July 1988

EPA-330/2-88-042

Hazardous Waste Ground-Water Task Force

Evaluation of Acme Fill Corporation Martinez, California

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CALIFORNIA DEPARTMENT OF HEALTH SERVICES

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

July 18,1988

UPDATE OF THE HAZARDOUS WASTE GROUND-WATER TASK FORCE EVALUATION OF THE ACME FILL CORPORATION, MARTINEZ, CALIFORNIA

The Hazardous Waste Ground-Water Task Force (Task Force) of the United States Environmental Protection Agency (EPA) in conjunction with the California Department of Health Services (DOHS) and the Regional Water Quality Control Board (RWQCB) conducted an evaluation of the ground-water monitoring program at the Acme Fill Corporation (Acme) hazardous waste disposal facility, Martinez, California. The onsite field investigation was conducted over a ten day period from June 2 through 12, 1987. The Acme facility is one of 58 hazardous waste treatment, storage and disposal facilities (TSDFs) evaluated by the Task Force. The Task Force effort came about in light of concerns as to whether operators of hazardous waste TSDFs are complying with the State and Federal ground-water monitoring requirements.

The objectives of the Task Force evaluation were to:

- Determine the facility's compliance with the interim status ground-water monitoring requirements of 40 CFR Part 265 and the equivalent State requirements;

- Evaluate the ground-water monitoring program described in the RCRA Part B permit application for compliance with 40 CFR Part 270.14 (c) and the equivalent State requirements, if applicable;

- Determine if the ground water at the facility contains hazardous waste or 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), as amended.

The Task Force prepared the accompanying evaluation report, which revealed a number of deficiencies in the ground-water monitoring program at the Acme facility, as well as numerous violations of other RCRA requirements. The Executive Summary of the report discusses the findings related to the

objectives of the investigation. In summary: 1) the facility was not in compliance with the interim status ground-water monitoring requirements; 2) the monitoring program submitted with the Part B permit application was inadequate; 3) the ground-water samples from onsite wells contain hazardous waste constituents and 4) the facility was not in compliance with the ground-water monitoring requirements for the CERCLA offsite policy.

This update provides information on ground-water related activities by Acme, as well as measures taken by EPA Region IX and State agencies (DOHS and RWQCB) to bring the facility into compliance with RCRA and other State regulations since the Task Force inspection.

On July 23, 1987, Acme entered into an administrative consent order and judicial consent order with the California DOHS regarding the North Parcel. These two orders addressed violations which were observed by EPA Region IX and referred to DOHS for enforcement follow-up.

The administrative consent order (No. HWCA 86/87-005) required Acme to submit closure and post-closure plans and implement an approved closure plan. Acme submitted a closure plan in August of 1987 and a revised plan in March 1988. DOHS and EPA are currently reviewing the proposal. The plan went to public hearing on June 9, 1988. Approval of the closure plan, by DOHS and EPA, is anticipated by September 1988.

The judicial consent order placed Acme on a compliance schedule to address deficiencies identified by the Task Force inspection as well as other RCRA violations noted by the Task Force, the State and the Region. The order addresses: 1) the ground-water monitoring program, 2) the run-off management control system, 3) the leachate control system, 4) the contingency plan and 5) security measures. Acme was also prohibited from receiving additional hazardous waste, and from disposing of bulk liquids into the landfill. To date, Acme has complied with the schedule for submission of documents specified in the consent order.

Acme has submitted a workplan as required by the consent order, to correct deficiencies in the ground-water monitoring program. DOHS is reviewing the work plan and coordinating the regulatory agencies' response. DOHS must approve the plan before it is implemented.

In addition to the submittal of documents required by the administrative and judicial consent orders, Acme also agreed to cease acceptance of hazardous wastes, and to ensure that only non-hazardous wastes were accepted. A DOHS inspection on August 11, 1987 revealed that Acme had accepted asbestos wastes (a California hazardous waste, although not a RCRA hazardous

waste). The California Attorney General's office is currently pursuing a resolution of this issue.

This update completes the Task Force evaluation of the Acme Fill Corporation, Martinez, California.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF ENFORCEMENT AND COMPLIANCE MONITORING

EPA-330/2-88-042

HAZARDOUS WASTE GROUND-WATER TASK FORCE EVALUATION

ACME FILL CORPORATION
Martinez, California

July 1988

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EXECUTIVE SUMMARY

INTRODUCTION

Concerns have been raised about whether commercial and onsite 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), and amended by the Hazardous and Solid Waste Amendments of 1984 (HSWA).* In question is the ability of existing or proposed ground-water monitoring systems to detect contaminant releases from waste management units at these facilities. The Administrator of the Environmental Protection Agency (EPA) established a Hazardous Waste Ground-Water Task Force (Task Force) to evaluate these systems and determine current compliance. The Task Force comprises personnel from the EPA Office of Solid Waste and Emergency Response, Office of Enforcement and Compliance Monitoring, National Enforcement Investigations Center (NEIC), Regional Offices and State regulatory agencies.

During the summer of 1987, the Task Force investigated the Acme Fill Corporation (Acme), located near Martinez, California [Figure 1]. The onsite inspection was conducted from June 2 through 12, 1987 and was coordinated by NEIC personnel. The objectives of this investigation are similar to those for other Task Force investigations, namely:

- Determine compliance with interim status ground-water monitoring requirements of 40 CFR Part 265, as promulgated under RCRA, and the equivalent California regulations, as appropriate
- 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 or hazardous waste constituents

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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.*

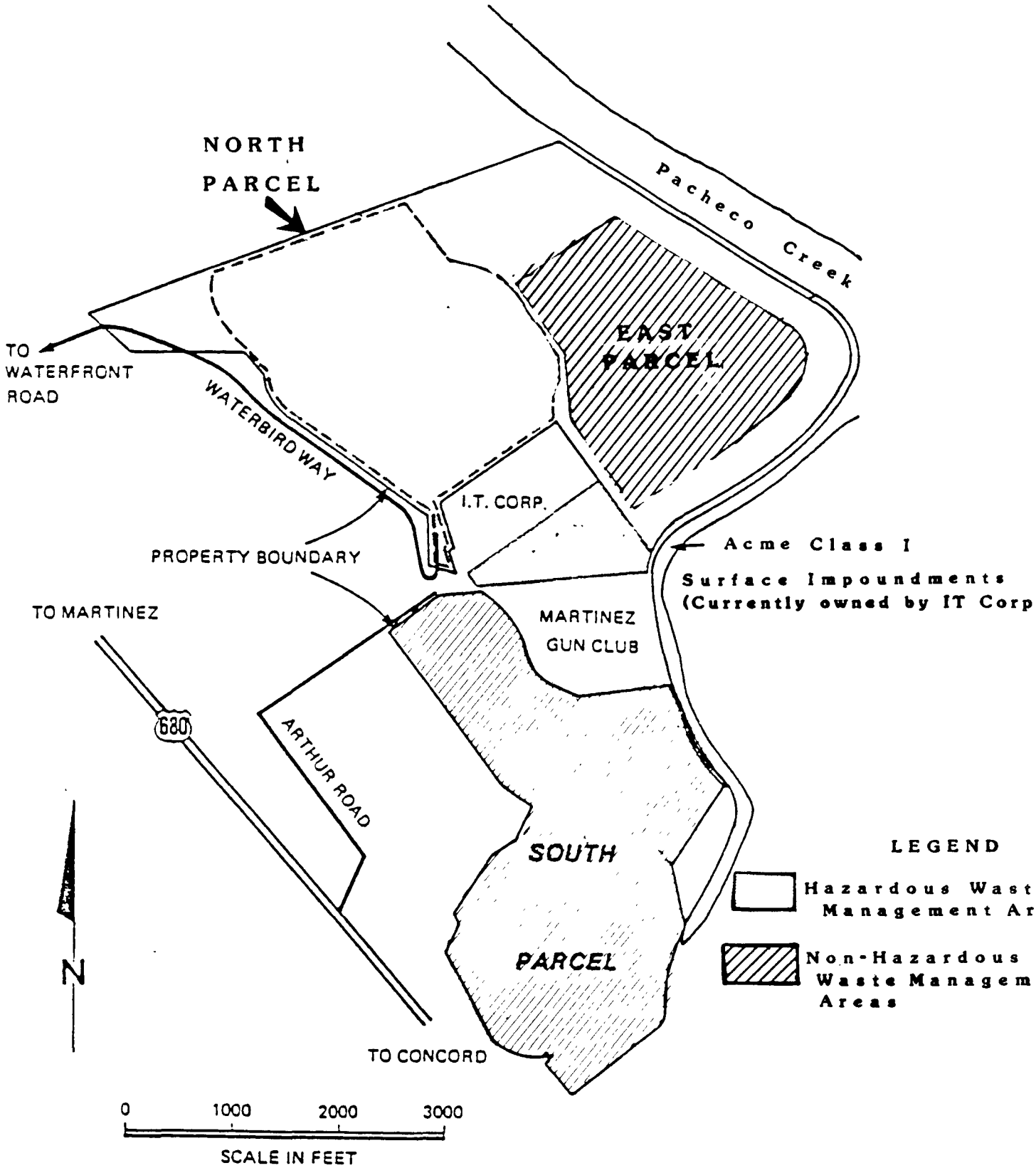

FIGURE 1
SITE MAP-ACME LANDFILL

Martinez, California

- 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).*

During the inspection, Task Force personnel evaluated compliance with interim status ground-water monitoring requirements of 40 CFR Part 265 and California equivalent regulations (Title 22 Article 22 of the California Hazardous Waste Management Regulations). The adequacy of the ground-water sampling and analysis plan, monitoring well construction and location, analysis of samples taken from the interim status monitoring wells and ground-water quality assessment program outline and plan were evaluated. Information was also obtained on present and past solid waste management units to aid in evaluating the well network and interpreting ground-water monitoring data. The evaluation involved: (1) review of State, Federal and facility records, (2) facility and laboratory inspections and (3) collection and analysis of both water level measurements and samples from ground-water monitoring wells.

Acme (EPA ID No. CAD041835695) has been used to dispose of municipal and industrial waste since 1949. The waste management units regulated by RCRA include a landfill (125-acre North Parcel, operated from 1980 to present), four surface impoundments (currently owned by IT Corporation), a leachate impoundment (in the North Parcel), an injection well (in the North Parcel) and two leachate storage tanks (in the North Parcel). Two additional landfills are used for nonhazardous waste disposal (East and South Parcels) and are not RCRA regulated. The leachate impoundment (operated 1981 to May 1986 in the North Parcel), the injection well (operated Spring 1985 to January 1986) and the two leachate storage tanks (operated mid-1986 to present) were never reported on the facility RCRA Part A or Part B applications, yet were in operation after November 1980 without interim status. None of these units underwent formal RCRA closure, nor were ground-water monitoring systems installed to detect releases from the units. The East and South Parcels (nonhazardous waste management areas) have ground-water monitoring systems.

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* *Policy, stated in May 1985 memorandum from Jack W. McGraw on "Procedures for Planning and Implementing Offsite Response", requires that TSDFs receiving CERCLA waste be in compliance with applicable RCRA ground-water requirements.*

Interim authorization was delegated to the California Department of Health Services (DOHS) on June 4, 1981. Under the EPA delegated program, DOHS further contracted portions of the State equivalent RCRA program to the State Water Resources Control Board (SWRCB) and the California Regional Water Quality Control Board (RWQCB). On January 31, 1986, the responsibility for the RCRA interim status program reverted back to EPA Region IX because the State failed to achieve Final Authorization for the RCRA program by that date, as required by RCRA Section 3006(c)(1). At the time of the Task Force inspection, the facility was required to comply with both Federal RCRA requirements and State Health Department hazardous waste regulations. DOHS is continuing to pursue Final Authorization for the RCRA program.

Between November 1981 and November 1982, no ground-water monitoring, pursuant to DOHS interim status document (ISD) requirements,* was conducted at Acme. On November 17, 1982, 1 year after the required date for implementation of the ground-water monitoring program, Acme requested a waiver of the ISD requirements from the RWQCB.

RWQCB approved the waiver on March 4, 1983 on the grounds that the existing self-monitoring program at Acme, under RWQCB Waste Discharge Requirements (Order 76-37), was "more appropriate" than the ISD requirements. The existing self-monitoring program did require ground-water monitoring but did not require numerous provisions of the ISD program, namely: (1) Designated upgradient and downgradient monitoring wells, (2) numerous inorganic and organic sampling parameters, (3) statistical analysis of quarterly monitoring data to determine if there had been a release of hazardous waste or hazardous waste constituents and (4) ground-water quality assessment outline or program. Following guidance from EPA, RWQCB rescinded the waiver and required Acme to initiate ISD ground-water monitoring in May 1985.

The facility submitted a ground-water monitoring program plan to RWQCB in May 1985 and a revised plan in August 1985. Two quarters of

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* *The Interim Status Document (ISD) was issued to existing waste management facilities, like Acme, as interim status permits under the Health and Safety Code, Division 20, Article 5.5, and were essentially equivalent to the Federal RCRA program. The ISD permit is the process used to adopt and enforce the Federal RCRA requirements at interim status facilities.*

monitoring were completed using the August plan. The program was further revised in February 1986. The current RCRA-equivalent monitoring well network consists of 26 wells around the North Parcel. These wells are sampled quarterly for interim status parameters. The facility identifies the first quarter of 1986 as the beginning of interim status detection monitoring. All the wells in the North Parcel were completed and sampled in 1985; however, all the remaining facility wells (34 additional non-RCRA/ISD wells around the South and East parcels) were not completed. At the time of the Task Force inspection six quarters of interim status ground-water monitoring data had been collected.

Acme submitted a RCRA Part B application to EPA Region IX in August 1983 for operation of the North Parcel landfill. California was never delegated authority to issue RCRA permits; therefore, review and issuance of a Part B permit has always been the responsibility of EPA. The Agency never completed the permit review because the facility reported that RCRA hazardous wastes (as defined in 40 CFR Part 261) had not been received since 1984. Task Force review of manifests indicates that RCRA wastes from offsite sources have been disposed of at the facility, at least until August 1985, and hazardous waste leachate was disposed of onsite until May 1986. The Task Force has, therefore, reviewed facility compliance with both ISD/RCRA interim status and RCRA Part B permit ground-water monitoring requirements.

SUMMARY OF FINDINGS AND CONCLUSIONS

The findings and conclusions presented reflect conditions existing at the facility in June 1987. Actions taken by the State, EPA Region IX and Acme subsequent to June are summarized in the accompanying update.

GROUND-WATER MONITORING DURING INTERIM STATUS

Task Force personnel evaluated the interim status ground-water monitoring program at Acme for the period between November 1981, when RCRA and applicable provisions of the RCRA-equivalent California Health and Safety Code became effective, and June 1987. The evaluation revealed that no RCRA equivalent interim status ground-water monitoring (ISD) program was implemented at Acme until the first quarter of 1986. The RWQCB approved a waiver request from Acme and substituted an alternative "self-monitoring program" in lieu of the ISD program which was effective between March 1983 and May 1985. The self-monitoring program, however, was not equivalent to the ISD (RCRA equivalent program).

The Task Force evaluated facility implementation of both the RWQCB self-monitoring and ISD monitoring programs and determined the implementation by Acme to be inadequate. The self-monitoring program was not appropriate as an alternative monitoring program because a waiver may only be approved if a low potential for migration of hazardous wastes can be demonstrated [ISD Section VIII (5)]. The waiver request was not granted under this provision. Acme was not in full compliance with the self-monitoring program requirements. The self-monitoring program is discussed further in the Technical Report.

Program components of the interim status equivalent program (implemented by Acme under the ISD in 1986), including the ground-water sampling and analysis plan and procedures, monitoring well network and assessment program outline and plan, did not comply with State or Federal RCRA requirements. Compliance with the ISD is discussed in the following sections.

Ground-Water Sampling and Analysis Plan

The ISD ground-water sampling and analysis plans submitted in August 1985 and revised in February 1986 are inadequate and do not comply with the ISD requirements in Section VIII (2)(a-c) or equivalent RCRA requirements in 40 CFR Part 265.92. The plans do not adequately detail the procedures followed for sample collection, sample preservation and shipment or analytical procedures. The forms presented for chain-of-custody control were adequate.

The August 1985 plan did not include information regarding: (a) methods and equipment for collection of samples, (b) procedures to measure total well depth, (c) accuracy of water level measurements, (d) method of determining purge volume, (e) calibrations and decontamination of field meters, (f) equipment and procedures for filtering samples, (g) procedures for collection and disposal of purge water, (h) procedures for preservation of samples, (i) a complete list of parameters, (j) a list of analytical methods or (k) a quality assurance/quality control program.

The February 1986 plan, although significantly more detailed than the August plan, still did not include details regarding: (a) methods and equipment for collection of purge and excess sample water, (b) method of determining purge volume, (c) calibration and decontamination of field meters, (d) equipment and procedures for filtering of samples, (e) a complete list of parameters or (f) a list of analytical methods. The plan also did not contain a sampling schedule, which is necessary because monitoring frequencies and parameter requirements change after the first year. Without these items, the sampling plan is deficient.

Sampling and Analysis Procedures

The contractor personnel for Acme, Harding Lawson Associates (HLA),* conducting the interim status sampling, did not follow the sampling and analysis procedures submitted in the August 1985 and February 1986 plans and,

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* *HLA provides Acme with hydrogeologic consulting, as well as, sampling and assistance with other aspects of RCRA compliance (e.g., sampling plans, permit applications, assessment outlines).*

therefore, did not comply with ISD requirements [Section VIII (2)(a)] or 40 CFR Part 265.92(c). In addition to not following the prepared sampling and analysis plan, the procedures used by HLA were inadequate. The contractor did not make the required water level measurements, use the sampling equipment specified or record field measurements. The plan required the total well depth to be measured quarterly and recorded to the nearest 0.01 foot. Sampling records indicate that the depths used to determine purge volumes are those from construction records rather than quarterly field measurements; therefore, sufficient purge volumes may not be extracted during purging. The depths recorded in construction records vary significantly from the current well depths and drilling logs, as demonstrated during the Task Force inspection. During the inspection, 23 of the 26 interim status wells were measured and found to vary significantly from the depths used by HLA (between 10.54 feet shallower to 6.42 feet deeper). The depths used by HLA were also recorded to the nearest 0.5 foot rather than the 0.01 foot required by the plan.

The facility does not use the equipment specified in the plan for purging wells. Conductivity, pH and temperature measurements taken in the field were also not recorded. The plan requires these measurements to be recorded on field data sheets.

Samples, collected for total metals analyses, are filtered in the field and then preserved with nitric acid to a pH < 2. The plan does not indicate that any samples will be filtered, and most metals are reported in analytical reports as total metals concentrations. If samples are filtered they must be reported as dissolved metals concentrations, instead of total concentrations, as currently reported by HLA.

The two methods used by the facility for disposal of purge water are inappropriate. Purge water for the majority of wells sampled is discharged from a bucket or pump directly to the ground adjacent to the well. Because this water may contain hazardous waste or hazardous waste constituents, it needs to be disposed of in a more environmentally sound manner. Water purged from wells along the southern border (IT Vine Hill property boundary) is collected in drums, but then the water from the drums is poured into the North Parcel hazardous

waste trenches, a violation of 265.314(b)* and (f).** Split samples given to Acme by the Task Force during the inspection were also disposed in the hazardous waste trenches, in the bottles provided, without being analyzed.

Task Force personnel inspected the laboratories contracted by Acme, which conduct the interim status analyses for ground-water samples. The inspection revealed analytical biases due to improper sample handling, improper analytical procedures and inadequate quality control methods for the majority of the parameters. The results of the laboratory evaluation are discussed further in the Technical Report.

Monitoring Well Network

The monitoring well construction procedures specified in the ground-water monitoring program were adequate; however, these procedures were not always followed and many discrepancies were discovered in well construction records. The construction records submitted to the State/EPA were often incomplete or inaccurate, when compared to field drilling records, as follows:

- No construction records for nine wells.
- Drilling depths on construction records do not match field records for five wells.
- Construction diagrams are inaccurate or incomplete regarding completion techniques (i.e., silt traps, cave-ins, hole size, cement volumes, etc.) for 21 wells.
- Sieve analyses were not performed for any of the monitoring wells, as required in the plan; therefore, the sand pack and screen size selections may be inadequate.
- Geologic descriptions were edited by HLA for 23 wells, and vary significantly from the drilling records for 9 of the wells. The descriptions, as edited, do not include important details available in the drilling logs. Some formation names were changed (e.g., did not include peat zones, or silty sands were called silty clays).

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* *Effective May 8, 1985, the placement of bulk or noncontainerized liquid hazardous waste or hazardous waste containing free liquids in any landfill is prohibited [265.314(b)].*

** *Effective the same date, placement of any liquid which is not a hazardous waste in a landfill is prohibited without authorization [265.314(f)].*

Additional construction problems were identified during the Task Force sampling, and include:

- Surface cement seals, installed around the wellhead to drain surface water away, were broken or missing at four wells (MW115, MW120, MW124 and G25).
- Locking well caps, to prevent unauthorized access and surface contamination, were missing at four wells (MW102, MW104, MW119 and G25).
- Surface casing was overflowing, indicating either inadequate cement seals or broken casing, at four wells (MW116, MW125, G15 and G20).
- Turbid samples were collected, suggesting deficiencies in the well construction and/or inadequate well development, at four wells (MW115, MW117, MW119 and G20).
- No abandonment records were available for three abandoned wells (G4, G6 and G14). Improperly abandoned wells can be conduits for migration of leachate into completion zones.

The uppermost aquifer and the hydrogeologic units that need to be monitored at the facility have not been adequately identified by Acme. Therefore, adequacy of the well locations (vertical and areal) cannot be verified because the ground-water flow zones, and the direction and rate of ground-water flow have not been defined. The facility designated upgradient/background well G6 is not adequate because it is completed into the bedrock rather than the unconsolidated formations, collectively identified by Acme as the uppermost aquifer (bay mud).

Under 40 CFR Part 265.91(a), the facility is required to further characterize water-bearing formations and determine the degree of interconnection, hydraulic gradients, flow directions and flow rates in the uppermost aquifer and any interconnected aquifers in order to adequately locate monitoring wells. Acme has not completed an adequate characterization.

Assessment Program Outline and Plan

An outline for a ground-water quality assessment program was required by the DOHS-issued ISD [Section VIII (3)] and 40 CFR Part 265.93, by November 19, 1981. Acme did not prepare the outline before the ground-water monitoring waiver was requested in 1982. After the waiver was rescinded in 1985, Acme did not prepare the assessment outline, as required. A report titled, "Comprehensive Ground-Water Monitoring Evaluation - FY85-86," was prepared by RWQCB and was sent to Acme on April 23, 1986, along with a cover letter. The cover letter delineated several areas of noncompliance, one being the lack of a ground-water assessment outline. Acme was requested to have a schedule for resolving the deficiencies by May 23, 1986.

Acme had not submitted an outline at the time of the Task Force inspection. The first outline was submitted in August 1987. The outline is required to describe a more comprehensive ground-water monitoring program capable of determining:

- Which 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 concentration of hazardous waste or hazardous waste constituents in the ground water

The August 1987 outline does not comply with the State or EPA regulations because:

- It does not address how the facility will verify that all contaminants have been identified in the plume.
- It does not address how the rate and extent of contamination would be determined, other than by review of existing data.
- It does not address how data triggering assessment would be evaluated to confirm apparent contamination.
- It was submitted to RWQCB for approval in August 1987, more than 5 years late.

Samples collected by Acme, under the RWQCB approved self-monitoring program (1983) contained elevated levels of total dissolved solids (TDS), total organic carbon (TOC), chlorides and conductivity when compared to the designated upgradient well (G6). (This well was first designated as an upgradient well in the Part B application, submitted in August 1983.) Volatile organics (including tetrahydrofuran, trichloroethylene and methylene chloride) and various heavy metals were also detected in several of the wells as early as 1983.

The facility had completed six quarters of interim status monitoring at the time of the Task Force inspection. No statistical analysis has ever been performed by the facility, as required by the ISD [Section VIII (3)(b-d)] and 40 CFR Part 265.93(b-d). A Task Force analysis of the data showed that at the end of the fifth quarter of monitoring (March 1987), had the facility performed the required statistical analysis, a statistically significant increase (or decrease for pH) would have been identified for several indicator parameters. All downgradient wells, 25 total, showed statistically significant increases (0.01 level of significance) in conductivity. Wells MW115 and G25 had an increase and decrease in pH, respectively, and 23 wells had significant increases in TOC. Total organic halide (TOX) data was not evaluated by the Task Force due to questioned validity of data because of high chloride concentrations in ground water beneath the site.

Based on the starting date for the interim status monitoring program, Acme should have initiated an assessment program, at a minimum in March 1987, at the end of the fifth quarter of interim status monitoring. The assessment program plan must specify:

- The number, location and depths of wells
- Sampling and analytical methods for those hazardous wastes or hazardous waste constituents at the facility
- Evaluation procedures, including any use of previously gathered ground-water quality information
- A schedule of implementation

Acme has never submitted an assessment program plan. The implementation of the assessment program must be in accordance with provisions and time tables specified in 40 CFR Part 265.93(d) and CAC* Title 22, Section 67194(a).

GROUND-WATER MONITORING PROGRAM PROPOSED FOR RCRA PERMIT

The ground-water monitoring portion of the RCRA Part B permit application, submitted to EPA Region IX on August 2, 1983 by Acme, does not comply with the requirements of 40 CFR Part 270.14(c).** The facility detected hazardous waste constituents in August 1982 (cadmium and lead), in wells at the point of compliance, at concentrations above the EPA-designated maximum contaminant levels [40 CFR Part 264.94]. Since heavy metals and volatile organics were detected at the point of compliance, before submission of the RCRA permit application, the application should have proposed a compliance monitoring system and submitted an engineering plan for a corrective action program [40 CFR 270.14(c)(7)] or adequate hydrogeologic characterization [40 CFR 270.14(c)(2)].

The permit application does not describe the plume of contamination [270.14(c)(4)], or the hazardous waste constituents in the plume [270.14(c)(8)]. The application also does not include the engineering plan required in 40 CFR Part 270.14(c)(7), which requires a feasibility plan for a corrective action program under 40 CFR Part 264.100.

The proposed detection monitoring program was not adequate because it did not characterize the hydrogeology, ground-water flow direction or rates, and proposed the use of inadequate existing self-monitoring wells in the system.

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* *The California Administrative Code (CAC) was revised effective January 1, 1988, and renamed the California Code of Regulations (CCR). However, at the time of the Task Force investigation, the CAC was in effect and is cited as such throughout this report.*

** *The State of California was never granted authorization to issue RCRA land disposal permits; therefore, Federal requirements are cited here.*

TASK FORCE SAMPLING AND MONITORING DATA EVALUATION

Results of the Task Force sampling and monitoring data evaluation indicate that the landfill is leaking hazardous waste constituents to the ground water.

Analysis of samples collected from the facility ground-water monitoring wells shows that volatile organics, metals, inorganics (e.g., SO_4 and Cl) and indicator parameters (TOC, TOX, pH, conductivity), as defined in 40 CFR Part 265.92(b)(3) are present in the designated downgradient wells at levels greater than those found in the designated upgradient well (G6). Furthermore, most of the constituents found in the wells were also found in the landfill leachate sampled from well NPGR5. The volatile organic and metals analyses of ground-water samples collected by the Task Force verify the data collected by HLA; however, several additional constituents were identified.

COMPLIANCE WITH CERCLA OFFSITE POLICY

The EPA offsite policy requires that any treatment, storage or disposal facility (TSDF) used for land disposal of waste from CERCLA response actions must be in compliance with the applicable technical requirements of RCRA. Interim Status facilities must have an adequate ground-water monitoring program to assess whether the facility has had a significant impact on ground-water quality. The Acme facility has not complied with the technical ground-water monitoring requirements for waste management facilities.

TECHNICAL REPORT

INVESTIGATIVE METHODS

The Task Force evaluation of Acme consisted of:

- Reviewing and evaluating records and documents from EPA Region IX, California Department of Health Services (DOHS), Regional Water Quality Control Board (RWQCB), State Water Resources Control Board (SWRCB), and Acme

- Conducting an onsite facility inspection June 2 through June 12, 1987

- Evaluating two offsite contractor laboratories

- Determining water level elevations in selected wells

- Sampling and subsequent analysis of ground water from selected wells

RECORDS/DOCUMENTS REVIEW AND EVALUATION

Records and documents from EPA Region IX and California State offices were reviewed prior to the onsite inspection. Additional state records were obtained by Task Force personnel during the onsite inspection. Facility records were reviewed to verify information currently in Government files and to supplement Government information where necessary. Selected documents requiring further evaluation were copied by Task Force personnel during the inspection. Records were reviewed to obtain information about facility operations, location and construction of waste management units and monitoring wells, and ground-water monitoring activities.

Specific documents and records that were requested and reviewed, if available, included the ground-water sampling and analysis plan. ground-water quality assessment program outline, analytical results from past ground-water sampling, monitoring well construction data and logs, site geologic reports, site operation plans, facility permits, unit design and operation reports, selected

personnel position descriptions and qualifications (those related to the required ground-water monitoring), and operation records showing the general types and quantities of wastes disposed of at the facility and their disposal locations.

FACILITY INSPECTION

A facility inspection was conducted to identify waste management units (past and present), to observe current waste management operations and pollution control practices, and to verify the location of ground-water monitoring wells and leachate collection sumps.

Company representatives supplied records and documents, answered questions about the information and explained: (1) past and present facility operations, (2) site hydrogeology, (3) the ground-water monitoring system and (4) the ground-water sampling and analysis plan. Ground-water samples are collected and analyzed by offsite contractors for Acme. Harding Lawson Associates (HLA) collects ground-water samples and Curtis and Tompkins Ltd. laboratories performs requested analyses. Personnel from HLA demonstrated sampling techniques and were questioned regarding sample collection, handling, analysis and document control. HLA personnel also provide hydrogeologic consulting and other services to Acme.

LABORATORY EVALUATION

The Curtis and Tompkins Ltd. laboratories in San Francisco and Los Angeles, California analyzed the majority of ground-water parameters for Acme during the interim status ground-water monitoring period (January 1986 through June 1987) evaluated by the Task Force. The laboratories were evaluated between June 2 and 11, 1987 to determine their ability to produce valid data. Analytical equipment and methods and quality assurance procedures were examined for adequacy. Laboratory records were inspected for completeness, accuracy and compliance with State and Federal requirements. The results of the evaluation are discussed in the "Sample Analysis and Data Quality Assessment" section of this report.

WATER LEVEL MEASUREMENTS AND SAMPLE COLLECTION

Sampling activities during the investigation included the following:

- Measuring total depth and water levels in 33 Acme-designated RCRA interim status monitoring wells
- Collecting ground-water samples from nine monitoring wells and a leachate sample from a former injection well
- Recording water levels in three monitoring wells continuously for approximately 48 hours

Task Force personnel measured water levels and total depth in 33 monitoring wells surrounding the North and East Parcel landfills [Table 1] to verify past Acme data. Wells adjacent to the Acme facility on the IT Vine Hill* property were measured at approximately the same time in order to compare water levels. All water levels were taken as close to low tidal phase as feasible in order to minimize tidal effects, if any, on the wells. Additional water level measurements were made on the wells sampled prior to purging the wells.

Samples were collected to determine if the ground water contains hazardous waste or hazardous waste constituents. Wells sampled were chosen for the proximity to hazardous waste management areas, depth of completion or historically containing hazardous waste constituents, when sampled by Acme [Figure 2]. Wells screened at different depths and geologic formations were chosen to sample a variety of horizons within the Acme-designated uppermost aquifer. Five of the wells (MW104, MW115, MW116, MW117 and G20) were drilled to depths of less than 40 feet and completed predominantly in a silty clay formation. One well, MW119, was drilled to a depth of 41 feet and completed in peat. Two wells, MW126 and

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* *The Acme property shares a common border with another hazardous waste disposal facility, International Technology (IT) Vine Hill and Baker properties. A Task Force inspection of the IT facilities took place during the same time frame as the Acme inspection.*

Table 1

WATER LEVEL ELEVATIONS

Well No.	Top of Casing Elevation* 5/18/87 (2)	Top of Casing Elevation (2, 4)	Water Level Elevations (1)	Total Well Depth (1)	Water Table Elevations (2)	Date	Time (3)	Screened Interval (5)
MW101	16.18	16.11	8.25	14.89	7.93	06/03/87	0945	S/C
MW102	26.35	21.75	6.73	42.42	19.62	06/03/87	1000	PT/C
MW103	22.33	22.49	15.97	30.45	6.36	06/03/87	1035	PT/C
MW104	13.43	13.34	8.28	21.67	5.15	06/03/87	1055	S/C
MW105	10.15	10.12	6.38	16.44	3.77	06/03/87	1115	C
MW106	5.64	6.39	0.10	19.05	5.54	06/03/87	1105	PT/C
MW107	3.80	3.71	5.02	18.29	-1.22	06/03/87	1140	C
MW108	8.84	8.71	7.54	20.46	1.30	06/03/87	1025	C
MW109	8.22	8.63	3.51	20.49	4.71	06/03/87	1155	PT
MW110	7.19	7.84	3.84	20.48	3.35	06/03/87	1120	PT/C
MW111	7.92	8.09	2.72	-	5.20	06/02/87	1230	S/C
MW113	5.62	5.70	4.36	18.45	1.26	06/03/87	1350	C
MW114	16.09	11.77	4.43	35.25	11.66	06/03/87	1420	PT
MW115	20.05	20.29	4.97	37.54	15.08	06/03/87	1410	C
MW116	17.12	17.47	2.12	36.95	15.00	06/03/87	1440	C
MW117	11.18	11.39	6.2	26.59	4.98	06/02/87	1520	PT/C
MW118	13.10	13.37	1.43	26.02	11.67	06/02/87	1455	PT
MW119	19.10	14.50	4.82	41.29	14.28	06/02/87	1405	PT
MW120	4.61	4.63	4.46	16.10	0.15	06/03/87	1515	C
MW121	5.88	5.82	4.48	16.65	1.40	06/03/87	1740	C
MW122	3.48	3.41	5.71	16.83	-2.23	06/03/87	1715	C
MW123	2.61	2.57	6.43	15.51	-3.82	06/03/87	1640	C
MW124	10.36	10.75	4.04	23.06	6.32	06/03/87	1430	PT/C
MW125	-	-	-	-	-	-	-	C
MW126	-	6.63	2.88	69.45	-	06/03/87	1345	C
MW128	13.15	-	5.72	65.5	7.43	06/02/87	1435	PT/C
G6A	36.14	-	29.26	36.44	6.88	06/03/87	0825	SS/SH
G14	3.60	3.58	-	-	-	-	-	PT/C
G15	9.23	4.01	-	-	-	-	-	PT/C/S
G18	4.10	4.11	5.69	19.04	-1.59	06/03/87	1525	C
G19	4.38	4.36	1.57	18.56	2.81	06/03/87	1445	C
G20	5.66	5.90	3.28	17.70	2.38	06/03/87	1400	C
G24	13.16	13.45	11.03	20.88	2.13	06/03/87	1455	C
G25	9.85	10.21	4.78	15.35	5.07	06/03/87	1400	C
G30	4.54	4.48	0.23	98.69	4.31	06/03/87	1600	S/G/C
G31	6.07	6.02	1.43	33.75	4.64	06/03/87	1555	S
G32	5.69	5.9	1.03	40.20	4.66	06/03/87	1540	S/G

* *Most recent measurement used by Task Force personnel*

1 *Measurement recorded in feet below the top of the surface casing*

2 *Elevations recorded in feet above/below mean sea level*

3 *Rounded to nearest 5 minutes*

4 *Elevations reported in 02/04/86 Harding Lawson Associates report titled "Implementation of Ground-Water Monitoring Plan; Acme Landfill"*

5 *Geologic units S/C - sand and silty clay units, PT/C - peat and silty clay units, C - silty clay, PT - peat, SS/SH - sandstone and shale units, S/G - sand and gravel units, S/G/C - sand, gravel, and silty clay units*

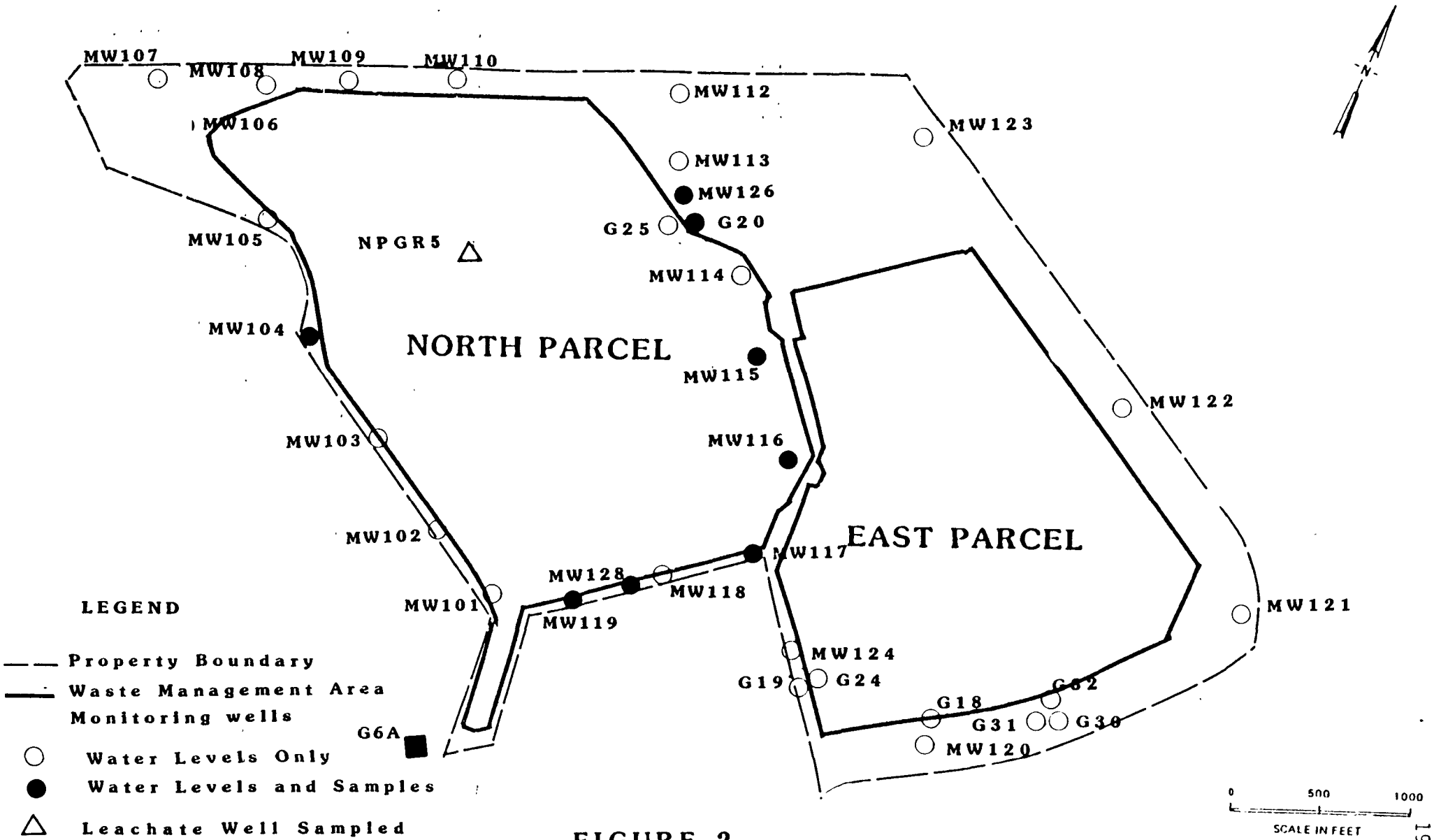

FIGURE 2

TASK FORCE SAMPLING LOCATIONS

MW128 were drilled to depths of approximately 65 feet and completed in peat and clay, respectively. The final well chosen was G6 (formerly G6A), the facility-designated upgradient well. One leachate monitoring well, NPGR5, was also sampled to characterize constituents in the leachate.

All samples were collected by an EPA contractor, Versar, Inc., Springfield, Virginia and sent either to NEIC (contract funds were not available for analysis of some wells) or contractor laboratories for analysis. Analytical data and methods, which were used by the Task Force for Acme samples, are presented in Appendix A. Duplicate volatile organic samples and split samples of other parameters were offered to Acme. Samples were accepted by the facility the first day of sampling and declined thereafter. The split and replicate samples provided to Acme for wells G6A, MW119, a field blank and a trip blank were later discovered to have been disposed of in Acme's "winter" hazardous waste disposal trench. Both EPA Region IX and California declined split samples.

None of the Acme-designated RCRA wells were equipped with pumps, therefore, the EPA contractor supplied purging and sampling equipment for each well sampled. Sample collection procedures were as follows:*

1. Acme contractor personnel unlocked the wellhead.

2. The open wellhead was checked for chemical vapors [PhotovacTIP® and organic vapor analyzer (OVA®)] and radiation.**

3. The depth to ground-water was measured using an oil/water sonic Interface Probe (Moisture Control Co., Inc. Model B2220-3) [Table 1] and recorded to the nearest 0.01 feet.

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* *Unless specified, the EPA contractors conducted the work.*

® *Photovac TIP and OVA are registered trademarks and appear hereafter without ®.*

** *Using Ludlum Survey meter model M44-9*

4. The Interface Probe was lowered through the water column until the bottom of the well was reached, and the total depth was recorded to the nearest .01 foot.

5. The Interface Probe was retrieved from the well bore. The cable and probe were decontaminated after each use with a pesticide-grade hexane wipe, followed by a distilled water rinse and wiped dry.

6. The well was relocked. The water levels were taken at selected wells on the first 2 days of the inspection and then the wells were locked until they were sampled later in the inspection.

7. When a well was ready to be sampled, HLA personnel reopened the wellhead.

8. Water level measurements were made before purging, as discussed in steps 3 and 5 above.

9. Water-column volumes were calculated using the height of the water column and the well casing radius.

10. Three water-column volumes were purged using equipment specified in Table 2 and the purge water was collected in a 4-gallon plastic bucket (marked in quarts). Purge water was either poured on the ground at a distance from the well (if the well historically showed no contaminants) or stored in barrels for facility disposal (if historically containing contaminants), as per facility procedures.

11. A sample aliquot was collected at the beginning, middle and end of the purge for temperature, specific conductance and pH measurements. Table 3 presents information on sample collection.

Table 2

PURGING RECORD

Well No.	Total Well Depth (1)	Top of Surface Casing Elevation (2,4)	Water Level Elevations (1)	Total Volume of Water Purged (Gallons)	Date	Time (3)	Methods/Remarks
MW104	21.67	13.43	8.63	20	06/09/87	0820-0915	Teflon bailer, well purged dry green, slight sulphur odor
MW115	36.95	20.05	4.02	26	06/08/87	0820-0945	Teflon bailer, well purged dry
MW116	36.95	17.12	1.04	26.25	06/08/87	0755-0905	Teflon bailer, well purged dry yellow, silty purge water
MW117	26.59	11.18	4.85	18	06/05/87	1430-1445	Keck pump, well purged dry yellow odoriferous purge water
MW119	41.29	19.10	4.37	30	06/04/87	0955-1030	Keck pump, well purged dry
MW126	69.45	-	2.85	128	06/08/87	1240-1450	Keck pump
MW128	65.50	13.15	5.75	1.20	06/04/87	1435-1610	Keck pump
G20	17.70	5.66	1.82	21	06/08/87	1000-1045	Teflon bailer, well purged dry yellow/brown purge water
G6A	36.44	36.14	29.26	4.5	06/03/87	0855-0930	Teflon bailer, well purged dry

1 *Measurements recorded by Task Force personnel in feet below the top of the surface casing.*
2 *Elevations recorded in feet above mean sea level*
3 *Rounded to nearest 5 minutes*
4 *Top of casing elevation as recorded by Harding Lawson Associates on 05/18/87*

Table 3

SAMPLING RECORD

Well No.	Date	Time (1)	Sample No.	Methods/Remarks
MW104	06/09/87	1055-1125	MQB417	Teflon bailer
Field Blank	06/09/87	0810-0825	MQB418	Field blank poured at MW104
MW115	06/08/87 06/08/87	1130-1150 1550-1605	MQB413	Teflon bailer
MW116	06/08/87 06/08/87	1045-1100 1620-1645	MQB412	Teflon bailer
MW117	06/08/87 06/09/87	1515-1520 0945-1015	MQB415	Teflon bailer, sample very black and sediment filled, bailer oily
MW119	06/04/87 06/05/87	1245-1335 0810-1020	MQB405 MQB406 MQB407	Teflon bailer, triplicate sample, sample very green/black
Field Blank	06/04/87	0855-1000	MQB404	Field blank poured at MW119
MW126	06/08/87	1520-1535	MQB416	Teflon bailer
MW128	06/04/87	1615-1655	MQB409	Teflon bailer, matrix spike, sample has yellow tinge
G20	06/08/87	1235-1325	MQB414	Teflon bailer, sample is yellow but not turbid
G6A	06/03/87 06/04/87	1550-1630 0820-0855	MQB402	Teflon bailer
NPGR5	06/05/87	1015-1120	MQB410	Teflon bailer
Eqp. Blank	06/04/87	1215	MQB408	Equipment blank, through the Keck pump
Eqp. Blank	06/05/87	1530	MQB411	Equipment blank, through a Teflon bailer
Trip Blank	05/27/87	0900	MQB401	Prepared at contract lab Sent into field

1 Rounded to nearest 5 minutes

12. Sample containers were filled in the order specified in Table 4 using dedicated Teflon® bailers. All samples collected from the monitoring wells were filled directly from the Teflon bailers. Split samples were collected by filling one-third of each sample bottle for Acme and Task Force, respectively, from the bailer until each bottle was filled. If the volume in the bailer could not fill one-third of each bottle, the bailer was divided equally between the bottles.

Table 4
ORDER OF SAMPLE COLLECTION,
BOTTLE TYPE AND PRESERVATIVE LIST

Parameter	Bottle	Preservative*
Volatile organic analysis (VOA) purge and trap	2 60-ml VOA vials	
Purgeable organic carbon (POC)	2 60-ml VOA vials	
Purgeable organic halogens (POX)	2 60-ml VOA vials	
Extractable organics	6 1-qt. amber glass	
Dioxin/Furans	2 1-qt. amber glass	
Total metals	1 1-qt. plastic	HNO_3
Total organic carbon (TOC)	1 4-oz. glass	H_2SO_4
Total organic halogens (TOX)	1-qt. amber glass	
Phenol	1-qt. amber glass	$CuSO_4 + H_3PO_4$
Cyanide	1-qt. plastic	NaOH
Anions	1-qt. plastic	
Sulfides	1-qt. plastic	

* *All samples were stored on ice immediately after collection and during transport to the analytical laboratories.*

13. Samples were placed on ice in an insulated cooler.

14. Samples were taken to a staging area immediately after collection, where the samples were preserved [Table 4].

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The order of sample aliquot collection was modified when slow recharge prevented collection of all aliquots at one time. In these cases (wells MW115, MW116, MW117, MW119, and G6) organic samples were collected within 2 hours following purging; the remaining aliquots were collected as soon as recharge had provided a sufficient volume of water.

The EPA contractor prepared field blanks for each analytical parameter group (e.g., volatiles, organics and metals) twice during the investigation (near wells MW104 and MW119) by pouring distilled, deionized water into sample containers. Two equipment blanks were poured, one through a laboratory cleaned Teflon bailer and the other through the Keck pump. The pump equipment blank was taken to verify the field decontamination. One trip blank for each parameter group was also prepared during the inspection and submitted to the laboratory. The blanks were submitted with no distinguishing labeling or marking to identify them as blanks.

In addition to the blank samples, matrix spike and triplicate samples were taken for analytical quality assurance/quality control purposes. One laboratory matrix spike sample, which consisted of two duplicate VOA vials and two 1-liter amber glass bottles, was collected at well MW128. A laboratory triplicate of all parameter groups was collected at well MW119.

During collection of all samples, Task Force personnel complied with safety procedures contained in EPA 1440-Occupational Health and Safety Manual (1986 edition); Agency orders and applicable provisions of the NIOSH/OSHA/USCG/EPA Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities. OVA and/or HNU photoionization readings above background in the breathing zone were encountered at wells MW110, MW115, MW117, MW118, MW119, MW126 and MW128 during water level measurements or sampling; therefore, sampling personnel wore respiratory protection. These wells are thought to have had methane present since the OVA readings were higher than the HNU readings. Drager® tubes for vinyl chloride (0.5/a) were used when HNU readings were above background

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® *Drager is a registered trademark and will be shown hereafter without ®.*

(MW115, MW118 and NPGR5) in the breathing zone. The Drager tube readings for these wells were <0.5, <0.5 and >3 parts per million (ppm), respectively. Personnel sampling NPGR5 wore self-contained breathing apparatus, because respirator cartridges break through at 1 ppm of vinyl chloride and the threshold limit value is 5 ppm. The vinyl chloride Drager tubes have sensitivities to numerous chlorinated hydrocarbons [Appendix B]. Vinyl chloride was not detected in any of the samples analyzed; however, other chlorinated hydrocarbons were detected.

At the end of each day, Task Force samples were packaged and shipped according to applicable U.S. Department of Transportation (DOT) regulations (49 CFR Parts 171-177) to either the two EPA contract laboratories or the NEIC laboratory. Acme personnel were given receipts for all samples collected. EPA chain-of-custody procedures were followed during the handling, transfer and shipping of all samples.

Following collection of all ground-water samples, Versar installed ISCO® meters to continuously record the water levels in each of the three monitoring wells chosen [Figure 3]. These wells were chosen for their proximity to the East Parcel dikes along Pacheco Creek and represented the highest potential for detection of tidal influences, if present. The procedures listed in Appendix C were followed when assembling, calibrating and operating the ISCO water level meters. The ISCO meters were all shown to be accurate through repetitive water level measurements using the Interface Probe [Table 5].

® *ISCO is a registered trademark for Instrumentation Specialties Company and will be shown hereafter without ®.*

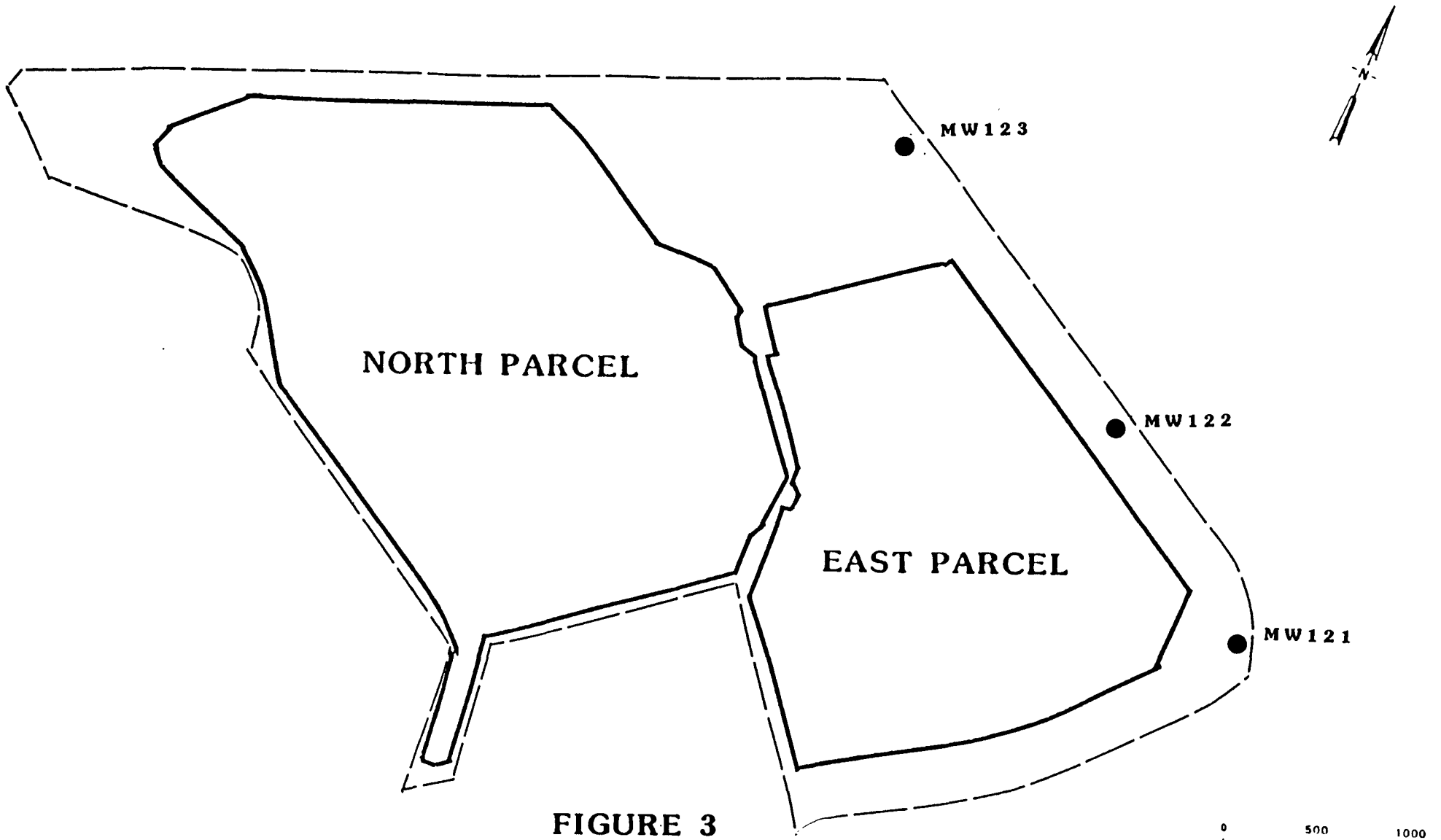


FIGURE 3

WELLS MONITORED WITH ISCO METERS

Table 5

ISCO METER VERIFICATION

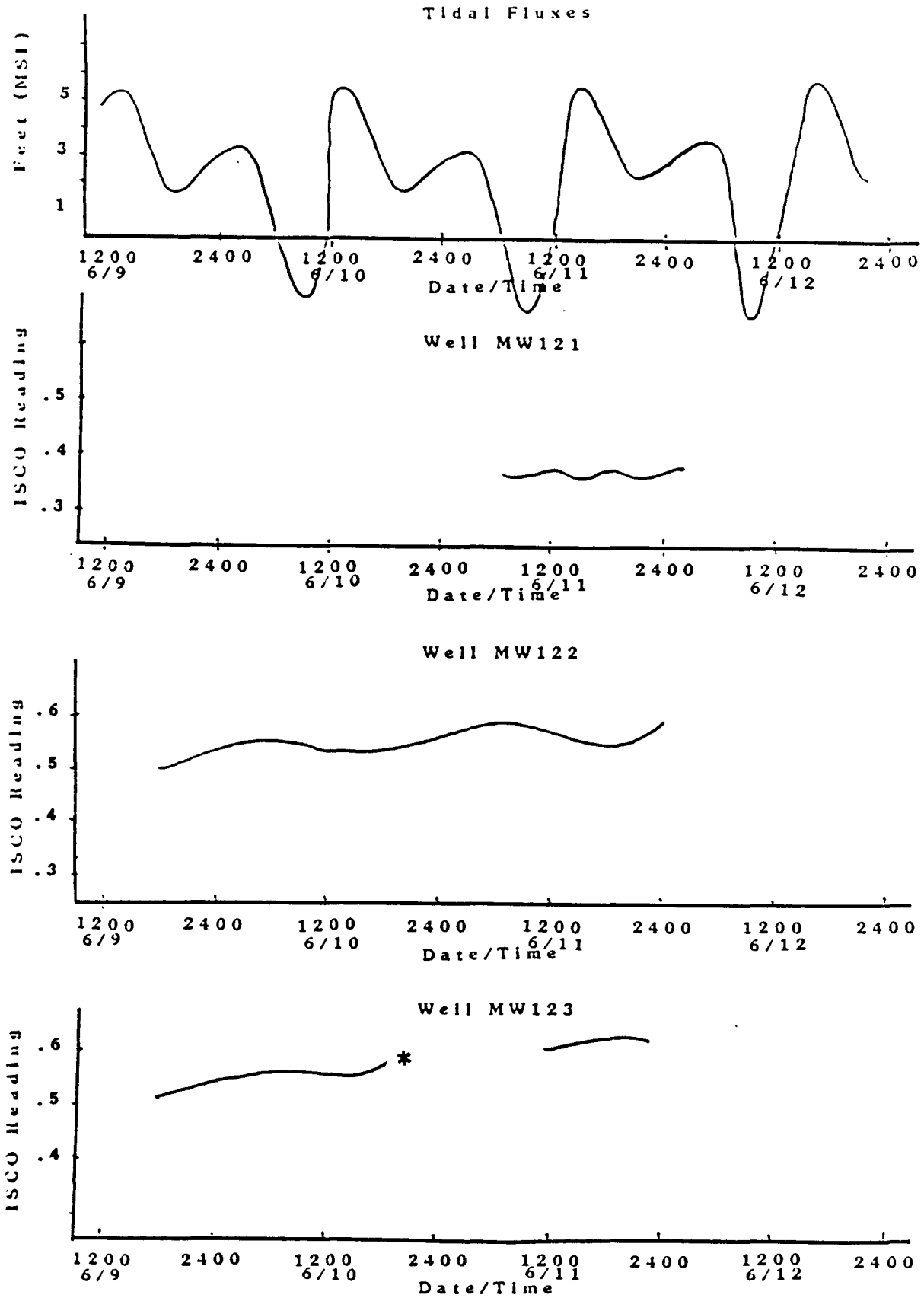
Date	Time	ISCO Display (ft.)	Water Level (ft.)
		Well MW121	
6/11	0759	1.512	4.33
6/11	1308	1.493	
6/11	1606	1.511	
6/12	0820	*	4.39
		Well MW122	
6/9	1652	1.499	5.41
6/10	0930	1.607	
6/10	1430	1.578	5.4
6/11	0820	1.698	5.3
6/11	1313	1.660	
6/11	1611	1.642	
6/12	0805	1.731	5.26
		Well MW123	
6/9	1621	1.501	5.41
6/10	0919	1.621	
6/10	1448	1.655	5.47
6/11	0842	1.764*	5.13
6/11	1319	1.777	
6/11	1616	1.790	
6/12	0748	*	5.03

* *ISCO meter stopped functioning due to low power source, battery replaced .*

The ISCO meters recorded water level fluctuations for a 2- to 3-day period and showed regular sine wave fluctuations (particularly in wells MW121 and MW122); however, the sine waves [Figure 4] were not in sequence with the tidal changes. IT performed a tidal study in 1975 and determined that wells completed in the upper bay mud showed tidal fluctuations which closely correlated to the tidal phases. The length of time the Acme wells were monitored during the Task Force investigation was too short to draw any significant conclusions regarding tidal influences.

The facility personnel could not provide a pumping schedule for the onsite leachate wells, and stated that the wells pump automatically when the leachate level reaches a specific level in the sumps. Water level fluctuations of up to two-tenths of a foot were observed in well MW122. The cause of these fluctuations and their effects on water levels across the facility must be determined to adequately interpret water level data obtained during quarterly monitoring. Pumping wells and/or tides may significantly affect water levels and define when water levels should be taken during quarterly monitoring to determine hydraulic gradients.

FIGURE 4
TIDAL AND ISCO METER FLUXES



* Battery Stopped

FACILITY DESCRIPTION AND OPERATIONS

The Acme landfill is a California Class II-1 [Table 6] disposal facility that currently receives designated wastes, as defined in Title 22 of the California Administrative Code (CAC). In addition to the RWQCB approved designated wastes, Acme also disposes of asbestos, municipal waste, construction waste and infectious waste.

Waste handling units and operations were identified during the Task Force inspection to determine whether hazardous waste or hazardous waste constituents handled at Acme might enter the ground water. At the time of the Task Force inspection, Acme was using two above-ground storage tanks for the storage of RCRA hazardous waste leachate. The tanks are not included on the Part A or Part B permit applications, and, therefore, did not have interim status.

Past operations included disposal of RCRA hazardous wastes in landfills, surface impoundments and an injection well. Figure 5 shows the location of all known past and present Acme storage and disposal units. A discussion of waste management units related to groundwater monitoring at the Acme site follows. This discussion is divided into two major areas: (1) Units subject to RCRA/ISD interim status regulations and (2) units not subject to RCRA/ISD interim status regulations but which may have released contaminants to the ground water.

INTERIM STATUS REGULATED WASTE MANAGEMENT UNITS

North Parcel Landfill

The North Parcel [Figure 5] was first used in 1949. It is bounded on the west by the Diablo Range, on the north by the Southern Pacific Railroad tracks and Waterfront Road, and on the south and east by Pacheco Slough. Waste loads were dumped directly on the ground surface (top of bay mud) and burned. In the late 1950s the practice of open burning ceased and the unengineered landfill was created when municipal and demolition wastes were co-disposed with industrial wastes. As before, no liner was constructed and wastes were disposed of by area filling, directly on the bay mud and on top of existing fill.

Table 6

CALIFORNIA HAZARDOUS WASTE MANAGEMENT UNIT CLASSIFICATIONS*

Classes of Waste Management Units	Description
	Part I
Class I	Accepts hazardous and State designated** wastes Underlain by materials $1x10^{-7}$ permeability Includes sites formerly classified as Class I and Class II-1
Class II	Accepts designated wastes as long as they are adequately contained Underlain by a liner or materials of $1x10^{-6}$ permeability Nonhazardous wastes as long as they do not render designated wastes hazardous
Class III	Accepts nonhazardous wastes Dewatered sewage or water treatment sludge but must have leachate collection and removal

Groups of Wastes (pre-1984 name)	Description
	Part II
Group I	Hazardous waste
Group II	Designated wastes**
Group III	Nonhazardous solid waste - municipal refuse

* *Summarized from CAC Title 23, Chapter 3, Section 2522, revised 1984.*

** *Designated waste is nonhazardous waste which consist of pollutants which, under ambient environmental conditions, could be released at concentrations in excess of applicable water quality objectives or which could cause degradation of waters of the State, or hazardous waste which has been granted a variance under Section 66301 of Title 22 (CAC Title 23, Chapter 3, Section 2522).*

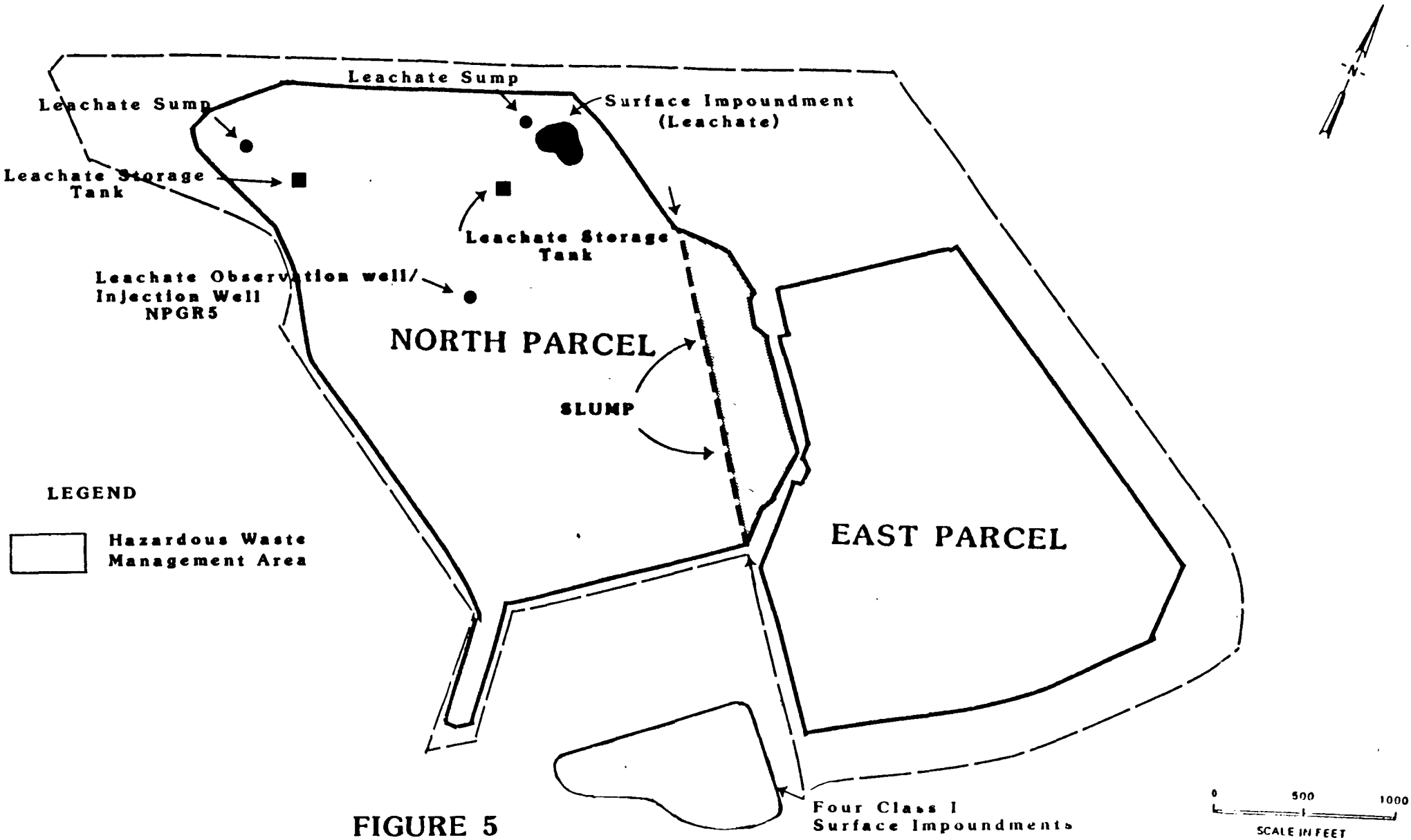


FIGURE 5

ACME HAZARDOUS WASTE MANAGEMENT UNITS

Approximate Location

Hazardous and nonhazardous wastes were commingled and compacted at the working face. During that time period, the wastes were not always covered at the end of the day. The lack of cover allows percolation of rainfall into the landfill which causes leachate generation and compromises the structural integrity of the landfill.

In the 1960's and early 1970's, area filling and co-disposal of municipal and industrial wastes continued. By 1975 the fill height was approaching 40 feet. At that time, the landfill was estimated, by HLA, to be receiving 1,100 tons per day of refuse from commercial haulers, 150 tons per day of various refinery wastes, and an unspecified amount from the general public.

Studies were performed by HLA in 1973 and 1975 in order to obtain a permit to operate a Class II-1 landfill. Borings were drilled through the bay mud to obtain information about the subsurface. At least five of the borings were drilled through the existing North Parcel and were backfilled with pea gravel. A 20-foot length of perforated PVC was installed near the surface of each so that ground-water samples could be taken later. This method of well completion has compromised any natural liner capabilities of the bay mud and could provide a pathway for vertical contamination from the North Parcel directly to the ground water.

In December of 1978, a rotational slump failure occurred along the southeastern slope of the North Parcel [Figure 5]. The exact cause of the failure was not known. The slump displaced a Contra Costa County Sanitary District (CCCSD) sewer line 5 to 10 feet and threatened the structural integrity of the Acme-owned, IT-operated Class I disposal ponds at the toe of the slope. The toe moved 50 to 75 feet horizontally.

Radial cracks and two large fissures developed in the slumped area, as it slid toward the wetland. Leachate escaped from the cracks into the wetland. The area was regraded, compacted and covered with soil. The fissures were closed and regraded.

The slump could have been caused by the method of construction and operation of the landfill, since design specifications were not followed. Other

possibilities include differential settlement, structural damage from a potentially ruptured sewer line, or displacement along the Concord Fault, which runs underneath the East Parcel.

Acme did not construct the North Parcel according to the HLA design, which specified that the toe of the fill was to be located at least 50 feet from any adjacent improvements such as levees or sewer lines to accommodate expected settlement. The toe of the fill was placed against the dike of the IT-operated Class I Ponds and less than 50 feet from the CCCSD sewer line. Recommended compaction studies were not performed, and the 85% design compaction rate may not have been achieved. The HLA design of the North Parcel may have underestimated the time needed for the bay muds to consolidate and gain strength under the waste loading. The height of the fill was estimated to be 63 feet at the time of the failure; the design height was only 60 feet. When questioned at that time, Acme representatives said that there were no known limits on fill height.

The CCCSD sewer line, parallel to the eastern slope of the North Parcel, was displaced 5 to 10 feet to the east by the slope failure. The sewer line was ruptured, discharging treated effluent to the adjacent wetlands. To relieve the pressure on the sewer line, thousands of tons of waste material were moved from the slide area to the northwest portion of the North Parcel. The CCCSD repaired the sewer line by re-aligning the pipe and packing bay mud around it.

Acme monitors settlement of the landfill and displacement of nearby soils with a series of inclinometers. The inclinometers are placed into the bay mud and are allowed to settle for about 1 month before readings are taken. The deflections noted are measured in inches. The Waste Discharge Requirements (Order 84-18) issued on February 6, 1978, required Acme to prepare and submit quarterly slope stability reports to RWQCB, including both an analysis of the slope stability data and the data itself.

Acme relies on the natural features of the *in-situ* bay mud to restrict vertical migration of leachate. The integrity of the bay mud as a liner is questionable. The permeability and continuity of the bay mud beneath the North Parcel is not known because it was covered with fill material when the first

engineering studies were performed. HLA studies have stated that sand lenses exist in the bay mud and that the bay mud has a maximum permeability of at least 1 x 10^{-6} cm/sec. Seepage and ponding observed outside of the clay barriers, wet areas around ground-water monitoring wells, and water levels indicative of artesian conditions are evidence that the leachate mound may be penetrating the bay mud and contaminating the ground water.

This landfill presently occupies about 125 acres and accepts Groups I, II and III waste [Table 6]. Available documentation indicates that RCRA wastes were accepted from offsite facilities between 1980 and 1985. The trench method of landfilling is currently in use. The trenches are excavated into existing fill, and are in use from 1 to 6 months, depending on the volume of incoming waste. The trenches are typically 15 feet deep by 12 feet wide by 50 to 600 feet long.

Acme has designated one trench as a "winter trench," because it was designed with a pad to allow access during wet weather. The remaining trenches are designated "summer trenches." A truck wash is located at the winter trench. For years, both hazardous and nonhazardous waste hauling vehicles have washed their trucks out at this location, allowing contaminated water to run into the trench. Pursuant to 40 CFR 265.314, bulk liquids are not to be added to a hazardous waste trench. This practice adds to the leachate generation in the North Parcel, which in turn increases the potential for vertical migration of contaminants through the bay mud to the ground water. Excess liquids can also compromise the structural integrity of the landfill, causing slope failures.

The North Parcel is filled to a maximum height of approximately 85 feet above the surface of the bay mud with side slopes from 4:1 to 16:1 (run:rise). During the years when Group I hazardous wastes were accepted, they made up approximately 3 to 4% of the total wastes disposed of in the North Parcel, according to Acme representatives. In addition to the offsite wastes which were accepted, hazardous waste leachate from the North Parcel was disposed of in the North Parcel from 1981 to 1986 (see discussion of surface impoundment and injection well).

Runoff Management System

The North Parcel does not have an adequate runoff collection or storage system. The volume of runoff from a 24-hour, 25-year storm was calculated by HLA to be 48.61 acre-feet. Runoff from the North Parcel is diverted through four channels which flow to the wetlands in the northeast and northwest corners of the Acme property. There is no storage capacity in the northeast corner. The northwest corner was used by HLA in calculating the runoff storage capacity. In a May 28, 1986 HLA letter to EPA, Region IX, the northwest corner lowland was described as a 5-acre storage pond averaging approximately 3 feet in depth. During the Task Force investigation, the area in question was inspected and found not to be an engineered pond, rather it is a relatively flat area with a low ridge of soil along the northern perimeter. It drains through a culvert along the northern perimeter into a tidal gate, which opens twice per day with the low tides, and empties into Walnut Creek. If the level of runoff accumulating in the northwest corner reached the bottom of the culvert, it would drain directly into the creek. Acme does not have an NPDES permit for the discharge.

According to a 1973 HLA study, the surface runoff drainage is collected in a marsh area where it either penetrates to the ground-water supply or leaves the site through the Southern Pacific Railroad embankment. HLA recommended that the runoff be diverted away from the fill areas, collected in a sump area, and pumped within 48 hours to prevent contamination. As of the Task Force investigation, runoff still drained to the wetland (marsh) areas. In the May 28, 1986 letter to EPA, mentioned above, HLA explained that the runoff evaporates from the marsh areas (the 1973 HLA report stated that runoff penetrated to the ground-water supply in the same marsh areas). The runoff management system consists of ditches and pipes, which ultimately discharge to Walnut or Pacheco Creeks. The only storage capacity is the 5-acre lowland described above, which is classified as a "seasonally ponded wetland," according to the 1983 Final Environmental Impact Statement for the Acme landfill expansion.

Leachate Management System

Leachate control problems have been documented at the North Parcel since the early 1970s. The landfill was originally constructed without a leachate management system. Leachate was observed leaking outside the hazardous waste management area by inspectors during inspections in June, July and December 1982, January 1983 and October 1984.

Subsurface earthen barriers with above ground dikes were constructed on the north, east, and the west sides of the landfill in order to restrict lateral migration of leachate. Engineering reports by HLA indicate that the dikes were constructed with a minimum thickness of 5 feet of compacted clay and a maximum permeability of 1×10^{-6} cm/sec. The dikes were to be keyed 2 feet into the underlying bay mud.

A series of leachate barriers were constructed on the north and east perimeters of North Parcel between 1979 and 1981. They were constructed of compacted fill and clay. Dikes were constructed around the remaining portions of the North parcel, except the southern boundary under a court stipulated agreement in 1981 and 1982. Subsequent to the construction of the dikes, leachate levels in the landfill increased markedly. The North Parcel leachate is currently collected in the two sumps designated as the northeast and northwest sumps. The sumps consist of 500-gallon perforated metal underground tanks with riser pipes to facilitate pumping. The leachate is pumped from the two sumps, through hoses to two 10,000-gallon holding tanks at the crest of the fill.

Eleven leachate monitoring wells have been installed in the North Parcel [Figure 6]. Representative leachate levels measured in the monitoring wells as a part of the self-monitoring program are shown in Table 7.

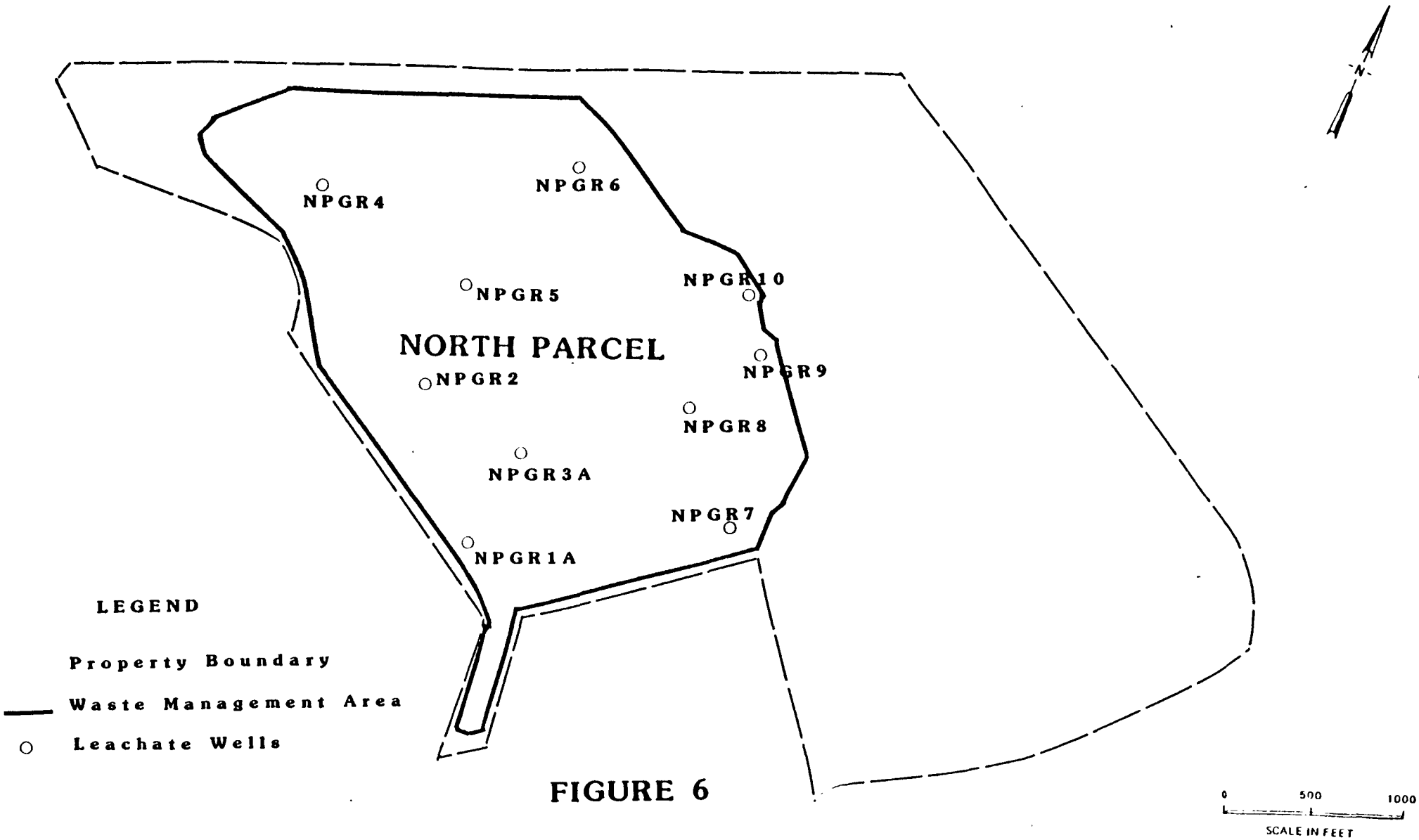


FIGURE 6

LEACHATE MONITORING WELLS IN THE NORTH PARCEL HAZARDOUS WASTE MANAGEMENT AREA

Table 7
LEACHATE LEVELS IN ACME WELLS

Well Number	Leachate Levels (ft. above MSL) 06/07/85	09/17/85	01/13/86	08/22/86
NPGR1	11.55	12.03	13.30	-
NPGR1A	-	-	-	22.20
NPGR2	14.16	13.57	14.13	13.57
NPGR3A	14.07	15.33	18.63	15.41
NPGR4	3.49	6.34	10.06	8.02
NPGR5*	58.78	55.14	49.45	32.30
NPGR6	8.08	8.89	10.27	6.71
NPGR7	11.75	11.70	13.49	12.22
NPGR8	11.05	11.47	12.77	12.66
NPGR9	-0.04	0.21	0.85	2.20
NPGR10	2.73	3.14	4.12	4.93

* *Used as an injection well from the spring of 1985 until January 1986.*

HLA reports indicate that a leachate barrier on the southern perimeter is not needed because the leachate mound in the North Parcel is at a higher elevation than in the IT Class I disposal pond 101 on the south, creating a gradient toward pond 101. HLA maintains that this gradient precludes the need for a leachate barrier on the south side of the landfill because no Class I wastes can migrate toward the Acme property boundary. Acme does not acknowledge that hazardous wastes may migrate toward IT, creating the need for a southern leachate barrier.

Gas Collection System

The North Parcel produces a mixture of gases from waste decomposition, including methane, carbon dioxide, hydrogen and nitrogen. A gas collection system is in place in the North Parcel which is operated and maintained by Getty Synthetic Fuels, Inc. (GSF). The gas is extracted from recovery wells located throughout the North Parcel, which are interconnected by a collection pipe system terminating at a processing facility at Acme's front gate. The

capacity of the system is 2 million cubic feet per second (cfs) per day. The processing facility dehydrates the gas, which is then pumped directly to the CCCSD sewage treatment plant where it is used as fuel.

Surface Impoundment on North Parcel

Acme operated an unengineered, unlined surface impoundment [Figure 5], covering an area of approximately 32,000 square feet on top of the North Parcel starting in 1981. The capacity was estimated, by HLA, to be 718,000 gallons if allowing for 2 feet of freeboard. The impoundment started as a depression in which rainfall accumulated, and was later used to store and evaporate/recycle leachate from the North Parcel.

Although the North Parcel leachate is defined as a hazardous waste under 40 CFR 261.3(c)(2)(i), the surface impoundment was never added to the RCRA Part A or Part B permit applications. No ground-water monitoring system within the refuse/fill was installed to detect releases from this waste management unit. No closure plan was submitted to EPA for the surface impoundment. The impoundment was filled in with waste material and never underwent a formal RCRA or CAC closure.

The leachate was collected from the northeast sump (see discussion under landfill description) using a 4-inch portable pump and was discharged to the surface impoundment. The frequency of pumping varied depending on the level of leachate in the collection sump. HLA estimated that 25,000 gallons of leachate per week (the average pumping rate was estimated at about 75 gallons per minute) were discharged into the impoundment.

On December 11, 1985 and February 20, 1986, EPA inspectors observed a discharge of leachate from a breach in the dike around the surface impoundment flowing down across the north face of the landfill into an unnamed drainage ditch located along the northern property boundary. The drainage ditch flows in an easterly direction, and is a tributary to Walnut and Pacheco Creeks and adjacent wetlands. The existence of the surface impoundment and injection well were not known to EPA before these inspection dates. EPA requested additional information from Acme in a letter dated

May 8, 1986, in order to determine the regulatory status of the impoundment. HLA responded to this letter on May 28, 1986.

Pumping of leachate into the impoundment was supposed to be discontinued in January 1986 at the request of the RWQCB. Leachate was still added to the impoundment on an "emergency basis" until at least May 1986, according to HLA. This "emergency basis" was stated by HLA to be whenever the leachate wells were going to overflow due to artesian conditions.

Acme intended to evaporate the leachate by creating this surface impoundment. Although some evaporation would have taken place during dry weather, precipitation would have added to the liquid volume. Because the impoundment was unlined, the leachate would have percolated back into the landfill.

Injection Well

In the spring of 1985, Acme began using leachate observation well NPGR5 to inject North Parcel leachate back into the North Parcel landfill. This practice was intended to control the levels of leachate in the North Parcel by reintroducing and redistributing leachate, "utilizing the in-place refuse as a sponge." Although all injection wells (except as related to CERCLA or RCRA cleanup actions) which discharged into or above underground sources of drinking water were banned by EPA in December 1984, the pumping was not discontinued at Acme until January of 1986. This injection well was not included on the Part A or Part B permit applications, nor was an Underground Injection Control (UIC) permit obtained. The well was no longer in use, but not plugged, as of the date of the Task Force investigation.

NPGR5 was originally constructed as a leachate observation well by drilling a 24-inch borehole to the bottom of the landfill. The borehole was cased with 4-inch diameter PVC pipe. The casing was perforated from the bottom for 20 to 30 feet, to within 5 feet of the ground surface. The annular space was backfilled with pea gravel to within 2 to 4 feet of the ground surface. The remaining annulus was backfilled with a bentonite-soil mixture.

Leachate was pumped from the northwest collection sump to the well, where it flowed down the well via gravity. The pumping rate was estimated to be from 50 to 100 gpm. The frequency of pumping was reportedly 4,500 to 35,000 gpd, depending on the levels of leachate in the sump.

Tanks

Acme installed two 10,000-gallon tanks for the storage of leachate from the North Parcel hazardous waste landfill in mid-1986. The Part A and Part B permit applications were not revised to show tank storage at the facility. The tanks were still in use during the Task Force investigation.

The tanks were disposed of at the landfill from an unidentified source. One of the tanks had holes rusted through it and other holes from apparent bullet holes. It was located at the crest of the inactive portion of the North Parcel and had no secondary containment. The other tank was located near the northwest sump.

Acme personnel stated that the tanks are currently emptied by IT Corporation when they become full (about once per month). The hazardous waste leachate is then taken to the IT Vine Hill facility, via a tank truck, for disposal. Shipment of this waste began in the spring of 1987. The leachate is listed incorrectly as RCRA exempt on the manifest. The leachate is a listed RCRA hazardous waste since it was generated from the disposal of hazardous wastes [40 CFR 261.3(c)(2)(e)*]. Acme personnel submitted a delisting petition to EPA for the hazardous waste leachate on December 10, 1986. At the time of the Task Force inspection, EPA had not made a determination regarding the delisting petition.

DOHS performed an inspection of Acme on October 1, 1986. Two leachate wells, NPGR6 and NPGR8, were sampled and analyzed for hazardous qualities. Various organics were detected, in concentrations up to 400 µg/L, including xylene, ethyl benzene, chlorobenzene, toluene, benzene, 1,2,4-

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* *This citation states that any solid waste generated from the treatment, storage or disposal of a hazardous waste, including any sludge, spill residue, ash, emission control dust or leachate is a hazardous waste.*

trimethyl benzene, and chloroform. The inspection report which includes the analytical results is included in Appendix D.

Class I Surface Impoundments (Currently Owned by IT Corporation)

Four unlined surface impoundments, encompassing a 22-acre area, were used in the 1960s for the disposal of Group I wastes [Figure 5]. Prior to 1960, Acme used the property for disposal of industrial and sanitary wastes. The land was leased to IT Corporation in 1960 to use in conjunction with their Vine Hill facility. (The Vine Hill facility was evaluated concurrently by the Task Force. The findings are under separate cover.) There was an enhanced potential for vertical migration of contaminants through the bay mud to the ground water since the impoundments were unlined.

In 1970, IT stopped adding wastes to the four surface impoundments. In 1979, RWQCB ordered IT to build a dike around the surface impoundments. The dikes were constructed jointly by IT and Acme. In 1980, hazardous waste loads from Acme were temporarily stored in the area due to an RWQCB cease and desist order against disposal of wastes in the North Parcel. The order was issued because the earthen dikes were not complete and rainy weather set in.

In an April 23, 1983 letter, DOHS set a deadline of May 30, 1983 for the submission of a closure plan for those portions of the surface impoundments located within 2,000 feet of a residential area. At that time, Acme intended to develop Waste Discharge Requirements acceptable to RWQCB so that wastes could be added to the ponds. Acme maintained that it was unreasonable for immediate closure to be required. During the fall of 1985, IT bought the property from Acme, and the surface impoundments were still in service (no new wastes, but sludge still remaining) as of the Task Force inspection.

NONINTERIM STATUS REGULATED WASTE MANAGEMENT UNITS

East Parcel Landfill

Acme was granted a Corps of Engineers permit on June 11, 1984 to construct the Class II-2 East Parcel landfill expansion covering 97.6 acres

including related perimeter levees and interior dikes. The 3-year permit (extended in 1987 through June 1989) allowed disposal of nonhazardous solid wastes. The landfill was still in operation as of the Task Force investigation.

In addition to the approvals of household refuse and construction debris for disposal, the following RWQCB approvals were on file: CCCSD digested sludge, gasoline contaminated soil, refinery evaporation pond sludge, diatomaceous earth saturated with vegetable oil, oil contaminated pea gravel, dried paint containers, and inert balls coated with a thin layer of dried oil.

There is no leachate collection system for the landfill. For this reason, the permit does not allow disposal of wastes which have less than 50% solids. As with the North Parcel, no liner was utilized other than the *in-situ* bay mud.

South Parcel Landfill

The northeastern portion of the 178-acre South Parcel [Figure 5] contains a 22-acre landfill and borrow pit which started operating in 1981. The landfill is a Class II-2 facility, used for the disposal of nonhazardous domestic and commercial wastes. This landfill may have also received some of the unauthorized shipments of Cordis Dow wastes (see Unauthorized Disposal section). Disposal of wastes was discontinued in the spring of 1985.

Conflicting information was found regarding the lining under the landfill. According to one document, a 5-foot-thick compacted clay liner was placed along the west side of the landfill to an elevation of 20 feet above mean sea level. However, HLA interviews during the Task Force investigation revealed that the clay liner may have only been 2 feet thick. The liner was constructed as the fill progressed.

Subsurface clay leachate barriers were constructed on the east, north and most of the west of the landfill. Leachate monitoring wells designated SPGR4-SPGR6 were installed which could later be used for collection.

The South Parcel landfill was designed to be filled to a maximum elevation of 80 feet with nonhazardous solid wastes. As of the July 1983

closure plan, 400,000 cubic yards of waste had been disposed. The closure schedule specified that the last receipt of wastes would be in the fall of 1984, and that the final cover would be constructed in fall of 1985. The last receipt of wastes was in late 1984, according to HLA. The final cover was not completed as of the date of the Task Force investigation.

FACILITY OPERATIONS

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

To either conduct an interim status assessment monitoring program or complete a RCRA Part B permit application, the owner/operator of a TSD needs to know the identity and location of wastes in the regulated units. This and other information must be maintained in the facility operating record. Accordingly, the operating record, including waste characterization procedures, waste analysis plan, and tracking records were reviewed to evaluate how well waste constituents have been identified for incoming waste loads, whether the disposal locations have been properly recorded, and what disposal procedures were followed.

Acme submitted a Part A application, dated November 19, 1980. It was revised on March 19, 1981 and on August 2, 1983. The documents indicated the following hazardous wastes were handled at the North Parcel:

EPA Hazardous Waste No.	Description
K049	Slop oil emulsion solids from the petroleum refining industry
D002	Solid waste that exhibits the characteristic of corrosivity
D008	Solid waste that exhibits the characteristic of EP Toxicity for lead
P119 & P120	Vanadic acid, ammonium salt, vanadium pentoxide

Since 1985, waste streams must be approved by the RWQCB prior to acceptance. After a generator submits analytical data to Acme, an approval request letter is required to be sent to RWQCB.

Waste Characterization Procedures

Waste characterization before receipt at a TSDF and tracking after receipt are required under both RCRA and California interim status regulations. Both are important for determining what constituents could potentially be released from waste management units. Effective November 19, 1980, Acme was required, under 40 CFR Part 265.13, to obtain a detailed chemical and physical analysis of any hazardous waste prior to storage or disposal. The analysis must be repeated, as necessary, to ensure that it is accurate and up to date. Each load must be inspected to ensure that the hazardous waste received matches the manifest waste description. Acme has deviated from these requirements on numerous occasions.

To determine whether Acme adequately characterizes wastes it receives, the Task Force reviewed pre-acceptance records and manifests for waste loads received during the months of March, June and December from 1980 to 1987. The review of the files revealed that several waste streams had been accepted with no analysis. Many manifests had analyses rubber stamped onto them, and those analyses specified a wide range of constituents. One manifest was lacking any waste description. RCRA hazardous wastes were accepted which

were not specified on the Acme Part A application, which is a violation of 40 CFR 270.71(a)(1). Table 8 is a summary, prepared by HLA, for wastes accepted at the facility, between 1980 and 1985. (This list is not complete, but is as reported by HLA.)

HLA explained that the waste characterization consists of an analysis submitted by the generator which, once accepted by Acme for disposal, is updated annually. A jar of the waste is then kept at the guard gate for visual comparison. Acme maintains that they are familiar with most of the waste streams because they are accepted regularly.

The records review indicated that the paperwork was not always complete, the waste analysis information was often several years old or non-existent, analyses were not performed when waste was accepted and no formal records were kept of waste disposal locations.

Waste Analysis Plan

No waste analysis plan was on file at the site at the time of an RWQCB inspection in July 1982. A waste analysis plan dated August 1983 was utilized at Acme during EPA Region IX inspections on December 11, 1985 and February 20, 1986. The plan did not identify the testing parameters, test methods or sampling methods. The RWQCB repeatedly cited waste analysis plan deficiencies.

The current facility waste analysis plan provided to the Task Force by HLA, was revised after the Part B submission, but is undated (submitted as an attachment to a May 28, 1986 letter to EPA) and does not comply with RCRA as follows:

- The parameters to be analyzed are not specified in the waste analysis plan [40 CFR 265.13(b)(1].

- Test methods are not specified in the waste analysis plan [40 CFR 265.13(b)(2)].

Table 8

WASTES STREAMS DISPOSED AT ACME*

Manifest Description	Year(s) Received	Waste Analysis
RCRA Wastes		
Methylene chloride	1982	No
Trichloroethane	1981, 1982	No
Tetrahydrofuran	1981	No
Acetone	1981, 1982	No
Alkaline sludge	1980, 1981	No
Alkaline sludge	1981, 1982	Yes
Sand blasting waste	1981, 1982	Yes
Catalyst fines	1981, 1982	Yes
Alkaline sludge	1982-1984	Yes
Sand blasting waste	1982	Yes
Catalyst fines	1982	Yes
Designated Wastes		
Oil	1981-1982	No
Resin waste	1981-1982	No
Ammonium hydroxide	1981	No
Sodium hydroxide	1981	No
Isopropanol	1981-1982	No
Mix of isopropanol benzyl alcohol and chloroethede (sic)	1982	No
Catalyst fines	1980-1982	Yes
ASD filter cake	1980-1982	No
Tergol filter cake	1980-1982	No
Fly ash	1980-1982	No
Oily waste	1980-1982	No
Asbestos	1980-1982	No
Laboratory refuse	1981-1983	No
Centrifuge waste	1981, 1982	No
Catalyst fines	1982-1985	Yes
ASD filter cake	1982-1983, 1985	No
Tergol filter cake	1982-1983	No
Fly ash	1982-1985	Yes
Coke Breeze	1983-1985	No
Oily waste	1984	No
Asbestos	1982-1985	No
Centrifuge waste	1982-1983	No

* *Information from HLA letter dated April 11, 1985*

- There is no discussion of how representative samples of wastes will be selected [40 CFR 265.13(b)(3)].

The current waste analysis plan is not followed, in that some annual updates of waste stream analyses are not on file. Also, shipments received by Acme are not all checked at the gate. During the Task Force inspection, Task Force personnel observed numerous waste loads being driven past the gate without checking in, and proceeding directly to the North Parcel for disposal in the hazardous waste trenches. Gate personnel did not know that hazardous waste shipments had arrived, when questioned by Task Force personnel. Acme does not have an adequate method of tracking wastes that arrive onsite for disposal, since each load is not verified before disposal.

Available documentation indicated that the following RCRA hazardous wastes were accepted between 1980 and 1985 which were not on the Part A application:

EPA Hazardous Waste No.	Description
U080	Methylene Chloride
U226 & F002	Trichloroethane
U213	Tetrahydrofuran
U002	Acetone
D010	Catalyst fines that exhibit the characteristic of EP Toxicity for selenium
D001	Isopropanol
D001	Isopropanol benzl alcohol and chloroethede [sic]

Of the wastes listed above, only the D010 waste had a waste analysis prior to acceptance.

Landfill Operations

Acme is open for business 24 hours per day. Waste from the public is accepted between 8 a.m. and 4 p.m. A guard is posted at the entrance at all times. During the day shift, an escort is supposed to accompany transporters of all hazardous/designated waste shipments as they are disposed in the North Parcel. However, Task Force personnel observed both escorted and unescorted dumping at the North Parcel. After public business hours no such escort is provided. Waste loads accepted after the escorted workshifts could be disposed of in unauthorized areas. Manifests from wastes accepted at night are not always signed by the guard, although he is the one responsible for any disposal activity while on duty. In the past, State inspectors noted that manifests from waste loads accepted after hours were not signed until the next day rather than when the loads were received.

A State inspector once observed two loads of waste disposed on the morning of an inspection, yet when a records review was performed for that week only one manifest was found. When questioned, Acme representatives stated that materials which appear to be hazardous or "hard to control" are routinely dumped in the North Parcel, and that no records are kept of what the materials are or where they originated. HLA also pointed out that designated wastes are not required to be manifested, but they are for recordkeeping purposes.

The disposal locations of individual waste loads are not recorded. The system that Acme uses to locate individual loads by manifest is to check the precipitation records on the dates the loads were accepted. If it was a particularly rainy day it would be assumed that it was too muddy for any trucks to access the dry weather or "summer" trench; therefore, the loads on that date are assumed to have been disposed in the "winter" trench. Historically, manifests have not always been signed as the load is accepted, so this system does not appear to be reliable in all cases. The sample splits provided to Acme by the Task Force were observed disposed in the winter trench during the investigation. Because the disposal took place on a dry day, it is apparent that the wet weather criteria is not always followed. Maps with sketches of trench

locations are drawn, but not from survey data, so no horizontal or vertical coordinates are given.

A water truck is parked at the North Parcel winter trench so that waste trucks can be rinsed after waste loads are dumped. The water runs into the hazardous waste trench, which is a violation of 265.314(f), which prohibits the placement of any liquid which is not a hazardous waste in a RCRA landfill, effective May 8, 1985.

Unauthorized Disposal

According to HLA personnel, the Cordis Dow Company arranged for disposal of some reportedly empty drums at the Acme landfill. HLA personnel conducted a review of the manifests and identified that the drums were later discovered to be partially to completely full of trichloroethylene and tetrahydrofuran. They also identified a variety of other wastes that were disposed and were not authorized by the State.

A manifest review by Task Force personnel revealed that such disposal activity took place from at least January 1979 to July 25, 1982 [Table 9]. No waste analysis was performed for these wastes prior to acceptance. Disposal records were not kept except for the manifests, which did show the loads to contain the wastes listed in Table 8. No statements were written on the manifests that would indicate empty drums; the volumes of wastes were listed.

The RWQCB inquired about the location of the Cordis Dow wastes, but Acme stated that the drums which were disposed in 1981 and early 1982 were crushed and covered with 10 to 30 feet of fill. Acme suggested that the drums disposed in June and July of 1982 would be more accessible and more likely intact.

A DOHS letter to Acme dated April 28, 1983 set forth the following: (1) NPGR2 and NPGR3 were to be monitored quarterly for the disposed solvents for a minimum of one year whereupon the need for further monitoring would be evaluated, (2) groundwater monitoring wells G1 through G6 would also be monitored quarterly for the disposed solvents, and (3) drummed wastes

Table 9

WASTE ACCEPTED AT ACME FROM CORDIS DOW

Waste Identified from Manifest	Date	Quantity (gallons)*	No. of Drums
Trichloroethane 97-99.5% with resin .5-3%	07/12/82	1,150	21
	03/26/82	75	2
	05/26/82	150	3
	08/31/81	110	2
	06/23/81	110	2
	TOTAL	1,595	30
Resin waste with water	03/26/82	400	8
	05/26/82	520	10
	06/16/81	935	17
	08/31/81	880	16
	06/23/81	1,265	23
	01/11/82	280	5
	06/09/82	450	9
	TOTAL	4,730	88
Oil	07/12/82	250	5
	03/26/82	165	3
	05/26/82	55	1
	08/31/81	165	3
	06/23/81	55	1
	TOTAL	690	13
Tetrahydrofuran	06/23/81	55	1
	TOTAL	55	1
Sodium hydroxide	06/23/81	55	1
	TOTAL	55	1
Isopropanol	06/09/82	440	8
	05/26/82	55	1
	06/16/81	30	1
	08/31/81	80	2
	06/23/81	15	1
	01/11/82	330	6
	TOTAL	950	19
Ammonium hydroxide	06/16/81	8	1
	TOTAL	8	1

* *Quantities are gallons unless otherwise stated.*

Table 9 (cont.)

Waste Identified from Manifest	Date	Quantity (gallons)*	No. of Drums
Acetone	05/26/82	200	4
	06/16/81	110	2
	01/11/82	110	2
	TOTAL	420	8
Methylene chloride	06/09/82	165	3
	TOTAL	165	3
Pump oil	06/16/81	440	8
	01/11/82	275	5
	TOTAL	715	13
Trichloroethane 65% Benzl alcohol 35%	06/09/82	850	16
	TOTAL	850	16
Isopropanol 33.3% Benzl alcohol 33.3% Chloroethane 33.3%	07/12/82	300	6
	06/09/82	440	8
	TOTAL	740	14
Skasol with water	05/26/82	40	1
	TOTAL	40	1
Polyurathane [sic], polyglycol, alfa 1059, solfolane [sic], propanol wastes	01/30/80	12,285 (No units)	27
Polyueathane [sic], polyglycol, Acitone [sic] wastes	12/11/79	12,285 (No units)	27
Pump oil, polyglycol, resin, sulfolane, hardner, skasol, polycin, glycerine, chlor-nu, formaldehyde wastes	08/09/79	528,000 lbs.	24
Vorite, polycin, hardner, sulfolane, oil, chlor-nu wastes	09/13/79	5,060 lbs.	23
Polyurthane [sic], polyglycol, sulfolane, resin, hardner, vorite, polyglycol E600, RN2000 wastes	08/15/79	19,340 lbs.	

* *Quantities are gallons unless otherwise stated.*

Table 9 (cont.)

Waste Identified from Manifest	Date	Quantity (gallons)*	No. of Drums
Polyurathane, polyglycol, formaldyhyde [sic] wastes	04/01/80	12,285 lbs	27
Polyurathane, polyglycol, acid wastes	05/07/80	12,055 lbs.	71
Polyurathane, polyglycol wastes	05/16/80	12,285 lbs.	27
Polyurathane, polyglycol wastes	07/07/80	10,920 lbs.	24
Polyurathane, polyglycol, ammonia, formaldhyde [sic] wastes	08/13/80	12,285 lbs.	27
Polyurathane, polyglycol wastes	10/09/80	9,240	22
Sulfolane, glycerine, polyethylene glycol, solvents, polyurathane wastes	01/04/79	5,940 lbs.	27
Sulfolane, glycerine, polyurathane, solvent, acid wastes	01/05/79	5,940 lbs.	27
Solvents, polyurathane, sulfolane, glycerine, oil, chlorothane-nu wastes	01/15/79		24
Solvents, polyurathane, sulfolane wastes	04/11/79		26
Sulfoalane [sic], polyurathane, solvents, polyethylene glycol wastes	04/17/79	5,720 lbs.	26
Cellulose acetate, polyurathane, acid, solvents, sulfolane, glycerine, polyethylene glycol wastes	04/25/79	5,500 lbs.	25
Polyuranthane [sic], acid, solvents, sulfolane, glycerine, polyethylene glycol wastes	05/03/79	63,800 (No units)	29

* *Quantities are gallons unless otherwise stated.*

buried in June and July of 1982 were to be uncovered and removed if the drums were intact and contained any liquids. Tetrahydrofuran and trichloroethane were detected in leachate monitoring wells in the North Parcel

HLA explained that Acme later attempted to locate the drums, but only one or two were recovered. The search was eventually abandoned by Acme. During the Task Force investigation, HLA personnel informed Task Force members that the drums may have been disposed of in the sanitary landfill. The South Parcel was the sanitary landfill operating at the time, and was only permitted to accept nonhazardous waste.

Infectious Waste

Acme is authorized to accept infectious wastes at the facility. Infectious wastes are regulated under Title 22, Division 4, Chapter 30 of the California Administrative Code. The Contra Costa County Health Services Department, Environmental Health Division is authorized to enforce the regulations. Acme receives infectious wastes which are not autoclaved. The waste is double-bagged, placed in cardboard boxes and taped.

An Infectious Waste Operation Plan was submitted to the County in 1985. Incoming infectious waste loads are to be signed into a logbook at the gate and checked for proper packaging and labeling. The waste is to be disposed either in a hazardous waste trench or 100 feet away from the public disposal area. If the waste is placed in a hazardous waste trench it is to be immediately covered with soil and subsequently with the 6 inches of compacted soil which is required at the end of the day. If the wastes are placed in a nonhazardous trench they are to be covered with additional refuse prior to compaction.

The Task Force observed the disposal of a load of infectious waste in a hazardous waste trench in the North Parcel. The load was not immediately covered with soil, nor was any compacted soil applied at the end of the day. The following morning the sealed boxes of infectious waste were crushed with heavy equipment and sprayed with water.

The plan also states that steam cleaning equipment for decontamination would be located near the hazardous waste trench. No such equipment was present during the Task Force investigation.

SITE HYDROGEOLOGY

The Acme facility has submitted several hydrogeologic reports to State and EPA Region IX personnel. The most recent was submitted on February 4, 1986 in a document titled "Implementation of Ground-Water Monitoring Plan Acme Landfill; Martinez, California." The Acme consultant, HLA, reported to Task Force personnel that this document contains the most recent and accurate assessment of the site hydrogeology. The following information, unless otherwise specified, was derived primarily from a DOHS report[1] which evaluates and contradicts the site characterization presented in the aforementioned HLA report and the hydrogeologic overview presented by the HLA hydrogeologist during the Task Force inspection.

Conflicting site characterizations, related to both structural geology and stratigraphy, were identified during review of available documents for preparation of the Task Force report. DOHS documents take into account information from a variety of sources, including data from surrounding facilities. The DOHS documents were determined by Task Force personnel to be more appropriate to characterize the site than those presented by HLA.

The site hydrogeology, as presented by HLA on behalf of Acme, has not been adequately characterized for the purpose of monitoring the North Parcel. The purpose of a hydrogeologic site characterization is to identify the uppermost aquifer, as defined in 40 CFR Part 260.10, and the direction of ground-water flow (hydraulic gradient). Both must be characterized to enable development of a monitoring well network which complies with the requirements of 40 CFR Part 265.91 [or equivalent in ISD Section VIII (1)] (i.e., monitoring water quality in the uppermost aquifer, installation of at least one upgradient well and three downgradient wells and capable of yielding samples for analysis). The facility has not fully characterized the uppermost aquifer and has stated that an upward vertical gradient observed at the site results in the widely varying ground-water elevations observed in the monitoring wells. It is stated by HLA that because of this condition "it is not possible to establish a horizontal ground-water gradient and flow direction for the North and East Parcels, nor to define the upgradient or downgradient wells."[2] The facility has not assessed the

effects of landfill loading on pore pressures within the saturated, compressable younger bay mud and the resultant effects on water levels in monitoring wells.

HYDROLOGIC UNITS

The site is located on the alluvial plain of Pacheco Creek, [Figure 7] . The plain is bounded by the Diablo Range to the south, east and west, and Suisun Bay to the north. The site has two structural features, the axis of the Diablo Anticline and the Concord Fault. The site stratigraphy (from oldest to youngest) consists of bedrock, older alluvium, older bay mud, regressive sands, younger bay mud and fill. The following discussions further describe the structural geology and stratigraphy at the site, and inconsistencies with HLA interpretations.

Structural Geology

The structural geology in the vicinity of the North Parcel has potential effects on the degree of fracturing in bedrock formations and associated influence on both the rate and direction of ground-water movement at the site.

The Diablo Anticline has been mapped (projected) beneath the eastern boundary of the Acme North Parcel by Dibblee.[3] It is reflected in the orientation of the sandstone and shale beds of the bedrock (Panoche Formation) exposed near the site. The dip of the bedrock exposed west of the North Parcel is to the west. The bedrock exposed at the Avon (TOSCO) refinery, across Pacheco Creek and to the east of Acme, is dipping to the east. Bedrock beneath most of the North Parcel at Acme would be expected to be southwest dipping, while bedrock beneath and east of the eastern edge of the North Parcel is expected to be northeast dipping.

Two subparallel segments of the Concord Fault have been mapped[4] as being within the vicinity of, but not transecting, the North Parcel. The fault is a north-south trending fault zone which essentially trends subparallel to Pacheco Creek. The California Division of Mines and Geology has designated the Concord Fault as active and capable of generating large earthquakes of up to a magnitude of seven on the open-ended Richter scale. In 1973, two smaller,

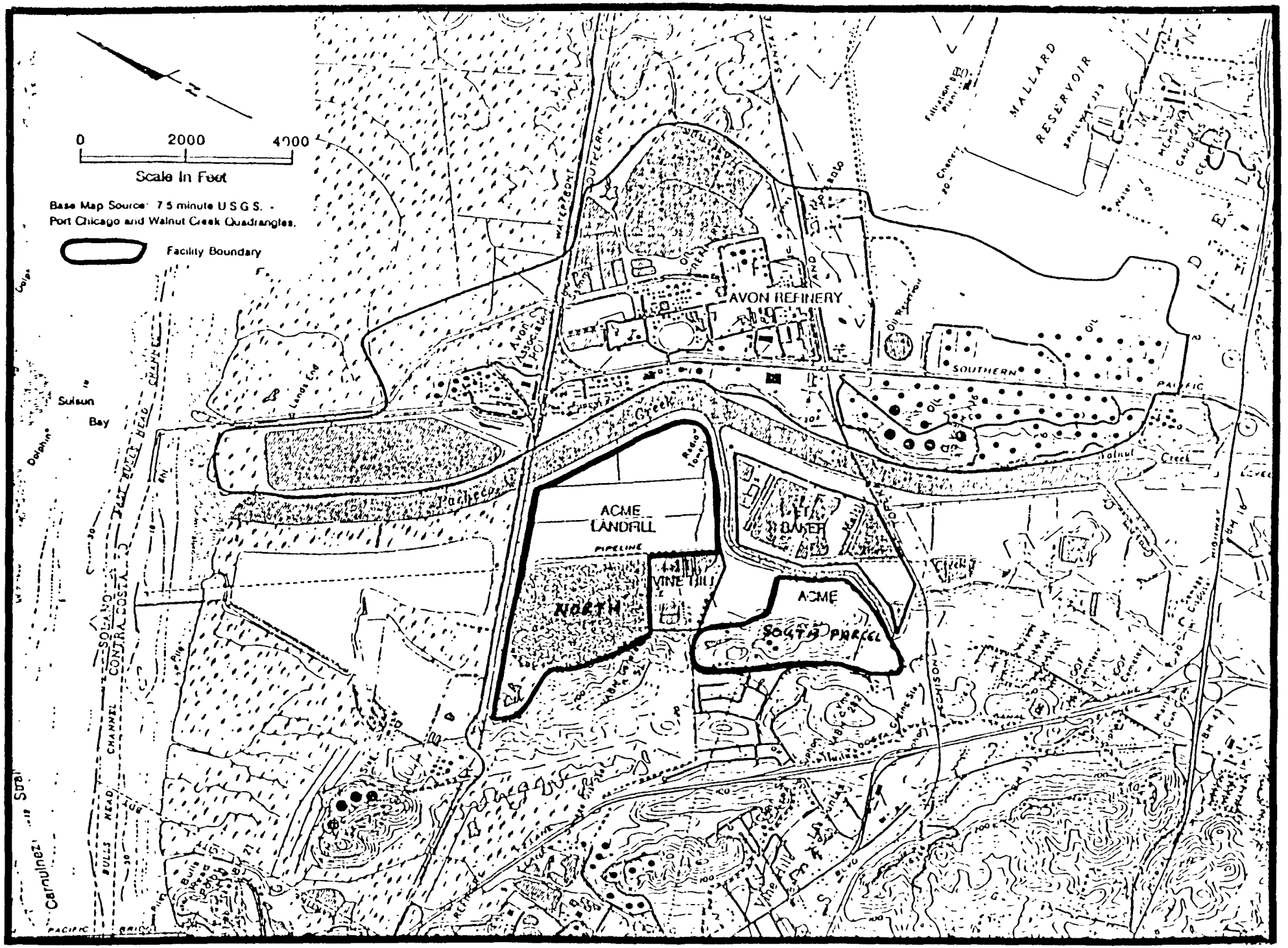
0
2000
4000
Scale In Feet
Base Map Source: 7.5 minute U.S.G.S. -
Port Chicago and Walnut Creek Quadrangles.
Facility Boundary
AVON REFINERY
MALLARD
RESERVOIR
ACME
LANDFILL
NORTH
VINE HILL
ACME
SOUTH PARCEL
SOUTHERN
PACIFIC
Suisun
Bay
Carquinez
Strait
Walnut
Creek
Pacheco
Creek

FIGURE 7

unnamed faults were mapped, traversing the site by Simms et al.[5] These faults displayed a southwest-northeast trend and occur at the northern and southern ends of the hill defining the western boundary of the North Parcel. These faults were not shown in the later Dibblee work and whether these two faults are present, active or capable of response to an event on the Concord Fault is not known.

HLA reports that the "approximate traces of the Mount Diablo Anticline and the Concord Faults have been inferred by Dibblee (1981), but no fault traces have been observed in the immediate vicinity of the landfill."[6] Further characterization of the effects of both structural features must be made by the facility to determine the degree of interconnection between stratigraphic units (discussed at length in the following sections), and effects on ground-water flow.

Stratigraphic Units

The facility has not fully characterized the lithology of the stratigraphic units, their respective water-bearing capabilities or the degree of interconnection. The following discussion describes available information and contradictions between State and facility accounts of the site geology.

Bedrock underlying the facility is predominantly sandstone and shale of the Panoche Formation of Upper Cretaceous Age. Bedrock is exposed at the surface on the western edge of the site and estimated to be at a depth of about 110 feet beneath the eastern limits of the North Parcel and up to 5 to 600 feet at the eastern extent of the East Parcel. Where exposed, the bedrock strikes to the northwest and dips 50 to 70 degrees to the southwest.[7] Facility reports characterized the bedrock as "composed of well indurated (cemented) clean to silty sand," and of questionable interpretation, include "peat" deposits as part of the bedrock in geologic cross-sections (Plate 6 - February 1986 report).

Hydraulic properties of the bedrock are not known; however, the proximity of the site to the Diablo Anticline and Concord Fault, as discussed above, indicate the possibility that bedrock could be highly fractured, possessing high secondary hydraulic conductivity. The facility characterizes the bedrock to be "containing ground-water of poor quality and low yield and is

considered a nonwater-bearing unit."[8] The facility does not provide any documentation of water quality to support this statement.

Overlying the bedrock is a thick alluvial sequence of predominantly coarse-grained materials referred to as older alluvium. Interbedded within the coarse-grained deposits are discontinuous lenses of silt and clay. These materials were deposited during periods of the Pleistocene Age when sea level was lower and the Diablo range was being uplifted.

According to the facility reports the older alluvium was not encountered in the immediate area of the landfill.[9] Few borings were drilled and sampled to an appropriate depth. State personnel interpret the sequence of sands and gravels encountered in Acme borings, G29 and G30, to be the older alluvium. These borings and those from the International Technology (IT) facility (to the south), according to State personnel, indicate that the older alluvium thickens to the east, and is approximately 35 feet thick beneath the North Parcel.

The older bay mud overlies the older alluvium and consists of generally continuous deposits of semi-consolidated organic clays and silty clays, and discontinuous deposits of gravelly and sandy clays, silts, sandy silts, silty sands and peat in various stages of decomposition. The depth to older bay mud is variable throughout the site due to topographic relief and is estimated to be between 35 and 50 feet.

Overlying the older bay mud is a series of discontinuous but often interconnected, regressive sands, which were deposited during a period of declining sea level. When encountered, these deposits were found at depths of approximately 25 feet, near the bottom of the younger bay mud. The younger bay mud, above the regressive sands, consists of mostly clays, silty clays, silts, peat and discontinuous bodies of silty sand. Within the younger bay mud are discontinuous deposits of coarser mining detritus, from gold mining during the mid 1800's, primarily of silt and silty sand.

The facility does not distinguish between the older alluvium, older bay mud, regressive sands, and younger bay muds, and groups all of the deposits overlying bedrock into a formation called the bay mud. The facility

characterizes the bay mud as a low permeability soft clay with silt, ranging in thickness from 0 to greater than 70 feet across the facility and capable of only low water yields.

Acme has not identified the differences between the aforementioned formations; this is probably the primary cause of their difficulty identifying ground-water flow directions. Monitoring wells have been completed through multiple water-bearing formations, (although all characterized by Acme as the "bay mud") each with varying composition, grain-size, porosity and permeability. These formations have different abilities to transmit water, and other properties which affect water level measurements across the site.

Although trash/fill is not a geologic material, it impacts significantly on the hydrogeology of the site. The trash is a random arrangement of solid material with no layers to create perched or artificially high levels of leachate. A daily cover of soil is supposed to be placed over the trash at the end of the day, creating individual trash cells, however, the facility has been frequently cited by State officials for noncompliance with cover requirements. In addition, one of the methods used to dispose of hazardous wastes in the North Parcel is to trench into existing trash, therefore interconnecting any trash "cells" that had been created. The leachate wells are also perforated from the top of the trash to the top of the younger bay mud, and interconnect the entire height of fill.

Since "cells" cannot be considered to provide any impediment to leachate migration, the excess hydraulic head represented by the height of leachate in the landfill creates a leachate mound and causes a driving force for the migration of leachate radially through the fill and into underlying interconnected geologic materials. While the surface impoundment and injection well were in operation on top of the fill, large volumes of leachate were pumped either into or on top of the landfill. The repumping of leachate back into the landfill and the influence of the topography creates a leachate mound which is still evident by the level of leachate in the "NPGR" series of monitoring wells [Figures 8 and 9]. (These plots are computer generated, using limited points, as indicated.) The leachate collection/dike system also contributes to the leachate mound.

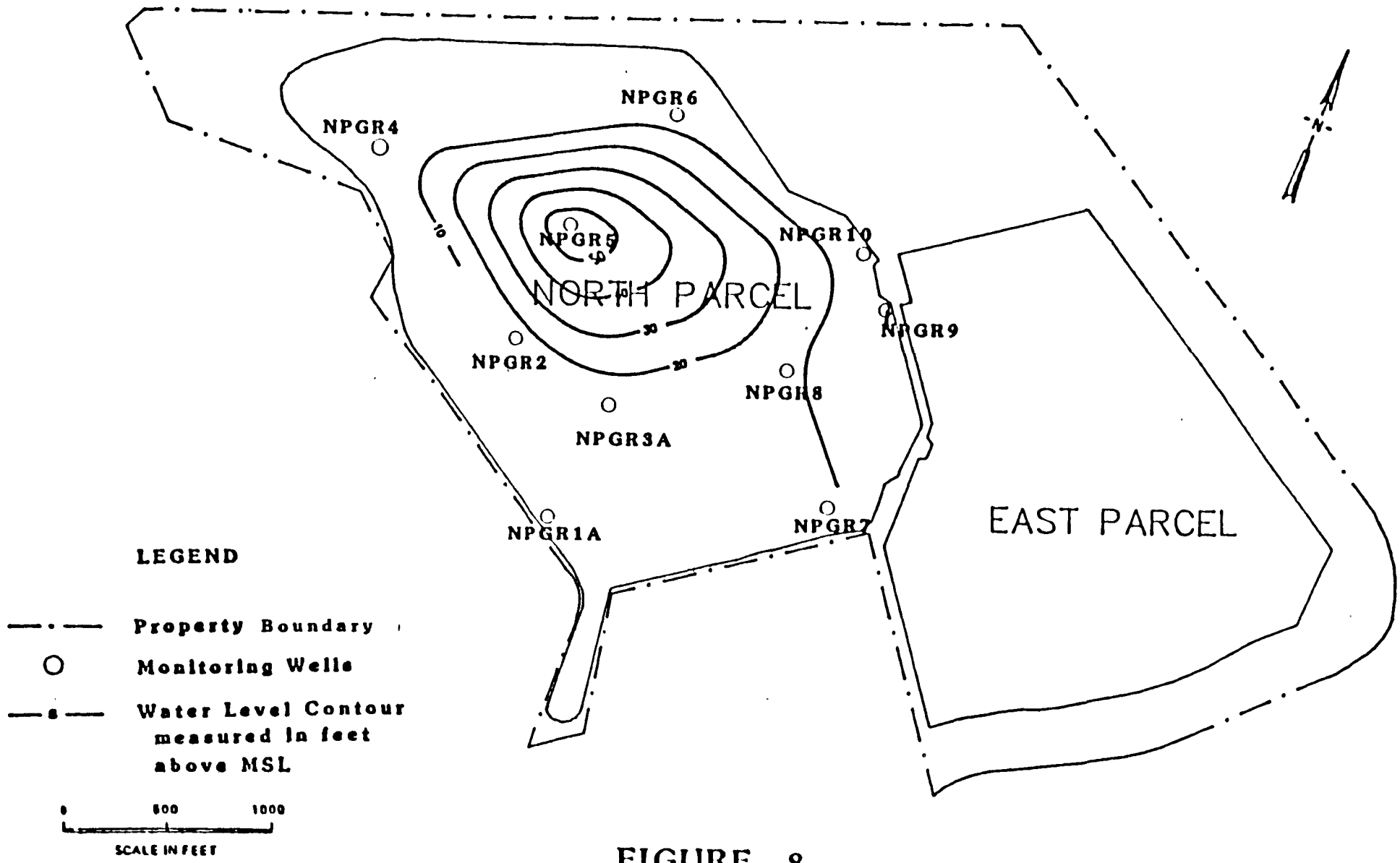

FIGURE 8

LEACHATE LEVELS JUNE 7,1985

measured in feet above MSL

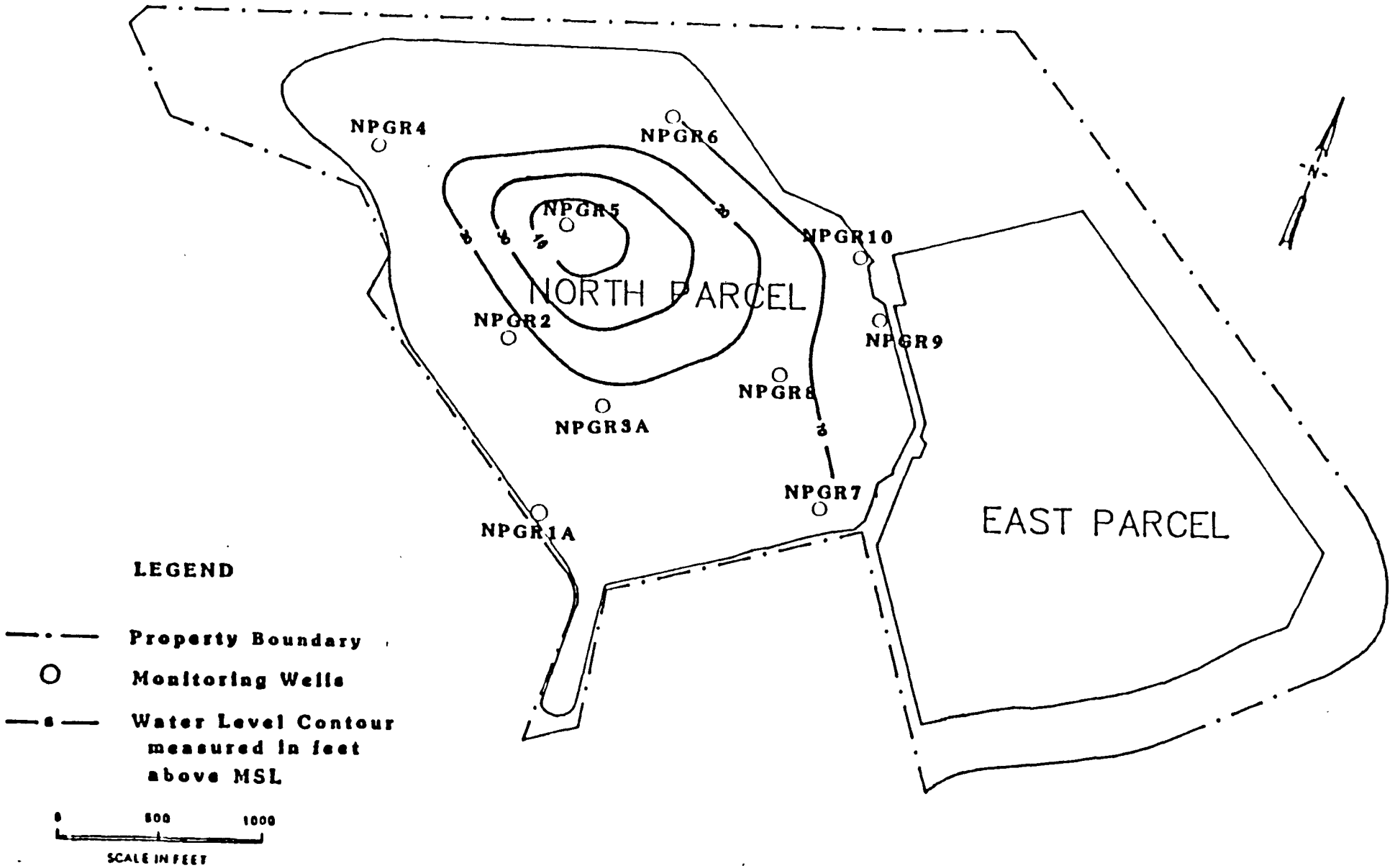

FIGURE 9

LEACHATE LEVELS JANUARY 13, 1986

measured in feet above MSL

The facility has designated the "bay mud" to be the uppermost aquifer for the RCRA/ISD monitoring program. As previously described, they have not adequately characterized this bay mud layer to include the multiple formations. Once the formations are characterized, either by continuously logged borings, nested piezometers, pump tests, etc., additional evaluation will be necessary to determine the degree of interconnection between the fill, "bay mud"(and constituents) and bedrock, to adequately define the uppermost aquifer.

GROUND-WATER FLOW DIRECTIONS AND RATES

The facility has not determined ground-water flow directions or rates for the North Parcel. As previously quoted, the facility cites an upward vertical gradient at the site, resulting in varying ground-water elevations and has reported a finding that it is not possible to establish horizontal ground-water gradient or flow directions for the North or East Parcels.

Analysis by Task Force personnel of the water levels in wells completed primarily in the peat zone (older bay mud) yielded pieziometric contours displayed in Figure 10. This strongly suggests a radial ground-water flow from the landfill but trending north-northwest toward Suisun Bay. An evaluation of wells completed primarily in the silty clay (younger bay bud) also demonstrated radial flow directions [Figure 11]. (These plots were computer generated, using limited points, as indicated.)

The facility must further characterize individual flow zones as described in the previous section, and determine the degree of interconnection, hydraulic gradients, flow directions and flow rates. Few of the existing monitoring wells are completed in just one formation, as defined by the State, and several shallow wells (35-foot average depth) have well screens of up to 20 feet in length. Both of these factors make analysis of water levels, for determination of hydraulic gradients, difficult. Depth staggered and/or clustered wells, with short screened intervals may be necessary to define hydraulic gradients and the degree of interconnection within the uppermost aquifer.

Water levels and constituent concentrations for wells bordering the Acme/IT Vine Hill property boundary were compared to determine if any

conclusions could be drawn regarding ground-water flow directions and/or the degree of contaminant migration. The majority of water levels cannot be compared because the wells are not completed in similar formations. The remaining data is inconclusive. Additional data is necessary to evaluate the degree of hydraulic connection.

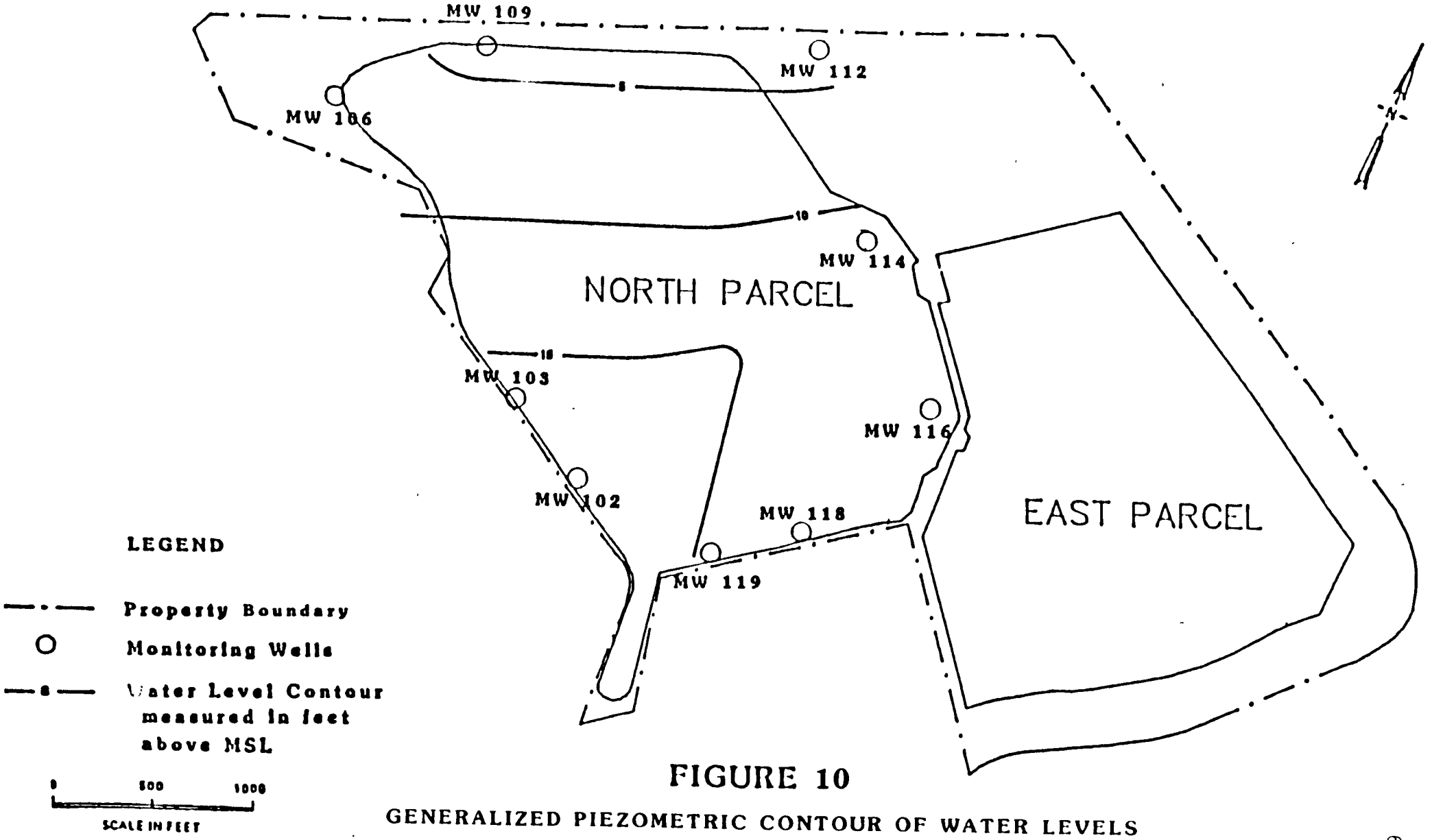

FIGURE 10

GENERALIZED PIEZOMETRIC CONTOUR OF WATER LEVELS FROM THE WELLS COMPLETED IN PEAT (JUNE 1987)

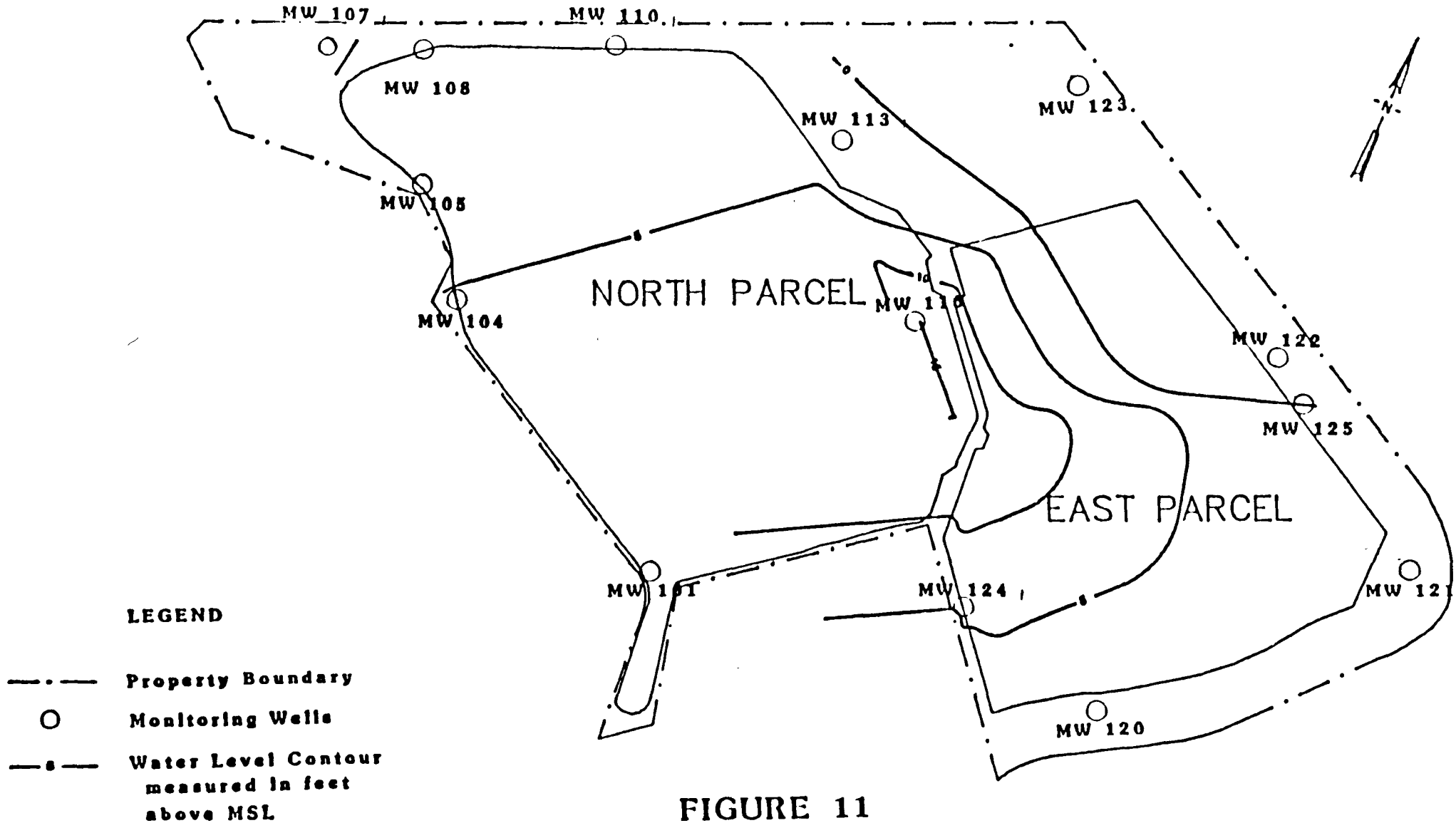

FIGURE 11

GENERALIZED PIEZOMETRIC CONTOUR OF WATER LEVELS FROM THE WELLS COMPLETED IN SILTY CLAY (JUNE 1987)

GROUND-WATER MONITORING PROGRAM UNDER INTERIM STATUS

FEDERAL AND STATE REGULATORY HISTORY

Both Federal and State regulations are applicable to hazardous waste management at Acme Fill Corporation. There are two State agencies which regulate hazardous waste activities in California: The Department of Health Services (DOHS) and the State Water Resources Control Board (SWRCB). DOHS was delegated authority to administer a RCRA equivalent State hazardous waste program.* The SWRCB has never applied for authorization to implement RCRA but has been granted numerous authorities (e.g., waiver approval, monitoring analyses review, assessment outline approval, etc.) by DOHS relating to the implementation of this program. In addition to these authorities, the SWRCB implements an independent State hazardous/non-hazardous waste program (CAC Title 23, Chapter 3, Subchapter 15, Article 5). The Regional Water Quality Control Board (RWQCB) subcontracts through SWRCB to assist DOHS (through grant monies) with implementing the State equivalent RCRA program through inspections and permit applications review.

Acme began handling waste at their facility in 1949. The regulatory history of the site began in May 1975 when Acme submitted an application to the RWQCB to operate a sanitary/hazardous waste landfill. The RWQCB adopted Waste Discharge Requirements (Order No. 76-37) for the Acme landfill on April 20, 1976. These requirements described waste discharge prohibitions, waste disposal specifications, and provisions designed to protect the waters of the State (including ground water). The requirements also involved implementing a self-monitoring program in order to obtain data and document compliance with the waste discharge requirement permit. A chronology illustrating the regulatory history of Acme is shown in Table 10.

On June 4, 1981, EPA delegated the authority to administer portions of the Federal RCRA program for existing facilities (interim authorization) to the

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* *California Hazardous Waste Management Regulations: California Administrative Code (CAC), Title 22; Revised and Recodified May 10, 1979, most recently updated on July 29, 1985*

Table 10

CHRONOLOGY OF REGULATORY HISTORY OF ACME LANDFILL

May 1975	Acme submitted an application to RWQCB to operate a sanitary/hazardous waste landfill.
April 20, 1976	Waste Discharge Requirements (Order No. 76-37) were adopted by Acme.
February 6, 1978	Updated Waste Discharge Requirements (Order No. 84-18) were submitted by Acme, which resulted in a reduction in monitoring parameters for monitoring wells under self-monitoring program.
March 19, 1981	Acme submitted RCRA Part A Application.
October 23, 1981	DOHS issued an Interim Status Document (ISD) permit to Acme.
November 17, 1982	Acme requested an ISD ground-water monitoring program wavier.
March 4, 1983	The ISD ground-water monitoring program requirements were waived by RWQCB.
August 2, 1983	Acme submitted a RCRA Part B Application to EPA.
May 6, 1985	Acme was ordered by the RWQCB to prepare and implement an ISD ground-water monitoring program.
May 28, 1985	Acme submitted a proposal for a ground-water monitoring program.
August 28, 1985	Acme revised their ground-water monitoring program.
February 4, 1986	Acme revised the sampling and analysis plan of the ground-water monitoring program.

State (DOHS). The California regulations (California Administrative Code - Title 22) were codified and patterned after the RCRA Part 265 regulations. The State regulations were not equivalent to the RCRA regulations, though. The State regulations do not require monitoring the ground-water, except via RWQCB issued Waste Discharge Requirements. The State program requires monitoring of the air and of the soil-pore liquid of the naturally unsaturated zone, instead of the ground water. A Statute was passed by the State [Health and Safety Code, Division 20, Article 5.5, Section 25159.5 (b)] in 1982 and was amended several times. The final revision was made in 1987, currently reading:

> "Until the state program is granted final authorization by the Environmental Protection Agency pursuant to Section 6926 of Title 42 of the United States Code, all regulations adopted pursuant to the Resource Conservation and Recovery Act of 1976, as amended, (42 U.S.C. Sec. 6901 et seq.) shall be deemed to be the regulations of the department, except that any state statute or regulation which is more stringent or more extensive than a federal regulation shall supersede the federal regulation."

The statute places those more stringent RCRA ground-water monitoring requirements on the State's hazardous waste facilities. In order to duplicate the RCRA requirements for interim status facilities, the State issued Interim Status Document (ISD) permits which are equivalent to the RCRA interim status ground-water monitoring requirements. The DOHS issued an ISD to Acme for the North Parcel landfill on October 23, 1981. Section VIII of the ISD details the ground-water monitoring requirements applicable to Acme. These requirements are equivalent to the Federal RCRA interim status requirements in 40 CFR Parts 265.90 through 94.

The ISD program required Acme to prepare and implement a ground-water monitoring program by November 19, 1981. Acme did not implement the required ground-water monitoring program (i.e., upgradient/downgradient monitoring wells, sampling and analysis plan, ground-water quality assessment outline or program plan) by November 19, 1981. On June 15 and July 28, 1982 inspections of the facility, by DOHS personnel, confirmed noncompliance with the ground-water monitoring provisions of the ISD.

The ISD program allows the ground-water monitoring program to be waived if the facility can demonstrate, in writing to the RWQCB, that there is a low potential for contaminant migration. Acme requested such a waiver on November 17, 1982 (1 year after the program was required to be implemented) and was granted the waiver by the RWQCB on March 4, 1983. This waiver was approved on the grounds that the existing self-monitoring program (for ground water) under the RWQCB Waste Discharge Requirements was more appropriate than the ISD requirements. However, the existing self-monitoring program did not require numerous provisions of the ISD program. Acme was ordered by RWQCB to continue the self-monitoring program specified by the Waste Discharge Requirements, in lieu of the ISD requirements.

Guidance to the DOHS from EPA indicated that the waiver granted to Acme, by the RWQCB, was inappropriate. In a letter to Acme dated May 6, 1985, the RWQCB rescinded the waiver. Acme was ordered to prepare an expanded ground-water monitoring program in line with the ISD requirements and 40 CFR Parts 265.90-94. The first ground-water monitoring program plan was prepared by Acme and submitted to the RWQCB on May 28, 1985. The plan was revised on August 28, 1985. Quarterly interim status detection monitoring under this plan started in October of 1985. The monitoring program consists of approximately 60 monitoring wells. The 60 wells were drilled to comply with RCRA and non-RCRA State monitoring programs. The RCRA well network consists of 26 wells surrounding the North Parcel landfill. These wells are sampled quarterly for RCRA interim status parameters.

Acme submitted a RCRA Part B Application to EPA for the North Parcel landfill on August 2, 1983. A final permit had not been granted at the time of the Task Force inspection. The application was submitted to EPA because DOHS had not been granted authorization to issue RCRA permits.

The following is an evaluation of the interim status monitoring program between November 1981, when the ground-water monitoring provisions of the RCRA regulations (and State equivalent) became effective, and June 1987, when the Task Force investigation was conducted and addresses:

- Regulatory requirements

- Ground-water monitoring program - November 1981 to May 1985 (Self-monitoring program)
- Ground-water monitoring program - May 1985 to June 1987 (ISD/RCRA program)
- Acme sample collection and handling procedures
- Ground-Water Quality Assessment Outline and Program

REGULATORY REQUIREMENTS

The State was granted portions of two phases of RCRA authorization as indicated below:

- June 4, 1981 - DOHS received Interim Authorization for Phase I, which included 40 CFR Parts 260, 261, 262, 263 and 265. This granted the State authority to regulate hazardous waste facilities for waste treatment, storage and disposal during interim status.

- January 11, 1983 - DOHS received Interim Authorization for Phase II, Component A, which granted the authority to write RCRA permits for treatment and storage of hazardous wastes in tanks, containers, waste piles and surface impoundments.

- February 7, 1985 - DOHS was granted an extension of Interim Authorization.

On January 31, 1986, the responsibility for the RCRA interim status hazardous waste program reverted back to EPA Region IX because the State failed to achieve Final Authorization by that date, as required by RCRA Section 3006(c)(1). Since February 1, 1986, EPA has implemented the RCRA program for the State of California, including the 1984 Hazardous and Solid Waste Amendments (HSWA). EPA also implemented the RCRA program before the State was granted interim authorization, November 19, 1980 through June 3, 1981. The DOHS is continuing to pursue Final RCRA Authorization.

Hazardous waste management at Acme has been regulated by the State (DOHS and RWQCB) since May 1975. The State equivalent of the RCRA program was implemented from June 4, 1981 until January 31, 1986. The California requirements for interim status ground-water monitoring program are contained in the California Administrative Code, Title 22, Sections 67191-67195. These requirements are similar to the RCRA Part 265 Subpart F interim status requirements but additionally require monitoring of the air and the soil-pore liquid in the normally unsaturated zone. The regulation counterparts are shown below in Table 11.

Table 11

STATE AND FEDERAL COUNTERPARTS FOR INTERIM STATUS GROUND-WATER MONITORING REGULATIONS

Section Title*	California State Regulation CAC, Title 22, Article 22	RCRA Regulation 40 CFR Part
Applicability	67191	265.90
Ground-Water Monitoring	67192	265.91
Sampling and Analyses	67193	265.92
Preparation, Evaluation and Response	67194	265.93
Recordkeeping and Reporting	67195	265.94

* *Subpart titles are given for RCRA regulations; the State Subparts have similar titles.*

Acme is required to comply with both State and Federal hazardous waste management requirements. This includes the State requirements under Title 22 (e.g., monitoring of the air and soil-pore liquid of the normally unsaturated zone), as well as the ground-water monitoring provisions of the ISD (November 1981 through January 1986) and RCRA (November 1980 to June 1981 and February 1986 to present). Acme has not complied with these requirements.

The facility has not monitored the air or the soil-pore liquid of the normally unsaturated zone, as required by Title 22. These two media are to be monitored for all the hazardous waste constituents disposed at the facility, as

well as indicator parameters [e.g., specific conductance, total organic compounds (TOC), total organic halides (TOX)]. (See Appendix E for a detailed comparison of State and Federal monitoring requirements.)

GROUND-WATER MONITORING PROGRAM - NOVEMBER 1981 THROUGH MAY 1985

Acme did not comply with the ground-water monitoring requirements specified in the Interim Status Document (issued by DOHS) by November 19, 1981, as required. Acme was in noncompliance with the ISD until November 17, 1982, when a ground-water monitoring waiver was requested from RWQCB.

The review and approval of Acme's waiver request was in accordance with the unofficially delegated authority to RWQCB, under the ISD (although delegation to RWQCB was not included in the DOHS program approved by EPA). Therefore, the self-monitoring program has been evaluated by the Task Force, as a substitute ground-water monitoring program, for the period from November of 1982 until May of 1985. However, the waiver should not have been granted since the waiver provision of the ISD [Section VIII(5)] does not allow for substitution of alternate monitoring plans; it permits waiver approval, only if low potential for migration can be proved. The waiver approval by RWQCB was not in accordance with State (DOHS) and Federal monitoring requirements.

The self-monitoring program of the Waste Discharge Requirements issued by RWQCB as Order Number 76-37, on April 20, 1976, required development of both a sampling program and a monitoring well network. The subsequent revisions to the Waste Discharge Requirements (including 1981 revision) self-monitoring program did not require numerous provisions of a RCRA or ISD ground-water monitoring program, including: (1) development of a monitoring well system including upgradient and downgradient wells, (2) establishing background data or statistical analysis of monitoring well data to determine if a significant increase (or decrease for pH) in analytical parameters had occurred or (3) preparation of a ground-water quality assessment outline or program. The program did include monitoring for

parameters deemed by RWQCB to be representative of leachate. Acme's compliance with the ground-water monitoring portions of the self-monitoring program, including sampling program and monitoring well location, number and construction, follows.

Sampling Program

The ground-water monitoring provisions of the self-monitoring program were originally issued to Acme on April 20, 1976 (Order 76-37) and revised on February 6, 1978 (Order 84-18). The programs included analytical parameters and sampling frequency. The original and revised programs specified the location and approximate depths of ground-water monitoring wells and the locations of other leachate monitoring points. The original program included quarterly sampling for 18 inorganic and organic parameters and yearly analysis for pesticides and chlorinated hydrocarbons. The revised program eliminated quarterly sampling for all but 10 of the previously required parameters and specified quarterly analysis for color, chloride, chemical oxygen demand (COD), total dissolved solids (TDS), nitrate nitrogen (as N), total kjeldahl nitrogen (as N), conductivity, pH and water level. The parameters were not expanded after the state RCRA equivalent program became effective or the RWQCB review of the Acme waiver request, yet the existing self-monitoring program was deemed to include "more appropriate" parameters for a landfill monitoring program by RQWCB.

There are inconsistencies in both the substance and implementation of the self-monitoring program. The program requires the facility to submit an annual report summarizing "the compliance record and corrective actions taken or planned which may be needed to bring the discharger into full compliance with Waste Discharge Requirements";[10] however, there are no discharge requirements or quality standards identified for ground water. The annual report was also required to summarize ground-water analyses and indicate any change in the quality of ground water. As mentioned previously, the monitoring system did not require upgradient or downgradient monitoring wells, and the facility was never required to determine "background" water quality, to enable a determination of changes in ground-water quality.

The annual reports submitted by HLA personnel on behalf of Acme for monitoring between 1981 and 1985 noted fluctuations in numerous analytical parameters; however, HLA repeatedly reported in the transmittal letter that "except for well K1, the parameters have not changed significantly over the past year."[11] The reports do not define how the "significance" of the fluctuations was determined, nor does the self-monitoring program require any statistical analysis of quarterly data to quantify any changes in the quality of ground water.

Chlorinated hydrocarbons and volatile organics were analyzed and detected in leachate samples in November 1982 and in two wells (G5 and G6) in June 1983, yet the results were not discussed in the annual report summary nor were corrective actions discussed. These parameters were not analyzed as part of the self-monitoring program (yet reported in tables) and were reported, by HLA, to have been analyzed voluntarily.

Tetrahydrofuran and trichloroethane were detected in both leachate and ground-water monitoring wells during June, September and December monitoring in 1983, yet the facility reported that analytical parameters had "not changed significantly."[12] The volatile organics detected are the same as those contained in the unauthorized waste loads (Cordis Dow wastes) accepted by the facility, and should have been acknowledged in the summary of the annual report. The need for corrective action plans, in compliance with the self-monitoring requirements should also have been included in the 1984 annual report. Acme did not perform volatile analysis beyond 1983, after constituents were detected.

The self-monitoring program also required a variety of records to be maintained at the facility for each sample collected, including: (1) complete sampling procedures, (2) method of sample preservation and identification of reagents used, (3) calculation of results and (4) results of analysis. Acme did not comply with any of these recordkeeping requirements. The 1983 ground-water monitoring program submitted as part of the RCRA Part B permit application stated that the facility did not have a document containing sampling procedures and preservation methods, both of which were required by the self-monitoring program in 1976.

Monitoring Well Location, Number and Construction

The self-monitoring program specified the location [Figure 12], number and approximate depth (to the first available ground water) of each Acme monitoring well [Table 12]. The program also specified construction standards. The monitoring system included six ground-water monitoring wells, numbered G1, K1 (replacement for designated G2), G3, G4, G5 and G6, and an unspecified number of leachate observation wells. Acme complied with the required location and number of monitoring wells, but did not fully comply with specified construction standards.

The self-monitoring program specified that Acme must follow the well construction standards of the Contra Costa County Health Department (CCCHD). The CCCHD construction requirements specify that wells be constructed in accordance with standards specified in the California Department of Water Resources Bulletin Number 74 (Bulletin 74).

The CCCHD construction requirements and the self-monitoring program specify that a permit is required for construction or abandonment of each well [CCCHD Article 414-4.801(a)] and upon completion of each well, a log must be submitted to the county health officer [Article 414-401(d)]. This apparently was not complied with since there were no logs available from Acme for the abandonment of original wells G4 (replaced by well G4A in the second quarter of 1983) and G6 (replaced by well G6A in the second quarter of 1982 and renamed to G6), nor were there logs, or construction information for wells K1, G1, G3, G4A, G4 or G5.[13]

Task Force personnel attempted to locate original well G6 which was reported, by HLA, to be within 6 feet of the present well location; however, no evidence was found of the casing or the cement cap required for abandonment by CCCHD [Article 414-409] and Bulletin 74 [Part III Section 23 E].

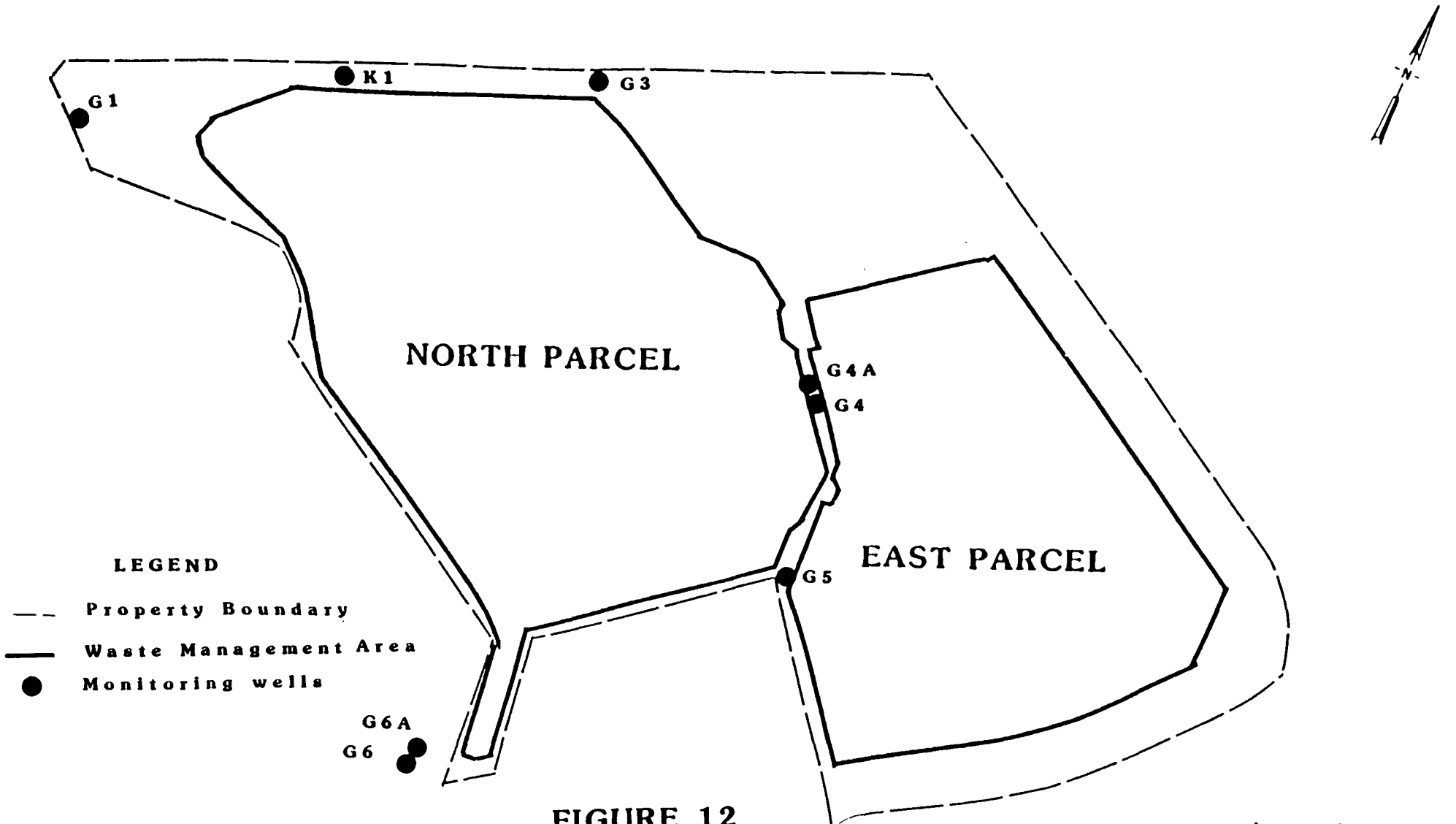

FIGURE 12

SELF-MONITORING PROGRAM

MONITORING WELL NETWORK FOR THE NORTH PARCEL

Table 12

DESIGNATED LOCATIONS/DEPTHS OF SELF-MONITORING PROGRAM WELLS* AS DESCRIBED IN THE ACME WASTE DISCHARGE REQUIREMENTS
(Orders No. 76-37 and 84-18)

Station	Description
G1	A well located within 50 feet of the northwesterly corner of the area I and III, as shown on Attachment "D". The depth shall be to the first available ground water.**
G2	A well located 1,000 feet easterly of well G1, as shown on Attachment "D". The depth shall be to the first available ground water.
G3	A well located 50 feet westerly of the sewer outfall, as shown on Attachment "D". The depth shall be to the first available ground water.**
G4	A well located between well No. G18 of International Technology (IT) and well G3, as shown on Attachment "D". The depth shall be to the first available ground water.**
G5	A well located within 50 feet of the southeasterly corner of area I. (Same as IT well no. G18).
G6	A well located at southwesterly corner of the site (same as IT well number G23).

* *Well locations illustrated on Figure 12.*
** *Required to penetrate and fully perforate the uppermost permeable coarse grain layer such as sand and/or gravel.*

Bulletin 74 also requires wells to be cased so that the top of casing is above any known conditions of flooding by drainage or runoff from surrounding land. During several quarters of monitoring, wells G1, K1 and G3 were submerged and quarterly samples were not taken. Uncapped or poorly sealed wells can be contaminated by surface runoff. Well construction data are not available for these wells to verify surface grouting, therefore well integrity is unknown.

None of the self-monitoring wells had construction records available. These records should include information related to volume of grout or

bentonite used in seals, bit size used in drilling, volume of sand in the sand/ gravel pack, or sieve analysis of surrounding formation materials for determination of the sand pack and screen slot size, etc.; therefore, compliance with construction standards cannot be further evaluated.

The only boring log available is for well G6A (renamed G6). It appears that this well is screened in more than one formation [both silty sandstone (15 feet), and sandy silty shale (10 feet)], contrary to the requirements of the self-monitoring program. The hole diameter is also not noted on the log. A total well diameter of 4 inches greater than the production casing is required [Bulletin 74 Part II Section 9(B)]. Proper hole diameter is necessary to insure uniform placement of both the sand/gravel pack and surface grout seals, both of which are essential for quality water samples.

GROUND-WATER MONITORING PROGRAM - MAY 1985 THROUGH JUNE 1987

On May 6, 1985, the RWQCB rescinded the Acme waiver approval. Following receipt of guidance from EPA, the RWQCB decided the waiver issued to Acme was inappropriate under RCRA requirements, and required the facility to develop an expanded ground-water monitoring program, in accordance with the previously issued ISD requirements. The facility drilled new monitoring wells in the summer of 1985 and started sampling for interim status parameters in October 1985. The facility reported to Task Force personnel that, although all of the wells surrounding the North Parcel were completed and sampled in 1985, all of the facility wells were not completed; therefore, the first quarter of interim status detection monitoring was the first quarter of 1986. At the time of the Task Force inspection the facility had completed six quarters of monitoring (March, May, August and November of 1986 and February and May of 1987) and had reported analytical results for all but the most recent quarter.

Facility compliance with the ground-water monitoring requirements of RCRA and the equivalent requirements in the ISD, including the sampling and analysis plan and monitoring well location, number and construction, are discussed in the following sections.

Sampling and Analysis Plan

Acme submitted the first sampling and analysis plan in May 1985 and a revised plan in August 1985. The procedures in the August plan were used for sample collection in October and December of 1985. The sampling procedures outlined in the August plan did not include sufficient detail regarding the general procedures and techniques for sample collection, sample preservation and shipment or analytical procedures, as required in ISD Section VIII (2)(a-c), and equivalent requirements in 40 CFR Part 265.92. The forms presented for chain-of-custody were adequate.

The sampling procedures did not discuss whether dedicated pumps and/or bailers would be used to purge and sample each well. If a single pump/bailer is used, decontamination procedures need to be described. Improper decontamination procedures for reusable sampling and monitoring equipment can lead to cross-contamination of wells. Contamination of a well, caused by improperly cleaned equipment, will generate misleading data.

The procedures did not require measurement of the total well depth in conjunction with the measurement of the static water level. Both measurements are necessary for determination of the total well volume and associated purge volumes. The precision of measurements was also not specified. Accurate water level measurements are necessary to adequately characterize the ground-water gradient. Measurements taken by Acme were usually recorded to the nearest one-half foot which is not adequate, particularly, for facilities with relatively flat water tables. EPA guidance[14] recommends water level measurement with a precision of 0.01 foot.

The monitoring plan does not describe methods for determining purge volumes nor does it include procedures to collect and dispose of purge and excess sample water. If this water is not properly handled, contaminants can be introduced into the well(s) and affect sample results.

The sample preservation procedures are referenced rather than listed. This is inadequate because the referenced sources contain multiple methods and preservation procedures. The plan does not mention cooling samples until

shipment, nor does it require pH verification in the field for preserved aliquots. Most analytical methods require samples to be cooled to 4 °C, in addition to any chemical preservatives.

The analytical methods are neither referenced nor listed. All analytical methods must be specified to ensure replication of analysis and comparability of results from one quarter to the next. Different methods can result in different analytical results.

The plan does not describe a quality assurance/quality control (QA/QC) program. The failure to require standard operating procedures to ensure accurate calibration curves, fresh reagents, equipment calibration procedures, equipment cleaning procedures, etc., can result in erroneous and/or unreproducible data.

The drinking water parameters are referenced rather than listed in the plan. All parameters collected must be listed and their sampling frequency included, to ensure that parameters are all collected at the proper frequency, since sampling requirements change after the first year of interim status monitoring.

On February 4, 1986, Acme submitted a report prepared by HLA titled, "Implementation of Ground-Water Monitoring Plan; Acme Landfill, Martinez, California." This report is identified by HLA personnel as an update of the sampling and analysis plan submitted in August 1985, and is the plan followed at the time of the Task Force inspection.

The sampling and analysis portion of this report is a significant improvement over the August 1985 plan; however, it is still incomplete. The plan does not include the method used to determine purge volumes. It does not include decontamination of the tape used for water level measurements. Sampling procedures still do not include methods for collection or disposition of purge water, nor does it include procedures for calibration and decontamination of field meters (pH meter, conductivity meter and thermometer).

A table is included with the sample preservation procedures; however, no mention is made of field preservation or verification of pH for acidified samples. The sample preservation table indicates that several of the metals (lead, mercury, selenium and silver) are to be filtered and reported as dissolved concentrations while all other metals are to be reported as total concentrations. The plan does not explain the purpose of filtering selected metals. The methods (in the table) used for preservation of the fluoride, pesticide, herbicide and TOX aliquots are inconsistent with EPA methods. Equipment for filtering and decontamination of the same is not addressed in the plan.

In addition, the list of analytical parameters is incomplete because it does not include turbidity, as required by the ISD. The plan also does not specify the frequency of sample collection except for the water level measurements, taken on a quarterly basis. A sampling schedule is necessary because monitoring frequencies and parameter requirements change after the first year.

The February 1986 monitoring plan did not contain a ground-water quality assessment program outline. The plan did not include requirements for quadruplicate measurements of indicator parameters or statistical evaluation of data as required in the August plan [and both the ISD Section VIII(3) and 40 CFR Part 265.93(a)].

Monitoring Well Location, Number and Construction

The ISD [Section VIII (1)] and RCRA (40 CFR Part 265.91) requirements are identical regarding the location and number of monitoring wells, and require:

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

  - Representative of background ground-water quality in the uppermost aquifer near the facility

- Not affected by the facility

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

The facility has not fully complied with these regulatory requirements.

The current monitoring well system around the North Parcel consists of 26 wells [Figure 13] encircling the North Parcel. Well G6 (G6A) is designated by Acme personnel as the background well and the remaining 25 wells, numbered MW101 through MW119, MW126 through MW128, G20, G25 and G28 are designated as downgradient wells. The facility has not fully characterized the site and cannot verify that the monitoring well network is adequate for this facility.

As previously discussed in the Hydrogeology section of this report, facility personnel have not determined the direction of ground-water flow and stated that it is not possible to establish horizontal hydraulic gradients. Therefore, facility personnel cannot verify the proper location of the designated upgradient well as representative of background ground-water quality.

The facility also has not fully characterized the uppermost aquifer; therefore, additional wells of differing depths may be necessary to adequately represent the water quality upgradient of the facility. The driller's log of well G6, the designated upgradient well, indicates that the well is not completed in either the grey silty clay or the peat zones monitored in the remaining downgradient wells, or other strata characteristic of the bay mud designated by the facility as the uppermost aquifer. The well is instead screened in a sandstone formation. To be an acceptable background well, the well should be screened in the same formation as the downgradient wells. Well G6 is not acceptable as a background well. The facility needs to establish a background well.

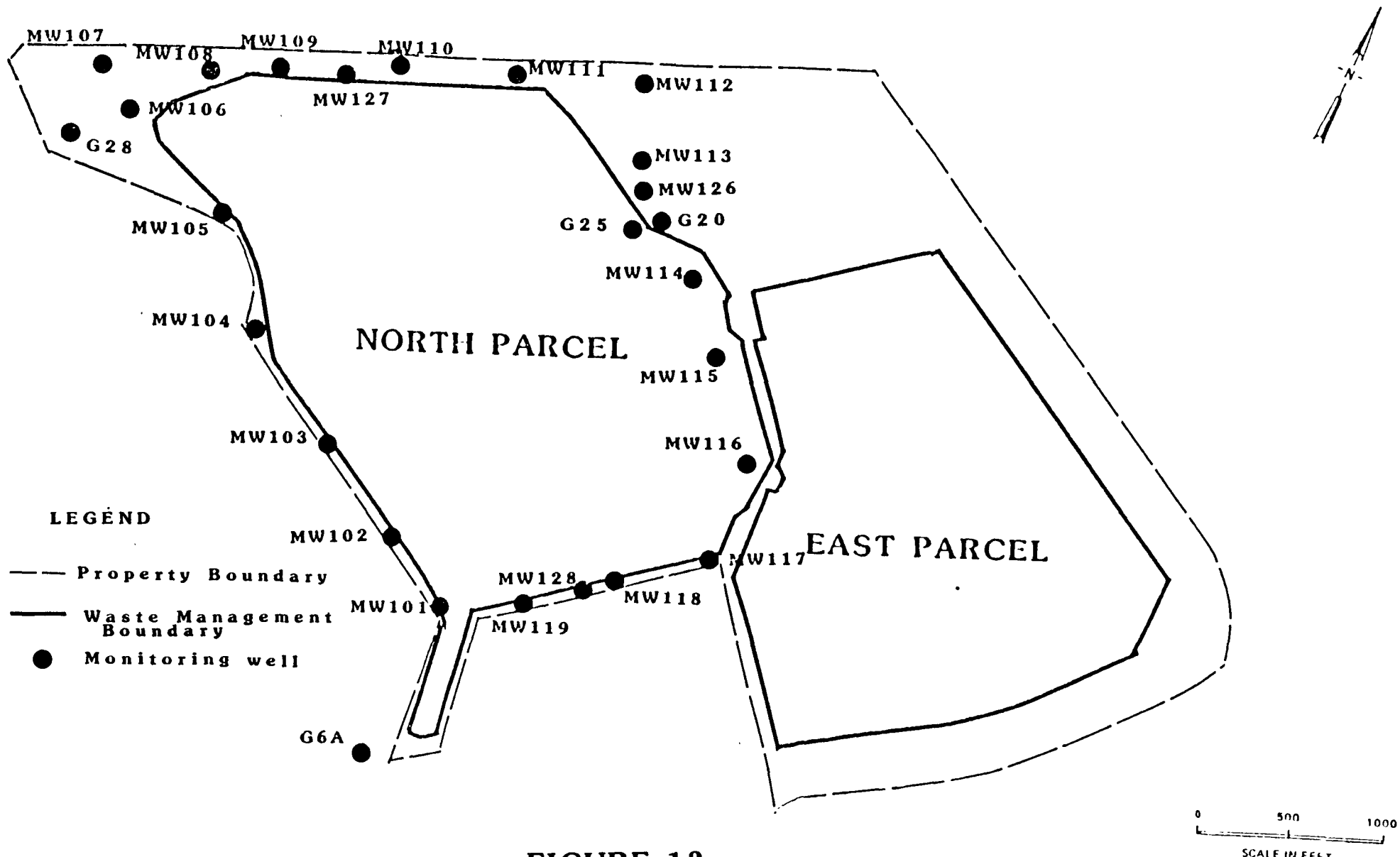

FIGURE 13
ACME ISD/RCRA MONITORING WELL NETWORK

The facility contact from HLA also reported during the Task Force inspection that well G6 may not be an appropriate background well because it does not adequately identify contaminants suspected of migrating onsite from neighboring facilities. This was the reason given for not completing the statistical analysis required by 265.93(b). An abandonment plan submitted by HLA, after completion of the Task Force inspection, also lists well G6 as proposed for abandonment because of a broken surface casing. In addition, the leachate levels in the North Parcel are above the water levels in G6 and all other wells, therefore, suggesting that none of the wells are upgradient. All of the RCRA wells are within the potential area of influence of the leachate mound.

In order to properly locate upgradient wells, the facility personnel must fully understand the hydraulic gradients, the extent and degree of inter-connection in the uppermost aquifer and any effects of leachate mounding. Once the hydrogeology is understood, the location, number and depths of upgradient wells may be chosen, which are representative of background ground-water quality.

The downgradient wells are all at the limit of the waste management unit; however the vertical and horizontal distribution of the wells is inadequate to monitor the multiple formations (discussed in the Hydrogeology section) with varying hydraulic conductivities (e.g., peat, clay, sand, gravel, etc.) in the uppermost aquifer. Each of the designated wells is hydraulically downgradient of the leachate mound created by the North Parcel, but may not be capable of immediately detecting a release of hazardous constituents.

The Acme monitoring wells are described by HLA as being constructed as follows. Shallow wells were drilled with a 10-inch diameter hollow-stem auger. The borings were drilled to depths ranging from 15 to 35 feet and were sampled continuously with a 5-foot long, $2^1/_2$-inch diameter split barrel sampler. A mud-rotary rig was used when peat or mud clogged the auger. When refuse was encountered above the bay mud, conductor pipe was set through the entire length of the refuse. Deeper wells (MW125-127) were drilled to depths ranging from 60 to 75 feet. They were drilled with 8-inch hollow stem augers and/or mud rotary rigs when difficulty was encountered.

The wells were constructed with 4-inch diameter Schedule 40, flush-threaded PVC well casing. No glues or resins were used to connect the casing lengths. The lower 10 feet (approximately) of the borings were screened with machine slotted 0.02-inch well screen. Sand packs, designed for the screen, were placed between the casing and the boring wall, completely covering the screened section. Bentonite pellets were added above the sand pack and a cement/bentonite grout was placed from the top of the pellets to ground surface. All wells were completed above grade and were equipped with a locking steel cover.

Most wells were developed using an airlift method until several well volumes were removed. Wells MW117, MW118 and MW119 had an oily substance on the water and the wells were bailed in order to contain all of the development water.[15]

There were numerous discrepancies between the field drilling logs and the construction records submitted by HLA to the regulatory agencies. Many of these discrepancies raise significant questions regarding the formations screened and the integrity of the wells and/or any samples taken from them.

Many field logs were edited by HLA personnel and the records submitted to EPA/DOHS are inconsistent or inaccurate. The field logs specify the approximate percentage of peat in the core sample. In some logs a silty clay formation containing as much as 40% peat has been edited by HLA to read "minor" peat. In other wells, the same silty clay with 40% peat was reported to contain "high" peat content. The percentage of peat present has been omitted from the final construction logs. Many well logs were edited (23) and some have been altered to be significantly different than the original field logs (9) for the geologic description.

The field records for well MW125 identified a silty clay zone with 5% peat at depths between 30 and 50 feet below the surface. The log submitted to regulatory agencies identify the zone as peat. Another comment on the same well log identified a zone with interbedded clay zones of 1/4-inch thick. The final construction log shows interbedded zones of clay 4 inches thick.

The construction records for numerous wells are either incomplete or inaccurate. The main types of problems and the wells affected are as follows:

- No field construction logs and/or driller's logs - MW112, MW128, MW132, G6A, G13, G14, G26 and G28 through G32.

- Drilling depths in construction records do not match field logs - MW105, MW114, MW115, MW116 and MW135

- Construction records are not complete or are inaccurate when compared to the field drilling logs as follows:

  - No mention of the silt trap - MW102, MW114, MW116, MW126 and MW127

  - No mention of the well cave-in and inability to install a full length of sand pack around the screen - MW106, MW108, MW111 and G22

  - No mention of backfilling the hole in well MW131 (no cement grout) - or well MW134 (with cement grout)

  - Borehole sizes differ - MW115, MW133, G15, G16, G17, G18, G23 and G27

  - No documentation of the type and/or volume of cement grout (MW131, MW134 and G17)

  - Final construction record does not mention the 15 pounds of "wheat bran" used possibly due to a loss of circulation in MW115. HLA representatives could not explain the use of the wheat bran.

  - No well cover initially installed - MW106, G23, G24, and G27

- No sieve analyses were conducted for any of the wells constructed; therefore, the filter pack and screen size are questionable considering the variety of formations screened.

In addition, the construction diagrams submitted do not include the field comments regarding high OVA readings (MW117, MW118 and MW119), strong odors of creosote (MW133 and MW136), kerosene (MW101), hydrogen sulfide (MW106, MW109, MW127), etc., nor do they identify when wells were drilled through oily zones of up to several feet in length (MW117, MW118, MW119, MW133 and MW128). Most of these wells were completed below the zone(s) where indicators of contaminants were present and migration of contaminants may not be monitored adequately.

In addition to the problems revealed following review of the drillers logs, additional potential problems were noted during the course of Task Force field activities.

- Broken or missing surface cement seals around well, potentially allowing contamination to enter these wells from the surface - G25, MW115, MW120 and MW124

- No locking well cap and the potential for allowing unauthorized entry or surface contamination - MW102, MW104, MW119, G25

- Surface casing c erflowing, indicating either broken surface casing and/or inadequate cement seal - MW116, MW125, G15 and G20

- Samples very turbid, indicating either inadequate development of the well or inappropriate grain size of the sand pack - MW115, MW117, MW119 and G20

- Abnormally high pH, indicating possible cement grout contamination (or wheat bran contamination) - MW115

- Unable to find well, buried in refuse, potential conduit for migration of leachate - G14

- No abandonment records, therefore, the wells may not be adequately plugged, creating a potential conduit for migration of contaminants to the completion zone(s) - G4, G6, and G14

Most wells are completed in several zones of differing hydraulic conductivities: MW101 through MW108, MW110, MW111, MW113, MW117, MW124, MW128, G6A, G14, G15, G30, and G32. This would not allow for adequate monitoring of the uppermost aquifer.

ACME SAMPLE COLLECTION AND HANDLING PROCEDURES

HLA personnel sample the Acme wells for the required interim status monitoring. The Sampling and Analysis Plan (SAP) submitted in February 1986, is the most recent plan and reflects the current sampling procedures. Some of the sampling procedures are inadequate and the plan, in several instances, is not strictly followed, as required by the ISD [Section VIII (2)(a)] and 40 CFR Part 265.92(a). HLA was requested to demonstrate their sampling protocol for Task Force personnel. The following is an evaluation of the sampling procedures used by HLA while sampling well MW111 and their compliance with the procedures outlined in the February 1986 SAP. The information was derived from the HLA demonstration, interviews with HLA personnel and a review of facility field data sheets from sampling during May 1987.

Water Level Measurements

The method used by HLA to measure the static water level and total depth of the monitoring wells is not accurate and all of the procedures are not followed. HLA personnel lower an unweighted metal tape, the end of which is coated with blue carpenters' chalk, into the well to the approximate water level. The length lowered is noted relative to a casing reference point (at the top of the PVC casing) at the surface. The tape is withdrawn to determine the wetted chalk length. The wetted length is subtracted from the total length lowered, to determine the depth to water from the surface. According to the February 1986 plan, the total depth of the well is also supposed to be measured with the steel

tape by extending the tape until the bottom is reached. Both measurements are supposed to be recorded in the field log to the nearest 0.01 foot.

The use of an unweighted metal tape may not produce accurate or reproduceable results since the tape can bend in the well. The total depth of the well was not measured during the HLA demonstration. Review of the field data sheets from May 1987 indicates that the depths of the wells recorded on the field sheets is the depth from the construction records rather than the actual depths. The total depth of the well may not be measured quarterly, as indicated in the plan. Accurate measurements of both the total depth and water levels are necessary to calculate purge volumes. Depths in the field notes were also reported to the nearest one-half foot rather than to the nearest 0.01 foot, as specified in the plan.

Total depths for the majority of the interim status wells (23 of 26 wells around the North Parcel) were measured during the Task Force inspection, and found to vary significantly from the depths recorded in the field notes or those depths used by HLA to determine purge volumes. The differences in the total depths ranged from 10.54 feet shallower to 6.42 feet greater than the depths recorded by HLA in the field notes. The differences in total depths affect the required purge volumes by up to 20 gallons, using the three well volumes specified in the plan. Therefore, the volumes purged by HLA would not be adequate for some wells sampled.

The plan does not contain adequate decontamination procedures for the metal tape. The last several feet of tape are rinsed with municipal water before reuse. The entire length of the tape entering the well should be properly decontaminated with anionic detergent and deionized water in order to avoid cross contamination of wells.

Purging Procedures

The purging methods in the plan are incomplete and the methods specified are not followed. The plan states that low yielding wells are supposed to be purged using a hand-operated suction pump or centrifugal pump until dry and allowed to recover before sampling. High yielding wells are purged of at

least three well volumes prior to sampling. During water removal, temperature, pH and conductivity are supposed to be measured and recorded on field sampling sheets.

Stainless steel bailers are used in low yield wells, as well as centrifugal pumps; bailers should be added to the equipment referenced in the plan. The method for determining the purge volume is not included in the plan, nor are the methods for collection and disposal of purge water.

During the demonstration HLA personnel calculated the volume of water in the well using a table of conversion factors. The well volume was multiplied by three, to determine the purge volume. As cited previously, the total depths were not measured. The table of conversion factors used to determine the volume should also be included in the plan.

The methods used to measure the volume of purge water collected were inaccurate and the disposal of the water was not carried out in an environmentally sound manner. The submersible pump, used during the demonstration, was allowed to discharge into an uncalibrated bucket during the purge. While pH, conductivity and temperature were measured the bucket was overflowing. Therefore, the measurement of the purge volume was inaccurate, even though volumes to the nearest gallon are recorded on field data sheets.

Purge water from the bucket was discharged directly to the ground adjacent to the well. Because this water may contain hazardous waste or hazardous waste constituents, it needs to be disposed of in a more environmentally sound manner. Task Force personnel were informed by HLA that purge water collected from wells along the IT Vine Hill border (found to be contaminated with volatile organics in 1983) was contained in drums and then properly disposed. When the Task Force collected samples along the IT border the purge water was contained in drums provided by Acme. The purge water was then disposed of by Acme. The Task Force discovered, via discussions with the Acme General Manager, that the purge water was disposed of in the

hazardous waste trenches, a violation of 265.314(b) and (f).* (Unwanted split samples provided to the facility during the inspection were also improperly disposed of in the trenches.)

The plan requires pH, conductivity and temperature measurements, taken during the purging, to be recorded on the field sampling sheets. These measurements were not recorded on the May 1987 field sheets or on the sheets completed during the demonstration for the Task Force.

Sampling Methods

Ground water from high yielding wells is reportedly sampled by HLA immediately after purging. Low yielding wells are sampled the day after purging because of insufficient volume, with the exception of the volatile organics aliquot, which is poured as soon as there is sufficient volume. Water samples are obtained using a stainless steel bailer. The sample is poured from the bailer into laboratory prepared sample containers. The sample order, bottle type and preservation methods are in Table 13.

Pumps (used for purging) and bailers are cleaned between wells by rinsing the exterior with hot water from a municipal tap. The interiors are rinsed with anionic detergent and water. The equipment is given a final rinse, exterior and interior, with water from the municipal supply. The rope attached to the bailer is changed after each well.

Quality assurance/quality control samples are taken quarterly as follows: (1) One trip blank provided by a laboratory, (2) field blanks which are 10% of the samples and (3) one duplicate sample for the North Parcel. Samples are submitted with coded identification numbers to the lab. The labels contain the date of sampling, sample collector and job number.

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* *Liquid either hazardous (b) or nonhazardous (f), is not to be disposed of in landfills after May 8, 1985.*

Table 13
ACME SAMPLE ORDER, BOTTLE TYPE AND PRESERVATION METHODS

Parameter	Bottle	Preservative
Volatile Organics		
TOC, TOX	8 40-ml VOA vials	
Coliform bacteria	8 oz. plastic	
Phenols	2 1-pt. amber glass	H_2SO_4 to pH<4
Anions*	1 qt. plastic	
Metals	2 1-qt. plastic	Filtered, HNO_3 to pH<2
Pesticides	2 1-qt. amber glass	
Radiological	1 gal. plastic	

* *pH and conductivity measurements are taken from the aliquots for anions, metals and pesticides.*

The procedures stated are unacceptable and incomplete. The use of water from the municipal supply is unacceptable for use in decontaminating equipment. The municipal water should be tested to determine if there are contaminants present or deionized water should be used to rinse equipment. The plan does not specify that preservation or filtering procedures which are used in the field. The pH, conductance and temperature are measured at the beginning of sampling and should be stated in the plan. In addition, samples are reportedly preserved by HLA in the field and the pH of the preserved sample is verified before shipment to the lab; this should also be added to the plan. The laboratory evaluation indicated that samples were not filtered or preserved in the field, as reported by HLA personnel to Task Force field personnel. Samples should be field preserved.

The plan is not always followed. Despite what the plan requires, HLA personnel reported that all metal samples are filtered in the field using a .45 micron millipore disposable filter, and then preserved with nitric acid to a pH <2.

The plan does not indicate that any samples will be filtered, and most metals are stated to be reported as total metals concentrations. If samples are filtered, they must be reported as dissolved metals concentrations.

Shipment and Chain-of-Custody Control

The shipment and chain-of-custody procedures used by HLA are adequate. Sample containers are placed directly in a ice chest, with ice, and transported to the analytical laboratory on a daily basis. A chain-of-custody record accompanies the samples and includes: Sample number, signature of collector, date and time of collection, sample type, identification of well, parameters requested for analysis, and signatures and dates of persons involved in chain-of custody.

GROUND-WATER QUALITY ASSESSMENT PROGRAM OUTLINE AND PROGRAM

The ISD issued by DOHS on October 23, 1981, (and RCRA 40 CFR Part 265.93), required Acme to prepare, by November 19, 1981, a ground-water quality assessment program outline. The outline is required to describe a more comprehensive ground-water monitoring 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

A ground-water quality assessment program outline had not been prepared for the Acme facility at the time of the Task Force inspection. Personnel from HLA were questioned at length regarding assessment responsibilities and were unaware of the requirements in both the ISD

[Section VIII (3)] and 40 CFR Part 265.93. Task Force personnel were told that an assessment outline would be prepared before their departure from the site. This, however, did not occur.

The first assessment outline for Acme was submitted by HLA to EPA Region IX and DOHS on August 21, 1987. The outline was reviewed by Task Force personnel and found to be inadequate. The outline does not address the following items:

- How data triggering assessment would be evaluated to confirm apparent contamination
- Circumstances under which additional monitoring wells would be necessary if the initial phase of the program indicates contamination
- How volume/concentration of released contaminants would be determined
- How the rate and extent of contaminant migration would be determined, other than by review of existing data
- How the facility would be sure that all potential contaminants were identified in the plume
- How an assessment monitoring plan would be developed and the projected sampling frequency
- Which aquifer(s) would be monitored
- Approximate schedules for the time needed to initiate assessment sampling, analyses, data evaluation and report results

In addition, the document references the use of existing hydrogeologic data as the source for determination of both rate and extent of migration of constituents. As mentioned in previous sections, the existing hydrologic evaluation does not identify ground-water flow directions or the uppermost

aquifer adequately; therefore, use of this information in an assessment program is meaningless. The outline should instead indicate how additional hydrogeologic data would be collected in the event of detection of significant increases (or decreases for pH) in hazardous waste or hazardous waste constituents.

The outline also references statistical analysis of well data to determine if assessment is triggered. However, the most recent site characterization indicates that well G6 is not monitoring the same saturated intervals as the downgradient wells and, therefore, is not acceptable as a background well. Statistical analyses are not truly meaningful until background is established; however, statistical analysis using the data from the designated well G6 would have triggered assessment at an early date, and could have led to a more appropriate well network.

The fifth quarter of interim status detection monitoring was completed in March 1987. Had facility consultants performed statistical analyses, as required by 40 CFR Part 265.93(b) (using G6 as the upgradient well), a statistically significant increase (or decrease for pH) would have been identified for several indicator parameters. All downgradient wells, 25 total, showed statistically significant (0.01 level of significance) increases in conductivity. Two wells, MW115 and G25, had a significant increase or decrease in pH, respectively, and 23 wells had significant increases in TOC. TOX data was not evaluated due to the questioned reliability of the data, as described in the Sample Analysis and Data Quality Assessment section of this report.

Analytical results prepared for Acme contain biases and are probably not based on comparable methods (a fault of the February 1986 SAP), as discussed in the Sample Analysis and Data Quality Assessment of this report. However, comparison of data generated within the same quarter continuously demonstrate an order of magnitude difference between values reported for the designated upgradient well G6, and all other designated downgradient wells, for TOC, TOX and conductivity. A review of ground-water data presented during the self-monitoring program also indicated statistically significant (0.01 level of significance) differences between wells.

The 1983 Part B permit application designated well G6 as the upgradient well for the self-monitoring program. Prior to that time no designation was required, or stated. The data generated for the self-monitoring program from 1981 through 1985 also indicate higher concentrations for conductivity, TDS, kjeldahl nitrogen, TOC and chlorides for numerous wells compared to G6. No statistical evaluation was required under the self-monitoring program. The facility had completed five quarters of analytical results between November 1981 and November 1982 (when a waiver of the ISD interim status requirements was requested) and should have performed a statistical analysis, as required by the ISD. An evaluation of the data generated under the self-monitoring program (data since 1976) should also have been conducted by RWQCB as part of the waiver review process.

No statistical evaluation had been conducted by the facility, at the time of the Task Force inspection, for any data generated either during the self-monitoring program or RCRA interim status monitoring, a violation of 40 CFR Part 265.93(b) and Section VIII(3)(b) of the ISD.

Historical compliance reports and site characterizations, 1981 to present, have characterized the differences in parameter concentrations across the site as either "fluctuations...over ranges which have been present in the past"[16] or "... differences attributable to the characteristics of bay mud."[17] Volatile organics, including tetrahydrofuran, trichloroethylene and methylene chloride were detected in leachate samples as early as November 1982 and in several monitoring well samples as early as June 1983. These parameters are not naturally found in bay mud and indicate hazardous waste migration. These and other volatile organics were among the unauthorized wastes improperly disposed at the facility (Cordis Dow - refer to Table 9).

Acme personnel have repeatedly ignored the presence of hazardous waste constituents or indicator parameters in the monitoring wells. The facility should have triggered assessment, at a minimum, in March 1987, at the end of five quarters of ISD monitoring. A program similar to assessment should have begun (during self-monitoring) as early as August 1982 when heavy metals were detected, or in June 1983 when volatile organics were detected in several

wells. A corrective action program, rather than "assessment," would have been required under the self-monitoring program.

The assessment program plan should be based on the assessment outline, which as previously discussed was not written until August of 1987, and must specify:

- The number, location, and depth of wells
- Sampling and analytical methods for those hazardous wastes or hazardous waste constituents in the facility
- Evaluation procedures, including any use of previously-gathered ground-water quality information
- A schedule of implementation

The implementation of the assessment program must be in accordance with provisions of 40 CFR Part 265.93(d) and CAC Title 22, Section 67194.

SAMPLE ANALYSIS AND DATA QUALITY ASSESSMENT

This section provides an evaluation of the quality and completeness of interim status ground-water monitoring data gathered by Acme Landfill (Acme) between January 1986 and March 1987. At the time of the laboratory evaluation, Acme had completed five quarters of detection monitoring under the current ground-water sampling and analysis plan dated February 4, 1986. Detection monitoring started in October 1985, but facility personnel chose to identify the first quarter of 1986 as the official beginning of the initial year of monitoring. HLA was responsible for sampling and reporting ground-water monitoring data to Acme during the five quarters of monitoring. Under contract to HLA, the analytical laboratories of Curtis and Tompkins, Ltd. (CT) have been primarily responsible for analyzing the samples. Curtis and Tompkins has laboratories at two locations, one in San Francisco (CTSF) and one in Los Angeles (CTLA).

CTSF has performed all pH, specific conductance, elemental (metals) and phenol determinations (except first quarter 1987). CTLA has performed all anion determinations and during the last quarter of 1986, total organic carbon (TOC), total organic halide (TOX) and fecal coliform determinations. Under contract to CT, three other laboratories have analyzed Acme ground-water samples. Reportedly, (according to CTSF personnel) during the first two quarters of 1986, Brown and Caldwell of Emeryville, California performed the determinations for TOC, TOX and coliform. Brown and Caldwell also analyzed samples for coliform during the third quarter of 1986. Radium, gross alpha and gross beta determinations were performed by Thermo Analytical/Norcal of Richmond, California during the second quarter of 1986 and by Environmental Laboratories Incorporated (ELI) of Gulf Port, Mississippi for the last two quarters of 1986 and the first quarter of 1987. ELI also reportedly analyzed samples for TOC and TOX during the third quarter of 1986.

NEIC chemists conducted laboratory inspections between June 2 and June 11, 1987 at the two CT laboratories. Five quarterly monitoring reports and associated laboratory records for the RCRA monitoring well network were reviewed. Laboratory procedures were evaluated and laboratory equipment was inspected. The examinations revealed problems that could affect the data

quality. Most of the problems stem from inadequate quality assurance measures which include inadequate methodology and calibration procedures and improper sample handling. Improper sample handling has potentially affected pH, dissolved elemental (metals) and nitrate results. Acme did not follow the February 1986 sampling and analysis plan (SAP) when handling samples collected for dissolved elemental constituents. The results reported for TOX, elemental constituents and radionuclide parameters may be unreliable. The analytical methods used did not take into account the high dissolved solids content of the samples. Analytical records for some of the analyses could not be located. All reported detection limits, with the possible exception of those associated with radionuclide measurements, are unreliable because of the manner in which they were calculated or estimated. These inadequacies adversely affect the reliability of data in establishing background levels and/or in detecting releases into the ground water. A detailed discussion of these problems is given in the following sections.

INITIAL YEAR OF MONITORING

RCRA regulations [40 CFR 265.92(c)] require quarterly monitoring of all wells during the initial year of interim status monitoring to establish background values. Quarterly monitoring of the upgradient wells must include quadruplicate measurements of the four parameters used as indicators of ground-water contamination: TOC, TOX, pH and specific conductance. In March 1986, Acme initiated quarterly monitoring pursuant to 40 CFR 265.92 for its RCRA/ISD designated monitoring well network. The network consisted of 25 wells around the North Parcel, in the first quarter, and 26 wells in succeeding quarters. Well number G6 was designated as the upgradient well. A review of the data submitted showed that the indicator parameters were reported at the frequency specified.

Chain-of-custody procedures used in the laboratory are inadequate. Frequently the date and time of receipt of samples at CTSF were not noted on custody sheets. This notation is necessary to show the exact whereabouts of the samples. The date and time of analyses for coliform and anion determinations were not recorded. When determining parameters with limited holding times such as these, it is especially necessary to record the time of

analysis in order to demonstrate the integrity of reported results. Access to the samples at CTSF is inadequately restricted; the sample storage area is accessible to anyone entering the main door of the facility. Laboratory personnel were not always present to monitor outside access to the sample storage area, therefore, custody can not be demonstrated.

Reported pH results may be unreliable because recommended holding times were exceeded. Failure to analyze the samples within holding times may have resulted in changes in sample pH. EPA currently recommends that pH measurements be performed *in situ* or immediately after collection. The samples from which quadruplicate pH measurements were made were transported from the site to the laboratory in San Francisco where they were typically analyzed a day or more after collection. For example, pH measurements on samples collected November 25, 1986 were not performed until December 1, 1986 (6 days after collection). The February 1986 SAP specified analyses of pH samples within 2 hours. Thus, the SAP was not followed. Measurements for pH were also commonly performed on filtered samples. This practice further reduces the reliability of reported results. Filtration may degas or otherwise alter constituents in the sample, thereby affecting pH.

Errors may be present in specific conductance data. For example, fourth quarter data for two wells, MW117 and MW118, were identical. This is highly unlikely and probably indicates that either one or both were reported in error. The average of the data for those two wells was approximately 18,000 which does not agree with reported data for all other quarters at either well. The other quarterly data reported for well MW117 ranged from approximately 45,000 to 48,000 µmhos/cm. The other data for well MW118 ranged from approximately 50,000 to 60,000 µmhos/cm. Reported chloride results also discount the 18,000 µmhos/cm values reported. This fourth quarter data for specific conductance may therefore indicate a measurement error or sample mix up.

The standard TOX method can often achieve a detection limit of between 5 mg/L and 30 mg/L. However, the high chloride levels in the site's groundwater samples would prevent such a detection limit from being achieved. High chloride levels can cause TOX results to be biased high. Typically 50 mg/L

chloride could cause an apparent TOX of 1 mg/L. Some of the ground-water samples were found to contain as much as 30,000 mg/L chloride. Such samples, therefore, show an apparent TOX of 600 mg/L. Furthermore, the high sodium content of these samples can cause the quartz furnace of the TOX analyzer to deteriorate resulting in a negative bias for TOX measurements.

TOX measurements using the standard method and instrumentation for ground water containing such high levels of dissolved salts can not serve as an indicator of low level contamination of halogenated organics and, thus, the reported TOX results are inherently unreliable. POX (purgeable organic halide) measurements could serve as an indicator of low-level contamination of volatile halogenated organics, assuming proper care is taken to ensure the quartz furnace does not deteriorate due to an excessive purge rate introducing sodium in the furnace.

TOC results reported for the last quarter of 1986 may have been biased low. These results were obtained by acidifying and purging samples prior to analysis. The results for this type of analysis are best termed non-purgeable organic carbon (NPOC), since the purging not only eliminates inorganic carbon from the measurement but also purgeable organic carbon (POC). TOC can be defined as the sum of NPOC plus POC. In order to equate NPOC with TOC, the facility would need to measure POC to establish that it is not a significant component.

Problems were observed in the TOC data reported. Significant differences in the data were noted between quarters. Data from the second quarter of 1986 is believed to be high in relation to other quarters. For example, the reported concentrations for well MW117 for this quarter average 301 mg/L, while all other quarters range from 69 to 107 mg/L. Similarly for well G6, the average value reported for the second quarter was 33 mg/L; whereas, values for other quarters were below 20 mg/L. The nonconforming results observed for this sampling may be due to systematic error rather than to actual changes in the concentrations in well samples. Also, some of the replicate data for the second quarter was noted to be imprecise. For example, the replicates reported for well G20 were 133, 184, 130 and 170.

Although samples were spiked to determine TOC recoveries, apparently no correction was made when recoveries were low. For example, data was reported for the samples from monitoring well MW109 (384 mg/L average) even through the spike recovery was 14%. Recoveries for other samples analyzed on the same date ranged from 75 to 81% which would also be considered low.

Review of laboratory records revealed additional problems related to sample handling and analyses. Examination of chain-of-custody forms showed that replication procedures for the four indicator parameters are inappropriate. Samples were split in the field. Analysis was performed on each of the four field aliquots rather than from the same aliquot. The regulations specify quadruplicate measurements on the same sample [40 CFR 265.92(c)(2)] which implies measurements on the same container or from aliquots of the sample taken concurrently with the analyses. Thus, the standard deviation obtained from the pooled results on field aliquots may be greater than that calculated from aliquots obtained concurrently with the analyses. Higher standard deviations degrade the ability to statistically assess ground-water contamination where this is relevant.

In addition to the indicator parameters, the regulations [40 CFR 265.92] also require the analysis of drinking water and ground-water quality parameters including certain elemental constituents (metals), herbicides, pesticides and radionuclides as well as coliform, fluoride, chloride and sulfate. Radionuclide data was not reported for the first quarter of 1986; however, the required reporting was completed in the subsequent four quarters. Data for the other parameters was reported at the frequency specified.

The percent levels of dissolved solids contained in some samples (as indicated by conductance) caused problems with a number of the analytical procedures used. Elemental determinations were performed exclusively by atomic absorption spectroscopy (AA) techniques. Many of these determinations for elemental constituents are unreliable because of the serious interferences from dissolved solids present in the ground-water samples. An example of unreliable data would be the results for arsenic and selenium (quarter one and two) generated using the furnace technique. The detection limits specified for ground-water protection can be achieved for samples containing relatively low

amounts of dissolved solids. However, the high chloride concentration in these samples causes so much molecular background that the analyte atomic absorption signal cannot be reliably distinguished by the background correction system of the furnace instrument. Further, ionization interference would have been severe when the flame AA technique was used for arsenic and selenium in the other three quarters and for all other metals except sodium during all five quarters. This ionization interference would have resulted in unreliable data for these parameters.

The dissolved elemental results may also be unreliable because of the sample handling procedures used. Filtration and preservation immediately after sample collection is necessary to preserve the integrity of the dissolved constituents. The February 1986 SAP stated that filtration and preservation would be performed in the field. Instead, metals samples from Acme were taken to the laboratory and reportedly filtered the next morning before preservation with nitric acid. The filtered sample was reportedly poured back into the original container. Failure to perform the necessary filtration and preservation immediately after sample collection may result in changes in the dissolved elemental concentrations in the sample due to oxidation-reduction reactions and sorbtion onto the container.

Although metals samples were spiked, resultant recoveries may have been overestimated because spike levels were too high in relationship to sample concentration. Under these circumstances low concentration matrix effects may not be observed. A chemical species present in the sample at low concentration, which would interact with the analyte of interest, may be completely consumed by the analyte spiked at high concentration and, consequently, not interact to bias recoveries. For example, 2.5 milligrams per liter (mg/L) spike levels were used for chromium, copper and lead, whereas, sample concentrations were reported at less than 0.05 mg/L. Detection limits were determined on blanks with little or no dissolved solids. The detection limits for many of the elemental constituents reported by the laboratory are therefore likely to be conservative.

Barium is often reported in Acme samples at levels above the maximum contaminant level (MCL) specified for ground-water protection and is, therefore,

a matter of concern. However, on the basis of accompanying sulfate concentrations and using approximations for high ionic strength,[18] the calculated barium solubilities are lower than the concentrations reported. This finding is a further indication that the methods used did not adequately correct for ionization interferences.

Arsenic was reported at levels in excess of the MCL [50 micrograms per liter (µg/L)], e.g., 54 mg/L, for the second quarter of 1986, in well MW126; however, for reasons mentioned below, data may be unreliable. In subsequent quarters, the laboratory switched from furnace AA to flame AA when analyzing arsenic and selenium. Flame AA did not achieve the required detection limits for ground-water protection standards. The different amounts reported or reported as nondetected between quarters are the result of the change in methods and stated detection limits. The methods used for arsenic and selenium were inappropriate during all quarters. The hydride technique, which separates these elements from interferences due to dissolved solids, is recommended for these samples.

The methods used for lead, chromium and cadmium were also inappropriate. Laboratory records show that the flame AA methods could not reliably measure concentrations at the MCLs specified for ground-water protection even in the absence of high dissolved solids.

The procedure used for calibrating the atomic absorption instrument at CTSF may have contributed to data unreliability. The calibration is reportedly accomplished using a single calibration standard. This type of calibration does not verify the functional relationship between concentration and response. In order to document this relationship, and as an integral part of good quality control, a multipoint calibration should have been performed at least once during the time each group of samples were analyzed.

Mercury levels in the samples could have been underestimated. Mercury was determined exclusively by cold vapor atomic absorption spectroscopy. This methodology requires a heated digestion of the samples. The digestion renders mercury species to the divalent ionic form, prior to reduction to the

measureable elemental form for cold vapor atomic absorption spectroscopy. This heated digestion was not performed for the facility samples.

The methodology used for gross alpha and gross beta measurements was inappropriate for samples containing high dissolved solids. The use of such methodology is understandable because standard procedures, including those referenced in EPA publications, do not reliably measure MCLs for gross alpha or gross beta in the presence of high amounts of solids. Other methodology has been suggested for samples with high dissolved solids;[19] however, it would be necessary to validate its use on these particular samples.

Some of the reported gross alpha results are significantly above the MCL of 2 picocuries per liter (pCi/L). For example, gross alpha values of 166 +/- 82 pCi/L were reported for well MW117 and 174 +/- 89 for well G25 during the second quarter of 1986. Accounting for the confidence intervals (indicated by +/-), these results infer respective gross alpha values of at least 84 and 85 pCi/L, respectively. If these levels are accurate, they are a matter of concern because they exceed the MCL; however, the procedures used to obtain these results were not evaluated. Most of the other results reported are questionable since the counting errors are frequently of the same magnitude as the values reported. The same comments are also applicable to gross beta values reported.

Fluoride and nitrate results may be unreliable. These parameters were analyzed by Ion Chromatography (IC). Using this method, several weak acids may be inappropriately measured as fluoride. Thus, fluoride results may be biased high. Although the laboratory bench sheets do not show the exact times of analyses, nitrate was reportedly analyzed past the maximum 48-hour holding time EPA has recommended in similar applications. The excessive holding time may have resulted in changes in the nitrate concentrations in the samples and, therefore, produced unreliable data. Nitrite was reported in some samples and although it may have been present at the time of sampling, it may also be a result of nitrate degradation through chemical reduction.

The daily calibration of the ion chromatograph used to measure fluoride, chloride, nitrate and sulfate was inappropriate. Standard analytical practice

recommends daily, multipoint calibration to maximize and document accuracy. Daily IC instrument calibrations by the laboratories were based instead, on a single calibration standard rather than several standards, needed to verify a functional relationship over a discrete concentration range.

Analytical results reported for phenols during the first three quarters of 1986 and for pesticides and herbicides during all quarters are suspect because raw data, including essential quality control data, could not be located for review during the Task Force inspection. In some cases, essential quality control procedures were reportedly not performed. 40 CFR Part 265.94(a)(1) requires the maintenance of analytical records. No raw data for phenol determinations were found for the first and third quarters in any of the sample files examined. During the first quarter of 1986, the sample files for wells MW117 and G20 contained some pesticide raw data records, but the quality control information was incomplete and the detection limits reported were not verifiable. No raw data records for pesticide determinations could be found for other samples reviewed for the first quarter, or any subsequent quarters. During the first quarter of 1986 when herbicide raw data records were located, the detection limits reported could not be verified and the quality control procedures were inadequate to support the data.

The pesticide and herbicide data may also be unreliable because the effects of appreciable suspended solids in some of the samples were not evaluated. Suspended solids interfere with extraction of pesticides and the conversion of herbicides to the chemical forms necessary for measurement. Thus, in order to show that the results reported were reliable, it was necessary to spike real samples with the analytes of interest and to determine that the recoveries achieved were satisfactory. Real samples were not spiked with herbicides in any quarters. The reliability of spike data reported for phenols during the first three quarters and pesticides during all quarters could not be determined because the raw data could not be located.

The February 1986 SAP developed by Acme was not sufficiently detailed to insure uniform analytical methodology since no methodology was specified. The SAP listed incorrect preservation procedures. Acidification to pH less than 2 was specified for fluoride and the pesticides and herbicides. The preservative

specified for TOX samples was sodium sulfate and not sulfite. In comparing the data from each quarter, it is important to note that three different methodologies were used to determine phenol concentrations. Each of the methods used contain inherent biases and, therefore, inhibit the comparison of data from quarter to quarter. One method for determining phenols should have been specified in the Acme SAP of 1986, and the same method should have been used for all quarters.

MONITORING IN 1987

The laboratory findings discussed in the initial year of monitoring are also applicable to the second year data since most of the methods did not change. Because 1987 was the second year of monitoring, samples analyzed for each of the indicator parameters were required (40 CFR 265.92) to be performed in quadruplicate. This was apparently done; however, as noted before, results were obtained from separate analyses of field replicates rather than quadruplicate measurements from the same sample aliquot.

GROUND-WATER MONITORING PROGRAM PROPOSED FOR RCRA PERMIT

The ground-water monitoring program proposed in the Part B permit application, submitted to EPA Region IX on August 2, 1983, does not meet the requirements of 40 CFR Part 270.14 (c).* The ground-water monitoring results (self-monitoring program) indicated a release of hazardous wastes or hazardous waste constituents at the proposed point of compliance [Figure 14], before the submission of the Part B application. The monitoring program proposed in the permit should have been a compliance monitoring program instead of a detection monitoring program. The facility has not supplied the information regarding protection of ground water, as required of an owner of a landfill, and specified in 40 CFR Parts 270.14(c)(1, 2, 3, 4, 5, 7, and 8). The ground-water monitoring portion of the Part B permit application is deficient as follows:

- 270.14(c)(1) - The facility has not supplied a complete summary of the ground-water monitoring data obtained during interim status under 265.90 through 265.94. The application does not include the self-monitoring program data from the fourth quarter of 1982. The data submitted with the application is also not complete for the quarters submitted. The application does not include volatile organics data for 1982 and 1983, as reported to DOHS and RWQCB.

- 270.14(c)(2) - The facility has not adequately characterized the uppermost aquifer, ground-water flow directions or rates. Acme personnel characterized the clay zone overlying the uppermost aquifer; however, the company never characterized the uppermost aquifer. The facility has not adequately defined ground-water flow directions. The application states that the ground-water flow direction is "...most likely to be to the north toward Suisun Bay and/or to the east toward Walnut Creek."[20] There is no discussion of the rate of ground-water flow.

- 270.14(c)(3) - The topographic map referenced in the application (Plate 2) does not show the location of the monitoring wells. Plate 5 in the application, does show the well locations, waste management area, property boundary and proposed "point of compliance." None of the maps provided show any of the information in 270.14(c)(2) (e.g., uppermost aquifer, direction of ground-water flow, etc.), as required.

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* *The State of California was never granted authorization to issue RCRA permits; therefore, Federal requirements are cited.*

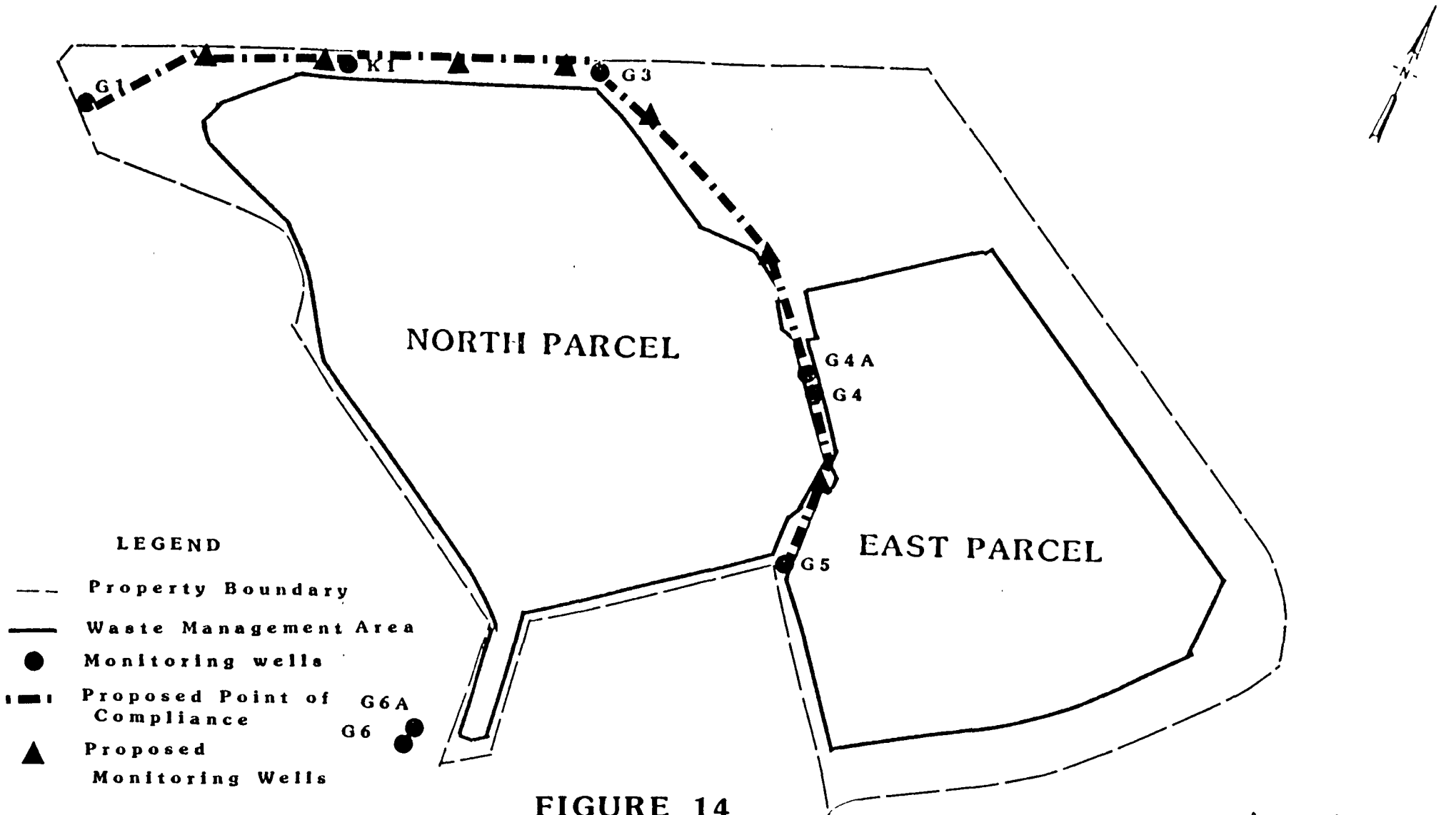

FIGURE 14

PROPOSED POINT OF COMPLIANCE

- 270.14(c)(4) - The facility has not described the plume of contamination from the North Parcel, as required. Heavy metals and volatile organics were detected in several wells. The facility reported that the results "did not indicate if the facility's present containment system (dikes) was or was not containing the wastes onsite. The low levels of metals detected could be the result of surface contamination from leachate seeps prior to the construction of the leachate containment barriers."[21] The facility never attempted to characterize a plume nor did they address the volatile organics detected in leachate samples in November 1982 and February 1983, or in monitoring wells in June, September and December 1983. The application did not attempt to identify the concentrations of hazardous wastes in the ground water.

- 270.14(c)(5) - The application does not include an engineering report describing the proposed monitoring program (264.97). The application did not include: information required in 264.99 (compliance monitoring program), background water quality data, water quality data at the point of compliance, a list of sampling parameters, sampling and analysis procedures, etc.

- 270.14(c)(7) - The facility did not submit the information required for a compliance monitoring program under 264.99, nor did they include a feasibility study for a corrective action program under 264.100. The application also did not include a description of the wastes handled, characterization and concentrations of hazardous wastes in the ground water, etc.

- 270.14(c)(8) - Hazardous constituents detected in ground water exceeded the maximum concentrations in 264.94 for cadmium and lead in August 1982. The limits of detection were not adequate to determine the presence of endrine, lindane, methoxychlor or toxaphene at the maximum contaminant levels. Samples were not analyzed for 2,4-D or 2,4,5-TP. The application did not address the minimum requirements for a facility detecting constituents above maximum concentrations (i.e., characterization of ground water, corrective action program, concentration limits for constituents, and a description of how the monitoring program will demonstrate the effectiveness of the corrective action program).

EVALUATION OF MONITORING DATA FOR INDICATIONS OF WASTE RELEASE

This section presents an analysis of Task Force and Company monitoring data regarding indications of waste releases to ground water from the North Parcel landfill. Field and laboratory analytical results from samples collected by Task Force personnel are presented in Appendix A, together with the analytical methods. The Task Force data indicates that hazardous waste constituents have leaked from the landfill. The designated upgradient well G6 is used for comparison although the well is not considered to be an adequate background well. Until the uppermost aquifer is fully characterized, however, it is not certain whether the bedrock is interconnected to the overlying formations, either naturally or because of Acme drilling activities; therefore, well G6 is used for comparison.

VOLATILE ORGANIC SAMPLING RESULTS

Volatile organic results from the Task Force samples indicate the presence of volatile organic compounds at concentrations above the detection limits in five downgradient wells, and similar constituents in the leachate well NPGR5 [Table 14]. The facility-designated upgradient well (G6) was found to contain only one volatile organic compound (di-n-butylphthalate) but the concentration was below the limit of quantitation and is estimated. The Task Force sample results identified the presence of tetrahydrofuran in the leachate, but did not find detectable quantities of the compound in the monitoring wells sampled. Acme data has also shown detectable quantities of this compound in the leachate and several monitoring wells (G3, G5 and G6). These three wells were not sampled during the Task Force inspection. The Task Force analyses also identified numerous volatile and semi-volatile organic compounds, in both leachate and monitoring wells, which Acme has not identified including: benzene, 1,2-dichlorobenzene, 1,4-dichlorobenzene, toluene, xylene, ethylbenzene, vinyl acetate and phenol. Many of the volatile organics identified were present in Cordis Dow or Shell Oil Company waste loads.

Table 14

SELECTED VOLATILE ORGANIC CONSTITUENTS PRESENT IN TASK FORCE SAMPLES[1]
ACME FILL CORPORATION
Martinez, California

Constituent[2]	Designated Upgradient Well G6	Well MW104	Well MW115	Well MW116	Well MW117	Well MW119[3]	Leachate Well NPGR5
Benzene	ND*	5.	3.**	ND*	ND	4.**	2.**
1,2-Dichlorobenzene	ND	2.	ND	ND	ND	ND	2.**
1,4-Dichlorobenzene	ND	4.	ND	ND	ND	ND	17.
Toluene	ND	2.	13.	ND	5.	ND	7.
Xylenes	ND	10.	ND	ND	ND	ND	7.
Ethylbenzene	ND	7.	ND	ND	ND	ND	6.
1,2,4-Trimethylbenzene	ND	15.	ND	ND	ND	ND	5.
1,3,5-Trimethylbenzene	ND	3.	ND	ND	ND	ND	2.**
Tetrahydrofuran	ND	ND	ND	ND	ND	ND	150.
Vinyl Acetate	ND	ND	84.	ND	ND	ND	ND
Di-n-Butyl Phthalate	2.**	ND	ND	ND	3.**	ND	ND
Phenol	ND	ND	100.	2.*	ND	ND	ND

1 *Wells MW126, MW128 and G20 were analyzed but not listed since no volatile organic compounds were detected.*
2 *Concentrations are expressed in micrograms per liter (µg/L).*
3 *Average of results from triplicate samples*
* *Not detected*
** *Estimated value or below detection limit*

In the past (since 1982), facility samples have also identified acetone, methylene chloride and trichloroethylene at detectable quantities, in both leachate and other monitoring wells which were not sampled during the Task Force inspection. These constituents were also present in wastes disposed by Cordis Dow at Acme from 1979 through 1982.

INORGANIC SAMPLING RESULTS

The inorganic data from the Task Force samples also indicate that hazardous constituents have migrated into the ground water. The total metals concentrations in the downgradient wells are well above the concentrations found in the ground water of the bedrock in the facility-designated upgradient well [Table 15]. In most cases, the concentrations were over an order of magnitude greater in the downgradient wells (although completed in different formations) and the leachate well. Some of the metals present in the downgradient wells exceed current primary drinking water standards (40 CFR Part 265 Appendix III). For instance, barium was present at 0.39 milligrams per liter (mg/L) in the upgradient well (G6) but ranged up to 2.9 mg/L in the downgradient wells. The drinking water standard for barium is 1.0 mg/L. Five wells (MW104, MW115, MW119, MW128 and the leachate well) exceeded this standard. Downgradient wells exceed maximum contaminant levels for arsenic (MW117 and MW126) and chromium (MW126) also. Task Force samples were not analyzed for coliform, but Acme analyses have detected coliform concentrations in excess of the maximum contaminant level. Acme personnel stated the high fecal coliform levels must come from leaks in the Contra Costa County Sewer outfall. However, the facility also received 2,000 tons of sanitary waste sludge (containing 84% liquids) from the Contra Costa County Sanitary authority. Acme was ordered by RWQCB to not accept this waste again due to the high percentage of liquids.

Most of the inorganics present in the designated downgradient wells were also present in the samples from the leachate well. Many of the inorganics present in the wells are representative of the types of wastes accepted for disposal [e.g., iron slag and iron scale (Fe), alkaline sludges (Ca, Ba, Mg, K and Na)], alum sludge [Al and SO_4, boiler fly ash (Ni and V), etc.].

Table 15

SELECTED INORGANIC CONSTITUENTS PRESENT IN TASK FORCE SAMPLES*
ACME FILL CORPORATION
Martinez, California

Constituent	Upgradient Well G6	Well MW104	Well MW115	Well MW116	Well MW117	Well MW119**	Well MW126	Well MW128	Well G20	Leachate Well NPGR5
As	<.010	.011	<.050	<.045	.054	<.010	.155	<.010	.007	.012
Al	5.36	<.30	5.60	15.7	2.38	3.51	47.3	0.132	2.5	<0.30
Ba	.39	2.37	1.23	0.895	0.774	1.67	0.457	2.92	0.493	2.9
Ca	111.0	78.5	2,860.	482.	720.	454.	NA***	392.0	509.	304.
Fe	5.22	10.0	4.38	20.1	14.2	9.34	81.	13.0	17.0	77.
Mg	70.8	236.0	195.	518.	1,860.	1,270.	922.	969.0	1,040.	325.0
Mn	.177	1.34	0.061	3.01	.449	1.52	NA	.926	NA	0.86
K	5.01	528.0	259.	156.	246.	198.	357.	73.7	561.	821.
Na	88.	4,360.	12,800.	4,740.	10,800.	8,090.	3,430.	5,260.	6,750.	2,880.
V	<.015	0.01	0.037	0.095	.024	.027	.19	<.015	0.11	0.14
Zn	.059	0.17	0.045	0.079	.031	.035	.19	<.011	0.069	0.41

* *Concentrations are expressed in milligrams per liter (mg/L) and are for total inorganic concentrations.*
** *Average of results of triplicate samples for this well*
*** *Not analyzed*

RESULTS OF INDICATOR PARAMETERS

The interim status monitoring requirements specify sampling of pH, specific conductance, TOC and TOX as parameters used to indicate ground-water contamination. The Task Force results for these parameters indicate that the North Parcel landfill has impacted ground-water quality. Table 16 summarizes the results for the indicator parameters.

The pH of all the wells is approximately the same except for well MW115, which has a pH of 11.0 units. As discussed in the monitoring well construction section, this well may be contaminated with cement grout, causing the elevated pH. The specific conductance values in the designated downgradient wells indicate a statistically significant (.01 level of significance) increase over the values measured in the designated upgradient well G6. This data represents the effect of elevated chlorides and other dissolved solids in the samples.

The TOC results for Task Force samples are reported as purgeable (POC) and nonpurgable organic carbon (NPOC) instead of total organic carbon. The designated upgradient well has significantly lower concentrations of POC (160 mg/L) when compared to the downgradient wells, which have POC concentrations of up to 508,000 micrograms per liter (µg/L) (well MW119).

The analysis of TOX is affected by high chloride concentrations and are not reliable for the Acme facility [Appendix A]. The purgable organic halide (POX) analysis is not normally affected by chlorides, however, and is a very good indicator of ground-water contamination. As was noticed for the other indicator parameters, the designated upgradient well had a POX concentration of <5 µg/L (below the stated detection limit) while most of the downgradient wells had concentrations several times, to several orders of magnitude higher. While the absence of measurable compounds in the VOA analyses and lower results for TOX would at first contradict POX results for MW117 and MW119, these discrepancies, at least in part, are explainable by the laboratory procedures used. The detection of specific compounds in the VOA analysis relies on trapping efficiency (a tenax/silica gel trap was used in this case). The

Table 16

SELECTED RESULTS OF INDICATOR PARAMETERS FOR TASK FORCE SAMPLES
ACME FILL CORPORATION
Martinez, California

Parameter	Units	Upgradient Well G6	Well MW104	Well MW115	Well MW116	Well MW117	Well MW119*	Well MW126	Well MW128	Well G20	Leachate Well NPGR5
pH	Units	NA**	6.5	11.0	7.0	6.7	6.7	6.5	6.8	6.7	NA
Conductance	umhos/cm	1,650.	20,000.	46,900.	22,000.	49,000.	27,600.	21,500.	23,600.	32,000.	NA
POC	µg/l	160.	150.	5,160.	5,300.	2,460.	12,700.	45.	15,520.	54.	1,850.
NPOC	µg/l	61,000.	265,000.	60,000.	42,000.	77,000.	508,000.	21,000.	60,000.	50,000.	670,000.
POX	µg/l	<5.	14.	90.	<5.	3,900.	4,500.	20.	<5.	20.	28.

* *Sample concentration is the average for a triplicate sample.*
** *NA = Not analyzed*

majority of compounds with high vapor pressures such as vinyl chloride, pass through this column and are thus undetected. The POC and POX methodologies by comparison used no traps and thus all of the compounds purged would have been detected. Secondly, the discrepancy between TOX, which should be as high or higher than POX can potentially be explained through handling techniques normally employed with the TOX sample. TOX is typically run well beyond the normal holding time for POC and POX. TOX samples are typically collected in large mouth sample containers where head space is allowable. TOX samples are also opened and poured at the time of analysis. All of these conditions promote the loss of volatile compounds especially the type of light molecular weight compounds in question here.

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APPENDICES

A ANALYTICAL DATA AND METHODS
B DRAGER TUBE DATA
C PROCEDURES FOR OPERATING ISCO WATER LEVEL RECORDERS
D OCTOBER 1, 1986 INSPECTION REPORT
E COMPARISON OF STATE AND FEDERAL MONITORING REQUIREMENTS

APPENDIX A
ANALYTICAL DATA AND METHODS

Table A-1 Sample Preparation, Analytical Techniques and Methods
Table A-2 Organic Results
Table A-3a Organic Limits of Quantitation - NEIC
Table A-3b Organic Limits of Quantitation - Contract Laboratory
Table A-4 Total Metal Results
Table A-5 Field Measurements and General Analytical Parameters

Table A-1
SAMPLE PREPARATION AND ANALYTICAL TECHNIQUES AND METHODS
Acme/Vine Hill

Parameter	PreparationTechnique	AnalysisTechnique	MethodReference
Specific Organic Constituents			
Volatiles	Purge and trap	Gas Chromatography - Mass Spectroscopy	CLP Method (a)
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	Diethyl ether extraction/methylation	Gas Chromatography with Electron Capture Detection	Method 8150 (b)
Dioxins and Diobenzofurans	Methylene chloride/hexane extraction	Gas Chromatography - Mass Spectroscopy	Method 8280 (b)
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	UV Persulfate, Non-dispersive Infrared	Method 415.1 (c)
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
General Constituents			
Nitrate	None	Ion Chromatography	EPA Method 300.0
Sulfate	None	Ion Chromatography	EPA Method 300.0
Chloride	None	Ion Chromatography	EPA Method 300.0
Nitrite	None	Ion Chromatography	EPAMethod 300.0
Bromide	None	Ion Chromatography	EPA Method 300.0
Fluoride	None	Ion Chromatography	EPA Method 300.0
Sulfide	None	Iodometric, Titration	Method 9030 (b)
Phenol	Automated distillation	Colorimetric, Distillation, Automated 4-AAP	Method 9066 (b)
Cyanide	Manual distillation	Pyridine Pyrazolone Colorimetry	Method 9010 (b)

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 A-2

SPECIFIC ORGANIC CONSTITUENTS (a)
Acme Landfill

STATION:	MW104[b]	MW115	MW116	MW117	MW119[c]	G-6	NPGR5[b]
SMO NO.	MQB417	MQB413	MQB412	MQB415	MQB405	MQB402	MQB410
COMPOUND	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Carbon disulfide	ND *d*	ND	ND	3. *e*	2. *e*	ND	ND
Benzene	5.	3. *e*	ND	ND	4. *e*	ND	2. *e*
Chlorobenzene	2.	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	2.	ND	ND	ND	ND	ND	2. *e*
1,4-Dichlorobenzene	4.	ND	ND	ND	ND	ND	17.
Toluene	2.	13.	ND	5.	ND	ND	7.
Xylenes	10.	ND	ND	ND	ND	ND	7.
Ethylbenzene	7.	ND	ND	ND	ND	ND	6.
1,2,4-Trimethylbenzene	15.	ND	ND	ND	ND	ND	5.
1,3,5-Trimethylbenzene	3.	ND	ND	ND	ND	ND	2. *e*
Tetrahyrofuran	ND	ND	ND	ND	ND	ND	150.
Vinyl acetate	ND	84.	ND	ND	ND	ND	ND
di-n-Butyl phthalate	ND	ND	ND	3. *e*	ND	2. *e*	ND
Benzoic acid	ND	ND	ND	4. *e*	ND	ND	ND
Phenol	ND	100.	2. *e*	ND	ND	ND	ND
LOQ FACTORS (f)							
VOLATILE	1X	1X	1X	1X	1X	1X	2X
SEMIVOLATILE	NA *g*	2X	2X	2X	2X	2X	NA *g*
PESTICIDE	NA *g*	1X	1X	NA *i*	1X	1X	NA *g*
DIOXINS AND FURANS	NA *h*	NA *g*	NA *g*	NA *g*	1X	1X	NA *h*

a) MW126, MW 128, and MW G-20 were analyzed but not listed since no HSL compounds were found.
b) Note: Sample was analyzed at NEIC using Purge and Trap GCMS, SW-846 Methods 5030/8240.
c) Monitoring well 119 was sampled and analyzed in triplicate (MQB405, 406, 407); results were averaged for report.
d) Compound was not detected.
e) Estimated concentration. Compound was detected, but the concentration was below the Limit of Quantitation (LOQ).
f) LOG Factor is the factor that the LOQ must be multiplied by to correct the LOQ for dilutions.
g) Sample not analyzed.
h) Analysis not requested.
i) Low volume collected; possibly insufficient sample for pesticide analysis.

Table A-3a

LIMITS OF QUANTITATION
NEIC ORGANIC RESULTS
Acme Landfill
Martinez, California

	Limit of Quantitation (ug/L)
Volatile Compounds (Purge Trap)	
Bromomethane	20.
Chloromethane	30.
Bromodichloromethane	2.
Dibromochloromethane	2.
Bromoform	2.
Chloroform	2.
Carbon tetrachloride	2.
Chloroethane	20.
1,1-Dichloroethane	2.
1,2-Dichloroethane	2.
1,1,1-Trichloroethane	2.
1,1,2-Trichloroethane	2.
1,1,2,2-Tetrachloroethane	2.
1,1-Dichloroethene	2.
trans-1,2-Dichloroethene	2.
Trichloroethene	2.
Tetrachloroethene	2.
Methylene chloride	4.
Vinyl chloride	20.
1,2-Dichloropropane	2.
1,2-Dibromo-3-chloropropane	2.
Benzene	2.
Chlorobenzene	2.
1,2-Dichlorobenzene	2.
1,3-Dichlorobenzene	2.
1,4-Dichlorobenzene	2.
1,2,3-Trichlorobenzene	2.
1,2,4-Trichlorobenzene	2.
Toluene	2.
Xylenes	2.
Ethylbenzene	2.
n-Propylbenzene	2.
1,2,4-Trimethylbenzene	2.
1,3,5-Trimethylbenzene	2.
2-Butanone	10.
Tetrahydrofuran	2.
Styrene	10.

Table A-3b
LIMITS OF QUANTITATION FOR ORGANIC COMPOUNDS
Acme Landfill
Martinez, California

Volatile Compounds	ug/L	Volatile Compounds	ug/L	Semi-Volatile Compounds	ug/L	Semi-Volatile Compounds	ug/L
Bromomethane	10.	2-Hexanone	10.	2,6-Dinitrotolulene	10.	Fluoranthene	10.
Dibromomethane	5.	4-Methyl-2-pentanone	10.	N-Nitrosodimethylamine	10.	Pyrene	10.
Chloromethane	10.	2-Chloroethyl vinyl ether	10.	N-Nitrosodiethylamine	10.	Indeno (1,2,3-c,d)pyrene	10.
Iodomethane	5.	Ethyl cyanide	50.	N-Nitrosomethylethylamine	10.	Isophorone	10.
Bromodichloromethane	5.	1,4-Dioxane	5,000.	N-Nitrosodiphenylamine and/or		Naphthalene	10.
Dibromochloromethane	5.	Styrene	5.	Diphenylamine	10.	2-Chloronaphthalene	10.
Dibrochlorodifluoromethane	5.	Vinyl Acetate	10.	N-Nitroso-di-n-butylamine	10.	2-Methylnaphthalene	10.
Trichlorofluoromethane	5.	Crotonalydehyde	50.	alpha, alpha-		Phenanthrene	10.
Bromoform	5.			Dimethylphenethylamine	50.	3-Methylcholanthrene	10.
Chloroform	5.	Semi-Volatile Compounds		1-Naphthylamine	10.	Methapyrilene	50. a
Carbon tetrachloride	5.			2-Naphthylamine	10.	5-Nitro-o-toluidine	10.
Carbon disulfide	5.	Pentachloroethane	10.	bis(2-Chloroethyl) ether	10.	o-Toluidine	10.
Chloroethane	10.	Hexachloroethane	10.	4-Chlorophenyl phenyl ether	10.	2-Picoline	10.
1,2-Dibromoethane	5.	1,2-Dibromo-3-chloropropane	10.	4-Bromophenyl phenyl ether	10.	N-Nitrosopiperidine	10.
1,1-Dichloroethane	5.	Hexachloropropene	10.	bis(2-Chloroisopropyl) ether	10.	Safrole	10.
1,2-Dichloroethane	5.	trans-4-Dichloro-2-butene	10.	bis(2-Chloroethoxy) methane	10.	1,4-Naphoquinone	10.
1,1,1-Trichloroethane	5.	2-Hexanone	10.	Hexachloroethane	10.	Pyridine	10.
1,1,2-Trichloroethane	5.	Acetophenone	10.	Hexachlorobutadiene	10.	Methyl Methacrylate	10.
1,1,1,2-Tetrachloroethane	5.	4-Methyl-2-pentanone	10.	Hexachlorocyclopentadiene	10.	Ethyl Methacrylate	10.
1,1,2,2-Tetrachloroethane	5.	Aniline	10.	bis(2-Ethylhexyl) phthalate	20.	p-Dimethylaminoazobenzene	10.
1,1-Dichloroethene	5.	4-Chloroaniline	10.	Butyl benzyl phthalate	10.	4-Aminobiphenyl	10.
trans-1,2-Dichloroethene	5.	2-Nitroaniline	50.	di-n-Butyl phthalate	10.	Pronamide	10.
Trichloroethene	5.	3-Nitroaniline	50.	di-n-Octyl phthalate	10.	Isosafrole	10.
Tetrachloroethene	5.	4-Nitroaniline	50.	Diethyl phthalate	10.	N-Nitrosopyrrolidine	10.
Methylene chloride	5.	4-Methyl-2-nitroaniline	10.	Dimethyl phthalate	10.	Clyclophosamide	10.
Vinyl chloride	10.	3,3'-Dichlorobenzidine	20.	Acenapthene	10.	Phenacetin	10.
1,2-Dichloropropane	5.	3,3'-Dimethylbenzidine	100. a	Acenapthylene	10.	Methyl methane sulfonate	10.
1,2,3-Trichloropropane	5.	3,3'-Dimethoxybenzidine	10.	Anthracene	10.	4,4'-Methylene-bis	
1,2-Dibromo-3-chloropropane	5.	Benzyl alcohol	10.	Benzo(a)anthracene	10.	(2-chloroaniline)	10.
3-Chloropropene	5.	1,2-Dichlorobenzene	10.	7,12-Dimethylbenz(a)anthracene	10.	N-Nitrosomorpholine	10.
trans-1,3-dichloropropene	5.	1,3-Dichlorobenzene	10.	Benzo(b)fluoranthene and/or		Benzoic Acid	50.
1,4-Dichloro-2-butene	50.	1,4-Dichlorobenzene	10.	Benzo(k)fluoranthene	10.	Phenol	10.
Benzene	5.	1,2,4-Trichlorobenzene	10.	Benzo(g,h,i)perylene	10.	2-Chlorophenol	10.
Chlorobenzene	5.	1,2,4,5-Trichlorobenzene	10.	Benzo(a)pyrene	10.	2,4-Dichlorophenol	10.
Toluene	5.	Pentachlorobenzene	10.	Dibenzo(a,e)pyrene	10. a	2,6-Dichlorophenol	10.
Xylenes	5.	Hexachlorobenzene	10.	Dibenzo(a,h)pyrene	10. a	2,4,5-Trichlorophenol	50.
Ethylbenzene	5.	Pentachloronitrobenzene	10.	Dibenzo(a,j)pyrene	10. a	2,4,6-Trichlorophenol	10.
2-Methyl-1-propanol	50.	Nitrobenzene	10.	Chrysene	10.	2,3,4,6-Tetrachlorophenol	10.
Acetone	10.	Dinitrobenzene	10.	Dibenzo(a,h)anthracene	10.	Pentachlorophenol	50.
2-Butanone	10.	2,4-Dinitrotolulene	10.	Dibenzofuran	10.	4-Chloro-3-methylphenol	10.

a — not available at the time of analysis

Table A-4

DISSOLVED AND TOTAL METALS ANALYSIS RESULTS
Acme Landfill

Station:	MW 104[a]		MW 115		MW 116	
SMO No.:	MQB417		MQB413		MQB412	
Element	Dissolved Value, ug/L	Total Value, ug/L	Dissolved Value, ug/L	Total Value, ug/L	Dissolved Value, ug/L	Total Value ug/L
Al	<200. b	<300.	297.	5,600. c,d	58.	15,700. c,d
Sb	<1.3	<3.	<300. d	17.	<30. d	<4.
As	6.8	11.	<3. d	<50.	27. d	<45. d
Ba	2,480.	2,370.	1,230.	1,230. c,d	846.	895. c,d
Be	<3.	<2.	<1.	1.	<1.	<1.
Cd	<4.	<9.	<25. d	<5. d	<2. d	<5. d
Ca	57,800.	78,500.	2,810,000.	2,860,000.	496,000.	482,000.
Cr	<20.	<20.	<9.	<9.	<9.	37.
Co	<9.	<50.	<23.	<23.	<23.	<23.
Cu	<10.	<30.	<7.	12	<7.	25.
Fe	4,080.	10,000.	144.	4,380. c	65.	20,100. c
Pb	<40.	<100.	<25.	<25. d	12.	<25. d
Mg	227,000.	236,000.	181,000. d	195,000. c	474,000. d	518,000. c
Mn	1470.	1340.	5.	61. c	2,820.	3,010. c
Hg	<.1	<.1	<.4	<.4 d	<.4	<.4
Ni	<100.	<200.	<20.	36.	<20.	67.
K	443,000.	528,000.	296,000. c	259,000. c	158,000. c	156,000. c
Se	<3.4	<6.	<25. d	<25. d	<25. d	<25. d
Ag	<10.	<8.	7.	<7.	<7.	<7.
Na	3,720,000.	4,360,000.	12,400,000.	12,800,000.	4,370,000.	4,740,000.
Tl	<300.	<700.	<10. d	<50. d	<10. d	<10.
Sn	NA e		<32.	<32.	<32.	<32.
V	40.	10.	19.	37.	62.	95.
Zn	250.	170.	19.	45.	68.	79.

a *Note: Sample analyzed at NEIC*
b *Sample concentration is less than (<) the value shown.*
c *Estimated value; interference present causing possible bias*
d *Batch spike sample recovery was not within control limits indicating possible bias.*
e *Not analyzed.*

Table A-4 (Cont.)

SMO No.:	MQB415				MQB405, 406, 407				MQB416	
Station:	MW117				MW 119*				MW126	
Element	Dissolved Value, ug/L		Total Value, ug/L		Dissolved Value, ug/L		Total Value, ug/L		Dissolved Value, ug/L	Total Value ug/L
Al	122.		2,380.	c,d	145.		3,510.	c ,d	<200.	47,300.
Sb	<60.	b,d	<60.		<6.	d	<4.		<1.3	<3.
As	<45.	d	54.	d	20.	d	< 10.	d	37.4	155.
Ba	785.		774.	c,d	1,800.		1,670.	c ,d	320.	457.
Be	<1.		<1.		<1.		<1.		<3.	<2.
Cd	<.4	d	<5.	d	<2.	d	< 5.	d	<4.	<9.
Ca	504,000.		720,000.		494,000.		454,000.		NA	NA
Cr	<9.		<9.		11.		<9.		<20.	90.
Co	<23.		<23.		<23.		<23.		<9.	<50.
Cu	<7.		12.		<23.		10.		<10.	60.
Fe	<45.		14,200.	c	527.		9,340.	c	20,600.	81,000.
Pb	<25.		<25.	d	<20.		<5.	d	<40.	<100.
Mg	478,000.	d	1,860,000.	c	1,130,000.	d	1,270,000.	d	872,000.	922,000.
Mn	410.		449.	c	1,440.		1,520.	d	NA	NA
Hg	<.4	d	<.4	d	<.4	d	<.4	d	<.1	<.1
Ni	<20.		20.		36.		20.		<100.	<200.
K	259,000.	c	246,000.	c	219,000.	c	198,000.	c	189,000.	357,000.
Se	<25.	d	<25.	d	<25.	d	<25.	d	5.4	<8.
Ag	<7.		<7.		<7.		7.		<10.	<30.
Na	4,440,000.		10,800,000.		7,330,000.		8,090,000.		3,080,000.	3,430,000.
Tl	<50.	d	<10.	d	<10.	d	<50.	d	<300.	<700.
Sn	<32.		<32.		<32.		<32.		NA	NA
V	18.		24.		<23.		27.		60.	190.
Zn	21.		31.		84.		35.		210.	190.

* *Average of replicate analyses*
a *Note: Sample analyzed at NEIC*
b *Sample concentration is less than (<) the value shown.*
c *Estimated value; interference present causing possible bias*
d *Batch spike sample recovery was not within control limits indicating possible bias.*
e *Not analyzed.*

Table A-4 (Cont.)

SMO No.:	MQB409		MQB402		MQB414	
Station:	MW 128		MWG6		MWG20[a]	
Element	Dissolved Value, ug/L	Total Value, ug/L	Dissolved Value, ug/L	Total Value, ug/L	Dissolved Value, ug/L	Total Value, ug/L
Al	77.	132. *c,d*	111.	5,360 *c,d*	600.	2,500.
Sb	<60. *b*,d	<60.	<60. *d*	<4.	<1.3	<3.
As	15. *d*	<10.	<10. *d*	<10. *d*	19.3	7.
Ba	2,700.	2,920. *c,d*	366.	390. *c,d*	411.	493.
Be	<1.	<1.	<1.	<1.	<3.	<2.
Cd	<2.	<5.	<5.	<5. *d*	<4.	<9.
Ca	444,000.	392,000.	124,000.	111,000.	513,000.	509,000.
Cr	<9.	<9.	<9.	<9.	<20.	<20.
Co	<23.	<23.	<23.	<23.	<9.	<50.
Cu	<7.	<7.	<7.	7.	<10.	<30.
Fe	5,860.	13,000. *c*	<45.	5,220. *c*	2,870.	17,000.
Pb	<20. *d*	<25. *d*	<5.	8.3 *d*	<40.	<100.
Mg	870,000. *d*	969,000. *c*	80,600. *d*	70,800. *c*	960,000.	1,040,000.
Mn	1,020.	926. *c*	169.	177. *c*	NA	NA
Hg	<.4 *d*	<.4 *d*	.3 *d*	<.2 *d*	<.1	<.1
Ni	<20.	<20.	<20.	<20.	<100.	<200.
K	82,100. *c*	73,700. *c*	5,020. *c*	5,010. *c*	357,000.	561,000.
Se	<25. *d*	<20. *d*	<5. *d*	<5. *d*	4.	<8.
Ag	<7.	<7.	<7.	<7.	<10.	<30.
Na	4,680,000.	5,260,000.	97,100.	88,000.	6,120,000.	6,750,000.
Tl	<10. *d*	<50. *d*	<2. *d*	<2. *d*	<300.	<700.
Sn	<32.	<32.	<32.	<32.	NA[e]	NA
V	<15.	<15.	<15.	<15.	90.	110.
Zn	32.	<11.	23.	59.	100.	69

a *Note: Sample analyzed at NEIC*
b *Sample concentration is less than (<) the value shown.*
c *Estimated value; interference present causing possible bias*
d *Batch spike sample recovery was not within control limits indicating possible bias.*
e *NA: Not analyzed.*

Table A-4 (Contd.)

Station:	NPGR5[a]	
SMO No.:	MQB410	
Element	Dissolved Value, ug/L	Total Value, ug/L
Al	NA [e]	<300. [c]
Sb	NA	<3.
As	NA	12.
Ba	NA	2,900.
Be	NA	<2.
Cd	NA	<9.
Ca	NA	304,000.
Cr	NA	20.
Co	NA	<50.
Cu	NA	<30.
Fe	NA	77,000.
Pb	NA	<100.
Mg	NA	325,000.
Mn	NA	860.
Hg	NA	<.1
Ni	NA	<200.
K	NA	821,000.
Se	NA	<8.
Ag	NA	<30.
Na	NA	2,880,000.
Tl	NA	<700.
Sn	NA	NA
V	NA	140.
Zn	NA	410.

a *Note: Sample concentration is less than X at 99% confidence.*
b *Sample concentration is less than (<) the value shown.*
c *Estimated value; interference present causing possible bias.*
d *Batch spike sample recovery was not within control limits indicating possibe bias.*
d *Duplicate analysis not within control limits.*
e *Not analyzed.*

Table A-5

GENERAL CONSTITUENT ANALYSIS
Acme Landfill

Station:		MW 104[a]	MW 115	MW 116	MW 117	MW 119
SMO No.		MQB417	MQB413	MQB412	MQB415	MQB405, 406, 407
Parameter	Units	Value	Value	Value	Value	Value[b]
pH	Units	6.5	11.0	7.0	6.7	6.7
Conductance	umhos/cm	20,000.	46,900.	22,000.	49,000.	27,600.
Temperature	'C	16.	21.	20.	20.	20.
Turbidity	NTU	52.	72.	116.	130.	208.
POX	ug/L Cl	14.	90.	<5.	3,900.	4,500.
TOX	ug/L Cl	NA c	335.	115.	400.	483.
POC	ug/L C	150.	5,160.	5,300.	2,460.	12,700.
NPOC	ug/L C	265,000.	60,000.	42,000.	77,000.	508,000.
Bromide	mg/L	<.5	58.	23.	50.	35.
Chloride	mg/L Cl-	9,200.	18,800.	7,100.	18,600.	11,700.
Nitrate	mg/L N	<.6	<.3	<.3	<.3	<.3
Sulfate	mg/L S04=	1.6	1,380.	34.	630.	22.
Nitrite	mg/L	<.3	<.3	<.3	<.3	<.3
Cyanide	ug/L	NA	<10.	<10.	NA	20.
Phenol	ug/L	NA	<50.	<50.	<50.	<50.
Sulfide	mg/L	NA	290.	190.	36.	98.
Fluoride	mg/L F-	NA	32.	16.	34.	31.

a *Note: Sample analyzed at NEIC*
b *Average of replicate analyses*
c *NA: Not analyzed*

Table A-5 (contd.)

Station:		MW 126[a]	MW 128	G-6	G-20[a]	NPGR5[a]
SMO No.		MQB416	MQB409	MQB402	MQB414	MQB419
Parameter	Units	Value	Value	Value	Value	Value
pH	Units	6.5	6.8	6.9	6.7	NA
Conductance	umhos/cm	21,500.	23,600.	1,650.	32,000.	NA
Temperature	'C	20.	19.	14.	19.	NA
Turbidity	NTU	122.	128.	88.	NA	NA
POX	ug/L C	20.	<5.	<5.	20.	28.
TOX	ug/L C	NA	NA	74.	NA	NA
POC	ug/L C	45.	15,520.	160.	54.	1,850.
NPOC	ug/L C	21,000.	60,000.	61,000.	50,000.	670,000.
Bromide	mg/L	<.5	22.	<1.	50.	<.5
Chloride	mg/L C1-	8,200.	7,300.	153.	13,000.	26.
Nitrate	mg/L N	<.6	<.3	0.5	<.6	26.
Sulfate	mg/L SO4=	600.	<1.	38.	850.	<.6
Nitrite	mg/L	<.3	<.3	<.3	<.3	<.3
Cyanide	ug/L	<.3	<10.	<10.	NA	NA
Phenol	ug/L	NA	<50.	<50.	NA	NA
Sulfide	mg/L	NA	<1.	58.	NA	NA
Fluoride	mg/L F-	NA	17.	2.	NA	NA

a *Note: Samples analyzed at NEIC*

APPENDIX B
DRAGER TUBE DATA

1 **DRÄGER Tube Vinyl Chloride 0.5/a** (67 28[illegible])

2 **Standard range of measurement** (20°C, 1013 mbar) — 0 5 to 3 ppm vinyl chloride

3 **Number of strokes of the DRAGER gas detector pump** — n = 20; n = 5

4 **Relative standard deviation** — 15 to 10%

5 **Description**

Scale tube • double tube (pretube and indicating tube are joined together with a piece of tubing before testing) • pale grey precleanse layer (pretube), reagent: alkali hydroxide • yellowish brown oxidation layer in the pretube, reagent: chromate • bluish grey indicating layer (indicating tube), reagent: bromophenol blue • colour change to yellow.

6 **Reaction principle**

(in the oxidation layer)

$CH_2{=}CHCl + Cr^{6+} \rightarrow HCl$

Vinyl chloride — Hydrogen chloride

(in the indicating layer)

HCl + Bromophenol blue → Yellow reaction product

7 **Cross-sensitivity**

Other chlorinated hydrocarbons also react, but the sensitivity of indication is different.

Examples:

1 ppm 1,1-dichloroethylene	Indication 2 ppm
1 ppm chlorobenzene	Indication app. 0 5 to 1 ppm
10 ppm perchloroethylene	Indication app. 0 5 ppm
10 ppm trichloroethylene	Indication app. 2 ppm
10 ppm chloroform	No indication
10 ppm carbon tetrachloride	No indication
10 ppm 1,1,1-trichloroethane	No indication

Allyl chloride is measured with 15 strokes of the gas detector pump. Indication (i.e. numerical value on scale) multiplied by a factor of 2 gives ppm allyl chloride (deviation ± 50%).

Dichlorobenzene (ortho and para) is measured with 1 pump stroke. Indication multiplied by a factor of 5 gives ppm dichlorobenzene (deviation ± 50%). Hydrocarbons should have scarcely any effect on the vinyl chloride indication; up to the present, the following measurements have been made: 10 ppm ethylene, no influence, as also 10 ppm butadiene. Acetone, heptane, methanol had no influence on the indication up to a concentration of 100 ppm. Chlorine and hydrogen chloride are absorbed in the precleanse layer (alkali hydroxide) and do not, therefore, interfere.

8 **Extension of the range of measurement**

With n = 5 strokes: 1 to 6 ppm vinyl chloride

With n = 20 strokes: 0 25 to 1 5 ppm vinyl chloride

APPENDIX C
PROCEDURES FOR OPERATING ISCO WATER LEVEL RECORDERS

Appendix C
PROCEDURES FOR OPERATING ISCO WATERLEVEL RECORDERS

1. EPA contract personnel assembled the ISCO meters using Model 1870 meters and 1/4-inch ID (inside diameter) stainless steel tubing.

2. The meters were calibrated as follows:

   (a) Chart recorder was set to a speed of 4 inches per hour.

   (b) The bubbler was adjusted to release one air bubble per second.

   (c) The end of the stainless steel tubing was lowered into a graduated cylinder containing distilled water. The tip of the tubing was moved up and down in the water column while the LED display on the ISCO meter was calibrated for depth of immersion.

3. The tubing was lowered into the well to a depth approximately and 1 1/2 feet below the water surface as indicated by the ISCO calibrated display (1.500).

4. The date, time and ISCO display were recorded on the strip chart.

5. The water level was verified with the Interface Probe and recorded. The probe was decontaminated according to the same procedures identified previously.

6. The wellhead was sealed with a plastic bag around both the well and the ISCO meter and taped. The tape was signed by the EPA contractor to verify security between water level measurements.

7. Steps 4, 5 and 6 above were repeated two times daily to verify the accuracy of the ISCO meters [Table 5].

APPENDIX D
OCTOBER 1, 1986 INSPECTION REPORT

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