EPA-330/2-86-010

Hazardous Waste Ground-Water Task Force

Evaluation of Rollins Environmental Services (TX), Inc. Deer Park, Texas

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

July 31, 1986

UPDATE OF THE HAZARDOUS WASTE GROUND-WATER TASK FORCE
EVALUATION OF ROLLINS ENVIRONMENTAL SERVICES (TX)
DEER PARK FACILITY

The Hazardous Waste Ground-Water Task Force (Task Force) of the Environmental Protection Agency in conjunction with the Texas Water Commission (TWC) conducted an evaluation of the ground-water monitoring program at the Rollins Environmental Service, Deer Park, Texas (RES-TX) hazardous waste treatment, storage and disposal facility. The on-site field inspection was conducted over a two-week period from September 23 to October 4, 1985. RES-TX is one of 58 facilities that are to be evaulated by the Task Force.

The purpose of the Task Force evaluations is to determine the adequacy of ground-water monitoring programs at land disposal facilities in regard to the applicable State and Federal ground-water monitoring requirements. The Task Force effort was initiated due to concerns as to whether operators of hazardous waste treatment, storage and disposal facilities are complying with the State and Federal ground-water monitoring regulations. The evaluation of the RES-TX facility focused on (1) determining if the facility was in compliance with applicable regulatory requirements and policy, (2) determining if hazardous constituents were present in the ground water and (3) providing information to assist EPA in determining if the facility meets the EPA requirements for facilities receiving wastes from response actions conducted under the Federal Superfund program.

Prior to the Ground-Water Task Force evaluation, a Comprehensive Ground-water Monitoring Evaluation (CME) inspection was performed by representatives from the TWC and EPA Region VI at the facility on July 16, 1985. Based on the results of this inspection, the TWC required the facility to conduct a ground-water quality assessment program and to submit a plan for that program within 15 days following the notification.

While the Task Force evaluation was being conducted at RES-TX, the owner/operator and the TWC were developing the details to be included in the assessment plan, and the owner/operator was constructing new monitoring wells that would be part of the assessment program. TWC granted approval of the assessment plan on October 12, 1985. As part of the first phase of the assessment program, RES-TX constructed approximately thirty-five (35) monitoring wells, many in a nested configuration, to monitor and test three seperate permeable zones beneath the facility. Several additional wells were installed in the second phase of the assessment, and four upgradient monitoring wells were designated.

The results of the Task Force evaluation indicate that the facility was out of compliance at the time of the evaluation with the Federal and State regulatory requirements for ground-water monitoring. Deficiencies were found in well construction, location of downgradient wells, and sampling procedures. The analytical results for samples obtained during the Task Force evaluation indicate that there are hazardous waste constituents in the ground water beneath the facility.

The TWC is issuing a compliance order that addresses these deficiencies and requires RES-TX to submit a plan for determining the extent and rate of contaminant migration and a proposal to clean up the ground water at the site. If the plans submitted under the provisions of the compliance order are approved by the TWC, RES-TX may be eligible to treat, store and dispose of hazardous waste from CERCLA response actions. A facility is eligible to handle CERCLA waste if the owner/operator has met the requirements of the CERCLA Offsite Policy, as mentioned on page 1 of the Executive Summary.

A description of the Task Force activities and findings are contained the attached report. This completes the Hazardous Waste Ground-Water Task Force evaluation of the Rollins Environmental Services facility in Deer Park, Texas.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
HAZARDOUS WASTE GROUND-WATER TASK FORCE

EPA-330/2-86-010

GROUND-WATER MONITORING EVALUATION

ROLLINS ENVIRONMENTAL SERVICES (TX), INC.
Deer Park, Texas

July 1986

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CONTENTS

CONTENTS (cont.)

CONTENTS (cont.)

FIGURES

TABLES

EXECUTIVE SUMMARY

INTRODUCTION

Concerns have recently been raised about whether hazardous waste treatment, storage and disposal facilities (TSDFs) are complying with the ground-water monitoring requirements promulgated under the Resource Conservation and Recovery Act (RCRA)*. In question is the ability of existing or proposed ground-water monitoring systems to detect contaminant releases from waste management units. To evaluate these systems and determine the current compliance status, the Administrator of the Environmental Protection Agency (EPA) established a Hazardous Waste Ground-Water Task Force (Task Force). The Task Force comprises personnel from EPA Office of Solid Waste and Emergency Response (OSWER), National Enforcement Investigations Center (NEIC), Regional Offices and State regulatory agencies. The Task Force is conducting in-depth, onsite investigations of commercial TSDFs with the following objectives:

- Determine compliance with interim status ground-water monitoring requirements of 40 CFR Part 265, as promulgated under RCRA or the State equivalent (where the State has received RCRA authorization)
- Evaluate the ground-water monitoring program described in the RCRA Part B permit application, submitted by the facility, for compliance with 40 CFR Part 270.14(c)
- Determine if the ground water at the facility contains hazardous waste constituents
- Provide information to assist the Agency in determining if the TSDF meets EPA ground-water monitoring requirements for waste management facilities receiving waste from response actions conducted under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)**

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* *Regulations promulgated under RCRA address hazardous waste management facility operations, including ground-water monitoring, to ensure that hazardous waste constituents are not released to the environment.*

** *EPA policy, stated in May 6, 1985 memorandum from Jack McGraw on "Procedures for Planning and Implementing Off-site Response," requires that TSDFs receiving CERCLA waste be in compliance with applicable RCRA ground-water monitoring requirements.*

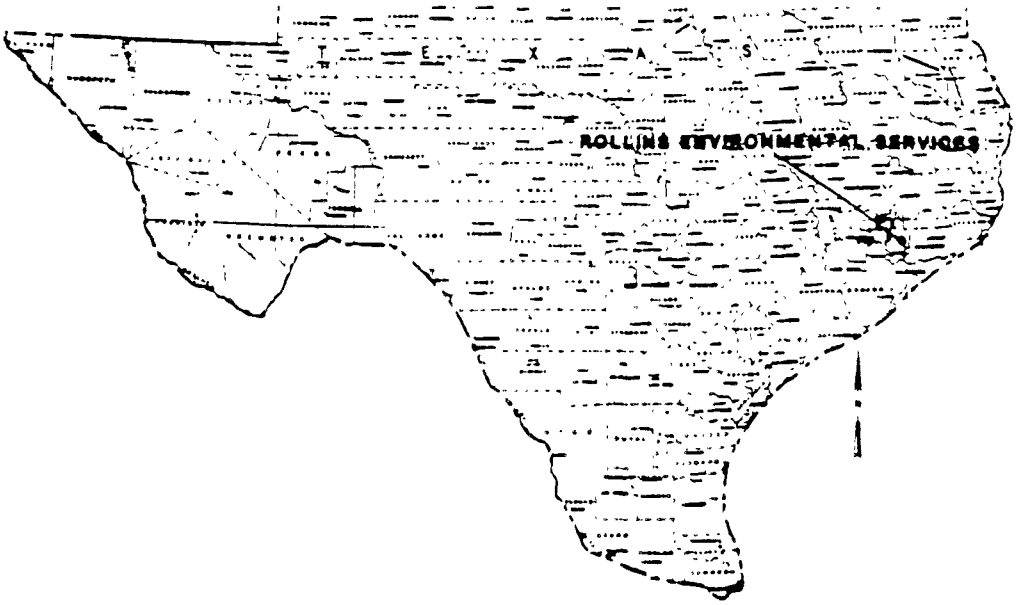
To address these objectives, this Task Force evaluation will determine if:

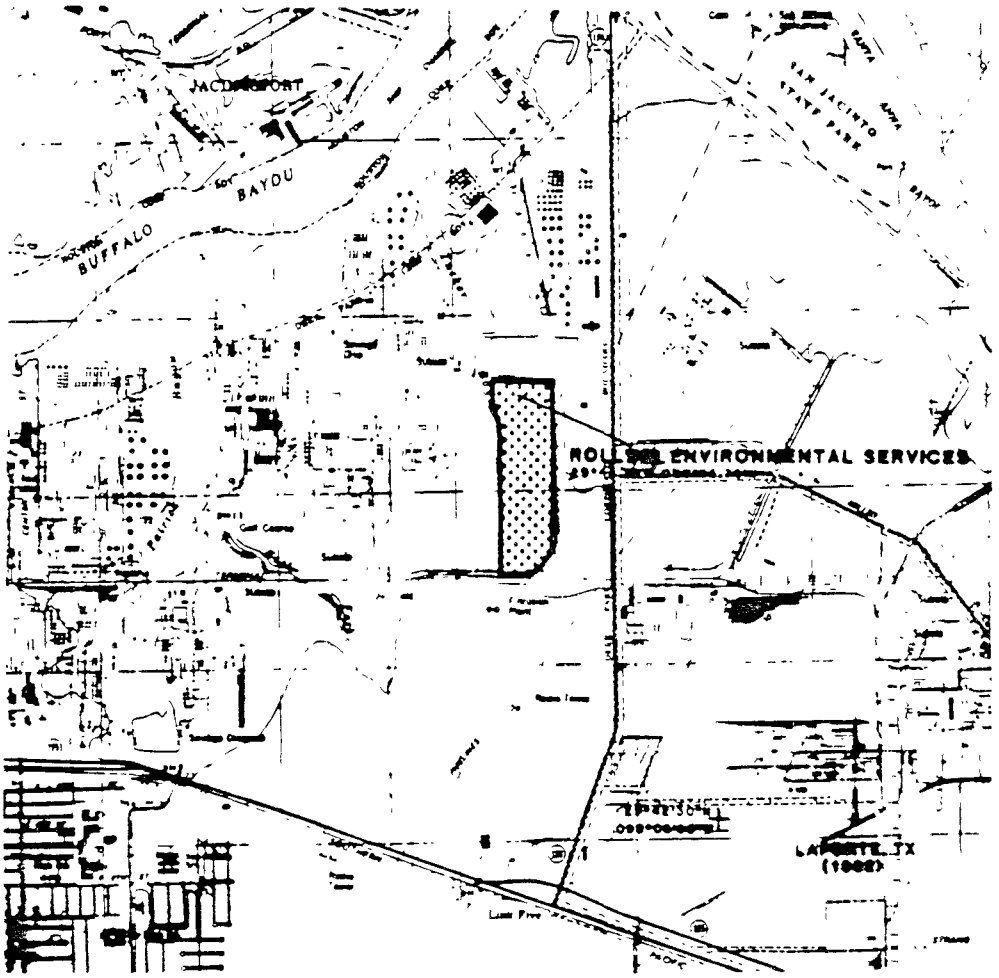
- The facility has developed and is following an adequate ground-water sampling and analysis plan
- Designated RCRA and State-required monitoring wells are properly located and constructed
- Required analyses have been properly conducted on samples from the designated RCRA monitoring wells
- The ground-water quality assessment program outline (or plan, as appropriate) is adequate

The first TSD facility the Task Force inspected in EPA Region VI was the Rollins Environmental Services (RES), Deer Park, Texas site located in the Houston, Texas metropolitan area about 2 miles south of the Houston Ship Channel [Figure 1]. The onsite inspection was coordinated by personnel from NEIC, a field component of the Office of Enforcement and Compliance Monitoring.

On September 16, 1985, the Texas Water Commission (TWC) notified Rollins that ground-water monitoring data from the facility indicated a "substantial likelihood" that waste constituents had entered the uppermost aquifer. As a result, the facility was required to initiate an assessment monitoring program.

Technically, the facility was in assessment during the Task Force inspection, which was conducted from September 24 through October 4, 1985. During the inspection, Rollins personnel were working closely with TWC personnel to develop details of an assessment program plan. Because the program plan was still being developed, the interim status program was evaluated by Task Force personnel for compliance with State requirements. The evaluation involved a review of State, Federal and facility records; facility and laboratory inspections and ground-water and landfill leachate sampling and analysis.





Location Map

Rollins Deer Park Facility

Figure 1

The area of land surrounding the current RES waste management site was undeveloped coastal plain prior to purchase by RES in 1970. The area has subsequently been developed into an industrial park with many large petrochemical facilities, several of whom are RES customers. This area has no residential population and is several miles from downtown Deer Park.

In 1970, Rollins Properties, Inc., a subsidiary of Rollins International, Inc., purchased a 200-acre tract, which includes the land the present facility occupies, for several other subsidiaries including Rollins-Purle, Inc. In 1972, Rollins-Purle, Inc. changed its name to Rollins Environmental Services, Inc., then, in 1978, to Rollins Environmental Services (TX), Inc. to show the formation of a Texas subsidiary for hazardous waste management activities.

Rollins-Purle began hazardous waste management activities at the Deer Park site in June 1971. Initial operations included liquid waste stabilization (settling, cooling, neutralization) and thermal waste destruction (incineration). Chemical and biological treatment and landfilling of waste began by 1974. About 150 acres of the original 200-acre tract were sold in 1974 with 7 acres repurchased in 1975 and 30 acres repurchased in 1976. The current site occupies these 87 acres.

The RES site has been regulated by State waste disposal regulations since operations began. Currently, the site is operated pursuant to interim status regulations promulgated under the Texas Administrative Code (TAC) Section 335 rules. The State received RCRA Interim Authorization in December 1980 and Final Authorization in December 1984. RES currently operates under the authority of a State permit (No. 01429) and as a Federal interim status facility under EPA Identification Number TXD055141378. The Company initially submitted a RCRA Part B permit application to EPA Region VI and the TWC in August 1984; a revised Part B was submitted on November 20, 1984. On September 20, 1985, TWC issued a 32-page notice of deficiency (NOD) concerning the Part B permit application, which addressed many ground-water issues.

Waste management operations at this site are also regulated by waste disposal, surface water discharge and air emissions permits. A State-issued waste disposal permit (No. 01429) addresses waste management, ground-water monitoring and effluent quality from two surface water discharges. An NPDES* permit (No. TX0005941), issued by EPA Region VI, also regulates the surface water discharges. Finally, a State air emissions permit (No. R-679) establishes limits for the incinerator.

In addition to the State requirements and permits, which regulate polychlorinated biphenyls (PCBs) as a Class I industrial solid waste, RES manages PCBs and PCB waste pursuant to Federal regulations promulgated under the Toxic Substances Control Act (TSCA, 40 CFR 761) and a PCB disposal approval issued by EPA Region VI for incineration of PCBs.

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* *NPDES refers to the EPA National Pollutant Discharge Elimination System program administered under the Clean Water Act.*

SUMMARY OF FINDINGS AND CONCLUSIONS

The findings and conclusions presented in this report reflect conditions existing at the facility in October 1985. Actions taken by the State, EPA Region VI and RES subsequent to October are summarized in the accompanying update.

Task Force personnel investigated the interim status ground-water monitoring program at the RES Deer Park facility for the period between November 1981, when applicable provisions of the Texas regulation became effective, and October 1985. There are no substantial differences between the TAC and RCRA interim status requirements. The investigation revealed that an interim status program was not implemented until May 1983 and, then, for only half of the monitoring wells in the designated network. Although the program has improved since 1983, some parts were inadequate and did not fully comply with State requirements.

The ground-water monitoring program, proposed in the August 1984 RCRA Part B permit application submitted by RES, was inadequate. Further explanation was necessary for the selection of monitoring parameters, statistical procedure used for evaluating the ground-water monitoring data, and how the proposed monitoring well network would satisfy the regulatory requirements. Revised monitoring program proposals were submitted in November 1984 and April 1985. The April revision was improved over the previous submittals, but was still inadequate regarding the number, location and depths of wells in the monitoring network; sample collection and analysis procedures; and the statistical test to be used in evaluating the monitoring data.

The analytical data for samples collected by Rollins, EPA and the Task Force indicate ground-water contamination by hazardous waste constituents. During the Task Force inspection, 9 of the 25 wells in service either

contained organic compounds identified in landfill leachate or had elevated (i.e., greater than 100 μg/ℓ)* TOX concentrations.

Under current EPA policy, if an offsite TSDF is used for land disposal of waste from a CERCLA site, that site must be in compliance with the applicable technical requirements of RCRA. As of October 1985, some parts of the ground-water monitoring program were inadequate and did not fully comply with State requirements.

Additional findings and conclusions, specific to selected ground-water monitoring program requirements, are summarized below.

GROUND-WATER MONITORING PROGRAM DURING INTERIM STATUS

As of October 1985, the RES Deer Park facility did not have an adequate interim status ground-water monitoring program. Program components, including the ground-water sampling and analysis plan, monitoring well network, sample analysis procedures and the assessment program outline, did not comply with TAC requirements.

Rollins did not implement a ground-water monitoring program pursuant to the TAC interim status requirements until May 1983. The State regulations required that the program be implemented on November 19, 1981. The 1983 monitoring program included only 9 of the 18 existing wells in the designated network. The other nine wells were monitored for the parameters required by the TAC but not by the frequency specified for the first year of monitoring (quarterly rather than semiannually).

On September 16, 1985, TWC notified RES that monitoring data indicated a "substantial likelihood that hazardous waste or hazardous waste constituents from the facility have entered the uppermost aquifer". As a result,

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* *The TOX value of 100 μg/ℓ, used as a benchmark for identifying elevated concentrations, was based on a literature review, two data sets and professional judgment.*

RES was required to submit a Ground Water Quality Assessment Plan within 15 days. TWC and RES personnel were developing the assessment program plan during the Task Force inspection. Because the assessment program was not completed or implemented until after the Task Force inspection, it is not discussed in this report.

The adequacy of the interim status program in meeting regulatory requirements at the time of the Task Force inspection is summarized below and discussed in detail in the Technical Report section. The adequacy of the program before October 1985 is also addressed in the Technical Report section.

Ground-Water Sampling and Analysis Plan

Generally, the monitoring procedures described in the sampling and analysis plan being followed during the inspection were adequate. However, the plan did not comply with TAC requirements because it did not (1) incorporate ground-water monitoring requirements imposed by the State operating permit for monitoring parameters and frequencies, (2) contain either a list of monitoring wells or a sampling schedule, (3) present sufficient details for the procedures described and (4) specify analytical procedures for a few of the required monitoring parameters.

A two-part regulatory framework controls the ground-water monitoring program at the RES facility. These are the TAC regulations (Title 31, Section 335, Subchapter I) and the State waste disposal permit (Part III, paragraphs 4g and 5i) issued on September 3, 1981, both of which are administered by the TWC. The permit specifies more frequent monitoring after the first year and more analytical parameters during both the first and subsequent years. The TAC (335.45) states that the regulations shall be followed except where the permit contains additional or more stringent requirements, in which case the permit requirements will be met. The ground-water monitoring plan must, therefore, include the permit requirements, which it does not.

The permit requires that the monitoring well network at the Rollins facility include a minimum of 15 wells. The TAC specifies different monitoring requirements for the upgradient and downgradient wells during the first year of monitoring. The monitoring plan is deficient because there is no list of wells or a sampling schedule.

Some of the monitoring procedures described in the plan were incomplete. For example, procedures for measuring depth to water and water level elevations and calculating purge volumes were not supplemented with key information on well-head elevations and well depths. Procedures were described for using the pumps in some of the wells (those equipped with bladder-type pumps), but not for others (those equipped with electric submersible pumps). Samples for some parameters, such as metals, are preserved by adding acid until a specified pH is achieved; however, the monitoring plan does not describe a procedure for determining when the proper pH has been reached.

Analytical procedures are specified in an appendix to the monitoring plan pursuant to the TAC [335.193(a)(3)]. Procedures for four monitoring parameters required by the TAC (methoxychlor, radium, gross alpha and gross beta) are not included.

Monitoring Well Network

The monitoring network included 25 wells during the Task Force inspection; however, 10 were to be replaced by November 7, 1985 in response to a directive from the TWC on September 16. The TWC had determined that the 10 wells (MW-1 through 3 and 19 through 25) were unacceptable because they were ". . .so completed as to allow cross-contamination of several saturated strata." Task Force personnel agree with this determination. Construction of the remaining 15 wells was found to be marginally adequate. Some wells had excessive sand-pack lengths relative to the screen, no bentonite seals between the sand pack and overlying grout, PVC casing and filter fabric wrapped around the screen.

The number and location of the 25 wells in the network were not sufficient to immediately detect any statistically significant amounts of hazardous waste constituents migrating to the uppermost aquifer from the waste management units, as required by the TAC [335.192(a)]. The well locations were not sufficient to immediately detect leakage from all or major portions of six surface impoundments subject to the ground-water monitoring requirements.

Sample Handling and Analysis Procedures

Laboratory records and data reviewed for samples collected from the monitoring wells since 1981 revealed that inappropriate sample handling, analysis and quality control procedures have been used. For example, the procedures used for arsenic and selenium analyses did not follow the referenced EPA method. Some of the data generated during the first year for metals of interim status monitoring are not adequate to establish background concentrations or values, as required by the TAC [335.193(c)].

Samples for metals and total organic carbon (TOC) analysis were filtered before concentrations were determined. Filtering of samples for TOC analysis yields data representing dissolved rather than the total organic carbon concentrations required by the TAC [335.193(b)(3)(C)]. Dissolved organic carbon data are not adequate for establishing background concentrations. Data from analysis of filtered samples may be biased low. The effects of filtering ground-water samples from the RES facility need to be documented and evaluated.

The analytical method used for TOC is appropriate only when the inorganic carbon is a small part of the total carbon present, which was not the case in ground-water samples from wells at the Rollins facility. Consequently, TOC concentrations of less than 5,000 μg/ℓ are considered unreliable. In July 1985, the method was changed to include acidifying the sample and purging it with nitrogen gas before measuring the carbon present The purging results in loss of volatile carbon compounds and the method yields results only for the nonpurgeable carbon content, which does not satisfy the TAC requirements for total organic carbon.

Inappropriate methods were also used for arsenic, selenium, cadmium, chromium and lead. Samples for arsenic and selenium determinations were not digested before analysis, as required by the referenced EPA methods used. The methods used for cadmium, chromium and lead (flame atomic absorption spectroscopy), which are used as indicators for drinking water suitability, do not achieve reliable results near the drinking water limits for these parameters; furnace atomic absorption spectroscopy is more appropriate.

The variation in total organic halogen (TOX) concentrations, where quadruplicate measurements were made by Rollins during the first year of monitoring, indicates that values below about 50 μg/ℓ are unreliable. Also, the instrument used for TOX analyses produces data that are biased low.

Insufficient quality control measures were taken to assure that analytical results for pesticides and herbicides were reliable. No analyses have been performed on duplicates or matrix spikes; sample blanks have only been analyzed since 1984.

Assessment Program Outline

An outline for a ground-water quality assessment program was required [335.194(a)] by November 19, 1981. Rollins prepared an initial outline in November 1982 in response to a notice of deficiency from TWC. A revised outline, which was completed during mid-1985 and was on file during the Task Force inspection, was updated over the initial version but needs further improvement.

The TAC requires that the outline describe a more comprehensive program than the one for routine interim status monitoring and be capable of determining:

- Whether hazardous waste or hazardous waste constituents have entered the ground water
- The rate and extent of migration of hazardous waste or hazardous waste constituents in the ground water

- The concentrations of hazardous waste or hazardous waste constituents in the ground water

The monitoring parameters listed in the outline are not sufficiently comprehensive for the hazardous waste constituents potentially present in ground water. The one set of samples indicated is not adequate to determine if leakage is occurring. Multiple samples are necessary. The outline does not indicate how a monitoring plan would be developed nor does it propose schedules for sampling, data evaluation or report preparation.

GROUND-WATER MONITORING PROGRAM PROPOSED FOR FINAL PERMIT

A revised Part B ground-water sampling and analysis plan, dated April 9, 1985, was submitted to the TWC. The State, in a letter dated September 27, 1985, outlined three major deficiencies in the April plan. First, the letter noted an inadequate number of monitoring wells (well clusters were recommended) and suggested dividing the facility into two waste management areas. Second, an alternate statistical test was proposed by Rollins for evaluating monitoring data; however, the Company did not provide a demonstration indicating that the Student's t-test was not applicable to the RES data, as required by the TAC. Third, no justification was presented for the proposed location of the point of compliance, which was defined as a line through the locations of the proposed monitoring wells.

In addition to the deficiencies noted by the TWC, Task Force personnel determined that the Company definition of uppermost aquifer does not correspond to that in the TAC [335.42(a)]. Wells designated by RES to be monitored in accordance with the regulatory requirements are only completed in the water bearing zone designated by RES as the uppermost aquifer.* Because shallower saturated units are part of the uppermost aquifer, as defined by the TAC, the proposed well network does not comply with TAC requirements. Further, the proposed plan indicates that data from samples from three

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* *A "continuous" permeable water-bearing unit occurring at a depth of about 50 to 70 feet.*

shallow wells will not be subject to the required statistical comparisons; no provisions for such exceptions are indicated in the Texas regulations.

Some of the existing wells are to be abandoned and replacements constructed. Descriptions of procedures for abandonment and construction are incomplete. Two of the proposed downgradient monitoring well locations (MW-45 and 46) do not comply with TAC requirements because they are 300 feet from the point of compliance, as defined by the State regulations [335.461].

Sample collection and analysis procedures were incomplete and do not comply with TAC requirements. The plan submitted for the Part B containing these procedures was subsequently revised into a document that was being used for the interim status program, which was evaluated in the previous section. The procedures in the monitoring plan for the interim status program are the *de facto* replacements for those in the Part B proposal. The proposal has not been formally revised and submitted to the TWC because the facility is in assessment and preparation of a revised plan is pending the outcome of that program.

TASK FORCE SAMPLING AND MONITORING DATA EVALUATION

During the inspection, Task Force personnel collected samples from 14 ground-water monitoring wells and 4 leachate collection sumps to determine if the ground water contains hazardous waste constituents or other indicators of contamination. Samples were drawn from some wells by RES personnel, using their standard procedures, while others were drawn by an EPA contractor. Monitoring data from the Task Force samples were evaluated together with previous Rollins and EPA data from the monitoring wells.

Analytical data for Task Force samples from five monitoring wells (MW-2, 6, 13, 25 and 26) indicate the presence of organic hazardous waste

constituents in ground water beneath the site.* Four of the wells (MW-6, 13, 26 and 35) containing organic compounds are adjacent to the operating landfill; one (MW-2) is adjacent to a surface impoundment used for receiving incoming loads of wastewater and one (MW-25) is adjacent to a disposal area for sludge dredged from impoundments used for treating scrubber water.

Although previous data for organic analysis of samples from RES is limited, organic compounds were detected in samples from five other wells (MW-3, 8, 12, 15 and 18) by EPA and Rollins during 1980 and 1981. Well MW-3 is adjacent to an old landfill (LF-17) and the other wells are adjacent to the current landfill. Wells MW-8 and 12 are adjacent to wells MW-7 and 13, respectively, in which hazardous waste constituents were detected in Task Force samples.

Elevated barium concentrations were also measured in the sample from well MW-2. The concentration was nearly twice the next lower concentration measured in other samples. Data from samples collected by EPA in 1981 and Rollins in 1984 confirm this finding.

Monitoring data also indicate elevated (i.e., greater than 100 μg/ℓ) total organic halogen concentrations in 14 wells, as follows.

MW-1	MW-9	MW-17
MW-2	MW-10	MW-25
MW-6	MW-13	MW-26
MW-7	MW-14	MW-38
MW-8	MW-16	

These include the five where hazardous waste constituents were detected and five (MW-9, 10, 14, 16 and 17) that were abandoned during 1982 and 1983. One (MW-2) is adjacent to an impoundment; one (MW-25) is next to a sludge pond; and the remainder are (or were) adjacent to the operating landfill.

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* *The organic compounds were identified as waste constituents because they were detected in leachate samples. Appendix F in the Technical Report section contains all analytical results for Task Force samples.*

Some wells, from which samples have been collected for several years, had significant changes in TOX concentrations. Levels increased in three wells (MW-1, 26 and 38) during 1985 while those in two wells (MW-8 and 7) decreased. The increases suggest the arrival of a "plume", whereas the decreases suggest improving ground-water quality.

The specific halogenated compounds have not all been identified because the standard analytical methods used by EPA, Rollins and Task Force laboratories were not sensitive to them; special or research-type methods are required. These compounds, and their sources, need to be identified.

TECHNICAL REPORT

INVESTIGATION METHODS

The Task Force evaluation of RES consisted of:

- Review and evaluation of records and documents from EPA Region VI, TWC and RES
- Facility onsite inspection conducted September 24 through October 4, 1985
- Onsite and offsite analytical laboratory evaluations
- Sampling and subsequent analysis and data evaluation for selected site ground-water and leachate monitoring systems

RECORDS/DOCUMENTS REVIEW

Records and documents from the TWC and EPA Region VI offices, compiled by an EPA contractor, were reviewed prior to the onsite inspection. Additional TWC records were copied and reviewed by Task Force personnel concurrently with the onsite inspection. Facility records were reviewed to verify information currently in Government files and supplement Government information where necessary. Selected documents requiring in-depth evaluation were copied by the Task Force during the inspection. Records were reviewed to obtain information on facility operations, construction of waste management units and ground-water monitoring activities.

Specific documents and records reviewed and evaluated included the ground-water sampling and analysis plan, outline of a ground-water quality assessment program, analytical results from past ground-water sampling, monitoring well construction data and logs, site geologic reports, site operations plans, facility permits, unit design and operation reports, selected personnel position descriptions and qualifications (those related to the required ground-water monitoring), and operating records showing the general types and quantities of wastes disposed of at the facility and their locations.

FACILITY INSPECTION

The facility inspection, conducted from September through October 1985, included identifying waste management units (past and present), waste management operations and pollution control practices, and verifying the location of ground-water monitoring wells and leachate collection sumps.

Company representatives were interviewed to identify records and documents of interest, answer questions about the documents, and explain: (1) facility operations (past and present), (2) site hydrogeology, (3) the ground-water monitoring system, (4) the ground-water sampling and analysis plan, and (5) laboratory procedures for obtaining data on ground-water quality. Because ground-water samples were analyzed by an offsite contractor laboratory, personnel from these facilities were also interviewed regarding sample handling, analysis and document control.

LABORATORY EVALUATION

The RES and contractor laboratories, which analyze the ground-water samples, were evaluated regarding their respective responsibilities under the RES ground-water sampling and analysis plan. Analytical equipment and methods, quality assurance procedures and documentation were examined for adequacy. Laboratory records were inspected for completeness, accuracy and compliance with State and Federal requirements. The ability of each laboratory to produce quality data for the required analyses was evaluated.

GROUND-WATER AND LEACHATE SAMPLING AND ANALYSIS

During the inspection, Task Force personnel collected samples for analysis from 14 ground-water monitoring wells and 4 leachate collection sumps [Tables 1 and 2, Figure 2] to determine if the ground water contains hazardous waste constituents or other indicators of contamination. Further, the sampling results were used in evaluating previous Company data. Wells were selected for sampling principally in areas where records show or suggest that ground-water quality may have been affected by hazardous waste management

Table 1

SAMPLE LOCATION AND WELL DESCRIPTION
MONITORING WELL DATA

Monitoring Well	Depth to Water (ft)	Water Volume in Casing (gal)	Purge				Sampling		Remarks	Location/Description
			Date	Time	Volume (gal)	Total (gal)	Date	Time		
MW-2	22.94	64 0	10/1	1145-1225	56		10/3	1055-1140	NEIC split sample collected, water had slight gray tint	West of lagoon 1000
			10/2	0845-0950	64					
				1330-1445	31					
			10/3	0855-0940	40	191				
MW-3	21 0	57.3	10/3	1330-1525	170	170	10/3	1545-1700	Container omitted - 1 extractable organics; water slightly hazy; suspended particles in VOA vial	220 feet northeast of L-2
MW-6	17 55	36 2	9/25	1155-1210	28		9/25	1515-1600	Triplicate sample collected; purge water cloudy	40 feet east of LF-5
				1320-1340	32					
				1425-1435	26					
				1455-1500	22	108				
MW-7	11 68	20.5	9/26	1150-1200	18		9/27	1515-1545	Water clear	400 feet northeast of active landfill
				1525-1530	12					
			9/27	0810-0815	16					
				1045-1100	14	60				
MW-8	18 42	34 3	9/27	0820-0840	28		9/27	1630-1655	Water clear	400 feet northeast of active landfill
				1025-1035	22					
				1250-1305	27					
				1450-1510	25	102				
MW-11	20 82	34 3	9/30	1145-1210	26		10/1	1600-1625	Water clear	300 feet east of active landfill
				1730-1745	26					
			10/1	0835-0855	26					
				12 -1245	24	102				
MW-12	14 18	30 2	9/26	1215-1230	26		9/27	1555-1620	Water clear	100 feet southeast of active landfill
				1545-1555	20					
			9/27	0850-0905	30					
				1320-1325	20	96				
MW-13	10 73	14 2	10/1	0905-0920	16		10/1	1510-1545	Water clear	100 feet southeast of active landfill
				1105-1120	16					
				1250-1300	14	46				
MW-21	23 84	13 3	9/26	1335-1550	40	40	9/26	1555-1615	Water very turbid and silty; pump pulled 9/25	130 feet northeast of L-1000
MW-23	15 85	13.7	10/1	1020-1145	41	41	10/1	1145-1215	Water very turbid and silty and contained fine brown sand; pump pulled 9/25, tubing had greasy deposit at water line	Southwest of F-4

Table 1 (cont)

Monitoring Well	Depth to Water (ft)	Water Volume in Casing (gal)	Purge				Sampling		Remarks	Location/Description
			Date	Time	Volume (gal)	Total (gal)	Date	Time		
MW-24	18.05	13.7	10/2	0925-1050	41	41	10/2	1050-1115	Water cloudy and turbid; pump pulled 9/25; tubing had greasy deposit at water line; 1.3 feet of air-line tubing above pump, discolored reddish-brown	220 feet west of F-2
MW-25	17.97	14.4	10/3	1020-1230	42	42	10/3	1235-1310	Water dark gray, moderately turbid, hydrogen sulfide odor, black flakes present; pump pulled 9/25; 1-foot band brown greasy deposit at water line; 1.3 ft. below brown deposit was black clayey type deposit	260 feet west of F-1
MW-26	11.93	20.6	10/2	1010-1025	26		10/2	1400-1435	Water clear; water hazy gray	Northwest corner of southern portion of waste management area
				1125-1140	24					
				1250-1300	14	64				
MW-35	20 95	34.6	10/2	1050-1120	42		10/2	1630-1715	NEIC split sample collected	Eastern edge of active landfill
				1300-1315	38					
				1500-1510	25	105				

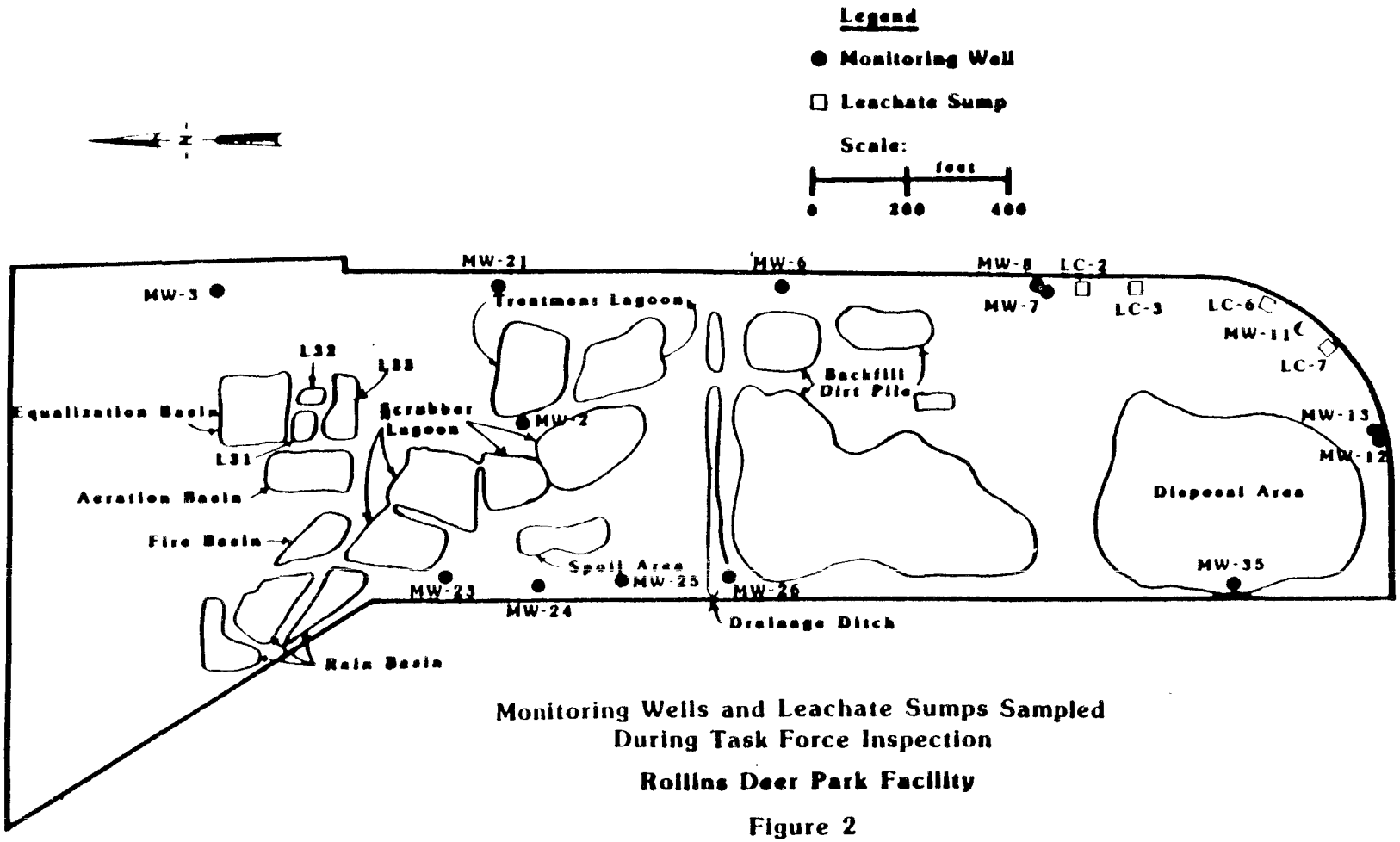
Table 2

SAMPLE COLLECTION AND WELL LOCATION DESCRIPTION
LEACHATE WELL DATA*

Sump	Time	Remarks	Location/Description
LC-2	1224-1227	Container omitted - 1 extractable organics; leachate black after first gallon collected	100 feet southwest of MW-7
LC-3	1006-1013	Container omitted - 1 extractable organics; leachate dark green, very strong odor detected, HNU reading 5 ppm**	150 feet southwest of MW-7
LC-6	1138-1140	Container omitted - 1 extractable organics; leachate had chocolate milk look (turbid and brownish), HNU reading 8-10 ppm	75 feet north of MW-11
LC-7	1057-1100	Container omitted - 1 extractable organics; leachate very dark muddy looking; HNU reading 3-4 ppm	75 feet southwest of MW-11

* *Leachate samples collected on September 30, 1985*

** *Background readings at the site were less than 1 ppm.*



Monitoring Wells and Leachate Sumps Sampled
During Task Force Inspection

Rollins Deer Park Facility

Figure 2

activities. Other wells were selected to confirm background ground-water quality. The leachate sumps were selected based on whether sufficient liquid was present for the samples. Duplicate volatile organic samples and splits of all other samples were provided to RES personnel.

The monitoring wells were sampled according to one of two protocols depending on whether the well was equipped with a dedicated pump. Sampled wells equipped with dedicated pumps included MW-2, 3, 6, 7, 8, 11, 12 and 13. Each well had a Well Wizard Purge Master® purge pump and a Well Wizard® sampling pump, which were operated by RES personnel. Samples were collected from these wells by the following procedure. Additional details of RES sampling procedures are described in the section on Ground-Water Monitoring Program During Interim Status.

1. Company personnel determined depth to ground water using a Powers Well Sounder®.

2. Company personnel calculated height of water column from depth to water measurement and well depth (from construction records).

3. Company personnel determined the water column volume, using height of water column and a graph containing a plot of volumes and heights for 4 and 2-inch diameter wells.

4. Company personnel purged three water column volumes (due to slow recovery rates in some wells, the purge period was protracted).*

5. After recharge, EPA contractor monitored open well head for chemical vapors (HNU® and/or a Foxboro® organic vapor analyzer - OVA) and radiation.

6. EPA contractor collected sample aliquot and made field measurements (water temperature, pH, specific conductance).

7. EPA contractor filled sample containers in the order shown in Table 3, alternating between filling a sample aliquot for the Company and one for the EPA contract laboratory. When NEIC samples were collected, the above protocol was modified to include filling a sample aliquot for NEIC after filling one for the EPA contractor.

® *Well Wizard Purge Master, Well Wizard, Powers Well Sounder, HNU, Foxboro and OVA are registered trademarks and appear hereafter without the ®.*

* *Purge water from all wells was captured in metal drums and later discharged into the onsite wastewater treatment facility.*

Table 3

PREFERRED ORDER OF SAMPLE COLLECTION, BOTTLE TYPE AND PRESERVATIVE LIST

	Parameter	Bottle	Preservative
1.	Volatile organic analysis (VOA)		
	Purge and trap	2 60-mℓ VOA vials	
	Direct inject	2 60-mℓ VOA vials	
2.	Purgable organic carbon (POC)	1 60-mℓ VOA vial	
3.	Purgable organic halogens (POX)	1 60-mℓ VOA vial	
4.	Extractable organics	4 1-qt. amber glass	
5.	Total metals	1-qt. plastic	HNO_3
6.	Dissolved metals	1-qt. plastic	HNO_3
7.	Total organic carbon (TOC)	4-oz. glass	H_2SO_4
8.	Total organic halogens (TOX)	1-qt. amber glass	
9.	Phenols	1-qt. amber glass	H_2SO_4
10.	Cyanide	1-qt. plastic	NaOH
11.	Sulfate/chloride	1-qt. plastic	
12.	Nitrate/ammonia	1-qt. plastic	H_2SO_4
13.	Radionuclides (NEIC only)	4 1-qt. amber glass	

8. Samples were placed on ice in an insulated container.

Wells not equipped with dedicated pumps during sample collection included MW-21, 23, 24 and 25.* At these wells, an EPA contractor installed a submersible bladder-type pump, purged the wells and collected samples by the following procedures:

1. EPA contractor monitored open well head for chemical vapors (HNU and/or OVA) and radiation.

2. EPA contractor determined depth to ground water using an Oil Recovery Systems' Interface Probe® water level meter.**

3. EPA contractor calculated height of water column from depth to water measurement and well depth.***

4. EPA contractor calculated water column volume, using height of water column and well casing radius.

5. EPA contractor installed a clean Timco® bladder-type pump and purged three water column volumes. The pump was operated using compressed air.

6. After recharge, EPA contractor collected sample aliquot and made field measurements (water temperature, pH, specific conductance).

7. EPA contractor filled sample containers in the order shown in Table 3 alternating between filling a sample aliquot for the Company and one for the EPA contract laboratory.

8. Samples were placed on ice in an insulated container.

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* *These wells were previously equipped with dedicated pumps, which were removed at the beginning of the Task Force inspection to enable use of the interface probe.*

** *After measuring depth to water, while the tape and sensor were being rewound onto the interface probe reel, they were cleaned with a hexane-soaked laboratory wipe, then a distilled water-soaked wipe and finally a dry wipe.*

*** *Wells having depths of less than 100 feet were measured with the interface probe; those with depth greater than 100 feet were measured with a weighted steel tape.*

® *Oil Recovery Systems' Interface Probe and Timco are registered trademarks and appear hereafter without the ®.*

Volatile organic samples at MW-6 were first poured into a 250-mℓ beaker then poured into 60-mℓ vials (sample containers) due to difficulties in controlling the pump flow rate. Other sample containers were filled directly from the discharge line. At other wells, all sample containers were filled directly from the sample pump discharge line.

After sampling was completed at a well, EPA contractor personnel took their samples to a staging area where a turbidity measurement was taken and one of two sample aliquots for metals analysis was filtered. In addition, metals, TOC, phenols, cyanide, nitrate and ammonia samples were preserved [Table 3].

Leachate was collected at sumps below the operating landfill in the southern part of the facility. All leachate samples were collected on the same day to prevent possible cross-contamination of well samples. EPA contractor personnel directly involved in the sampling wore full-face respirators and protective clothing. The EPA contractor collected composite samples in 5-gallon and/or 2½-gallon glass jugs. Containers (provided by the EPA contractor) for the Company, EPA and State (LC-3, 7) samples were then filled from the jugs on a concrete slab on the south side of the RES laboratory, with the VOA samples first being poured into a 250-mℓ beaker then into 60-mℓ vials. Leachate samples were not preserved.

At the end of each day, samples were packaged and shipped to the two EPA contract laboratories according to applicable Department of Transportation (DOT) regulations (40 CFR Parts 171-177). Samples from monitoring wells were considered "environmental" and those from leachate collection system sumps were considered "hazardous" for shipping purposes.

Each day of sampling, the EPA contractor prepared field blanks for each analytical parameter group (e.g., volatiles, organics, metals) in a parking lot southeast of the RES laboratory by pouring distilled deionized water into sample containers. An equipment blank was prepared by running distilled deionized water through the apparatus used to filter metals. An additional equipment blank was prepared by running distilled deionized water

through the new Well Wizard Purge Master and sampling pumps installed at MW-2. One set of trip blanks for each parameter group was also prepared and submitted during the inspection. The blanks were submitted with no distinguishing labeling or markings.

Samples were analyzed by the EPA contractor laboratories for the parameter groups shown on Table 3 minus the groups indicated on Tables 1 and 2. NEIC received and analyzed split samples for two ground-water monitoring wells (MW-2 and MW-35).

WASTE MANAGEMENT UNITS AND FACILITY OPERATIONS

WASTE MANAGEMENT UNITS

The RES facility handles both hazardous waste, as defined in the Texas Administrative Code Section 335 rules and regulated by the Texas Water Commission, and polychlorinated biphenyl (PCB) waste, as defined in 40 CFR 761 and regulated by Texas (under TAC 335 rules) and EPA. Waste handling units and operations were identified to determine where waste constituents handled at RES might enter the ground water.

As of October 1985, RES reportedly used the following management units/areas for the treatment, storage and/or disposal of hazardous waste:

- 19 surface impoundments - storage and treatment*
- 1 landfills - disposal
- 41 tanks - storage and treatment
- 3 drum storage areas - container storage
- 1 incinerator - thermal destruction

Past operations included filter beds for aerobic and anaerobic biological digestion of waste, other surface impoundments, landfill cells, tanks and drum storage areas. As a result, most of the RES facility has been used for management of hazardous waste.

PCB waste processing and disposal operations include storage, processing for disposal (transformer draining and flushing) and incineration of PCB liquids. PCB solids (transformer carcasses, contaminated debris, etc.) are disposed of offsite.

Figure 3 shows the location of all known RES treatment, storage and disposal facilities. A discussion of waste management units related to

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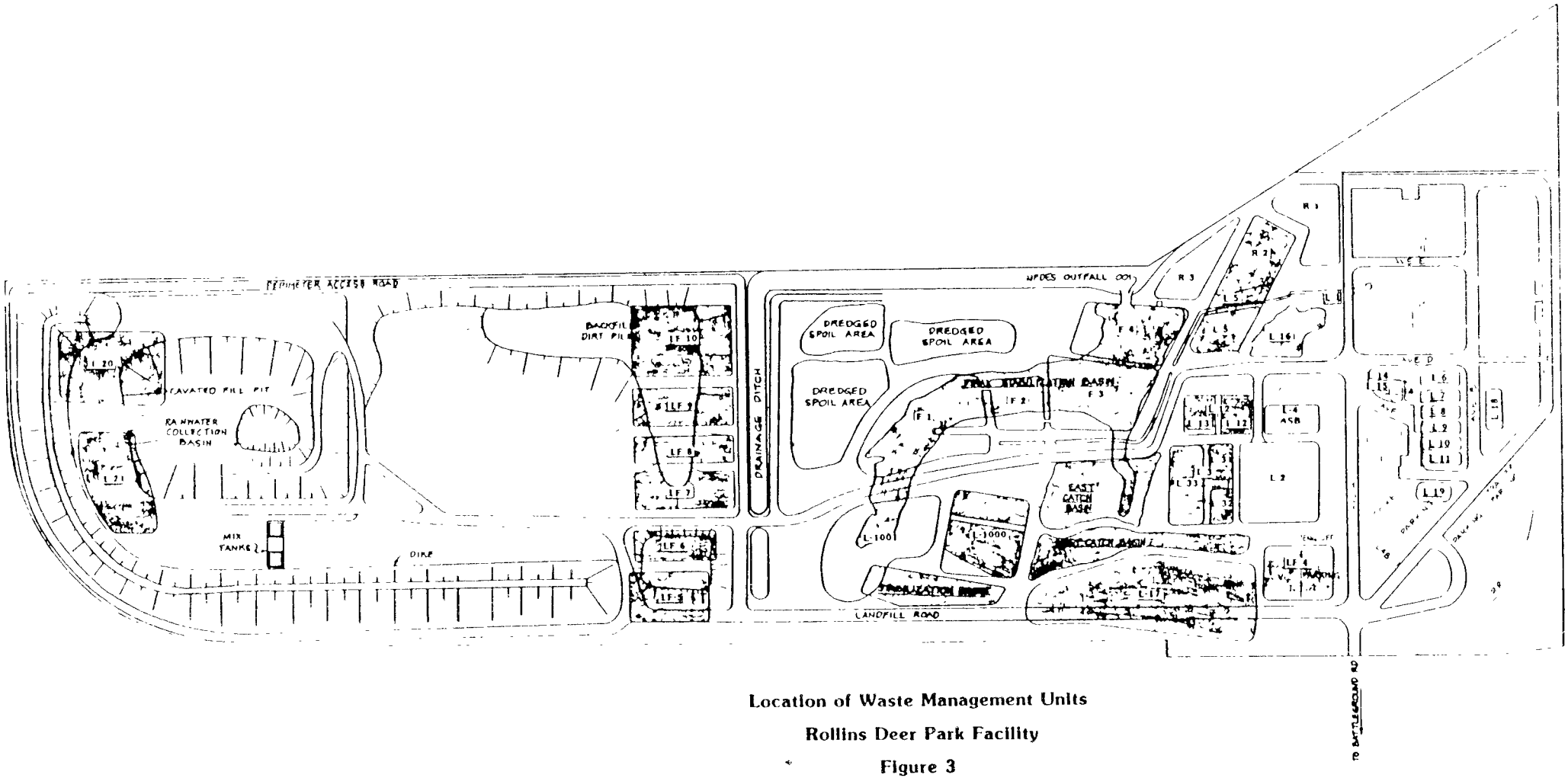
* *Includes three "rainwater" lagoons*



Location of Waste Management Units

Rollins Deer Park Facility

Figure 3

ground-water monitoring at the RES site follows. This discussion is divided into two major areas: (1) units subject to RCRA/TAC interim status requirements and (2) units operated and closed prior to RCRA/TAC interim status regulations but which may have released contamination to the ground water.

Interim Status Regulated Waste Management Units

Surface Impoundments

Surface impoundments are used at the site for hazardous waste treatment and storage [Figure 4]. RES has a total surface impoundment storage capacity of about 21 million gallons; surface impoundment treatment capacity is about 6 million gallons.* The 24 surface impoundments described in Table 4 and discussed below are subject to the ground-water monitoring requirements of the RCRA/TAC interim status.

Most surface impoundments at RES were similarly constructed. The RES site is underlain by clay into which shallow (up to about 20 feet deep) lagoons were excavated. The natural clay was compacted with a sheepsfoot roller to achieve a permeability of 10^{-7} cm/second for the impoundments. Clay dikes and the natural drainage were used to control runon/runoff from the impoundments. When impoundments were cleaned or closed, waste sludge was excavated until "clean" clay was observed. Thus, impoundments that were cleaned tended to grow in depth if additional natural clay was not brought in and recompacted.

According to a 1981 Ecology and Environment, Inc. report, the depth to ground water is 10 feet and, during the Task Force inspection, similar results were recorded with depth to ground water ranging from 8 to 22 feet.[1] Because water levels in the impoundments were maintained above the level of

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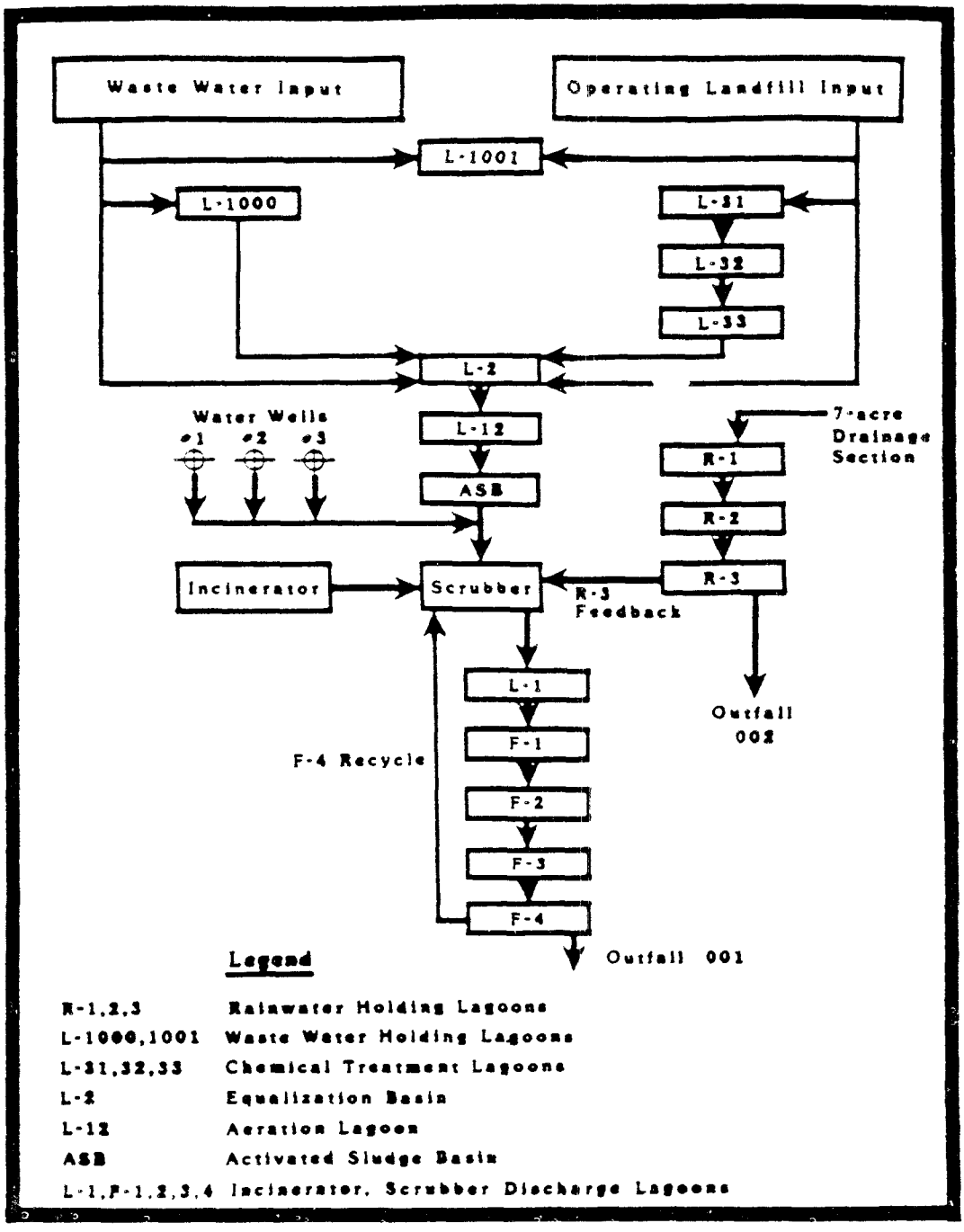
* *As reported in RES' November 20, 1984 RCRA Part B application revision, Section III, E.1.1.a., pages 6 and 704*

Figure 4



Schematic of Waste Water Flow Through Management Units
Rollins Deer Park Facility

Table 4

REGULATED SURFACE IMPOUNDMENTS

Impoundment Number	Impoundment Type	Capacity (gallons)	Remarks
L-1000	Leachate treatment/storage	2,400,000	Out of service 10/85
L-1001	Leachate treatment/storage	4,900,000	Out of service 10/85
L-31	Chemical treatment	475,000	
L-32	Chemical treatment	400,000	
L-33	Chemical treatment	1,000,000	
L-2	Equalization/chemical treatment	2,200,000	
L-12	Equalization/chemical treatment	1,450,000	
ASB	Bio-treatment	350,000	
R-1	Rainwater collection	700,000	
R-2	Rainwater collection	1,000,000	
R-3	Rainwater collection	150,000	
L-1	Incinerator scrubber discharge	40,000	
F-1	Incinerator scrubber discharge	1,200,000	
F-2	Incinerator scrubber discharge	800,000	
F-3	Incinerator scrubber discharge	1,400,000	
F-4	Incinerator scrubber discharge	1,500,000	
Unnumbered	Three sludge ponds	Unknown	
L-5	Firewater storage	750,000	
L-14	Truck washing lagoon	145,100	
		20,861,100 present storage capacity	
L-16	Wastewater storage		Unit closed in 1982
L-20	Wastewater treatment/storage		Unit closed in 1982
L-21	Wastewater storage		Unit closed in 1982

the water table, an outward hydraulic gradient exists(ed) at these units. This gradient would promote release of hazardous waste constituents to ground water.

Lagoons L-1000 and L-1001

Lagoons L-1000 and L-1001 are surface impoundments most recently used for storage and pretreatment of landfill leachate from the RES facility. Both lagoons were out of service during the Task Force inspection and RES plans to excavate these units during future landfill expansion. When constructed in 1972 and 1974, respectively, the lagoons were used as holding lagoons for incoming loads of wastewater prior to chemical and biological treatment.

A wide variety of wastes have been received in these surface impoundments and RES plans to analyze underlying soils for heavy metals, cyanides and priority pollutants when these units are excavated. Wastes placed in L-1000 and L-1001 after November 1980 (effective date of RCRA regulations) have primarily been landfill leachate for metals precipitation, wastewaters received for biological treatment and wastewaters with heavy metals. L-1000 and L-1001 are considered primary treatment or, as needed, storage lagoons and receive wastes with high concentrations of heavy metals. Table 5 summarizes the historical use of these lagoons. Table 6 lists types of wastewaters RES has historically accepted for chemical and biological treatment. With L-1000 and L-1001 out of service, wastewater now goes directly to the chemical and biological treatment units or to holding/treatment lagoons within the landfill.

To prevent runon, lagoons L-1000 and L-1001 were constructed by excavating 10 and 20 feet below grade, respectively, and building partial dikes 5 feet above grade.

Table 5

CHRONOLOGY OF USE OF SURFACE IMPOUNDMENTS
L-1000 AND L-1001

Year	Impoundment L-1000	Impoundment L-1001	Use
1972	X	X	Rainwater and wastewater storage
1974		X	Wastewater storage
1975		X	Aeration of wastewater
1977		X	Storage of neutralized supernatant from treated wastewater (metals precipitated) pumped from LF-6 and LF-9
1979	X	X	Storage of treated contaminated water (heavy metals precipitated) from landfill L-20
1980	X	X	Contaminated water from landfill pumped from L-21 for chemical treatment in L-1000 and L-1001
1982	X	X	Emptied/sludges landfilled/liners repaired (sand lenses removed)
1983	X	X	Leachate pumped from landfill for chemical precipitation of metals in L-1000 and L-1001
1985	X	X	Emptied/sludges landfilled

Table 6

WASTE MATERIALS TREATED AND/OR STORED
IN RES TREATMENT IMPOUNDMENTS
(L-1000, 1001, 31, 32, 33, 2, 12 and ASB)

Treatment	Waste Type	Waste Materials Treated
Chemical	Acids	Pickle liquors (sulfuric, hydrochloric, nitric, phosphoric, hydrofluoric acids and mixtures of these with various dissolved metals)
		Chromic acid and sulfuric acid - dichromate mixtures
		Ferric and cupric chloride
		Lab COD wastes
	Alkalies	Caustic soda
		Sodium sulfide - sodium hydrogen sulfide mixtures
		Cyanide plating wastes
		Latex suspensions
		Soda ash
	Other	Metal salts solutions
		Oil-water emulsions
		Mixed acrylate emulsions
		Metallic oxides, halides, nitrates, phosphates
		Spent welding flux
		Calcium sulfate, sludge
Biological		Organic acids and selected alcohols
		Ammonia, phosphate - containing salt solutions
		Secondary sewage sludge
		Aqueous truck washings

Lagoons L-31, 32 and 33

Lagoons L-31, 32 and 33 are surface impoundments used for chemical treatment of waste generated both on and offsite at the RES facility. L-31 and 32 are considered secondary treatment lagoons (L-1000 and L-1001 previously being primary treatment lagoons) and L-33 is considered a final treatment lagoon. Landfill leachate, contaminated stormwater from R-1, 2 and 3 and wastewaters with moderate concentrations of heavy metals are treated with an alum and lime slurry to precipitate metals. Aerators are occasionally used in L-33 before treated wastewaters are pumped to L-2 or L-12.

When constructed in 1980, L-31, 32 and 33 replaced lagoon L-3 (discussed in section on Non-Interim Status Regulated Waste Management Units). After L-3 was emptied, sludges and contaminated soil were removed. Natural clay from the RES site was used to construct three smaller lagoons in the excavation. Lagoons L-31, 32 and 33 extend approximately 12 feet below grade with runon prevention dikes approximately 4½ feet above grade.

Lagoons L-2 and L-12

Lagoons L-2 and L-12 are surface impoundments used for flow equalization and aeration of wastewater prior to biological treatment in the activated sludge basin (ASB). Lagoon L-2 receives wastewater from L-33 and on and offsite wastewater with low concentrations of heavy metals for flow equalization and, occasionally, aeration. From L-2 wastewater goes to L-12, where it is aerated.

After construction in 1971, L-2 was used as a filter bed (aerobic/ an aerobic biological digestion) and L-12 and L-13 were used as neutralization basins for storage and neutralization for contaminated sulfuric acid. By 1975, the filter bed had been removed from L-2, and L-13 and L-12 had been combined by removing the dike separating the two impoundments. The resulting single impoundment was designated as L-12. Since then, L-2 has been used primarily for equalization and L-12 primarily for aeration.

Lagoons L-2 and L-12 were constructed by excavating 9 and 10 feet below grade, respectively, and building runon prevention dikes of 0 to 9 and 10 to 15 feet above grade, respectively.

Lagoon ASB

Lagoon ASB (activated sludge basin) is a surface impoundment used for biological treatment of wastewater. Lagoon ASB receives pretreated and pre-aerated wastewater from L-12. After activated sludge treatment in the ASB, effluent is used for makeup water for the incinerator scrubber.

Lagoon ASB was constructed by excavating 9 feet below grade and building runon prevention dikes 5 to 11 feet above grade. A ½-inch Gulf Seal® (tar and asphalt) liner was installed over compacted natural clay.

Lagoons L-1, F-1, F-2, F-3 and F-4

Lagoons L-1 and F-1, 2, 3 and 4 are surface impoundments operated in series and used for settling and cooling of incinerator scrubber water. Prior to 1976, the scrubber water effluent was from a spray tower which used aqueous caustic soda to treat incinerator gases. In 1976, RES switched from a caustic scrubber to a lime scrubber. The lime sludge ($CaSO_4$) and CaOH) settles out primarily in F-1 and F-2. The lime sludge is pumped/dredged from the F-series lagoons to spoils areas where it is mixed with cement kiln flue dust prior to landfilling. The F-series lagoons are also used for final pH adjustment, cooling and flow equalization.

In 1970, three lagoons (L-1, an intermediate stabilization basin and a final stabilization basin) were constructed to treat incinerator scrubber waste. By 1974, the final stabilization basin had been converted to a series of four lagoons (F-1, 2, 3 and 4) to improve retention time. By 1977, the intermediate stabilization basin was taken out of service for

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® *Gulf Seal is a registered trademark and appears hereafter without ®.*

treatment of incinerator scrubber water and had been divided into two impoundments, L-5 for firewater storage and R-2 for rainwater collection. A scrubber water canal was constructed to move incinerator scrubber water from L-1 to F-1.

L-1 is a small basin 2 to 4 feet deep with a natural clay liner. F-1, 2, 3 and 4 are 7, 7, 6 and 8 feet deep, respectively. Runon prevention dikes vary from 0 to 3 feet above grade.

Unnumbered Sludge Ponds

Three unnumbered sludge ponds or dredged spoils areas are surface impoundments used for drying/storage of calcium sludges removed from lagoons F-1 and F-2. The calcium sludges result from the neutralizing of incinerator gases in the lime scrubber. The sludge ponds are interconnected and are designed to drain to lagoon F-2. These ponds cover about 3 acres and have been in use since 1976 when RES switched from caustic to lime scrubbing for the incinerator. Dried sludge is mixed with cement kiln flue dust and landfilled.

The dredged spoils area is about 8 feet above the water level in the F-series lagoons and was formed by compacting the natural clay and building dikes to control drainage.

Lagoons R-1, R-2 and R-3

Lagoons R-1, 2 and 3 are surface impoundments operated in series and used for rainwater collection. Collected rainwater is sampled for total organic carbon (TOC) prior to discharge. If the TOC level is less than 55 mg/ℓ, the rainwater is discharged from R-3 through NPDES Outfall 002 to Tucker Bayou or used for incinerator scrubber makeup water. If the TOC level is greater than 55 mg/ℓ in R-3, the water is pumped to lagoon L-2, L-12 or ASB for treatment.

R-1, 2 and 3 were constructed in 1976 with R-2 constructed by partitioning part of L-5, the intermediate stabilization basin. Prior to partitioning, L-5 was used as part of the incinerator scrubber water cooling and settling system. The new lagoons were excavated to depths of 10, 7 and 8 feet, respectively (for R-2, the excavation was already in place). Dikes and natural grade are used for runon diversion.

Lagoon L-5

Lagoon L-5 is a surface impoundment used for storage of firewater. Prior to 1977, lagoon L-5 was an intermediate stabilization basin for incinerator scrubber water. In 1976, lagoon L-5 was partitioned into two lagoons, R-2 and L-5. Since 1977, water stored in lagoon L-5 included well water and stormwater runoff. Stormwater runoff may contain hazardous waste constituents from throughout the RES site.

Lagoon L-5 was constructed by excavating 6 to 8 feet below grade and compacting the bottom and sides. Clay excavated onsite was used for the dike to partition L-5 in 1976. Natural drainage was used to prevent runon.

Lagoon L-14

Lagoon L-14 is a surface impoundment originally used as a sludge receiving/settling basin and currently used as a lagoon to receive truck wash wastes. From 1971 to 1976, lagoon L-14 was originally two lagoons, L-14 and L-15. Sludge from tanks T-43 and T-44 was placed in L-14 until these tanks were removed in 1985. These tanks were chemical treatment tanks for neutralization and settling of wastewater.

Lagoons L-14 and L-15 were constructed in 1971 and combined by removing the dike between them in 1976. Construction consisted of excavation to a depth of 7 feet below grade and compacting the natural clay by sheepsfoot.

Lagoons L-16, L-20 and L-21

Lagoons L-16, 20 and 21 were surface impoundments that were closed in 1981, although RES claims these are pre-RCRA units. Lagoon L-16 was constructed in 1971 and was used for firewater storage during the 1970s. Water stored in this lagoon included well water and rainwater which may have contained hazardous waste constituents. After L-5 was converted to a firewater lagoon in 1976, L-16 continued to be used as a storage lagoon and received accumulated fluids from the tank farm and drum storage pad sumps. This fluid often had a high COD. In 1981, L-16 was converted to a truck parking lot. The empty impoundment was filled with clay excavated onsite, which was compacted and covered with a geomembrane to aid drainage. The geomembrane was covered with clay and gravel for truck parking.

Lagoons L-20 and 21 were constructed in 1978 and 1979, respectively. These lagoons were used primarily for storage of runoff and landfill leachate from the moving face landfill. The water was pumped to L-1000 and L-1001 for pretreatment prior to chemical and biotreatment. In 1981, these lagoons were dewatered by pumping the water to the chemical/biotreatment system. Remaining sludge was landfilled after being mixed with cement kiln flue dust. The empty impoundments were then incorporated into the moving face landfill.

Drawings are not available to provide construction details of lagoons L-16, 20 and 21. Reportedly, construction was similar to other lagoons with excavation in natural clay and compaction by sheepsfoot.

Landfill Rainwater Collection Basin

The rainwater collection basin is a surface impoundment in the present moving face landfill (see description below). Because the landfill has a leachate collection system and transverse berms are used to separate clean and contaminated areas, RES has not listed the rainwater collection basin as a RCRA-regulated unit. RES contends only rainwater is collected in this basin. If analytical testing for hazardous waste constituents is negative,

stormwater is discharged without treatment through NPDES Outfall 002. If hazardous waste constituents are found, the stormwater is pumped to the chemical treatment system.

Landfill

The landfill at the RES site (designated as LF-19) is used for the burial of hazardous waste. RES has applied (RCRA Part B application) to increase its permitted landfill capacity from 730,000 cubic yards to 6,300,000 cubic yards. Some 14 discrete landfill cells of about 10,000 cubic yards each were filled and completed in the 1970s before RCRA regulations became effective in November 1980. The current landfill is operated under a "moving face" concept of disposal, where waste is covered and capped as the landfill progresses. Thus, closure is an ongoing process and only a small portion of the excavation has exposed waste and the potential for contaminated rainwater is reduced. The moving face landfill (LF-19) is subject to the interim status ground-water monitoring requirements of RCRA.

Landfill LF-19

Landfill LF-19 is located on the southern half of the RES facility. The currently active portion of this below-grade moving face landfill is noted as the Excavated Fill Pit on Figure 3. The moving face landfill was started in late 1976 or early 1977 and the depth gradually increased from 30 to 50 feet below grade. RES proposes to continue excavating northward, excavating and re-landfilling waste from old completed landfill cells until the entire southern portion of the facility has been excavated and filled to 50 feet below grade. RES then proposes to landfill waste to a height of 23 feet above original grade over the southern portion of the facility.

Above-ground disposal will be made possible by completing the containment dike that currently borders the east and south sides of LF-19. The northern portion of the proposed RES landfill will be developed after (1) the southern portion of the landfill is filled, (2) the drainage ditch and pipeline that presently separates the north and south portions are relocated

and (3) present surface impoundments are closed. Above and below grade disposal would occur concurrently until the landfill is extended to just south of Avenue A [Figure 3].

Landfill LF-19 was constructed by excavating the natural clay to the desired depth. Sand lenses were dug out as encountered and refilled with compacted clay in 6 to 8 inch lifts to a thickness of 12 feet. After excavation, the bottom of the landfill was broken up (scarified) to a depth of 6 to 12 inches and recompacted with a Cat 815 sheepsfoot roller. Walls were compacted by the same Cat 815 sheepsfoot roller but without scarification.

A leachate collection system was installed during a 6-month period in 1982 before landfilling in the current cell began. Eight transverse dike-like structures made of sand were constructed from the middle to the side of the landfill. The structures are about 10 feet wide and 2 feet high. The bottom of the landfill also sloped about 1% from the middle to the sides of the landfill. The sand "dikes" end where the landfill floor meets the side wall and drain to perpendicular trenches filled with pea gravel. To enable leachate removal, 6-inch PVC standpipes (numbered CC-1 through 8) run to ground level on the outside of the dike. Leachate is periodically pumped to tank trucks and hauled to the chemical/biotreatment system. The landfill also has one sand trench containing an 8-inch slotted PVC pipe with a vertical 8-inch PVC riser inside 10-inch steel casing. A tenth leachate collector with a radial collection system is to be installed soon.

Tanks

RES has operated and continues to operate a series of tanks and tank farms for storage of RCRA waste and PCBs. The existing tank farms have surrounding containment berms constructed either of clay or concrete. Leakage from the tanks, piping and waste transfer operations is collected in sumps. Tank pads are either sand or concrete. The containment basins have compacted clay floors. A list of existing tanks, capacity and types of waste stored is presented in Table 7.

Table 7

REGULATED TANKS

Tank Number	Type of Waste	Capacity (gallons)
	No. th Tank Farm	
T-1	Transformer oils containing PCBs	21,000
T-2	Transformer oils containing PCBs	25,300
T-4	Out of service	
T-5	Out of service	
T-6	Transformer oils containing PCBs	26,400
T-7	Transformer oils containing PCBs	26,400
T-8	Transformer oils containing PCBs	26,400
T-9	Transformer oils contianing PCBs	26,400
T-10	Transformer oils containing PCBs	26,400
T-11	Transformer oils containing PCBs	15,000
T-12	Transformer oils containing PCBs	15,000
T-18	Transformer oils containing PCBs	25,300
T-19	Transformer oils containing PCBs	21,500
T-20	Dichlorobenzene, furfural, amine tars, phenolics	7,400
T-21	1,4-dichlorobutene-2 mixture	7,400
T-22	Out of service	
T-27	Methacrylates, cyclohexane, amine tars	15,400
T-28	Methacrylates, cyclohexane, amine tars	15,400
T-31	PCB blends	30,000
T-32	PCB blends	30,000
T-60	Transformer oils containing PCBs	100,000
T-61	Transformer oils containing PCBs	200,000
	East Tank Farm	
SX-2	Liquid waste for thermal oxidation	15,000
SX-3	Liquid waste for thermal oxidation	20,300
SX-4	Liquid waste for thermal oxidation	20,300
T-40	Liquid waste for thermal oxidation	12,600
	West Tank Farm	
V-22	Transformer oils containing PCBs	7,000
V-23	Transformer oils containing PCBs	7,000
T-24	Transformer oils containing PCBs	2,400
T-25	Transformer oils containing PCBs	18,000
T-26	Transformer oils containing PCBs	15,400
T-29	Transformer oils containing PCBs	7,000
T-30	Transformer oils containing PCBs	7,000
	Others	
PVT-1	Appendix VIII emulsions	1,000 (portable)
PVT-2	Appendix VIII emulsions	1,000 (portable)
T-49	Clarified sludge	10,200
T-50	Clarified waste water	45,000
T-54	PCB-contaminated sludges	900
V-1	Knock-out pot	300
West Mix Pan	Liquid waste for solidification/landfilling	90-100 cubic yards
East Mix Pan	Liquid waste for solidification/landfilling	90-100 cubic yards

Tanks listed in the "Others" section have no containment but are used for short-term storage for special wastes, mixing wastes or when cleaning out other tanks. Leakage from these tanks could contaminate ground water.

Container Storage Area

The container storage area consists of two warehouses and two pads with interconnected roofs, walls and curbs. The warehouses are 3,000 and 10,000 square feet and were built in 1978 and 1982, respectively. Drummed PCB transformer oils and drummed or boxed PCB capacitors are the main items stored in the warehouses. The buildings have concrete floors with 6-inch curbs and the RCRA Part B application lists the capacity of the warehouses at 2,200 55-gallon drums and 200 wooden PCB capacitor containers.

The container storage pads are 7,800 and 3,900 square feet, respectively. A large concrete drum storage pad of about 80 by 270 feet was installed in 1973 after the State of Texas issued RES an Enforcement Order because of contaminated stormwater runoff from the drum storage area. The configuration of the drum storage area has changed with the building of the PCB warehouses and completion of needed repairs. Potential for the release of hazardous waste constituents to the ground water has existed from early 1970's storage of drums on the ground and later storage of drums off the concrete pad or broken curbs allowing runoff from the concrete pad to the ground. The RCRA Part B application lists the capacity of the pads as 800 55-gallon drums, 50 35-gallon fiber drums and 900 steel PCB capacitor bins.

Non-Interim Status Regulated Waste Management Units

Waste management units and activities operated before November 19, 1980, which are not subject to the TAC interim status ground-water monitoring requirements, are also potential sources for release of hazardous waste constituents to ground water. RES submitted information to TWC in August 1985 on past waste management units and activities at the Deer Park facility, pursuant to Section 3004(u) of RCRA. Lagoon L-998/999 (stabilization basin) and unnamed disposal trenches, described below, were not included in the submittal.

This, along with other information about these units/activities, is discussed below. Some areas, such as old landfill trenches are under study to locate where waste was buried to facilitate monitoring well placement and removal activities. Pre-RCRA units are the shaded units shown in Figure 3.

Surface Impoundments

Surface impoundments were used at the site for hazardous waste treatment and storage Some landfill cells were originally used as surface impoundments and then filled with waste and completed as landfill cells. All of the old surface impoundments are to be excavated and landfilled in the new proposed moving face above and below-grade landfill. The 15 pre-RCRA surface impoundments described in Table 8 and discussed below were subject to pre-RCRA/TAC regulations.

Lagoon L-3

Lagoon L-3 was a 200-foot-square surface impoundment used for treatment of wastewater and rainwater at the RES facility. After construction in 1971, L-3 was used as a filter bed (aerobic/anaerobic biological digestion). According to a 1970 site development drawing, lagoon L-3 was to be constructed by excavating 2 feet below grade and constructing a dike to a height of 4½ feet above grade. This shallow impoundment was closed in 1980 by draining and treating liquids, solidifying and landfilling sludges, excavating and landfilling underlying clay, and compacting additional clay from onsite excavation to form three treatment lagoons (L-31, 32 and 33) - deeper, but smaller in surface area.

Lagoon L-5

Lagoon L-5 was an approximately 100-foot by 400-foot rhomboidal surface impoundment used as a settling basin for incinerator scrubber water from 1971 to 1974 when F-1, 2, 3 and 4 and the scrubber-water ditch were constructed. From 1974 to 1976, lagoon L-5 was used to store rainwater.

Table 8

NON-RCRA REGULATED SURFACE IMPOUNDMENTS

Impoundment Number	Impoundment Type	Waste Received	Completion Date
L-3	Hypurle filter basin	Wastewater and rainwater	Converted to L-31, 32 and 33 in 1980
L-5	Intermediate stabilization basin	Incinerator scrubber water	Converted to L-5 and R-1 in 1976
L-6	Receiving basin	Aqueous sludge	1976
L-7	Receiving basin	Aqueous sludge	1976
L-8	Receiving basin	Aqueous sludge	1976
L-9	Receiving basin	Aqueous sludge	1976
L-10	Receiving basin	Aqueous sludge	1976
L-11	Receiving basin	Aqueous sludge	1976
L-17	Receiving basin	Burnable liquids	1974
L-18	Receiving basin	Acid	1976
L-19	Receiving basin	Wastewater and rainwater	1976
Unnumbered	*West Catch Basin*	*Contaminated rainwater*	1979
	East Catch Basin	Contaminated rainwater	1979
	Final stabilization basin	Incinerator scrubber water	1973
998/999	Stabilization basin	Acid	1973

According to a 1970 Site Development drawing, lagoon L-5 was to be constructed by excavating 2½ feet below grade and constructing a dike to a height of 2 feet above grade. This shallow impoundment was converted into two impoundments in 1976; R-2 for collection of rainwater and L-5 for fire-water storage. Both R-2 and L-5 were still in operation during the Task Force inspection.

Lagoons L-6 through L-11

Lagoons L-6 through L-11 were 20-foot by 85-foot surface impoundments used as receiving/storage basins for incoming loads of aqueous sludges. L-6, 7 and 8 were hypalon-lined and were initially used for acidic aqueous sludges. However, the liners were ruined by portable aerator pipes after approximately 1 year and after that there was no distinction between waste placed in L-6, 7, 8 and L-9, 10, 11 (compacted clay liners). According to a 1970 Site Development drawing, L-6 through 11 were to be constructed by excavating 4 feet below grade and constructing dikes to a height of 3 feet above grade. These shallow impoundments were closed in 1976 by pumping wastewater to the biosystem, mixing sludges with cement kiln flue dust for onsite landfilling and capping the excavated lagoon areas with clay.

Lagoons L-17, L-18 and L-19

Lagoons L-17, 18 and 19 were surface impoundments constructed in 1971, 1972 and 1973, respectively. These lagoons were "home built" and drawings are not available to provide construction details. Construction was reportedly similar to other lagoons with excavation in natural clay and compaction by sheepsfoot. L-17 was used as a settling basin for solids, incinerable dregs and customer filter cakes. In 1974, L-17 was allowed to dry out and sludge was mixed with flue dust and landfilled in cell LF-4. L-18 was used for acidic aqueous waste and L-19 was used for neutral wastewater and rainwater. In 1976, these two lagoons were closed by pumping neutralized wastewater to the biosystem, mixing sludges with flue dust for onsite landfilling and capping the lagoons with clay.

East and West Catch Basins

The East and West Catch Basins were surface impoundments used for collection of rainwater. These lagoons were "home built" and drawings are not available that would provide construction details. In general, these were shallow basins that were bulldozed in natural clay and compacted by sheepsfoot. Rainwater was collected in these areas until 1979 when the area was recontoured.

Final Stabilization Basin

The Final Stabilization Basin was a surface impoundment used for final cooling, settling and neutralization of incinerator scrubber water. This shallow lagoon was "home built" in 1971 and detailed drawings are not available. In 1973, the Final Stabilization Basin was converted to a series of four lagoons (F-1, 2, 3 and 4).

Lagoon L-998/999 (Stabilization Basin)

Lagoon L-998/999 was a surface impoundment that was formed in 1972 from excavation of natural clay used in the construction of other lagoons/dikes at RES. This lagoon is marked Stabilization Basin on Figure 3 and was near L-1000 and L-1001. Acid was neutralized in L-998/999 by mixing the acid with ammonia. This basin was not used after 1973 and no detailed drawings are available.

Landfills

Landfills were used at the site both as surface impoundments and landfill cells through 1978. The moving face landfill was started in 1977 and the last discrete landfill cells were closed in 1979. All of the old discrete landfill cells are to be excavated and re-landfilled in the new proposed moving face landfill. The 13 pre-RCRA landfills, listed in Table 9 and discussed below, were subject to the RCRA/TAC regulations. Landfill records began on or about January 1, 1977. Records indicate the waste

Table 9

PRE-RCRA LANDFILL CELLS

Cell Number	Date Constructed	Date Completed	Remarks
LF-4	1973	1974	Old surface impoundment
LF-5	1973	1976	Old surface impoundment
LF-6	1974	1978	Old surface impoundment
LF-7	1974	1976	Old surface impoundment
LF-8	1973	1978	Old surface impoundment
LF-9	1975	1976	Used as landfill only
LF-10	1075	1076	Used as landfill only
LF-12	1976	1977	Start of moving face landfill
LF-14	1977	1979	Moving face landfill
LF-15	1978	1980	Moving face landfill
Unnamed trenches	pre-1975	pre-1976	Under dredged spoil area

number, amount, depth in the cell and distance from the perimeter. Diagrams of waste locations were made but a coordinate system was not used until 1980.

Landfill Cells LF-4 through LF-8

These landfill cells were constructed in 1973 and 1974, primarily as wastewater lagoons. These cells were "home built" and detailed drawings are not available. As with other units from this era, construction reportedly consisted of bulldozing a shallow lagoon, less then 20 feet deep, in the natural clay deposits at RES and compacting with a sheepsfoot. When these units were closed, wastewater was pumped to the biotreatment system, drummed solid waste was placed in the cells, and the cells were capped with clay.

Landfill Cells LF-9 and LF-10

These landfill cells were similar to LF-4 through LF-8 except they were never used as surface impoundments.

Landfill Cells LF-12, LF-14 and LF-15

These landfill cells started the moving face landfill and were more of a continuum than discrete cells. The depth of these cells gradually increased from 30 to 50 feet deep. These cells were capped wit clay as landfilling progressed.

Unnamed Trenches

Drums were buried in other locations at the RES facility. Records of these trenches are poor or nonexistent. RES has recently investigated the site to locate old drum disposal areas and drums have been discovered buried south of lagoon L-1001. Drums may also have been buried underneath the dredged spoils area. RES has been conducting magnetometer studies to locate these areas. Buried drums would be excavated and re-landfilled in the moving face landfill.

FACILITY OPERATIONS

Improper facility operation can result in the release of hazardous waste constituents to ground water. Task Force personnel reviewed records of facility operations for indications of problems that might lead to waste releases and information to aid in interpreting ground-water monitoring data.

To either conduct an interim status assessment monitoring program or complete a RCRA Part B permit application, TSD personnel need to know the identity and location of wastes in the regulated units. This information must be maintained in the operational record for the facility. Consequently, operational records, including selected waste preacceptance and

tracking records, were reviewed to evaluate how well waste constituents have been identified in incoming waste and whether the disposal locations have been properly recorded.

Waste Storage Operations

Waste storage operations at RES, including drum and container storage and bulk liquid or tank storage, have evolved with State and Federal regulation changes. In the early 1970s, drums were stored throughout the site and sometimes lined the roadways. Waste drums and containers are now kept on curbed, drum storage areas.

In the early 1970s, tanks were built on sand, clay or concrete foundations, but often without containment. Containment basins were initially constructed with clay floors and dikes. The clay dikes were subsequently replaced with concrete walls. All tanks are vented into either a high pressure or low pressure vent system. Overflow controls vary from manual to automatic. As part of the RCRA Part B permitting process, many older tanks are being replaced.

Internal Waste Transfer Operations

Internal waste transfers at RES include dredged spoils, incinerator ash, surface impoundment sludge, tank clean-out material and spill clean-ups. Incinerator ash is tested for PCBs and usually contains less than 5 parts per million (ppm) PCBs. Although internal waste transfers are not manifested, RES tracks and analyzes the material with lab and landfill records similar to waste accepted from offsite. RES has only recently begun keeping internal waste transfer information.

Waste Treatment Operations

Waste treatment operations at RES include treatment in surface impoundments, tanks and incineration. Waste treatment units and internal waste transfers have been previously discussed. NPDES discharge points 001 and

002 and surface runoff remain as possible sources of release of hazardous waste constituents from the RES facility. Surface runoff is controlled by design features using dikes and natural contours. Discharge points 001 and 002 are monitored and sampled by RES.

Landfill Operations

Landfill operation at RES has evolved with increasing demands for efficient use of landfill space and in response to changes in State and Federal regulations. In 1971, when RES began accepting waste, burial was in shallow trenches and few records were kept (RES is currently conducting magnetometer studies to locate these shallow trenches). According to RES officials, liquids were never landfilled without being solidified; flue dust has been used for solidification since about 1975. Early landfill records, starting in the mid-1970s, did not use a coordinate waste locating system but included diagrams showing the depth at which the waste was buried and the distance from the site perimeter. In 1980, a grid system to locate buried waste was initiated and the landfill supervisor kept daily records.

The present grid system began in January 1984 and features a smaller grid system capable of locating waste within 10 feet vertically and 5 to 10 feet horizontally. Records consist of a Daily Landfill Report by HO number [Table 10]; Lab Discharge Slip, which includes analytical results (usually percentage of solids and pass or fail on a paint filter test used since May 8, 1985); Batch Composition Sheet for mix pan waste; Monthly Landfill Summary and Grid Map. The landfill is surveyed quarterly, using reference placards on the western boundary of the site. Waste is placed in the landfill in 5 to 10-foot lifts with about 2 feet of stabilized waste from the mixing pan over and around the drums, which are usually stacked two high. Each batch of stabilized waste must pass a paint filter test and is tested for unconfined compressibility using ASTM Methods for penetrometer testing. RES indicated they have never retrieved any landfilled waste. Because of the random nature of waste burial, any hazardous waste constituents accepted by RES could be present throughout the landfill areas.

Table 10

RES WASTE TRACKING RECORDS

RES Tracking Number HO No.	Suffix Code	Suffix Meaning	Waste Type	Date on Waste Data Sheet	Dates Waste Accepted	Analyses Performed When Waste Accepted
1431	50	Landfill, direct	Scrap sulfur	5/28/81	1981-1985	None
1696			Butadiene process catalyst	8/30/76	1980-1981	None
1992			Leachate filter cake	2/3/77	1980-1985	% solids starting in 1982
212f	51	Landfill, mix with dust	Chrome oxide slurry, corrosive	7/12/77	1980-1985	% solids and/or pH starting in 1983
3521			Spent catalysts: alumina/chrome, alumina/silica alumina	5/7/79	3/18/81	None
3791	51	Landfill, mix with dust	Phenol-formaldehyde resin	7/20/79	1982-1985	% solids starting in 1983
4021	51	Landfill, mix with dust	Cooling tower blowdown	Original dated 8/27/79 with an updated waste data sheet that was not dated	1980-1985	% solids starting in 1982
4284	51	Landfill, mix with dust	Water treatment sludge, ferrous sulfate lime sludge or synthesis process carbon recovery blowdown containing CN and sulfides	11/12/79	1980-1985	% solids starting in 1983
	55	Encapsulation for landfill				
5175	51	Landfill, mix with dust	Paint spray booth sludge	6/17/80	1980-1985	% solids
5481	50	Landfill, direct	Amorphous polyethylene (HDE) wax	9/10/80	1980-1985	None
6157	51	Landfill, mix with dust	Tank bottoms-rust containing lead	2/20/81	1981-1985	% solids starting in 1982
6473	51	Landfill, mix with dust	Waste perchloroethylene mixture	6/24/81	1981-1985	Flue dust test starting in 1982, % solids starting in 1983
6540	51	Landfill, mix with dust	Mixed organics or tank sludge with mercaptans	6/22/81	1981-1982	None
6599	51	Landfill, mix with dust	Sulfur sludge/polyethylene glycol	7/15/81	1981-1985	% solids starting in 1983
6807	37	Landfill, "put in hole with flue dust to absorb"	Paint residues/solvents or flammable waste paint sludge containing MEK	10/2/81	1981-1982	None
6891	51	Landfill, mix with dust	Creosote sludge	1/8/82	1982	None
7083	52	Landfill, full drums	Naphthalene	10/18/84	1982-1985	None
7821	51	Landfill, mix with dust	Leaded gasoline tank sludge	8/2/82	9/14/82	Flash point/% solids
7852	51	Landfill, mix with dust	Plating sludge	8/4/82	1983-1985	% solids
8612	55	Encapsulation for landfill	Arsenic-contaminated equipment	1/17/83	1983-1984	Visual
9451	51	Landfill, mix with dust	Sludge or cyanides (zinc phosphate bath sludge)	6/10/83	1983-1985	One out of five deliveries analyzed for pH and % solids
11039	51	Landfill, mix with dust	Water/oily sludge	11/22/83	1983-1985	% solids
11692	50	Landfill, direct	Solvents/soil	Not dated	1984	Flash point
14989	51	Landfill, mix with dust	Oily sludge	1/24/85	3/22/85	% solids

Landfill operations at RES did not comply with TWC permit [Appendix A] requirements for waste handling (Part III, Section 5, Requirements f, j, k and l). Leachate collection systems have not been inspected weekly and no log has been kept as required by "f". Compatibility tests, when performed, involve mixing two wastes together. Chemical analyses for compatibility have not been conducted and records have not been maintained as required by "j". Noncompatible wastes are often not identified, resulting in exothermic reactions when the wastes are mixed in the mix pans. During the Task Force inspection, "smoking" waste was observed and one day the contents of a mix pan had to be unloaded to allow an exothermic reaction to go to completion before the material could be landfilled. Incompatibles that are not identified or mixed may be placed in the landfill without regard to segregation. This lack of identification and segregation of incompatibles is not in compliance with "k". Landfill records have become more sophisticated and specific with time, but no records exist of leachate collection system inspections or leachate removal, as required by "l".

Waste Acceptance and Tracking

Waste characterization before receipt at a TSDF and tracking after receipt are required under both RCRA and State interim status regulations. These are important in determining the constituents that could potentially be released from waste handling units. To determine whether RES sufficiently characterizes waste it receives and records the disposal location, a review of preacceptance and tracking records for 24 waste loads* received between January 1980 and May 1985 was conducted.

The records review indicated that the paperwork was not always completed, the waste analysis information was often several years old and analyses performed when waste was accepted were very limited [Table 10].

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* *About four waste loads were selected for each year and an attempt was made to select wastes that would require more detailed analyses to adequately characterize and fingerprint the waste.*

In general, the initial waste analysis may have been fairly comprehensive for waste streams continually received, but it was seldom updated. Also, the analyses performed when waste is accepted are not adequate to determine if the waste stream is the same one originally approved for acceptance by RES.

Waste acceptance at RES has evolved with State and Federal regulation changes. In 1971, when RES began accepting waste, the facility reportedly accepted all types of waste. In 1976, manifest records began and in 1977 landfill records began at RES. Waste data/acceptance information dates back to 1977 for the 24 waste loads tracked during the Task Force inspection. After 1980, when RCRA regulations became effective, Rollins revised and updated its "pre-acceptance/acceptance package." Basically, customers have to provide RES with detailed waste characteristics, safety information and a representative sample or analytical results for a representative sample of the waste. Rollins does not accept radioactive waste or PCB waste for landfilling. (PCB liquids are incinerated and RES brokers all PCB transformers/solids to other landfills).

RES conducts no or only limited "fingerprinting" of incoming waste loads to ensure that the manifested waste is the same as the waste stream approved for receipt. RES contends that they have long-term steady customers whose waste does not vary much. Waste loads to be landfilled are usually only checked for percent of solids, which is used to determine the amount of flue dust necessary to solidify the waste. Waste to be solidified is placed in one of two large mix pans in the landfill area, and the flue dust is added and mixed with a backhoe. Waste is directed to the mix pans by laboratory personnel. Pan selection is based on mix pan capacity which is tracked by the landfill operators. RES reports that exothermic reactions between wastes mixed in the pans can result in steam generation, but RES claims they have never had to evacuate the plant or had a fire as a result of this operation.

SITE HYDROGEOLOGY

Two major hydrogeologic investigations had been conducted by RES consultants at the Deer Park facility prior to the Task Force field investigation. The first investigative report was prepared by Harding-Lawson Associates in 1978, and the second by Law Engineering in 1980. At the time of the Task Force field investigation, a third study was being conducted by Ralph Reuss, a private consultant, with field support provided by Professional Services Industries, Inc. (PSI). A verbal update of that study was provided by Mr. Reuss to Task Force personnel at the time of the field investigation. The following information is provided to explain the complexities of the site hydrogeology, the extent of work done up to the time of the field investigation, and the plans for continuing studies at this site.

The Deer Park facility is situated in the Gulf Coast structural province, which is described as a huge sedimentary basin consisting of several thousand feet of unconsolidated sand, silt and clay units, dipping regionally toward the Gulf of Mexico. At the Deer Park facility, the upper 150 to 200 feet of these deposits consists of the Beaumont Formation, which comprises the Upper Chicot Aquifer. The Beaumont Formation is characterized as a high-energy, wave-dominated delta facies. Characteristics of this type of environment include:

- Interbedded and interfingering sand, silt and clay strata in which the strata are typically more horizontally continuous, one long shore wave action
- Channel sand deposits which are more prevalent in the pre-delta regions and
- Clay deposits, primarily found in the backswamp and lagoonal environments

The Lower Chicot Aquifer, 300 to 500 feet in thickness, is comprised primarily of the Alta Loma Sand, and is a major source of ground water in

the Houston area. The Alta Loma Sand is predominantly sand, with intermittent silt and clay layers.

The Alta Loma Sand is immediately underlain by the Evangeline Aquifer (also a major source of ground water) and are differentiated by an increase in transmissivity in the Evangeline.

Collectively, these aquifers are interpreted as being part of the Gulf Coast Aquifer.

In regard to required ground-water monitoring, the most important hydrogeologic units underlying the site are the permeable in the upper portion of the Beaumont Formation because of their potential to transport waste constituents from the management units. During the Task Force investigation, a hydrogeologic study was being conducted to better define these zones.

Prior to the present investigation, data from several test pits and approximately 39 borings had been used to characterize the hydrogeology at the Deer Park facility. Soil and geologic data were also obtained by observing the side walls in the landfill excavation, which expose the upper 40 feet of strata. Samples obtained from about half of the test borings were undisturbed samples taken at 5-foot intervals with a split-spoon or a Shelby-tube sampler. Samples from the other half of the test borings were disturbed samples taken at 5-foot intervals. About 43 field and laboratory permeability tests were performed.

A major shortcoming of these investigations was that the visual observations used to classify the hydrogeologic units at the site were inconsistent and inadequate to define the complex geology.

As part of the current investigation being conducted by Mr. Reuss, continuous soil samples were taken from 29 boreholes in the northern portion of the waste management area. Samples of cohesive sediments were obtained with Shelby-tube samplers and non-cohesive samples were obtained with split-spoon samplers. Results of liquid limit, plastic limit and penetrometer

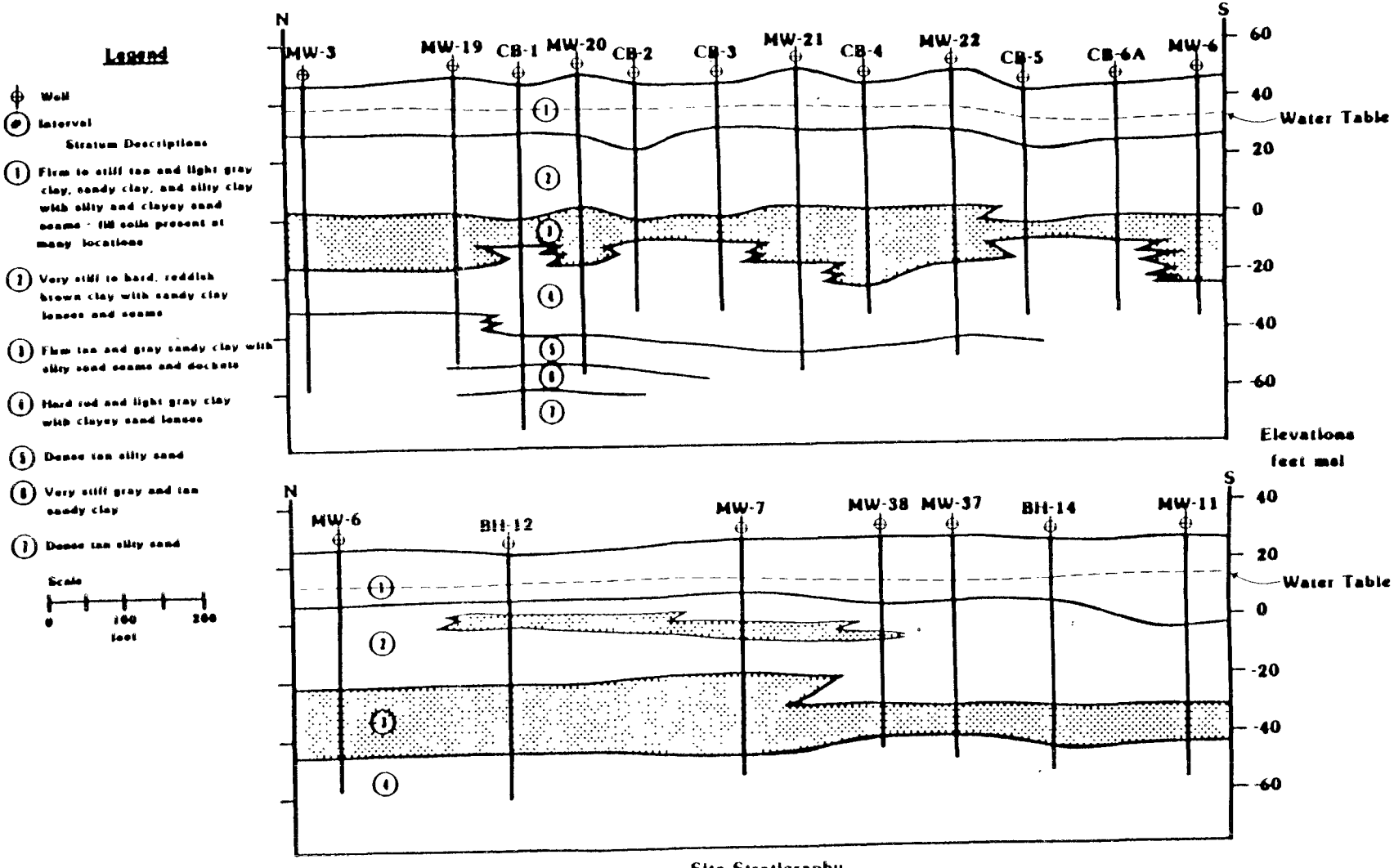
tests were used to classify the sample materials. Fifteen field permeability tests had been performed.

HYDROGEOLOGIC UNITS

All the consultants to RES identified the same principal hydrogeologic units [Figure 5]. However, different terms were applied to them in the various reports. For ease of reference the Reuss unit designations will be used in this report because they represent refined interpretations made from a more comprehensive data base than that available to the previous investigators. The different terms applied to the units are presented in Table 11.

The clays of the Beaumont Formation are very plastic due to the high montmorillonite content, especially in Stratum No. 4. The high montmorillonite content is also responsible for the shrink/swell characteristics of the Beaumont. The clays shrink or swell in response to moisture content changes. As the clays undergo cycles of shrinking and swelling, fracture planes or "slickensides" may develop. Additionally, subsidence resulting from ground-water withdrawals may be partially responsible for slickensides observed in the Beaumont. These fracture planes provide secondary permeability. Clays with high montmorillonite content also have relatively high cation exchange capabilities, which is a desirable characteristic for a landfill site.

Stratum 3 has been proposed as the uppermost aquifer by the consultants to RES. Task Force personnel consider the uppermost aquifer to include the entire saturated interval down to the Burkeville aquiclude at the base of the Evangeline Aquifer (approximately 3,000 feet below ground surface).[z] The Evangeline Aquifer and the Chicot Aquifer are hydraulically interconnected with the highest head in the upper portion of the Chicot and the lowest head in the Evangeline. Therefore, in addition to the horizontal component of movement, a vertically downward component is present in the hydrogeologic system.



Site Stratigraphy
Rollins Deer Park Facility

Figure 5

Table 11

HYDROGEOLOGIC UNITS IDENTIFIED
AT RES DEER PARK FACILITY

Reuss Designation		Harding-Lawson and Law Designation	
Stratum	Description	Stratum	Description
1	7 to 32 feet of firm to stiff tan and light gray clay, sandy clay, and silty clay with silty and clayey layers; replaced by fill soils at many locations	I	Black to dark gray surface clay
2	30 feet of very stiff to hard reddish-brown clay; contains occasional fractures	II	Gray to tan silty clay with sandy and silty layers and red mottled clay and red silty clay
2A	Silt and sand layers and lenses; contains perched water	IIA	Sandy silt and silty sand layers
3	4 to 28 feet of firm tan and gray silty fine sand and sandy silt with some low plasticity clay zones	III	Fine sand, silty fine sand and fine sandy silt
4	15 to 42 feet of hard red and light gray high plasticity clay with clayey sand lenses; contains pronounced fractures	IV	Gray, tan and red mottled clay to silty clay
5	5 to 40 feet of dense tan silty sand		
6	4 to 16 feet of very stiff gray and tan sandy clay		
7	16 to 20 feet of dense silty sand		
8	Very stiff gray and tan sandy clay		

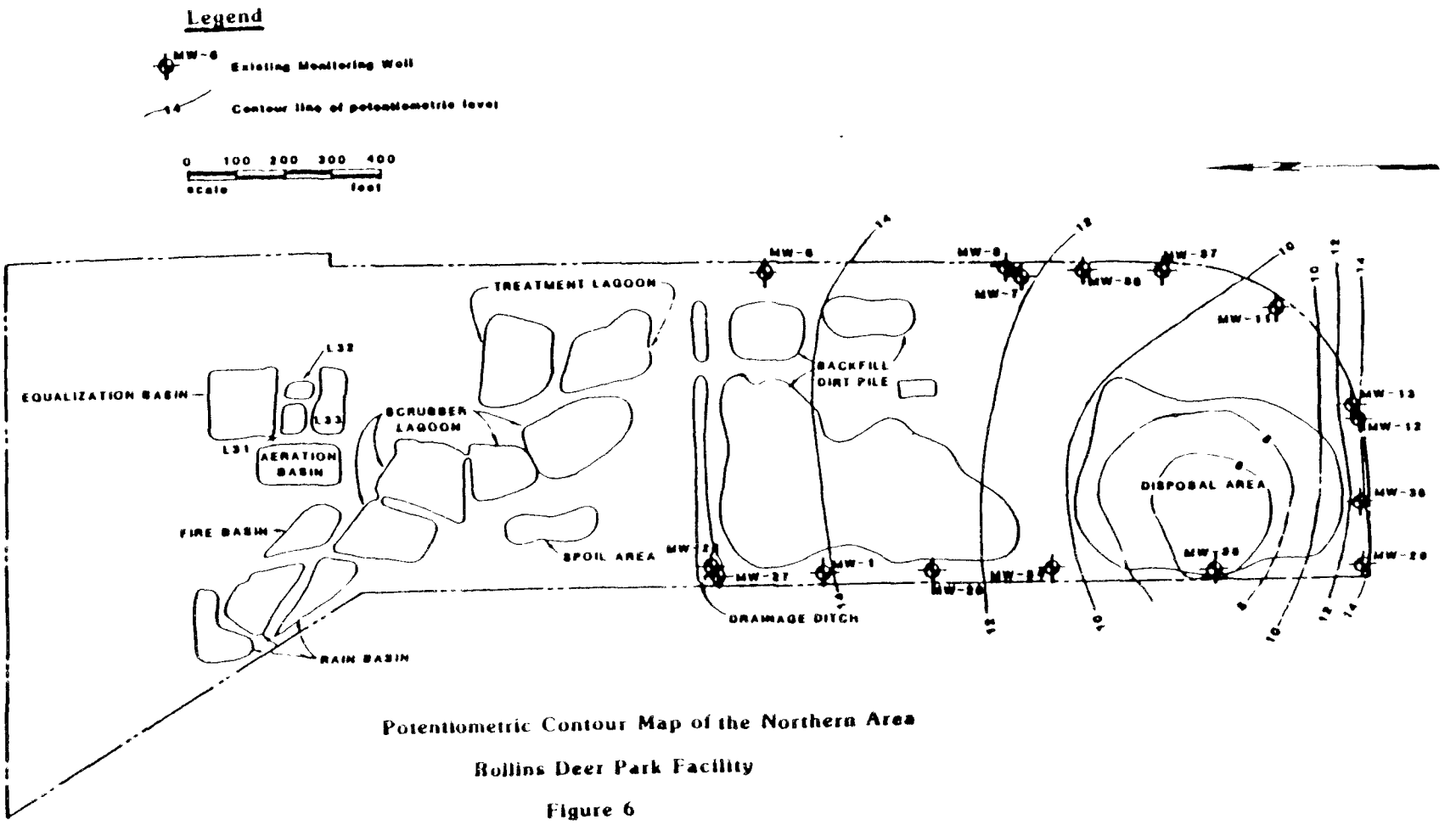
Task Force personnel determined that, in addition to the silty sand unit (Stratum 3), the silt and sand zones of Stratum land 2 need to be monitored. As these are permeable, saturated zones, monitoring wells completed in these zones would supplement monitoring of Stratum 3 to ensure immediate detection of any statistically significant amounts of hazardous waste or hazardous waste constituents that might migrate from the waste management units.

GROUND-WATER FLOW DIRECTIONS AND RATES

A potentiometric contour map was presented in the Harding-Lawson report for Stratum 3 in the southern portion of the waste management area [Figure 6] and one for the northern portion of the waste management area [Figure 7] where the monitoring wells are completed through multiple zones (Strata 2, 3, 4 and 5). Harding-Lawson's interpretation of the water level measurements, as illustrated by the contour maps, was confirmed by Task Force personnel.

The potentiometric contour map for Stratum 3 in the southern portion of the site [Figure 6] suggests that horizontal ground-water flow is radially toward the active below-grade disposal area. This localized ground-water depression or sink is the result of pumping runoff and ground-water seepage ponded in the excavated area to dewater the active disposal cell.

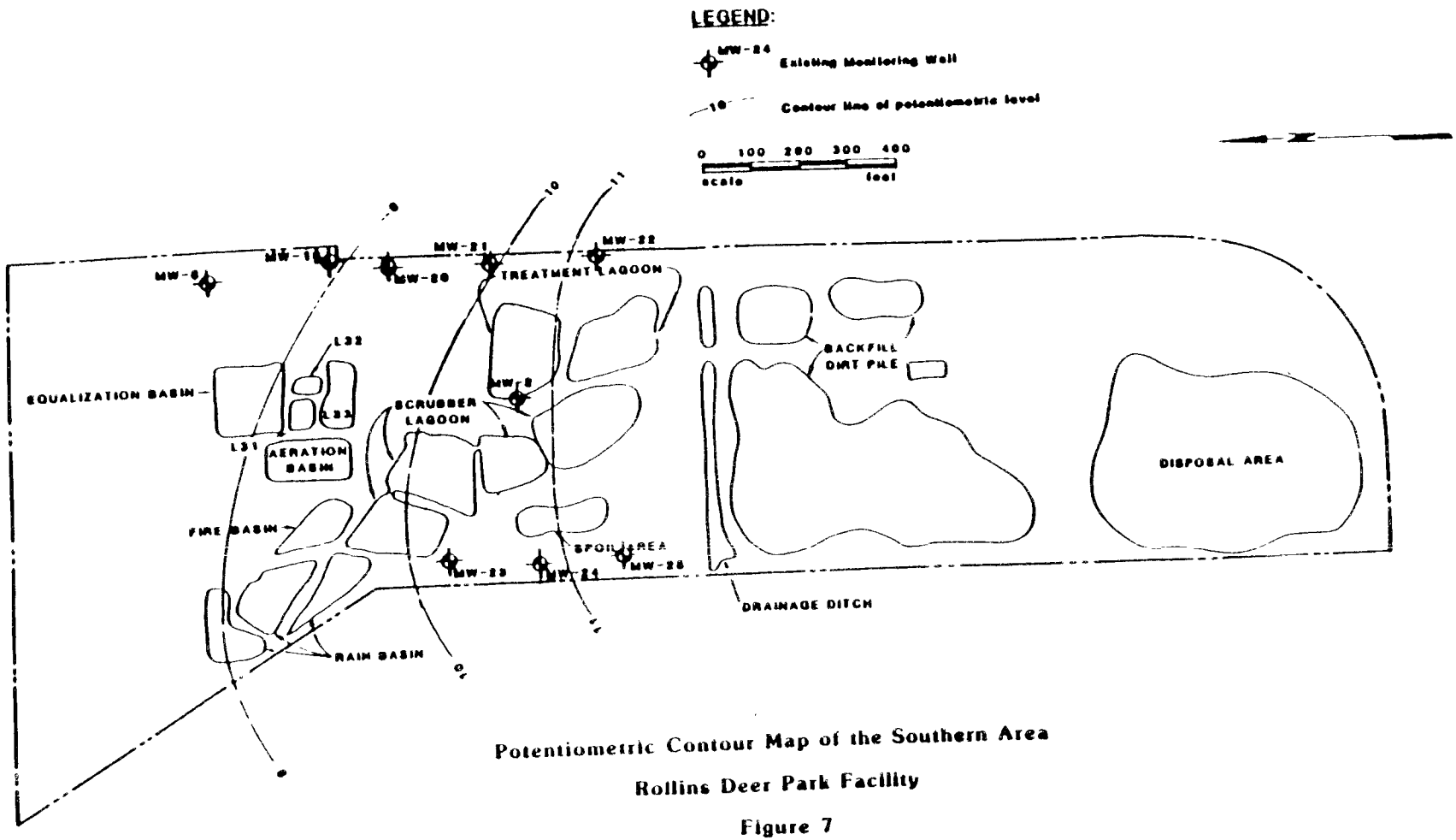
The potentiometric contour map for the northern portion of the site is based on water levels in wells completed in multiple zones, and indicates ground-water flow to the north-northeast. From data available to Task Force personnel at the time of the inspection, the ground water in the northern portion of the waste management area appears to be unaffected by the ground-water sink. The RES consultant interpreted (Task Force personnel concurred) the potentiometric contours in the northern portion of the waste management area as reflecting the water levels and flow direction of Stratum 5. At the time of the Task Force inspection, available data were inadequate for characterizing the ground-water flow directions and rates for Stratum 3 in the northern portion of the waste management area.



Potentiometric Contour Map of the Northern Area

Rollins Deer Park Facility

Figure 6



Potentiometric Contour Map of the Southern Area

Rollins Deer Park Facility

Figure 7

The permeability (hydraulic conductivity) of Strata 1, 2 and 3 at the Deer Park site has been estimated by the RES consultants using two different methods. These are (1) laboratory testing of "undisturbed" soil samples with the permeability measured primarily in the vertical direction and (2) *in situ* recovery tests. A summary of the permeabilities for the various strata is presented in Table 12.

Table 12

ESTIMATED PERMEABILITIES OF THE HYDROGEOLOGIC UNITS

Hydrogeologic Unit	Maximum Permeability (cm/s)		Minimum Permeability (cm/s)		Mean Permeability (cm/s)	
	Vertical	Horizontal	Vertical	Horizontal	Vertical	Horizontal
Stratum 1	$3x10^{-7}$	$2x10^{-5}$	$1x10^{-8}$	-	$8x10^{-8}$ (4)*	-
Stratum 2	$4x10^{-6}$	$4x10^{-6}$	$1x10^{-10}$	-	$5x10^{-7}$ (18)	-
Stratum 2A	$1x10^{-4}$	$6x10^{-4}$	$1x10^{-6}$	$1x10^{-4}$	$2x10^{-5}$ (6)	$4x10^{-4}$ (4)
Stratum 3	-	$4x10^{-3}$	-	$1x10^{-5}$	-	$7x10^{-4}$ (24)

* *Number of measurements*

The reliability of the laboratory and field permeability data cannot be fully evaluated because the methods used are not sufficiently described. For example, 19 measurements made by Harding-Lawson in 1978 used either an unspecified falling head test or permeability was calculated from a measured coefficient of compressibility. There are several different methods for measuring permeability by these general procedures, each having different shortcomings.[3]

Most of the field permeabilities, which should be more reliable than the laboratory data, are suspect due to potential interferences caused by well construction. Results for 20 rising-head permeability tests conducted on 18 wells were reviewed. Eight of the wells (MW-6, 7, 8, 11, 12, 13, 15 and 18) were installed with filter fabric wrapped around the "screen" (see

section on Monitoring Wells), which could slow water entry into the well and yield permeability results biased low.

Recovery tests yield results for transmissivity, which is a measure of water production from the monitored zone. Permeability is then calculated by dividing the transmissivity value by the composite thickness of the principal water-producing zone(s) yielding water to the well or the length of screen open to the water producing zone(s). Determining the composite thickness is difficult when a water-producing zone is intersected above or below the screened section of the well by an oversize sand pack. The head loss of water moving from such a zone through the sand pack to the well screen effectively reduces the thickness of the zone in the permeability calculation. Whether corrections were made is not reported.

The lack of method descriptions make data discrepancies difficult to understand. Both Law Engineering and PSI, for example, conducted recovery tests on well MW-12. The results were 6.1×10^{-4} and 8×10^{-5}, respectively The apparent decrease (almost an order of magnitude) in permeability between 1980 and 1985 could be due to (1) clogging of the filter fabric, (2) different value used for the composite thickness of the water-producing zone, (3) different equations used to calculate transmissivity or (4) deterioration of the well screen.

One of the wells (MW-9) was a production-type used to dewater the ground near the landfill excavation. The well had (it was abandoned in 1983) a 10-inch diameter casing with a 24-foot screen installed in a nominal 24-inch borehole that was 60 feet deep. The entire annular space was sand packed so that any water-bearing unit could yield water to the well. No information was provided on the value used for the composite thickness of the transmissive units or how it was derived. Permeability data are also suspect from three of the monitoring wells (MW-35, 37 and 38), which had 10-foot screens and 18 or 19-foot long sand packs.

In summary, permeability data for 12 of the 18 wells tested are suspect because of potential construction interferences. Considering typical permeability values for the materials being measured in conjunction with the other results, the suspect values are probably accurate withn an order of magnitude.

GROUND-WATER MONITORING PROGRAM DURING INTERIM STATUS

Ground-water monitoring at the Rollins Deer Park facility has been conducted entirely under State interim status regulations because TWC was delegated Interim Authorization in December 1980. The following is an evaluation of the monitoring program between November 1981, when the ground-water monitoring provisions of the TAC became effective, and October 1985, when the Task Force investigation was conducted. This section addresses:

- Regulatory requirements
- Ground-water sampling and analysis plan
- Monitoring wells
- Sample collection and handling procedures
- Sample analysis and data quality
- Ground-water Quality Assessment Program outline

REGULATORY REQUIREMENTS

Between November 1981 and October 1985, a two-part regulatory framework controlled the design, installation and operation of the ground-water monitoring program at the RES facility. These parts were (1) the TAC regulations and (2) the State permit (No. 01429) issued to the facility. The information presented here is included as a background for subsequent discussions of the monitoring wells and program and compliance by RES with the monitoring requirements.

State regulations for interim status facilities are contained in Title 31 of the TAC Section 335, Subchapters E through T, which became effective on November 19, 1980. The State ground-water monitoring requirements (Subchapter I) are nearly identical to the RCRA interim status requirements contained in Title 40 of the Code of Federal Regulations, Part 265 (40 CFR Part 265), Subpart F; there are no substantive differences. Regulation counterparts are shown in Table 13.

Table 13

STATE AND FEDERAL COUNTERPART
INTERIM STATUS REGULATIONS

Subpart Title*	TAC (Title 31)	RCRA Regulation (40 CFR Part)
Applicability	335.191	265.90
Ground-Water Monitoring System	335.192	265.91
Sampling and Analysis	335.193	265.92
Preparation, Evaluation and Response	335.194	265.93
Reporting and Recordkeeping	335.195	265.94

* *Subpart titles are the same in both the State and RCRA regulations.*

The TAC specifies a monitoring schedule, parameter list, requirements for a sampling and analysis plan, and data evaluation and reporting procedures. The permit only specifies a monitoring schedule and parameter list. The monitoring schedule in the permit is different from the TAC and additional monitoring parameters are required by the permit, as discussed below. The TAC states [335.45] that the regulations shall be followed except where the permit contains additional or more stringent requirements, in which case the permit requirements shall take precedence.

Since the 1980s, the Deer Park facility has been operated under a State permit (No. 01429) that covers all phases of facility operation, but is basically an expanded NPDES-type permit. In accordance with a State directive [Appendix B], permit conditions for the monitoring schedule and parameters were to be followed.

The monitoring program followed by RES after November 19, 1980 began with requirements contained in a revised version of the 1974 permit, which was approved on April 9, 1979. At that time, the facility had an 18-well monitoring network. The 1979 permit required monthly monitoring of the wells for the first year and quarterly monitoring thereafter and nearly the same permit parameters listed in Table 14. The 1979 permit also required monitoring for silica, but not for iron, total organic halogen, radium, gross alpha, or gross beta, as required by the TAC.

Following approval of the 1979 permit, RES applied to the State for an expansion of landfill capacity. The mechanism for approval of the expansion was through revision of the permit. During the permit revision process, other necessary changes were made, including some to the monitoring well network. Since the 1979 permit was issued, RES and TWC had determined that 9 of the 18 monitoring wells needed to be replaced. As a result of improvements to the drainage channel at the southwest corner of the property, four wells (MW-4, 5, 15 and 18) were to be abandoned. Five other wells (MW-9, 10, 14, 16 and 17) had been installed for landfill dewatering and were not acceptable as monitoring wells.*

A revised permit was issued on September 3, 1981 that approved the landfill expansion and imposed monitoring requirements on the replacement ("new") wells, when constructed [Appendix A]. The new wells were to be sampled within 1 week of completion, then quarterly for 1 year and semi-annually thereafter. The parameters to be monitored are compared to those required by the TAC/RCRA interim status regulations in Table 14.

Since the permit only referred to new wells and the monitoring frequency was different from that required for the existing wells by the 1979 permit, RES requested clarification of the 1981 permit requirements in a December 3, 1981 letter to the State. The response was the letter in

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* *The wells were not abandoned until 1982 and 1983, respectively.*

Table 14

COMPARISON OF GROUND-WATER MONITORING REQUIREMENTS IN THE STATE PERMIT AND TAC[1]

Parameters for Quarterly Samples Collected During First Year of Monitoring	
1. Required by both 1981 Permit and TAC	
pH[2]	Cadmium
Specific conductance [2]	Chromium
Total organic carbon[2]	Lead
Total organic halogen[2]	Mercury
Chloride	Selenium
Iron	Silver
Manganese	Endrin
Phenols	Lindane
Fluoride	Toxaphene
Sodium	Methoxychlor
Sulfate	2,4-D
Arsenic	2,4,5-TP (Silvex)
Barium	Nitrate
2. Required by Permit Only	
Calcium	Chemical oxygen demand (COD)
Magnesium	Total organic nitrogen
Carbonate	Copper
Bicarbonate	Nickel
Total dissolved solids	Zinc
Phenolphthalein alkalinity	Polychlorinated biphenyls (PCBs)
Total alkalinity	
3. Required by TAC Only	
Radium	Gross alpha
Gross beta	Fecal coliform
Parameters for Semi-Annual Samples Collected After First Year of Monitoring	
1. Required by Permit and TAC	
pH[3]	Specific conductance[3]
Total organic carbon[3]	Total organic halogen[3]
2. Required by Permit Only	
Total organic nitrogen	Total dissolved solids
Chloride[4]	Iron[4]
Manganese[4]	Phenols[4]
Sodium[4]	Sulfate[4]

1 *Texas Permit to Dispose of Wastes (No. 01429) issued by Texas Water Commission on September 3, 1982 and TAC regulations Chapter 335.193.*

2 *TAC requires quadruplicate measurements for these parameters in the quarterly samples from the upgradient wells where the permit does not.*

3 *TAC requires quadruplicate measurements for these parameters from all wells semi-annually.*

4 *Also required by TAC; however, monitoring frequency is "at least annually".*

Appendix B, which states that the existing wells were to be in the semi-annual sampling schedule (per the permit requirements).

The letter apparently contradicts TAC regulations. Under the TAC interim status requirements, a new "first year" of quarterly monitoring should have commenced on November 19, 1981 on the existing monitoring well network by the schedule and for the parameters specified in the regulations, as a minimum.

In summary, between November 1981 and October 1985, the ground-water monitoring program was regulated by TAC and State permit requirements. The monitoring schedule provisions are apparently inconsistent and additional monitoring parameters are specified by the permit. In this report, the ground-water monitoring program implemented at the RES Deer Park facility is compared to both sets of requirements for the purpose of determining compliance.

GROUND-WATER SAMPLING AND ANALYSIS PLAN

Since the effective date of the TAC interim status ground-water monitoring requirements (November 19, 1981), at least two sampling and analysis plans have been developed and followed at the Deer Park facility. Neither the first nor second plan, which was being followed in October 1985, fully complied with the TAC requirements.

Monitoring procedures were not well documented until after the second plan was developed in mid-1985. The previous procedures and records could not be fully explained by RES personnel because the person who had been responsible for ground-water monitoring at the facility for many years died in December 1984. The new person responsible for monitoring is a supervisory chemist from the onsite lab and who has no previous experience with the required program (or ground-water monitoring, in general).

The first plan has no cover date, but, because it alludes to permit requirements for semi-annual sampling, it is presumed to have been developed

after the permit was revised in September 1981. Company personnel stated that this was the only plan on file that predated the mid-1985 plan. This plan apparently constituted the interim status plan until a revised version of the one submitted in the Part B permit application was implemented.

The following describes each of the plans and discusses the deficiencies.

Plan Followed Until Mid-1985

The undated plan, followed until mid-1985, is three pages long [Appendix C] and does not comply with the TAC requirements. It is incomplete, lacks many necessary details and describes procedures for sample collection that are unacceptable, as described below.

The TAC [335.193(a)] requires that the plan include procedures and techniques for (a) sample collection, (2) sample preservation and shipment, (3) analytical procedures and (4) chain-of-custody control. The regulations [335.193(c)] also require that the monitoring wells be sampled according to a two-phase schedule (first and subsequent years) and, during the first year, additional measurements must be made on samples from upgradient wells.

The monitoring plan does not contain a list of wells composing the monitoring network, nor does it designate wells upgradient and downgradient from the waste management units. Neither does it present a schedule that would indicate which wells were to be sampled quarterly or semi-annually in accordance with the permit.

The plan states that wells will be purged once a month, but does not specify whether the wells are to be purged just before the required sampling. Purging just before sampling is necessary to ensure collection of representative ground-water samples.

The plan does not describe how depth-to-water measurements are to be made or whether the depth is to be measured before or after sample collection. The plan erroneously states that water levels are not necessary for reporting requirements. This is at variance with the TAC which requires that the elevation of the ground-water surface be determined each time a sample is obtained [335.193(e)] and that an evaluation of the ground-water surface elevations must be submitted in an annual report [335.195(a)(2)(C)]

Samples are to be collected with an air eductor (air-lift) pump, which is not an acceptable device. The parameters used as indicators of ground-water contamination, including pH, specific conductance, total organic carbon (TOC) and total organic halogen (TOX) [335.193(b)(3)], are all sensitive to the vigorous aeration caused by the air-lift device. Concentrations and values can change significantly as a result of the aeration.

If pH changes occur, which is likely using an airlift device, change in specific conductance is likely. If organics were leaching from the waste management units, volatile organic compounds would likely be the first to arrive at the monitoring wells. Volatiles could be easily stripped from the sampled water by the air-lift device and would decrease TOX and, possibly, TOC concentrations.

Records of sampling, as described in the plan, are limited to the sample tag and either a chain-of-custody record (if samples are shipped to an off-site lab) or an analytical report form (if samples are analyzed "in-house"). No logs of depth-to-water measurements, purge volumes, sample preservation well condition or other field observations are described. The plan does not specify sample handling procedures such as whether samples are to be filtered (analytical records show that some samples were filtered after collection), placed on ice after collection or if field measurements were to be made.

All methods used for preservation and analysis of samples are not specified, as required by the TAC [335.193(a)(2) and (3)]. The plan indicates that methods for sample preservation and analysis are contained in "Methods

for Chemical Analysis of Water [and Wastes]" published by EPA (EPA-600/4-79-020). The referenced EPA document does not contain preservation and analytical methods for the following parameters required by the permit and the TAC.

TOX	PCB
Endrin	radium
Lindane	gross alpha
Methoxychlor	gross beta
Toxaphene	carbonate*
2,4-D	bicarbonate*
2,4,5-T (Silvex)	phenolphthalein alkalinity*
Fecal coliform	

Also, citing general analytical methods is not acceptable because those methods often have alternate subparts that can yield significantly different results for the same sample.

No sample shipment procedures are described, as required by the TAC [335.193(a)(2)]. Nevertheless, samples were regularly shipped to a contractor laboratory during the period the plan was being followed.

A chain-of-custody log is described in the plan, however, it is inadequate. The "log" does not indicate the number of sample containers in custody or the parameters for which the samples are to be analyzed. Whether a single log may accompany a shipment from several wells or a log must be filled out for samples from each well is not clear.

In summary, the ground-water sampling and analysis plan reportedly in effect until mid-1985, was inadequate and did not comply with the TAC requirements.

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* *Required by the permit only*

Plan Followed After Mid-1985

Like the previous plan, the second plan has no cover date. RES personnel stated only that it was a revised version of the Part B plan completed on April 9, 1985 and could not be more specific. Since the plan describes operating procedures for pumps that Company records show were ordered and shipped in late June, an approximate date of mid-1985 is assigned by Task Force personnel for the purpose of this discussion.

The plan developed and followed after mid-1985 was much improved over the previously described plan. It is divided into six sections with additional details presented in appendices and provides much more detail on sample collection, preservation shipment, analytical procedures and chain-of-custody control. However, it does not fully comply with the TAC requirements because it does not (1) incorporate the permit requirements for monitoring parameters or frequencies, (2) contain either a list of monitoring wells or a sampling schedule, (3) present adequate details for the procedures described and (4) specify analytical procedures for all required monitoring parameters.

Section I of the plan, which addresses the purpose and scope, states that the plan is intended to satisfy the TAC provisions for ground-water monitoring, which are contained in Appendix 1 of the plan. Because monitoring requirements in the permit modify some of the TAC provisions (e.g., increase the sampling frequency for some parameters), reference should be made to them. Further, those requirements must be incorporated into the plan for it to be complete.

The plan does not contain a list or map of the wells composing the monitoring network, which must also identify those upgradient and downgradient from the waste management units. In the southern portion of the site where dewatering of the landfill excavation causes a ground-water "sink" (see section on Site Hydrogeology), the presumed upgradient and downgradient wells are not obvious from a map of the ground-water flow direction.

No sampling schedule is included in the plan, which is especially important, as new wells have been added to the monitoring network twice since November 1981 (see section on Monitoring Wells). Therefore, not all wells are sampled at the same time (i.e., some are in the first year of monitoring, a quarterly requirement).

Section II and Appendix 2 of the plan address sample collection and lack several necessary details. The subsection on measuring ground-water surface elevations provides an adequate step-by-step procedure for determining depth-to-water, but does not provide a table of wellhead elevations. This subsection should also include periodic calibration of the markers on the meter cord.

Similiarly, the subsection on calculation of purge volumes presents an adequate procedure, but omits a table of total well depths necessary for the calculation. This section should also include periodic determinations of well depth. The samplers do not use the procedure described in the plan to calculate the volume of water; rather, they have a graph where the height of the water column in 2 and 4-inch-diameter wells is plotted with the corresponding volume. Also, no procedure is described for measuring the volume of water removed during purging.

The plan indicates that <u>each</u> monitoring well is equipped with Well Wizard purge and sampling pumps. Adequate descriptions of the pumps and operating procedures are described. However, from the time the plan went into effect until late September 1985, three of the 25 monitoring wells had electric submersible pumps (MW-1, 2 and 3) and seven wells (MW-19 through 25) did not have purge pumps. The locations of the pumps, with respect to the well screens, were not documented either in the plan or elsewhere.

Section II of the plan also specifies filtering of all samples for metals analysis. In contrast to the plan, Company personnel stated that samples for TOC are also filtered, but not all samples are filtered. The decision on whether to filter is based on field observation of the settleable solids content of individual samples. Consequently, inconsistent

results are obtained because samples from a particular well may be filtered one time and not the next. Samples filtered before TOC analysis yield results for dissolved rather than total organic carbon, which are required by the TAC [335.193(b)(3)]. The principal concern is that data from filtered samples may be biased low.

The sampling section also addresses making field measurements for temperature and pH. No procedure is described for making temperature measurements; the result of which is used for adjusting the pH meter. Field measurements are to be made for pH only if the sample holding time is expected to exceed 1 hour. However, the storage and preservation requirements on Table III-1 indicate that the sample should be analyzed immediately. If a field measurement is made, the instrument calibration is to be checked and four replicate measurements are to be made. No procedures are described for either calibrating the meter or making the replicate measurements.

Section III of the plan addresses sample labeling, preservation and shipment. Information to be included on the sample container labels (tags) is incomplete because parameters to be analyzed and whether the sample is preserved are omitted. The sample tags being used by the Company during the Task Force inspection did not contain spaces for some of the information specified in the plan. For example, no space was provided on the tag for the "collector's unique sample identification" (nor does the plan explain what this is). The tag does, however, include spaces for specifying the analytical parameters.

Sample preservation is to be conducted in accordance with a table in the plan that identifies the parameter, appropriate sample container, preservative and recommended maximum holding time. No holding time for total organic halogen is presented and that for fecal coliform should be 6 hours rather than 24 [40 CFR Part 136.3, Table II]. For several parameters, acid is to be added to the sample until a specified pH is achieved. No procedures are described for determining if the specified pH has been achieved in the sample.

Section 4 [*sic*] and Appendix 3 address analytical procedures. The text states that the analytical procedures used are from one of three identified references. Appendix 3 contains the detailed methods for each parameter, however, it is deficient because none is presented for the following parameters required by the TAC.

methoxychlor
radium
gross alpha
gross beta

Section V addresses chain-of-custody and field records of sample collection. The procedures described are adequate; however, the sampling log needs to indicate the parameters for which samples were collected and whether preservatives were used. Section VI addresses State reporting requirements and forms for the ground-water monitoring data.

MONITORING WELLS

The monitoring well network at the Deer Park facility has changed twice since November 1981 when the ground-water monitoring provisions of the TAC became effective. A third change was begun during the Task Force inspection, which was to be completed by early November. In each of the network configurations, the construction of some wells did not comply with TAC requirements for isolating the monitored zone [335.192(c)].

Also, the location and number of wells were not sufficient to ensure immediate detection of leakage migrating from the waste management area to the uppermost aquifer, as required by the TAC [335.192(a)(2)].

On September 16, 1985, TWC notified Rollins that monitoring wells MW-1 through 3 and 19 through 25 (10 of the 25 wells in the monitoring network) were "so completed as to allow potential cross-contamination of several saturated strata." As a result, TWC would "no longer accept such data [from these wells] as part of [the] monitoring system" and RES was required to install single-zone completion wells by November 7, 1985, as replacements.

The old wells were to be plugged and abandoned using state-of-the-art technology.

The following is a description and evaluation of well construction and the number and location of wells in the three network configurations.

Well Construction

Information on well construction was derived from boring logs and well completion and certification reports and is summarized in Table 15.

The first of the monitoring network wells (MW-1, 2 and 3) were installed in 1976. The casing in well MW-2 collapsed twice and the well was replaced in September 1978 with two new ones. The two new wells, designated MW-2A and 2B, were to monitor a deep sand unit and shallow "perched" water, respectively. Well MW-2B, located about 15 feet from MW-2A, is 65 feet deep and monitors the interval between 40 and 65 feet. Records suggest that in about 1980, well MW-2B was dropped from the monitoring program and the distinction between the wells in monitoring reports was dropped. Subsequently, data for well MW-2A were reported only as data from well MW-2. Discussions of well MW-2, which follow, refer to MW-2A, unless otherwise noted.

Records of construction procedures for wells MW-1 and 3 were not available for review. Well MW-2 was constructed in a borehole drilled by the mud-rotary method. Wells MW-1 and 3 have PVC casing and MW-2 has a steel casing; records of screen construction materials and slot sizes for these wells were not found. These wells are inadequate for the interim status network because the strata actually being monitored cannot be determined. The long (51 to 87 feet) sand packs (and screen in MW-1) intersect multiple ground-water flow zones and may provide conduits for downward contaminant migration.

Monitoring wells MW-4, 5, 6, 7, 8, 11, 12, 13, 15 and 18 were generally constructed in 8-inch diameter boreholes drilled with a hollow-stem auger.

Table 15

INTERIM STATUS MONITORING WELLS
RES DEER PARK FACILITY

Monitoring well	Strata Monitored	Date Installed	Bottom of Screen (ft.)	Screen Length (ft.)	Sand Pack Length (ft.)	Annular Space Seal Material
MW- 1	3,4,5,6,7[a]	05/01/76	127	59	59	Grout
MW- 2	2,3,4,5	09/06/78	121	10	51	Grout
MW- 3	2,3,4,5	05/01/76	106	10	87	Grout
MW- 4	*b*	05/04/78	40	20	20	Grout
MW- 5	*b*	05/04/78	70	15	15	Grout
MW- 6	3	05/02/78	70	20	20	Grout
MW- 7	1,2	05/01/78	42	26	26	Grout
MW- 8	3	05/01/78	68	13	13	Grout
MW- 9[c]	*b*	12/01/78	60	60	60	Grout
MW-10[c]	*b*	12/01/78	60	60	60	Grout
MW-11	2,3	04/26/78	70	15	15	Grout
MW-12	3	04/19/78	58	13	13	Grout
MW-13	1,2	04/19/78	30	15	15	Grout
MW-14[c]	*b*	12/15/78	60	60	60	Grout
MW-15	*b*	02/24/78	74	10	10	Grout
MW-16[c]	*b*	12/15/78	60	60	60	Grou
MW-17[c]	*b*	12/15/78	60	60	60	Grout
MW-18	*b*	04/24/78	75	10	10	Grout
MW-19	2,3,4,5	11/24/81	100	10	67	Grout over bentonite
MW-20	2,3,4,5	11/20/81	102	10	58	Grout over bentonite
MW-21	2,3,4,5	11/19/81	106	10	73	Grout over bentonite
MW-22	2,3,4,5	11/13/81	100	10	55	Grout over bentonite
MW-23	2,3,4,5	11/16/81	99	10	64	Grout over bentonite
MW-24	2,3,4,5	11/17/81	100	10	72	Grout over bentonite
MW-25	2,3,4,5	11/19/81	102	10	50	Grout over bentonite
MW-26	2	01/25/83	40	10	16	Grout over bentonite
MW-27	3,4	01/26/83	69	15	20	Grout over bentonite
MW-28	3	01/28/83	70	15	20	Grout over bentonite
MW-29	3	01/18/83	74	15	20	Grout over bentonite
MW-34	3	05/04/83	65	10	15	Grout over bentonite
MW-35	3	05/06/83	70	10	19	Grout over bentonite
MW-36	3,4	04/28/83	72	10	15	Grout over bentonite
MW-37	2,3	05/02/83	70	10	18	Grout over bentonite
MW-38	2,3	05/03/83	70	10	18	Grout over bentonite

a *Strata underlined are primary ground-water contributing formations.*
b *Not specified*
c *Dewatering wells - Screen length includes sand-pack length. Design drawing for a typical dewatering well has screen length of 24 feet.*

Key to Table

Strata Monitored:

1 *Clay, sandy clay and silty clay with silty and clayey sandy layers, fill soils present at many locations*
2 *Clay with sandy clay lenses and layers*
3 *Silty fine sand and sandy silt with some clay zones*
4 *High plasticity clay with clayey sand lenses*
5 *Silty sand*
6 *Sandy clay*
7 *Silty sand*

The annular space (space between the casing and borehole) above the sand pack was filled with cement grout. These wells have 4-inch-diameter PVC casing. The perforated section* of the casing is wrapped "with a polypropylene filter fabric (U.S. Filters, No. 17085-045-72) to prevent silt and fine sand-size particles from entering the casing". The reported installation sequence was:

- Drill test boring and select zone from which water samples are to be obtained
- Drill second boring to bottom of the targeted monitored zone
- Ream boring to 8-inch diameter, using water (of unknown origin) for drilling fluid
- Install PVC casing with perforations at monitored zone
- Place sand backfill in monitored zone (method of placement not specified)
- Place cement grout up to ground surface (method of placement not specified)
- Develop well by pumping formation water until "reasonably" clear

Screen lengths for this group of wells range from 10 (MW-18) to 26 feet (MW-7) with most being 13 to 20 feet; sand-pack lengths equal screen lengths. The construction of these wells is marginally adequate for an interim status network. Future wells should be constructed with manufactured screens instead of perforated casing, no filter fabric, a bentonite seal above the sand pack, a bentonite/cement or bentonite grout, and an inert casing material.

Wells MW-9, 10, 14, 16 and 17 were installed as production-type wells for dewatering the ground around the landfill excavation in the southern portion of the facility. Records of construction procedures were not found.

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* *Whether the casing was perforated or has a manufactured screen for water entry is not clear in the 1978 Harding-Lawson report, which contains construction details for these wells.*

The wells were all 60 feet deep and had 10-inch diameter steel casing. They were screened and sand-packed throughout the entire depth. They monitored several water bearing zones and were not sealed above the "monitored zone", as required by the TAC [335.192(c)] and were not acceptable interim status monitoring wells as also determined by the TWC.

Wells MW-19 through 25 were installed in November 1981, although they were not included in the monitoring network until March 1985. Records of construction procedures were not found. The wells have 2-inch-diameter PVC casing and screens. These wells are about 100 feet deep with 10-foot screens and have sand-pack lengths ranging from 50 to 73 feet. Consequently, the wells also monitor multiple saturated strata and may be providing undesirable hydraulic connections between them.

These connections are potential conduits for contaminated ground water to reach deeper strata more quickly than through the natural connections. This potential is the reason the TWC required RES to replace these wells. Also, three of the wells (MW-21, 23 and 24) sampled during the Task Force inspection produced very turbid water indicating either improper construction (sand-pack deficiencies) or development.

Monitoring wells 26 through 29 and 34 through 38* were generally constructed in 8 or 9-inch diameter boreholes using a wash-bore drilling method. Whether mud or other additives were used is not reported in the records reviewed. The annular space above the sand pack was filled with 3 to 5 feet of bentonite pellets, then backfilled with cement grout to the surface. These wells were developed using an air-lift device. They have 4-inch PVC casing and 10-slot (0.010-inch) screens and have locking well-head caps. Screen length is 10 feet except for wells 27, 28 and 29 which have 15-foot screens. Sand-pack length ranges from 15 to 20 feet.

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* *Wells MW-30 through 33 were not installed.*

The construction of wells MW-27 through 29 and 34 through 38 is marginally adequate for an interim status monitoring network. Future wells, however, should be constructed with the sand-pack length being about the same as the screen and complete records on well installation need to be kept.

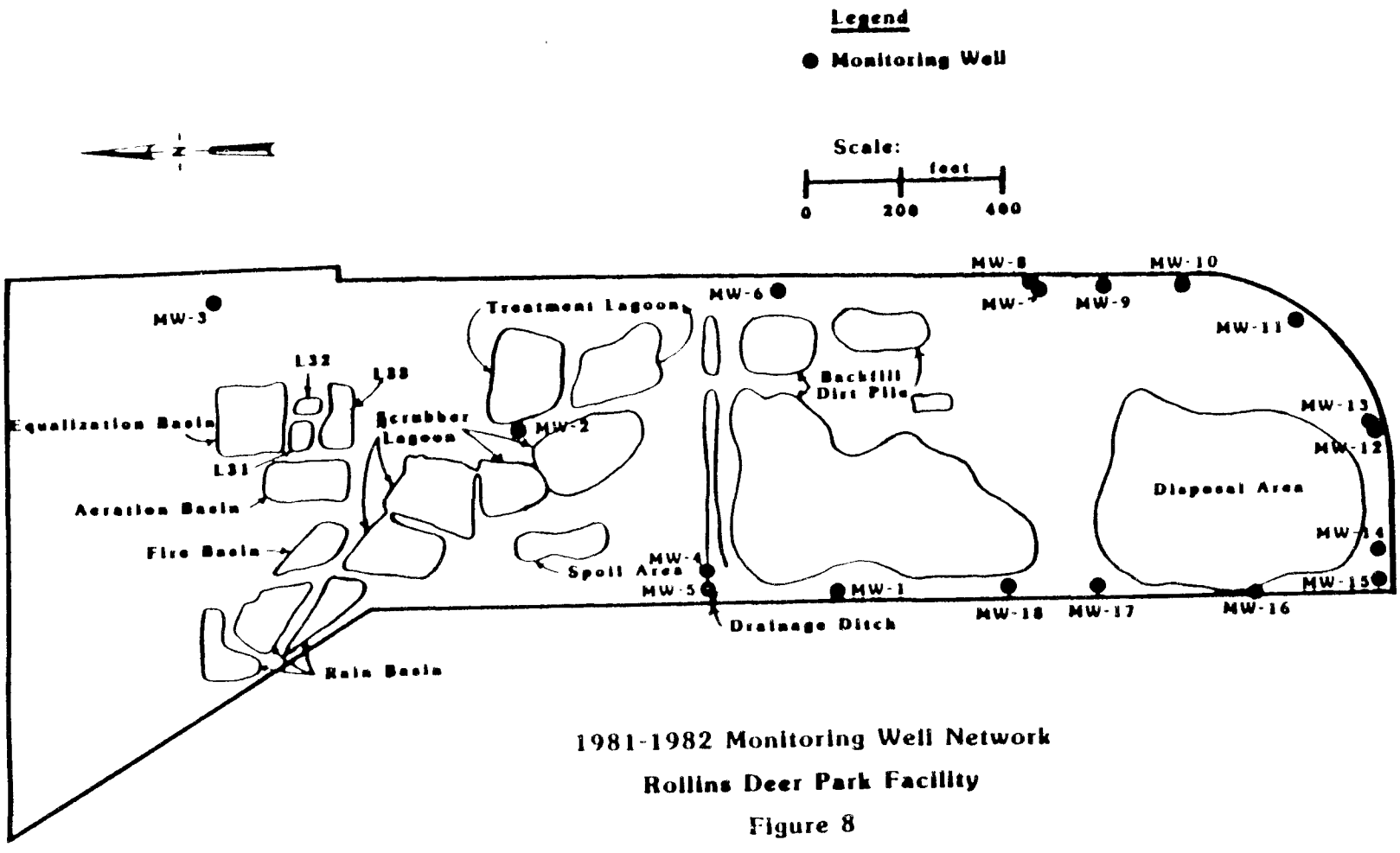
Other construction deficiencies were noted at the existing wells, including cracked aprons and one that had a plastic bottle for a cap (MW-2); the others had locking caps. The concrete aprons are supposed to drain surface water away from the well and prevent it from entering the well bore. Some wells had no discernible apron. Wells MW-3 and 37 were in small depressions and the well head for MW-1 was buried.

Well Locations and Numbers

From November 1981 to approximately mid-1982, the monitoring well network included wells MW-1 through 18 [Figure 8]. During the spring of 1982, wells MW-4, 5, 15 and 18 were abandoned because of drainage improvements at the southwestern corner of the facility. In January 1983, four monitoring wells (MW-26 through 29) were constructed to replace MW-4, 5, 18 and 15, respectively. During the period between spring 1982 and January 1983, the monitoring well network comprised 14 wells instead of 15, as required by the State permit.

On March 30, 1983, TWC notified Rollins that wells MW-9, 10, 14, 16 and 17, which were constructed as dewatering wells, were not acceptable as monitoring wells and needed to be replaced. In May 1983, five wells (MW-34 through 38) were constructed to replace wells MW-17, 16, 14, 10 and 9, respectively. The nine replacements and remaining nine original wells made up the network from May 1983 to March 1985 [Figure 9].

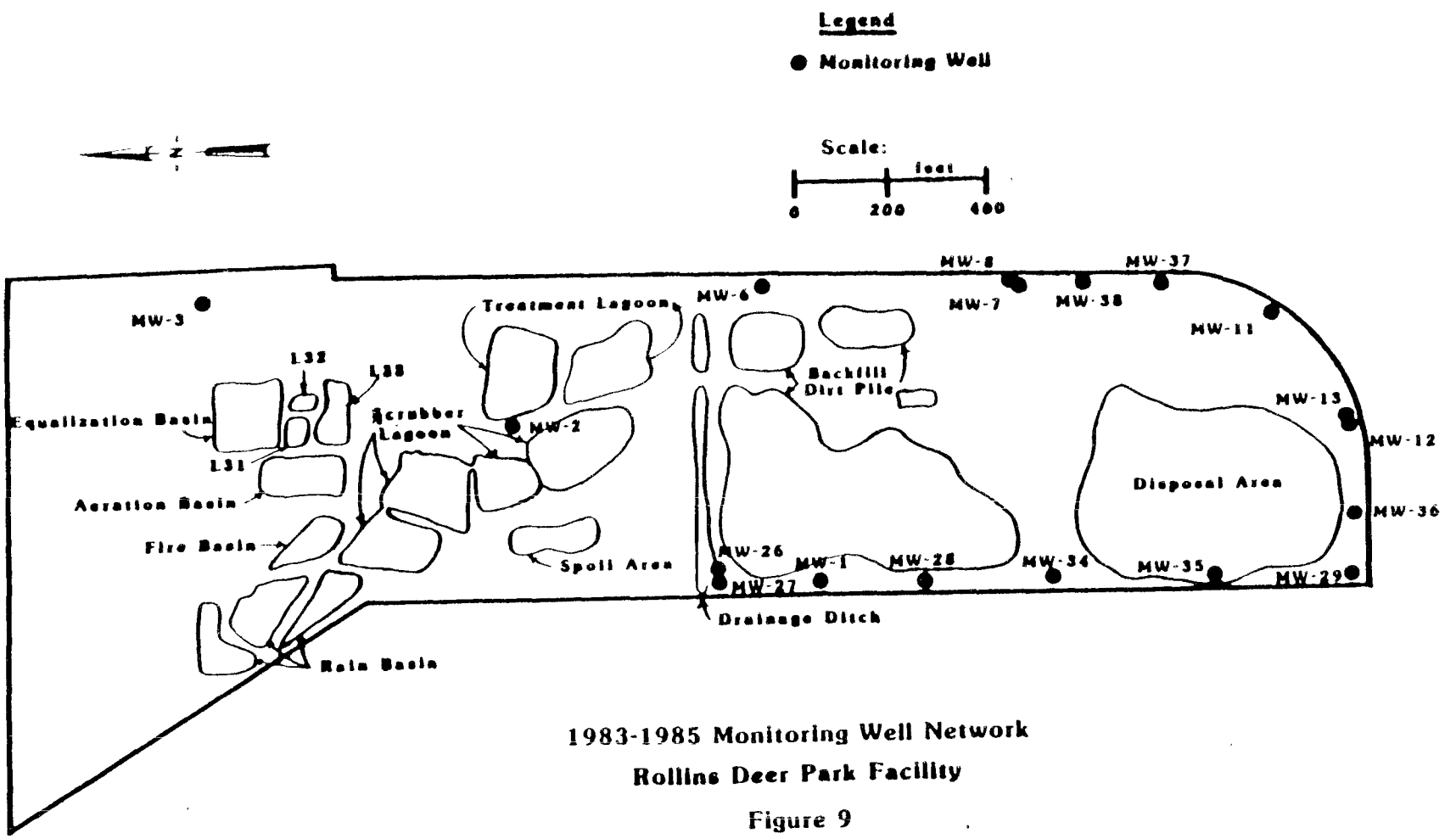
In March 1985, seven monitoring wells (MW-19 through 25), which were constructed in November 1981, were added to the network bringing the total to 25 wells [Figure 10]. However, on September 16, TWC ordered Rollins to abandon these and three other wells (MW-1, 2 and 3).



1981-1982 Monitoring Well Network

Rollins Deer Park Facility

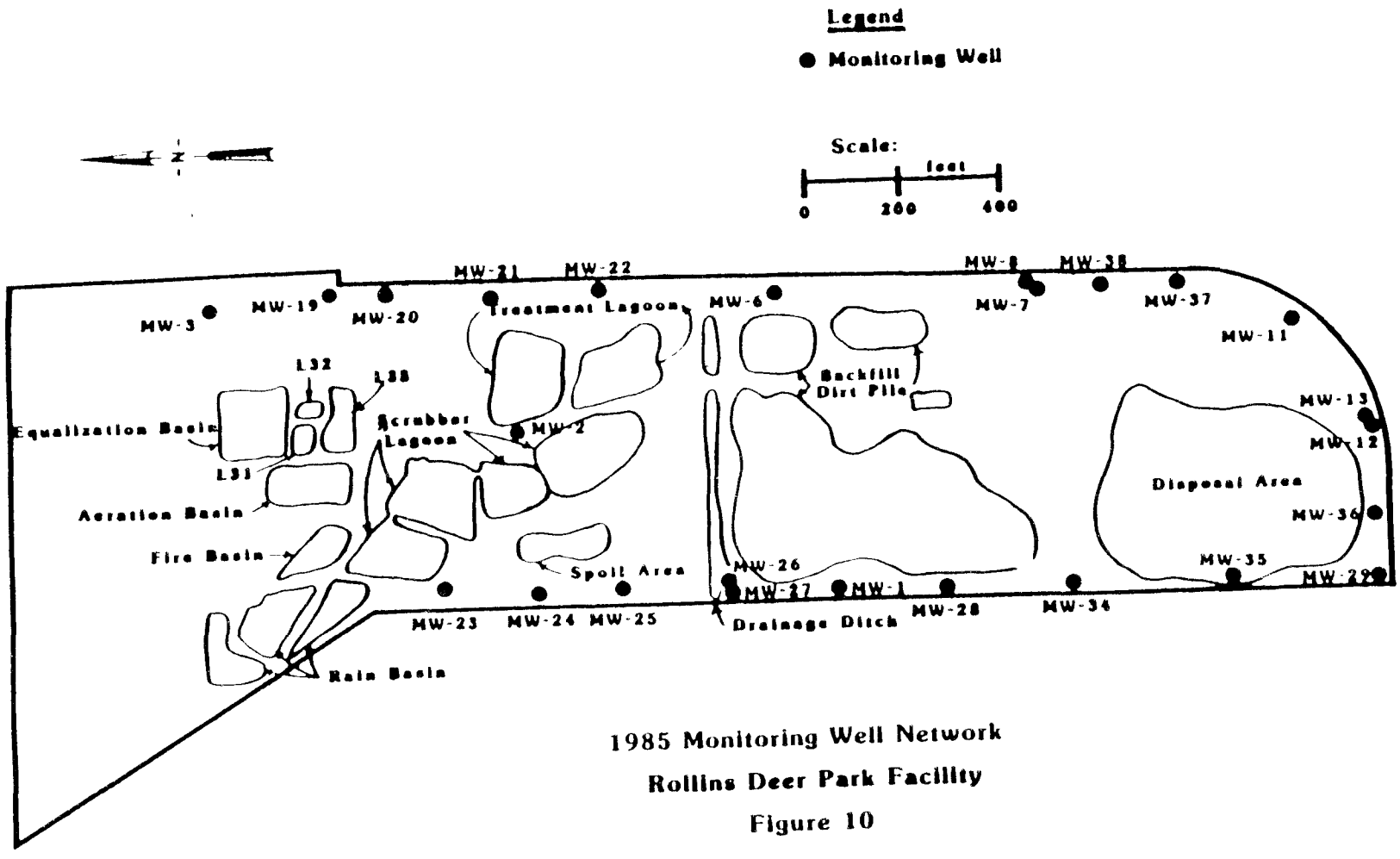
Figure 8



1983-1985 Monitoring Well Network

Rollins Deer Park Facility

Figure 9



1985 Monitoring Well Network

Rollins Deer Park Facility

Figure 10

The number and location of wells in three successive networks are addressed and encompass the following periods:

- November 1981 to November 1982
- May 1983 to March 1985
- March 1985 to September 1985

November 1981 to November 1982 Well Network

According to Texas interim status regulations [335.192(a)(2)], the number and locations (and depths) of monitoring wells downgradient from waste management units must be sufficient to ensure that any statistically significant amounts of hazardous waste or hazardous waste constituents that migrate to the uppermost aquifer are immediately detected. The monitoring well network, used from November 1981 until about November 1982, did not comply with that requirement.

Given the northerly ground-water flow beneath the facility, there are no monitoring wells downgradient from most of the surface impoundments [Figure 8] in the northern part of the facility. The two designated downgradient wells in that area (MW-2 and 3) are inadequately constructed, as previously described.

May 1983 to March 1985 Well Network

Although nine new wells were installed between November 1982 and May 1983 as replacements for those abandoned, the monitoring network used from May 1983 to March 1985 was essentially the same as the previous network. No new wells were installed in the northern part of the facility. The same regulated units had no downgradient monitoring wells; therefore, the network did not comply with TAC requirements.

March to September 1985 Well Network

Seven wells installed in November 1981 (MW-19 through 25) were added to the monitoring well network in March 1985. Many of the downgradient wells are not located close enough to the waste management area nor are there a sufficient number to ensure immediate detection of chemicals migrating from those areas to the uppermost aquifer.

State regulations [335.192(b)] require that downgradient monitoring wells be installed at the limit of the waste management area. Where facilities have multiple waste management components subject to the groun. water monitoring requirements, such as the Deer Park facility, the waste management area is described by an imaginary line which circumscribes several components.

RES considers the site boundary lines as the waste management boundary lines. Under present precepts, the site boundary lines are too far away from the waste management units to constitute the circumscribing line, as described in the regulations. At facilities having only one unit subject to ground-water monitoring requirements, the waste management area is described by the waste boundary. By analogy, the downgradient side of the circumscribing boundary lines at the Deer Park facility should be the waste boundaries (with allowance for containment structures), which is where the wells should be installed.

In the northern portion of the waste management area, the designated downgradient wells include MW-2, 3, 21, 23, 24 and 25.* Of these, only MW-2 is close enough to the adjacent waste management unit (lagoon 1000). Well MW-3 is about 220 feet from the nearest unit (Equalization Basin); MW-21 is about 130 feet from lagoon 1000; MW-24 is about 220 feet from scrubber lagoon F-2, and MW-25 is about 260 feet from the nearest unit (F-1).

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* *Upgradient and downgradient wells were designated in monitoring reports sent to the TWC.*

Although only about 50 feet from scrubber lagoon F-4, MW-23 is upgradient from that unit according to the potentiometric contour map presented in the revised Ground-Water Monitoring Plan, dated April 9, 1985, submitted for the Part B permit application. Further, the number of wells is not sufficient to immediately detect leakage from all or major portions of the following units.

- Equalization Basin (L-31)
- Aeration Basin
- Lagoon 32
- Lagoon 33
- Scrubber Lagoons F-3 and F-4

RES SAMPLE COLLECTION AND HANDLING PROCEDURES

During the inspection, samples were collected from 14 monitoring wells and four leachate collection sumps for analysis by EPA contractor laboratories, as discussed in the section on Investigation Methods. At wells equipped with dedicated pumps, RES personnel made water level measurements, calculated purge volumes and purged the wells using their standard procedures. At several wells, RES personnel collected samples for PCB analyses. The procedures observed were generally acceptable, although some improvements need to be made.

The Corporation has a RCRA compliance training program that was reportedly given at RES Deer Park several months before the inspection; however, the program does not address ground-water monitoring. Sampling personnel receive on-the-job training. The sampling team comprises a coordinator and any of four laboratory technicians. The RES sampling procedures are described and assessed in the following.

Water Level Measurements

At the wellhead, the first step in collecting samples is to measure depth to water using an electric water level indicator (Powers Well Sounder).

The water level indicator consists of a reel with cable and sensor enclosed in a metal box equipped with ammeter and battery power supply in the lid. A two-conductor, extension-cord-type cable connects the ammeter to the sensor. The cord had several spherical lead weights attached to it just above the sensor. When the box lid is opened, a mercury switch closes and the meter is activated. The sensor and cable are pulled from the reel, then lowered into the well.

Wells having dedicated Well Wizard pumps have a wellhead assembly from which the pumps are suspended. The wellhead assembly has an access port through which the water level sensor and cord are lowered. Water levels are measured with reference to the top of the access port. The surveyed reference point at each well is the top of casing; therefore, a correction must be made for the height of the access port above the top of casing. This height was measured and correction was made during the Task Force inspection, but had not been done previously.

The cord, which was marked in sequential 5-foot increments, was lowered into the well until the sensor reached the water, as indicated by deflection of the ammeter needle. The cord was then slowly raised and lowered until the exact point at which the sensor made contact was determined. The cord was then pinched by the sampler adjacent to the access port lip and the distance from the bottom of his fingers to the next higher cord marker was measured with a measuring tape. Depth to water is calculated by subtracting the reading made with the measuring tape from the cord marker value.

Following the measurement, the lower portion of the cord and the sensor are cleaned by the following procedure.

1. Washed in a container with a soap and water solution
2. Rinsed in a container of tap water
3. Sprayed with distilled water
4. Sensor-dryed with a packaged paper towel

Tap water in the rinse container is changed after every two wells.

The depth indicator's cord (with side-by-side conductors) was twisted, which effectively shortened the length, and was probably yielding inaccurate depths to water. The cord needs to be replaced with a coaxial cable to eliminate this problem. Also, the correction factor for the access port elevation should be accurately determined for each well. The wells should be periodically checked for total depth and immiscible fluids. Otherwise, the water level measurement and equipment decontamination procedures are adequate.

Purging

The volume of water in the casing is determined using the depth to water measurement, total well depth and casing diameter. Total well depth data usually came from a table dated August 22, 1985, which presented total casing length and was derived from construction records. When RES personnel forgot to bring the table, they used information from a plastic placard attached to the protective steel frame at each well.

The plastic placard contained the well number, construction date, screened interval, well elevation and well depth below the ground surface. The well depth on the placard does not include the above-ground casing length (usually about 3 feet) as does the August table. When the placard well depth was used, the casing stick-up length was not accounted for by RES personnel.

Once the height of the water column was determined, RES personnel used a graph, where column height had been plotted with volumes for 2 and 4-inch diameter wells, to determine the water column volume. The volume of water in the casing was then used to compute purge volumes by multiplying by three. Purge water was discharged into 55 and 85-gallon drums. The purge volume was calculated using the liquid height in the drums, measured directly in those with open-tops or estimating it in those with closed tops (by tapping or feeling the side) and the drum dimensions.

Drums containing purge water had a sample container label placed on them indicating the source well. The purge water was later disposed of in the onsite wastewater treatment system.

The purging procedures are marginally adequate. They need to be improved through consistent procedures for calculating purge volumes and more accurate methods for measuring the volume purged into closed-top drums.

Sample Collection

Wells sampled by RES personnel during the inspection were equipped with Well Wizard pumps and purge and sampling pumps, as previously described. Electric submersible pumps were removed from wells MW-1, 2 and 3 before the Task Force inspection, as part of abandonment procedures required by the State. A recent study indicates that submersible centrifugal pumps, such as those in the wells at the Deer Park facility, cause sample alteration as a result of a partial vacuum developed by the impellers.[4] Heat produced as a result of friction between the water and the impeller can increase the temperature of water passing through the pump.* During another Task Force inspection, foaming was observed in submersible pump discharges and small bubbles were entrained in the volatile organics sample.[5]

The principal effect is degassing of the samples, which may alter levels of parameters such as volatile organics, total organic halogen, total organic carbon, pH, alkalinity and others. Consequently, previous data for samples collected from these three wells may be biased because of the pumps used.

The 2-inch-diameter wells (MW-19 through 25) were equipped with only sampling pumps; however, these were removed from the wells to be sampled on the first day of the inspection to allow use of the interface probe in these

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* *Average temperature increases of 14% were reported in the cited reference.*

wells. The pumps were not replaced because the wells were also to be abandoned; they were sampled with EPA-supplied pumps.

The purge pumps (Model HR 4500) have stainless steel bodies and PVC plastic assemblies. The sampling pumps (Model T 1200) have stainless steel bodies and Teflon® assemblies. In low yielding wells, the purge pump is located beneath the sampling pump and in high yielding wells, it is above. The pumps were powered by a small portable air compressor driven by a 3-horse-power gasoline engine. The compressor/engine was positioned down or cross-wind during purging and sample colleciton.

Following the purge, the sampling pump is activated and cycled 10 times before samples are collected to clear stagnant water from the pump. The sample containers are placed on ice in an insulated cooler. No preservatives are added to samples and no field measurements are made on them, such as for pH. Sample logs are completed and the samples are taken to the onsite laboratory. Copies of the logs were provided to Task Force personne .

The observed sample collection and documentation procedures were adequate. However, the log of sample collection needs to be modified to include a list of parameters for which samples are collected and whether preservatives were added.

Shipping and Chain-of-Custody

Samples going to the RES contractor laboratory, NUS Corporation in Clear Lake, Texas, were placed in ice chests on ice and transported by car on the day of collection. A chain-of-custody form accompanies each shipment. Copies of the chain-of-custody forms for samples collected during the inspection were provided to Task Force personnel. The shipping and custody procedures are adequate.

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SAMPLE ANALYSIS AND DATA QUALITY EVALUATION

This section provides an evaluation of the quality and completeness of interim status ground-water monitoring data gathered by Rollins between November 1981 and October 1985. Analytical procedures for ground-water samples and data quality were evaluated through laboratory inspections and review of documents containing the required monitoring data. The onsite laboratory and contractor laboratory doing required analyses for Rollins were inspected in October 1985. The evaluations involved reviewing laboratory operating and analytical procedures, internal data reports, raw data and quality control records; interviewing key laboratory personnel; and inspecting laboratory facilities and analytical equipment.

The evaluation revealed that the monitoring of wells existing before November 1981 has, for the most part, followed the permit for sampling frequency and analytical parameters rather than the TAC regulations, which are different. Table 16 compares regulations and permit monitoring requirements to the monitoring actually conducted. The first part of the table lists requirements for quarterly monitoring by RES during the first year with the sampling or reporting dates for three well groupings; the second part provides information on semi-annual monitoring.

No quarterly monitoring, pursuant to the TAC interim status requirements [335.193(c)], has been conducted for the monitoring network wells existing in November 1981. The permit only required quarterly monitoring of new wells (constructed after September 1981). Quarterly monitoring was conducted between May 1983 and April 1984 for new wells incorporated into the monitoring network. In March 1985, quarterly monitoring was initiated for the second group of new wells. Table 16 also indicates when single and quadruplicate measurements are required for upgradient and downgradient wells and what type of measurements were made for the different parameter groupings. Further, the table indicates where data could not be found in the documents examined.

Table 16

COMPARISON OF REQUIRED INTERIM GROUND-WATER MONITORING
TO THAT CONDUCTED BY ROLLINS ENVIRONMENTAL SERVICES
Deer Park, Texas

	TAC and Permit Requirements Up/Down	MW 1-3, 6-8, 11-13 Monitoring Conducted (Up/Down)	MW 26-29, 34-38 Monitoring Conducted (Up/Down)	MW 19-25 Monitoring Conducted (Up/Down)
QUARTERLY MONITORING	First year	None	05/83 to 04/84	03/85 to 07/85
335 193(b)(1)				
Group I[1] Parameters As Pb endrin Ba Hg lindane Cd NO_3 methoxychlor Cr Se 2,4,5-TP silvex F 2,4-D toxaphene	Both sm/sm[2]		05/83 sm/sm 09/83 sm/sm 12/83 sm/sm 04/84 no metals sm/sm others	03/85 sm/sm 07/85 sm/sm
Group II[3] Parameters (5) Ra GA GB Fecal coliform	TAC sm/sm		05/83 sm/sm 09/83 sm/sm 12/83 sm/sm 04/84 no data	03/85 sm/sm 07/85 sm/sm
335.983(b)(2)				
Group III parameters chloride iron manganese phenols sodium sulfate	Both sm/sm		05/83 sm/sm 09/83 sm/sm 12/83 sm/sm 04/84 no data	03/85 sm/sm 07/85 sm/sm
335.193(b)(3)				
Group IV[4] parameters pH Specific conductance TOC TOX	TAC qm/sm[5] Permit sm/sm		05/83 qm/sm 09/83 qm/sm 12/83 qm/qm 04/84 qm/qm	03/85 qm/qm[6] 07/85 qm/qm
Permit Only				
Group V[7] parameters Ca Zn COD Cu bicarbonate PCBs Mg carbonate Ni P-alk T-alk	Permit sm/sm		05/83 no p-alk sm/sm others 09/83 no metals or alkalinity sm/sm others	03/85 sm/sm 07/85 sm/sm
Group VI[8] parameters TON TDS	Permit sm/sm		05/83 no TON sm/sm TDS 09/83 no data 12/83 no data 04/84 no data	03/85 sm/sm 07/85 sm/sm

Table 16 (cont)

	TAC and Permit Requirements Up/Down	MW 1-3, 6-8, 11-13 Monitoring Conducted (Up/Down)	MW 26-29, 34-38 Monitoring Conducted (Up/Down)	MW 19-25 Monitoring Conducted (Up/Down)
SEMI-ANNUAL MONITORING	After first year	11/81 to 07/85	05/84 to 07/85	Not applicable
335 193(b)(2)				
Group III parameters Chloride iron Manganese phenols Sodium sulfate	Permit sm/sm	06/82 sm/sm 12/82 sm/sm 05/83 sm/sm 12/83 sm/sm 06/84 sm/sm 03/85 sm/sm 07/85 sm/sm	03/85 sm/sm 07/85 sm/sm	
335.193(b)(3)				
Group IV parameters pH Specific conductance TOC TOX	TAC qm/qm Permit sm/sm	06/82 sm/sm 12/82 sm/sm 05/83 qm/qm TOX sm/sm others 12/83 qm/qm 06/84 qm/qm 03/85 qm/qm 07/85 qm/qm	03/85 qm/qm 07/85 qm/qm	
Permit Only				
Group VI parameters TON TDS	Permit sm/sm	06/82 no TON sm/sm TDS 12/82 no TON sm/sm TDS 05/83 no TON sm/sm TDS 12/83 no data 06/84 no data 03/85 sm/sm 07/85 sm/sm	03/85 sm/sm 07/85 sm/sm	

1 *Group I parameters are arsenic (As), barium (Ba), cadmium (Cd), chromium (Cr), fluoride (F), lead (Pb), mercury (Hg), nitrate (NO_3), selenium (Se), endrin, lindane, methoxychlor, 2,4,5TP silvex, 2,4-D and toxaphene*

2 *sm/sm indicates a single measurement for a sample for each of the upgradient and downgradient wells.*

3 *Group II parameters are radium (Ra), gross alpha (GA), gross beta (GB) and fecal coliform bacteria.*

4 *Group IV parameters are pH, specific conductance, total organic carbon (TOC) and total organic halide (TOX).*

5 *qm/sm indicates quadruplicate measurements for a sample for each upgradient well and a single measurement for a sample for each downgradient well.*

6 *qm/qm indicates quadruplicate measurements for a sample for each upgradient and downgradient well.*

7 *Group V parameters are calcium (Ca), copper (Cu), magnesium (Mg), nickel (Ni), zinc (Zn), bicarbonate, carbonate, phenolphthalein alkalinity (p-alk), total alkalinity (t-alk), chemical oxygen demand (COD) and polychlorinated biphenyls (PCBs).*

8 *Group VI parameters are total organic nitrogen (TON) and total dissolved solids (TDS).*

Since 1981, ground-water samples have been analyzed at the Rollins onsite laboratory for pH, conductance, TOC, metals, PCBs and other conventional parameters (e.g., chloride, sulfate, phenols, TDS). A Rollins contractor laboratory, NUS Corporation in Clear Lake, Texas, has analyzed samples for TOX, fluoride and organic constituents. At times, NUS has also determined TOC and nitrate.

Much of the reported data are unreliable, biased or inadequate due to sample handling, laboratory or reporting methods. Although present methods are improved over past methods, major inadequacies still exist, as discussed below.

Initial Monitoring Well Network (November 1981 to November 1982)

The TAC [335.193(c)] requires quarterly monitoring for the first (initial) year of all wells to establish background concentrations or values. The quarterly monitoring must include analysis of well samples for the indicators of ground-water contamination, ground-water quality parameters and the drinking water supply parameters. The quarterly monitoring of the upgradient wells must include quadruplicate measurements for the parameters used as indicators of ground-water contamination (pH, specific conductance, TOC and TOX).

After the first year, each well must be sampled at least semi-annually and samples from both upgradient and downgradient wells must be analyzed in quadruplicate for the indicators of ground-water contamination. Annually, each well must be sampled and analyzed for the ground-water quality parameters. The permit, however, requires semi-annual monitoring for these parameters.

The initial year of quarterly monitoring was not conducted. Rollins started semi-annual monitoring with reports produced in May and November 1982. As indicated in Table 17, quadruplicate measurements were not obtained for the indicator parameters and total organic nitrogen was not determined.

The analysis plan indicates that the sample preservation procedures in "Methods for Chemical Analysis of Water and Wastes" (EPA 600/4-79-20) were to be followed. However, Company personnel reported that samples collected for phenol, total organic carbon (TOC), iron, manganese and sodium were not preserved. The phenol samples should have been preserved with phosphoric acid and cupric sulfate. Samples collected for TOC should have been acidified to a pH of less than 2 with sulfuric acid. Samples collected for iron, manganese and sodium analyses were not acidified and were filtered prior to analysis. Because the samples were not preserved after filtration, the results would be expected to be biased low even for dissolved concentrations.

The total organic halogen (TOX) values are probably biased low. The TOX levels are often very large. Literature published by the instrument manufacturer and experience indicate that the instrument used for TOX analysis underestimates concentrations when they exceed about 300 μg/ℓ.

TOC concentrations were determined with a method that was inappropriate for the organic carbon levels present in the samples. The organic carbon was calculated from the difference between total carbon and inorganic carbon concentrations. When the inorganic carbon makes up most of the total carbon, as is the case of samples from Rollins, the analysis variability becomes a significant factor and results in large systematic errors. TOC should have been determined by measuring nonpurgeable organic carbon and purgeable organic carbon. Bias is evident in the data between samplings for a well. Most TOC values for the November 1982 samples are greater than the May 1982 sample values. The bias is substantial. For example, the TOC value for the May 1982 sample for well MW-14 was 1 mg/ℓ while in November a TOC value of 14 mg/ℓ was reported.

The conductance and total dissolved solids (TDS) values often do not correlate. The ratio of TDS to conductance should be similar for a particular well. However, comparison of the ratios for the two semi-annual samplings for many of the wells are discordant. The TDS to conductance ratio for the May sample for well MW-17 was 0.3, while the November sample ratio was 0.8. Little change was observed in conductance and the major ion values between samplings, which indicates that the TDS values are in error.

Second Monitoring Well Network (May 1983 to March 1985)

The second ground-water well system consisted of nine of the wells of the first system and nine new wells. The upgradient wells for this system, as designated in monitoring reports sent to TWC, were MW-11, 12, 29 and 37.* In May 1983, Rollins initiated quarterly monitoring, pursuant to 335.93(c) on only the nine new wells. Quarterly monitoring on wells MW-26 through 29 (installed in January 1983) did not begin within 1 week after installation, as required by the permit. The older nine wells were not part of this quarterly monitoring effort and, as discussed above, no prior quarterly monitoring had been conducted.

The laboratory findings discussed above are also applicable to these data; except as described below, the methods did not change.

TOX values were reported incorrectly in May 1983 for many of the well samples. Concentrations were reported one thousand times higher than found by NUS. For example, NUS found a concentration of 3,025 μg/ℓ TOX for the sample from well MW-7 while it was reported to the State as 3,025 mg/ℓ.

Evaluation of the quadruplicate meausrements for TOX indicate a detection limit of about 50 μg/ℓ; reported concentrations less than this value are unreliable. The quadruplicate values varied widely for a given sample. For example, values ranging from 49 μg/ℓ to 80 μg/ℓ were reported for well MW-12 in May 1983, and a range of 23 μg/ℓ to 100 μg/ℓ was reported for well MW-38 in March 1984.

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* *A ground-water monitoring report submitted to TWC in January 1984 for samples collected on September 15, 1983, indicated that MW-26 was also an upgradient well. However, the report from the contractor laboratory to Rollins indicated that the well was downgradient. A similar ground-water monitoring report containing data for samples collected in August 1985 indicated that the upgradient wells were MW-12, 13, 29 and 36. All other reports designating the upgradient wells list those stated in the above text.*

The TOC quadruplicate measurement variability indicates that values below about 5 mg/ℓ are unreliable. For example, TOC values ranging from 1 mg/ℓ to 6 mg/ℓ were reported for well MW-29 in March 1984. The variation between samplings suggests systematic errors. In December 1983, an average TOC value of 2 mg/ℓ was reported for well MW-12 in June 1984 an average TOC value of 17 mg/ℓ was reported.

As discussed above for iron, manganese and sodium results, samples collected for the eight metals on the TAC drinking water parameter list [Part 335, Appendix II] were filtered before analysis and not acidified, thereby generating data that would be expected to be less than dissolved metals results.

The methods used to determine arsenic and selenium resulted in unreliable data. Arsenic and selenium were determined without digestion by hydride generation atomic absorption spectroscopy. EPA-approved hydride generation methods require digestion. This practice would probably cause results to be biased low even if the samples had been properly preserved.

Flame atomic absorption spectroscopy methods have been used for chromium, lead and cadmium determinations. These methods often do not achieve reliable results near the drinking water limits for these parameters. Normally, detection limits of 100 to 200 μg/ℓ for lead and chromium and 10 to 20 μg/ℓ for cadmium can be reliably achieved by these methods. This is reflected in apparently wide data variations for some of the wells. A chromium concentration of 64 μg/ℓ was reported for well MW-35 in May 1983 while the two subsequent reported values were reported as <10 μg/ℓ. A lead concentration of 140 μg/ℓ was reported for well MW-34 in December 1983, while the two previous reported values were less than 50 μg/ℓ. A lead value of 80 μg/ℓ was reported for three wells (MW-28, 11 and 7) in December 1983. A cadmium value of 10 μg/ℓ was reported for well MW-8 in December 1983 while previous and subsequent reported values were less than 5 μg/ℓ. Furnace atomic absorption spectroscopy methods are more applicable in establishing background concentrations and subsequent monitoring of the wells for these parameters.

Insufficient quality control measures were taken to assure that the pesticide and herbicide results were reliable. Prior to 1984, no blanks were analyzed. Duplicates and matrix spikes have never been analyzed. Further, data was reported with detection limits that were at the drinking water limits when the analysis methods were capable of achieving detection limits at least 10 times lower than those reported.

Third Monitoring Well Network (March to September 1985)

Quarterly monitoring was initiated for seven new wells in March 1985. The first two quarterly monitoring reports (March and July 1985) were reviewed. The laboratory findings discussed above are applicable to these data with one exception. The TOC method changed between the first quarter sampling and the second. Samples are acidified and purged with nitrogen gas prior to determination of organic carbon, which results in the loss of purgeable (volatile) organic carbon. Thus nonpurgeable organic carbon is actually determined, which is not acceptable because total organic carbon results are required.

As discussed above, it was suspected that TOX values were biased low and data obtained in July 1985 demonstrates that a bias does exist. For example, concentrations of 470 μg/ℓ trichloroethene, 100 μg/ℓ chlorobenzene, 26 μg/ℓ 1,1-dichloroethane and 13 μg/ℓ 1,1,2-trichloroethane were reported for a sample from well MW-26. The calculated TOX from these data is 400 μg/ℓ while the measured TOX was 290 μg/ℓ.

Finally, RES has been reporting data for total coliform rather than fecal coliform, as required by State regulations [335.93(b)(1)].

GROUND-WATER QUALITY ASSESSMENT PROGRAM OUTLINE

The TAC [335.193(a)] requires a facility to prepare, before November 19, 1981, an outline of a ground-water quality assessment program. The outline must describe a more comprehensive program than the one for routine interim status monitoring and be capable of determining:

- Whether hazardous waste or hazardous waste constituents have entered the ground water
- The rate and extent of migration of hazardous waste or hazardous waste constituents in the ground water
- The concentrations of hazardous waste or hazardous waste constituents in the ground water

Between November 1981 and November 1982, the facility had no such outline. In response to a deficiency notice from the Texas Water Commission, dated October 18, 1982, RES prepared an outline and sent it to the State on November 9. A revised outline was included in the mid-1985 Ground-Water Sampling and Analysis Plan, previously described. An assessment monitoring program was required by TWC at the Deer Park facility in 1985 based on a data review.

On September 16, 1985, TWC notified RES that monitoring data indicated a "substantial likelihood that hazardous waste or hazardous waste constituents from the facility have entered the uppermost aquifer." As a result, RES was required to submit a Ground-Water Quality Assessment Plan within 15 days. Further, the notification required RES to install replacements for wells 1 through 3 and 19 through 25 with wells consistent with interim status guidelines (constructed to monitor a single zone). TWC and RES personnel were working out details of the assessment program plan and well installation during the Task Force inspection.

The following discussion addresses the initial and the revised assessment program outlines. The assessment program plan is not addressed because it was not completed or implemented until after the Task Force inspection.

Initial Assessment Program Outline

The one-page outline submitted to the TWC in November 1982 [Appendix D, Part 1] was inadequate. It does not address determining whether hazardous waste or constituents have entered the ground water (requirement 1, above). Further, the outline does not address:

- Whether or how data triggering assessment would be evaluated to confirm the apparent contamination
- How the apparent source would be determined
- Whether or how additional hydrogeologic data would be collected
- How the rate and extent of contaminant migration would be determined
- Which aquifer zones would be monitored
- How a monitoring plan would be developed and what the projected sampling frequency would be
- Which analyses would be conducted on ground water, surface water and soil samples to identify contaminants of concern
- Analytical methods to be used on samples
- How the data would be evaluated to determine if more work is required or the facility could return to the indicator evaluation program required by 335.193 and 335.194(b)
- Approximate schedules for sampling, analysis, data evaluation and report preparation

Revised Assessment Program Outline

The revised outline [Appendix D, Part 2], although much improved over the initial outline, requires further revision to include additional details.

The outline specifies that priority pollutant analyses would be conducted on samples from monitoring wells and the suspected source (landfill leachate or surface impoundment liquids). The priority pollutant list is incomplete with respect to hazardous waste or constituents potentially present in ground water at the site. Finding no priority pollutants in ground water samples could not be considered conclusive evidence that no hazardous wastes or constituents were present. A more comprehensive list of analyses or methods is necessary.

The revised outline indicates that samples would be collected to determine if leakage were occuring; however, it suggests that only one set would

be collected. One sample set is not adequate for the required determination; multiple samples are necessary to verify findings and conclusions. The outline needs to specify how a monitoring plan would be developed and what the projected sampling schedule would be. It should also indicate an approximate schedule for data evaluation and report preparation.

GROUND-WATER MONITORING PROGRAM PROPOSED FOR FINAL PERMIT

In August 1984, RES submitted a RCRA Part B permit application to EPA and TWC. Texas determined that the initial application was incomplete and sent comments to the Company on September 24 [Appendix E]. On November 20, a revised Part B was submitted which contained an updated ground-water sampling and analysis plan (monitoring plan). A second revision to the Part B monitoring plan dated April 9, 1985 was also submitted to TWC.

On September 27, TWC sent a letter to RES outlining deficiencies in the revised Part B, including those in the April 9 monitoring plan [Appendix E, Part 2]. Task Force personnel concur with the TWC deficiencies noted in the plan and found others.

The April 9 monitoring plan outlines a detection monitoring program, pursuant to the TAC (335.464), for the uppermost aquifer and describes the proposed monitoring well network and sample collection, analysis and data evaluation procedures.

Because the facility was in assessment during the inspection, the proposed detection monitoring program may not be appropriate. Instead, a compliance monitoring (335.465) and/or a corrective (335.466) action program may be required by the final permit. Based on the State notices of deficiency, the number of wells in the final program will be greater than that indicated in the Part B monitoring program. These issues will be resolved by the State upon completion of the assessment program studies. The following presents a general description of the April 9 plan and other deficiencies in the monitoring well network and sample collection and analysis procedures.

PROPOSED MONITORING WELL NETWORK

The TAC requires ground-water monitoring in the uppermost aquifer beneath the regulated units at the point of compliance* (335.461 and related provisions). The plan inadequately defines the uppermost aquifer by not including hydraulically connected aquifers and ignores shallower water-bearing zones that would yield significant water to monitoring wells. Consequently, the well network proposed for monitoring the "uppermost aquifer" is categorically inadequate because additional water-bearing zones need to be monitored, as indicated in the sections on Site Hydrogeology and Monitoring Data Analysis for Indications of Waste Release.

The monitoring plan defines the uppermost aquifer as the ". . .shallowest continuous water bearing unit across the site. . .." This definition is inconsistent with Texas regulations [335.42(a)], which state that the uppermost aquifer is the "the geologic formation nearest the ground surface that is an aquifer, as well as lower aquifers that are hydraulically connected within the facility's property boundary." An aquifer, according to the TAC, is "a geologic formation or group of formations, or part of a formation capable of yielding a significant amount of ground water to wells or springs."

The point of compliance is not clearly defined in the April 9 proposed monitoring plan. A topographic map showing the location of the point of compliance is supposed to be provided with the application [341.180(4), *et seq.*]. No such map was provided or referenced in the plan. A "definition" is presented on page 11, where it states "The new plan essentially calls for the entire waste management area to be circled by a series of regularly spaced ground-water monitoring wells (i.e., point of compliance)." The inference is that the point of compliance is defined by a line passing

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* *TAC defines the point of compliance as the "vertical surface located at the hydraulically downgradient limit of the waste management area that extends down to the uppermost aquifer underlying the regulated units".*

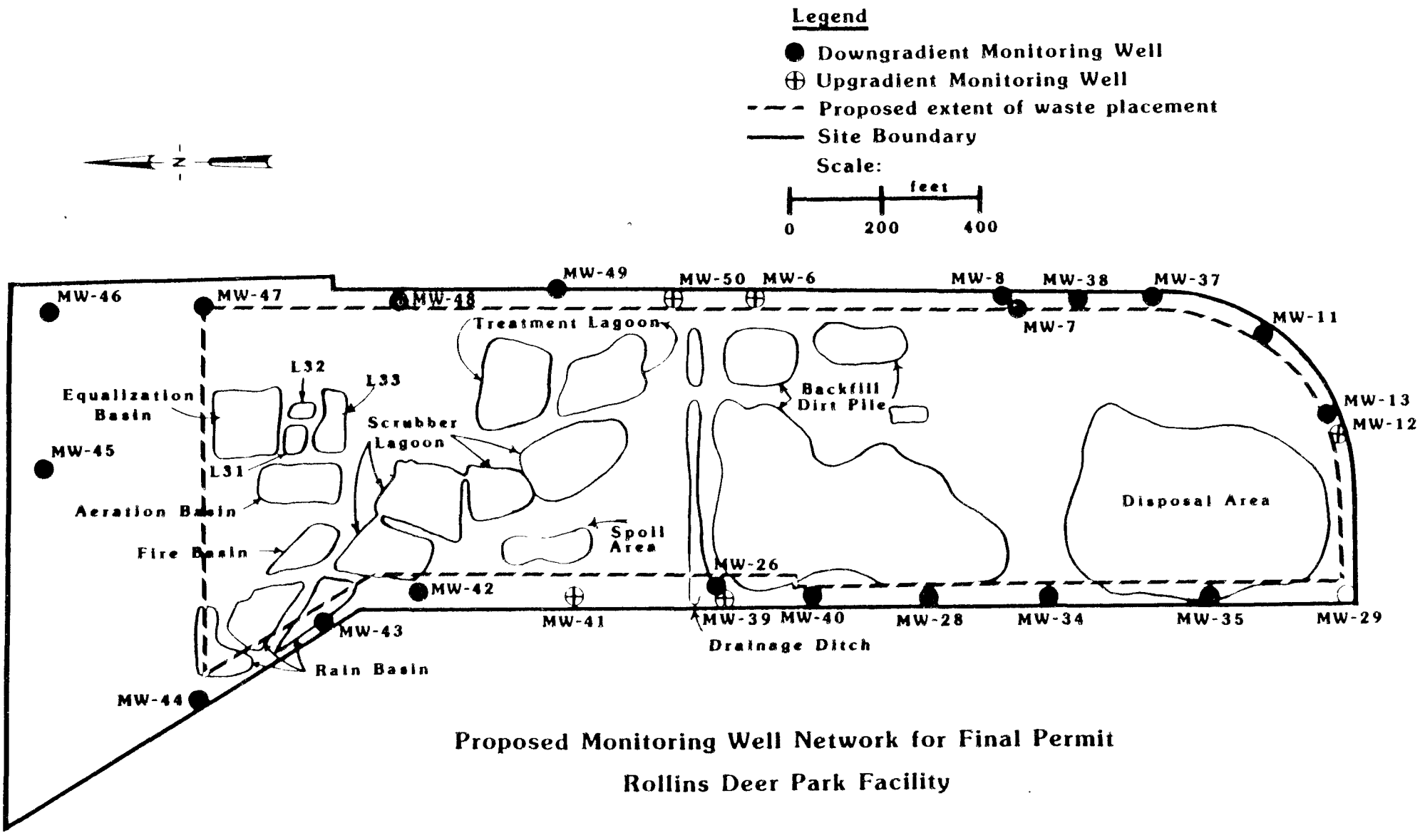
through the locations of proposed monitoring wells [Figure 11], which is essentially the site boundary.

State regulations [335.461] define the point of compliance as a vertical surface located at the hydraulically downgradient limit of the area where waste will be placed during the active life of the regulated unit plus the area occupied by any containment structure. The reason the point of compliance is so far north of the boundary of the proposed landfill is neither apparent nor explained in the plan.

The plan proposes a 25-well network around the waste management area which will ultimately consist of one large landfill. Because of the subsurface hydrology of the site, the well network is subdivided into northern and southern sections, each having a respective set of upgradient and downgradient wells. In the southern section, dewatering of the landfill excavation created a ground-water sink in the southern half of the site, thereby creating a different flow regime than in the unaffected northern half [Figures 6 and 7]. Task Force personnel concur with the sectioning of the waste management area delineations.

The 25-well network will comprise 13 from the existing network and 12 installed as replacements for older ones. The description of abandonment procedures for the wells being replaced is incomplete. More detail is necessary on how the casing and sand pack would be removed. Specifications for the bentonite/grout mixture used to backfill the hole and details of emplacement are necessary in order to evaluate the adequacy of the proposal.

Construction details for the replacement wells are also incomplete. Mud rotary is an acceptable method; however, water should be tried as the initial fluid and mud added only if necessary. Also, the type of mud and any additives used should be specified. The method and rationale for selecting the screen slot and sand pack sizes needs to be stated in the text. Details on how the casing, sand pack and grout will be implaced need to be included. The use of PVC casing is not recommended by the Task Force because of absorption/desorption problems with some hazardous waste constituents.



Proposed Monitoring Well Network for Final Permit

Rollins Deer Park Facility

Figure 11

In the southern section of the waste management area, four upgradient wells, two on the northern side and two on the southern side, and eight downgradient wells are proposed. Three shallow wells from the previous network (MW-7, 13 and 26) are also proposed; however, the plan states that the analytical results will not be subject to the required [335.463(8)] statistical data comparisons. Texas regulations do not provide for such exceptions. Notwithstanding the requirement, the plan does not address use of data from the three wells, only that they will be reported to the State.

In the northern section of the waste management area, 10 monitoring wells are proposed, including two upgradient and eight downgradient. The locations of two of the "downgradient" wells (MW-45 and 46) are clearly inadequate because they are about 300 feet from, instead of at, the point of compliance, as defined in and required by 335.461.

Four of the "downgradient" wells (MW-46 through 49) may not be downgradient from the waste management area. The water-table contour map of the northern area (Figure 4 in the plan) has no reliable data points between the eastern and western boundaries to suggest northeasterly flow toward the four wells. The monitoring plan should use past water level elevation data to indicate whether there are seasonal variations in flow directions and illustrate interpretations on maps.

SAMPLE COLLECTION AND ANALYSIS

The sample collection and analysis portion of the monitoring plan does not comply with Texas requirements (335.463). Procedures and equipment for water level measurements and sample collection are inadequate because they are not defined for the site and analytical procedures are not presented for all required monitoring parameters. For example, the plan states that water level measurements may be made with a fiberglass, plastic or steel tape, an electric water level indicator [page 31], or an airline, electric tape or "popper" [page 44]. No procedures are described for the use of this equipment. Depending on how the devices would be used, some of them

may be acceptable, while others may not. Also, the dedicated Well Wizard equipment, which has been installed in the monitoring wells, is not discussed.

Procedures for water level measurements, sampling and documentation (field logs, tags and chain-of-custody) presented in the interim status ground-water monitoring plan, are site specific revisions to the Part B plan. Although not formally submitted as a Part B revision, procedures in the interim status plan are *de facto* replacements for those in the April 9 plan. These procedures are evaluated in the section on Ground-Water Monitoring Program During Interim Status. A revised Part B monitoring plan is expected after the assessment program is completed.

The specific analytical procedures in the April 9 plan do not include methods for methoxychlor, radium, gross alpha and gross beta, as required by the TAC [335.463(4)(C)].

EVALUATION OF MONITORING DATA FOR INDICATIONS OF WASTE RELEASE

This section presents an analysis of both Task Force and RES monitoring data regarding indications of apparent leakage from the waste management units. Analytical results from and methods used on samples collected by Task Force personnel are presented in Appendix F.

Task Force data indicate the presence of organic compounds in five of the 14 wells sampled [Table 17]. Many of the compounds detected in five of the wells (MW-2, 6, 13, 25 and 26) were also detected in the leachate samples.

Organic compounds were detected in samples from five other wells (MW-3, 8, 12, 15 and 18) by EPA and Rollins during monitoring in 1980 and 1981 [Table 18]. Well MW-3 is adjacent to an old landfill (LF-17) and the other wells are adjacent to the current landfill. Wells MW-8 and 12 are adjacent to wells MW-7 and 13, respectively, in which hazardous waste constituents were detected in Task Force samples.

Elevated barium (Ba) concentrations (663 μg/ℓ for dissolved Ba; 669 μg/ℓ for total Ba) were measured in the Task Force sample from well MW-2. These concentrations were nearly twice the next lower ones measured. Data from previous samples corroborate this finding. A concentration of 600 μg/ℓ for total barium was measured by an EPA contractor laboratory in a sample collected in September 1981.

In a January 20, 1984 monitoring report to the TWC, RES reported 700 μg/ℓ Ba for a sample collected from MW-2 on December 15, 1983, which was higher than any other measurement during the round of sampling of the monitoring wells. However, laboratory records of raw data for these samples indicate that the 700 μg/ℓ value is actually for well MW-2B, rather than well MW-2A for which data is usually reported under the MW-2 designation.*

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* *See section on Monitoring Wells.*

Table 17

ORGANIC COMPOUNDS DETECTED IN TASK FORCE SAMPLES FROM MONITORING WELLS

Compound[1]	Well				
	MW-02	MW-06	MW 13	MW-25	MW-26
1,1,1-Trichloroethane[2]	NC[3]	ND	ND	ND	5.60
1,1,2-Trichloroethane	ND	ND	ND	ND	17.
1,1-Dichloroethene	ND	<5.	ND	ND	20.
Trans-1,2-dichloroethene[2]	ND	<5.	ND	ND	ND
Trichloroethene[2]	ND	<5.	ND	ND	430.
Tetrachloroethene[2]	ND	ND	ND	ND	8.20
Vinyl chloride[2]	120.	<5.	ND	ND	ND
Benzene[2]	ND	ND	ND	<5.	<5.
Chlorobenzene[2]	4000.	<5.	ND	<5.	110.
1,2,4-Trichlorobenzene[2]	ND	ND	ND	<10.	ND
Acrolein[2]	ND	ND	<500.	ND	ND
4-Chloroaniline	36.	ND	ND	ND	ND
2-Chlorophenol	<10.	ND	ND	ND	ND
Benzoic acid[2]	ND	ND	ND	10.	ND

1 *Concentrations are reported in μg/ℓ.*
2 *Compound also detected in leachate samples.*
3 *ND - not detected.*

Table 18

ORGANIC COMPOUNDS PREVIOUSLY DETECTED IN WELL SAMPLES[1]

Well:	MW-2		MW-12	MW-13	MW-18	MW-26
Date:	9/2/81	8/85	9/2/81	9/2/81	9/2/81	7/85
Data Source: RES						
Organic Compounds[2]						
2-Chlorophenol	42					
Chloroform					20	
Dichlorodifluoromethane					17	
Butyl benzyl phthalate			12	37		
Chlorobenzene						100
1,1-Dichloroethylene						26
Phenol			130			
1,1,2-Trichloroethane						13
Trichloroethylene						470
Vinyl chloride		38				

Well:	MW-2		MW-3	MW-8	MW-12	MW-13	MW-15	MW-18
Date:	3/20/80	9/2/81	3/20/80	9/2/81	9/2/81	9/2/81	9/2/81	9/2/81
Data Source: EPA								
Organic Compounds[2]								
2-Chlorophenol	110			X[3]				
Chloroform							X	
Butyl benzyl phthalate				X				
bis(2-Ethylhexyl)phthalate			X	X			13	
Benzene	X	X	X	X		X	X	
Chloroform	X	X	X	X		X	X	
Methylene chloride	X	18	X	23			X	
Toluene	X	X	X	X		53		
Chlorobenzene	15000	X		X	X			
1,1-Dichloroethylene	X							
1,2-Dichloropropane	X							
Tetrachloroethylene	X	X		X				
Heptachlor	X					X		
Phenol					X			
Trichloroethylene				X		X		
Vinyl chloride						X		
Naphthalene					X			X
1,1,1-Trichloroethane				X				
1,1,2,2-Tetrachloroethane				X				
2,4-Dinitrophenol				15	X			
2,4-Dimethylphenol		X		X				
1,2-Dichloroethylene		X						
1,2-Dichloropropane		X		X				
2,4,6-Trichlorophenol					X		X	
2,4-Dichlorophenol				X	X			X
p-Chloro-m-cresol					X			
Hexachlorobenzene				X			X	
Acenaphthene				X			X	
Acenaphthylene				X			X	
2-Chloronaphthalene							X	
4-Chlorophenyl phenyl ether							X	
4-Bromophenyl phenyl ether							X	
Fluorene							X	
Anthracene							X	
Pentachlorophenol				X				

1 *Data base is limited because only a few wells had been sampled for organic compounds before the Task Force inspection.*

2 *All concentrations are in micrograms per liter.*

3 *Present but not quantified (less than 10 μg/ℓ).*

The barium concentration in MW-2A for the December 1983 sampling was 3260 μg/ℓ. This indicates inconsistencies in data reporting procedures and corroborates the elevated Ba concentrations at this location.

RES data indicate high total coliform counts were reported for many of the wells in June 1984. Well MW-7 was reported to have a coliform count of greater than 30,000 per 100 milliters (mℓ); 22,300 per 100 mℓ was reported for well MW-2 and 28,000 per 100 mℓ was reported for well MW-11. Potential sources of these bacteria were not identified.

RES and Task Force data indicate elevated TOX concentrations (i.e., greater than 100 μg/ℓ)* in 14 wells [Table 19] some of which were abandoned in 1982 and 1983. Elevated TOX concentrations indicate the presence of halogenated (containing chlorine, bromine or iodine) organic compounds.[6 7] Their presence is significant because most halogenated organics are suspected of being toxic or carcinogenic and they rarely occur in nature.[8]

The compounds composing the measured TOX were not all identified by the standard methods used on Task Force samples, nor have they been identified by Rollins, whose methods are essentially the same. High concentrations of many halogenated organic compounds are present in leachate samples [Appendix F]. The TOX "indicator" test can detect these compounds at low levels, where the analytical methods used to identify compounds in the leachate and well samples may not be sensitive to them.[7 8 9 10] Special or research-type methods may be required to identify the compounds.

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* *The TOX value of 100 μg/ℓ, used as a benchmark for identifying elevated concentrations, was based on the referenced literature, two data sets and professional judgment. The first data set included RES data presented in Table 20, which contains more than 160 values. The lowest values, which may represent background concentrations, are the 1984 data for the wells monitoring the zone 50 to 70 feet deep. Concentrations generally range from less than 10 to about 50 μg/ℓ. Secondly, literature reviewed contained data for samples collected from 22 water supply wells in the United States. Concentrations range from 5 to 85 μg/ℓ, with an average of 18 μg/ℓ.[7] The value of 100 μg/ℓ is, therefore, considered to be a conservative benchmark concentration.*

Table 19

SUMMARY OF DATA FOR TOTAL ORGANIC HALOGEN (TOX) FROM MONITORING WELL SAMPLES[a]

Sand Pack Depth (ft.)	Well	Data Source: Date:	RES 05/82	11/82	05/83	09/83	12/83	04/84	06/84	03/85	0 /85	EPA 10/85
			Wells Monitoring Multiple Zones									
68-127	1[b]		140	180	47		56		32	375	503	
70-212	2[b]		730	1200	1475		6150		3400	580	568	9860
19-106	3		76	100	12		18		<10	<10	17	6
33-100	19									70	93	
44-102	20									<22	75	
33-106	21									<22	10	15
45-100	22									21	16	
35-99	23									42	<10	16
28-100	24									<22	18	32
52-102	25[b]									<12	15000	3840
			Wells Monitoring "First Continuous Zone" (50-70 ft. depth)									
50-70	6[b]		360	300	285		282		150	310	113	286
55-68	8[b]		4200	1400	1250		640		340	145	110	42
55-70	11		120	170	115		29		53	50	<10	24
45-58	12		110	160	64		12		49	<20	18	6
49-69	27				90	66	50	48	30	45	11	
50-70	28				71	87	44		22	29	50	
54-74	29				110	37	27	24	38	24	<10	
50-65	34				160	75	41	24	45	<10	<10	
50-70	35				110	38	25	21	63	56	<10	19
57-72	36				66	41	20	61	32	40	19	
52-70	37				150	41	25	53	27	36	24	
52-70	38[b]				120	94	22	38	25	578	600	
			Wells Monitoring Shallow Zones and Shallow Single Zone Completions (0-50 ft. depth)									
16-42	7[b]		7600	3300	3025		3500		790	610	200	100
0-60	9[b]		300	850	-							
0-60	10[b]		210	350	-							
15-30	13[b]		220	510	260		150		91	118	170	107
0-60	14[b]		120	180	-							
0-60	16[b]		4300	580	-							
0-60	17[b]		100	180	-							
24-40	26[b]				110	110	120	82	70	145	290	397

a *Concentrations expressed in micrograms per liter (μg/ℓ)*

b *Well has elevated TOX concentrations (i.e., greater than 100 μg/ℓ)*

Well MW-2 was installed to monitor ground water adjacent to L-1000, according to a March 9, 1979 State inspection report. The outward hydraulic gradient would promote leakage (see section on Waste Management Units). Organic compounds have been detected in ground-water samples from this well since at least 1979.* Detection of hazardous waste/constituents in samples from this well, where the depth interval of the sand-pack is 70 to 121 feet, suggests substantial downward migration.

Well MW-25 is adjacent to (and may be downgradient from) the dewatering/disposal impoundments for sludge dredged from F-1 and F-2 (scrubber water impoundments). Drums of hazardous waste may also have been buried in this area.

Other wells having elevated TOX concentrations are (or were) adjacent to the landfill in the southern portion of the facility. Wells monitoring shallow ground water all have elevated TOX concentrations, which suggests (1) widespread contamination of the shallow zones by hazardous waste constituents and (2) monitoring of this zone is necessary under the final permit rather than just the zone at the 50 to 70-foot depth proposed in the Part B submittal. Data from three nests of two wells illustrate these points. TOX concentrations in samples from paired wells MW-7 and 8, 12 and 13 and 26 and 27 are consistently higher in the shallow well (7, 13 and 26, respectively).

Some wells, from which samples have been collected for several years, had significant changes in TOX concentrations. Levels increased in three wells (MW-1, 26 and 38) during 1985 while those in two wells (MW-7 and 8) decreased. The increases suggest the arrival of a "plume", whereas the decreases suggest improving ground-water quality.

Additional work is necessary to identify the specific halogenated organic compounds being detected by the TOX analyses in their sources.

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* *Phenol was detected by RES in a sample collected on January 18, 1979 at a concentration of 80 μg/ℓ.*

Once these compounds are identified, samples from the other wells should be analyzed for them as TOX concentrations of less than 100 μg/ℓ in the RES data may represent analytical error.

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APPENDICES

A PERMIT CONDITIONS FOR HAZARD WASTE MANAGEMENT AND GROUND-WATER MONITORING

B CORRESPONDENCE REGARDING PERMIT CONDITIONS

C GROUND-WATER SAMPLING AND ANALYSIS PLAN IN EFFECT UNTIL MID-1985

D GROUND-WATER QUALITY ASSESSMENT OUTLINES

Part 1 - Outline Dated November 9, 1982
Part 2 - Outline in Revised Sampling and Analysis Plan (Mid-1985)

E NOTICE OF DEFICIENCY LETTER ON REVISED PART B GROUND-WATER SAMPLING AND ANALYSIS PLAN

F ANALYTICAL TECHNIQUES AND RESULTS FOR TASK FORCE SAMPLES

APPENDIX A

PERMIT CONDITIONS FOR HAZARD WASTE MANAGEMENT AND GROUND-WATER MONITORING

(5)

A-1

T 005 = P09 - 302 = 006

PERMIT NO. 01429
(Corresponds to
NPDES PERMIT NO. TX 0005941)

This permit supersedes and replaces Permit No. 01429 approved April 9, 1979

TEXAS WATER COMMISSION
Stephen F. Austin State Office Building
Austin, Texas

PERMIT TO DISPOSE OF WASTES
under provisions of Chapter 26
of the Texas Water Code
& Article 4477-7, Texas Revised Civil Statutes

Rollins Environmental Services (TX), Incorporated

whose mailing address is
P. O. Box 609
Deer Park, Texas 77536

is authorized to dispose of wastes from its industrial waste disposal facilities

located south of Tidal Road, west of State Highway 134 and east of and adjacent to Tucker Bayou in Deer Park, Harris County, Texas

to Tucker Bayou; thence to the Houston Ship Channel, Segment No. 1006 of the San Jacinto River Basin

RECEIVED
SEP 24 1981
TDWR

in accordance with effluent limitations, monitoring requirements and other conditions set forth herein. This permit is granted subject to the rules of the Department, the laws of the State of Texas, and other orders of the Commission.

This permit and the authorizations contained herein shall expire at midnight, five years after the date of Commission approval.

APPROVED, ISSUED, AND EFFECTIVE this 3rd day of September, 19 81.

expires 9-3-86

ATTEST: Mary Ann Hefner

For the Commission

PART III

OTHER REQUIREMENTS

The following additional limitations apply to outfall No. 001:

Volume: The 30-day average shall not exeed 975,000 gallons per day.

The daily maximum shall not exceed 2,000,000 gallons per day.

Table 1

Pollutants	Grab Samples Column 1	Grab Samples Column 2
Biochemical Oxygen Demand (5-day), mg/l	45	90
Total Suspended Solids, mg/l	45	90
Total Organic Carbon, mg/l	75	140
Oil and Grease, mg/l	15	30
Phenolics, mg/l	0.1	0.3
Temperature, °F	N/A	100

1. Storm runoff that has been segregated from the main waste treatment system and discharged at points other than outfall Nos. 001 and 002 shall not exceed a concentration of 55 mg/l total Organic Carbon (TOC) and 15 mg/l oil and grease when discharged.

2. The permittee shall utilize incineration, chemical and biological facilities to dispose of materials amenable to these disposal processes. Residues from these processes and those materials not amenable to the above processes may be disposed of by landfill as authorized herein.

3. Solid Waste Management Authorization:

   a. Permittee is authorized to store, process, and dispose of Class I, II, and III industrial solids wastes in accordance with the terms and provisions of this permit. This authorization includes disposal of materials by use of incineration, chemical, biological treatment and landfill facilities.

   b. Permitted facilities are limited to:

      1. tank farm(s) of 51,100 square feet and total waste storage capacity, within the tank farm(s), not to exceed 2,540,000 gallons.

PART III

OTHER REQUIREMENTS

2. one containerized waste storage area of 16,000 square feet and, within the drum storage area, a total volume of wastes not to exceed 231,000 gallons (equivalent to 4,200 drums (55 gallons).

3. waste water treatment tankage and surface impoundments of not greater than 12,500,000 gallons total capacity.

4. secure class I landfill capacity not greater than 730,000 cubic yards and a maximum active landfill area not to exceed 20,000 square yards at the base of the dike.

5. two mixing pits not to exceed a volume of 3,000 cubic yards each.

c. All facilities shall be designed, constructed, maintained, and operated to be compliant with the terms of this permit, the TDWR rules, and in accordance with plans and specifications, except as modified by the permit, submitted in support of the applications for Permit No. 01429. Modifications to plans and specifications following permit approval must conform to the standards established by this permit and TDWR Rules, and be approved in writing by the Executive Director prior to construction and operation.

d. Rainfall runoff segregated from active disposal areas is subject to discharge limitations of this permit.

4. Solid Waste Disposal Facilities; Design and Construction Criteria:

a. All bottoms and sides of landfill cells, mixing pits and liquid impoundment facilities shall serve as barriers to waste and leachate movement. As a minimum, barriers shall meet the following:

1) In-place soil liner thickness $\geq$ 4 feet, scarified to a minimum depth of six (6) inches and recompacted; or

2) Constructed soil liner thickness $\geq$ 3 feet, recompacted in lifts not less than six (6) inches nor greater than nine (9) inches, and scarified to a minimum depth of two (2) inches prior to placement of the following lift.

3) All compaction to 95% Standard Proctor density at or slightly above optimum moisture content.

b. Clay-rich materials serving as barriers to waste and leachate movement shall exhibit the following minimum specifications:

1) Coefficient of permeability $\leq 1 \times 10^{-7}$ cm/sec.

2) Plasticity index $\geq$ 15.

PART III

OTHER REQUIREMENTS

3) Liquid limit $\geq$ 30.

4) Percent passing no. 200 sieve $\geq$ 30.

c. Inundation of and discharges from active storage, process and disposal areas shall be prevented. As a minimum, surface water control facilities shall be constructed of clay-rich material to a level two (2) feet above grade level, the historical high hurricane storm-surge tide, or one hundred (100) year flood level, whichever is the greater elevation, measured nearest the facility boundary.

d. Landfill facilities shall be designed and constructed to intercept, collect, and remove on a permanent basis all waste, leachate, and other liquids, prior to their penetration of protective barriers.

e. All waste deposited above-grade shall be confined by permanent barriers to provide protection at least equivalent to a perimeter dike constructed of clay-rich soil, described in Provision 4.b., with an exterior slope of 4:1 (horizontal:vertical), 2:1 interior slope, eight (8) foot minimum crest width, and erosion protection including a vegetative cover, and concrete lined flumes which direct runoff from the cap to natural grade elevation.

f. Landfill facilities shall be designed and constructed to provide, on a permanent basis, monitoring of area ground water quality horizontally adjacent to and vertically beneath the disposal area. Depth of required monitoring shall not exceed fifty (50) feet below the deepest excavation, nor be less than twenty (20) feet below natural grade level.

g. Permittee shall maintain a minimum of fifteen (15) monitor wells distributed about the perimeter and along a North-South center line through the disposal area. Distances between monitor wells shall not exceed five hundred (500) feet. The Executive Director may require additional monitoring devices for subsequent landfill excavations.

5. Operation and Management of Solid Waste Disposal Facilities:

a. Semi-solid and free liquid containing waste materials shall be mixed with clay-rich soils, flue dust from cement kilns, or other sorbent approved by the Executive Director prior to their placement in landfill(s). Direct landfill of such wastes unmixed, or containers of such wastes, is prohibited.

PART III

OTHER REQUIREMENTS

b. Waste materials shall not be deposited in landfill(s) containing free-standing liquids. Free-standing liquids shall be removed to surface retention facilities prior to deposition of additional waste materials. Liquid wastes may be disposed of:

1) When mixed with a binder such as soil or other sorbent in accordance with Provision 5.a. above,

2) by incineration, and

3) at a disposal facility authorized to receive such materials.

c. Waste materials which have not been mixed with sorbent materials shall be covered daily.

d. Waste materials shall be compacted in lifts not greater than six (6) feet.

e. Solid wastes for which disposal requirements are established by the federal government pursuent to the Toxic Substances Control Act due to polychlorinated biphenol (PCB) content when landfilled shall be segregated and landfilled seperately from other wastes. Such landfill operations shall be in compliance with applicable federal requirements.

f. leachate collection systems in open landfill(s) shall be inspected at least weekly. The opeator shall maintain a log of the inspections and the data shall be available for review.

g. Accumulated liquid shall be removed before one-half of the leachate collection reservoir capacity is reached.

h. A minimum two (2) foot freeboard shall be maintained at all times in open liquid retention facilities.

i. Monitoring:

1) New ground water monitor wells shall be sampled within one week of well completion and quarterly for one year in an attempt to obtain ground water for analysis. Samples shall be analyzed for iron, calcium, magnesium, sodium, carbonate, phenols, bicarbonate, sulfate, chloride, fluoride, nitrate, pH, total dissolved solids, phenolpthalein alkalinity as $CaCO_3$, total alkalinity as $CaCO_3$, specific conductance (micromhos/cm at 25°C), chemical oxygen demand, total organic carbon, total organic nitrogen, arsenic, barium, cadmium, chromium, copper, lead, manganese, mercury, nickel, selenium, silver, zinc, endrin, lindane, methoxychlor, toxaphene, 2,4-D, 2,4,5-TP, total organic halogens and polychlorinated biphenyls (PCB's).

PART III

OTHER REQUIREMENTS

2) Permittee shall notify the local Texas Department of Water Resources district office a minimum of one (1) week in advance, of the date and time of any initial sampling of ground water monitor wells.

3) Following sampling required by Provision 5.i.l., permittee shall sample monitor wells semi-annually. Samples required by this provision shall be analyzed for specific conductance, pH, total organic carbon, total organic nitrogen, chloride, iron, manganese, phenols, sodium, sulfate, total organic halogen, and total dissolved solids.

4) All results of sampling and analyses shall be submitted to the Department not later than sixty (60) days following the respective sampling.

j. Wastes shall be evaluated for non-compatible characteristics utilizing chemical analysis or other means as necessary. Non-compatible wastes shall include those wastes which when mixed in the disposal operation would produce a material, such as gas or liquid, that is more toxic than the material prior to mixing. Permittee shall maintain records demonstrating compliance with this provision. These records shall be available for review.

k. Non-compatible wastes shall be segregated in storage and disposal operations. A minimum of four (4) feet of clay-rich materials as described in Provision 4.b. shall be placed between deposited non-compatible wastes.

l. The permittee shall maintain records of landfilling operations consisting of the location, date, and quantity of each waste deposited. Records of leachate collection system inspections and leachate removal shall be maintained and made available for review.

m. Emissions from this facility must not cause or contribute to a condition of "air pollution" as defined in Section 1.03 of the Texas Clean air Act or violate Section 4.01 of the Texas Clean Air Act, Article 4477-5, V.A.T.S. If the Executive Director of the Texas Air Control Board determines that such a condition or violation occurs, the holder shall implement additional abatement measures as necessary to control or prevent the condition or violation.

n. All dikes, ditches, tanks, and other structures and equipment shall be maintained in good functional condition.

PART III

OTHER REQUIREMENTS

6. Closure of Solid Waste Management Facilities:

a. Permittee shall secure and maintain in force at all times a bond or other financial assurance acceptable to the Executive Director in an amount of $1,946,000 that will provide for proper and adequate closure of the site at any time as outlined in Provisions 6.b. and 6.c. The bond amount or other financial assurance required shall be subject to review, alteration and approval by the Executive Director so as to assure adequate and proper closure. This permit does not become effective until the permittee obtains a bond or other financial assurance acceptable to the Executive Director in the amount above.

b. Permittee shall close areas of the site where wastes materials have been landfilled to forty-four (44) feet above mean sea level or six (6) feet below the top of the perimeter dike, which ever is the lower elevation. Such closure at a minimum shall be in accordance with Provision 6.d.4., 5. and 6.

c. Site closure shall commence:

1) Upon direction of the Texas Water Commission for violations of the permit or Department Rules,

2) Upon abandonment of the site, or

3) Upon direction of the Executive Director for failure to secure and maintain an adequate bond or other financial assurance as outlined in Provision 6.a.

d. Site Closure shall include the following minimum actions:

1) Removal of all wastes from storage and mixing areas authorized by Provision 3.b. to open landfill excavation, or off-site to a facility authorized to receive such wastes.

2) Completion of the perimeter dike surrounding all wastes deposited above natural grade in the landfill area.

3) Filling the diked landfill area with soil or Class III waste to an elevation of forty-four (44) feet above mean sea level or six (6) feet below the top of the perimeter dike, whichever is the lower elevation.

4) Placement of a minimum four (4) foot clay-rich soil cover over all areas where wastes have been deposited and grading of this cover to a crown with a slope of 2%. Cover shall meet the specifications described in Provisions 4.a. and 4.b.

PART III

OTHER REQUIREMENTS

5) Placement of a minimum of twelve (12) inches of uncompacted soil cover over the constructed cover.

6) Establishment and maintenance of a grass cover on the uncompacted soil layer and perimeter dike.

7) Installation of rainfall runoff control structures in accordance with the Provision 4.d.

8) Decontamination of all waste storage and processing facilities.

e. Closure shall be completed within ninety (90) days following commencement of closure.

f. Permittee shall notify the local Texas Department of Water Resources district office for purposes of a closing inspection, of the date final closure of any portion of the site commences.

g. Until permit cancellation, permittee shall continue to sample all ground water monitoring devices according to the following schedule:

1) quarterly for a full year following final closure.

2) every six (6) months thereafter.

3) Samples shall be analyzed for parameters cited in Provision 5.i.3., and the results shall be reported as cited in Provision 5.i.4. above.

h. Leachate collection systems in closed landfill(s) shall be inspected at least monthly for one (1) year following closure, and thence quarterly until permit cancellation. The records shall be maintained for review as cited in Provision 5.f. above.

i. Permittee shall maintain on-site a stockpile of excavated clay-rich soil as described in Provision 4.b. which is equivalent to not less than 178,000 cubic yards when compacted as required by Provision 4.a.3.

J. Permittee shall maintain on-site a stockpile of excavated topsoil of not less than 7,100 cubic yards.

DEFINITIONS

All definitions contained in Section 26.001 of the Texas Water Code and Paragraph 502 of the Act shall apply to this permit and are incorporated therein by reference. Additional definitions of words or phrases used in this permit are as follows:

1. The term "Act" means the Federal Water Pollution Control Act, as amended, Public Law 92-500 (33 USC 1251 et seq).

2. The term "Environmental Protection Agency" means the U. S. Environmental Protection Agency.

3. The term "Administrator" means the Administrator of the U. S. Environmental Protection Agency.

4. The term "Regional Administrator" means one of the Regional Administrators of the U. S. Environmental Protection Agency.

5. The term "National Pollutant Discharge Elimination System" (hereinafter referred to as "NPDES") means the system for issuing, conditioning, and denying permits for the discharge of pollutants from the point sources into the navigable waters, the contiguous zone, and the oceans, by the Administrator of the Environmental Protection Agency pursuant to section 402 of the Federal Water Pollution Control Act, as amended.

6. The term "applicable effluent standards and limitations" means all State and Federal effluent standards and limitations to which a discharge is subject under the Act, including, but not limited to, effluent limitations, standards of performance, toxic effluent standards and prohibitions, and pretreatment standards.

7. The term "applicable water quality standards" means all water quality standards to which a discharge is subject under the Act and which have been (a) approved or permitted to remain in effect by the Administrator following submission to him pursuant to Section 303(a) of the Act, or (b) promulgated by the Administrator pursuant to section 303(b) or203(c) of the Act.

8. The term "sewage" means human body wastes and the wastes from toilets and other receptacles intended to receive or retain body wastes.

9. The term "sewage sludge" shall mean the solids and precipitates separated from wastewater by unit processes.

10. The term "treatment works" means any devices and systems used in the storage, treatment, recycling, and reclamation of municipal sewage or industrial wastes of a liquid nature to implement section 201 of the Act, or necessary to recycle or reuse water at the most economical cost over the estimated life of the works, including intercepting sewers, sewage collection systems, pumping, power, and other equipment, and their appurtenances; extension, improvement, remodeling, additions, and alterations thereof; elements essential to provide a reliable recycled supply such as standby treatment units and clear well facilities; and any works, including site acquisition of the land that will be an integral part of the treatment process or is used for ultimate disposal of residues resulting from such treatment.

11. The term "grab sample" means an individual sample collected in less than 15 minutes.

12. The term "uncontaminated water" means water which has no direct contact with any product or raw material and which does not contain a level of constituents detectably higher than that of the intake water.

13. The term "permitting authority" means the State water quality control agency or the Environmental Protection Agency, who physically issu the permit.

14. Items stamped N.P.D.E.S. REQUIREMENTS ONLY do not apply to this permit and are retained in this permit to preserve the form and numbering system of a National Pollutant Discharge Elimination System permit. The items stamped N.P.D.E.S. REQUIREMENTS ONLY in this permit were secured from a standard U.S. Environmental Protection Agency permit format existent in February, 1974, and they may or may not be identical to the requirements or conditions of the actual N.P.D.E.S. permit applicable to the facility covered by this permit. It is necessary to examine the issued N.P.D.E.S. permit authorizing discharge to determine the actual N.P.D.E.S. requirements.

15. The term "active landfill area" means that area within the landfill which has not been closed in accordance with Provision III.6.b.

APPENDIX B

CORRESPONDENCE REGARDING PERMIT CONDITIONS

Rollins Environmental Services (TX) Inc.
P O Box 609, Deer Park, Texas 77536 (713) 479-6001

B-1

Rec'd 5/5/86

Rollins

December 3, 1981

Mr. Allen Messanger, Permits Section
Texas Dept. of Water Resources
Stephen F. Austin Bldg.
P.O. Box 13087
Capitol Station
Austin, Texas 78711

DEC 21 1981

Dear Allen:

I want to follow up our phone conversation last week with this formal letter so that you can give me a written response to these questions for our TDWR Permit File.

My question(s) center around the sampling of ground water monitoring wells here at our present Deer Park Landfill Facility. Referring to Part III, sheet E of A thru H, provision 5, i, 1-4, new monitoring wells shall be sampled quarterly for one year and thence semi-annually; old (presently existing) monitoring wells shall be sampled semi-annually as we have already sampled these wells monthly and quarterly since 1979. Have I interpreted these provisions correctly? Please advise.

Also, regarding provision 5g on sheet H of A thru H in Part III of our present permit, at that point in time we would be sampling our monitoring wells semi-annually (every 6 months). Why would there be the need to revert back to a quarterly sampling frequency for only one year then back to a semi-annual schedule thereafter? Please respond once again and advise accordingly.

Thanks for your time regarding this matter. I await your written reply to these concerns.

Sincerely Yours,
Rollins Environmental Services (Tx.), Inc.

David C. Stang

David C. Stang
Project Manager

DCS/dr

cc/ Jerry D. Neel, Rollins
Donald C. Matter, Rollins
Michael Khatri, Rollins
Carl Brassaw, Law Engineering

B-2

TEXAS DEPARTMENT OF WATER RESOURCES
1700 N. Congress Avenue
Austin, Texas

TEXAS WATER DEVELOPMENT BOARD
Louis A. Beecherl, Jr., Chairman
John H. Garrett, Vice Chairman
George W. McCleskey
Glen E. Roney
W. O. Bankston
Lonnie A. "Bo" Pilgrim

Harvey Davis
Executive Director

TEXAS WATER COMMISSION
Felix McDonald, Chairman
Dorsey B. Hardeman
Lee B. M. Biggart

December 10, 1981

Mr. David C. Stang
Project Manager
Rollins Environmental Services (Tx.), Inc.
P.O. Box 609
Deer Park, Texas 77536

Dear Mr. Stang:

RE: Commercial Solid Waste Management Facility
Permit No. 01429
Harris County

The following is clarification of ground water monitoring requirements contained in your current TDWR Permit Number 01429, as you requested in your December 3, 1981 letter.

Provision 5i of Part III of the permit requires that new ground water monitoring wells shall be sampled quarterly for the first year of their operation, and semiannually thereafter for the active life of the facility. Presently existing ground water monitoring wells which were completed and sampled during their first year in accordance with provisions of your TDWR permit prior to 1981 amendment shall be sampled semiannually while the facility is active, under terms of the current permit.

When the facility closes, Part III, Provision 6g, of your permit requires that ground water monitoring wells must be sampled quarterly for one full year following closure and then semiannually until permit cancellation. The post-closure sampling frequency was not amended in 1981 and remains valid regardless of sampling frequency before closure.

Should you have any further questions regarding the terms of your permit, please contact me at AC 512/475-2041.

Sincerely,

Allen Messenger

Allen Messenger, Head
Disposal Facilities Unit
Solid Waste Section

RLA:wls

cc: TDWR District 7 Office - Deer Park

APPENDIX C

GROUND-WATER SAMPLING AND ANALYSIS PLAN IN EFFECT UNTIL MID-1985

Rollins Environmental Services (TX) Inc.
P O Box 609 Deer Park Texas 77536 (713) 479 6001

Rollins

SAMPLING AND ANALYSIS PLAN FOR MONITORING WELLS AT RES (TX) INC.

PURPOSE:

Demonstrate the facility's landfill has a low potential for the migration of hazardous waste constituents from the site. Furthermore, early detection system for any contamination that may possibly propagate from the landfill.

I. PROCEDURES:

1. WELL PURGING:

All wells should be pumped and sampled at the least - once a month. Analysis should include pH, TOC and conductivity. Any adverse results should be noted and further analysis determined.

2. SAMPLE COLLECTION ACCORDING TO PERMIT REQUIREMENT:

All wells currently semi-annual sampling and analysis according to the TDWR Permit 01429. Samples are collected from each well by an air eductor pump. A 2-3 gal sample must be taken.

Harris County and TDWR officials should be invited to attend 8-10 days prior to the sampling date. Samples can be collected in clean 1-gal plastic jars. The depth to the water level should be recorded for each water. (This is not necessary for reporting requirements). If samples are collected for PCB and pesticides, the sampler should use a Hexane rinsed glass bottle.

3. CHAIN OF CUSTODY

The Technician who samples the wells will be responsible for labeling each sample container and initiating the "Chain of Custody" form. No seal is required since the sampler and analyst are usually the same person.

The information required on the container label should read as follows:

WELL NO.:

DATE:

SAMPLER'S INITIALS:

The Chain of Custody log must contain the following information:

WELL NO.:

DATE: TIME:

SIGNATURE OF SAMPLER:

SIGNATURE(S) OF PERSONS(S) INCLUDED IN THE CHAIN OF POSSESSION:

INCLUSIVE DATES OF POSSESSION:

All samples sent to an "out-side" lab must have the above "Chain of'Custody" with a return request for our records.

For in-house analysis the analytical report form (for Lab use only) will serve both as Chain of Custody log and final data report.

4. PRESERVATION:

Normally the analysis is completed for volatile and unstable species on the same day as sampling. In the event that any of the samples must be stored, refer to the "Sample Preservation" section in "Methods for Chemical Analysis of Water and Wastes". EPA600/4-79-020.

5. ANALYTICAL METHODS:

All analyses are to be performed using methods stated in procedure manual according to "Methods for Chemical Analysis of Water". EPA-600/4-79-020. Any questions regarding procedures should be directed to the Laboratory Supervisor or Technical Manager.

II. REPORTS:

Semi-annual and annual reports (use forms-TDWR-0910 and 0150) should be sent to Texas Department fo Water Resources* at the address listed on the forms. Copies of the above reports should be filed in appropriate file (in archives storage). An additional copy should be sent to the locar TDWR Director* in Deer Park. (Check with Technical Secretary for Names of these individuals).

APPENDIX D

GROUND-WATER QUALITY ASSESSMENT OUTLINES

Part 1 - Outline Dated November 9, 1982
Part 2 - Outline in Revised Sampling and Analysis Plan (Mid-1985)

APPENDIX D

GROUND-WATER QUALITY ASSESSMENT OUTLINES

Part I - Outline Dated November 9, 1982

Rollins Environmental Services (TX) Inc.

D-1

original sent to Gary Speed of Operations

Rollins Permit # 01429

MJC _____

TWK _____

CEJ _____

November 9, 1982

Mr. Merton J. Coloton
Supervisor, District 7
Texas Department of Water Resources
4301 Center Street
Deer Park, Texas 77536

Dear Mr. Coloton:

In response to your letter dated October 18, 1982, Rollins Environmental Services (TX) Inc. has taken the following actions:

1) As an attachment to this letter is the Groundwater Assessment Outline as specified by the Texas Administration Code 335.194. It is our understanding that a Groundwater Quality Assessment Plan is not required, but an outline as attached is.

2) Protective ground cover has been placed on the impoundment dikes as indicated by Mr. Johnson. Further seeding is scheduled to complete this requirement and should be completed by November 12, 1982.

I trust the actions taken as specified above will rectify the deficiencies noted.

Sincerely,

Rollins Environmental Services (TX) Inc.

Donald C. Matter
Plant Manager

DCM/cm

attachment

RECEIVED
NOV 10 1982
DEPT. OF
WATER RESOURCES
DISTRICT 7

19

GROUNDWATER ASSESSMENT OUTLINE FOR

ROLLINS ENVIRONMENTAL SERVICES (TX), INC.
2206 Battleground Road, Deer Park, Tx. 77536

I. Estimate the Extent of the Contamination

A. Model the Region of Flow

B. Install Additional Selected Piezometer and/or Monitoring Wells

C. Collect Additional Surface Water Samples

D. Collect Additional Water Samples

II. Determine any Change in Contaminate Concentration

A. Perform Additional Groundwater Quality Tests

B. Perform Additional Surface Water Quality Tests

C. Perform Attenuation Studies if Necessary

D. Perform Absorption Calculations if Necessary

E. Perform a Dispersion Model if Necessary

III. Determine the Outer Limits of the Contamination Plume

A. Install Additional Piezometers

B. Install Additional Obsenation Wells

C. Collect Additional Groundwater Samples

D. Perform Additional Groundwater Tests

E. Calibrate and Verify the Horizontal Extent from the Effected Phase

F. Produce a Suite of Groundwater Contour Maps and Groundwater Quality Maps on Each Selected Indicator Parameter; Indicate the Extent of the Contaminate Movement

This Groundwater Assessment Outline is in compliance with the Texas Department of Water Resources(Permit No. 01429) Texas Administration Code 335.194 as required by RCRA.

APPENDIX D

GROUND-WATER QUALITY ASSESSMENT OUTLINES

Part 2 - Outline in Revised Sampling and Analysis Plan (Mid-1985)

GROUNDWATER QUALITY ASSESSMENT PLAN OUTLINE
31 TAC 335.194(a)

Rollins Environmental Services (TX) Inc.
Deer Park, Texas
Permit No. 01429

D-4

I. INTRODUCTION

The following outlines the Groundwater Quality Assessment Plan for th RES (TX) Inc. Deer Park facility (Permit No. 01429). The outline ha been prepared in accordance with the requirements of 31 TAC 335.194(c) RES (TX) Inc. will use this outline to prepare a Groundwater Qualit Assessment Plan as required by 31 TAC 194(d)(2).

II. GROUNDWATER QUALITY ASSESSMENT PROCEDURE

A. Hazardous Waste and Hazardous Waste Constituent Identification

1. Sample and analyze groundwater from the down gradient well(s which indicate a statistically significant variation in ground water quality. Sample for priority pollutants in accordance wit the Sampling and Analysis Plan. As necessary, modify th Sampling and Analysis Plan to include required analytica procedures.

2. If II.A.1. indicates that hazardous waste or hazardous wast constituents are in the uppermost aquifer, sample and analyz each adjacent monitoring well for identified constituents.

3. If II.A.1. and II.A.2. indicate hazardous waste or hazardou waste constituents are in the uppermost aquifer, locate th nearest hazardous waste land disposal unit and obtain a sample If the unit is a landfill cell, sample the leachate collection pipe If the unit is a surface impoundment, sample the surface impound ment contents. Analyze the sample for parameter(s) identified i II.A.1. and II.A.2.

4. If II.A.1. does not indicate the presence of hazardous waste o hazardous waste constituents in the uppermost aquifer, prepar and submit a report as described in II.C. and reinstate th indicator evaluation program required by 31 TAC 335.193 an 194(b).

5. If II.A.1. and II.A.2. indicate hazardous waste or hazardou waste constituents have entered the uppermost aquifer, sample an analyze the groundwater from the affected monitoring wells fo detectable hazardous waste or hazardous waste constituents on quarterly basis after the determination required by 31 TA 335.194(d)(4).

B. Rate, Extent and Concentration Determinations.

1. Corings and Monitoring Well Installation, Sampling and Analysis

   a. Core and continuously sample surficial clay strata to withi five feet of uppermost aquifer. Then take precaution necessary to prevent vertical contaminant migration an complete coring through the uppermost aquifer.

(1) Conduct at least two corings around affected well(s). One coring should be located as close as practicable to the hazardous waste land disposal unit nearest the affected well(s). One coring should be located as close as practicable to the property boundary. Additional corings may be necessary during this initial coring procedure.

(2) A qualified geologist or geotechnical engineer will classify all encountered soils and will identify any significant thicknesses (>2 feet) of relatively permeable soils. Retain and preserve all core samples.

(3) Install monitoring well clusters in each coring. Screen interval and number will be based on the information obtained in II.B.1., above. Determine water levels in each screened interval.

(4) If corings/monitoring wells yield sufficient water for sampling and analysis, obtain sample.

(5) If corings/monitoring wells do not yield sufficient water for sampling and analysis within one week, use procedure approved by TWC staff to extract pore water from applicable interval of the coring.

(6) Analyze groundwater/pore water from each interval for hazardous waste or hazardous waste constituents identified in II.A.1.

(7) Determine water levels in each screened interval on at-time intervals, based on monitoring well completion data, until a constant water level is obtained for three consecutive measurements. The frequency of water level measurements should be adjusted, if it is possible, to conduct rising head tests.

(8) The transmissivity and hydraulic conductivity of each screened interval should be determined using appropriate test methods after a constant water level [II.B.1.a.(7)] is established.

b. Determine water/leachate levels in adjacent hazardous waste land disposal units.

(1) Landfill Cells - If affected monitoring well(s) is adjacent to a hazardous waste landfill cell, install piezometer(s) in cell. Determine water levels in leachate collection pipe(s) and piezometer(s). Additional water level determinations should be made at intervals which allow comparisons with water level measurements made in corings/monitoring well.

D-6 (2) Surface Impoundments - If affected monitoring well(s) is adjacent to a hazardous waste surface impoundment(s), determine water level in the surface impoundment(s). Review surface impoundment design information. If design provides for a constant water level, then no additional measurements are required. If the surface impoundment is designed for variable water levels, then additional water level determinations will be made which correlate with water level determinations in the corings/monitoring wells.

C. Data Reduction and Reporting

1. Use water level measurements obtained above in combination with other available data to determine horizontal and vertical components of flow in each screened interval above the uppermost aquifer. Determine the horizontal component of flow in the uppermost aquifer.

2. Use chemical analytical data to determine concentration gradients in each screened interval and between each screened interval.

3. Prepare the report required by 31 TAC 335.194(d)(5) and submit to the TWC within 15 days of completion of data reduction described above.

D. Additional Assessment Procedures

1. Install additional corings/monitoring wells as necessary to finalize the results of the activities described above. The need for and location of additional corings and monitoring wells will be based on guidance from TWC staff.

2. Report results obtained by additional assessment procedures within 15 days of data evaluation to the TWC staff.

3. If the groundwater quality assessment demonstrates that hazardous waste or hazardous waste constituents have not entered the uppermost aquifer, reinstate the indicator evaluation program required by 31 TAC 335.193 and 31 TAC 335.194(b).

E. Additional Assessment Requirements

If activities described in II.A. and II.B. determine that hazardous waste or hazardous waste constituents have entered the uppermost aquifer, resample monitoring wells on a quarterly basis with RCRA Part A issuance or with full facility closure. These data will be reduced as described in II.C.

APPENDIX E

NOTICE OF DEFICIENCY LETTER ON REVISED PART B GROUND-WATER SAMPLING AND ANALYSIS PLAN

TEXAS WATER COMMISSION

UP-44
From J. Gingerich
10-1-85

Paul Hopkins, Chairman
Ralph Roming, Commissioner
John O. Houchins, Commissioner

Larry R. Soward, Executive Director
Mary Ann Hefner, Chief Clerk
James K. Rourke, Jr., General Counsel

9/27/85

Mr. Tracy Hollister
Plant Manager
Rollins Environmental Services (Tx.), Inc.
P. O. Box 609
Deer Park, Texas 77536

CERTIFIED MAIL

Dear Mr. Hollister:

Re: Rollins Environmental Services (TX) Inc. - Deer Park
Amendment to Consolidated Permit No. 01429
Proposed Hazardous Waste Permit No. HW-50089
Harris County

We have completed a technical review of the above-referenced application. Our review indicates that insufficient information was presented to demonstrate compliance with Title 31 Texas Administrative Code (TAC) Sections 341.153 and 341.180 and Title 40 of the Code of Federal Regulations (CFR) Parts 270.13-270.21. The deficiencies in the application are detailed below and follow the format of the Part A and Part B application forms and instructions, which you will find enclosed:

PART A

Section III. Wastes and Waste Management

III.A.2.:

(1) In order to complete Table III-1, Rollins Environmental Services (TX), Inc., hereinafter referred to as RES (TX), should also list all mixtures containing any hazardous waste which are presently or proposed to be handled at your facility. However, because it is infeasible to anticipate and list every permutation of a waste mixture that you may handle at your facility, RES (TX) should list the major categories of wastes which you intend to handle. A rationale for the waste categories selected should also be provided.

(2) For clarification purposes, please provide a list of hazardous wastes which will not be accepted at your facility as an attachment to Table III-1.

III.B.1.:

For each waste category listed in Table III-1, complete a copy of the summary sheet shown in Table III-2. Be sure to indicate all the facility components used for storage/processing/disposal of each waste category by entering the number of such facility components managing the waste.

(3) Qualifications of the field inspector who will be in charge of identifying transmissive layers based on information from boring logs and field inspection of the landfill excavation;

(4) The procedure for determining the extent of each identified transmissive layer exposed by the landfill excavation;

(5) The procedure for excavating a sufficient area to ensure a minimum of a six (6) foot separation distance between the containment barrier and all portions of each major transmissive layer;

(6) The construction and quality control procedures to be followed and equipment to be used to ensure a hydraulic conductivity of less than 1×10^{-7} cm/sec for the backfilled material; and

(7) An evaluation of the effectiveness and the feasibility of constructing a slurry wall to seal off all minor transmissive layers (i.e., transmissive layers which will not be excavated and backfilled).

5. Please develop a plan for monitoring the leak detection system, and a contingency plan describing the actions that RES (TX) will take if monitoring results indicate failure of the top liner.

III.G.8.:

Please explain how operating procedures will ensure that incompatible wastes and material will not be placed into the same landfill section or indicate how the design or operation within a landfill provides adequate buffer zones or waste segregation for incompatible wastes.

III.H.:

Waste which is stabilized in the mixing facility is stored in a waste pile on a slab adjacent to the mixing tanks. If RES (TX) intends to seek authorization to continue operating this waste pile, then the permit application should be amended to include a complete response to all applicable information requested by the Part A and B application forms and instructions as they pertain to a waste pile.

Section IV. Geology Report

D.9.:

Please determine and depict the location of all ground-water recharge and discharge areas on the facility property on a plan-view map of not less than 1"=200' scale.

E.1.b.:

Please provide geologic cross-sectional drawings of each waste management area, as well as a full facility geologic cross-sectional drawing; this can be one drawing. These cross-sectional drawing(s) should also include all water levels.

E.1.c. and d.:

The subsurface soils above 60 feet are reported to contain perched water. Please provide appropriate field test data to accurately define these soils (i.e., field permeability, cohesive shear strength, dry unit weight, degree of saturation, rate of dewatering, and estimated amounts of available water). Please also provide hydraulic field parameters and data for the proposed uppermost aquifer.

E.2.b.:

Please submit a table of all recorded water level measurements for both historic and new monitor wells.

E.2.c., d. and e.:

The information requested in E.2.c., d., and e. of the Part B instructions was not submitted in the application. Please submit this information.

E.3.:

1. Please provide additional geologic and hydraulic information including field data (i.e., field permeability, hydraulic conductivity, effective porosity, etc.) on each of the saturated units to:

   a. Identify the uppermost aquifer; and

   b. Demonstrate that hydraulic separation exists between the proposed uppermost aquifer and the permeable zones above and below.

2. Please submit the method for determining that artesian conditions exist in the proposed uppermost aquifer.

Section V. Ground-Water Monitoring

These questions refer to the Ground-water Monitoring Plan dated April 9, 1985.

General:

1. The construction and completion of the existing monitoring wells does not provide a representative ground water sample. We recommend that supplemental monitor wells be installed with limited screened intervals in such a manner to individually screen each permeable zone (i.e., cluster wells). Please revise the application with the requested information.

2. Please provide the basis for determining new well locations and spacings; ground water modeling or other hydrogeologic tools or applicable guidance will be necessary to determine the information requested.

3. It may be advisable to separate the facility into two (2) waste management areas (a North half and a South half) to adequately understand the complexity of the subsurface and ground water flow patterns. If the site is split into two waste management areas then two (2) points of compliance should be identified. The monitor wells should be closely associated with each regulated unit. If the landfill expands, as it is suggested, then the point of compliance would correspondingly expand.

4. The applicant must consider the effect that dewatering by the existing landfill has had on the ground water flow direction, flow rate and levels when designating the points of compliance. We recommend the use of cluster wells at the points of compliance.

5. RES (TX) must provide the justification for locations of the points of compliance. These points of compliance must be hydraulically downgradient of each waste management area. RES (TX) must also provide technical justification that the monitor well locations and spacing will provide samples that represent the quality of ground water passing the points of compliance.

6. Individual supplementary monitoring programs will be required for each identified saturated zone and also for all zones that are hydraulically interconnected. Please submit the indicator parameters, proposed sampling schedule, and time frames for submittal of the proposed graphs for the supplementary monitoring programs. These monitoring programs will help establish the different potential pathways for migration at the site.

7. Before an alternative statistical method can be considered, in accordance with 31 TAC 335.463(8)(A)(ii), the applicant must demonstrate that the Student's t-test, as required by 31 TAC 335.463(8)(A)(i), is not applicable for evaluating ground water data at the RES (TX) facility and that the alternative method will not increase the number of false negative results.

8. One of the objectives of the monitoring system is to determine any change in ground water flow due to mounding effects and/or the dewatering caused by the existing landfill. We recommend that you establish a permanent water-level monitoring system in the interior of the facility as well as in the existing landfill. The elevations should be measured before every sampling event.

9. Please submit a set of indicator parameters to be used in monitoring at the point of compliance. The list must consist of indicator parameters, waste constituents, or reaction products that can provide a reliable indication of the presence of hazardous constituents in ground water. Indicator parameters may include pH, specific conductance, total organic carbon, total organic halogen, etc. The parameters proposed by RES (TX) do not adequately demonstrate either the mobility or the detectability of the proposed parameters. The applicant should revise the list of indicator parameters, if necessary, and fully justify the suitability of each parameter and of the list as a whole. Indicator parameters would not need to be capable of detecting all known waste constituents. The parameters used must provide a reliable indication of the presence of hazardous constituents in ground water.

10. During water sample collecting, RES (TX) should submit more specific information concerning: (1) recordkeeping of estimated yield during the bailing process; (2) decontamination of water level equipment; (3) decontamination of pumps; and (4) methodology of obtaining a representative sample.

11. The sample schedule for all monitor wells needs to be revised to maintain a quarterly sample schedule. Please submit a revised schedule.

12. Please submit a legible copy of Figure 12.

Section VI. Closure and Post-Closure Plans

1. The final facility closure plan proposes a four-phased closure. For clarity please present the schedule for all four phases of closure on one master chart.

2. Container Storage Areas:

   For each container storage area, please submit a closure plan which details the procedures for removing and verifying the removal of all hazardous waste, waste residues, and PCBs.

3. Tanks:

   Please revise "Closure Plan VI-CP-1 Detailed Closure Plan for Tanks" by preparing one closure plan for each tank and/or group of identical tanks (i.e., same capacity, design, and secondary containment), storing similar wastes (i.e., waste requiring the same closure procedures and rinsate analysis). Each closure plan should also include the following:

   a) Identify the tank(s) to which the plan applies;

VII.B.1.:

Please provide a cost estimate for post-closure care following the assumptions and guidance presented in the TWC Closure and Post-Closure Cost Estimate guidelines.

VII.B.2.:

Please update the financial assurance for post-closure care of the facility to reflect the revised post-closure cost estimate.

If in response to this letter a facility component or structure is modified in design or operation, or is added to or deleted from the permit application, then all relevant sections of the application should be amended to reflect the change and to provide any additional information requested by the application form and instructions.

The information requested above is necessary for a complete hazardous waste permit application. Please submit four copies of your response to this letter. Failure to submit the requested information by February 28, 1986 may result in dismissal of the application or a recommendation to deny the permit for the subject facility.

Communications relating to Parts A and B of the permit application should be directed to Joe Gingerich of the Hazardous and Solid Waste Permits Section at AC512/463-8187.

Sincerely,

Jeff Korth, Head
Facility Unit II
Permits Section
Hazardous and Solid Waste Division

JG/CLSP:lab
Enclosure
cc: TDWR District 7 Office - Deer Park
Guy Tidmore, Hazardous & Solid Waste Enforcement Section - Austin
Allen Messenger, Espey, Huston, & Associates - Austin
Marc Sides, Environmental Protection Agency Region VI - Dallas

APPENDIX F

ANALYTICAL TECHNIQUES AND RESULTS FOR TASK FORCE SAMPLES

Appendix F

ANALYTICAL TECHNIQUES AND RESULTS FOR TASK FORCE SAMPLES ROLLINS ENVIRONMENTAL SERVICES FACILITY Deer Park, Texas

The following discusses analytical techniques, methods and results for water and leachate samples collected by the Task Force at the Rollins Environmental Services facility, Deer Park, Texas. Water sample analyses and results are discussed in the first section; the second section addresses the leachate analyses and results.

Field measurements on water samples, including conductance, pH and turbidity, were made by the EPA sampling contractor at the time of sampling. No field measurements were made on the leachate samples. Laboratory analysis results were obtained from two EPA contractor laboratories (CL) participating in the Contract Laboratory Program (CLP). One CL analyzed the samples for organic compounds while the other analyzed for metals and other parameters.

Standard quality control measures were taken including: (1) the analysis of field and laboratory blanks to allow distinction of possible contamination due to sample handling, (2) analysis of laboratory spiked samples and performance evaluation samples and comparison of the CL results with NEIC split sample results to estimate accuracy, and (3) analysis of laboratory duplicates and field triplicates to estimate precision. The performance evaluation samples were samples of known analyte concentrations prepared by the EPA Environmental Monitoring Systems Laboratory, Cincinnati, Ohio. Split samples from wells MW-2 and MW-35 were analyzed by the NEIC.

Table F-1 provides a summary, by parameter, of the analytical techniques used and the reference methods for the sample analyses. The CLP results are reported in the data tables and the split sample results are discussed where applicable in establishing the reliability of the CLP results.

WATER SAMPLE ANALYSIS RESULTS

Specific Organic Analysis Results

Table F-2 lists the organic compounds which can be reported with certainty as being present in the ground-water samples for the identified wells. None of the organic compounds for which concentrations were reported were detected above blank levels in other monitoring well samples.

Table F-3 contains the limits of quantitation for the analyses for the volatile, semivolatile, pesticide and herbicide organic compounds. Based on matrix spike data, the volatile organic limits of quantitation are probably reliable to within a factor of two, while the extractable organic, pesticide and herbicide limits are probably reliable to within factors of two to twenty.

The CL results for four of the five direct injection compounds were unacceptable; only 1,4-dioxane was correctly identified and quantitated. These findings are generally consistent with past and subsequent Task Force performance evaluations for the direct injection analysis. Because of the apparent erroneous direct injection analysis results, compounds determined by this method should be considered to have been 'not analyzed'.

NEIC analyzed samples supposedly from wells MW-2 and MW-35. NEIC volatile organic results for the MW-2 well sample are not consistent with the CL results or with the facility's monitoring data for this well. Chlorobenzene and vinyl chloride were detected by the CL at many times the detection limit, while these two compounds were not detected in the sample received by NEIC. NEIC analyzed the MW-2 well sample in triplicate and obtained an acceptable chlorobenzene spike recovery. It appears the sample mixup only occurred with the 60-mL VOA bottles, as NEIC and the CL both detected 2-chlorophenol and 4-chloroaniline in the extractable sample. Further, the purgable organic halide (POX) and purgable organic carbon (POC) values obtained by NEIC are consistent with the NEIC volatile organic analyses. The POX and POC samples are also in 60-mL VOA bottles. Based on

conversations with the NEIC project coordinator, NEIC apparently received sampling equipment rinses instead of ground water from well MW-2 for samples taken in the VOA bottles. Neither NEIC nor the CL detected volatile or semivolatile organic compounds in the samples from well MW-35.

The CL incorrectly identified the presence of benzyl alcohol in the performance evaluation sample. This compound should be considered to have not been determined for the sample analyses.

A few problems were encountered in the CL pesticide analyses; however, the results are considered reliable. The contract required detection limits for the pesticides that were not achieved by the CL, based on the performance evaluation sample analysis results. Lindane and methoxychlor were not identified by the CL. Pesticide surrogate spike recoveries were high for the samples from wells MW-8 and MW-13. Due to early eluting interferences present in the chromatogram for sample MW-2, the extract for this sample was analyzed at a tenfold dilution. Neither the CL or NEIC detected pesticides or PCBs in the samples from wells MW-2 and MW-35.

The CL reported the presence of 3 µg/L of 2,4-D in the sample from well MW-35. However, the second column confirmation of 2,4-D was not acceptable. The difference in the second column retention time between the unknown and the standard was too large. The CL also incorrectly found 3.8 µg/L 2,4-D and 0.7 µg/L silvex in a field blank.

Acetone, methylene chloride and 2-butanone were detected in all the field blanks and most of the laboratory blanks. Bis(2-ethylhexyl) phthalate was also frequently detected in the field and laboratory blanks. Chloroform was detected in half of the field blanks. None of the sample concentrations for these compounds exceeded the upper 99% confidence limit of the blank values after subtraction of the average blank contaminant concentrations.

Metals Analysis Results

The dissolved and total metals results for the ground-water monitoring well samples are reported in Table F-4. The reliability of detectable value is footnoted in the table.

The dissolved elemental concentrations determined by Inductively Coupled Argon Plasma Optical Emission Spectroscopy (ICAP-OES) for many of the samples are biased high. Mismatching of the calibration standards acid matrix to the dissolved preserved sample acid matrix was the cause of the bias. The bias for the dissolved concentrations does not exceed 20%, based on results for the sample split with NEIC and the "total" concentrations determined by the CL.

The CL reported 82 µg/L and 51 µg/L total lead, respectively, in the samples from wells MW-23 and MW-32. These concentrations were obtained by ICAP-OES. The CL performed an ICAP-OES duplicate analysis on the well MW-23 sample and obtained a total lead concentration of 62 µg/L. Examination of the raw data revealed that the CL also analyzed the well MW-23 sample by furnace atomic absorption spectroscopy (AAS) but indicated the data was 'not used' in reporting the sample analysis results. The duplicate furnace AAS analysis results for the well MW-23 sample were 44 µg/L and 32 µg/L. Comparison of the furnace AAS results to the ICAP-OES results indicates a substantial bias. Although not reported, the sample of well MW-3 was found to contain 33 µg/L by the ICAP-OES; however, the CL reported the furnace AAS result of 7 µg/L. Based on the standard deviation of the blanks, the ICAP-OES method had a detection limit of about 60 µg/L instead of the 20 µg/L reported by the CL. Thus, the ICAP-OES lead concentrations reported for the samples from wells MW-21 and MW-23 are unreliable as they are near or below the detection limit and are in discordance with the furnace AAS results. The furnace AAS results are reported for well MW-23; however, the well MW-21 sample is indicated to have been not analyzed as no furnace AAS analysis was performed for this sample for total lead.

Total lead was detected in two of the field blanks. Concentrations of 3 µg/L and 7 µg/L lead were reported. For previous Task Force projects, some of the field blanks have been found to contain lead. Based on the lead found in these previous blanks and in the two blanks for this project, an average field blank of 6 µg/L lead was calculated and the standard deviation of the blank lead values would indicate a detection limit of 15 µg/L. Therefore, the lead concentration reported by the CL for the well MW-3 sample of 7 µg/L may be due to sampling handling contamination and has been changed to not detected at 15 µg/L.

Zinc contamination due to sampling handling was evident as some of the dissolved zinc concentrations are greater than the total zinc concentrations. For example, a dissolved zinc concentration of 27 µg/L was reported for the well MW-12 sample while the total zinc was not detected at 2 µg/L. Further, zinc was a common contaminant in the laboratory and field blanks. A number of the field blanks were reported to contain over 20 µg/L zinc. Because these levels are greater than or near to the levels reported for many of the samples, dissolved and total zinc will not be reported.

Although antimony was determined, the results were unreliable and are not reported. The lower 99% confidence limit for the spike recoveries was below zero. The low antimony spike recoveries may be related to the spiking standards used by the CL. Tin spike recoveries were also low; however, little variability was observed in the spike recoveries indicating a problem with the spiking standard mix. No tin was detected and the tin detection limits have been raised to reflect the low spike recovery.

The total values for aluminum, iron and copper reported by the CL required subtraction of the digestion blank contamination levels. The reported sample values have been corrected for blank levels of 11 µg/L aluminum, 40 µg/L iron and 5 µg/L copper. The variability observed in the digestion blank contaminant levels has been accounted in the determination of the detection limits for these elements.

The CL reported results for arsenic, lead, selenium and thallium that did not account for furnace AAS matrix effects. These effects have been corrected for in the results reported in the data tables. Further detection limits were recalculated based on the variability in the calibration curves and on the variability in the signal response.

General Analysis Results

The field measurements for conductance, pH and turbidity and the results of other analytical testing for ground-water monitoring well samples are reported in Table F-5. The reliability of the detectable values are footnoted in the table.

The performance evaluation sample had true pH of 5.7 and 5.6 was reported by the field crew. Based on past comparisons with concurrent field measurements, the pH values are indicated to be reliable to within 0.5 pH units.

The reported conductance values have not been corrected for daily cell constant variability as no standardization data was found in the field notebooks. A cell constant of unity must be assumed. The values have been corrected for temperature. After temperature correction, the measured performance evaluation sample value was 970 µhmos/cm which compares well to the true value of 963 µhmos/cm. NEIC split sample conductance measurements for the samples from wells MW-2 and MW-35 were 1,030 µhmos/cm and 2,300 µhmos/cm, respectively. These values are 130 µhmos/cm and 200 µhmos/cm greater than the temperature corrected field measurements. The data tables indicate the conductance values are reliable to within 200 µhmos/cm.

Purgable organic halide (POX) was detected in the samples for wells MW-2, MW-6 and MW-26. The POX values for these samples are in good agreement with the volatile organic constituent analysis results. For example, the measured POX values for the samples from wells MW-2 and MW-26 were 78% and 88%, respectively, of the POX calculated from the specific organic analysis results. The measured POX for the performance evaluation sample was

283 µg/L while the true value was 291 µg/L. Spike recovery data also indicates good accuracy. Laboratory duplicate data and the field triplicate data for the samples from MW-6 indicate good precision. The field triplicate sample values averaged 27 µg/L with a standard deviation of 4.6 µg/L.

NEIC did not detect POX in the sample from well MW-35 which is in agreement with the CL data. As discussed above in the organic section, the samples in 60-mL VOA bottles received by NEIC for well MW-2 were probably sampling equipment rinses and not actually ground water from well MW-2. The POX value of 21 µg/L and the purgable organic carbon (POC) value of 22 µg/L obtained by NEIC, although in agreement with NEIC specific organic analysis results, are in discordance with the CL results as well as the facility's past monitoring data for well MW-2.

Although POC was measured by the CL and quality control data gathered concurrently with the sample analyses indicate acceptable precision and accuracy, the POC results are not reported. Previous and subsequent control measures for other Task Force projects have indicated frequently that the POC results are unreliable.

The total oganic halide (TOX) concentrations are of questionable reliability. The CL reported a TOX value of 139 µg/L for the performance evaluation sample which had a true value of 336 µg/L. Although a negative bias is indicated by the performance evaluation sample, the TOX levels for some of the wells are substantiated by the specific organic analyses results. For example, the measured TOX for the sample from well MW-26 differs by less than 6% from a calculated TOX using the specific organic analyses results. Further, TOX spike recoveries were 115% and 125% which would indicate values could be biased high. Where specific chlorinated organic compounds were detected in well samples, the TOX values confirm the presence of at least the concentrations found and often substantially more halogenated organic matter than found by the specific organic analyses. For example, the measured TOX for the sample from MW-2 was 9,680 µg/L, while a calculated TOX from the specific organic analysis results was 1,330 µg/L. This would indicate that the common organic constituent analysis methods are apparently not sensitive to the halogenated compounds present.

The TOX values reported for the field triplicate samples from well MW-6 indicate good precision at high TOX levels as the average was 284 µg/L and the standard deviation as 11 µg/L. However, poor reproducibility was indicated by laboratory duplicate data for analyses of the sample from well MW-23. The CL reported duplicate analysis results of 16 µg/L and 9 µg/L. A detection limit of 30 µg/L was calculated from the variability in TOX blanks; therefore, although the CL reported a detection limit of 5 µg/L, values below 30 µg/L are not reported in the data tables. The data tables also indicate the TOX values are of questionable reliability as discussed above.

Although results for laboratory duplicates, spiked samples and the performance evaluation sample would indicate acceptable precision and accuracy for nonpurgable organic carbon (NPOC), the NPOC results are probably unreliable. The NPOC values reported for the field triplicate samples from well MW-06 ranged from 1.0 mg/L to 5.3 mg/L. A similar variability was also observed in comparison of the well MW-2 split sample value of 2.2 mg/L obtained by NEIC and the CL reported value of 4.6 mg/L. The split sample NPOC values for the samples from well MW-35 compared much better, differing by only 0.4 mg/L.

Although no field blanks were provided for the ammonia preservative, field blanks from subsequent Task Force projects have found the blank level to be about 0.1 mg/L N as ammonia. Based on the variability in the calibration curve and the variability of the field blank contamination, the detection limit for ammonia was calculated to be 0.23 mg/L. All ammonia values have had the blank contamination subtracted.

Samples collected for nitrate analyses were preserved with sulfuric acid which is appropriate only when distinction between nitrate and nitrite is not needed. Samples collected for nitrate analysis should be cooled to 4° C. and analyzed within 48 hours of collection. The CL colorimetric method is subject to positive interferences that were apparently not compensated for by the CL procedure. For example, NEIC split sample results for wells MW-2 and MW-35 were not detected at 0.05 mg/L nitrate, while the CL reported

0.2 mg/L and 0.1 mg/L nitrate, respectively. NEIC analyzed samples by ion chromatography. The samples were cooled to 4° C. and not acidified. No nitrite was detected by the ion chromatographic method which indicates that the CL positive bias is not due to nitrite interference. Further, the CL reported a nitrate value of 2 mg/L for the performance evaluation sample which had a true value of 1.6 mg/L. Substantial bias in the CL results has been found in sample results for previous and subsequent Task Force projects. The nitrate results are unreliable and are not reported in the data tables.

The CL reported a chloride value of 2,040 mg/L for the well MW-11 sample, which is greater than the conductance and is not substantiated by the cation data. Review of the bench records found a calculation mistake and the correct chloride value should have been 510 mg/L. The results of other control measures for chloride were found to be acceptable. Comparison of split sample results also indicates the results are reliable, as NEIC obtained chloride concentrations of 113 mg/L for the well MW-2 sample and 550 mg/L for the well MW-35 sample.

Although control measures indicate that the sulfate results should be reliable, data for one of the well samples was determined to be unreliable. NEIC obtained a sulfate concentration of 3.7 mg/L for the well MW-2 sample, which compares favorably with a value of 3 mg/L reported by Rollins for this well in July 1985. The CL reported a value of 38 mg/L sulfate for the well MW-2 sample. Examination of the raw data found a discrepancy in the CL analyses of the sample for sulfate. The CL initially analyzed all samples by a high-level procedure and those samples found to contain less than 50 mg/L were reanalyzed with a low level procedure. With the high-level procedure, 38 mg/L sulfate should have given an absorbance of 0.019 units. However, an absorbance of zero was obtained for the analysis of the well MW-2 sample which is in discordance with the concentration obtained using the low-level procedure. The data table indicates that sulfate was not quantified for the well MW-2 sample. Comparison of the sulfate results reported by Rollins for the other wells analyzed by the CL indicates only one other discrepancy. Rollins found 17 mg/L sulfate in a well MW-26 sample, while the CL reported that the sulfate was less than 5 mg/L. Because an

error was discovered for the CL analysis of the MW-2 sample, it is possible that the CL result for the MW-26 sample was in error. Therefore, the data table indicates the sulfate concentration reported for the MW-26 sample may be unreliable. NEIC obtained a sulfate concentration of 27 mg/L for the MW-35 sample which compares favorably with the CL value of 28 mg/L.

LEACHATE SAMPLE ANALYSIS RESULTS

Specific Organic Analysis Results

Table F-6 reports the organic constituent analysis results for the three leachate samples. The leachate samples contained high concentrations of numerous volatile and semivolatile compounds. Many compounds given in Table F3 were not detected in any of the samples and, thus, are not listed in Table F-6.

The CL erroneously reported phenol as not detected and reported the presence of 18 µg/L bis(chloroethyl)ether in the LC-7 leachate sample. Review of the data showed phenol was present at 1,000 µg/L and the bis(chloroethyl)ether was not present.

A reporting error was discovered for the acid fraction compound concentrations in the LC-3 leachate sample. The CL reported the concentrations at one-half of the actual concentrations due to an error in calculating a dilution factor. The concentrations reported in the data table have been corrected for this error.

Early eluting interferences were present in the pesticide extract chromatograms for all the leachate samples. This caused the detection limits for many of the pesticides to be raised by factors of 5 to 100.

All leachate organic analyses results should be considered semi-quantitative; that is, concentrations are probably reliable to within 10% to 300% of actual sample concentrations for the semivolatiles and 50% to 200% for the volatiles. These ranges are what has been observed for leachate

samples from previous Task Force projects where split sample analysis results were provided.

Metals Analysis Results

The dissolved and total metals results for the leachate samples are reported in Table F-7. Depending on the suspended matter composition, the values reported for certain elements may not represent "total" concentrations. If the suspended matter is siliceous, then values for aluminum, magnesium, potassium and sodium are not "total" because the silicate matrix was not dissolved. The heavy metal results would approximate "total" concentrations because they are usually absorbed and are not incorporated in the silicate matrix.

The CL reported ICAP-OES total lead concentrations for the LC-6 and LC-7 samples and furnace AAS results for total lead results for the LC-2 and LC-3 samples. Total lead was determined by ICAP-OES and furnace AAS for all samples. The furnace AAS results are substantially lower than the ICAP-OES results. For example, the CL reported the ICAP-OES value of 993 µg/L for the LC-7 sample while examination of the raw data revealed that 540 µg/L lead was found by furnace AAS. Similarly, the CL reported 665 µg/L lead in the LC-6 sample while the furnace AAS analysis found 380 µg/L. Although the furnace AAS analysis result of 65 µg/L was reported for the LC-3, the ICAP-OES analysis found 286 µg/L. Because of severe spectral interference often encountered in the ICAP-OES analysis for lead in complex samples, the furnace AAS results are reported in the data table.

Similarly, ICAP-OES arsenic determinations are often severely interferred by many elements in complex sample matrices. The CL reported furnace AAS total arsenic results for three of the leachate samples but reported both dissolved and total ICAP-OES arsenic results for the LC-3 sample and a dissolved ICAP-OES arsenic result for the LC-2 sample. No furnace AAS analyses were performed for samples where ICAP-OES arsenic results were reported. The ICAP-OES analysis results are suspected to be biased substantially high based on comparison with furnace AAS results. For example,

the CL reported a furnace AAS total arsenic result of 94 µg/L for the LC-7 sample while examination of the raw data revealed that the ICAP-OES analysis found 570 µg/L arsenic. Similarly, the furnace AAS analysis found 49 µg/L total arsenic for the LC-6 sample while the ICAP-OES analysis found 300 µg/L. Based on these findings, the 176 µg/L reported for the dissolved arsenic in the LC-2 sample is probably biased high and the data tables indicated the value was not quantified. Very large concentrations of dissolved and total arsenic were found for ICAP-OES analysis of the LC-3 sample. No furnace AAS analyses were performed on the LC-3 samples. It is likely that the arsenic concentrations found by ICAP-OES for the LC-3 samples are biased high. Because the concentrations are very high, the arsenic values for the LC-7 samples are reported but are indicated to be biased high.

Although zinc values were not reported for the well samples, the total concentrations for the leachate samples are contained in the data table because the concentrations are substantially greater than blank levels discussed above. the dissolved zinc concentrations are not reported because they were indistinguishable from the field blank contaminant levels.

General Analysis Results

Table F-8 reports the results of other testing for the leachate samples. As mentioned, no field measurements were made for pH, conductance or turbidity. Further, samples were not collected for POX and POC. Although nitrate was determined, the results are not reported for the reasons discussed above.

Similar to the comparison between the calculated and measured TOX for some of the well samples, the measured TOX values for the leachates are much greater than the TOX calculated from the specific organic analyses. Assuming the measured TOX values are not in error, then the common organic methods are not sensitive to many of the halogenated organics present in the leachate samples. Similarly, the organic compounds detected by the methods are accounting for only a small percentage of the organic carbon.

The ammonia spike recovery was only 48%; therefore, the ammonia values are probably unreliable and are not reported. Spike recoveries of only 7% and 14% were observed for the cyanide analyses. The cyanide results are not reported.

The chloride and sulfate spike recoveries were around 92%, indicating that the values are reliable. However, the CL reported 539 mg/L chloride for both the LC-6 and LC-7 samples. From the metals, the cation equivalences are calculated to be 21.7 meg/L and 6.02 meg/L, respectively, for the LC-6 and LC-7 samples. However, from the chloride and sulfate concentrations, the anion equivalences are calculated to be 16 meg/L for both samples. The metals data would indicate that the chloride concentration reported in the LC-7 sample could not be present. The fact that both samples were reported to contain exactly the same concentration chloride suggests a sample mixup either at the laboratory or in the field. Chloride and sulfate are not reported for the LC-7 sample. Sulfate was determined from the same sample bottle as chloride.

The sum of the phenolic compounds detected by the specific organic analyses are from 7% to 69% of the colorimetrically determined phenol concentrations. Low recoveries of phenolic compounds are expected for the specific organic analysis method.

Table F-1

Sample Preparation and Analysis Techniques and Methods

Parameter	Preparation Technique	Analysis Technique	Method Reference
Specific Organic Constituents			
Volatiles	Purge and trap	Gas Chromatography with Electron Capture Detection	CLP Method (a)
	Direct injection	Gas Chromatography - Mass Spectroscopy or	CLP Method
		Gas Chromatography with Flame Ionization Detection	CLP Method
Semi-volatiles	Methylene chloride extraction	Gas Chromatography - Mass Spectroscopy	CLP Method
Pesticides/PCB	Methylene chloride/hexane extraction	Gas Chromatography with Electron Capture Detection	CLP Method
Herbicides	Diethylether extraction/methylation	Gas Chromatography with Electron Capture Detection	Method 8150 (b)
Elemental Constituents			
Mercury	Wet digestion for dissolved and total	Cold Vapor Atomic Absorption Spectroscopy	CLP Method
As, Pb, Se and Tl	Acid digestion for total	Furnace Atomic Absorption Spectroscopy	CLP Method
Other Elements	Acid digestion for total	Inductively Coupled Plasma Emission Spectroscopy	CLP Method
Field Measurements			
Conductance	None	Electrometric, Wheatstone Bridge	Method 120.1 (c)
pH	None	Potentiometry	Method 150.1 (c)
Turbidity	None	Nephelometric	No reference
Non-specific Organic Parameters			
POX	None	Purgable combusted, Microcoulometry	EPA 600/4-84-008
TOX	Carbon absorption	Carbon combusted, Microcoulometry	Method 9020 (b)
POC	None	Purgable combusted, Non-dispersive Infrared	No reference
NPOC	Acidify and purge	Liquid combusted, Non-dispersive Infrared	Method 415.1 (c)
General Constituents			
Ammonia	Particulates settled	Phenolate Colorimetry of supernatant	Method 350.1 (c)
Chloride	Particulates settled	Mercuric Precipitation Titration of supernatant	Method 9252 (b)
Nitrate	Particulates settled	Brucine Sulfate Colorimetry of supernatant	Method 9200 (b)
Sulfate	Particulates settled	Barium Sulfate Turbidimetry of supernatant	Method 9038 (b)
Cyanide	Manual distillation	Pyridine Barbituric Acid Colorimetry	CLP Method
Phenol	Manual distillation	Ferricyanide 4-Aminoantipyrine Colorimetry	Method 420.1 (c)

a) Contract Laboratory Program, IFB methods.
b) Test Methods for Evaluating Solid Wastes, SW-846.
c) Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020.

Table F-2

Organic Constituent Analysis Results
for the Monitoring Well Samples
Rollins Environmental Services, Deer Park, TX

Compound	Station: MW-02 Value(a)	MW-06 Value	MW-13 Value	MW-25 Value	MW-26 Value
1,1,1-Trichloroethane	ND b	ND	ND	ND	6.
1,1,2-Trichloroethane	ND	ND	ND	ND	17.
1,1-Dichloroethene	ND	5. c	ND	ND	20.
Trans-1,2-dichloroethene	ND	5. c	ND	ND	ND
Trichloroethene	ND	5. c	ND	ND	430.
Tetrachloroethene	ND	ND	ND	ND	8.20
Vinyl chloride	120.	5. c	ND	ND	ND
Benzene	ND	ND	ND	5. c	5. c
Chlorobenzene	4000.	5. c	ND	5. c	110.
1,2,4-Trichlorobenzene	ND	ND	ND	10. c	ND
Acrolein	ND	ND	500. c	ND	ND
4-Chloroaniline	36.	ND	ND	ND	ND
2-Chlorophenol	10. c	ND	ND	ND	ND
Benzoic acid	ND	ND	ND	10. c	ND
LOQ FACTORS					
Volatiles	5X	1X	1X	1X	1X
Base/Neutral/Acids	2X	2X	2X	2X	2X
Pesticides	1X	1X	1X	1X	1X
Herbicides	10X	1X	1X	1X	1X

a) Concentrations are reported in ug/L.
b) ND is not detected.
c) Compound is present put below the given limit of quantitation.

Table F-4

Dissolved and Total Metals Analysis Results
for the Monitoring Well Samples
Rollins, Deer Park, TX

Element	Well MW-02 Dissolved Value (a)	Well MW-02 Total Value	Well MW-03 Dissolved Value	Well MW-03 Total Value	Well MW-06 Dissolved Value	Well MW-06 Total Value
Al	< 30. b	< 40.	< 30.	153. c	< 30.	149. c
As	< 14.	< 6.	< 13.	< 6.	< 7.	< 7.
Ba	663. d	669. d	352. d	346. d	302. d	278. d
Be	< 1.3	< 1.3	< 1.3	< 1.3	< 1.3	< 1.3
Cd	< 10.	< 11.	< 10.	< 11.	< 10.	< 11.
Ca	29,500. d	28,900. e	55,600. d	53,800. e	51,800. d	49,500. e
Cr	< 9.	< 11.	< 9.	< 11.	< 9.	< 11.
Co	< 6.	< 6.	< 6.	< 6.	< 6.	< 6.
Cu	< 7.	< 22.	< 7.	< 22.	< 7.	< 22.
Fe	< 43.	595. c	142. c	823. c	< 43.	147. c
Pb	< 6.	< 11.	< 6.	< 15.	< 6.	< 6.
Mg	16,700. d	16,200. d	29,900. d	28,400. d	35,100. d	33,800. d
Mn	58. d	58. d	80. d	83. d	51. d	47. d
Hg	< .1	< .1	< .1	< .1	< .1	< .1
Ni	< 12.	< 12.	< 12.	13. d	< 12.	< 12.
K	< 2,170.	< 2,170.	< 2,170.	< 2,170.	< 2,170.	< 2,170.
Se	< 16.	< 16.	< 11.	< 11.	< 8.	< 17.
Ag	< 9.	< 15.	< 9.	< 15.	< 9.	< 15.
Na	176,000. c	172,000. c	233,000. c	220,000. c	229,000. c	229,000. c
Tl	< 9.	< 8.	< 9.	< 6.	< 5.	< 8.
Sn	< 64.	< 110.	< 64.	< 110.	< 64.	< 110.
V	< 6.	< 7.	< 6.	< 7.	< 6.	< 7.

a) Concentrations are reported in ug/L.
b) Sample concentration is less than X at 99% confidence.
c) Control measures indicate value is within 50% to 150% of actual concentration at 95% confidence and dissolved values are often biased high.
d) Control measures indicate value is within 75% to 125% of actual concentration at 95% confidence and dissolved values are often biased high.
e) Control measures indicate value is within 90% to 110% of actual concentration at 95% confidence.

Table F-4 (continued)

Dissolved and Total Metals Analysis Results
for the Monitoring Well Samples
Rollins, Deer Park, TX

Element	Well MW-07 Dissolved Value (a)	Well MW-07 Total Value	Well MW-08 Dissolved Value	Well MW-08 Total Value	Well MW-11 Dissolved Value	Well MW-11 Total Value
Al	< 30. b	661. c	< 30.	< 40.	< 30.	< 40.
As	< 7.	< 9.	< 7.	< 7.	< 14.	< 6.
Ba	389. d	350. d	405. d	360. d	182. d	193. d
Be	< 1.3	< 1.3	< 1.3	< 1.3	< 1.3	< 1.3
Cd	< 10.	< 11.	< 10.	< 11.	< 10.	< 11.
Ca	101,000. d	104,000. e	101,000. d	103,000. e	73,800. d	79,100. e
Cr	< 9.	< 11.	< 9.	< 11.	< 9.	< 11.
Co	< 6.	< 6.	< 6.	< 6.	< 6.	< 6.
Cu	< 7.	< 22.	< 7.	< 22.	< 7.	< 22.
Fe	< 43.	491. c	< 43.	< 110.	< 43.	< 110.
Pb	< 6.	< 9.	< 6.	< 6.	< 6.	< 10.
Mg	50,400. d	49,000. d	50,300. d	50,700. d	56,000. d	55,000. d
Mn	82. d	82. d	18. d	19. d	51. d	59. d
Hg	< .1	< .1	< .1	< .1	< .1	< .1
Ni	< 12.	< 12.	< 12.	< 12.	< 12.	< 12.
K	< 2,170.	< 2,170.	< 2,170.	< 2,170.	< 2,170.	< 2,170.
Se	< 9.	< 19.	< 6.	< 15.	< 11.	< 11.
Ag	< 9.	< 15.	< 9.	< 15.	< 9.	< 15.
Na	223,000. c	211,000. c	211,000. c	216,000. c	316,000. c	312,000. c
Tl	< 6.	< 6.	< 5.	< 6.	< 10.	< 7.
Sn	< 64.	< 110.	< 64.	< 110.	< 64.	< 110.
V	< 6.	< 7.	< 6.	< 7.	< 6.	< 7.

a) Concentrations are reported in ug/L.
b) Sample concentration is less than X at 99% confidence.
c) Control measures indicate value is within 50% to 150% of actual concentration at 95% confidence and dissolved values are often biased high.
d) Control measures indicate value is within 75% to 125% of actual concentration at 95% confidence and dissolved values are often biased high.
e) Control measures indicate value is within 90% to 110% of actual concentration at 95% confidence.

Table F-4 (continued)

Dissolved and Total Metals Analysis Results
for the Monitoring Well Samples
Rollins, Deer Park, TX

Element	Well MW-12 Dissolved Value (a)	Well MW-12 Total Value	Well MW-13 Dissolved Value	Well MW-13 Total Value	Well MW-21 Dissolved Value	Well MW-21 Total Value
Al	< 30. b	< 40.	< 30.	172. c	< 30.	29,788. c
As	< 7.	< 7.	< 13.	< 6.	< 7.	< 10.
Ba	251. d	211. d	256. d	257. d	198. d	328. d
Be	< 1.3	< 1.3	< 1.3	< 1.3	< 1.3	2.1 d
Cd	< 10.	< 11.	< 10.	< 11.	< 10.	< 11.
Ca	86,600. d	88,800. e	57,100. d	56,800. e	63,000. d	251,000. e
Cr	< 9.	< 11.	< 9.	< 11.	< 9.	37. c
Co	< 6.	< 6.	< 6.	< 6.	< 6.	17. d
Cu	< 7.	< 22.	< 7.	< 22.	< 7.	37. c
Fe	< 43.	< 110.	< 43.	313. c	< 43.	30,558. c
Pb	< 6.	< 7.	< 6.	< 11.	< 7.	NQ f
Mg	60,900. d	59,000. d	43,300. d	42,600. d	38,500. d	57,200. d
Mn	89. d	86. d	276. d	278. d	21. d	625. d
Hg	< .1	< .1	< .1	< .1	< .1	< .1
Ni	< 12.	< 12.	< 12.	< 12.	< 12.	35. d
K	< 2,170.	< 2,170.	< 2,170.	< 2,170.	< 2,170.	8,760. d
Se	< 9.	< 18.	< 9.	< 9.	< 9.	< 210.
Ag	< 9.	< 15.	< 9.	< 15.	< 9.	< 15.
Na	302,000. c	284,000. c	319,000. c	315,000. c	318,000. c	303,000. c
Tl	< .5.	< 6.	< 9.	< 7.	< 7.	< 8.
Sn	< 64.	< 110.	< 64.	< 110.	< 64.	< 110.
V	< 6.	< 7.	< 6.	< 7.	6. d	98. d

a) Concentrations are reported in ug/L.
b) Sample concentration is less than X at 99% confidence.
c) Control measures indicate value is within 50% to 150% of actual concentration at 95% confidence and dissolved values are often biased high.
d) Control measures indicate value is within 75% to 125% of actual concentration at 95% confidence and dissolved values are often biased high.
e) Control measures indicate value is within 90% to 110% of actual concentration at 95% confidence.
f) Control measures indicate value was not quantified.

Table F-4 (continued)

Dissolved and Total Metals Analysis Results
for the Monitoring Well Samples
Rollins, Deer Park, TX

Element	Well MW-23 Dissolved Value (a)	Well MW-23 Total Value	Well MW-24 Dissolved Value	Well MW-24 Total Value	Well MW-25 Dissolved Value	Well MW-25 Total Value
Al	< 30. b	32,488. c	< 30.	6,688. c	< 30.	2,548. c
As	< 15.	< 6.	< 13.	< 7.	< 13.	< 7.
Ba	179. d	331. d	126. d	150. d	151. d	169. d
Be	< 1.3	1.9 d	< 1.3	< 1.3	< 1.3	< 1.3
Cd	< 10.	< 11.	< 10.	< 11.	< 10.	< 11.
Ca	71,100. d	124,000. e	63,200. d	74,700. e	64,900. d	73,700. e
Cr	< 9.	40. c	< 9.	< 11.	< 9.	< 11.
Co	< 6.	17. d	< 6.	< 6.	< 6.	7. d
Cu	< 7.	32. c	< 7.	< 22.	< 7.	< 22.
Fe	< 43.	31,758. c	< 43.	6,998. c	83. c	3,178. c
Pb	< 6.	38. d	< 6.	< 10.	< 6.	< 11.
Mg	40,000. d	48,900. d	38,000. d	39,700. d	36,500. d	38,300. d
Mn	28. d	325. d	19. d	80. d	80. d	115. d
Hg	< .1	< .1	< .1	< .1	< .1	< .1
Ni	< 12.	33. d	< 12.	< 12.	< 12.	20. d
K	< 2,170.	6,620. d	< 2,170.	< 2,170.	< 2,170.	< 2,170.
Se	< 11.	< 11.	< 10.	< 10.	< 11.	< 11.
Ag	< 9.	< 15.	< 9.	< 15.	< 9.	< 15.
Na	279,000. c	260,000. c	297,000. c	292,000. c	288,000. c	292,000. c
Tl	< 9.	< 7.	< 9.	< 5.	< 9.	< 9.
Sn	< 64.	< 110.	< 64.	< 110.	< 64.	< 110.
V	< 6.	69. d	< 6.	21. d	< 6.	9. d

a) Concentrations are reported in ug/L.
b) Sample concentration is less than X at 99% confidence.
c) Control measures indicate value is within 50% to 150% of actual concentration at 95% confidence and dissolved values are often biased high.
d) Control measures indicate value is within 75% to 125% of actual concentration at 95% confidence and dissolved values are often biased high.
e) Control measures indicate value is within 90% to 110% of actual concentration at 95% confidence.

Table F-4 (continued)

Dissolved and Total Metals Analysis Results
for the Monitoring Well Samples
Rollins, Deer Park, TX

Element	Well MW-26 Dissolved Value (a)	Well MW-26 Total Value	Well MW-35 Dissolved Value	Well MW-35 Total Value
Al	< 30. b	< 40.	< 30.	988. c
As	< 14.	< 5.	< 15.	< 6.
Ba	145. d	139. d	206. d	201. d
Be	< 1.3	< 1.3	< 1.3	< 1.3
Cd	< 10.	< 11.	< 10.	< 11.
Ca	54,000. d	51,200. e	90,500. d	87,200. e
Cr	< 9.	< 11.	< 9.	< 11.
Co	< 6.	< 6.	< 6.	< 6.
Cu	< 7.	< 22.	< 7.	< 22.
Fe	< 43.	< 110.	< 43.	998. c
Pb	< 6.	< 10.	< 6.	< 11.
Mg	32,300. d	30,400. d	59,500. d	56,800. d
Mn	24. d	24. d	64. d	66. d
Hg	< .1	< .1	< .1	< .1
Ni	< 12.	< 12.	< 12.	< 12.
K	< 2,170.	< 2,170.	< 2,170.	< 2,170.
Se	< 11.	< 11.	< 11.	< 11.
Ag	< 9.	< 15.	< 9.	< 15.
Na	279,000. c	263,000. c	345,000. c	328,000. c
Tl	< 6.	< 8.	< 14.	< 9.
Sn	< 64.	< 110.	< 64.	< 110.
V	< 6.	< 7.	< 6.	< 7.

a) Concentrations are reported in ug/L.
b) Sample concentration is less than X at 99% confidence.
c) Control measures indicate value is within 50% to 150% of actual concentration at 95% confidence and dissolved values are often biased high.
d) Control measures indicate value is within 75% to 125% of actual concentration at 95% confidence and dissolved values are often biased high.
e) Control measures indicate value is within 90% to 110% of actual concentration at 95% confidence.

Table F-5

Field Measurements and General Constituent Results
for the Monitoring Well Samples
Rollins, Deer Park, TX

	Station:	MW-02	MW-03	MW-06	MW-07	MW-08	MW-11	MW-12
Parameter	Units	Value	Value	Value	Value	Value	Value	Value
pH (a)	Units	7.5	7.2	7.2	7.	7.1	7.1	7.1
Conductance (b)	umhos/cm	900.	1200.	800.	1100.	1700.	2300.	1700.
Turbidity (c)	NTU	4.	4.5	4.	15.	1.5	15.	1.
POX (d)	ug/L Cl	1040.	< 5. e	27.	< 5.	< 5.	< 5.	< 5.
TOX (f)	ug/L Cl	9680.	< 30.	286.	100.	42.	< 30.	< 30.
NPOC (g)	mg/L C	4.6	.9	2.5	4.7	2.9	5.4	4.6
Ammonia	mg/L N	< .23	< .23	< .23	< .23	< .23	< .23	< .23
Chloride (d)	mg/L Cl-	125.	269.	216.	323.	336.	510.	462.
Sulfate (d)	mg/L SO4=	NQ h	20.	9.2	28.	18.	25.	22.
Cyanide	ug/L	< 10.	< 10.	< 10.	< 10.	< 10.	< 10.	< 10.
Phenol (d)	ug/L	42.	< 20.	< 20.	< 20.	< 20.	< 20.	< 20.

a) Control measures indicate values are within 0.5 units.
b) Control measures indicate values are within 200 uhmos/cm.
c) Values are of unknown reliability due to lack of control measures.
d) Control measures indicate values are with 75% to 125% of actual concentrations.
e) Sample concentration is less than X at 99% confidence.
f) Values are of questionable reliability because of conflicting control measure indications.
g) Values are of questionable reliability because of a large variability in the field triplicate sample values.
h) Control measures indicate value was not quantified.

Table F-5 (continued)

Field Measurements and General Constituent Results
for the Monitoring Well Samples
Rollins, Deer Park, TX

	Station:	MW-13	MW-21	MW-23	MW-24	MW-25	MW-26	MW-35
Parameter	Units	Value	Value	Value	Value	Value	Value	Value
pH (a)	Units	7.1	7.2	7.1	6.8	7.	7.1	7.
Conductance (b)	umhos/cm	1700.	1300.	1200.	1700.	1700.	1300.	2100.
Turbidity (c)	NTU	4.	200.	400.	100.	40.	1.	15.
POX (d)	ug/L Cl	< 5. e	< 5.	< 5.	< 5.	< 5.	374.	< 5.
TOX (f)	ug/L Cl	107.	< 30.	< 30.	32.	3840.	397.	< 30.
NPOC (g)	mg/L C	3.5	47.	19.	13.	14.	11.	.76
Ammonia (d)	mg/L N	< .23	< .23	< .23	< .23	.7	< .23	< .23
Chloride (d)	mg/L Cl-	322.	314.	328.	339.	341.	270.	588.
Sulfate (d)	mg/L SO4=	60.	32.	32.	34.	15.	< 5. h	28.
Cyanide	ug/L	< 10.	< 10.	< 10.	< 10.	< 10.	< 10.	< 10.
Phenol (d)	ug/L	< 20.	< 20.	< 20.	< 20.	23.	< 20.	< 20.

a) Control measures indicate values are within 0.5 units.
b) Control measures indicate values are within 200 uhmos/cm.
c) Values are of unknown reliability due to lack of control measures.
d) Control measures indicate values are with 75% to 125% of actual concentrations.
e) Sample concentration is less than X at 99% confidence.
f) Values are of questionable reliability because of conflicting control measure indications.
g) Values are of questionable reliability because of a large variability in the field triplicate sample values.
h) Value may be unreliable.

Table F-6

Organic Constituent Analysis Results
for the Leachate Samples
Rollins Environmental Services, Deer Park, TX

Compound	Station: LC-2 Value(a)	LC-3 Value	LC-6 Value	LC-7 Value
Carbon disulfide	40.	900.	ND b	ND
1,1,1-Trichloroethane	ND	ND	ND	74.
Trans-1,2-dichloroethene	36.	ND	ND	ND
Trichloroethene	25. c	ND	ND	34.
Tetrachloroethene	25. c	ND	ND	25. c
Methylene chloride	25. c	ND	25. c	28.
Vinyl chloride	50. c	ND	50. c	ND
Benzene	320.	500. c	ND	ND
Chlorobenzene	690.	500. c	48.	25. c
Ethylbenzene	1300.	20000.	25. c	25. c
Toluene	400.	500. c	ND	140.
Xylenes	220.	ND	ND	64.
Acetone	300.	20000.	100.	700.
2-Butanone	ND	1000.	4800.	2700.
4-Methyl-2-pentanone	290.	ND	ND	240.
Acrolein	ND	50000. c	ND	ND
Styrene	180.	700.	ND	ND
Aniline	1200.	ND	ND	ND
P-Chloroaniline	1600.	ND	ND	ND
1,2,4-Trichlorobenzene	ND	ND	ND	580.
Bis(2-chloroethyl) ether	ND	ND	ND	ND
Isophorone	10. c	ND	ND	ND
Naphthalene	100.	ND	ND	10. c
2-Methylnapthalene	20.	ND	ND	ND
Benzoic acid	ND	140000.	ND	ND
Phenol	140.	100000.	ND	1000.
2-Chlorophenol	47.	ND	10. c	ND
o-Cresol	240.	4000. c	14.	53.
p-Cresol	88.	18000.	ND	12.
2,4-Dimethylphenol	160.	ND	ND	ND
LOQ Factors				
Volatiles	5X	100X	5X	5X
Base/Neutrals	4X	2000X	4X	4X
Acids	4X	1600X	4X	4X
Pesticides	5X d	10X e	1X	1X f

a) Concentrations are reported in ug/L.
b) ND is not detected.
c) Compound is present but below the given limit of quantitation.
d) LOQ factor is 10X for the BHC isomers, heptachlor, heptachlor epoxide and aldrin.
e) LOQ factor is 100X for the BHC isomers, heptachlor, heptachlor epoxide and aldrin.
f) LOQ factor is 5X for the BHC isomers, heptachlor, heptachlor epoxide, aldrin and PCBs.

Table F-7

Dissolved and Total Metals Analysis Results
for the Leachate Samples
Rollins, Deer Park, TX

Element	LC #2 Dissolved Value (a)	LC #2 Total Value	LC #3 Dissolved Value	LC #3 Total Value
Al	< 30. b	170,000.	< 150.	194,000.
As	NQ c	220.	8,750.	8,990.
Ba	354.	1,070.	572.	1,020.
Be	< 1.3	< 13.	< 6.5	< 13.
Cd	< 10.	< 110.	65.	< 110.
Ca	48,700.	385,000.	308,000.	626,000.
Cr	< 4.	207.	< 20.	252.
Co	< 6.	95.	30.	121.
Cu	< 7.	123.	< 35.	132.
Fe	< 43.	171,000.	248.	183,000.
Pb	< 9.	78.	< 19.	76.
Mg	30,600.	92,500.	63,800.	121,000.
Mn	187.	2,380.	236.	2,030.
Hg	3.7	< 1.	< 1.	< 1.
Ni	24.	243.	287.	703.
K	115,000.	156,000.	1,150,000.	1,210,000.
Se	< 50.	< 170.	NQ	< 250.
Ag	< 9.	< 150.	< 45.	< 150.
Na	387,000.	362,000.	3,200,000.	3,120,000.
Tl	< 80.	< 80.	< 130.	< 120.
Sn	< 64.	< 1,100.	< 320.	< 1,100.
V	< 6.	344.	< 30.	400.
Zn	NQ	468.	NQ	509.

a) Concentrations are reportin ug/L.
b) Sample concentration was less than X at 99% confidence.
c) Control measures indicate value was not quantified.

Table F-7 (continued)

Dissolved and Total Metals Analysis Results
for the Leachate Samples
Rollins, Deer Park, TX

Element	LC #6 Dissolved Value (a)	LC #6 Total Value	LC #7 Dissolved Value	LC #7 Total Value
Al	< 30. b	465,000.	< 30.	929,000.
As	20.	< 70.	< 5.	81.
Ba	315.	3,640.	131.	6,230.
Be	< 1.3	29.	< 1.3	56.
Cd	< 10.	< 110.	< 10.	< 110.
Ca	45,000.	1,050,000.	37,000.	2,000,000.
Cr	< 4.	567.	< 4.	1,700.
Co	< 6.	198.	< 6.	490.
Cu	< 7.	413.	< 7.	1,030.
Fe	< 43.	446,000.	< 43.	919,000.
Pb	< 11.	370.	< 11.	540.
Mg	43,400.	220,000.	13,000.	357,000.
Mn	10.	6,520.	219.	14,200.
Hg	< 1.	14.	< 1.	1.6
Ni	< 13.	485.	14.	1,750.
K	3,940.	83,500.	13,800.	192,000.
Se	< 20.	< 240.	< 20.	< 1,700.
Ag	< 9.	< 150.	< 9.	< 150.
Na	362,000.	354,000.	63,000.	53,200.
Tl	< 70.	< 70.	< 12.	< 60.
Sn	< 64.	< 1,100.	< 64.	< 1,100.
V	44.	2,050.	< 6.	2,160.
Zn	NQ c	1,640.	NQ	2,720.

a) Concentrations are reportin ug/L.
b) Sample concentration was less than X at 99% confidence.
c) Control measures indicate value was not quantified.

Table F-8

General Constituent Results
for the Leachate Samples
Rollins, Deer Park, TX

Parameter	Station: Units	LC-2 Value	LC-3 Value	LC-6 Value	LC-7 Value
TOX	ug/L Cl	1590.	10900.	1120.	770.
NPOC	mg/L C	153.	3210.	49.	47.
Chloride	mg/L Cl-	899.	4990.	539.	NQ a
Sulfate	mg/L SO4=	60.	255.	32.	NQ
Phenol	ug/L	3800.	176000.	140.	1600.

a) Control measures indicate value was not quantified.

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