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Interim Status Groundwater Monitoring Program Evaluation

A Guidance Manual

INTERIM STATUS GOUNDWATER MONITORING PROGRAM EVALUATION

A Guidance Manual

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1.0 INTRODUCTION

The intent and purpose of this document is to provide compliance status and technical guidance to administrative authority personnel for the preliminary evaluation of ground-water monitoring systems, ground-water quality assessment programs, and monitoring waiver demonstrations pursuant to the RCRA ground-water monitoring requirements of Subpart F of 40 CFR 265 (45 Federal Register 33239 et seq., May 19, 1980). The Compliance Checklists and Technical Information Forms (see Appendices A, B, C,and D) have been developed to provide only a preliminary check for completeness and adequacy and will not involve detailed hydrogeologic or engineering review.

While detailed technical analysis of individual ground-water programs will ultimately be conducted, the preliminary field evaluation process will provide a mechanism whereby rapid determinations of the compliance status and apparent adequacy of various ground-water programs can be made. The initial review of technical data and site information will allow the administrative authority to prioritize the need for detailed analysis by indicating which monitoring programs do not appear adequate or seem marginal in view of the regulations. Only "first cut" determinations can be made and any final decision on the adequacy of an individual ground-water program must be made based on in-depth analysis of all available technical data.

1.1 APPLICABILITY

Subpart F - Ground-Water Monitoring requires that the owner or operator of a surface impoundment, landfill, or land treatment facility managing hazardous waste and has qualified for interim status, implement a ground-water monitoring program capable of determining the facility's impact on water quality in the uppermost aquifer underlying the facility.

The ground-water monitoring programs, designed and implemented to detect and assess changes in the ground-water quality due to the emanation of leachate derived from the waste materials, may be partially or fully waived if the owner or operator of the facility can demonstrate that there is a low potential for

migration of hazardous waste or hazardous waste constituents from the facility through the ground-water system.

In cases where the owner or operator of a facility suspects or knows that the facility has already impacted the uppermost aquifer in such a way that the indicator parameters would show statistically significant increases when evaluated, an alternate ground-water monitoring system may be utilized to determine the rate and extent of contaminant migration and the concentrations of hazardous waste and hazardous waste constituents in the ground water.

2.0 SITE INSPECTIONS

2.1 GENERAL

The site inspection allows the field investigator to ascertain the level of RCRA compliance at a facility by gathering information relative to the effectiveness of any ground-water monitoring programs instituted at the site or the validity of any waiver demonstrations. The compliance status evaluation is generally straightforeward and requires that the investigator fill out the appropriate checklist(s) contained in Appendix A.

Determination of the effectiveness of ground-water monitoring systems requires that the investigator be aware of the general subsurface conditions in the area. Aside from obvious things like ensuring that monitoring wells are installed at the facility and that there are no surficial sources of contaminant discharge to the ground-water system, the field inspector is somewhat limited by what may be documented on the surface. The nature of ground-water systems requires that subsurface data, including the physical and hydrogeologic character of the underlying materials as well as the construction of the monitoring system components, be examined prior to the site inspection.

2.2 DOCUMENT REVIEW

The Agency expects that some information on ground-water monitoring system details, ground-water assessment programs, and monitoring waiver demonstrations will be submitted to the administrative authority for review prior to site visit. There will, however, be instances when such information will not be available for review until the site inspection. In either case the inspector will have to carefully review the data in order to obtain as much information as is possible.

The Appendix A checklists are provided to record compliance status information. These checklists should be used by the inspector to examine those areas where RCRA requirements apply. They are organized in accordance with Part 265, Subpart F and are cross-referenced to those sections in the regulations where applicable.

Technical Information Forms (TIF's) are included in Appendicies B, C, and D. These forms, while not checklists, may be used in a similar fashion to allow the field inspector to collect data in an orderly manner.

The general organization of the TIF's is such that the field inspector may collect data in related blocks, (e.g., soil boring, well construction, regional hydrogeology). Experience has shown that most professionally compiled reports (geologic, hydrogeologic, engineering) present these types of data together. In the cases where the facility data was not prepared or compiled by a professional, the investigator is advised to collect data in the same manner and order as is shown on the TIF's. If maps or plot plans are included, it is recommended that these be examined first.

The TIF's should be filled out to the fullest extent in order to gain the maximum amount of information about the facility. The inspector should also inquire about the possibility of obtaining copies of the information for office review, thereby reducing time at the facility and increasing accuracy.

During the review of the ground-water program, several aspects of information should be noted for later field verification. These include:

- the locations of waste handling, storage, or disposal areas and the type(s) of hazardous waste(s)
- the proximity of surface water bodies (e.g., stream courses, lakes, wetlands)
- the topographic and surficial features of the site
- the number, locations, and the depths of the ground-water monitoring wells
- the depths to ground water, hydraulic gradients, and the inferred ground-water flow directions, and
- the locations of off-site ground-water wells and their depths

The field inspector is advised to record this information in his/her Field Inspection Log Book, for reference during the site reconnaissance.

2.2.1 Hydrogeologic Setting

The geologic formations underlying a facility and their hydrogeologic properties are of extreme interest since they determine the rate and direction of ground-water movement. Prior to the site visit the field inspector should:

1) locate the facility on a U.S.G.S. topographic quadrangle map;

2) check the geologic and hydrogeologic data available for the area; and,

3) review U.S.D.A. Soil Conservation Service soil maps.

As aerial photographs of the area are always available through the soil service, they should also be examined in order to identify any significant topographic, geologic, or hydrologic features. The use of aerial photographs facilitates the location of surface water bodies, as well as dwellings and other structures in the vicinity. Some sources of geologic and hydrogeologic data include:

U.S. Geological Survey, Ground-Water Branch;

U.S. Soil Conservation Survey;

State Geological Surveys;

State Departments of Environmental Protection;

State Divisions of Solid Waste;

State Divisions of Water Resources;

Regional and Local Planning Authorities;

Local Universities and Colleges;

Local Consulting Firms;

Private Environmental Groups; and,

Resource Related Industries.

The review of the above cited sources and materials should provide the field inspector with an understanding of the regional geologic and general hydrogeologic conditions in the site vicinity. This knowledge will allow the inspector to

be able to determine the general accuracy of the information presented in the various ground-water programs.

2.2.1.1 Unconsolidated Materials

Some local deviations from the general geologic and hydrogeologic patterns may be expected due to natural heterogeneity and the field inspector should document these where they occur. Glacial, alluvial valley and coastal plain deposits exhibit alternating textural differences and it is necessary that the investigator be aware of and record certain factors. These include:

1) the areal extent, depth, and orientation of individual strata;

2) the head differentials which may occur between individual water bearing formations;

3) the differences in permeability between individual strata; and,

4) the degree of hydraulic connection that may exist between various water bearing units.

2.2.1.2 Karst Terrain

Areas of karst terrain should be identified and assessed for collapse potential and the presence of solution channels. While the regional net ground-water flow patterns may be identified for the karst region, local flow systems may sometimes be quite different.

2.2.1.3 Bedrock

The occurrence of bedrock (or indurated sediments) at or near the surface requires additional considerations. Consolidated materials may exhibit small effective porosities and low hydraulic conductivities which impede ground-water flow. The development of secondary porosity may allow ground-water to flow through fractures, joints, cleavage planes and foliation and should be noted where they occur. These features tend to be highly directional in nature, exhibit varying degrees of interconnection, and may produce local ground-water flow regimes much different from the regional trends.

Care must be taken when evaluating data from ground-water monitoring wells in bedrock due to the irregularities of fracture interconnections. It is possible that monitoring wells may be located out of the path of flow from the waste management area. The field inspector must understand the relationship of fracture trends and monitoring well location to be able to ascertain whether the wells intercept the appropriate flow path.

2.2.2 Site-Specific Information

Data in the various ground-water monitoring programs provides information on the geologic and hydrogeologic conditions beneath the site.

These data should include:

- detailed logs of the test pits or soil borings;
- well construction details;
- geologic cross-sections;
- a description of the subsurface conditions including extent of formations, fracture patterns, and dip;
- the estimation of various hydraulic properties of the strata encountered (e.g., transmissivity, intrinsic permeability, porosity, hydraulic conductivity, etc.);
- the depths to ground water;
- potentiometric map; and,
- the inferred hydraulic gradients between the wells.

The review of this material will give the field inspector the information necessary to evaluate the adequacy of the monitoring programs.

Soil boring or test pit logs will provide the basis for the description of the subsurface materials and the construction of geologic cross-sections. This information should:

- provide lithologic descriptions of the subsurface materials;
- indicate the presence of apparent low permeability materials that may act as confining beds;and,

- show the areal extent and thickness of the unsaturated and saturated zones.

The installation of ground-water monitoring wells provides a means whereby the various hydraulic properties of the subsurface materials may be measured as well as allowing ground water samples to be periodically collected.

Hydraulic properties may be determined from several in situ tests at the site. These include:

- pumping/recovery tests;
- packer tests; and,
- falling or constant head tests.

Textural analysis of boring samples may be performed in the laboratory, and permeameter tests can be used to determine hydraulic conductivity. However, in most cases, field tests may provide more reliable information since measurements are made under natural conditions and include all hydraulic features of the substrate. Laboratory analyses usually entail some disturbance of the materials and examine only small localized horizons in the substrate.

Ground water elevations, measured from some common datum, provide useful information when properly analyzed. It is essential that the water level measurements are made at all wells in as short a time period as possible to ensure that conditions are relatively constant. It is also important that the well's depth and screened interval be known in order to avoid serious error in evaluating the data. Potentiometric contour maps may be constructed which show the inferred direction of ground-water flow and hydraulic gradient. It is important to use water levels from wells open to the same aquifer horizon in order to prevent possible distortions caused by pressure differences in the aquifer due to vertical flow. A properly constructed equipotential contour map will show whether the required monitoring wells are, indeed, upgradient or downgradient and indicate whether the monitoring wells appear capable of detecting any leachate generated from the hazardous wastes on site in the uppermost aquifer.

The design and construction of the monitoring wells must also be considered in the evaluation of a monitoring program. Wells may be screened (open to the formation) for the entire length of the saturated thickness, or completed with intakes set at discrete intervals. In cases where the entire saturated thickness is screened, the water levels will represent an average elevation of the potentiometric surface. Fully penetrating wells indicate contaminant stratification but allow a large volume of water to enter the well and, in cases where contaminants may be in trace amounts, dilution would tend to mask their presence.

Well clusters with intakes set at discrete depths in the saturated zone provide more detailed information on ground-water pressure gradients and allow for less dilution of contaminants should chemical stratification occur, since a smaller quantity of ground water enters through the shorter screen. By setting the well intakes at specific depths, recharge and discharge effects can be measured and monitored.

2.2.3 Sample Collection/Analysis

Since the primary goal of the regulations is to obtain reliable information on the changes in ground-water quality, the proper collection of ground-water samples, their handling and analysis is of great importance. The ground-water sampling and analysis plan should outline the methods utilized to obtain samples of the ground water.

Prior to sample collection, it is necessary to evacuate some quantity of water from the well to ensure that fresh ground water is sampled. The amount of water flushed may vary due to differences in transmissivities of individual water bearing zones. It is generally accepted that the removal of three to five well volumes is sufficient to ensure the flow of fresh water. In very low transmissivity aquifers with slow recovery times, only one casing volume may be available for evacuation. Depending on the depth of the well and production capability, evacuation may be by:

- bailing;
- centrifugal pump;
- airlift pump;

- submersible pump; or,
- positive displacement pump.

The ground-water programs should indicate the well evacuation procedures to be utilized prior to sampling.

The manner in which the ground-water samples are collected from the well should also be considered along with equipment decontamination procedures necessary to avoid cross contamination between samples. In cases where samples are collected from the discharge of centrifugal, airlift or submersible pumps the potential for volatilization of organic contaminants should be evaluated along with the increased opportunity of cross contamination since complete cleaning of these types of pumps is difficult. If such equipment is used, the potential loss of constituents through volatization should also be evaluated. This is very important when trace concentrations of contaminants are expected.

In most cases inorganic constituents samples can be sampled with a bailer or positive displacement pump. Peristaltic pumps provide good samples of water tables within 25 feet of the surface. They are not, however, advised to be used for volatile organic compounds in minute quantities when pressure differentials may cause volatilization.

Once samples are collected they should be handled in a manner that will minimize the alteration of the constituents to be analyzed for. The samples should be filtered when necessary and the appropriate chemical preservatives added as soon as possible. Recommended sample containers should be utilized and samples should be kept refrigerated or on-ice during transport to the laboratory. Recommended holding times should be adhered to in order to ensure that constituent alteration is minimized. (See Scalf, et al, 1981 for summary of recommended sampling methods.)

The chain-of-custody control should be outlined in the sampling and analysis plan to ensure that the possession of samples may be documented from the time of collection to the time that the analyses are performed.

For detection monitoring programs, analysis of the ground-water samples should include:

Drinking Water Suitability Parameters

Arsenic	Lindane
Barium	Methoxychlor
Cadmium	Toxaphene
Chromium	2,4, D
Fluoride	2,4,5-TP Silvex
Lead	Radium
Mercury	Gross Alpha
Nitrate (as N)	Gross Beta
Selenium	Coliform Bacteria
Silver	Endrin

Parameters Establishing Ground-water Quality

Chloride	Phenols
Iron	Sodium
Manganese	Sulfate

Parameters Used as Indicators of Ground-water Contamination

pH	Total Organic Carbon
Specific Conductance	Total Organic Halogen

The sampling and analysis plan should also indicate a schedule of analyses, as follows:

1) For the first year, all above cited parameters must be analyzed on a quarterly basis to establish background concentrations.

2) After the first year, ground-water quality samples must be obtained and analyzed at least annually.

3) After the first year, ground-water contamination indicator parameters must be obtained and analyzed at least semi-annually.

The owner or operator must also prepare an outline of a ground-water quality assessment program that is capable of determining whether hazardous waste constituents have entered the ground-water system, the rate and extent that the contaminants have migrated, and the concentration of any contaminants. The field inspector should review this outline to determine whether the program appears capable of performing the required functions.*

The field inspector should review the monitoring program for information relating to statistical analysis to be performed on the water quality analysis results and to see that the proper reporting procedures are being followed.

*The compliance date for this requirement has been extended to August 1, 1982 (Federal Register, February 23, 1982, p. 7841-7842). EPA will be proposing (Spring 1982) to eliminate this requirement and extend from 15 to 90 days the time frame for development and submission of ground-water quality assessment programs that would have been based upon these outlines.

2.3 SITE RECONNAISSANCE

With the completion of the review and collection of information contained in the ground-water monitoring program, either at the facility or in the office, field verification of certain data must be undertaken. A copy of the site plot plan should be available for the reconnaissance.

2.3.1 Surface Features

An important aspect of the site investigation is to ensure that all potential sources of discharge of hazardous waste to the ground-water system are addressed in the program. It is necessary for the inspector to locate the sources described in the program and determine if any source has been omitted. In the event that any waste management areas have been left out, the inspector must note the location, size and type of area in his/her inspection log book.

During the reconnaissance attention should be paid to any surface water bodies or streams on or adjacent to the site. Since ground water may be discharged to these surface water bodies, there is a possibility that contaminants in the ground water may be present in the surface water. Signs of contamination may be:

- an oily sheen on the surface of the water;
- discoloration on the banks from precipitation of contaminants;
- dead or distressed vegetation along the banks; and,
- unusual foaming or odors.

The distances of surface water bodies, streams and wetlands should be noted and compared to information in the program.

The occurrence of significant topographic or surficial features, if any, should be noted and located on the plot plan. These features may indicate areas of ground-water recharge or discharge.

2.3.2 Monitoring Wells

While it is not possible to observe the complete well construction detail, there are several items that can be checked. These include the construction materials, the location and number of the monitoring wells, the total depths and the ground-water elevations. During the field reconnaissance the locations and numbers of the monitoring wells should be checked to ensure that all wells are located and in agreement with the monitoring program locations.

It is recommended that the field inspector sound each well to ensure that the well is completed to the described depth. This is also a means of determining if the wells are numbered properly. The soundings are performed by measuring the total depth of the well with an appropriate steel tape. There is a chance that the bottom of the well may have been filled in by some sediment which entered through the screen. A discrepancy of up to one foot may be tolerated, except in cases where short well screens are indicated in the construction detail. If more than 30% of the screened area is filled in, usefulness of the well may be jeopardized.

Discrepancies in the well depths of more than two feet should be noted. Large deviations of more than five feet may indicate that the well numbering system may be in error. When this is noted, the field investigator should inquire about that possibility.

2.3.3 Water Levels

All monitoring wells must be constructed so they are screened below the lowest level of ground-water fluctuation to prevent wells from being periodically dry. Any dry wells encountered must be noted during the field investigation. Ground-water elevations must be measured during the visit to verify present data. The elevations are determined by subtracting the depth to water from the marked datum on the well casing or standpipe. It is important to note whether the elevations were determined by field surveying or from a topographic map in order to assess the accuracy of the elevations. The water level elevation will be utilized later in the construction of a potentiometric contour map to determine ground-water flow direction and hydraulic gradients.

3.0 MONITORING WAIVER DEMONSTRATION

This section presents information on the evaluation of monitoring waiver demonstrations. This material, in conjunction with that presented in previous sections, will outline the steps that the field inspector should take in order to assess the practicality of such demonstrations. The Waiver Demonstration Technical Information Form (Appendix D) is to be filled out, in addition to the Ground-water Monitoring System Technical Information Form (Appendix B), during the data review.

The technical nature of any waiver demonstration requires that the investigator be aware of, and record the existence of more detailed geologic and hydrogeologic information. Since the owner or operator is requesting the waiver, the burden of proof is upon the applicant to sufficiently convince the administrative authority that a waiver should be approved for the facility.

The major areas of interest in the review process are:

- depth to ground water;
- the character of the hazardous waste materials;
- the water balance in the facility area (i.e., precipitation, runoff, evapotranspiration and infiltration);
- the physical and chemical nature of the unsaturated zone;
- the physical and chemical nature of the saturated zone; and,
- proximity to water supply wells and surface water.

The information supplied by the applicant should be compared to that gathered from other sources during the background information search to ensure the validity of the applicant's data. In some cases, the applicant may utilize computer modeling techniques to predict the ground-water flow, solute transport in the ground-water system and flow through the unsaturated zones. When models are used, the field inspector should inform his/her technical supervisor who will make appropriate arrangements to have the model information reviewed by expert personnel in that field.

Brief descriptions of the data and references for techniques used in the documentation are requested on the Waiver Demonstration Technical Information Form (Appendix D) and should be filled out as fully as possible. Whether the method or techniques are applicable to the conditions described in the waiver documentation will have to be determined. The evaluation of waiver demonstrations may prove to be more time consuming and complex than the detection monitoring or assessment programs. Discussions with the technical staff members experienced in such areas should be undertaken and are encouraged in order to aid the field inspector in evaulating the adequacy of waiver demonstrations.

4.0 EVALUATION REPORT PREPARATION

The field inspector's evaluation of ground-water monitoring program is geared toward an assessment of the accuracy, completeness and apparent technical adequacy of the plans and other information. At this time, detailed engineering and hydrogeologic analyses will not be undertaken. However, the information from the field investigation should be made available to the hydrogeologist or engineer performing the final evaluation since it will, in addition to the technical data included, provide key information on site conditions. Due to this later use of the site inspection information, the field inspector must be clear and concise in his/her site evaluation report.

The inspector should refer to Table 1 for an outline of the various components of the compliance reviews. Refering to this outline during the report preparation will ensure that required information will not be omitted in the presentation. The inspector should also refer to the information in Appendix E for RCRA Regulation References.

The reviewer must first determine whether the data supplied in the monitoring programs, in conjunction with the field verification reconnaissance, is sufficient to determine the capability of the monitoring program to perform the required functions. If information is not sufficient, or is inconsistent, the deficiencies should be noted and elaborated on.

The determination of the apparent capability of the monitoring program to perform in the required manner should be based on information presented in the various monitoring program documentations. Where assumptions and determinations presented are not logical or appear erroneous, the evaluation report should point them out.

The capability determinations should consider the points in the program that address:

- the type of facility and the nature of the various waste management areas on the site;
- the plot plan of the facility and its relationship to surface waters;

TABLE 1

INSPECTION OF FACILITIES FOR COMPLIANCE WITH THOSE INTERIM STATUS STANDARDS COVERING GROUND-WATER MONITORING (PART 265-SUBPART F)

1. Sampling and Analysis (check)

   a) valid techniques used for collection, preservation & analysis
   b) determined quarterly for first year

      1) drinking water suitability parameters
      2) ground-water quality parameters
      3) ground-water contaminant indicator parameters

2. Outline of Ground-Water Quality Assessment Program*

   a) capable of determining ground-water contamination
   b) capable of determining the rate and extent of migration and concentration of hazardous waste (HW) or HW constituents.

3. Number, Location, Depth and Effectiveness of the Wells

   a) are upgradient wells in fact upgradient?
   b) are wells at appropriate depth?
   c) are enough wells upgradient and downgradient?
   d) are wells in the uppermost aquifer likely to be contaminated?
   e) are upgradient wells unaffected by the facility?
   f) will upgradient wells yield representative samples?
   g) were ground-water surface elevations evaluated annually?
   h) if wells were no longer upgradient/downgradient, were they brought into compliance?
   i) method of sample collection?

4. Record Keeping and Reporting

   a) do presented data appear consistent and valid?

INSPECTION OF FACILITIES USING AN ALTERNATE SYSTEM FOR GROUND-WATER MONITORING

Check if:

1. Facility submitted a plan certified by a qualified geologist, etc., in which:

   a) number, location and depths of all wells were specified
   b) sampling and analysis methods were specified
   c) evaluation procedures were specified
   d) previously gathered data was used in evaluation procedures
   e) there is a schedule for implementation of the plan

*See note Page 2-10

2. The following were determined:

   a) rate and extent of migration of HW or HW constituents in ground water
   b) concentrations of HW or HW constituents in ground water (gw)

3. Facility submitted (to RA) a report containing assessment of the ground-water quality within 15 days of first determination of 2a & b.

4. Facility continued making determinations of HW or HW constituents in ground water until closure or date of inspection.

5. Facility kept records of sampling and analyses, and evaluations specified in plan.

6. Facility annually submitted to RA results of ground-water quality assessment which included calculated or measured rate of migration of HW or HW constituents in ground water*.

INSPECTION OF FACILITIES USING A WAIVER OF THE GROUND-WATER MONITORING REQUIREMENTS (CAN WAIVE ALL OR PART OF THE REGULATIONS)

1. Demonstration must be written and kept at the facility.

   a) certified by a qualified geologist, etc.

2. Does the demonstration evaluate:

   a) water balance based on precipitation, runoff, infiltration and evapo-transpiration?

   b) unsaturated zone characteristics by determining its geologic materials, physical properties and depth to ground water?

3. Does the demonstration evaluate the potential for HW entering the uppermost aquifer to migrate to surface water or supply wells? This should include:

   a) saturated zone characteristics
   b) rate and direction of ground-water flow
   c) proximity to surface water or water supply wells

*EPA will propose (Spring 1982) new regulatory language that would enable waiving of this annual reporting requirement at facilities where the ground-water quality assessment program reports indicate that there has been no change in the rate and extent of contamination. If subsequent changes occur, annual reporting would be resumed.

INSPECTION ITEMS FOR A FACILITY WHICH HAS DETERMINED THAT IT MAY BE AFFECTING GROUND-WATER QUALITY

1. Did the facility resolve doubt as to whether the data was real or spurious?

   Were additional samples split in two?

2. If real,

   a) did the facility notify the RA within seven days?
   b) did the facility submit to the RA the required certified plan within 15 days?

3. Did the plan specify:

   a) number, location and depth of wells?
   b) sampling and analytical methods for HW or HW constituents?
   c) evaluation procedures, including any use of previous information?
   d) a schedule of implementation?

4. Did the facility owner or operator determine:

   a) rate and extent of migration of HW in ground water?
   b) concentrations of HW in ground water?
   c) the above (a&b) as soon as technically feasible?

5. Did the facility submit a written report to RA containing an assessment of the ground-water quality?

6. If determinations in 4 a&b revealed ground water was not affected, did facility notify RA within 15 days, and reinstate indicator monitoring program?

7. If determinations in 4 a&b revealed HW has entered ground water, did facility continue making these determinations quarterly until closure?

8. If ground-water quality assessment plan was instituted prior to closure, was it:

   a) completed?
   b) reported in accordance with 265.93(d)(5)?

9. 265.94(b)(1) - Did the facility keep records of analyses and evaluations specified in the ground-water quality assessment plan throughout life of facility and during post-closure if necessary?

10. Annual Report submitted to RA*

    a) did it include results of its ground-water quality assessment program?
    b) did it contain measured or calculated rate of migration of HW in ground water?

*See note Page 4-3.

- the location and construction of ground-water monitoring wells;
- the subsurface geologic and hydrogeologic information.

4.1 SAMPLING AND ANALYSIS PLANS

The field investigator must determine if appropriate sample collection, handling and storage procedures, and analysis techniques are being performed. The ground-water sampling and analysis plan should outline the methods and techniques to be employed at the site. Where inadequate sampling methods and analytical techniques are indicated, the reviewer should note which procedures do not appear appropriate.

The schedule of sample collecting must also be checked to ensure that the proper time intervals are adhered to.

4.2 SUMMARY

The reviewer should provide a brief summary of site conditions and comments on the ground-water monitoring programs. This summary should highlight areas where the monitoring program appears to not be in compliance or inadequate. A recommendation should also be included as to whether or not more detailed technical evaluation is required to determine the adequacy of the program.

REFERENCES

Scalf, M. R., McNab, J. F., Dunlap, W. J., Cosby, R. L., and Friberger, J. S., 1981, Manual of Ground-Water Quality Sampling Procedures, EPA PB-82-103-045.

APPENDIX - A

COMPLIANCE CHECKLIST FORMS

APPENDIX A-1

FACILITY INSPECTION FORM FOR COMPLIANCE WITH INTERIM STATUS STANDARDS COVERING GROUND-WATER MONITORING

Company Name:_____; EPA I.D. Number:_____

Company Address:_____; Inspector's Name:_____

_____

_____

Company Contact/Official:_____; Branch/Organization:_____

Title:_____; Date of Inspection:_____

	Yes	No	Unknown	Waived
Type of facility: (check appropriately)				
a) surface impoundment	_____	_____		
b) landfill	_____	_____		
c) land treatment facility	_____	_____		
d) disposal waste pile*	_____	_____		
Ground-Water Monitoring Program				
1. Was the ground-water monitoring program reviewed prior to site visit? If "No",	_____	_____		
a) Was the ground-water program reviewed at the facility prior to site inspection?	_____	_____		
2. Has a ground-water monitoring program (capable of determining the facility's impact on the quality of groundwater in the uppermost aquifer underlying the facility) been implemented? 265.90(a)	_____	_____	_____	_____

*Listed separate from landfill for convenience of identification.

		Yes	No	Unknown	Waived
3.	Has at least one monitoring well been installed in the uppermost aquifer hydraulically upgradient from the limit of the waste management area? 265.91(a)(1)	____	____		____
	a) Are ground-water samples from the uppermost aquifer, representative of background ground-water quality and not affected by the facility (as ensured by proper well number, locations and depths?)	____	____		
4.	Have at least three monitoring wells been installed hydraulically downgradient at the limit of the waste handling or management area? 265.91(a)(2)	____	____		
	a) Do well number, locations and depths ensure prompt detection of any statistically significant amounts of HW or HW constituents that migrate from the waste management area to the uppermost aquifer?	____	____		____
5.	Have the locations of the waste management areas been verified to conform with information in the ground-water program?	____	____	____	
	a) If the facility contains multiple waste management components, is each component adequately monitored?	____	____		
6.	Do the numbers, locations, and depths of the ground-water monitoring wells agree with the data in the ground-water monitoring system program? If "No", explain discrepancies.	____	____	____	
7.	Well completion details. 265.91(c)				
	a) Are wells properly cased?	____	____	____	
	b) Are wells screened (perforated) and packed where necessary to enable sampling at appropriate depths?	____	____	____	
	c) Are annular spaces properly sealed to prevent contamination of ground-water?	____	____	____	

	Yes	No	Unknown
8. Has a ground-water sampling and analysis plan been developed? 265.92(a)	____	____	____
a) Has it been followed?	____	____	____
b) Is the plan kept at the facility?	____	____	____
c) Does the plan include procedures and techniques for:			
1) Sample collection?	____	____	
2) Sample preservation?	____	____	
3) Sample shipment?	____	____	
4) Analytical procedures?	____	____	
5) Chain of custody control?	____	____	
9. Are the required parameters in ground-water samples being tested quarterly for the first year? 265.92(b) and 265.92 (c)(1)	____	____	
a) Are the ground-water samples analyzed for the following:			
1) Parameters characterizing the suitability of the ground-water as a drinking water supply? 265.92(b)(1)	____	____	
2) Parameters establishing ground-water quality? 265.92(b)(2)	____	____	
3) Parameters used as indicators of ground-water contamination? 265.92(b)(3)	____	____	
(i) For each indicator parameter are at least four replicate measurements obtained at each upgradient well for each sample obtained during the first year of monitoring? 265.92(c)(2)	____	____	
(ii) Are provisions made to calculate the initial background arithmetic mean and variance of the respective parameter concentrations or values obtained from the upgradient well(s) during the first year? 265.92(c)(2)	____	____	
b) For facilities which have completed first year ground-water sampling and analysis requirements:			
1) Have samples been obtained and analyzed for the ground-water quality parameters at least annually? 265.92(d)(1)	____	____	
2) Have samples been obtained and analyzed for the indicators of ground-water contamination at least semi-annually? 265.92(d)(2)	____	____	

	Yes	No	Unknown
c) Were ground-water surface elevations determined at each monitoring well each time a sample was taken? 265.92(e)	____	____	
d) Were the ground-water surface elevations evaluated annually to determine whether the monitoring wells are properly placed? 265.93(f)	____	____	
e) If it was determined that modification of the number, location or depth of monitoring wells was necessary, was the system brought into compliance with 265.91(a)? 265.93(f)	____	____	
10. Has an outline of a ground-water quality assessment program been prepared? 265.93(a)*	____	____	
a) Does it describe a program capable of determining:			
1) Whether hazardous waste or hazardous waste constituents have entered the ground water?	____	____	
2) The rate and extent of migration of hazardous waste or hazardous waste constituents in ground water?	____	____	
3) Concentrations of hazardous waste or hazardous waste constituents in ground water?	____	____	
b) After the first year of monitoring, have at least four replicate measurements of each indicator parameter been obtained for samples taken for each well? 265.93(b)	____	____	
1) Were the results compared with the initial background means from the upgradient well(s) determined during the first year?	____	____	
(i) Was each well considered individually?	____	____	
(ii) Was the Student's t-test used (at the 0.01 level of significance)?	____	____	
2) Was a significant increase (or pH decrease as well) found in the:			
(i) Upgradient wells	____	____	
(ii) Downgradient wells	____	____	
If "Yes", Compliance Checklist A-2 must also be completed.			

*See note Page 2-10

	Yes	No	Unknown
11. Have records been kept of analyses for parameters in 265.92(c) and (d)? 265.94(a)(1)	____	____	
12. Have records been kept of ground-water surface elevations taken at the time of sampling for each well? 265.94(a)(1)	____	____	
13. Have records been kept of required elevations in 265.93(b)? 265.94(a)(1)	____	____	
14. Have the following been submitted to the Regional Administrator 265.94(a)(2) :*			
a) Initial background concentrations of parameters listed in 265.92(b) within 15 days after completing each quarterly analysis required during the first year?	____	____	
b) For each well, have any parameters whose concentrations or values have exceeded the maximum contaminant levels allowed in drinking water supplies been separately identified?	____	____	
c) Annual reports including:			
1) Concentrations or values of parameters used as indicators of ground-water contamination for each well along with required evaluations under 265.93(b)?	____	____	
2) Any significant differences from initial background values in up-gradient wells separately identified?	____	____	
3) Results of the evaluation of ground-water surface elevations?	____	____	

*EPA will be proposing (Spring 1982) to replace this reporting requirement with an exception reporting system where reports will be submitted only where maximum contaminant levels or significant changes in the contamination indicators or other parameters are observed. EPA has delayed compliance stage for 14 a) above until August 1, 1982 (Federal Register, February 23, 1982, p.7841-7842) to be coupled with exception reporting in the interim.

APPENDIX A-2

INSPECTION COMPLIANCE FORM FOR A FACILITY WHICH MAY BE AFFECTING GROUND-WATER QUALITY

Company Name:_____; EPA I.D. Number:_____

Company Address:_____; Inspector's Name:_____

_____

_____

Company Contact/Official:_____; Branch/Organization:_____

Title:_____; Date of Inspection:_____

	Yes	No	Unknown
Type of facility: (Check appropriately)			
a) surface impoundment	____	____	
b) landfill	____	____	
c) land treatment facility	____	____	
d) disposal waste pile	____	____	
1. Have comparisons of ground-water contamination indicator parameters for the upgradient well(s) 265.93(b) shown a significant increase (or pH decrease as well) over initial background?	____	____	
a) If "Yes", has this information been submitted to the Regional Administrator according to 265.94(a)(2)(ii)?	____	____	
2. Have comparisons of indicator parameters for the downgradient wells 265.93(b) shown a significant increase (or pH decrease as well) over initial background?		____	____
a) If "Yes", were additional ground-water samples taken for those downgradient wells where the significant difference was determined? 265.93(c)(2)	____	____	
1) Were samples split in two?	____	____	
2) Was the significant difference due to human (e.g., laboratory) error? (If "Yes", do not continue.)	____	____	

	Yes	No	Unknown
3. If significant differences were not due to error, was a written notice sent to the Regional Administrator within 7 days of confirmation?	____	____	
4. Within 15 days of notification of the Regional Administrator was a certified ground-water quality assessment plan submitted? 265.93(d)(2)*	____	____	
a) Does the plan specify 265.93(d)(3) :			
1) well information (specifics)	____	____	
(a) number?	____	____	
(b) locations?	____	____	
(c) depths?	____	____	
2) sampling methods?	____	____	
3) analytical methods?	____	____	
4) evaluation methods?	____	____	
5) schedule of implementation?	____	____	
b) Does the plan allow for determination of 265.93(d)(4) :			
1) Rate and extent of migration of hazardous waste or hazardous waste constituents?	____	____	
2) Concentrations of the hazardous waste or hazardous waste constituents?	____	____	
c) Is it indicated that the first determination was made as soon as technically feasible? 265.93(d)(5)	____	____	
1) Within 15 days after the first determination was a written report containing the assessment of ground-water quality submitted to the Regional Administrator?		____	____
d) Was it determined that hazardous waste or hazardous waste constituents from the facility have entered the ground water?	____	____	
1) If "No", was the original indicator evaluation program, required by 265.92 and 265.93(b), reinstated?	____	____	
(a) Was the Regional Administrator notified of the reinstatement of program within 15 days of the determination? 265.93(d)(6)	____	____	

*See note Page 2-10

	Yes	No	Unknown
e) If it was determined that hazardous waste or hazardous waste constituents have entered the ground water 265.93(d)(7) :			
1) For facilities where program was implemented prior to final closure, are determinations of hazardous waste or hazardous waste constituents continued on a quarterly basis? (If program was implemented during the post-closure care period, determinations made in accordance with the ground-water quality assessment plan may cease after the first determination.)	____	____	
(a) Were subsequent ground-water quality reports submitted to the Regional Administrator within 15 days of determination?	____	____	
2) Were records kept of the analyses and evaluations, specified in the ground-water quality assessment (throughout the active life of the facility)? 265.94(b)(1)	____	____	
(a) If a disposal facility, were(are) records kept throughout the post-closure period as well?	____	____	
f) Are annual reports submitted to the Regional Administrator containing the results of the ground-water quality assessment program? 265.94(b)(2)*	____	____	
1) Do the reports include the calculated or measured rate of migration of hazardous waste or hazardous waste constituents during the reporting period?	____	____	

*See note Page 4-3

APPENDIX A-3

INSPECTION COMPLIANCE FORM FOR DEMONSTRATING A WAIVER OF INTERIM STATUS REQUIREMENTS

Company Name:_____; EPA I.D. Number:_____

Company Address:_____; Inspector's Name:_____

_____

_____

Company Contact:_____; Branch/Organization:_____

Title:_____; Date of Inspection:_____

		Yes	No	Unknown
1.	Is a written waiver demonstration kept at the site?	_____	_____	
2.	Is the demonstration certified by a qualified geologist or geotechnical engineer? 265.90(c)	_____	_____	
3.	Does the waiver demonstration establish:			
	a) The potential for migration of hazardous waste or hazardous waste constituents from the facility to the uppermost aquifer? 265.90(c)(1)	_____	_____	
	b) An evaluation of a water balance including:			
	1) Precipitation?	_____	_____	
	2) Evapotranspiration?	_____	_____	
	3) Runoff?	_____	_____	
	4) Infiltration? (including any liquid in surface impoundments)	_____	_____	
	c) Unsaturated zone characteristics?	_____	_____	
	1) Geologic materials?	_____	_____	
	2) Physical properties?	_____	_____	
	3) Depth to ground water?	_____	_____	

	Yes	No	Unknown
d) The potential for hazardous waste or hazardous waste constituents which may enter the uppermost aquifer to migrate to a water supply well or surface water, by evaluation of: 265.90(c)(2)			
1) Saturated zone characteristics, including:			
(a) Geologic materials?	_____	_____	
(b) Physical properties?	_____	_____	
(c) Rate of ground-water flow?	_____	_____	
2) Proximity of the facility to water supply wells or surface water?	_____	_____	

APPENDIX -B

GROUND-WATER MONITORING AND ALTERNATE SYSTEM TECHNICAL INFORMATION FORM

APPENDIX B

GROUND-WATER MONITORING AND ALTERNATE SYSTEM
TECHNICAL INFORMATION FORM

1.0 Background Data:

Company Name:_____; EPA I.D.#:_____

Company Address:_____

_____

_____

Inspector's Name:_____; Date:_____

1.1 Type of facility (check appropriately):

1.1.1 surface impoundment _____
1.1.2 landfill _____
1.1.3 land treatment facility _____
1.1.4 disposal waste pile _____

1.2 Has a ground-water monitoring system been established? (Y/N) _____

1.2.1 Is a ground-water quality assessment program outlined or proposed? (Y/N) _____

If Yes,

1.2.2 Was it reviewed prior to the site visit? (Y/N) _____

1.3 Has a ground-water quality assessment program been implemented or proposed at the site? (Y/N) _____

If yes, Appendix C, Ground-Water Quality Assessment Program Technical Information Form must be utilized also.

2.0 Regional/Facility Map(s)

2.1 Is a regional map of the area, with the facility delineated, included? (Y/N) _____

If yes,

2.1.1 What is the origin and scale of the map?_____

_____

2.1.2 Is the surficial geology adequately illustrated? (Y/N) _____

2.1.3 Are there any significant topographic or surficial features evident? (Y/N) _____

If yes, describe _____

_____

2.1.4 Are there any streams, rivers, lakes, or wet lands near the facility? (Y/N) _____

If yes, indicate approximate distances from the facility _____

_____

_____

2.1.5 Are there any discharging or recharging wells near the facility? (Y/N) _____

If yes, indicate approximate distances from the facility. _____

_____

_____

2.2 Is a regional hydrogeologic map of the area included? (This information may be shown on 2.1) (Y/N) _____

If yes:

2.2.1 Are major areas of recharge/dishcarge shown? (Y/N) _____

If yes, describe. _____

_____

_____

2.2.2 Is the regional ground-water flow direction indicated? (Y/N) _____

2.2.3 Are the potentiometric contours logical? (Y/N) _____
If not, explain. _____

_____

_____

2.3 Is a facility plot plan included? (Y/N) _____

2.3.1 Are facility components (landfill areas, impoundments, etc.) shown? (Y/N) _____

2.3.2 Are any seeps, springs, streams, ponds, or wetlands indicated? (Y/N) _____

2.3.3 Are the locations of any monitoring wells, soil borings, or test pits shown? (Y/N) _____

2.3.4 Is the facility a multi-component facility? (Y/N) _____

If yes:

2.3.4.1 Are individual components adequately monitored? (Y/N) _____

2.3.4.2 Is a Waste Management Area delineated? (Y/N) _____

2.4 Is a site water table (potentiometric) contour map included? (Y/N) _____

If yes,

2.4.1 Do the potentiometric contours appear logical based on topography and presented data? (Consult water level data) (Y/N) _____

2.4.2 Are groundwater flowlines indicated? (Y/N) _____

2.4.3 Are static water levels shown? (Y/N) _____

2.2.4 May hydraulic gradients be estimated? (Y/N) _____

2.4.5 Is at least one monitoring well located hydraulically upgradient of the waste management area(s)? (Y/N) _____

2.4.6 Are at least three monitoring wells located hydraulically downgradient of the waste management area(s)? (Y/N) _____

2.4.7 By their location, do the upgradient wells appear capable of providing representative ambient groundwater quality data? (Y/N) _____

If no, explain._____

_____

_____

3.0 Soil Boring/Test Pit Details

3.1 Were soil borings/test pits made under the supervision of a qualified professional? (Y/N) _____

If yes,

3.1.1 Indicate the individual(s) and affiliation(s):_____

_____

_____

3.1.2 Indicate the drilling/excavating contractor, if known_____

_____

3.2 If soil borings/test pits were made, indicate the method(s) of drilling/excavating:

- Auger (hollow or solid stem) _____
- Mud rotary _____
- Air rotary _____
- Reverse rotary _____
- Cable tool _____
- Jetting _____
- Other, including excavation (explain) _____

_____

3.3 List the number of soil borings/test pits made at the site

3.3.1 Pre-existing _____

3.3.2 For RCRA compliance _____

3.4 Indicate borehole diameters and depths (if different diameters and depths use TABLE B-1).

3.4.1 Diameter:_____

3.4.2 Depth:_____

3.5 Were lithologic samples collected during drilling? (Y/N) _____

If yes,

3.5.1 How were samples obtained? (Check method(s))

- Split spoon _____
- Shelby tube, or similar _____
- Rock coring _____
- Ditch sampling _____
- Other (explain) _____

_____

INFORMATION TABLE B-1

BORING NO.	DEPTH	DIAMETER

3.5.2 At what interval were samples collected?_____

_____

3.5.3 Were the deposits or rock units penetrated described? (boring logs, etc.) (Y/N) _____

3.6 If test pits were excavated at the site, describe procedures._____

_____

_____

4.0 Well Completion Detail

4.1 Were the wells installed under the supervision of a qualified professional? (Y/N) _____

If yes:

4.1.1 Indicate the individual and affiliation, if known_____

_____

_____

4.1.2 Indicate the well construction contractor, if known_____

_____

_____

4.2 List the number of wells at the site

4.2.1 Pre-existing _____

4.2.2 For RCRA Compliance _____

4.3 Well construction information (fill out INFORMATION TABLE B-2)

4.3.1 If PVC well screen or casing is used, are joints (couplings):

- Glued on _____
- Screwed on _____

4.3.2 Are well screens sand/gravel packed? (Y/N) _____

4.3.3 Are annular spaces sealed? (Y/N) _____

If yes, describe:

- bentonite slurry _____
- Cement grout _____
- Other (explain) _____

_____

- Thicknesses of seals _____

4.3.4 If "open hole" wells, are the cased portions sealed in place? (Y/N) _____

If yes, describe how: _____

_____

_____

4.3.5 Are there cement surface seals? (Y/N) _____

If yes,

- How thick? _____

4.3.6 Are the wells capped? (Y/N) _____

If yes,

- Do they lock? (Y/N) _____

4.3.7 Are protective standpipes cemented in place? (Y/N) _____

4.3.8 Were wells developed? (Y/N) _____

If yes, check appropriate method(s):

- Air lift pumping _____
- Pumping and surging _____
- Jetting _____
- Bailing _____
- Other (explain) _____

_____

5.0 Aquifer Characterization

5.1 Has the extent of the uppermost saturated zone (aquifer) in the facility area been defined? (Y/N) _____

If yes,

5.1.1 Are soil boring/test pit logs included? (Y/N) _____

5.1.2 Are geologic cross-sections included? (Y/N) _____

INFORMATION TABLE B-2

	WELL NO.						
	GROUND ELEVATION						
	TOTAL DEPTH						
WELL CASING	TYPE MATERIAL						
	DIAMETER						
	LENGTH						
	STICK-UP						
	TOP ELEVATION						
	BOTTOM ELEVATION						
WELL SCREEN	DEPTH TOP/BOTTOM						
	TYPE MATERIAL						
	DIAMETER						
	LENGTH						
	SLOT SIZE						
	TOP ELEVATION						
	BOTTOM ELEVATION						
OPEN HOLE OR SAND/GRAVEL PACK	DEPTH TOP/BOTTOM						
	DIAMETER						
	LENGTH						
	TOP ELEVATION						
	BOTTOM ELEVATION						

5.2 Is there evidence of confining (low permeability) layers beneath the site? (Y/N) _____

If yes,

5.2.1 Is the areal extent and continuity indicated? (Y/N) _____

5.2.2 Is there any potential for saturated conditions (perched water) to occur above the uppermost aquifer? (Y/N) _____

If yes, give details: _____

_____

_____

a) Should or is this perched zone being monitored? (Y/N) _____

Explain _____

_____

5.2.3 What is the lithology and texture of the uppermost saturated zone (aquifer)? _____

_____

_____

5.2.4 What is the saturated thickness, if indicated? _____

_____

5.3 Were static water levels measured? (Y/N) _____

If yes,

5.3.1 How were the water levels measured (check method(s)).

- Electric water sounder _____
- Wetted tape _____
- Air line _____
- Other (explain) _____

_____

5.3.2 Do fluctuations in static water levels occur? (Y/N) _____

If yes,

5.3.2.1 Are they accounted for (e.g. seasonal, tidal, etc.)? (Y/N) _____

If yes, describe: _____

_____

_____

5.3.2.2 Do the water level fluctuations alter the general ground-water gradients and flow directions? (Y/N) _____

If yes,

5.3.2.3 Will the effectiveness of the wells to detect contaminants be reduced? (Y/N) _____

Explain _____

_____

_____

5.3.2.4 Based on water level data, do any head differentials occur that may indicate a vertical flow component in the saturated zone? (Y/N) _____

If yes, explain _____

_____

_____

5.4 Have aquifer hydraulic properties been determined? (Y/N) _____

If yes,

5.4.1 Indicate method(s):

- Pumping tests _____
- Falling/constant head tests _____
- Laboratory tests (explain) _____

_____

_____

5.4.2 If determined, what are the values for:

- Transmissivity _____
- Storage coefficient _____
- Leakage _____
- Permeability _____
- Porosity _____
- Specific capacity _____

5.4.3 In cases where several tests were undertaken, were discrepancies in the results evident? (Y/N) _____

If yes, explain _____

_____

5.4.4 Were horizontal ground-water flow velocities determined? (Y/N) _____

If yes, indicate rate of movement _____

_____

6.0 Well Performance

6.1 Are the monitoring wells screened in the uppermost aquifer? (Y/N) _____

6.1.1 Is the full saturated thickness screened? (Y/N) _____

6.1.2 For single completions, are the intake areas in the: (check appropriate levels)

- Upper portion of the aquifer _____
- Middle of the aquifer _____
- Lower portion of the aquifer _____

6.1.3 For well clusters, are the intake areas open to different portions of the aquifer? (Y/N) _____

6.1.4 Do the intake levels of the monitoring wells appear to be justified due to possible contaminant density and groundwater flow velocity? (Y/N) _____

7.0 Ground-Water Quality Sampling

7.1 Is a sampling (groundwater quality) program and schedule included? (Y/N) _____

7.2 Are sample collection field procedures clearly outlined? (Y/N) _____

7.2.1 How are samples obtained: (check method(s))

- Air lift pump _____
- Submersible pump _____
- Positive displacement pump _____
- Centrifugal pump _____
- Peristaltic or other suction-lift pump _____
- Bailer _____
- Other (describe) _____

_____

7.2.2 Are all wells sampled with the same equipment and procedures? (Y/N) _____

If no, explain _____

_____

_____

7.2.3 Are adequate provisions included to clean equipment after sampling to prevent cross-contamination between wells? (Y/N) _____

7.2.4 Are organic constituents to be sampled? (Y/N) _____

If yes,

7.2.4.1 Are samples collected with equipment to minimize absorption and volatilization? (Y/N) _____

If yes,

Describe equipment _____

_____

_____

8.0 Sample Preservation and Handling

8.1 Have appropriate sample preservation and preparation procedures been followed (filtration and preservation where appropriate)? (Y/N) _____

8.2 Are samples refrigerated? (Y/N) _____

8.3 Are EPA recommended sample holding period requirements adhered to? (Y/N) _____

8.4 Are suitable container types used? (Y/N) _____

8.5 Are provisions made to store and ship samples under cold conditions (ice packs, etc.)? (Y/N) _____

8.6 Is a chain of custody control procedure clearly defined? (Y/N) _____

8.7 Is a specific chain of custody form illustrated? (Y/N) _____

If yes,

8.7.1 Will this form provide an accurate record of sample possession from the moment the sample is taken until the time it is analyzed? (Y/N) _____

9.0 Sample Analysis and Record Keeping

9.1 Is sample analysis performed by a qualified laboratory? (Y/N) _____

Indicate lab _____

9.2 Are analytical methods described in the records? (Y/N) _____

9.2.1 Are analytical methods acceptable to EPA? (Y/N) _____

9.3 Are the required drinking water suitability parametters tested for? (Y/N) _____

9.4 Are the required groundwater quality parameters tested for? (Y/N) _____

9.5 Are the required groundwater contamination indicator parameters tested for? (Y/N) _____

9.6 Are any analytical parameters determined in the field? (Y/N) _____

Identify:

- pH _____
- Temperature _____
- Specific conductance _____
- Other (describe) _____

_____

9.7 Is a plan included to record information about each sample collected during the groundwater monitoring program? (Y/N) _____

9.7.1 Are field activity logs included? (Y/N) _____

9.7.2 Are laboratory results included? (Y/N) _____

9.7.3 Are field procedures recorded? (Y/N) _____

9.7.4 Are field parameter determinations included? (Y/N) _____

9.7.5 Are the names and affiliation of the field personnel included? (Y/N) _____

9.8 Are statistical analyses planned or shown for all water quality results where necessary? (Y/N) _____

9.8.1 Is an analysis program set-up which adheres to EPA guidelines? (Y/N) _____

9.8.2 Is Student's t-test utilized? (Y/N) _____
If other evaluation procedure used, identify _____

_____

9.8.3 Are provisions made for submitting analysis reports to the Regional Administrator? (Y/N) _____

10.0 Site Verification

10.1 Plot Plan indicating the locations of various facility components, ground-water monitoring wells, and surface waters? (Y/N _____)

10.1.1 Is the plot plan used for the inspection the same as in the monitoring program plan documentation? (Y/N) _____

If not, explain _____

_____

10.1.2 Are all of the components of the facility identified during the inspection addressed in the monitoring program documentation? (Y/N) _____

If not, explain _____

_____

10.1.3 Are there any streams, lakes or wetlands on or adjacent to the site? (Y/N) _____

If yes, indicate distances from waste management areas _____

_____

_____

10.1.4 Are there any signs of water quality degradation evident in the surface water bodies? (Y/N) _____

If yes, explain _____

_____

_____

10.1.5 Is there any indication of distressed or dead vegetation on or adjacent to the site? (Y/N) _____

If yes, explain _____

_____

_____

10.1.6 Are there any significant topographic or surficial features on or near the site (e.g., recharge or discharge areas)? (Y/N) _____

If yes, explain _____

_____

10.1.7 Are the monitor well locations and numbers in agreement with the monitoring program documentation? (Y/N) _____

If no, explain _____

_____

10.1.7.1 Were locations and elevations of the monitor wells surveyed into some known datum? (Y/N) _____

If not, explain _____

_____

10.1.7.2 Were the wells sounded to determine total depth below the surface? (Y/N) _____

If not, explain_____

_____

10.1.7.3 Were discrepancies in total depth greater than two feet apparent in any well? (Y/N) _____

If yes, explain_____

_____

10.1.8 Was ground water encountered in all monitoring wells? (Y/N) _____

If not, indicate which well(s) were dry_____

_____

10.1.9 Were water level elevations measured during the site visit? (Y/N) _____

If yes, indicate well number and water level elevation_____

_____

If not, explain_____

_____

APPENDIX - C

GROUND-WATER QUALITY ASSESSMENT PROGRAM INFORMATION FORM

APPENDIX C

GROUND-WATER QUALITY ASSESSMENT PROGRAM
INFORMATION FORM

Company Name:_____; EPA I.D.#:_____

Company Address:_____

_____

_____

Inspector's Name:_____; Date:_____

1.0 Background

1.1 List the constituents (contaminants) originating from the waste management area: (use separate sheet if necessary_____

_____

_____

1.2 Have the concentrations of the hazardous waste or hazardous waste constituents shown significant increases in:

- upgradient monitoring wells (Y/N) _____
- downgradient monitoring wells (Y/N) _____

1.2.1 List or indicate on a map, the wells which have shown significant increases: (use separate sheet if necessary)_____

_____

_____

1.3 Were the significant increases in contaminant concentration determined through the use of the student's t-Test? (Y/N) _____

If no,

1.3.1 Explain procedure used_____

_____

_____

1.4 Has the possibility of error (e.g., laboratory) been eliminated? (Y/N) _____

1.4.1 Explain_____

_____

_____

2.0 Contaminant Characteristics

2.1 If available, list the chemical and physical properties of the contaminants which have been detected in the ground water: (density, solubility, etc.). Include on a separate sheet if list is extensive _____

_____

_____

3.0 Implementation of the Assessment Program

3.1 Has the extent of the migration of hazardous waste or hazardous waste constituents been determined? (Y/N) _____

If yes,

3.1.1 Indicate how: (check appropriate method(s))

- additional ground-water monitoring wells _____
- geophysical methods _____
- computer simulation _____
- other, explain _____

_____

3.2 Were monitoring wells installed? (Y/N) _____

If yes,

3.2.1 Record monitoring well/peizometer completion data on INFORMATION TABLE C-1.

3.2.2 Were well clusters (nests) used or were wells with multiple intake areas constructed? Give details _____

_____

_____

3.2.3 Show the numbers and locations of the additional wells/peizometers on a site map.

3.2.4 Are the locations of the wells/piezometers justified in view of the water table or potentiometric surface map? (Y/N) _____
Give details _____

_____

_____

INFORMATION TABLE C-1

	WELL NO.						
	GROUND ELEVATION						
	TOTAL DEPTH						
WELL CASING	TYPE MATERIAL						
	DIAMETER						
	LENGTH						
	STICK-UP						
	TOP ELEVATION						
	BOTTOM ELEVATION						
WELL SCREEN	DEPTH TOP/BOTTOM						
	TYPE MATERIAL						
	DIAMETER						
	LENGTH						
	SLOT SIZE						
	TOP ELEVATION						
	BOTTOM ELEVATION						
OPEN HOLE OR SAND/GRAVEL PACK	DEPTH TOP/BOTTOM						
	DIAMETER						
	LENGTH						
	TOP ELEVATION						
	BOTTOM ELEVATION						

3.2.5 Are the depths of the monitoring wells/ piezometers justified due to the relative characteristics (e.g., densities) of the contaminants? (Y/N) _____
Give details _____

_____

_____

3.2.6 List any other methods (e.g., soil sample analysis) used to document the extent of the contamination. (use separate sheet if necessary) _____

_____

_____

3.3 Has the rate of contaminant migration been determined? (Y/N) _____

If yes, what is it and how was it determined? _____

_____

_____

3.3.1 Does the rate of migration differ for various contaminants? (Y/N) _____
Give details _____

_____

_____

3.3.2 If known, what is the cause (reason) of (for) this differential in migration rates? _____

_____

_____

APPENDIX - D

WAIVER DEMONSTRATION TECHNICAL INFORMATION FORM

APPENDIX D

WAIVER DEMONSTRATION TECHNICAL INFORMATION FORM

Company Name:_____; EPA ID.#:_____

Company Address:_____

_____

_____

Inspector's Name:_____; Date:_____

1.0 Site Characterization

Regional Map (U.S.G.S., 7.5 min. Topographic Quadrangle Map, or similar) showing facility location with water supply wells near the facility indicated.

1.0.1 Are there discharging wells near the facility? (Y/N) _____

If yes, give distances to wells _____

_____

1.0.1.1 Which aquifers in the vicintiy provide water supplies?_____

_____

1.0.1.2 What is the estimated withdrawal (diversion) rate from these aquifers?_____

_____

1.0.2 Are there any streams, rivers, or lakes near the facility? (Y/N) _____

1.0.2.1 If so, indicate approximate distances from the facility._____

_____

1.1 Regional Hydrogeologic/Surficial Geologic Map

1.1.1 Is the surficial geology adequately illustrated? (Y/N) _____

1.1.2 Are areas of recharge/discharge shown? (Y/N) _____

1.1.3 Is regional groundwater flow direction indicated? (Y/N) _____

1.1.4 Are the water table or potentiometric contours logical? (Y/N) _____

1.2 Map of Facility (scale at least 1" = 200'), showing the locations of facility components (e.g., surface impoundments, and disposal areas), and groundwater monitoring wells, springs, seeps, streams, etc.

1.2.1 Is the facility a multi-component facility? (Y/N) _____

1.2.2 Are locations of test borings (or pits) and observation wells shown? (Y/N) _____

1.2.2.1 Are borings, pits, or wells located in or near the waste management area? (Y/N) _____

If yes,

1.2.2.2 Do the borings, pits, or wells appear to be of such number, and depth to adequately characterize the substrate? (Y/N) _____

Give brief detail _____

_____

_____

1.3 Boring Logs and Geologic Cross Sections

1.3.1 Are there logs of the borings or test pits? (Y/N) _____

1.3.2 How are the sub-surface materials described: (check as appropriate)

1.3.2.1 Unified Soil Classification System _____

1.3.2.2 U.S.D.A. Soil Classification System _____

1.3.2.3 Burmeister Classification System _____

1.3.2.4 Other (explain) _____

_____

1.3.3 Are geologic cross-sections included? (Y/N) _____

1.3.4 Is there evidence of confining (low permeability) layers beneath the facility? (Y/N) _____

2.0 Waste Characterization

2.1 Has the waste material been stabilized in any way to preclude the potential of leachate being generated? (Y/N) _____

If yes, briefly explain methods _____

_____

2.2 Have specially engineered features been incorporated into the facility design to minimize the migration of leachate? (Y/N) _____

If yes, briefly explain _____

_____

3.0 Water Balance

3.1 Is precipitation data included? (Y/N) _____

3.1.1 How is it tabulated? (check one)

- Daily _____
- Weekly _____
- Monthly _____
- Annually _____

3.1.2 Source of data (check one)

- U.S. Weather Service _____
- State Agency _____
- Other Source _____
  Identify _____

_____

3.1.3 Length of record, in years _____

3.1.4 Distance of measuring point from the facility _____

3.2 Is actual evapotranspiration (AET) data included? (Y/N) _____

3.2.1 Is the source of AET data indicated? (Y/N) _____

If yes, give reference _____

_____

3.3 Is run-off calculated? (Y/N) _____

3.3.1 Is the technique referenced? (Y/N) _____

If yes, give reference _____

_____

3.4 Is infiltration data included? (Y/N) _____

3.4.1 Is source of data referenced? (Y/N) _____

If yes, give reference _____

_____

3.5 Is there a positive net infiltration recorded? (Y/N) _____

If yes, how much? _____

4.0 Unsaturated Zone Characteristics

4.1 Has the applicant demonstrated that the unsaturated zone will isolate any waste derived leachate from the water table, chemically or physically? (Y/N) _____

Briefly describe mechanism(s) _____

_____

_____

4.2 Physical Properties

4.2.1 Has the applicant defined the unsaturated thickness and areal variability? (Y/N) _____

Briefly describe _____

_____

_____

4.2.2 Has the primary and secondary porosity (if any) of the unsaturated zone been determined? (Y/N) _____

Briefly describe _____

_____

4.2.3 Have hydraulic conductivity curves for each sediment type comprising the unsaturated zone been established? (Y/N) _____

4.2.4 Have textural analyses been performed? (Y/N) _____

4.2.5 Have bulk densities been estimated? (Y/N) _____

4.3 Chemical Properties

4.3.1 Has cation exchange been cited as an attenuation means? (Y/N) _____

If yes,

4.3.1.1 Type of clay _____

4.3.1.2 Percent of clay _____

4.3.1.3 Percent of organics _____

4.3.1.4 pH of materials _____

4.3.2 Have other attenuation mechanisms, if any, been adequately explained? (Y/N) _____

If yes, cite mechanism:

4.3.2.1 Biodegradation _____

4.3.2.2 Complexation _____

4.3.2.3 Precipitation _____

4.3.2.4 Chelation _____

4.3.2.5 Other _____

5.0 Saturated Zone Physical Characteristics

5.1 Have the saturated zone hydrologic properties been determined? (Y/N) _____

If yes, were pumping tests performed to determine (check appropriate determinations and give results)

5.1.1 Transmissivity _____

5.1.2 Hydraulic Conductivity _____

5.1.3 Storage Coefficient _____

5.1.4 Leakage _____

5.2 How many tests were performed? _____

5.2.1 The duration(s) of test(s) _____

5.2.2 The length(s) of the recovery test(s) _____

5.3 Were other insitu tests performed? (Y/N) _____

(check appropriate tests)

5.3.1 Falling head tests _____

5.3.2 Constant head tests _____

5.3.3 Packer tests _____

5.3.4 Other _____

Explain _____

_____

5.4 Was the saturated thickness determined? (Y/N) _____

5.5 Are static water level measurements included? (Y/N) _____

5.6 Is a site water table (equipotential) contour map included? (Y/N) _____

5.6.1 Does the contour map appear logical based on the presented data and topography? (Y/N) _____

5.6.2 Are groundwater flowlines indicated? (Y/N) _____

5.6.3 Are hydraulic gradients included? (Y/N) _____

5.6.4 Are flow velocities included? (Y/N) _____

5.7 Is there any indication of vertical flow in the saturated zone? (Y/N) _____

5.8 Saturated Zone Chemical Properties of Ground Water

5.8.1 Have water quality analyses been performed to establish background data? (Y/N) _____

5.8.2 Does background information indicate that the aquifer may be degraded in any way? (Y/N) _____

6.0 Computer Modeling

6.1 Was a computer simulation utilized in the demonstration? (Y/N) _____

Check appropriate model:

6.1.1 Mass transport _____

6.1.2 Flow model _____

6.2 Type of model? (check appropriate type)

6.2.1 Numerical _____

6.2.2 Analytic _____

6.2.3 Reference for model? _____

_____

_____

6.2.4 Does the data appear to warrant the use of modeling techniques? (Y/N) _____

If not, explain _____

_____

_____

APPENDIX - E

RCRA REFERENCES

APPENDIX E

RCRA REFERENCES

1. Implement a ground-water monitoring system (265.90)

2. Submit a written report to have all or part of the ground water requirements waived (265.90(c)) (by a geologist or geotechnical engineer)

   - migration of hazardous waste (or HW constituents) to the uppermost aquifer

   - potential for HW to migrate from uppermost aquifer to water supply wells or surface water

3. To qualify for an alternate plan (265.90(d))

4. Have at least one well hydraulically upgradient and at least three hydraulically downgradient (listing # and location and depths (265.91)

5. Have all wells properly completed (265.91(c))

6. Obtain and analyze samples; also must develop and follow a ground-water sampling and analysis plan (265.92(a))

7. Must determine the concentration or values of parameters listed in 265.92(b)

8. Must establish background concentrations or values for all wells as in Paragraph (b), quarterly (265.92(c))

   - for contaminant indicator parameters take at least four replicate measurements, initial background arithmetic mean & variance for upgradient wells (first year)

   - after first year, all wells must be sampled and analyzed with the following frequencies:

     - those in 265.92(b)(2) at least annually
     - those in 265.92(b)(3) (indicators) at least semi-annually

   - elevation of ground-water surface must be determined at each sampling

9. Within one year of effective date of regulations, prepare an outline of a ground-water assessment program (265.93(a))*

10. Calculate arithmetic mean and variance for each indicator for each well and compare with its initial background (265.93(b))

*See note page 2-10.

11. If comparisons (265.93(c)(1)) for upgradient wells show a significant change, info must be submitted as in 265.94(a)(2)(ii)

12. If comparisons (265.93(c)(2)) for the downgradient wells show a significant change, obtain additional samples, split in two, and obtain analyses of all additional samples to determine if difference was due to error.

13. If significant change is confirmed, notify Regional Administrator (RA) within seven days (265.93(d)(1))

14. Within 15 days after notification, develop and submit a specific plan to the RA (based on outline in Paragraph a) certified by a geologist, etc., for a ground-water assessment program at the facility (265.93(d)(2))

15. Must specify (265.93(d)(3))

    (i) No., location and depth of wells
    (ii) sampling and analytical methods
    (iii) evaluation procedures, including any use of previously gathered ground-water quality info
    (iv) schedule of implementation

16. Must implement ground-water quality assessment plan and determine

    (i) rate and extent of migration of HW in ground water
    (ii) concentrations of HW (or HW constituents) in ground water (265.93(d)(4))

17. Must make first assessment determination under Paragraph 265.93(d)(4) as soon as technically feasible, and submit a written report to the RA (265.93(d)(5))

18. If it is determined HW's or HW constituents have not entered the ground water:

    - reinstate the indicator evaluation program described in 265.92 and 265.93(b)

    - notify the RA within 15 days after determination

19. If it is determined HW's or HW constituents have entered the ground water:

    - (265.93(d)(7)(i)) continue to make determinations on quarterly basis until final closure; if implemented prior to final closure or

    - (ii) cease to make further determinations if plan was implemented during the post-closure care period

20. 265.93(e) (Notwithstanding any other provision of this subpart), any ground-water quality assessment to satisfy 265.93(d)(4) which is initiated prior to final closure must be completed and reported in accordance with 265.93(d)(5)

21. 265.93(f) Unless the ground water is monitored for 265.93(d)(4), at least annually o/o must evaluate ground-water surface elevations under 265.92(e) to determine if 265.91(a) is satisfied. If not, the system must be brought into compliance.