Report of Investigation
Preliminary Groundwater Monitoring Study

HERCULES, INC.
Hattiesburg, MS

September 22, 1980

Subsurface Disposal Corporation
5555 West Loop South, Suite 646 • Bellaire, Texas 77401 • (713) 666-8158 • Telex: 77-5907

22 September 1980

Mr. Thomas Thoms
Development Supervisor
P.O. Drawer 1937
Hattiesburg, MS 39401

Dear Tom:

I am enclosing the report of our investigation concerning a groundwater monitoring program at your plant. Thank you for the time extension you have afforded us in submitting the final report. We have been so busy this year that the extra time was much appreciated.

It was a real pleasure working with you during the study. If we can be of any further service, or if you have any questions, please don't hesistate to call.

Sincerely,

Larry Browning
Senior Hydrologist

LB/dr

Enclosure

1.0 PURPOSE AND SCOPE

The purpose of this report is to present the results of a preliminary hydrogeologic analysis of the Hercules Hattiesburg, Mississippi plant, for purposes of designing a groundwater monitoring system. The objects of this monitoring system are a process water pond located near the southeastern boundary of the plant, and a series of active and inactive sludge disposal pits located in the unused northwestern part of the plant (the "Back 40").

The data utilized in this study consisted of general geologic reports for the area, six electric logs run in water wells in the area, field observation, and two borings with related soil and groundwater sampling. Field testing was conducted between July 21-25, 1980.

2.0 STUDY AREA

The Hercules Hattiesburg, Mississippi plant is located at Highway 42 and Providence Street, within the city limits of Hattiesburg in Forrest County, Mississippi. The climate of the area is humid and subtropical. Average annual rainfall is approximately 64 inches. The study area lies in the East Gulf Coastal plain, within the drainage area of the Leaf River.

The rocks exposed at the surface at the plant site are a thin veneer of alluvial terrace sands and gravels of Eocene to recent age. Immediately underlying these terrace deposits is a sequence of clays, sands, and gravels known as the Miocene Hattiesburg formation (Figure 1). This formation dips regionally southward at from 20 to 25 feet per mile. Aerial photo interpretation does not reveal any significant fault expression near the plant site.

The primary drinking water aquifer in the area is a series of sands and gravels of Miocene age. This aquifer exists at a depth of approximately 400 feet at the plant site.

2.1 PROCESS WATER IMPOUNDING BASIN AND SLUDGE PITS

The process impounding basin is located near the eastern plant boundary on Providence street. The basin is approximately 250 feet by 70 feet. The pond was excavated in native clays to a depth of approximately 10 feet. The basin sides are lined with boards, diked, and bordered to the south by a runoff collection ditch. No evidence of seepage was observed. Sludge accumulation is approximately 8 cu. yards per day, which corresponds to 1 inch per week within the basin. The basin is periodically dredged, and the sludge is disposed of in a series of pits located in the "Back 40".

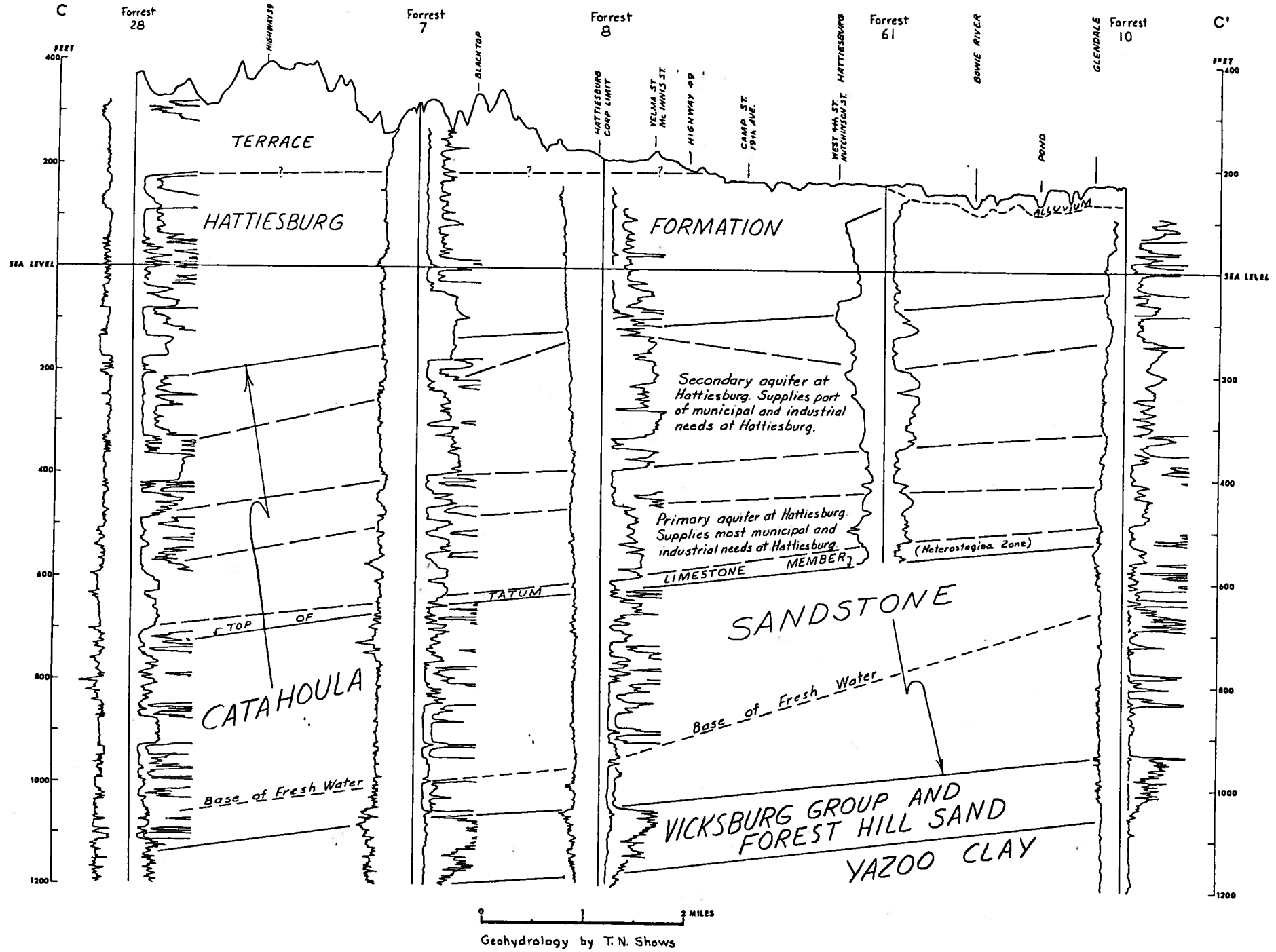


Fig. 1. Geohydrologic section (C-C') through the Hattiesburg area

The "Back 40" pits have been used for sludge disposal for at least 10 years. These beds vary in size. The largest pit is approximately 180' x 220', and the smallest is 80' x 140'. These pits were excavated by bulldozer into native clays to a depth of approximately 8 feet. The pits are diked on all sides with a combination of native clay and topsoil gravels. Four sludge pits are active, and consist of varying proportions of solidified black sludge, sludge liquors, and rainwater. One area of pits is inactive and covered by a cap of native clay.

This investigation was conducted during a period of higher than average rainfall. Some lowlying areas surrounding the active pits were marshy. Some leakage of pit contents was noticeable. This leakage was observed to result from both pit overflow and seepage at the dike toe.

Chemical analyses of impounding basin and sludge pit contents are presented in Appendix 1.

3.0 BORING PROGRAM

Two borings were completed at the plant site. One boring (B-1) was located at the southeast corner of the "Back 40" sludge pit area, and one boring was located across Providence Road, 100 feet east of the impounding basin. Drilling logs of these borings are presented in Appendix 2.

A generalized subsurface section of the soils beneath the plant site may be described as:

0-11	Sands and gravels, Fill
11-62	Very stiff blue clay
*62-69	Fine sands, coarse sand and gravel
*69-75	Stiff blue clay
75-102	Fine sands, coarse sand and gravel
102-Termination	Hard brown clay.

*Thickness varies.

The results of laboratory soil tests are presented in Appendix 2.

3.1 DISCUSSION

Borings B-1 and B-2, although located approximately one mile apart, exhibited very similar lithologies. This stratigraphic consistency is described in several soil and groundwater reports completed in the study area. Several points should be noted.

A. A thin veneer (approximately 10 feet) of fill and alluvial terrace deposits was noted in each boring. These sands, although relatively permeable, were not saturated at the time the wells were drilled. The thickness of the surficial deposits is highly variable at other locations within the Plant, ranging from 0 to 12 feet. The boring sites were located down-slope topographically from each facility. The thickness of the surficial deposits was observed to be less than 6 feet immediately surrounding both facilities.

B. At least 50 feet of relatively homogeneous, very dense blue clay underlies the area. Laboratory testing indicates the permeability of this clay to be at least 1.9×10^{-7} cm/sec. One in-place falling head permeability test of this clay was attempted in Boring B-2, but was discontinued after no inflow was determined after eight (8) hours. Furthermore, the upper 30 feet of this clay unit was unsaturated.

C. The lower sand and gravel units were observed to be very permeable, and correspond closely to established models of alluvial point-bar deposits. These deposits terminated unconformably upon a dense brown clay.

4.0 MONITORING WELLS

Borings B-1 and B-2 were completed as permanent monitoring wells. Two-inch schedule 40 PVC casing and #10 well screen were run to T.D. Bentonite clay pellets and portland cement were used to seal the wells according to EPA specification. The wells were pumped using a one-inch PVC air lift line and a portable air compressor. Both wells were pumped for four (4) hours prior to sampling. Results of chemical analyses and water level observation are presented in Table 1.

4.1 DISCUSSION

A. The sand and gravel zones below 62 feet constitute the first saturated "aquifer" to be encountered beneath each hazardous waste facility. These were the zones chosen for monitoring.

B. The permeability of the finest sand zones encountered was tested as 4.2×10^{-6} cm/sec. The permeability of the coarsest basal gravels is estimated to be at least 1×10^{-3} cm/sec. These extremes of permeability would correspond to a rate of water movement of from .03 to 4 feet/yr, under the observed hydraulic gradient.

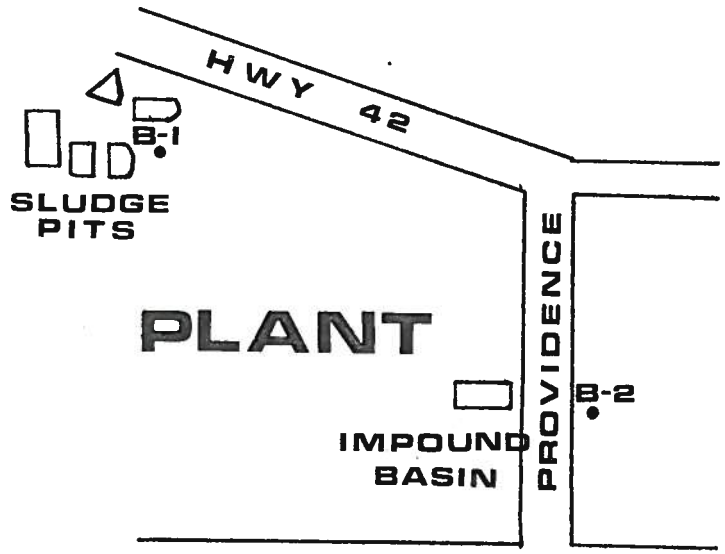
TABLE 1 - RESULTS OF CHEMICAL ANALYSES AND WATER LEVEL OBSERVATION

WELL NO.	pH	SP. COND (μ mhos)	Cl	SO4	ALK. TOTAL	ALK PHEN	ALK BICARB	Na	K	Ca	Mg	TOC	DELNAV
B-1	7.25	220	1.25	7.82	210	0.0	210.0	<1	<1	11.0	2.0	9	<1 ppb
B-2	8.25	270	1.00	8.23	245	5.0	235.0	<1	<1	<1	3.0	15	<1 ppb

Appearance of Samples: Clear
Odor: None
All units are mg/l unless specified

WATER LEVEL OBSERVATION (8/4/80)

WELL NO.	LAND ELEVATION (+MSL)	WATER LEVEL (+MSL)
B-1	155.0	130.6
B-2	159.7	121.5



C. Based on preliminary data, the hydraulic gradient of this zone is observed to generally correspond to the predicted dip of the aquifers. The general hydraulic gradient is from B-1 towards B-2, that is, from northwest to southeast. Supplementary data is necessary to determine the absolute direction and amount of gradient. The monitoring wells were sited generally downgradient of the subject facilities, and were observed to provide representative samples of formation water.

D. No evidence of groundwater contamination due to facility leakage was discovered in samples from the monitoring wells. Total Organic Carbon values are consistent with those encountered in shallow ground water of alluvial origin. Analysis for DELNAV (a Hercules product) was chosen as an indicator of organic contamination, as it is the chief organic constituent of facility contents and indicative of a wide range of organic species. All DELNAV analyses were below the limit of detection (1 part per billion).

5.0 REGULATORY REQUIREMENTS

The contents of both the impounding basin and "Back 40" sludge pits will be classified as hazardous waste under provisions of the Resource Conservation and Recovery Act (RCRA). RCRA also requires that a hydrologic assessment be made of each hazardous waste facility to determine the potential of each facility to contaminate ground water. A system of monitoring wells may be required for each facility. Details of these requirements are presented in Appendix 3.

6.0 CONCLUSIONS

A. The subject hazardous waste facilities have been in operation for over 10 years. No evidence of groundwater contamination was discovered.

B. The subject facilities are excavated into native clays of extremely low permeability. The pond bottoms are separated from the uppermost fresh water aquifers by over 50 feet of dense, very homogeneous, unsaturated clay of very low permeability. Electric logs of water wells indicate that this clay can be correllated throughout the study area. From a practical perspective, it is impossible for pond contents to migrate vertically through this clay and contaminate the uppermost fresh water aquifer.

C. Preliminary studies have shown that no water wells are completed in the uppermost aquifer within at least one (1) mile of the facilities. Drinking water supplies in the area are taken from aquifers at least 300 foot deep.

7.0 RECOMMENDATIONS

A. Field observation and testing have demonstrated an extremely remote potential for contamination of the uppermost aquifer by leakage of the contents of the subject facility. As provided in Section 265.90 (c) of RCRA, we recommend that these facilities be exempted from the groundwater monitoring requirements.

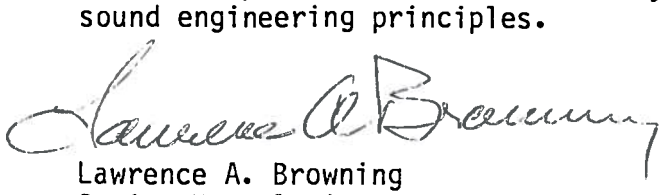
B. Surficial terrace deposits and fill material exist near each facility to some depth below land surface. These deposits were not found to be saturated at the time of this investigation and, as such, are neither considered "aquifers" nor subject to monitoring within the framework of RCRA. However, these deposits could conceivably transmit leakage from the facilities as a "perched" water table atop the dense clay described previously. This leakage would not pose any threat to the uppermost aquifer, but might run off laterally to ditches or streams. Therefore, we recommend that a series of dry auger borings to a depth of 12 feet be sited around each facility. These borings should be observed to determine if these soils are saturated. The boring may then be screened so as to intercept any shallow leakage, and sized to accept a bailer.

C. The sludge pits on the "Back 40" which are no longer used should be closed out. This closure would consist of a sloped native clay cap. This closure would not only prevent any future leaking of the contents, but also would eliminate any odor problem.

D. We recommend that an improved "housekeeping" program be instituted for the "Back 40". Better maintenance of dikes and periodic drainage of rainwater and sludge liquors from the pits would eliminate the hazard of surface contamination.

E. Details of construction of the present "Back 40" pits are not available. In the future, optimum construction techniques would allow for lining and compacting the pit sides and bottom with native clays. In light of better maintenance, optimum construction techniques for new pits, and correct closure of inactive pits, we can recommend the continued usage of the "Back 40" area for sludge disposal.

I certify that all of the data, conclusions, and recommendations contained in this report are true and correct, and represent an analysis based on sound engineering principles.



Lawrence A. Browning
Senior Hydrologist

APPENDIX 1

TAPLE 2

METALS CONCENTRATION (PPM)

Type Metal	Water Extract mg/l	Extract Limit mg/l	Extracted Ash ppm	Original ASH ppm	% Extracted
Arsenic	0.008	0.500	0.011	0.170	93.6
Barium	0.860	10.000	2.130	19.330	89.0
Cadium	0.019	0.100	0.062	0.440	86.0
Chromium	0.044	0.500	0.108	0.990	89.1
Lead	0.083	0.500	0.159	1.820	91.2
Mercury	0.000	0.020	0.003	0.003	0.0
Selenium	0.006	0.100	0.039	0.160	75.5
Silver	0.000	0.500	0.000	0.000	-
Nickel	0.121	-	0.378	2.800	86.5
Aluminum	0.134	-	0.457	3.140	85.4
Zinc	0.208	-50 mg/l	0.688	4.850	85.8
Copper	0.164	-10 mg/l	0.219	3.500	93.7
Iron	1.392	- 3 mg/l	1.753	29.590	94.1

WHERE

Water extract = heavy metals concentration in the actual water extract from the sample being analyzed.

Extract limit = the maximum heavy metals concentration which if exceed in the water extract would define the sample as being a hazardous waste under toxic waste characteristics.

Extracted Ash = heavy metals concentration left in the sample after extraction.

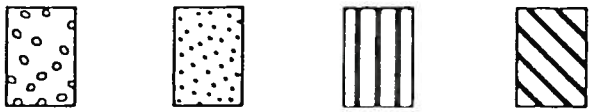
Original ash = heavy metals concentration is the ashed sample. This was calculated based on the amount of water and sample used during extraction and the amount of heavy metals left in the extracted ash sample.

% Extracted = percent heavy metals extracted based on the above data.

APPENDIX 2

SYMBOLS AND TERMS USED ON BORING LOGS

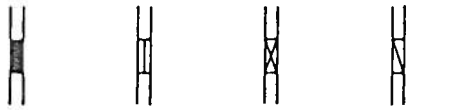
SOIL TYPES
(SHOWN IN SYMBOL COLUMN)



Gravel | Sand | Silt | Clay

Predominant type shown heavy

SAMPLER TYPES
(SHOWN IN SAMPLES COLUMN)



Shelby Tube | Pit Cutings | Split Spoon | No Recovery

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS (major portion retained on No. 200 sieve): Includes (1) clean gravels and sands, and (2) silty or clayey gravels and sands. Condition is rated according to relative density, as determined by laboratory tests.

DESCRIPTIVE TERM	RELATIVE DENSITY
Loose	0 to 40%
Medium dense	40 to 70%
Dense	70 to 100%

FINE GRAINED SOILS (major portion passing No. 200 sieve): Includes (1) inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as indicated by penetrometer readings or by unconfined compression tests.

DESCRIPTIVE TERM	UNCONFINED COMPRESSIVE STRENGTH TON/SQ FT
Very soft	less than 0.25
Soft	0.25 to 0.50
Firm	0.50 to 1.00
Stiff	1.00 to 2.00
Very stiff	2.00 to 4.00
Hard	4.00 and higher

Note: Slickensided and fissured clays may have lower unconfined compressive strengths than shown above, because of planes of weakness or cracks in the soil. The consistency ratings of such soils are based on penetrometer readings.

TERMS CHARACTERIZING SOIL STRUCTURE

Slickensided – having inclined planes of weakness that are slick and glossy in appearance.

Fissured – containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.

Laminated – composed of thin layers of varying color and texture.

Interbedded – composed of alternate layers of different soil types.

Calcareous – containing appreciable quantities of calcium carbonate.

Well graded – having wide range in grain sizes and substantial amounts of all intermediate particle sizes.

Poorly graded – predominantly of one grain size, or having a range of sizes with some intermediate size missing.

Terms used in this report for describing soils according to their texture or grain size distribution are in accordance with the UNIFIED SOIL CLASSIFICATION SYSTEM, as described in Technical Memorandum No 3-357, Waterways Experiment Station, March 1953.

LOG OF BORING NO. 1
HERCULES POWDER COMPANY
HATTIESBURG, MISSISSIPPI

TYPE: 3" Shelby tube & 2" split-spoon LOCATION: As directed by Larry Browning

SURFACE EL.: Not known

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT LB/CU FT	COHESION, KIP/SQ FT (1, 2, 3, 4) / PLASTIC LIMIT — WATER CONTENT, % — LIQUID LIMIT (20, 40, 60, 80)	ELEVATION, FT
			Medium dense light gray clayey fine sand	13			
5			Dense light gray fine to medium sand with coarse sand and gravel	62			
10				33			
			Hard gray and greenish clay, slightly silty				
15							
			-blue, slightly sandy below 18'				
20							
25			Hard blue silty clay with silty fine sand laminations and seams				
30							
35							
			Hard blue clay				
40							
			-blue and brown below 43'				
45							
50							
			-slightly sandy below 53'				

(continued next page)

WARE LIND ENGINEERS

LOG OF BORING NO. 1

(Continued)

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT LB/CU FT	COHESION, KIP/SQ FT (1 2 3 4) / PLASTIC LIMIT — WATER CONTENT, % — LIQUID LIMIT (20 40 60 80)	ELEVATION, FT
			Hard blue clay (continued)				
60			Hard blue very sandy clay with fine sand seams				
65			Dense blue clayey fine sand				
70			Hard blue clay, slightly sandy				
75			Dense blue silty fine sand -hard sandy clay layer 77'-80'	40		Note: A well screen was set in this stratum from 73' to 76'	
80							
85			-coarse sand and fine gravel seam at 87'				
90				35			
95			Dense coarse sand and gravel -large gravel below 96'			Note: A well screen was set in this stratum from 93' to 96' and from 97' to 100'	
100							
105			Hard brown clay				

COMPLETION DEPTH: 105 ft

DATE: 9/22/80

LOG OF BORING NO. 2
HERCULES POWDER COMPANY
HATTIESBURG, MISSISSIPPI

TYPE: 3" Shelby tube & 2" split-spoon LOCATION: As directed by Larry Browning

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE EL.: Not determined	BLOWS PER FT	UNIT DRY WEIGHT LB/CU FT	COHESION, KIP/SQ FT (1 2 3 4) / PLASTIC LIMIT — WATER CONTENT, % — LIQUID LIMIT (20 40 60 80)	ELEVATION, FT
			Loose medium to coarse sand with gravel (Fill)				
5			Loose gray and tan silty fine sand	9			
			-occasional clay seams 8'-11'				
10			-medium dense below 8'	14			
			Very stiff blue clay				
15				14			
			Very stiff blue silty clay with silty fine sand partings				
20							
			Hard brown and blue clay				
25							
			-blue, slightly sandy with occasional silty fine sand partings below 28'				
30							
			Hard blue silty clay, slightly sandy with occasional silty fine sand partings				
35			-very sandy 38'-43'				
40							
			-blue and brown 43'-46'				
45							
50							
			(continued next page)				

LOG OF BORING NO. 2

(Continued)

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT LB/CU FT	COHESION, KIP/SQ FT (1, 2, 3, 4) / PLASTIC LIMIT — WATER CONTENT, % — LIQUID LIMIT (20, 40, 60, 80)	ELEVATION, FT
60			Hard blue-green fine sandy clay with clay pockets (continued)				
65			Dense medium to coarse sand with fine gravel	100		Note: A well screen was set in this stratum from 62' to 72'	
70				76			
75			Hard blue clay, slightly sandy with silty fine sand partings and seams -very sandy to 74'				
80							
85						Note: A well screen was set in this clay stratum and the underlying sand stratum from 84' to 104'	
90			Dense blue silty fine sand -occasional clay pockets 88'-98'				
95				55			
100			-clay pockets 103'-104'				
105			Hard blue-green clay -slightly sandy to 106' -brown and blue 106'-110'				

COMPLETION DEPTH: 110 ft

DATE: 7/23/80

WARE LIND
SOIL AND FOUNDATION CONSULTANTS

SOIL BORINGS
LABORATORY TESTS ENGINEERING REPORTS

859 PEAR ORCHARD ROAD • POST OFFICE BOX 10115 • JACKSON, MISSISSIPPI 39206 • AREA CODE 601 TELEPHONE 956-4467

August 13, 1980

Subsurface Disposal
5555 West Loop South
Belaire, Texas 77401

Report No. 80095

Attention: Mr. Larry Browning

Soil Borings, Piezometer Installation
and Laboratory Tests
Hercules Power Company
Hattiesburg, Mississippi

Gentlemen:

Submitted here is a summary of work recently performed for you at the Hercules Power Company site in Hattiesburg, Mississippi. This work was authorized verbally by Mr. Browning on July 8, 1980.

Two borings were completed at the site to depths of 105 ft and 110 ft during the period July 21 through July 24, 1980. Undisturbed samples of clayey soils were taken from the borings at about 5-ft intervals of depth. In sands, disturbed samples were taken at about 5-ft intervals of depth by driving a 2-in. OD split-spoon sampler 18 in. with a 140-lb hammer falling 30 in. Representative portions of all samples were sealed in glass jars for later use in the laboratory.

After completion of the borings, piezometers were installed to approximately the bottom of each boring using 2-in. OD PVC pipe and 3-ft long by 2-in. OD continuous slot well screens. The piezometers were later sealed and pumped in accordance with your instructions.

In the laboratory, one falling head permeability test was performed on a sample of gray silty fine sand taken from 74-ft depth in Boring 1. Results of this latter test indicate a coefficient of permeability of 4.18×10^{-6} cm/sec. In addition, five permeability tests and four liquid and plastic limit tests were performed on selected samples of clays using floating ring consolidometers. The tests were performed using consolidation loads of 500 and 1000 lbs per sq ft. Results of these latter tests are as follows:

Boring No.	Depth, ft	Material	(1) k, cm/sec	(2) LL	(3) PL
1	14.5	clay	1.87×10^{-7}	51	23
1	54.5	silty clay	3.42×10^{-7}	35	18
2	19.5	silty clay, slightly sandy	6.08×10^{-7}	36	25
2	59.0	clay, sand and clayey sand	6.30×10^{-7}	43	20
2	79.5	silty clay	7.84×10^{-7}	-	-

(1) Permeability
(2) Liquid limit
(3) Plastic limit

If we could furnish you with any additional information at this time, please call on us.

Very truly yours,

WARE LIND ENGINEERS, Inc.

Edwin E. Ware, P. E.

EEW/cw

CULPEPPER TESTING LABORATORIES

Air and Water Analyses

205 SOUTH MAIN STREET TELEPHONE 601 583-0411

HATTIESBURG, MISSISSIPPI 39401

Client: Hercules, Inc.
Date: July 30, 1980
Invoice No.: 0425

Date Received: July 25, 1980
Date Analysis Begun: July 25, 1980
Collected By: Client

Laboratory Number: H-72580-4A
Remarks:
Sample labeled HT-517-36-1
Water Well
Back 40

B-1

Analytical Parameter	Concentration	Methodology*
Total Chlorides	1.25 mg/l	112B
Total Sulfate	7.82 mg/l	156B
Alkalinity, Total	210.0 mg/l	102
Alkalinity, Phenolphtalein	0.0 mg/l	102
Alkalinity, Bicarbonate	210.0 mg/l	102
Sodium	None detectable	Atomic Absorption
Potassium	None Detectable	Atomic Absorption
Calcium	11.0 mg/l	Atomic Absorption
Magnesium	2.0 mg/l	Atomic Absorption
pH	7.25 SU	144A

*Standard Methods for the Examination of Water and Wastewater

Certified by: T. J. Culpepper, Ph.D.

CULPEPPER TESTING LABORATORIES

Air and Water Analyses

805 SOUTH MAIN STREET TELEPHONE 601 583-0411

HATTIESBURG, MISSISSIPPI 39401

Client: Hercules, Inc.
Date: July 30, 1980
Invoice No.: 0425

Date Received: July 25, 1980
Date Analysis Begun: July 25, 1980
Collected By: Client

Laboratory Number: H-72580-4B
Remarks: Sample labeled HT-517-36-2

B-2

Well Water
Providence Street

Analytical Parameter	Concentration	Methodology*
Total Chlorides	1.00 mg/l	112B
Total Sulfate	8.23 mg/l	156B
Alkalinity, Total	245.0 mg/l	102
Alkalinity, Phenolphtalein	5.0 mg/l	102
Alkalinity, Bicarbonate	235.0 mg/l	102
Sodium	None detectable	Atomic Absorption
Potassium	None detectable	Atomic Absorption
Calcium	None detectable	Atomic Absorption
Magnesium	3.0 mg/l	Atomic Absorption
pH	8.25 SU	144A

*Standard Methods for the Examination of Water and Wastewater

Certified by: T. J. Culpepper, Ph.D.

RI NO. DATE 7-24-80 RECORD BOOK NO. HT-517

SUBJECT: New Water Well Sample for Analysis

Buck 40 Well

pH 6.8
Helium < 1 ppb
TOC 9
Micromhos Sp. Cond. = 220

Providence St Well

pH 9.0
Helium < 1 ppb
TOC 15
Sp Cond 270

SIGNED BY _____ (SIGNATURE OF PERSON DOING WORK) _____ (DATE OF SIGNATURE)

WORK OBSERVED BY _____ (SIGNATURE OF OBSERVER) _____ (DATE OF SIGNATURE) REPORTED

percent in weight, and (2) for batch waste, any variation in piece count, such as a discrepancy of one drum in a truckload. Significant discrepancies in type are obvious differences which can be discovered by inspection or waste analysis, such as waste solvent substituted for waste acid, or toxic constituents not reported on the manifest or shipping paper.

(b) Upon discovering a significant discrepancy, the owner or operator must attempt to reconcile the discrepancy with the waste generator or transporter (e.g., with telephone conversations). If the discrepancy is not resolved within 15 days after receiving the waste, the owner or operator must immediately submit to the Regional Administrator a letter describing the discrepancy and attempts to reconcile it, and a copy of the manifest or shipping paper at issue.

§ 265.73 Operating record.

(a) The owner or operator must keep a written operating record at his facility.

(b) The following information must be recorded, as it becomes available, and maintained in the operating record until closure of the facility:

(1) A description and the quantity of each hazardous waste received, and the method(s) and date(s) of its treatment, storage, or disposal at the facility as required by Appendix I;

(2) The location of each hazardous waste within the facility and the quantity at each location. For disposal facilities, the location and quantity of each hazardous waste must be recorded on a map or diagram of each cell or disposal area. For all facilities, this information must include cross-references to specific manifest document numbers, if the waste was accompanied by a manifest;

[*Comment:* See §§ 265.119, 265.279, and 265.309 for related requirements.]

(3) Records and results of waste analyses and trial tests performed as specified in §§ 265.13, 265.193, 265.225, 265.252, 265.273, 265.345, 265.375, and 265.402;

(4) Summary reports and details of all incidents that require implementing the contingency plan as specified in § 265.56(j);

(5) Records and results of inspections as required by § 265.15(d) (except these data need be kept only three years);

(6) Monitoring, testing, or analytical data where required by §§ 265.90, 265.94, 265.276, 265.278, 265.280(d)(1), 265.347, and 265.377; and,

[*Comment:* As required by § 265.94, monitoring data at disposal facilities must be kept throughout the post-closure period.]

(7) All closure cost estimates under § 265.142 and, for disposal facilities, all post-closure cost estimates under § 265.144.

§ 265.74 Availability, retention, and disposition of records.

(a) All records, including plans, required under this Part must be furnished upon request, and made available at all reasonable times for inspection, by any officer, employee, or representative of EPA who is duly designated by the Administrator.

(b) The retention period for all records required under this Part is extended automatically during the course of any unresolved enforcement action regarding the facility or as requested by the Administrator.

(c) A copy of records of waste disposal locations and quantities under § 265.73(b)(2) must be submitted to the Regional Administrator and local land authority upon closure of the facility (see § 265.119).

§ 265.75 Annual report.

The owner or operator must prepare and submit a single copy of an annual report to the Regional Administrator by March 1 of each year. The report form and instructions in Appendix II must be used for this report. The annual report must cover facility activities during the previous calendar year and must include the following information:

(a) The EPA identification number, name, and address of the facility;

(b) The calendar year covered by the report;

(c) For off-site facilities, the EPA identification number of each hazardous waste generator from which the facility received a hazardous waste during the year; for imported shipments, the report must give the name and address of the foreign generator;

(d) A description and the quantity of each hazardous waste the facility received during the year. For off-site facilities, this information must be listed by EPA identification number of each generator;

(e) The method of treatment, storage, or disposal for each hazardous waste;

(f) Monitoring data under § 265.94(a)(2)(ii) and (iii), and (b)(2), where required;

(g) The most recent closure cost estimate under § 265.142, and, for disposal facilities, the most recent post-closure cost estimate under § 265.144; and

(h) The certification signed by the owner or operator of the facility or his authorized representative.

§ 265.76 Unmanifested waste report.

If a facility accepts for treatment, storage, or disposal any hazardous waste from an off-site source without an accompanying manifest, or without an accompanying shipping paper as described in § 263.20(e)(2) of this Chapter, and if the waste is not excluded from the manifest requirement by § 261.5 of this Chapter, then the owner or operator must prepare and submit a single copy of a report to the Regional Administrator within 15 days after receiving the waste. The report form and instructions in Appendix II must be used for this report. The report must include the following information:

(a) The EPA identification number, name, and address of the facility;

(b) The date the facility received the waste;

(c) The EPA identification number, name, and address of the generator and the transporter, if available;

(d) A description and the quantity of each unmanifested hazardous waste the facility received;

(e) The method of treatment, storage, or disposal for each hazardous waste;

(f) The certification signed by the owner or operator of the facility or his authorized representative; and

(g) A brief explanation of why the waste was unmanifested, if known.

[*Comment:* Small quantities of hazardous waste are excluded from regulation under this Part and do not require a manifest. Where a facility receives unmanifested hazardous wastes, the Agency suggests that the owner or operator obtain from each generator a certification that the waste qualifies for exclusion. Otherwise, the Agency suggests that the owner or operator file an unmanifested waste report for the hazardous waste movement.]

§ 265.77 Additional reports.

In addition to submitting the annual report and unmanifested waste reports described in §§ 265.75 and 265.76, the owner or operator must also report to the Regional Administrator:

(a) Releases, fires, and explosions as specified in § 265.56(j);

(b) Ground-water contamination and monitoring data as specified in §§ 265.93 and 265.94; and

(c) Facility closure as specified in § 265.115.

§§ 265.78–265.89 [Reserved]

Subpart F—Ground-Water Monitoring

§ 265.90 Applicability.

(a) Within one year after the effective date of these regulations, the owner or

operator of a surface impoundment, landfill, or land treatment facility which is used to manage hazardous waste must implement a ground-water monitoring program capable of determining the facility's impact on the quality of ground water in the uppermost aquifer underlying the facility, except as § 265.1 and paragraph (c) of this Section provide otherwise.

(b) Except as paragraphs (c) and (d) of this Section provide otherwise, the owner or operator must install, operate, and maintain a ground-water monitoring system which meets the requirements of § 265.91, and must comply with §§ 265.92–265.94. This ground-water monitoring program must be carried out during the active life of the facility, and for disposal facilities, during the post-closure care period as well.

(c) All or part of the ground-water monitoring requirements of this Subpart may be waived if the owner or operator can demonstrate that there is a low potential for migration of hazardous waste or hazardous waste constituents from the facility via the uppermost aquifer to water supply wells (domestic, industrial, or agricultural) or to surface water. This demonstration must be in writing, and must be kept at the facility. This demonstration must be certified by a qualified geologist or geotechnical engineer and must establish the following:

(1) The potential for migration of hazardous waste or hazardous waste constituents from the facility to the uppermost aquifer, by an evaluation of:

(i) A water balance of precipitation, evapotranspiration, runoff, and infiltration; and

(ii) Unsaturated zone characteristics (i.e., geologic materials, physical properties, and depth to ground water); and

(2) The potential for hazardous waste or hazardous waste constituents which enter the uppermost aquifer to migrate to a water supply well or surface water, by an evaluation of:

(i) Saturated zone characteristics (i.e., geologic materials, physical properties, and rate of ground-water flow); and

(ii) The proximity of the facility to water supply wells or surface water.

(d) If an owner or operator assumes (or knows) that ground-water monitoring of indicator parameters in accordance with §§265.91 and 265.92 would show statistically significant increases (or decreases in the case of pH) when evaluated under § 265.93(b), he may, install, operate, and maintain an alternate ground-water monitoring system (other than the one described in §§ 265.91 and 265.92). If the owner or operator decides to use an alternate ground-water monitoring system he must:

(1) Within one year after the effective date of these regulations, submit to the Regional Administrator a specific plan, certified by a qualified geologist or geotechnical engineer, which satisfies the requirements of § 265.93(d)(3), for an alternate ground-water monitoring system;

(2) Not later than one year after the effective date of these regulations, initiate the determinations specified in § 265.93(d)(4);

(3) Prepare and submit a written report in accordance with § 265.93(d)(5);

(4) Continue to make the determinations specified in § 265.93(d)(4) on a quarterly basis until final closure of the facility; and

(5) Comply with the recordkeeping and reporting requirements in § 265.94(b).

§ 265.91 Ground-water monitoring system.

(a) A ground-water monitoring system must be capable of yielding ground-water samples for analysis and must consist of:

(1) Monitoring wells (at least one) installed hydraulically upgradient (i.e., in the direction of increasing static head) from the limit of the waste management area. Their number, locations, and depths must be sufficient to yield ground-water samples that are:

(i) Representative of background ground-water quality in the uppermost aquifer near the facility; and

(ii) Not affected by the facility; and

(2) Monitoring wells (at least three) installed hydraulically downgradient (i.e., in the direction of decreasing static head) at the limit of the waste management area. Their number, locations, and depths must ensure that they immediately detect any statistically significant amounts of hazardous waste or hazardous waste constituents that migrate from the waste management area to the uppermost aquifer.

(b) Separate monitoring systems for each waste management component of a facility are not required provided that provisions for sampling upgradient and downgradient water quality will detect any discharge from the waste management area.

(1) In the case of a facility consisting of only one surface impoundment, landfill, or land treatment area, the waste management area is described by the waste boundary (perimeter).

(2) In the case of a facility consisting of more than one surface impoundment, landfill, or land treatment area, the waste management area is described by an imaginary boundary line which circumscribes the several waste management components.

(c) All monitoring wells must be cased in a manner that maintains the integrity of the monitoring well bore hole. This casing must be screened or perforated, and packed with gravel or sand where necessary, to enable sample collection at depths where appropriate aquifer flow zones exist. The annular space (i.e., the space between the bore hole and well casing) above the sampling depth must be sealed with a suitable material (e.g., cement grout or bentonite slurry) to prevent contamination of samples and the ground water.

§ 265.92 Sampling and analysis.

(a) The owner or operator must obtain and analyze samples from the installed ground-water monitoring system. The owner or operator must develop and follow a ground-water sampling and analysis plan. He must keep this plan at the facility. The plan must include procedures and techniques for:

(1) Sample collection;

(2) Sample preservation and shipment;

(3) Analytical procedures; and

(4) Chain of custody control.

[*Comment:* See "Procedures Manual For Ground-water Monitoring At Solid Waste Disposal Facilities," EPA–530/SW–611, August 1977 and "Methods for Chemical Analysis of Water and Wastes," EPA–600/4–79–020, March 1979 for discussions of sampling and analysis procedures.]

(b) The owner or operator must determine the concentration or value of the following parameters in ground-water samples in accordance with paragraphs (c) and (d) of this section:

(1) Parameters characterizing the suitability of the ground water as a drinking water supply, as specified in Appendix III.

(2) Parameters establishing ground-water quality:

(i) Chloride

(ii) Iron

(iii) Manganese

(iv) Phenols

(v) Sodium

(vi) Sulfate

[*Comment:* These parameters are to be used as a basis for comparison in the event a ground-water quality assessment is required under § 265.93(d).]

(3) Parameters used as indicators of ground-water contamination:

(i) pH

(ii) Specific Conductance

(iii) Total Organic Carbon

(iv) Total Organic Halogen

(c)(1) For all monitoring wells, the owner or operator must establish initial

background concentrations or values of all parameters specified in paragraph (b) of this Section. He must do this quarterly for one year.

(2) For each of the indicator parameters specified in paragraph (b)(3) of this Section, at least four replicate measurements must be obtained for each sample and the initial background arithmetic mean and variance must be determined by pooling the replicate measurements for the respective parameter concentrations or values in samples obtained from upgradient wells during the first year.

(d) After the first year, all monitoring wells must be sampled and the samples analyzed with the following frequencies:

(1) Samples collected to establish ground-water quality must be obtained and analyzed for the parameters specified in paragraph (b)(2) of this Section at least annually.

(2) Samples collected to indicate ground-water contamination must be obtained and analyzed for the parameters specified in paragraph (b)(3) of this Section at least semi-annually.

(e) Elevation of the ground-water surface at each monitoring well must be determined each time a sample is obtained.

§ 265.93 Preparation, evaluation, and response.

(a) Within one year after the effective date of these regulations, the owner or operator must prepare an *outline* of a ground-water quality assessment program. The outline must describe a more comprehensive ground-water monitoring program (than that described in §§ 265.91 and 265.92) 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 the ground water; and

(3) The concentrations of hazardous waste or hazardous waste constituents in the ground water.

(b) For each indicator parameter specified in § 265.92(b)(3), the owner or operator must calculate the arithmetic mean and variance, based on at least four replicate measurements on each sample, for each well monitored in accordance with § 265.92(d)(2), and compare these results with its initial background arithmetic mean. The comparison must consider individually each of the wells in the monitoring system, and must use the Student's t-test at the 0.01 level of significance (see Appendix IV) to determine statistically significant increases (and decreases, in the case of pH) over initial background.

(c)(1) If the comparisons for the *upgradient* wells made under paragraph (b) of this Section show a significant increase (or pH decrease), the owner or operator must submit this information in accordance with § 265.94(a)(2)(ii).

(2) If the comparisons for *downgradient* wells made under paragraph (b) of this Section show a significant increase (or pH decrease), the owner or operator must then immediately obtain additional ground-water samples from those downgradient wells where a significant difference was detected, split the samples in two, and obtain analyses of all additional samples to determine whether the significant difference was a result of laboratory error.

(d)(1) If the analyses performed under paragraph (c)(2) of this Section confirm the significant increase (or pH decrease), the owner or operator must provide written notice to the Regional Administrator—within seven days of the date of such confirmation—that the facility may be affecting ground-water quality.

(2) Within 15 days after the notification under paragraph (d)(1) of this Section, the owner or operator must develop and submit to the Regional Administrator a specific plan, based on the outline required under paragraph (a) of this Section and certified by a qualified geologist or geotechnical engineer, for a ground-water quality assessment program at the facility.

(3) The plan to be submitted under § 265.90(d)(1) or paragraph (d)(2) of this Section must specify:

(i) The number, location, and depth of wells;

(ii) Sampling and analytical methods for those hazardous wastes or hazardous waste constituents in the facility;

(iii) Evaluation procedures, including any use of previously-gathered ground-water quality information; and

(iv) A schedule of implementation.

(4) The owner or operator must implement the ground-water quality assessment plan which satisfies the requirements of paragraph (d)(3) of this Section, and, at a minimum, determine:

(i) The rate and extent of migration of the hazardous waste or hazardous waste constituents in the ground water; and

(ii) The concentrations of the hazardous waste or hazardous waste constituents in the ground water.

(5) The owner or operator must make his first determination under paragraph (d)(4) of this Section as soon as technically feasible, and, within 15 days after that determination, submit to the Regional Administrator a written report containing an assessment of the ground-water quality.

(6) If the owners or operator determines, based on the results of the first determination under paragraph (d)(4) of this Section, that no hazardous waste or hazardous waste constituents from the facility have entered the ground water, then he may reinstate the indicator evaluation program described in § 265.92 and paragraph (b) of this Section. If the owner or operator reinstates the indicator evaluation program, he must so notify the Regional Administrator in the report submitted under paragraph (d)(5) of this Section.

(7) If the owner or operator determines, based on the first determination under paragraph (d)(4) of this Section, that hazardous waste or hazardous waste constituents from the facility have entered the ground water, then he:

(i) Must continue to make the determinations required under paragraph (d)(4) of this Section on a quarterly basis until final closure of the facility, if the ground-water quality assessment plan was implemented prior to final closure of the facility; or

(ii) May cease to make the determinations required under paragraph (d)(4) of this Section, if the ground-water quality assessment plan was implemented during the post-closure care period.

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

(f) Unless the ground water is monitored to satisfy the requirements of § 265.93(d)(4), at least annually the owner or operator must evaluate the data on ground-water surface elevations obtained under § 265.92(e) to determine whether the requirements under § 265.91(a) for locating the monitoring wells continues to be satisfied. If the evaluation shows that § 265.91(a) is no longer satisfied, the owner or operator must immediately modify the number, location, or depth of the monitoring wells to bring the ground-water monitoring system into compliance with this requirement.

§ 265.94 Recordkeeping and reporting.

(a) Unless the ground water is monitored to satisfy the requirements of § 265.93(d)(4), the owner or operator must:

(1) Keep records of the analyses required in § 265.92(c) and (d), the associated ground-water surface elevations required in § 265.92(e), and