Goals

In the opinion of EPA program managers, there are several reasons for the delays that have occurred in achieving EPA's groundwater monitoring program goals. One of these is owner/operator noncompliance with RCRA groundwater monitoring regulatory requirements. This problem has been the subject of several EPA and GAO reports. An EPA study issued to OMB in 1984 indicated that many facilities were not in compliance with the RCRA groundwater monitoring requirements. For example, EPA reported in October 1984 that at least 9 percent of the facilities nationwide had no groundwater wells and that of those evaluated with wells,

about 45 percent had not yet installed adequate monitoring well systems. In our 1983 and 1984 reports on inspection, enforcement, and permit activities, we also stated that many facilities were not in full compliance with groundwater monitoring requirements.<sup>4</sup> In our review we found evidence that this problem has continued to frustrate EPA and state efforts to get groundwater information from owner/operators of land disposal facilities. An example of this problem follows:

- A creosote/coal tar wood preserving facility included in our review in EPA region III operated a 220,000-gallon surface impoundment under interim status from November 1980 to November 1985, at which time its interim status was terminated for failure to certify compliance with RCRA's financial responsibility requirements. An estimated 1,000 to 3,000 people living within a 3-mile radius of the facility use groundwater for drinking purposes. Local groundwater has been contaminated by the facility, which has two shallow aquifer contaminant plumes and has also contaminated a deeper aquifer. Phenols, lead, benzene, arsenic, benzol (a) pyrone, and benzol (a) anthracene—which, according to EPA, are highly suspected of causing cancer and other serious health effects—are among the contaminants found in the groundwater affected by this facility. Although EPA requested the facility's permit application in October 1983, the site never completed the three program goals necessary to issue a permit. EPA made two attempts to get information from this site during the following 2 years but was unsuccessful. For example, EPA requested a second permit application in late 1984, which, when submitted, was judged by EPA to be "grossly deficient." The facility subsequently filed for bankruptcy in March 1985. The facility's permit was officially denied in September 1986 and the site was referred to the Superfund program for investigation.<sup>5</sup> This site was investigated by the Superfund program, which confirmed on-site contamination but determined that the contamination had not yet reached the local population. The site has subsequently been placed on the Superfund high-priority cleanup list.

Another problem, which will be discussed in chapter 3, stems from the fact that EPA has relied on performance-based regulatory requirements to guide owner/operators in installing groundwater monitoring systems

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<sup>4</sup>Interim Report on Inspection, Enforcement, and Permitting Activities at Hazardous Waste Facilities (GAO/RCED-83-241, Sept. 21, 1983) and Inspection, Enforcement, and Permitting Activities at New Jersey and Tennessee Hazardous Waste Facilities (GAO/RCED-84-7, June 22, 1984).

<sup>5</sup>The 1980 Comprehensive Environmental Response, Compensation and Liability Act—known as Superfund—provides for the cleanup of old, abandoned, and uncontrolled waste sites that exist as a result of past inadequate waste management practices.

and in collecting groundwater information. The lack of clarity and specificity regarding the type, amount, and quality of information needed by permit writers and enforcement officials to make regulatory decisions has allowed owner/operators considerable latitude in determining the groundwater information to be collected and how it will be collected. As a result, in many cases, owner/operators often have not provided EPA and state regulatory officials with sufficient groundwater information to make permit and other regulatory decisions. As will be discussed in chapter 3, EPA needs to establish data quality objectives specifying the type, amount, and quality of data needed to make permit and corrective action decisions. Data quality objectives, as defined by EPA, is a broad term that includes more than just the quality aspects of information or data. In EPA's definition, the establishment of data quality objectives begins with regulatory decisionmakers at both the headquarters and regional levels identifying the specific technical information, or data, needed for making decisions. Once the type of information needed is established, the decisionmakers are tasked with determining (1) how much data will be needed and (2) what the quality of that data must be in order to make and support regulatory decisions. Thus, the term "data quality objectives," in EPA's definition, is a statement specifying the type, amount, and quality of information needed for decision-making.

Another problem, which is tied to the establishment of data quality objectives, is that EPA has not promulgated specific technical regulatory requirements that owner/operators must adhere to in installing groundwater monitoring systems, collecting and analyzing groundwater samples, and reporting on groundwater conditions. For example, EPA has not specified the types of materials that are acceptable for constructing monitoring wells, the sample collection and test methods that are acceptable for taking and analyzing groundwater samples, or the records—such as well boring logs—that must be kept to document the construction and operation of a groundwater monitoring system.

Finally, EPA has not established a quality assurance/quality control system to ensure that information being provided by owner/operators is reliable for permit and other regulatory decision-making. The latter three problems are linked to a much broader program deficiency, which is the fact that EPA has not established a system of internal controls necessary to ensure that the data collected and reported by owner/operators is accurate and reliable. Protracted delays in obtaining groundwater information sufficient to support regulatory decisions have been the

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result of this program shortfall. These problems, except for owner/operator reluctance to comply with regulatory requirements, are discussed in more detail in chapter 3.

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## **Conclusions**

EPA has been delayed in meeting its groundwater monitoring goals for hazardous waste land disposal facilities. As a result, decisions regarding facility permits and corrective actions have been delayed—decisions that are designed to enhance human health and environmental protection from contaminated groundwater supplies. Owner/operator noncompliance has been a major factor in the past that has contributed to these delays. A larger and more significant factor today appears to be a lack of specificity and clarity regarding the groundwater data needed by EPA and state RCRA officials for making permit and regulatory decisions. As a result, many owner/operators generally have not produced sufficient data of a known and acceptable quality for EPA's decision-making purposes. Long-term remedies to alleviate this problem will depend on the establishment of more explicitly defined data quality objectives and more specific regulatory requirements governing the installation, operation, and recordkeeping for groundwater monitoring systems. Additionally, EPA will need to establish quality assurance/quality control mechanisms for the RCRA groundwater monitoring program. Chapter 3 discusses EPA's efforts to make improvements in these areas.

# Data Quality Objectives, Specific Standards, and Quality Assurance/Quality Control Mechanisms Would Help Achieve Groundwater Monitoring Goals

Originally, RCRA program officials believed that owner/operators would ensure that adequate groundwater monitoring systems would be installed at their facilities and that adequate groundwater information would be gathered to support regulatory decisions. However, as noted in chapter 2, this has not always occurred because EPA has not (1) established data quality objectives specifying the types, amount, and quality of groundwater information needed by EPA and state regulatory officials for making permit and corrective action decisions, (2) established a complete set of specific regulatory standards and requirements for owner/operators to adhere to in designing and installing monitoring systems, in collecting and analyzing groundwater samples, and in reporting on groundwater conditions, or (3) implemented comprehensive quality assurance/quality control mechanisms to ensure that owner/operator-supplied data fairly represents groundwater conditions. In our opinion, these deficiencies are illustrative of a more basic problem, which is that EPA has not instituted an adequate system of internal controls over the RCRA groundwater monitoring program. As a result, owner/operators of land disposal facilities have had considerable latitude in designing and installing groundwater monitoring systems, collecting groundwater samples, and selecting the testing methodologies to determine which contaminants, if any, might be in the groundwater. This latitude, in many cases, has meant that EPA and state permit writers have not been provided sufficient information on which to base their regulatory decisions.

Permit writers have attempted to obtain additional data from owner/operators but often have experienced delays in getting more information. Absent specific regulatory requirements and given the uncertainties and differences of opinion between decisionmakers and owner/operators regarding data needed to fully support a permit decision, owner/operators have sometimes been reluctant to collect and provide additional information, which is often costly to obtain. Lengthy, protracted negotiations are usually required in such cases to get needed information. In some cases, threat of or actual enforcement actions have been required to get information. The additional time for owner/operators to obtain needed data has slowed permit decisions and corrective actions thereby posing potential adverse public health and environmental impacts.

EPA has a number of efforts underway to improve the RCRA groundwater monitoring program. A November 1986 memorandum from EPA's Deputy Administrator emphasized that data quality objectives and quality assurance/quality control mechanisms need to be established. To examine this issue, EPA has established a work group, which produced an

options paper in early 1987 outlining different strategies for achieving this goal. In addition, the April 1986 EPA Groundwater Task Force Report recommending the promulgation of specific technical standards and requirements has already resulted in two Federal Register notices, with promises of more.

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## **Importance of Data Quality Objectives, Specific Standards, and Quality Assurance/Quality Control Mechanisms**

Obtaining a representative sample of the groundwater underlying a hazardous waste facility and a comprehensive analysis of the chemicals present in the sample are fundamental objectives of any groundwater monitoring program. Obtaining perfect information, however, is costly and nearly impossible to obtain. In most cases, less than perfect information is adequate for making certain regulatory decisions. According to EPA's Quality Assurance Management Staff (QAMS) Director, three generic, interrelated components are critical to the success of any significant compliance monitoring program, including EPA's groundwater monitoring program:

1. Objectives for the type, amount, and quality of data needed for decision-making purposes (called data quality objectives by EPA) should first be specified by agency regulatory officials since this is the baseline for defining needed measurements and against which all other actions are measured.
2. Once these objectives are established, specific standards and requirements need to be developed which translate and communicate the objectives for data type, amount, and quality to the individuals responsible for collecting the data—in this case, the regulated community.
3. Once objectives are established and clearly communicated to the regulated community in terms of specific standards and requirements, quality assurance and quality control mechanisms need to be implemented, which ensure that the type, amount, and quality of data actually collected by the regulated community is correct, sufficient, and acceptable for decision-making.

According to the QAMS Director, all three components are necessary to the smooth functioning of an environmental data collection program such as EPA's groundwater monitoring program. For example, he said that establishing objectives for data type, amount, and quality is of little benefit if those responsible for its collection and analysis do not understand specifically what is expected from them. Each of these three

important components of a smoothly functioning environmental data collection program will be discussed further.

According to the director, the specification of data type, amount, and quality depends on the decisionmaker's judgment of the risk of making an incorrect decision. The decisionmaker needs to balance the time and resources he/she is willing to commit to data collection design and implementation against the uncertainty he/she is willing to accept in the resulting data. Data quality objectives development thus can be quick or can take a significant amount of time and effort depending on the data quality needed and the consequences of a decision based on incorrect data. Data quality objectives development is an interactive process for consciously balancing costs, risks, resources, time, and other factors against the decision needed to ensure environmental protection. Most importantly, minimum acceptable levels of data need to be established in terms of the type, amount, and quality needed for decision-making.

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## **Requirements for Data Quality Objectives**

In a 1979 memorandum the EPA Administrator required that data needs and data quality goals be established for all EPA regulatory programs. As a result of this action, QAMS was established in 1980 to ensure that the Administrator's mandate was implemented. Specifically, QAMS was charged with ensuring that all environmentally collected data used in regulatory decisions would be of known quality, well documented, and acceptable for the decision to be made. In April 1984 the requirement to establish data quality objectives was further institutionalized through the issuance of EPA Order 5360.1.

In EPA, the establishment of data quality objectives involves a process whereby the users of groundwater data—those permit writers and enforcement officials actually charged with reviewing owner/operator-supplied data and making regulatory decisions—are involved in identifying the types, amounts, and quality of information needed to make such decisions. Consequently, as noted in chapter 2, the term data quality objectives means more than just an expression of the quality attributes that data must possess before they are acceptable for regulatory decisions.

EPA Order 5360.1 is more specific in discussing the quality aspects of information needed for regulatory decisions than its treatment of type and quantity requirements for information. For example, in terms of quality, the order requires that specific information on the following

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five data quality attributes be known before information is used for regulatory decisions:

- precision,
- accuracy,
- representativeness,
- completeness, and
- comparability.

According to the QAMS Director, all of the attributes are interrelated with each affecting the others. Each is individually important, however, in assessing the usefulness of information for the decision at hand. For example, since perfect measurements are rarely possible, precision refers to the degree of variability experienced in collecting and analyzing a sample. For decision-making, EPA may need a particular groundwater constituent measured at the 1-part-per-million concentration level with an allowable error of plus or minus 0.5 parts per million. The allowable error in this instance represents the data quality objective for the precision parameter. Samples collected with an error of 0.6 or more parts per million, in this case, would not meet EPA's needs for decision-making purposes. Precision is often expressed as the percentage of variability that can be tolerated, such as plus or minus 20 percent.

Again, EPA's concept of data quality objectives stresses the importance of collecting data in relation to the decision to be made. For example, determining the answer to the question of leaking allows considerable variability in measurement exactness, according to officials we contacted. On the other hand, determining the full horizontal and vertical extent of contaminant movement requires much more exact measurements if corrective actions based on these data readings are to be effectively evaluated. Additional details on the five parameters EPA uses to define the quality attributes of information, according to the QAMS Director, are presented in table 3.1.

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**Table 3.1: Five Attributes That Define the Quality of Environmental Data**

Attribute	Definition
Precision	Precision is the average amount of variability experienced in collecting and analyzing a sample, sometimes expressed as a relative standard deviation, such as plus or minus 20 percent. The lower the percentage, the more precise the data. Currently, laboratory analytical precision is much easier to control and quantify than sampling precision, which is often unique to each site. Laboratory conditions have been highly controlled for years, whereas groundwater sampling methods and practices still vary considerably from one site to another, and from one sampler to another. For example, decisions regarding filtering of samples, size of filter screens used, method of bailing the well, choice of bailing equipment, weather conditions, sampling technique, and a host of other factors can affect the sampling precision.
Accuracy	Accuracy refers to the amount of bias that a sample may be exposed to during sample taking and laboratory analysis. For example, an improperly calibrated piece of testing equipment may bias the sample analysis. Similarly, the equipment used in taking samples can also introduce bias into the sample. For example, the container used to store a sample prior to laboratory analysis can absorb 5 percent of the constituents present in the container, thus rendering or biasing the resultant readings by 5 percent—in other words, samples stored in these containers would typically show readings 5 percent below their true value. In establishing data quality objectives, minimum quantitative accuracy standards would be specified.
Representativeness	Representativeness involves a qualitative assessment as to whether a sample fairly represents the groundwater underlying a facility. Factors that could affect representativeness are the proximity of the monitoring well to the land disposal facility, the methods used to extract the sample, and the physical and climatic conditions that may be present at the time the sample is taken. Data quality objectives would specify the factors that must be addressed in determining that the sample taken is representative of the groundwater at the facility.
Completeness	Completeness refers to the number of samples that must be taken and analyzed before a confident judgment can be made that the groundwater conditions at a facility have been adequately assessed. For example, if 8 of 10 samples yield the same information, this may be an adequate number of readings to say that a reliable profile of the groundwater conditions underlying a facility at a particular time have been established.
Comparability	Comparability is the ability to fairly compare sample test results taken from the same facility at different times. For example, for results to be comparable, the sample-taking and testing processes must be comparable. Using different sampling and testing equipment or methodologies in subsequent groundwater analyses could result in an inability to make such comparisons. Data quality objectives would state the objectives for conditions that must be adhered to in collecting and analyzing samples to ensure acceptable comparisons.

According to QAMS guidance, these five attributes are essential to knowing the quality of the data reported. Without these five attributes,

according to the EPA order, data is of unknown quality, and decisions made using such data may not be supportable, defensible, or correct.

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Specific Standards and  
Quality Assurance/  
Quality Control  
Mechanisms Follow Data  
Quality Objectives

As noted previously, specific standards and quality assurance/quality control mechanisms are critical, interrelated components, which are tied to the type, amount, and quality of data that should be used for decision-making. According to the QAMS Director, until data quality objectives are established specifying baselines for the type, amount, and quality of data needed, it will not be possible to judge the adequacy of existing or proposed technical standards or the reasonableness of EPA's efforts toward establishing quality assurance/quality control mechanisms.

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EPA Has Not Yet  
Developed  
Groundwater Data  
Quality Objectives

EPA's Office of Solid Waste (OSW) has yet to establish data quality objectives for the RCRA groundwater monitoring program. According to the OSW Quality Assurance Officer, the Administrator's 1979 memorandum, the 1980 initiatives of the QAMS, and the 1984 EPA order on data quality have not been emphasized within the RCRA program until recently. We were told that no one at the program level was specifically assigned this responsibility until 1985. Although aware of the need for adequate, comprehensive, and quality data for making groundwater monitoring regulatory decisions, EPA did not implement a regulatory system that would provide this data. Instead, EPA developed a set of performance-based, self-implementing regulations in which it assumed that owner/operators, as part of their implementation of the groundwater monitoring regulations, would provide the right data, in sufficient quantities and of an acceptable quality, for making these decisions.

To the contrary, our review found that many owner/operators had not provided sufficient data for regulatory decision-making. As noted in chapter 2, on the basis of information obtained from permit writers we contacted in EPA regions III and IV, few—only 11 of the 50 sites we reviewed—had submitted sufficient information on which to base regulatory decisions. The EPA order on data quality objectives requires that all data be of known quality and states that the quality of data is known when all components associated with its derivation are thoroughly documented. Our review of the data submitted for the 50 facilities in our review showed that no such documentation existed in the files. This included seven facilities holding permits. Regional program officials told us that permit writers were doing their best to get reliable data with the regulatory tools available to them, but also emphasized that EPA's

absence of specific technical requirements and quality assurance/quality control mechanisms that would flow out of data quality objectives. We discussed the problems and our analysis with the QAMS Director and OSW officials charged with developing data quality objectives, drafting technical requirements, and establishing quality assurance/quality control mechanisms, and they agreed with our analysis.

According to one state permit writer in region III, the lack of data quality objectives has led to a lack of specificity in the regulations and has forced permit writers to negotiate with facilities to get the basic data they see as needed to issue a permit to a facility. The fact that these needs have not been established has resulted in protracted and lengthy negotiations with owner/operators, sometimes traversing years, according to the permit writer. The following examples are illustrative of the problems being experienced by permit writers in the two EPA regions we reviewed.

- One region III facility installed 76 monitoring wells in the fall of 1985 without maintaining any drilling logs showing geologic conditions encountered during the well drilling process, an integral component of site characterization. The permit writer for this facility told us that if data from these wells was to be used and trusted, in addition to the drilling logs, soil samples at 5-foot intervals needed to be laboratory analyzed; detailed records of drilling procedures, equipment, and supplies kept; and the entire process overseen and certified by a professional soils engineer or qualified hydrogeologist. Currently, no federal regulations require that these practices be followed or that such information be collected, retained, and reported to EPA. Discovered by the state in November 1986, this facility is being required to drill additional bore holes close to the 76 monitoring wells to establish the geologic conditions at the facility. According to the Virginia Hazardous Waste Director, the exact number of bore holes that will be required will be dependent on the data obtained during the drillings. He said the drillings are to be completed by December 1987. Initial estimates were that between 3 and 19 bore holes would have to be drilled. According to the permit writer, this was a compromise to avoid completely losing all the data from these wells; nonetheless, it had delayed their permit activity efforts by more than a year.
- Similarly, one region IV facility had data quality problems due to poor well construction. For more than 2 years, this facility, which had used local dirt instead of cement grout or bentonite slurry to seal the space around the well, claimed that no groundwater contamination had

groundwater monitoring regulations were developed without the data quality objectives order in mind. As such, inadequate regulatory tools have been available to them to get good data.

It should be pointed out that owner/operators may have had data that met the five attributes of the order, but the files lacked any documentation to that effect. Furthermore, EPA and state permit writers and enforcement officials stated that they had never been tasked with evaluating the quality of owner/operator-supplied groundwater data in accordance with the EPA order. Of the 33 EPA or state regulatory officials we interviewed concerning the order, 27 were unaware of the requirements that precision, accuracy, representativeness, completeness, and comparability of RCRA groundwater data be known, well documented, and acceptable for the decision to be made. Most regulatory officials we talked with stated that they looked only for aberrations in owner/operator-supplied data and that the groundwater monitoring regulations did not require owner/operators to collect or maintain the information necessary to make these determinations. Our review of EPA's RCRA Permit Writer's Guidance Manual, used by EPA and state permit writers nationwide as the primary evaluation tool for evaluating RCRA permit applications, confirmed that these individuals had not been tasked with evaluating data quality in accordance with the EPA order.

Another factor pointed out to us as affecting EPA's efforts to develop more specific regulatory guidance was a 1981 court order requiring the agency to issue regulations for land disposal facility groundwater monitoring by February 1, 1982—at least 18 months ahead of EPA's planned issuance schedule. This action was directed because of concerns that EPA was not moving quickly enough in promulgating regulations in this area. EPA generally met the deadline but in issuing the regulations stated that the regulations were not as specific as desired and that further efforts would be forthcoming to make them more specific. According to agency officials, because of other program priorities, EPA was unable to revisit these regulations until 1986.

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## Impact of Designing a Program Without Data Quality Objectives

Forty-four of the 50 RCRA program managers, permit writers, and enforcement officials we contacted during our review told us that they have experienced problems in using owner/operator-supplied groundwater data in making permit and other decisions. Our analysis of the problems these officials had experienced indicated that the problems were directly related to the absence of data quality objectives, or the

occurred. EPA regulations specify only minimal standards for well construction. In August 1985 EPA issued an order against this site, requiring, among other things, that at least six new wells be installed and that the wells be properly sealed. Groundwater contamination was subsequently confirmed at this facility, but years of data on specific harmful constituents had been delayed.

Several state officials in region IV told us of difficulties they had experienced in getting usable groundwater data because of sampling errors. EPA regulations do not prescribe acceptable sample collection practices. The supervisor of the hazardous waste compliance unit in one state in region IV noted that these facilities had "experienced what seems like every possible error that could be made in collecting samples." Sampling errors he noted included

- holding volatile organic samples in unrefrigerated mason jars for several weeks prior to analysis;
- using the same sampling equipment at all facility wells without any cleaning, rinsing, or decontamination of the equipment between wells;
- leaving a headspace in containers when collecting and/or storing groundwater samples thereby allowing volatile organic constituents to escape the sample prior to analysis;
- collecting organic samples in a plastic bucket while in the field, then later transferring these samples to approved, clean, glass containers; and
- using the same gloves for groundwater sampling that were previously used for mixing chemicals at the facility's wastewater treatment plant.

These problems, according to the hazardous waste compliance unit supervisor, were generally discovered during comprehensive groundwater monitoring inspections which, according to current EPA guidance, are to be performed once every 3 years. In the interim, he pointed out, any data collected under these conditions were probably not usable for permit or enforcement decisions.

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## EPA Initiatives to Correct Program Deficiencies

EPA has a number of efforts underway to improve the RCRA groundwater monitoring program. However, these improvements will probably not be completed in time to substantially improve data collection activities before the November 1988 land disposal facility permit deadline. Of the areas of program improvement, the establishment of data quality objectives delineating the type, amount, and quality of data required to make sound, defensible decisions seems to be the most important. Program

officials at the headquarters level told us that these objectives would dictate (1) the establishment of specific technical standards and requirements for owner/operators to adhere to in designing and constructing monitoring systems, collecting and analyzing groundwater samples, and reporting information to regulatory officials and (2) the extent of quality assurance/quality control mechanisms necessary to reasonably ensure that owner/operator data is appropriate for regulatory decision-making.

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### **Responses to Hazardous Waste Groundwater Task Force Recommendations**

As noted in chapter 2, in January 1986 EPA's Groundwater Task Force made a number of recommendations to improve the groundwater monitoring program. The task force identified five areas of concern in the program, as follows:

- Guidance documents are deficient and do not satisfy the information needs of owner/operators or EPA and state regulatory officials.
- Agency personnel have not been adequately trained to implement the program.
- Gaps in groundwater monitoring technology hinder program progress.
- Regulations need to be revised to facilitate program implementation and prevent dysfunctions.
- EPA organization and administrative problems impede implementation.

The task force made a number of specific recommendations to the EPA Assistant Administrator of the Office of Solid Waste and Emergency Response aimed at correcting identified problems in each of the above areas. The Assistant Administrator has taken action to implement a number of the recommendations; however, action on some recommendations has been deferred. (A list of the task force's specific recommendations and the status of activity in response to those recommendations is shown in app. I.) As we will explain later in this chapter, we did not evaluate the merits of each of the task force's recommendations because, in our view, the appropriateness of each recommendation would have to be judged against the data quality objectives for the groundwater monitoring program, which have not been established.

Three specific initiatives that have resulted from the task force's findings are aimed at (1) developing and providing specific technical guidance to EPA and state permit writers as to the types and amounts of information that should be considered in making permit decisions, including factors that could affect the quality of the data being provided by owner/operators, (2) initiating a training program for permit writers,

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and (3) promulgating specific technical requirements in the RCRA regulations. The first two initiatives focus primarily on improving the quality and consistency of groundwater permit decisions being made by EPA and state regulatory officials. The latter effort will affect owner/operators more directly.

With regard to the development of better guidance, a region IV RCRA official told us that the RCRA technical enforcement guidance document, which was finalized in September 1986, represents the first definitive guidance available to RCRA regulatory officials on how to evaluate groundwater monitoring systems. The document is specific in describing how a groundwater monitoring system should be designed and constructed, how groundwater samples should be taken and protected prior to laboratory analysis, how analytical test results should be evaluated, and the records and information needed from owner/operators to substantiate the integrity of their groundwater monitoring systems. The EPA region III RCRA Enforcement Section Chief noted that, in his opinion, more facilities would be closer to achieving EPA's groundwater program goals had EPA taken the time earlier to develop adequate guidance such as this, make it enforceable by promulgating it as a regulatory requirement, and then provide or require programmatic training on the document for owners and operators and others involved in groundwater monitoring. According to EPA region IV officials, such guidance should have been available for owner/operators, permit writers, and inspection staff from the beginning of the groundwater monitoring program.

This 1986 guidance, however, places no mandatory requirements on owner/operators to provide any additional information beyond what they now are required to include in their permit applications. Thus, while the guidance manual may be helpful to those doing the regulating, it is not enforceable and does not necessarily ensure that better groundwater information will be forthcoming from owner/operators. Indirectly, one benefit may be that owner/operators will now know more precisely what information EPA and states will be looking for in permit applications prior to making regulatory decisions. Given this information, owner/operators who are serious about continuing to operate may voluntarily provide the full complement of data needed for making these decisions.

In concert with the development of the technical enforcement guidance document, EPA has also developed a training program to explain this new guidance and how it is to be used in reviewing permits. RCRA program managers believed that getting well trained EPA and state staffs is the

best short-term improvement that can be made to the RCRA groundwater monitoring program. However, the focus of this training initiative is on permit writers and regulatory officials and does not affect owner/operators of land disposal facilities. We were told that owner/operators are often not proficient in installing groundwater systems and implementing sampling and analysis programs and also are in need of training. For example, over one half of the people we interviewed said that the lack of owner/operator skills was a basic problem in the RCRA groundwater monitoring program.

We were told that, over time, EPA will promulgate regulations that will impose new requirements on owner/operators regarding the type, amount, and quality of data they will be required to provide to regulatory officials. For example, on July 9, 1987, EPA promulgated new regulations specifying 222 chemical constituents that must be checked for in the groundwater at leaking hazardous waste land disposal facilities. The regulations recommended detection levels for which each of the chemicals should be tested and suggested analytical testing methods appropriate for each constituent. Other regulations are under development that will clarify and state explicitly the information to be supplied by owner/operators.

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**Quality Assurance/Quality  
Control Mechanisms  
Planned**

In addition to improving guidance documents, providing training for RCRA regulatory officials, and implementing more specific regulatory requirements, RCRA managers at EPA headquarters appear to be placing more management emphasis on quality assurance/quality control mechanisms to ensure that collected groundwater data is accurate and reliable. For example, partly in response to an EPA Deputy Administrator's memorandum dated November 1986, which reemphasized the need for environmental decisions to be supported by quality data, the Director, OSW, required that an options paper be developed detailing various strategies for ensuring the appropriateness and quality of RCRA groundwater information. This initiative addressed both the need for data quality objectives and effective quality assurance/quality control mechanisms. A quality assurance/quality control program, according to the options paper, ensures that data gathered in support of a regulatory program is of known quality, reliable, and sufficient for the decision to be made. For example, one method of checking on the analytical results of sample analyses would be for EPA officials to be present at the time a sample is taken from a groundwater monitoring well, split the sample with the owner/operator, and perform an independent laboratory analysis of the sample. EPA's analytical results would then be compared against that of

the owner/operator's laboratory to see if the analytical results were the same.

The cost estimated in the options paper for improving groundwater monitoring data, which, according to the group conducting the study, addressed all the important RCRA groundwater data needs but did not do a complete job in many areas, was \$3.25 million. A lesser option that would address critical problems was estimated to cost about \$1.7 million annually. The options paper reflected a summary cost for all recommended initiatives and thus did not break out the costs for recommended improvements in the quality assurance/quality control area. According to EPA officials, the options developed by the work group were presented to the Director, OSW, with the recommendation that the \$1.7 million option be adopted. According to the OSW officials, the decision was made to fund the program in fiscal year 1988 at a much lower level—approximately \$270,000—with the quality assurance/quality control parts of the plans being allocated about \$130,000. Agency officials told us that budgetary considerations were a major factor leading to the lower funding level. The quality assurance officer said that this is a substantial increase in funding emphasis, however, considering this effort had been unfunded in the past. Yet, this amount could be a dramatically low figure once data quality objectives are established. EPA headquarters officials stressed that they are putting a lot of money into research to develop better monitoring system designs and sampling procedures and hope that in the long run this will help them to establish better technical standards and requirements and better quality controls over owner/operators.

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## **Development of Data Quality Objectives**

EPA's initiatives to improve the RCRA groundwater monitoring program are commendable. Program managers have demonstrated an awareness of program problems, concern for their impact on program goals, and a desire to make improvements. However, without data quality objectives, these actions may go too far, adding costly additional requirements, or not far enough. As such, we are concerned that EPA's OSW may not be placing enough emphasis on the development of explicit objectives for the type, amount, and quality of data truly needed for short- and long-term regulatory decision-making before going ahead with major training initiatives and regulatory requirements.

As noted earlier, in November 1986 the EPA Deputy Administrator issued a memorandum reiterating the importance and need for quality information to support the agency's regulatory programs. In response to

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this memorandum, RCRA program officials at EPA headquarters have now established a work group to address this issue—which is a positive indication that EPA is committed to developing data quality objectives for the RCRA groundwater monitoring program. This effort is just beginning and, we were told, could be difficult to complete because of (1) the complexity of the program, (2) the many different short- and long-term decisions that will be made using groundwater data, and (3) the fact that scientific advances in laboratory precision and accuracy have not been paralleled in well system design, construction, and sampling aspects of the groundwater program. However, according to the OSW Quality Assurance Officer, they plan to have data quality objectives established by the end of fiscal year 1988. They do recognize that these will be interim objectives, which will be adjusted and improved over the next few years.

As discussed in the preceding section of this chapter, the development of data quality objectives for the RCRA groundwater monitoring program was included in the options paper presented to the OSW Director in early 1987 and in the \$1.7 million proposal setting forth recommended initiatives in the RCRA groundwater area. As with quality assurance/quality control initiatives, no specific costs were shown exclusively for data quality objective activities in the options paper. Of the \$270,000 budgeted for work in the RCRA groundwater monitoring area in fiscal year 1988, approximately \$140,000 is for data quality objectives development and training. No funds had been budgeted in the past for the actual development of data quality objectives. Once established, additional time will be required to institutionalize specific owner/operator technical and informational requirements derived from these objectives through the regulatory process.

In addition to being funded at a lower level than recommended by the options paper study group, OSW has also placed data quality objective work efforts, and efforts directed toward improvements in quality assurance/quality control mechanisms, in the third level of three levels of OSW project priorities. According to a senior OSW official, groundwater monitoring efforts are important but other RCRA activities—such as projects designed to support EPA decisions in implementing the land ban disposal provisions contained in the 1984 RCRA amendments—are of higher priority now.

While we are not in a position to make judgments on the relative priorities among EPA activities, we believe that EPA needs to vigorously pursue

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the establishment of data quality objectives for its groundwater monitoring program in order to have a baseline against which its efforts to develop regulatory requirements, guidance, training, and quality assurance/quality control mechanisms can be judged. Without established objectives, neither EPA nor we can judge the appropriateness of EPA's ongoing or planned actions in these or other program areas. As noted above, on July 9, 1987, EPA promulgated regulations requiring that 222 chemical constituents be tested for in the groundwater at leaking land disposal facilities. Yet, objectives have not been established regarding the type, amount, and quality of data that owner/operators need to provide to regulatory officials to demonstrate that the constituents have been tested for. The regulation contains suggested analytical test methods for analyzing each constituent, and the practical quantification limit that can be attained through each method. However, it does not require that these or equivalent analytical methods be used nor does it stipulate the level of detection that owner/operators must achieve in testing for the chemical constituents.

Under this regulation an owner/operator has the latitude to use any test method and detection level desired, including the easiest and least sensitive methods, which may be to a facility's advantage. For example, owner/operators may check for some constituents at the parts-per-billion level and others at the parts-per-million or -thousand level. Thus, the adequacy of the chosen test methods and detection levels continues to be an issue permit writers will have to decide on individually for each site and perhaps each set of data. If the permit writer determines that the chosen method or level is not appropriate for a particular facility, the owner/operator must be asked to supply better information. The appropriateness of the permit writer's actions and the owner/operator data cannot be determined since neither the permit writer nor the owner/operator knows what EPA's objectives for data quality are or how much risk is acceptable. In most cases in the past, senior RCRA officials in EPA regions III and IV stated, these initial decisions were a matter of individual judgment. Without data quality objectives, permit writers and enforcement officials have little basis for consistently applying individual judgment in assessing the adequacy of owner/operator-chosen analytical methods, sampling techniques, or other components of groundwater monitoring system design. We were told that EPA regions III and IV and some states, in response to these problems, have established peer review groups to review and improve the consistency of individual permit writer judgments.

Although EPA's Groundwater Task Force did not explicitly identify the lack of data quality objectives as a systemic program problem, it did identify many of the resultant problems that occur from not having stated objectives. For example, the task force identified problems with the lack of specificity in the regulations, the lack of programmatic training, and inadequate guidance as barriers to making progress toward their program goals discussed in chapter 2. The task force reported that inconsistent guidance alone can cause major problems and severe delays because:

"Owners and operators use conflicting documents to support selection of inappropriate technology or select the easiest or least sensitive approach. National consistency suffers, with various regions or states providing different levels of protection of groundwater. Data are less comparable due to differences in sampling techniques. Regional inconsistency enables conglomerate or multi-state owners to 'divide and conquer' the regional offices, citing favorable rulings they have gotten from other regions."

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## Internal Control System Needed

The lack of data quality objectives, specific groundwater monitoring regulatory requirements, and comprehensive quality assurance/quality control mechanisms are indicative of a broader and more fundamental problem in EPA's implementation of the RCRA groundwater monitoring program. In our opinion, the broader and more fundamental problem is that EPA had not developed an adequate system of internal controls to ensure that groundwater monitoring information being provided by hazardous waste land disposal facility owner/operators is adequate for making regulatory decisions.

Internal controls are the combination of organization, policies, procedures, methods, and measures adopted by management to safeguard its resources, ensure the accuracy and reliability of its information, achieve adherence with applicable laws, regulations and policies, and promote operational economy and efficiency. If properly implemented, internal controls serve as the checks and balances against undesired actions and help to achieve the positive aims of program managers.

Internal control standards constitute the criteria against which internal control systems and agency programs and activities are to be evaluated. First required under the Accounting and Auditing Act of 1950, the need for strengthened internal controls was made clear by the Congress'

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enactment of the Federal Managers' Financial Integrity Act in September 1982, (Public Law 97-255), which directed executive federal agencies to ensure compliance with governmentwide standards prescribed by the Comptroller General.<sup>1</sup> Of the 12 standards published in 1983, five general standards apply to all aspects of agency internal control systems. In our opinion, EPA has not met at least two of the five general standards. These two standards require agencies to

- develop internal control objectives specifying in detail the positive goals agency managers want to achieve or the negative events or situations they want to prevent and
- establish internal control techniques that continually provide a high degree of assurance that control objectives are being achieved.

In publishing these standards, the Comptroller General emphasized that internal controls are integral to all agency operations, not just the financial or administrative areas, and weak or nonexistent internal controls are often the underlying causes of agency problems. We believe an inadequate system of internal controls is the primary and underlying reason for the magnitude and duration of problems that have been encountered by EPA's groundwater monitoring program.

In our view the development of internal control objectives is synonymous with EPA's program of developing data quality objectives. As discussed earlier in this chapter, data quality objectives are statements of specific requirements regarding the type, amount, and quality of data needed for regulatory decision-making. Once established, data quality objectives should provide a clear statement to both hazardous waste facility owner/operators and EPA/state regulatory officials regarding the minimum groundwater data needed to demonstrate that EPA's groundwater monitoring program goals are being met. However, until established, confusion and disagreements between owner/operators and regulatory officials will continue as to the groundwater data needed to support regulatory decisions. As noted earlier, internal control techniques are the procedures and mechanisms managers use to provide reasonable assurance that control objectives are achieved. Techniques include, but are not limited to, specific policies, procedures, plans of organization, and physical arrangements. Within the RCRA groundwater monitoring program, information requirements, such as results of detailed well drilling logs, pump tests, and well construction records, would be control techniques that help permit writers and enforcement

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<sup>1</sup>Standards For Internal Controls In The Federal Government, GAO, (1983).

officials in evaluating data provided by owner/operators. Similarly, a number of techniques can be employed to check the appropriateness of owner/operator sample-taking techniques and the accuracy of laboratory testing techniques. However, EPA's current RCRA regulations do not require any of the above control measures.

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### **Absence of Internal Controls Is a Material Weakness in RCRA Program**

Since enactment of the Federal Managers' Financial Integrity Act in 1982, EPA, like all other executive federal agencies, has been required to annually assess its internal control systems. Under the act agency heads must also report to the President and the Congress annually on whether their internal control systems comply with the act's objectives and, to the extent systems do not comply, identify material weaknesses in their systems, together with plans for correcting these deficiencies. We reviewed the EPA Administrator's Federal Managers' Financial Integrity Act reports for fiscal years 1985 and 1986 and found that problems with the groundwater monitoring program had not been reported in either year. In discussing this point, the OSW Deputy Director told us that EPA's reporting of its RCRA corrective action program as a material weakness in both of these years would encompass groundwater monitoring. Our review of reasons for reporting corrective action as a material weakness suggests that it was reported for a lack of regulatory and program implementation guidance and not specifically for the problems we found in our review of the groundwater monitoring program. Furthermore, in our opinion, an adequate groundwater monitoring system is a prerequisite to developing a good corrective action program in that the purpose of the groundwater monitoring program is to identify the extent of leakage of hazardous waste into the groundwater. The focus of the corrective action program is to clean up those identified problems.

The concept of materiality has long been considered a fundamental part of financial accounting and reporting. Although guides exist, an explicit standard of what constitutes materiality has yet to be formulated. This is especially true in reviewing program functions and operations, which the Federal Managers' Financial Integrity Act covers, that go beyond accountability and financial reporting. Numerous factors are often considered in making materiality decisions, many of which are intuitive and involve judgment. In determining materiality, an agency should consider its individual circumstances and those things that are important to its mission and the magnitude of resources involved in a program in relation to the total available to the agency. While there are common materiality factors, their application should be tailored to the organization, and specific factors need to be developed on an agency-by-agency basis.

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Our first overall report on the act (GAO/OCG-84-3, Aug. 24, 1984) and the House Committee on Government Operations August 2, 1984, report on the act's first-year implementation identify factors to consider in determining what constitutes a material weakness. These factors are

- a loss or potential loss of resources that would impair an agency's fulfillment of a mission;
- adverse publicity or embarrassment to the agency, which would diminish credibility or reputation;
- importance to the public or third parties;
- a problem that warrants the personal attention or awareness of the agency head or higher management;
- violations of statutory or regulatory requirements; and
- potential conflicts of interest.

Until EPA achieves its groundwater monitoring goals, a thorough understanding of the groundwater conditions at hazardous waste land disposal facilities will remain uncertain with little assurance that public health and the environment are protected. In our view the absence of an internal control system is the fundamental reason for EPA not being able to achieve its groundwater monitoring goals in its planned time frames—and it continues to delay achievement of these goals today. Given the importance of the RCRA groundwater monitoring program in ensuring that public health is adequately protected, in our opinion, the absence of an adequate groundwater monitoring internal control system should be considered a material weakness in the RCRA program and reported as such by the EPA Administrator.

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## Conclusions

EPA and state RCRA regulatory officials need to have complete and reliable data on the groundwater conditions at hazardous waste disposal facilities to make permit and other decisions that are necessary to ensure that such facilities operate in an environmentally safe manner. Originally, EPA believed that owner/operators would provide sufficient groundwater information on the conditions at their facilities on which these decisions could be made. As such, EPA was not explicit in identifying the type, amount, and quality of information needed for groundwater decision-making—referred to as data quality objectives. Additionally, EPA has not prescribed the technical standards and requirements necessary to obtain the needed information from owner/operators whose financial positions can be dramatically affected by the results, nor has EPA established a comprehensive quality assurance/quality control system to ensure that information provided by owner/

operators is acceptable. Basically, EPA did not establish an effective system of internal controls that would ensure that groundwater information collected by owner/operators would be adequate for regulatory decision-making. Absent these requirements, owner/operators have been allowed considerable latitude in designing and installing groundwater systems—and in determining, collecting, and analyzing groundwater. In many cases, information collected, however, has not been sufficient for making regulatory decisions.

EPA has taken a number of actions to improve known deficiencies in its groundwater monitoring program. The appropriateness and utility of these actions cannot be assessed, however, without first establishing data quality objectives. EPA's OSW needs to vigorously pursue its long-delayed efforts to develop data quality objectives identifying the type, amount, and quality of data needed for groundwater decision-making. Following this, explicit technical standards and requirements translating and communicating these objectives into specific owner/operator regulatory requirements—and appropriate quality assurance/quality control mechanisms—can be developed. Although EPA has initiated efforts to develop data quality objectives, these efforts seem to be receiving a lesser amount of funding and emphasis than would be expected given their importance to the groundwater monitoring program.

As discussed in chapter 2, EPA plans to issue all operating land disposal facility permits by November 1988. However, until EPA communicates its data needs to owner/operators in terms of minimum requirements and develops systems and processes to ensure that the data supplied is adequate for decision-making, EPA will have little assurance that permits being issued are protective of human health and the environment. Consequently, these permits may have to be reopened at a later date to ensure appropriate levels of protection.

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## Recommendations

GAO recommends that the Administrator, EPA, develop data quality objectives for the RCRA groundwater monitoring program specifying the type, amount, and quality of data needed for regulatory decision-making. Once established, these objectives should be used to develop specific regulatory requirements and quality assurance/quality control mechanisms for the groundwater monitoring program.

Once implemented, these recommended actions should provide a basic system of internal controls on which EPA can build to ensure that owner/operator-supplied data is accurate and fairly represents groundwater

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conditions at hazardous waste land disposal facilities. GAO further recommends that, until this system is established, the Administrator report the absence of an internal control system in the RCRA groundwater monitoring program as a material weakness in the agency's annual Federal Managers' Financial Integrity Act report to the President and to the Congress.

# Status of Efforts to Implement RCRA Groundwater Monitoring Task Force Recommendations

Recommendation	Status as of September 1987
1. Propose and promulgate the essential, or "core," requirements from the technical enforcement guidance document (TEGD) and other manuals into a mandatory guidance document (SW-846).	This effort has been delayed approximately 2 years from the task force's projected completion date. A major revision is underway, which includes groundwater monitoring to ensure consistency with TEGD. Expected completion targeted for winter 1988.
2. Update and finalize guidance for field inspectors, owner/operators, and permit writers to conform with the TEGD.	EPA is working on field inspector guidance but does not plan to update owner/operator or permit writer guidance.
3. Reorganize the 60 or so existing groundwater monitoring guidance documents into a more workable number of volumes for consistency and completeness of coverage.	No action has started on this project.
4. Confirm the status of each guidance memorandum in a document control system, deleting obsolete documents and updating current ones.	This project has been delayed. Many key documents are indexed but not under the keyword "groundwater." Also, some key documents are not in the system.
5. Index all recent and precedent-setting consent decrees, notices of violation, and enforcement orders to facilitate national consistency.	This recommendation has not been fully implemented. An EPA study concluded that it was not feasible to include state orders and notices of violations.
6. Develop an overall training plan based on work loads, bottlenecks, efficiency in getting out orders, failures to observe violations, etc.	This effort has been delayed; however, a training development plan was finalized in September 1987, which includes the results of several needs assessments that identified 10 high-priority courses.
7. Prepare courses for new-hire orientation for inspectors, permit writers, and enforcement officials. Several efforts are on-going in this area; the task force recommends that these efforts be institutionalized and put under the direction of the overall training plan.	To date, 2 of the 10 high-priority courses have been developed and 1 of the 2 has been presented to all EPA regions. Three additional courses are under development. It is doubtful that the training courses will be completed in time to have an effect on the November 1988 permit decisions.
8. Provide dedicated funding for professional training and index and review course evaluations from the standpoint of program effectiveness.	This effort is on track and is being accomplished in conjunction with numbers 6 and 7.
9. Specify that groundwater monitoring systems must monitor all leachate pathways, not just the uppermost aquifer.	This effort has been delayed 3 to 4 months. The change is being developed as part of an overall modification project. The final rule is expected in the summer of 1988.
10. Revise specifications of the "point of compliance" for groundwater monitoring, removing loopholes, and ambiguities.	This effort has been delayed approximately 1 year. See also status of number 9.
11. Delete the requirement to monitor all appendix VIII parameters in favor of a more practical, meaningful list of compounds of concern.	Completed this effort with a <u>Federal Register</u> notice issued July 9, 1987.
12. Improve data comparison techniques and develop a statistical test procedure based on actual data.	This effort is on track. An Advance Notice of Proposed Rulemaking was published on August 24, 1986, and the proposed rule was published August 24, 1987.
13. Tighten the monitoring and data submission requirements in the permit application regulations.	This effort is on track. See also status of number 9.
14. The task force recommended increased research efforts in a number of areas.	This effort is on track. A number of projects are underway or are proceeding with increased effort.
15. Improve recruiting abilities and the factors leading to retention of highly qualified professionals.	This effort has been delayed. The Office of Solid Waste and Emergency Response has activities underway addressing this recommendation. Two regions now have direct hire authority.
16. Foster a more proactive role in obtaining compliance (e.g., encourage permit writers to design acceptable systems for recalcitrant operators rather than solely relying on "review and redo").	The Assistant Administrator for the Office of Solid Waste and Emergency Response elected not to implement this recommendation.

(continued)

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**Appendix I  
Status of Efforts to Implement RCRA  
Groundwater Monitoring Task  
Force Recommendations**

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<b>Recommendation</b>	<b>Status as of September 1987</b>
<b>17.</b> Provide research, library, and other assistance to back up regional office personnel in unusual, complex, or precedent-setting issues.	This effort is on track. Level-of-effort contracts are available to the regions through OSW, and the Office of Waste Programs Enforcement has been expanded. Also, increased interaction with EPA's Office of Research and Development has been beneficial with personnel available from this office to assist the regions.

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Note: The status of EPA's efforts presented in this appendix is as of September 1987, as reported to us by EPA officials.

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# Glossary

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<b>Aquifer</b>	An underground water-bearing porous rock formation that is capable of supplying a significant amount of groundwater to wells or springs.
<b>Assessment Monitoring</b>	An advanced stage of groundwater monitoring to determine the extent to which the groundwater has been contaminated.
<b>Background Concentration</b>	The amount of hazardous constituents found in the groundwater located above, or upgradient of, a hazardous waste facility. When compared with downgradient well concentrations, this amount is used to measure the extent to which the groundwater is affected by any releases from the facility.
<b>Bailing</b>	The act of obtaining water from a well by attaching a container to a rope or cable and lowering it into the well.
<b>Borehole</b>	A circular hole drilled into the ground to a specific depth usually for the installation of a monitoring well.
<b>Downgradient Well</b>	A well that has been installed to monitor the groundwater that is flowing away from a hazardous waste site.
<b>Extent of Migration</b>	The vertical and horizontal distances that the hazardous constituents have traveled from the hazardous waste site.
<b>Groundwater Flow</b>	The direction of movement of the water below the earth's surface.
<b>Grout or Cement Grout</b>	The material used to fill in the space between the well casing and the wall of the borehole to prevent surface water and rainwater from affecting groundwater monitoring wells.

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Note: This glossary was developed using technical publications dealing with groundwater and in consultation with EPA and state groundwater personnel in order to provide more easily understandable and less technical definitions.

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**Glossary**

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<b>Hydrogeologic Data</b>	The results obtained from analyses performed regarding the behavior of groundwater.
<b>Hydrogeology</b>	The science dealing with the behavior of groundwater.
<b>Hydrostatic Pressure</b>	The pressure exerted by the water at any given point in a body of water at rest.
<b>Hydrology</b>	The science encompassing the behavior of water as it occurs in the atmosphere, on the land surface, and underground.
<b>Land Disposal Facility</b>	A facility at which wastes are deposited into or on the land, such as a landfill or a surface impoundment.
<b>Leachate</b>	The leakage of waste materials from a land disposal site, generally mixed with rainwater.
<b>Liner</b>	A layer of natural or man-made materials designed to retard the escape of hazardous waste(s) from a surface impoundment or landfill.
<b>Quality Assurance</b>	The process of management review and oversight at the planning, implementation, and completion stages of an environmental data collection activity to ensure that data provided by a line operation to data users are of the quality claimed and needed.
<b>Quality Control</b>	Activities required during data collection to produce the data quality desired and to document the actual quality of the collected data (e.g., sample spikes and blanks).
<b>Rate of Migration</b>	The time a contaminant takes to travel from one stationary point to another, generally expressed in units of time/distance.

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**Glossary**

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**Screen** The slotted casing material of a monitoring well, which can easily be penetrated by the groundwater.

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**Site** The land or water area where any hazardous waste facility or activity is physically located or conducted, including adjacent land used in connection with the facility or activity.

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**Upgradient Well** A well installed to monitor the groundwater that will flow beneath the hazardous waste disposal site and that is not affected by the releases from that facility.

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**Well Casing** The material (usually a pipe) in the well borehole that prevents the borehole from collapsing and that is used to store groundwater that enters the borehole.







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