April 1986 EPA-330/2-86-003

Hazardous Waste Ground-Water Task Force

Evaluation of Chemical Waste Management, Inc. Kettleman Hills Facility Kings County, California

U.S. Environmental Protection Agency
Region 5, Library (PL-12J)
77 West Jackson Boulevard, 12th Floor
Chicago, IL 60604-3590

EPA UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

April 30, 1986

UPDATE OF THE HAZARDOUS WASTE GROUND-WATER TASK FORCE EVALUATION OF CHEMICAL WASTE MANAGEMENT, INC. KETTLEMAN HILLS FACILITY

The United State Environmental Protection Agency's Hazardous Waste Ground-Water Task Force (HWGWTF) conducted an evaluation of the ground-water monitoring program at the Chemical Waste Management, Inc. Kettleman Hills hazardous waste treatment, storage and disposal facility. This facility is located approximately 3 miles west of Kettleman City, California. The evaluation of the Kettleman Hills facility focused on (1) determining if the facility was in compliance with applicable Federal and State of California ground-water regulatory requirements and policy, (2) detemining if hazardous constituents were present in the ground water, and (3) providing information to assist EPA in determining if the facility meets EPA requirements for waste management facilities receiving waste from response actions conducted under the Federal Superfund program. The onsite field inspection was conducted over a two-week period from July 29, 1985 to August 6, 1985.

Kettleman Hills is one of 58 facilities that are to be evaluated by the HWGWTF. The Task Force effort came about in light of the recent concerns by Congress and the public as to whether operations of hazardous waste treatment, storage and disposal facilities are complying with the State and Federal ground-water monitoring regulations.

The results of the chemical analysis of ground-water samples collected from existing monitoring wells during the evaluation indicated low levels of

hazardous constituents in three wells. For one well (K-4) where contamination was previously known, the company has already completed an assessment program to determine the extent of the contamination, and is currently operating a ground-water extraction program. Based upon the available data which indicates that hazardous wastes have been released into the ground water, EPA has taken an enforcement action under Section 3013 of the Resource Conservation and Recovery Act. The company has consented to plan and perform a ground-water sampling and analysis program to evaluate the full nature and extent of any contamination that may be present in the other two wells (K-8 and K-13). If contamination is confirmed to be present, the company will submit a ground-water quality assessment program plan.

At the time of the inspection, the facility had 21 operating ground-water monitoring wells, as well as an additional 20 assessment and observation wells. Subsequently, the company installed 10 more monitoring wells and is continuing to conduct a hydrogeological study of this site. EPA and the State of California are currently reviewing the work completed to date as part of the hazardous waste management permitting process and will continue to work with the company to complete the design of the ground-water monitoring system. As a result, additional monitoring wells may be required in order to meet RCRA permitting requirements.

The Company's corporate sampling plan that was followed for collecting, handling and preserving samples from the monitoring wells, making field measurements, shipping and chain of custody, was extensively reviewed and found to be technically adequate and quite comprehensive. Overall, the

company's analytical procedures are properly selected and conducted. However, the Task Force investigation did reveal that the ground-water sampling procedure manuals do not provide detailed methods for some parameters required for interim status monitoring.

In November 1985, EPA, the California Department of Health Services and Chemical Waste Management Inc., completed a Consent Agreement and Final Order that covered violations of ground-water requirements at Kettleman Hills. The Consent Agreement required activities which included (1) submission of a report on site hydrogeology and ground-water quality investigations, (2) developing and implementing a ground-water monitoring program, and (3) performing remedial work.

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

EPA-330/2-86-003

GROUND-WATER MONITORING EVALUATION

CHEMICAL WASTE MANAGEMENT, INC.
KETTLEMAN HILLS FACILITY
Kings County, California

April 1986

Steven W. Sisk
Project Coordinator
National Enforcement Investigations Center

CONTENTS

EXECUTIVE SUMMARY

INTRODUCTION 1

SUMMARY OF FINDINGS AND CONCLUSIONS 7

TECHNICAL REPORT

INVESTIGATION METHODS 11

RECORDS/DOCUMENTS REVIEW 11
FACILITY INSPECTION 12
LABORATORY EVALUATION 12
GROUND-WATER SAMPLING AND ANALYSIS 12

WASTE MANAGEMENT UNITS AND FACILITY OPERATIONS 18

WASTE MANAGEMENT UNIT CONSTRUCTION 21
REMEDIAL SITE WORK 22
WASTE CHARACTERIZATION 24

SITE HYDROGEOLOGY 26

HYDROGEOLOGIC UNITS 27
GROUND-WATER FLOW DIRECTIONS AND RATES 29

GROUND-WATER MONITORING 33

GROUND-WATER SAMPLING AND ANALYSIS PLAN 33
CWM SAMPLE COLLECTION AND HANDLING PROCEDURES 35

Water Level Measurements 36
Purging 37
Sample Collection, Handling, Preservation and Field Measurements 38
Shipping and Chain-of-Custody 40

SAMPLE ANALYSIS 41
MONITORING WELLS 42

Well Locations 42
Well Construction 48

MONITORING DATA ANALYSIS FOR INDICATIONS OF WASTE RELEASE 55

CONTENTS (cont.)

REFERENCES

APPENDICES

A CONSENT AGREEMENT
B DESCRIPTION OF STRATIGRAPHIC INTERVALS WITHIN THE SAN JOAQUIN FORMATION
C ANALYTICAL RESULTS FOR TASK FORCE SAMPLES

FIGURES

1 Site Map With Waste Handling/Disposal Units 3
2 Geologic Cross-section 28
3 Wellhead Sampling Apparatus 44
4 Typical Well Completion 50
5 Typical Well Head Sampling Apparatus 51

TABLES

1 Sampling Locations and Descriptions 13
2 Monitoring Wells Initially Selected for Sampling 15
3 Preferred Order of Sampling Collection, Bottle Type and Preservative List 17
4 Hazardous Waste Management Units and Waste Types Received 19
5 Organic Priority Pollutant Concentrations Beneath Area S-5 . . . 23
6 Active Land Treatment/Disposal Units After Completing Site Remedial Work Required by Consent Agreement 24
7 Stratigraphic Intervals of the San Joaquin Formation 30
8 Estimated Hydraulic Conductivities of Geologic Beds within the San Joaquin Formation 32
9 Analytical Parameters, Volumes and Preservatives for CWM Samples 40
10 Kettleman Hills Facility Wells as of August 1, 1985 43
11 Monitored Zones of Selected Monitoring, Observation and Assessment Wells 46
12 Differences Between Reported Casing Depths and Measured Depths for Selected Wells 47
13 Company Designated Monitoring Wells 49
14 Sand Pack and Screen Length in Wells Within Reported Hydrologic Intervals 53
15 Organic Compounds Detected in Ground-Water Samples 56
16 Organic Compounds Detected in Well K-4 by CWM 57

EXECUTIVE SUMMARY

INTRODUCTION

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

- Determine compliance with interim status ground-water monitoring requirements of 40 CFR Part 265 as promulgated under RCRA or the State equivalent (where the State has received RCRA authorization).
- Evaluate the ground-water monitoring program described in the facility's RCRA Part B permit application for compliance with 40 CFR Part 270.14(c).
- Determine if the ground water at the facility contains hazardous waste constituents.
- Provide information to assist the Agency in determining if the TSDF meets EPA ground-water requirements for waste management facilities receiving waste from response actions conducted under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, Public Law 91-510).**

---

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

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

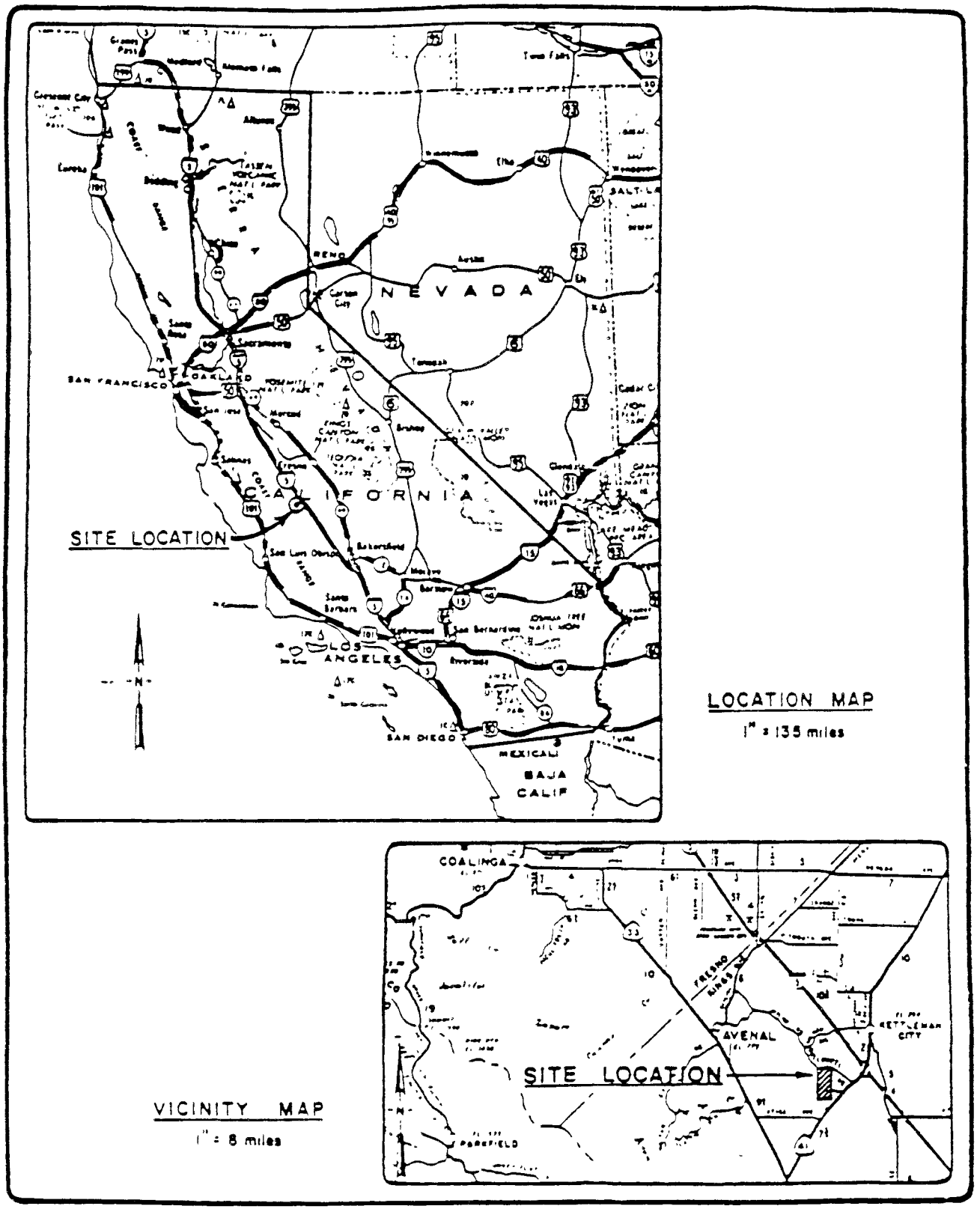
The first TSDF investigated by the Task Force in EPA Region IX was the Chemical Waste Management (CWM) Kettleman Hills Facility near Kettleman City, California [Figure 1]. The facility is located on State Route 41 about 2.5 miles west of Interstate Highway 5 (I-5). The onsite inspection was conducted from July 29 through August 6, 1985 and was coordinated by NEIC personnel.

Until 1984, CWM had a waiver demonstration for the State interim status ground-water monitoring requirements on file at the Kettleman Hills facility and had installed no monitoring wells at the site. The RCRA Part B permit application submitted in August 1983 contained a waiver demonstration, rather than a proposed monitoring program. Legal action taken by EPA Region IX regarding the inadequacy of the waiver demonstrations and other areas of noncompliance resulted in a ground-water monitoring program being required at the facility. The program was being developed during the Task Force inspection. Consequently, there was no interim status monitoring program to evaluate and, as no monitoring program had been proposed in the Part B, the Task Force was unable to evaluate compliance with 270.14(c).

The Task Force did evaluate monitoring plans, procedures and wells that would be part of the program proposed to EPA, as required by the Consent Agreement that resulted from the legal action and State regulations. In general, the investigation involved reviewing State, Federal and facility records; inspecting monitoring wells and CWM sampling procedures; and inspecting CWM's contractor laboratory. Samples were collected by Task Force personnel from monitoring wells for determining if and where contaminants are present.

The area surrounding the current CWM hazardous waste management site is undeveloped except for a few oil production facilities. From the 1920s through the 1950s, the Kettleman Hills were extensively explored for oil and gas. Some production is still occurring in the area.

The CWM facility was first developed in the early 1970s by the McKay Trucking Company (MTC) of nearby Coalinga, California for disposal of nonhazardous oil field wastes. In March 1975, MTC received a State permit for disposal of oil wastes and drilling fluids on a 60-acre portion of the



KETTLEMAN HILLS FACILITY LOCATION MAP

Figure 1

(from EMCON Associates)

current active disposal area. In May 1978, MTC applied to the California Department of Health Services (DOHS) for a hazardous waste facility permit.* DOHS subsequently issued an operating permit (No. 16-0001-78) on September 12, 1978. CWM acquired the facility in April 1979.

The permit issued by DOHS authorized disposal of hazardous wastes at the Kettleman Hills facility and contained management requirements for land disposal, surface impoundments and landfills; however, it did not require ground-water monitoring.

On November 18, 1980, CWM submitted a RCRA Part A permit application to EPA and received interim status (EPA identification No. CAT000646117), allowing operations to continue pending a decision on whether to issue a permit. In June 1981, EPA granted Interim Authorization to DOHS pursuant to Title 40, Code of Federal Regulations, Part 271 (40 CFR Part 271). DOHS codified State regulations, which were modeled after RCRA Part 265 regulations, into an Interim Status Document (ISD). The ISDs were issued to the interim status facilities as operating requirements.

The ISD for the CWM facility was issued as a revised permit on December 13, 1982. Five Part A revisions were submitted to the State for approval between May 1981 (just before the State received Interim Authorization) and September 1983. These revisions resulted in two addenda to the 1982 permit, which were issued in February and July 1983, respectively.

In addition to the State requirements and permit, which regulate PCBs as hazardous waste, PCBs and PCB items are managed at the Kettleman Hills facility under Federal regulations promulgated under the Toxic Substances Control Act (TSCA; 40 CFR Part 761) and PCB disposal approvals issued by EPA Region IX.

---

* *California enacted the Hazardous Waste Control Act in 1977.*

An EPA Region IX inspection of the CWM facility on April 13 and 14, 1983 revealed that the Company had not implemented a ground-water monitoring program and that the Company's demonstration for waiver of the monitoring requirements on file at the facility was inadequate. The waiver demonstration was subsequently revised. From March 21 to April 18, 1984, NEIC conducted a comprehensive RCRA interim status and TSCA inspection of the facility. The updated waiver demonstration was reviewed and determined to be inadequate, primarily because it contained no site specific data and CWM had not conducted investigations necessary to provide adequate technical support.

EPA Region IX issued an Administrative Order (AO) on July 3, 1984, which required, in part, the installation of a ground-water monitoring system. Analysis of samples from newly installed wells revealed hazardous waste constituents in the ground water. This discovery, plus information gathered during the NEIC inspection on other RCRA/TSCA compliance deficiencies, resulted in a June 5, 1985 amendment to the 1984 AO.

Regarding ground-water monitoring, the amended AO required:

1. Investigation of the site hydrogeology
2. Delineation of the contaminant plume in the area of Well K-4 (in northwestern area of facility)
3. Identification of the source of toluene identified in water samples from several of the wells
4. Submission of a sampling and analysis plan
5. Initiation of a ground-water monitoring program
6. Development of a comprehensive ground-water monitoring system

The above-listed activities were in progress during the Task Force investigation. Field work was being closely monitored by Region IX staff because investigation plans were being refined to reflect new information as it became available.

In November 1985, EPA, DOHS* and CWM completed a Consent Agreement and Final Order (Consent Agreement) [Appendix A] that addressed the issues raised in the AO and amended AO. The Consent Agreement outlined activities required which included: (1) submission of a report on site hydrogeology and ground-water quality investigations, (2) developing and implementing a ground-water monitoring program, and (3) performing remedial work. It also provided that EPA and DOHS personnel could review, upon request, consultants' driller logs and field notes relating to the facility, which were not made available to Task Force personnel during the onsite inspection.**

---

* *Participating as an intervenor.*

** *See paragraph B2a(2) of Consent Agreement.*

SUMMARY OF FINDINGS AND CONCLUSIONS

Task Force personnel conducted the onsite inspection of the Kettleman Hills facility from July to August 1985. The findings and conclusions presented in this report reflect conditions existing at the facility in early August 1985. Actions taken by the State, EPA Region IX and CWM in the period subsequent to this investigation are summarized in the accompanying update.

During the Task Force inspection, CWM was in the process of developing a ground-water monitoring program to meet interim status and Part B RCRA permit application requirements. Monitoring program proposals were submitted to EPA Region IX and DOHS for these requirements in November 1985. Previously, the Company had a waiver demonstration on file for interim status requirements and had submitted one in the Part B. Legal action by EPA Region IX resulted in a Consent Agreement that required development of a ground-water monitoring program for the facility.

Consequently, the Task Force evaluated the monitoring plans, procedures and wells that would be part of the required monitoring program. Samples were collected and analyzed from monitoring wells for determining if and where contaminants are present.

A corporate sampling plan was being followed by CWM's contractor for collecting, handling and preserving samples from the monitoring wells, making field measurements, shipping samples and chain-of-custody. An undated copy was provided to Task Force personnel during the inspection. The plan, although not site specific, was comprehensive and was the basis for the site specific plans submitted in November.

Analytical procedures for ground-water samples were presented in two manuals prepared by the CWM contractor laboratory. The manuals do not provide detailed methods for some of the parameters required for interim status monitoring, including chloride, nitrate, sulfate, phenol, sodium, total organic halogen, total organic carbon, gross alpha and gross beta.

Samples were drawn from most wells with submersible centrifugal pumps. This type of pump has been shown to alter the chemistry of samples collected with them, principally through degassing effects. Affected parameters include volatile organics, pH, alkalinity, temperature and others. The effect of these pumps on ground-water samples collected from the Kettleman Hills facility wells needs to be further investigated.

During sample collection, aliquots for metals and inorganic parameter analyses were passed through a disposable in-line filter installed on the pump discharge sampling tube. The corporate sampling plan specified that, when collected, other aliquots, including extractable organics, would be filtered during collection. Although EPA has no formal policy on filtering samples for organic and inorganic parameters, the Agency is on record as opposing such practice.* The principal objection is that the results may be biased low. Further, filtering samples for the drinking water supply parameters (Part 265, Appendix III) is inconsistent with procedures required for drinking water supplies [Part 141.23(f)].

Once samples were drawn, Task Force personnel observed the CWM procedures for documentation and chain-of-custody; taking field measurements; and preserving, packaging and shipping samples. These procedures were acceptable.

The CWM contract laboratory responsible for analyzing ground-water samples from the Kettleman Hills facility was inspected in July 1985 as part of another Task Force inspection. The laboratory was inspected to determine if priority pollutant** analyses and analyses required by the RCRA interim status regulations were being properly conducted. These

---

* *June 1985, Memorandum Number 7 by David Friedman, "Notes on RCRA Methods and QA Activities" and recent Agency decisions on ground-water analyses conducted by Hooker at Love Canal in New York*

** *Priority pollutants are defined in the June 7, 1976 Natural Resources Defense Council (NRDC) vs. Russell Train (USEPA) settlement agreement listing 126 compounds that are commonly referred to as the "Priority Pollutants List".*

analyses include those required on samples from the Kettleman Hills facility by the AO and Consent Agreement, except for one sample, which was analyzed for Part 261, Appendix VIII parameters.

Some inadequacies in analytical procedures were found at the contractor laboratory. Analytical methods with lower detection limits need to be used for pesticides, PCBs, cadmium, chromium and lead. The analytical method for total organic carbon is inappropriate because volatiles are stripped from the sample before the organic carbon concentration is measured.

The adequacy of the location and construction of many of the wells designated by CWM for the monitoring program, required by the amended AO, could not be determined. Conflicting and incomplete reports on site hydrogeology have been submitted to EPA. Summary well construction diagrams, boring logs, geologic cross sections, well deviation surveys and borehole geophysical logs were inconsistent with one another on points such as descriptions of geologic units, total well depths and monitored zones. Summary logs of well construction could not be verified because the Company did not provide the field records. A provision of the Consent Agreement provides access to these records by EPA and State personnel.

The information provided indicates that wells constructed in the same hydrologic zones had wide ranges in lengths of screens and sand packs. As a result, water levels measured in wells ostensibly monitoring the same hydrologic unit may not correlate, and predictions of ground-water flow directions based on these measurements may be erroneous.

Analytical data from samples collected by Task Force personnel from the monitoring wells indicate the presence of organic hazardous waste constituents in wells K-4, K-8 and K-13. The compounds identified in well K-4 were previously detected by CWM and an assessment program is required by the Consent Agreement to delineate the plume and remove the affected water. Low levels (less than 5 μg/ℓ) of two organic hazardous waste constituents (carbon disulfide and toluene) were detected in well K-8 and one (1,1,1-trichloroethane) in well K-13. Results are probably biased low for

wells K-4 and K-8 because submersible centrifugal pumps were used to draw the samples. The compounds identified in wells K-8 and K-13 had not been previously reported by CWM. The presence of these compounds needs to be further investigated.

Under current EPA policy, if an offsite TSDF must be used for land disposal of waste from a Superfund cleanup of a CERCLA site, that site must be in compliance with the applicable technical requirements of RCRA. At the time of the Task Force inspection, no interim status ground-water monitoring program had been implemented at the Kettleman Hills facility.

TECHNICAL REPORT

INVESTIGATION METHODS

The Task Force investigation of the CWM Kettleman Hills facility consisted of:

- Reviewing and evaluating records and documents from NEIC, EPA Region IX, California DOHS and Regional Water Quality Control Board, and CWM files
- Conducting an onsite facility inspection from July 30 through August 6, 1985
- Evaluating the offsite laboratory contracted by CWM for analysis of ground-water samples
- Sampling and analyzing data from selected ground-water monitoring wells

RECORDS/DOCUMENTS REVIEW

Much of the information on waste management units and operation normally collected during a Task Force inspection was obtained by NEIC for the facility during the RCRA/TSCA compliance investigation in 1984. NEIC records were reviewed and the information was updated during the onsite visit to reflect recent operational changes.

As previously noted, there was no ground-water monitoring program in place during the 1984 NEIC inspection. Consequently, CWM reports, plans, logs and records were obtained for the site hydrogeologic investigation, ground-water monitoring program and well construction.

CWM did not provide the field logs of well construction, as specifically requested by Task Force personnel, because its contractor, EMCON Associates, reportedly would not release the records for Task Force review. Rather, only unsubstantiated diagrams that summarized monitored units and construction details were provided. The November 1985 Consent Agreement between EPA Region IX, DOHS and CWM (after Task Force data collection was concluded) provided access to these field logs.

FACILITY INSPECTION

The facility inspection involved identifying the active waste management units and verifying the location of ground-water monitoring wells.

Company personnel were interviewed to identify records and documents of interest, discuss the contents of the documents and explain the site hydrogeology, ground-water monitoring system, ground-water sampling and analysis plan and field procedures for sample collection.

LABORATORY EVALUATION

The CWM contractor laboratory, Environmental Testing and Certification (ETC), Inc. of Edison, New Jersey, was evaluated by Task Force personnel about 2 weeks before the Kettleman Hills inspection as part of another site investigation. ETC was evaluated for its ability to produce quality data for those parameters required by Part 265.92 and priority pollutants.* Analytical equipment and methods and quality assurance procedures were examined for adequacy. Laboratory records were reviewed for completeness, accuracy and compliance with State and Federal requirements.

GROUND-WATER SAMPLING AND ANALYSIS

During the onsite inspection, a Task Force contractor collected ground-water samples from nine monitoring wells [Table 1 and Plate 1]. Those designated by the prefix letter "K" are tentatively designated by CWM to be included in the interim status network; wells with the prefix letter "A" are part of the K-4 assessment program required by the amended AO to address contaminants found in this well. The wells were sampled to determine if the ground water contained any waste constituents or other indicators of

---

* *Priority pollutants are defined in the June 7, 1976 Natural Resources Defense Council (NRDC) vs. Russell Train (USEPA) settlement agreement listing 129 compounds that are commonly referred to as the "Priority Pollutants List".*

Table 1

SAMPLING LOCATIONS AND DESCRIPTIONS

Well	Depth to Water (ft)	Calculated Water Column Volume[a] (gal)	Purged Volume (gal)	Purging Date	Purging Time[b]	Sampling Date	Sampling Time[b]	Remarks
A-2	336[c]	217	652	08/02	0950-1355	08/02	1415-1435[d]	Grundfos pump;[e] discharge cloudy, sediment in purge bucket
A-4	372 2	85	260	08/05	0745-1100	08/05	1155-1215	Grundfos pump; discharge clear
K-3	377.6	36	108	08/02	0825-0900	08/02	1030-1105	Grundfos pump, collected triplicate for analysis by EPA contractor laboratory; small bubbles entrained in samples,
K-4	292 1	14	22	08/06	0735-1115	08/06	1130-1210	Grundfos pump, sample collected for analysis by NEIC, collected metals sample for State, slow recharge; water light brown with sediments
K-5	437 4	54	165	08/01	1050-1110	08/01	1150-1210	Grundfos pump, degassing evident; collected metals sample for State
K-6	387 8	42	126	08/05	0810-0900	08/05	0955-1015	Grundfos pump, wellhead not completed, no concrete pad, open annular space to at least 7 feet below ground surface, discharge silty
K-8	434 6	19	57	08/01	0800-0820	08/01	1000-1015	Grundfos pump discharge periodically foamy and milky colored, then clear, HNU vapor readings on discharge ranged from 5 to 10 ppm
K-13	415	18	85	07/31 08/01	1555-2100 0715-1205	08/01	1250-1320	Well Wizard pump, discharge clear
K-17	380 5	36	113	08/02	0750-1120	08/02	1150-1200	Grundfos pump; discharge cloudy, silty

a *Standing water inside well casing*
b *Rounded to nearest 5 minutes*
c *Electric probe sounded at 336 feet, then became stuck in well; depth to water could not be rechecked.*
d *Time interval represents period when sample bottles were being filled; field measurements for pH, specific conductance and temperature were also made during this period*
e *Refer to pages 38-39 for discussion of Grundfos pumps*

contamination not previously detected by CWM. Initially, 10 wells were selected for sampling, either because hazardous waste constituents were previously detected in them or the wells were completed in geologic strata that outcrop beneath waste management units or both [Table 2]. Monitoring well A-1 could not be sampled because the Well Wizard bladder pump failed under the high pressures necessary to operate it at greater-than-designed depth (>300 feet).

Duplicate volatile organic samples and splits of all others were declined by CWM personnel; however, their contractor collected some samples at each well. Details of the CWM sample collection are described in the Ground-Water Monitoring section. All but one of the wells sampled were equipped with Grundfos® electric submersible pumps; the one was equipped with a high-pressure Well Wizard® bladder pump. The pumps were operated by the CWM contractor during collection of Task Force samples. Samples were collected for CWM and the Task Force from the wells by the following procedure:

1. CWM contractor measured depth to ground water using Slope Indicator® water level meter.

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

3. CWM contractor calculated water column volume using height of water column and well casing radius.

4. CWM contractor purged at least three water column volumes (measured using a 5-gallon bucket), except at well K-4 which was purged of about 1½ water column volumes.

5. After recharge, CWM contractor collected sample aliquots for field measurements (water temperature, specific conductance, pH) and volatile organics.

6. CWM contractor installed in-line filter on pump discharge tube.

7. CWM contractor filled sample containers for metals, nitrate and conventional parameter analyses.

8. CWM contractor removed in-line filter from pump discharge tube.

® *Grundfos, Well Wizard and Slope Indicator are registered trademarks and will appear hereafter without ®.*

Table 2

MONITORING WELLS INITIALLY SELECTED FOR SAMPLING
KETTLEMAN HILLS FACILITY
Kings County, California*

Well	Assumed Monitored Waste Management Unit(s)	Remarks
A-1	P-12	Contaminated assessment well located along strike from K-4; not sampled due to pump failure
A-2	P-12	Assessment well located downdip from K-4
A-4	P-12	Assessment well to K-4
K-3	B-9 expansion	Centrally located near burial units
K-4	P-12	Contaminated monitoring well
K-5	P-20, S-5	
K-6	Upgradient	Along strike from K-4
K-8	P-10, P-11	Along strike from P-10 and P-11
K-13	P-10, P-11	Along strike from P-10 and P-11
K-17	S-5	Along strike from P-8, B-1, B-6 and B-7

* *Selections based upon preliminary hydrogeologic interpretations by CWM consultants.*

9. EPA sampling contractor monitored open wellhead for chemical vapors (HNU®) and radiation.

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

11. EPA contractor filled sample containers in the order listed on Table 3. Volatile organic samples were first collected in a 250-mℓ beaker then poured into 60-mℓ vials (sample containers). All other sample containers were filled directly from the discharge line.

12. Samples were placed on ice in an insulated container.*

13. Within 2 hours after sampling was completed at a well, EPA contractor personnel took the samples to a staging area where a turbidity measurement was made and one of the two sample aliquots for metals analysis was filtered. In addition, metals, TOC, phenols, cyanide, nitrate and ammonia samples were preserved [Table 3].

When NEIC, State and triplicate samples were collected, Step 11 above was modified. Additional sample containers for each parameter group were filled after the initial one for the EPA contract laboratory.

® *HNU is a registered trademark and will appear hereafter without ®.*

** *During sampling of the first few wells, samples were placed on ice within about 2 hours after collection. Subsequently, they were placed on ice immediately after collection.*

Table 3

PREFERRED ORDER OF SAMPLE COLLECTION,
BOTTLE TYPE AND PRESERVATIVE LIST
Kettleman Hills Facility, California
August 1985

	Parameter	Bottle	Preservative (concentration)
1.	Volatile organic analysis (VOA)		
	Purge and trap	2 60 ml vials	
	Direct inject	2 60 ml vials	
2.	Purgeable organic carbon (POC)	1 60 ml vial	
3.	Purgeable organic halogens (POX)	1 60 ml vial	
4.	Extractable organics	4 1-qt. amber glass	
5.	Total metals	1-qt. plastic	HNO_3 (95-98%)
6.	Dissolved metals	1-qt. plastic	HNO_3 (95-95%)
7.	Total organic carbon (TOC)	4-oz. glass	H_2SO_4 (95-98%)
8.	Total organic halogens (TOX)	1-qt. amber glass	
9.	Phenols	1-qt. amber glass	H_2SO_4 (95-98%)
10.	Cyanide	1-qt. plastic	NaOH (12N)
11.	Nitrate/ammonia	1-qt. plastic	H_2SO_4 (95-98%)
12.	Sulfate/chloride	1-qt. plastic	
13.	Radionuclides (NEIC only)	4 1-qt. amber glass	

* *Volume added = 5 ml*

WASTE MANAGEMENT UNITS AND FACILITY OPERATIONS

The CWM Kettleman Hills facility is a California Class I* treatment, storage and disposal facility (TSDF) that receives liquid and solid hazardous and extremely hazardous wastes. The facility also manages polychlorinated biphenyl (PCB) waste, pursuant to DOHS regulations and 40 CFR Part 761 regulations promulgated under TSCA. The facility reportedly does not accept radioactive, explosive or infectious wastes.

CWM owns 1,600 acres of land at the Kettleman Hills location, which includes an active waste management area of 211 acres [Plate 1]. In the active area, CWM uses the following management units/areas for the treatment storage and/or disposal of hazardous waste:

- Surface impoundments - storage and treatment
- Landfills - disposal
- Tanks - storage and treatment
- Drum storage area - container storage
- Physical treatment unit - liquid solidification in drums

Various impoundments, landfills, drum storage areas, trenches for waste solidification and land treatment areas used in the past are currently inactive. Waste management units and types of wastes placed in them are listed in Table 4. Surface impoundments are designated by the prefix letter "P", landfills by a "B" and land treatment areas by an "S".

PCB waste processing and disposal operations include storage, processing for disposal (transformer draining and flushing) and landfill disposal. Some stored PCB wastes are disposed of offsite.

---

* *Under the California classification system, to be a Class I site, there must be no possibility of discharge of pollutant substances to usable waters. Usable ground water may underlie the site, but only under extreme cases where natural geological conditions prevent movement of the wastes to the water and provide protection for the active life of the site. All waste groups can be received.*

Table 4

HAZARDOUS WASTE MANAGEMENT UNITS AND WASTE TYPES RECEIVED
CHEMICAL WASTE MANAGEMENT
Kettleman Hills Facility, California

Unit	Waste Received	Approximate Active Period	Unit Active 7/85
	Surface Impoundments[1]		
P- 1	Pesticide wash water	Pre-11/80 to late 1981	
P- 2	Pesticide wash water	Pre-11/80	
P- 3	Waste oil	Late 1980 to mid-1983	
P- 4	Pesticide wash water and various other wastes	Pre-11/80 to 8/83	
P- 4c	Acid and alkaline solutions, pesticide wastes	6/83	
P- 4½	Acid solutions, pesticides, phenolic and resin wastes	2/81 to 7/82	
P- 5	Drilling mud and acid solutions	3/81	
P- 6	Acids and various other wastes	7/81 to 10/83	
P- 7	Acids and various other wastes	Pre-11/80 to 3/83	
P- 8	Acids and various other wastes	Pre-11/80 to 3/83	
P- 9	Scrubber wastes, organic liquids, solvents, brines, heavy metal solutions and various other wastes	Pre-11/80 to 3/84	X[2]
P-10	Pesticide rinse waters, acid and alkaline solutions and various other wastes	Pre-11/80 to at least 3/84	X
P-11	Cyanate solutions from treatment, acid and alkaline solutions, organic liquids and various other wastes	Pre-11/80 to at least 3/84	X
P-12	Corrosives and a wide variety of other organic and inorganic wastes	Pre-11/80 to at least 3/84	X[3]
P-12A	Acid solutions, reactives, laboratory waste chemicals	3/83 to 8/83	
P-13	Pesticide rinse waters, corrosive alkaline solutions and various other wastes	5/83 to at least 3/84	X
P-14	Pesticide rinse waters, heavy metal acid and alkaline solutions, organic solvents and various other wastes	12/83 to at least 3/84	X[2]
P-15	Drilling muds and scrubber waste, converted to hazardous waste unit during 1984	1/82 to 11/83	X
P-16	Drilling muds, brine waste and various other wastes	3/82 to 12/83	X
P-17	Drilling muds and various other wastes	2/81 to 1/83	X
P-18	Runoff from S-5 and S-6 areas	Not determined	X
P-19	Acid and alkaline solutions with metals and organics, metal sludges, ash, untreated process waters and various other hazardous wastes	2/84 to at least 3/84	X
P-20		No wastes received as of 4/84	
	Landfills[4]		
B- 1	Containerized waste solvents, sludges and toxics	Completed pre-11/80	
B- 2	Containerized waste solvents, sludges and toxics	Completed pre-11/80	
B- 3	Containerized waste solvents, sludges and toxics	Completed pre-11/80	
B- 4	Containerized waste solvents, sludges and toxics	Completed pre-11/80	
B- 5	Containerized waste solvents, sludges and toxics	Completed pre-11/80	
B- 6	Containerized waste solvents, sludges and toxics	Pre-11/80 to 8/83	
B- 7	Containerized waste solvents, sludges and toxics	Completed pre-11/80	
B- 8	Bulk solids of iron oxide hydroxide	Completed pre-11/80	

Table 4 (cont)

Unit	Waste Received	Approximate Active Period	Unit Active 7/85
	Landfills[4] *(cont.)*		
B- 9	Bulk solids of empty containers, solids contaminated soils	Pre-11/80 to unknown date (records do not distinguish between B-9, B-9 extension and expansion)	
B- 9 (extension)	No information provided in RCRA Part B application	Unknown (records do not distinguish from B-9 above)	
B- 9 (expansion)	Bulk and containerized solids and sludges, paint sludges, waste-water treatment sludges filter cakes, empty crushed containers and treated (solidified) liquid wastes	Late 1983 (?) to at least 3/84 (records do not distinguish from B-9 above)	X
B-10	Containerized reactive and high pH materials	Completed pre-11/80, possibly reopened 4/82 to 10/83	
B-11	Bulk solids of empty containers, solids, contaminated soil	Completed pre-11/80; reopened 11/80 to 4/83	
B-12	Containerized mineral acids	Completed pre-11/80	
B-13	Containerized mineral acids	Pre-11/80 to at least 3/84	
B-13 (expansion)	Empty crushed acid drums and soils contaminated with acids	3/84 to present (opened during NEIC investigation)	X
B-14	PCB solids	9/81 to at least 3/84	
B-15	Bulk and containerized organic wastes (sludges and solids), solidified alkaline corrosive wastes and solids, empty crushed containers, spill cleanup residues and contaminated soil from spill cleanups	2/81 to at least 3/84	
B-16	Bulk and containerized PCB-contaminated solids and sludges	12/83 to at least 3/84	X
	Land Treatment Areas[1]		
S- 1	Halogenated, oxygenated and hydrocarbon solvents, pesticides acid and alkaline solutions and various other wastes	Pre-11/80 to 11/83	
S- 2	Drilling mud, oily waste and various other wastes	5/81 to 12/83	
S- 3	Wide variety of wastes, acid and alkaline solutions, organics, sludges, resins and solvents	2/81 to at least 3/84	
S- 4	Acid and alkaline solutions, solvents, tank bottoms, organic liquids and various other wastes	Pre-11/80 to 11/83	
S- 5	Wide variety of wastes, acid and alkaline solutions, sludges, resins and solvents	Pre-11/80 to at least 3/84	
S- 6	Acid and alkaline solutions, solvents, tank bottoms, organic liquids and various other wastes	Pre-11/80 to 11/83	

1 *Wastes received and active period information is from facility receiving logs obtained during the 1984 NEIC investigation*
2 *P-14 was in cleaning cycle during the Task Force inspection.*
3 *Waste processing was occurring in reconstructed southern half of P-12*
4 *Waste-received information from RCRA Part B permit application submitted September 1983*

The following describes the construction of these units and site remedial work recently agreed upon by EPA, DOHS and CWM, which is in progress. The concluding subsection addresses waste characterization as it relates to ground-water monitoring.

WASTE MANAGEMENT UNIT CONSTRUCTION

To identify possible sources and pathways for waste constituents managed by CWM to enter the ground water, construction information for the land treatment/disposal units, primarily from the 1983 RCRA Part B permit application, was reviewed. The following information was derived from that permit application and information obtained by NEIC during the 1984 investigation unless otherwise noted.

The surface impoundments used for hazardous liquid waste at the CWM facility have bases and levees constructed of recompacted clayey soils from the site. The thickness of the compacted layer is not presented in the construction certification reports contained in the Part B. Generally, the impoundments were designed to contain 5 to 10 feet of liquid with 2 feet of freeboard. As will be discussed in the Site Hydrogeology section, the water table is several hundred feet beneath the ground surface at the site. Therefore, the impounded liquids create an outward hydraulic gradient across the compacted soil layer that would promote waste release.

Landfills, except for B-14 and B-16, also have bases and embankments constructed of recompacted site soil and are not equipped for leachate detection or collection. Landfills B-14 and B-16, which are for disposal of PCB wastes, were constructed pursuant to TSCA regulations and have low permeability compacted clay liners, underdrains and leachate detection and collection systems. If leachate exists in any of the landfills, it too would create an outward hydraulic gradient across the compacted soil layer because ground water is several hundred feet below the bases.

From at least November 1980 (effective date of RCRA regulations) until about April 1984, several land treatment areas were used for liquid hazardous waste. The land treatment areas were non-lined basin-type areas where

liquid wastes were applied and disced into the soil. At least one of the areas designated for land treatment (S-3) was used for solidifying wastes in unlined trenches.

Of the six land treatment areas, only S-3 and S-5 were recognizable units during the Task Force inspection; however, they were inactive. Area S-1 was removed during the excavation for the landfill B-9 expansion, S-2 was active from May 1981 to December 1983, S-3 was used for waste solidification in trenches until about March 1984, S-4 was removed during construction of P-14 through P-16, S-5 was used until about April 1984 and S-6 was deactivated by combining a small portion the northern part with S-5 and constructing P-19 and P-20 in a large portion of the remainder.

In January 1983, CWM collected and analyzed core samples from land treatment areas S-1, S-5 and S-6. Samples from the 5- to 5.5-foot depth, taken at several locations within an area, were composited before analysis. NEIC was provided the results of the core analysis during the 1984 investigation. The data show high concentrations of organic priority pollutants beneath the S-5 area [Table 5] and lower concentrations beneath S-1 and S-6, indicating some migration of waste constituents toward underlying ground water.

REMEDIAL SITE WORK

Whether the pollutants have migrated to ground water from the land treatment or any other units is the subject of investigative reports and remedial work required by the Consent Agreement.

The Consent Agreement requires that surface impoundments P-9, -14, -15, -16, -19 and -20 be retrofitted with a double liner system. Underlying contaminated soils are to be removed before the liners are installed. All other impoundments are to be closed in accordance with plans approved by DOHS. Core samples are to be collected and analyzed from beneath impoundments P-9, -12, -12A, -13, -14, -16, -18 and -19 for determining the extent of residual waste constituents in the soils.

Table 5

ORGANIC PRIORITY POLLUTANT CONCENTRATIONS
BENEATH AREA S-5
AT THE 5- to 5.5-FOOT DEPTH*

Semi-Volatile Priority Pollutant	Concentration (μg/ℓ)
1,2,3-trichlorobenzene	3,000
Naphthalene	17,000
Phenanthrene	59,000
Bis(e-ethylhexyl)phthalate	32,000
Di-n-butyl phthalate	14,000
Butyl benzyl phthalate	29,000
1,3-dichlorobenzene	6,400
1,4-dichlorobenzene	7,900
1,2-dichlorobenzene	44,000
Acenaphthene	12,000
Fluorene	17,000
Anthracene	12,000
Benz(a) anthracene	9,300
Chrysene	12,000

* *Results for sample S in data provided to NEIC by CWM during the 1984 investigation of the Kettleman Hills facility*

Inactive landfills are to be closed in accordance with plans submitted to and approved by DOHS. Landfills B-9 expansion and B-13 expansion will remain active until filled. New landfill B-19 is to be built with a double liner system if construction is approved by DOHS and other appropriate governmental agencies.

The Consent Agreement requires that land treatment areas be closed and that a core-sampling program be conducted in areas S-3 and S-5 to determine the vertical extent of waste constituent migration beneath these units. Areas S-2 and S-3 are to be closed by capping, in accordance with a plan approved by DOHS. Area S-5 is to be excavated as part of the construction of B-19. Visually contaminated soil, excavated from the S-5 area, is to be disposed of in either the B-9 or B-13 expansions or the double-lined portion of B-19.

After remedial work is completed, the land treatment/disposal units listed in Table 6 will compose active operations at the Kettleman Hills facility.

Table 6

ACTIVE LAND TREATMENT/DISPOSAL UNITS AFTER COMPLETING SITE REMEDIAL WORK REQUIRED BY CONSENT AGREEMENT

Surface Impoundments	Landfills	Land Treatment Units
P-9 P-14 P-15 P-16 P-19 P-20	B-9 expansion B-13 expansion B-19 (if approved for construction)	None

WASTE CHARACTERIZATION

Waste characterization before receipt at a TSDF is required under both RCRA regulations (265.13) and the revised permit (Section III3) issued by DOHS for the Kettleman Hills facility. Characterization is important in identifying the constituents that could potentially be released from waste handling units. Knowledge of the constituents is necessary to comply with the RCRA permit standards [264.93(a) and 264.98(a)].

To determine whether CWM sufficiently characterizes the waste it receives, findings from the 1984 NEIC investigation were reviewed. Based on this review, CWM was found to have inadequate information on specific hazardous constituents in each waste management unit. However, the information is adequate to identify waste constituents for a facility-wide detection monitoring program.

Waste characterization information is submitted to CWM as part of a preacceptance data package. The three-part package consists of a (1) generator waste material profile sheet, (2) a certification of representative sample and (3) a special waste analysis report. During the 1984 NEIC investigation, preacceptance procedures were evaluated, based on a review

of data packages for 175 waste loads received during the first and third weeks of March 1983 and March 1984. Only 125 of the 175 data packages requested were provided.

Of 37 packages received for 1983 and 88 packages for 1984, 73% and 40%, respectively, contained special analysis reports, which are supposed to specify the identity and concentrations of hazardous waste constituents. About 25% of the 125 packages did not contain the generator waste material profile sheet that presents basic information about the composition of the waste stream, including the major components.

SITE HYDROGEOLOGY

As discussed previously, limited site-specific hydrogeologic information was available for the Kettleman Hills facility before 1984. In February 1984, CWM initiated a hydrogeologic investigation as a result of discussions with EPA Region IX personnel regarding the waiver demonstration. The hydrogeologic investigation was still in progress during the Task Force inspection. The following is provided to explain the complexities of the site hydrogeology, the extent of work done to date and some of the shortcomings of that work.

By July 1985, hydrogeologic data had been collected from at least 41 borings that were subsequently completed as wells. Generally, the borings were over 300 feet deep. Stratigraphic data were obtained during geologic logging of the cuttings, from core samples and by geophysical logging of selected boreholes. Hydrologic data were obtained from packer and pumping tests conducted in boreholes and wells, and laboratory measurements on core samples for hydraulic conductivity. The following information was derived from reports submitted to EPA on the work performed, which include:

- Ground Water Assessment Program, dated August 15, 1984
- Revised K-4 Assessment Program Well Layout, dated February 6, 1985
- Supplemental Monitoring Program (K-4 area), dated February 21, 1985
- RCRA Part B Application, additional information requirements submitted by CWM, November 8, 1985

The Kettleman Hills, in which the CWM facility is located, form a part of the western edge of the San Joaquin Valley in south central California. The hills were formed by an upfolding of about 15,000 feet of marine sedimentary deposits some 5 million years ago and comprise three domal structures known as the North, Middle and South Domes. The CWM facility is on the western slope of the North Dome. The upfolding also produced faults perpendicular to the axis of the hills, which have been identified at the CWM facility. The Part B RCRA permit application for the facility states

that hydrogeologic site investigations revealed no evidence of Holocene faulting. Based on the information reviewed, Task Force personnel agree with this conclusion.

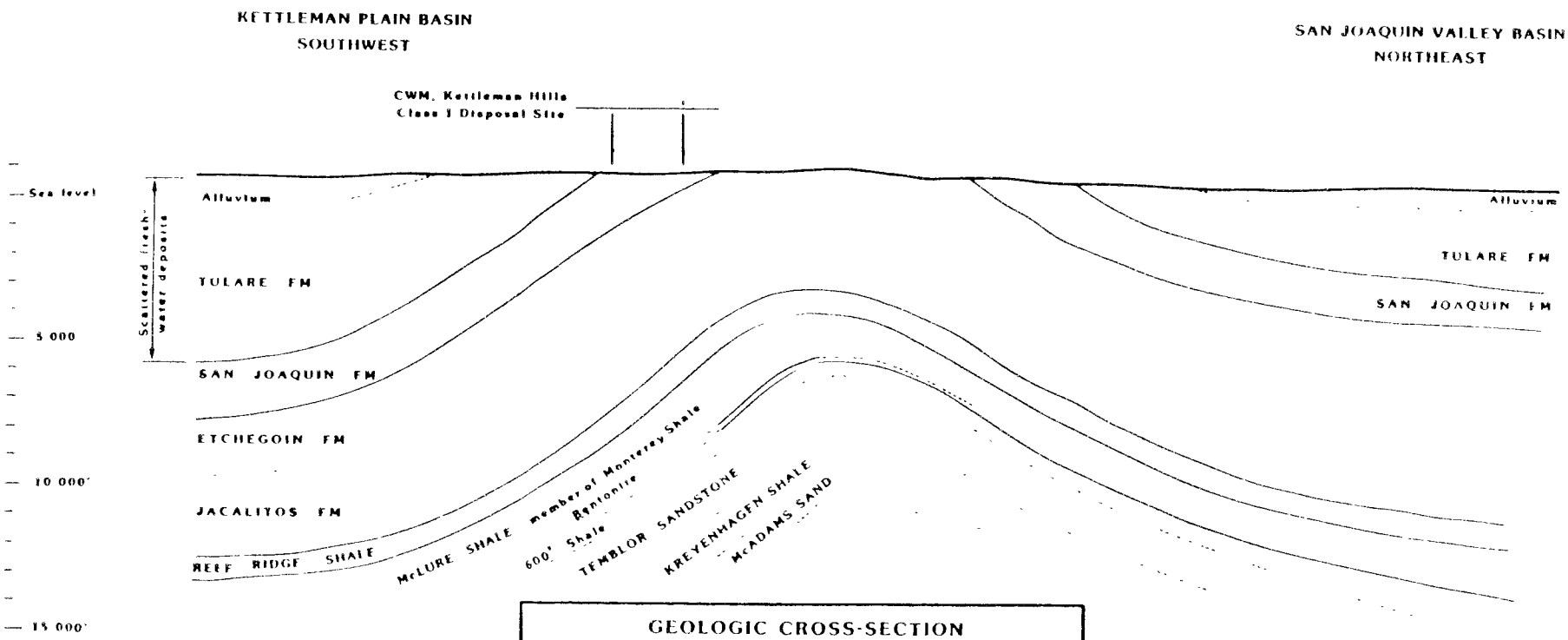
Erosion has exposed these faults and older strata along the center of the domes (anticlines). The facility is underlain by about 2,000 feet of dipping sedimentary strata of the San Joaquin Formation. These strata dip uniformly to the west at about 20 to 40° and consist of alternating sequences of sandstone, siltstone and claystone [Plate 1 and Figure 2].

To the southwest is the Kettleman Plain where the San Joaquin Formation is overlain by sediments of the Tulare Formation. The Part B application for the facility, indicates that the Tulare sediments range up to 5,000 feet in thickness, but are much thinner on the flank of the Kettleman Hills. The nearest water supply wells (closest one is about 1 mile northwest of the site) are constructed in the Tulare Formation: however, none is known to penetrate below the upper horizons.

During deposition of the sedimentary strata underlying the Kettleman Hills facility, marine seas encroached on the land (transgression), covered it and deposited sediments, then receded (regression). Nine identifiable cycles of transgression and regression are present in the Tulare, San Joaquin and underlying Etchegoin Formations which, with the structural deformation, create a very complex hydrogeologic setting. The upper portion of the Tulare Formation is primarily fluvial sandstone and conglomerate. The lower Tulare and the entire San Joaquin Formation consist of marine and non-marine sandstone, siltstone, claystone and a few beds of limestone. The Etchegoin Formation is mostly marine sandstone, siltstone and conglomerate.

HYDROGEOLOGIC UNITS

Under the RCRA permitting process, the uppermost aquifer and aquifers hydraulically interconnected beneath the facility property must be identified [270.14(c)(2)]. An "aquifer" is defined (260.10) as a "geologic



GEOLOGIC CROSS-SECTION
THROUGH NORTH DOME, KETTLEMAN HILLS
KINGS COUNTY, CALIFORNIA

Redrawn from Geology of the Kettleman Hills Oil Field, California, U S G S Professional Paper 198, 1940

Figure 2

formation, group of formations, or part of a formation capable of yielding significant amounts of ground water to wells or springs". The "uppermost aquifer" is defined as "the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary".

The San Joaquin Formation, which underlies the Kettleman Hills facility, contains numerous water-bearing strata. Some of these strata produce water at a substantial rate (e.g., greater than 5 gallons per minute). These water-bearing strata outcrop beneath waste management units. Task Force personnel consider the entire San Joaquin Formation and any hydraulically interconnected units in the overlying or underlying formations to be the uppermost aquifer.

CWM, however, reports that the water-saturated beds beneath the Kettleman Hills facility do not constitute an aquifer under the regulatory definition. The Company contends that the dipping stratified geologic structure precludes identification of an uppermost aquifer and that some of the clayey strata do not yield enough water (<1 gpm) to be classified as aquifers.

Consultants for CWM have divided the San Joaquin Formation into several stratigraphic intervals [Table 7 and Plate 1]. Several of these intervals are named for dominant marine fossils present, primarily bivalves (clams) or gastropods (snails). By convention, the name of the fossil is underlined. A description of the intervals is presented in Appendix B.

GROUND-WATER FLOW DIRECTIONS AND RATES

Despite the extensive site investigation by CWM, ground-water flow beneath and near the facility is still poorly defined. There is insufficient reliable data on water levels within the hydrologic units to determine ground-water flow directions and rates. Whether, and to what extent, hydraulic interconnections exist between saturated permeable units that are separated by relatively impermeable claystone layers is not reported.

Table 7

STRATIGRAPHIC INTERVALS OF THE SAN JOAQUIN FORMATION
KETTLEMAN HILLS FACILITY

Formation	Interval	Major Beds
Tulare		Sandstone
San Joaquin	*Acila* Interval	Claystone Sandstone Interbedded claystone and siltstone Claystone Sandstone Interbedded sandstone and claystone Claystone, clayey sandstone Sandstone *Acila* A sandstone
	Trachycardium Interval	Claystone Sandstone Interbedded sandstone and claystone Sandstone *Trachycardium* marker bed
	Pecten Interval	Sandstone Silty sandstone (*Pecten* B)* *Pecten* claystone *Pecten* marker bed
	Pecten - Mya Interval	Interbedded siltstone and sandstone Sandstone (*Pecten* A)* Interbedded siltstone and sandstone *Mya* B sandstone
	Mya Sandstone Interval	*Mya* A sandstone, *Mya* marker bed at base Interbedded claystone and siltstone
	Neverita Sandstone Interval	Tuffaceous B sandstone Claystone Tuffaceous A sandstone Interbedded sandstone, siltstone and claystone *Neverita* B sandstone *Neverita* A sandstone *Neverita* marker bed
	Cascajo Interval	Claystone Interbedded sandstone, siltstone* and claystone Claystone Silty sandstone Cascajo conglomerate
Etchegoin		Sandstone

* *Uncertain from information provided by CWM*

Tests for hydraulic conductivity have been run for some, but not all, of the geologic units at the facility.

The number and location of wells completed by early August 1985 were not adequate for defining hydraulic gradients and ground-water flow directions in the major hydrologic units. Some of the principal hydrologic units (e.g., Mya A, which outcrops beneath P-9 and P-19) had no wells completed in them. Information in CWM hydrogeologic reports shows that some wells (e.g., K-10 and K-18) do not monitor the beds indicated.

Water level elevation data are suspect because the wells are not straight. Consequently, measured depths to water do not reflect a vertical distance below the surveyed reference point, as they should. CWM consultants have conducted studies on the wells to obtain correct information on depths; however, they report that well deviations still cause some error in water level measurements.

CWM conducted numerous tests to measure the hydraulic conductivity of the major sandstone units, interbedded zones and claystones. The tests were conducted both in the field (packer and pumping tests) and in the laboratory on core samples. The ranges of hydraulic conductivity values across the site are shown in Table 8. These values represent numerous hydrologic strata grouped into rock-type categories. CWM concluded that the laboratory data indicate that hydraulic conductivities measured parallel to bedding exceed those measured perpendicular to bedding, thereby suggesting preferential flow down dip and along the strike of the inclined beds. Task Force personnel concur with this conclusion.

Table 8

ESTIMATED HYDRAULIC CONDUCTIVITIES OF GEOLOGIC BEDS
WITHIN THE SAN JOAQUIN FORMATION*

	Hydraulic Conductivity** (cm/sec)			
			Laborartory Core Analysis	
	Pumping Test	Packer Test	Horizontal	Vertical
Sandstone	2×10^{-4} to 1×10^{-3}	5×10^{-6} to 5×10^{-4}	7.7×10^{-9} to 5.9×10^{-4}	$<1 \times 10^{-8}$ to 9.5×10
Claystone		5×20^{-6} to 9×10^{-6}	$<1 \times 10^{-8}$ to 5.4×10^{-8}	$<1 \times 10^{-8}$
Siltstone			$<1 \times 10^{-8}$ to 8.2×10^{-8}	$<1 \times 10^{-8}$
Interbedded sequence		8×10^{-7} to 7×10^{-4}	$<1 \times 10^{-8}$ to 4.5×10^{-5}	$<1 \times 10^{-8}$
Claystone with siltstone and/or sandstone stringers		2×10^{-7} to 5×10^{-4}		

* *Reported by EMCON Associates, 1985*

** *Ranges include values obtained for a general lithologic type across the site and do not necessarily represent values obtained for any given bed.*

GROUND-WATER MONITORING

During the Task Force investigation, CWM was in the process of conducting site hydrogeologic studies, installing a well network and monitoring ground-water quality in response to the Administrative Order (as amended) issued by EPA. As previously discussed, a Consent Agreement between EPA, DOHS and CWM on required site work was reached in November 1985.

The ground-water monitoring plan, sampling and analysis procedures and wells used by CWM contractors during the onsite investigation will reportedly compose principal elements of the final program. Consequently, these were evaluated during the Task Force investigation and are discussed in this section.

GROUND-WATER SAMPLING AND ANALYSIS PLAN

Under the November 1985 Consent Agreement, CWM is to submit a report to EPA that contains, among other things, a site specific ground-water sampling and analysis plan to be followed whenever samples are taken from monitoring wells at the facility.

During the Task Force inspection, sampling and analysis plans employed by CWM and their contractors, which will be used to develop the site specific plan, included the following documents:

1. "WMI Manual for Groundwater Sampling" prepared for Waste Management, Inc. (CWM parent company) and a July 1, 1985 addendum

2. Laboratory Standard Operating Procedures, as amended February 21, 1985, by ETC*

3. Data Integration Standard Operating Procedures dated June 10, 1985, by ETC

---

* *Environmental Testing and Certification, Inc. Edison, New Jersey*

A copy of the WMI Manual for Groundwater Monitoring was provided to Task Force personnel and declared "business confidential" pursuant to 40 CFR Part 2.203; consequently, discussion of that document in this report will be limited.

The WMI Manual for Groundwater Sampling, received during the Task Force inspection (undated), is comprehensive and includes 89 pages of narrative and two appendices. The manual was the basis for a site specific ground-water sampling plan submitted to EPA in November 1985. It presents detailed procedures for collecting, preserving, handling, documenting (field records and chain-of-custody) and shipping samples, as required by 265.92(a) and Section VIII.2(a) of the revised permit. It also addresses field measurements for water level, pH, specific conductance and temperature, personnel training, equipment maintenance and well construction records.

The WMI manual describes two practices that need to be changed for the Kettleman Hills facility plan. First, the manual prescribes filtering of sample aliquots, other than those for volatile organics and total-type analyses (e.g., total organic carbon, total organic halogen, etc.). Although EPA has no formal policy on filtering samples for organics and inorganics, the Agency is on record as opposing such practice.* The principal objection is that the results may be biased low. Further, filtering samples for the drinking water supply parameters [Part 265, Appendix III] is inconsistent with analysis of samples required for drinking water supplies [40 CFR Part 141.23(f)].

Secondly, the plan specified purging the well of at least three casing volumes, which is less than the minimum of five casing volumes required under recent amendments to the California Hazardous Waste Act [Article 9.5, §25208.8(1)(7)] for wells monitoring surface impoundments.**

---

* *June 1985, Memorandum Number 7 by David Friedman, "Notes on RCRA Methods and QA Activities" and recent Agency decisions on ground-water analyses conducted by Hooker at Love Canal in New York*

** *These provisions became effective January 1, 1986.*

The "Laboratory Standard Operating Procedures" by ETC is a 509-page document that describes chain-of-custody, sample collection, analytical methods and quality assurance. The manual, provided to Task Force personnel, was updated October 31, 1984 and amended February 21, 1985. The amended version includes a description of sample management through the laboratory and many of the specific instrument operating procedures. A second manual entitled, "Data Integration Standard Operating Procedures, June 10, 1985", also by ETC, describes procedures for sample management and data processing to the report stage. This second manual also contains information on quality control procedures and procedures not presented in the former manual.

Detailed methods for chloride, nitrate, sulfate, phenol, sodium, TOX, TOC, gross alpha and gross beta are not contained in the manuals. Further, ETC subcontracts analyses and the methods used by the subcontractors are not included. For example, the metals digestion used by one subcontractor is not the one contained in the ETC manual. The ETC manual allows clients to ship samples for dissolved metals analysis to the lab with a maximum elapsed time of 48 hours before filtration and preservation. This procedure is not recommended, however, it is not followed by CWM personnel (filtering is done at the well head). EPA recommends filtration followed by preservation as soon after sampling as is practical.[1]

CWM SAMPLE COLLECTION AND HANDLING PROCEDURES

During the inspection, samples were collected from nine monitoring wells, as discussed in the Investigation Methods section. At each of the wells, CWM contractor personnel collected samples using their standard procedures for measuring water levels, purging, collecting and preserving samples, making field measurements, shipping samples and chain-of-custody.

CWM has a corporate training program to ensure that its personnel and contractors properly and uniformly implement the WMI manual procedures. The training also promotes consistency in sampling. One CWM and three contractor personnel onsite during the inspection reportedly had received

the training program. The CWM sampling procedures conformed to those described in relevant parts of the WMI manual and are described and assessed in the following

Water Level Measurements

At the wellhead, the first step in collecting samples is to measure depth to water using an electric water level indicator (Slope Indicator Company, Model 51453). The water level indicator consists of a reel with a control panel, cable and sensor. A two-conductor cable connects the control panel to the sensor. When the sensor makes contact with water, an indicator light and buzzer on the control panel are activated. The water level indicator was mounted on 2-inch x 4-inch boards propped directly over the well on an aluminum well box and the cord was lowered into the well through a 1-inch-diameter PVC sounding tube or an access port, if not equipped with a tube.

The cord, which was marked in sequential 1-foot increments, was lowered into the well until the probe reached the water. The probe was then slowly raised and lowered until the exact point at which contact was made was determined. The cord at the very top of the PVC tube was then pinched by the CWM sampling contractor and the distance from the bottom of his fingers to the next higher cord marker was measured with a 1-foot wooden ruler with 1/16-inch subdivisions. Depth to water is calculated by subtracting the reading made with the ruler from cord marker value.

Water level measurements were made with reference to the top of the 1-inch PVC tube or the access port, which was not the surveyed elevation point at the well. The top of the casing at each well was the surveyed point, thereby requiring a correction to be made for the difference between the PVC pipe and the top of casing elevations when calculating water level elevations. Task Force personnel requested this information, but it was not provided.

After measurement, the cord was rewound onto the spool and was rinsed periodically with deionized (DI) water from the CWM sampling contractor's laboratory. The probe was also rinsed with DI water after sounding. PVC gloves were worn by the CWM contractor personnel handling the samples and sampling equipment.

The CWM contractors were consistent in the procedures and care taken while measuring water levels and cleaning equipment. Although the procedures were consistent and results are reproducible (verified in the field), the accuracy is suspect because of the wells not being vertical, as discussed in the Monitoring Wells section.

Purging

The volume of water in the casing is calculated, using the depth to water measurement, total well depth (from construction records) and casing diameter. The volume of water in the casing is used to compute purge volumes by multiplying by three, except where removal of this quantity of water is not practicable. This was the case at K-4, where approximately one and one-half volumes were purged. Purge volumes were measured with a 5-gallon bucket, which was filled from the pump discharge line and emptied when full. Company personnel were requested to provide a list of wells not routinely purged of three casing volumes and the approximate purge volumes for those wells. The requested information was not provided for wells numbered higher than K-17.

Purged water was allowed to run directly onto the ground for all wells except K-4. This is not a good practice as the water may later be found to contain contaminants and remedial action or appropriate closure may be required for the affected area. CWM had previously determined that the ground water at K-4 contains hazardous waste constituents; therefore, purge water was poured from the 5-gallon bucket into a large drum. CWM personnel stated that the K-4 purge water is disposed of in an onsite hazardous waste management unit. Otherwise, the purging procedures are adequate.

Sample Collection, Handling, Preservation and Field Measurements

Wells sampled during the Task Force site inspection, except K-13, were fitted with Grundfos stainless steel, submersible impeller pumps powered by a gasoline generator. The generator was placed down or cross-wind from the well during sampling to avoid potential contamination by the exhaust. Well K-13 was equipped with a high-pressure Well Wizard bladder pump, driven by nitrogen gas and regulated by a high-pressure control box. The wells with Grundfos pumps discharged through a 1-inch diameter galvanized steel pipe. During sampling, a gate valve on the purging discharge line is used to divert flow to a teflon sampling tube. The Well Wizard discharges at a rate low enough (~500 mℓ/minute) so that separate purging and sampling lines are unnecessary; a single dedicated polypropylene tube is used.

The Grundfos pumps are used to purge and sample the 4-inch diameter wells because, according to CWM personnel, they are the most practical way of removing the water considering the volumes required (hundreds of gallons) and the depth to ground water (several hundred feet). A recent study indicates that submersible centrifugal pumps, such as the Grundfos, cause sample alteration as a result of a partial vacuum developed by the impellers.[2] Heat produced as a result of friction between the water and impellers can increase the temperature of water passing through the pump.* The principal effect is degassing of the samples, which may alter levels of parameters such as volatile organics, pH, alkalinity and others.

During sample collection at wells equipped with the Grundfos pumps, especially at K-3, many small gas bubbles were observed in the volatile organic sample vials filled directly from the discharge tube by the CWM contractor. The sampler had to let the bubbles dissipate for several minutes before the vial could be sealed with no head space. Foaming was observed in the pump discharge at well K-8.

---

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

Whether the Grundfos pumps have significant effects on sample collection at the Kettleman Hills wells has not been demonstrated in the CWM reports reviewed by Task Force personnel. The effects need to be studied, documented and appropriately addressed before the sample collection portion of the monitoring program is considered for acceptance.

Field measurements were being satisfactorily performed for specific conductance, temperature and pH using a Hydac Tester®, manufactured by Cambridge Scientific Industries, Cambridge, Massachusetts. The meter was calibrated prior to field measurements for each well with prepared, iced standards for conductance and pH. Conductance standards of 250 and 2,600 µmho/cm and pH standards of 4, 7 and 10 pH units were used. The meter probe was rinsed with DI water between standards and before and after measuring the sample. CWM contractor personnel measured specific conductivity four times and pH three to four times on the aliquot collected at each well. The results are recorded on a field record form (CC-2) provided by the contractor laboratory.

After making the field measurements, samples were collected for analysis by the CWM contractor laboratory [Table 9]. The usual procedure is for CWM contractor personnel to first fill sample bottles for "total"-type analyses (e.g., total organic carbon and total organic halogen) and volatile organics directly from the pump discharge line. An in-line filter* is then installed and all other samples are collected. Samples were preserved immediately after collection. The procedures for sample handling (except for filtering), preservation and field measurements were acceptable.

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

* *Sample Pro 0.45 micron High Capacity Field Filter manufactured by QED Environmental Systems, Ann Arbor, Michigan. The filter media is an acrylic polymer with a polypropylene binder.*

Table 9

ANALYTICAL PARAMETERS, VOLUMES AND PRESERVATIVES FOR CWM SAMPLES

Parameter	Container	Preservative
Volatile organics	40-mℓ glass	Sodium thiosulfate
Metals*	1 liter	Nitric acid (HNO_3)
NO_3	125-mℓ amber glass	Sulfuric Acid (H_2SO_4)
Conventionals**	1 liter	None

* *Includes calcium, magnesium, sodium, potassium and iron.*
** *Includes alkalinity, chloride, sulfate, fluoride and total dissolved solids*

Shipping and Chain-of-Custody

The sample bottles are all prepared by the principal contractor laboratory, ETC, in Edison, New Jersey, to ensure uniform procedures. The bottles are pre-labeled for the required parameters from each sampling point and shipped to the facility in sealed "shuttles" together with the required documents for sampling (chain-of-custody and field record sheets - documents CC-1 and CC-2, respectively). Pre-measured preservatives for each sample bottle are shipped in small vials attached to it.

Once the samples were collected, filtered (where done) and preserved, they were placed in the shuttles, which are insulated containers with fitted plastic foam inserts for the bottles. A signed chain-of-custody form (CC-1), designating the analytical requirements, accompanied each sample. This form also indicated the location, date and time of sampling; the sample size and preservatives; whether the sample was filtered and the numbers of the custody seals. Then, "blue ice" packs, frozen in an onsite freezer, were placed in the shuttles to cool the samples during shipment. After completing and enclosing the sampling documents, the shuttle was secured with a numbered plastic seal and shipped to the laboratory. The shipping and chain-of-custody procedures were consistent with those described in the corporate ground-water sampling manual and are acceptable.

SAMPLE ANALYSIS

Presently, the ETC laboratory is responsible for all ground-water monitoring analyses; however, sampling personnel perform pH, conductance and temperature measurements in the field. The ETC laboratory was inspected by Task Force personnel during the week of July 15, 1985, as part of another site investigation. The inspection was conducted to determine if priority pollutant analyses and analyses required by the interim status RCRA regulations were being properly conducted. These analyses include those done on samples from the Kettleman Hills facility except for a sample from well K-4 analyzed for the Part 261, Appendix VIII parameters.

Some inadequacies in the present laboratory procedures were found. As previously discussed, samples for semi-volatile organics, pesticides and herbicides are filtered prior to extraction. This practice may result in data biased low for these parameters. Similarly, samples are filtered before metal analyses;, thus, dissolved, instead of total, metals are determined.

ETC Method GC/MS-1-002 for base, neutral and acid extractable organics, pesticides and PCBs is not recommended by the Task Force for analysis of ground-water samples for pesticides and PCBs. The detection limits achieved for the pesticides and PCBs by this method are about 50 times higher than those achieved by gas chromatography-electron capture detector methods.

The flame atomic absorption spectroscopy methods used to determine cadmium, chromium and lead are not capable of reliably measuring levels near the drinking water limits for these parameters. Furnace atomic absorption spectroscopy should be used.

The analytical procedure for TOC is incomplete because the results represent only nonpurgable organic carbon. Samples are acidified and purged with nitrogen gas prior to determination of organic carbon. This results in the loss of purgable (volatile) organic carbon. Analyses must

be made for purgable and nonpurgable organic carbon and the concentrations summed to calculate a result for total organic carbon.

ETC performs TOX analyses near an area where samples are extracted with methylene chloride. This practice is cautioned against by the instrument manufacturers as the activated carbon used in the TOX analysis is highly susceptible to contamination by fugitive organic vapors. TOX analyses should be performed in an area isolated from the use of solvents. At the recommendation of the inspector, ETC has reportedly moved the TOX instrument to an isolated area.

MONITORING WELLS

At the time of the Task Force inspection, CWM had completed 41 wells. Of these, 21 were designated as monitoring wells, 4 as assessment wells and 16 as observation wells [Table 10]. The following discussion addresses location and construction of wells installed by the time of the Task Force inspection.

Well Locations

The dipping geologic structure and similarity of the stratigraphic intervals complicate siting of monitoring wells at the facility. Directly beneath any given waste management unit, the outcropping beds are unsaturated and remain so for several hundred feet downdip (to the southwest) [Figure 3]. Wells installed to ground water at the limit of the waste management area (i.e., near the waste boundary), as required by the State permit and RCRA regulations, would have to penetrate several relatively impermeable zones. These wells would not immediately (if ever) detect leakage. Consequently, wells have to be drilled some distance from the waste management units in order to monitor ground water in the permeable zones that crop out under them.

The characteristics of the stratigraphic intervals make identification of the zones targeted for monitoring difficult in borings made downdip from

Table 10

KETTLEMAN HILLS FACILITY WELLS
AS OF AUGUST 1, 1985

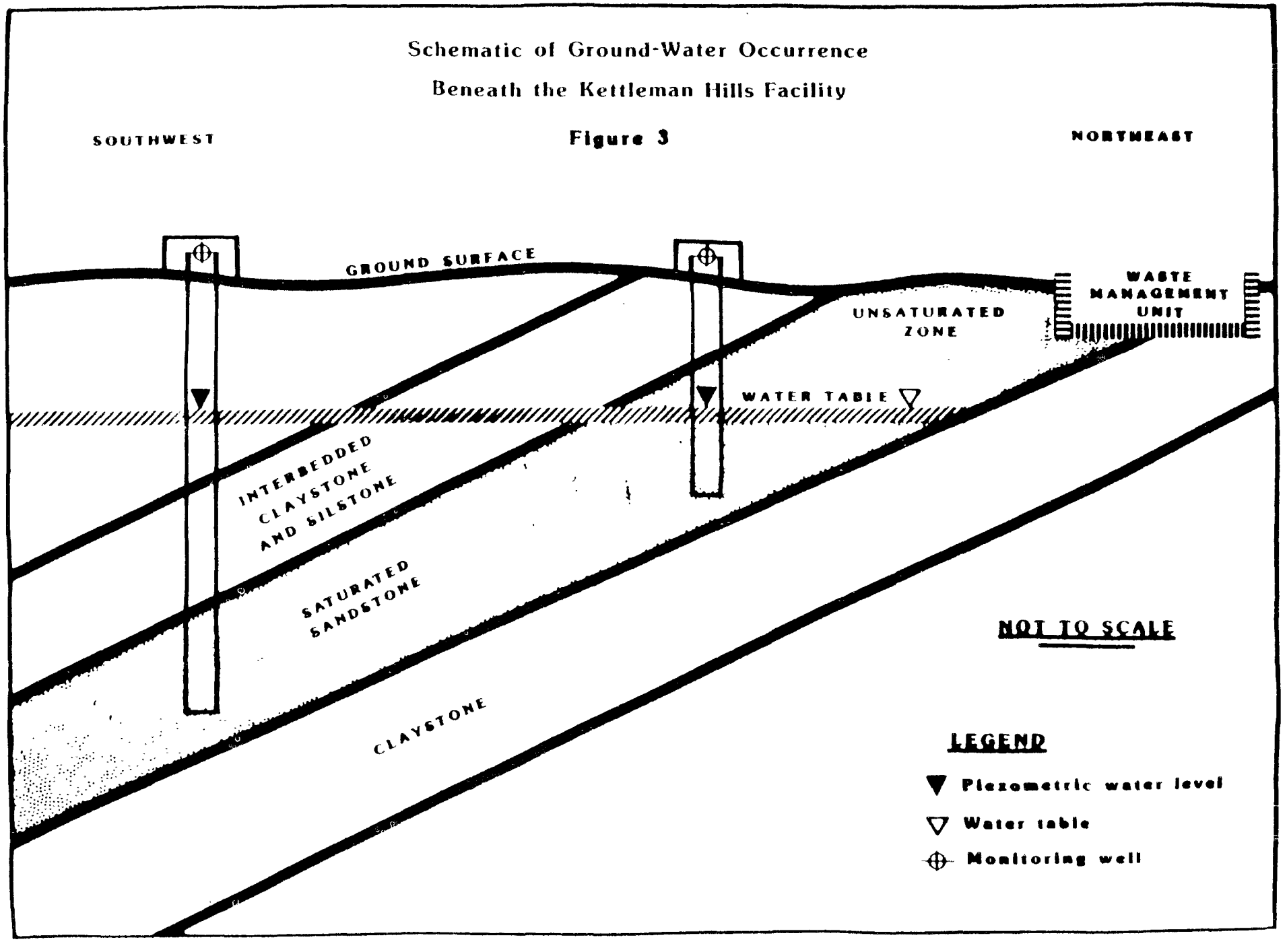
Well Identification Number	Designation[a]
K-1	M[a]
K-2	M
K-3	M
K-3a	O[b]
K-4	M
K-4a	O
K-5	M
K-5a	O
K-6	M
K-8	M
K-9	M
K-10	M
K-10a	O
K-11	M
K-11a	O
K-12	M
K-13	M
K-14	M
K-15	M
K-16	M
K-16a	O
K-17	M
K-17a	O
K-18	M
K-19	O
K-20	M
K-21	O
K-22	O
K-23	M
K-24	O
K-25	O
K-26	O
K-27	O
K-28	M
K-29	O
K-30	M
A-1	A[c]
A-2	A
A-2a	O
A-3	A
A-4	A

a *M denotes a monitoring well.*
b *O denotes an observation well.*
c *A denotes an assessment well (part of K-4 assessment program).*

Schematic of Ground-Water Occurrence

Beneath the Kettleman Hills Facility

Figure 3



the waste units. These difficulties arise especially where the composition of the strata changes gradually and where interbedded sands, silts and clays are not readily distinguishable.

To determine if monitoring wells are in the zone indicated by CWM consultants, data (and the reliability of those data) from selected wells were evaluated. The data reviewed included well deviation survey results, geologic cross sections, boring logs, well construction diagrams and borehole geophysical logs (natural gamma, spontaneous potential and resistivity).

Data presented on zones monitored by the wells in the various CWM reports were incomplete, inconsistent and, in some cases, erroneous. The adequacy of well locations could not be reliably determined. Inconsistencies were found in the monitored zones designated for the wells, as indicated on Table 11. Where beds are easily identified, CWM has identified the monitored zone adequately. Where bed definition is difficult, identification of the zones monitored is uncertain.

The vertical depth at which marker beds are encountered in the borings can sometimes be used to help identify the stratigraphic interval and the zone targeted for monitoring within it. Nonvertical depth can result in erroneous determinations. Many of the boreholes drilled for monitoring wells are not straight; a common result of drilling at depth. CWM consultants conducted a deviation study on the monitoring and assessment wells (except for K-23) to determine the true vertical depth and a correction factor to be applied to measured water levels. Knowing the angle of deviation also enables calculation of the true thickness of the stratigraphic interval monitored by the well. At some wells (e.g., A-2, K-13, K-19, K-21) deviation surveys were not performed for their full depth [Table 12]. True vertical depths for these wells are unknown because the data are incomplete.

Table 11

MONITORED ZONES OF SELECTED MONITORING, OBSERVATION AND ASSESSMENT WELLS

Well	Monitored Unit Identified by Facility	Bed Actually Monitored
A-1	Neverita B	Neverita B
A-2	Neverita B	Neverita B, slightly above interbedded zone of K-4
A-3	Sandstone in interbedded zone above Neverita B	Claystones or clayey interbedded Neverita B
A-4	Sandstone in interbedded zone below Neverita B	Insufficient data
K-1	Tuffaceous A	Top of Tuffaceous A
K-3	Sandstone between Tuffaceous A and B	Tuffaceous A
K-5	Tuffaceous B	Tuffaceous B
K-6	Neverita B	Neverita B
K-10	Pecten A	Pecten claystone
K-11	Acila A	Acila A sandstone and overlying claystone and interbedded strata
K-12	Neverita A	Neverita A
K-13	Pecten A	Completion uncertain, may be in interbedded strata below Pecten marker bed
K-17	Neverita A	Top of Neverita A and overlying interbedded zone
K-18	Pecten B	Interbedded standstone and claystone including Trachycardium marker bed
K-19[a]	Neverita A	Neverita A
K-24[a]	Tuffaceous A	Tuffaceous A
K-25[a]	Tuffaceous B	Tuffaceous B

a *Observation well*

Table 12

DIFFERENCES BETWEEN CASING DEPTH AND DEVIATION SURVEY DEPTHS FOR SELECTED WELLS

Monitoring Well	Casing Depth[a] (ft)	Deviation Survey Depth[b]
A-2	484	122
K-13	466[c]	445
K-19	456	425
K-21	565	345

a *From well-construction diagrams submitted November 8, 1985*

b *From a deviation study conducted in August 1985 and submitted to EPA November 8, 1985*

c *Bottom of inner 3-inch casing*

Post-deviation study reports were found to be inconsistent. For example, water-level data "corrected" after the deviation study and submitted to EPA November 8, 1985 indicate K-21 does not deviate. Data from the deviation study in the same submittal indicate that at a depth of 345 feet, the drift angle in K-21 is 9 degrees. Inconsistencies were also found in the deviation data for well K-18 where two companies did surveys and the results for connected depths differed by 4 feet. This single inconsistency suggests that the deviation data are suspect.

Geologic cross sections contained in the November 8, 1985 report, submitted to EPA, do not reflect well depths corrected for borehole deviation and are unreliable. Bottom elevations shown for some wells (e.g., K-17 K-24, A-4) do not correlate with depths indicated on boring logs. The Pecten sandstone, although discussed in the texts of CWM hydrogeologic reports, is not identified on any geologic cross-section diagram, well logs or stratigraphic column. Whether wells were screened in the Pecten sandstone could not be confirmed.

Well depths reported in boring logs and construction diagrams were also found to be inconsistent. For example, the boring log indicates K-13 is drilled to a depth of 478 feet, whereas, the well construction diagram indicates a depth of 475 feet. These discrepancies indicate that some of the depth/elevation data for the wells are erroneous.

The geophysical data provided the most reliable basis upon which to judge which geologic units are being monitored. Borehole geophysical data indicate that numerous thick and thin geologic units beneath the Kettleman Hills facility exhibit distinctive electric properties. These units are continuous and can be correlated across the site with confidence. Geophysical logs were run in all of the Company-designated monitoring and assessment wells. The logs were not run the full length of the borehole for every well (e.g., A-1, A-3, A-4, K-5, K-10 and K-24); therefore, the data are incomplete.

Well Construction

Construction details for the CWM designated ground-water monitoring wells are listed on Table 13. The wells were drilled using an air-rotary drilling method and have polyvinylchloride (PVC) casings, screens and bottom cap [Figure 4]. The annular space around the casing is sealed with cement grout over a sand pack that surrounds the well screen. Whether the grout and sand pack were properly installed could not be determined from the information provided by CWM. The detailed boring and well installation logs are contained in the field geologist's logbooks, which were not provided to Task Force personnel during the inspection.

The wellhead assembly consists of a sampling apparatus and a protective aluminum box with a security lock [Figure 5]. The sampling apparatus consists of a galvanized steel pumpline and discharge line and a Teflon or polypropylene dedicated sampling tube. Flow from wells equipped with Grundfos pumps is regulated through the discharge line with a valve during sampling to relieve pressure on the small-diameter sampling tube.

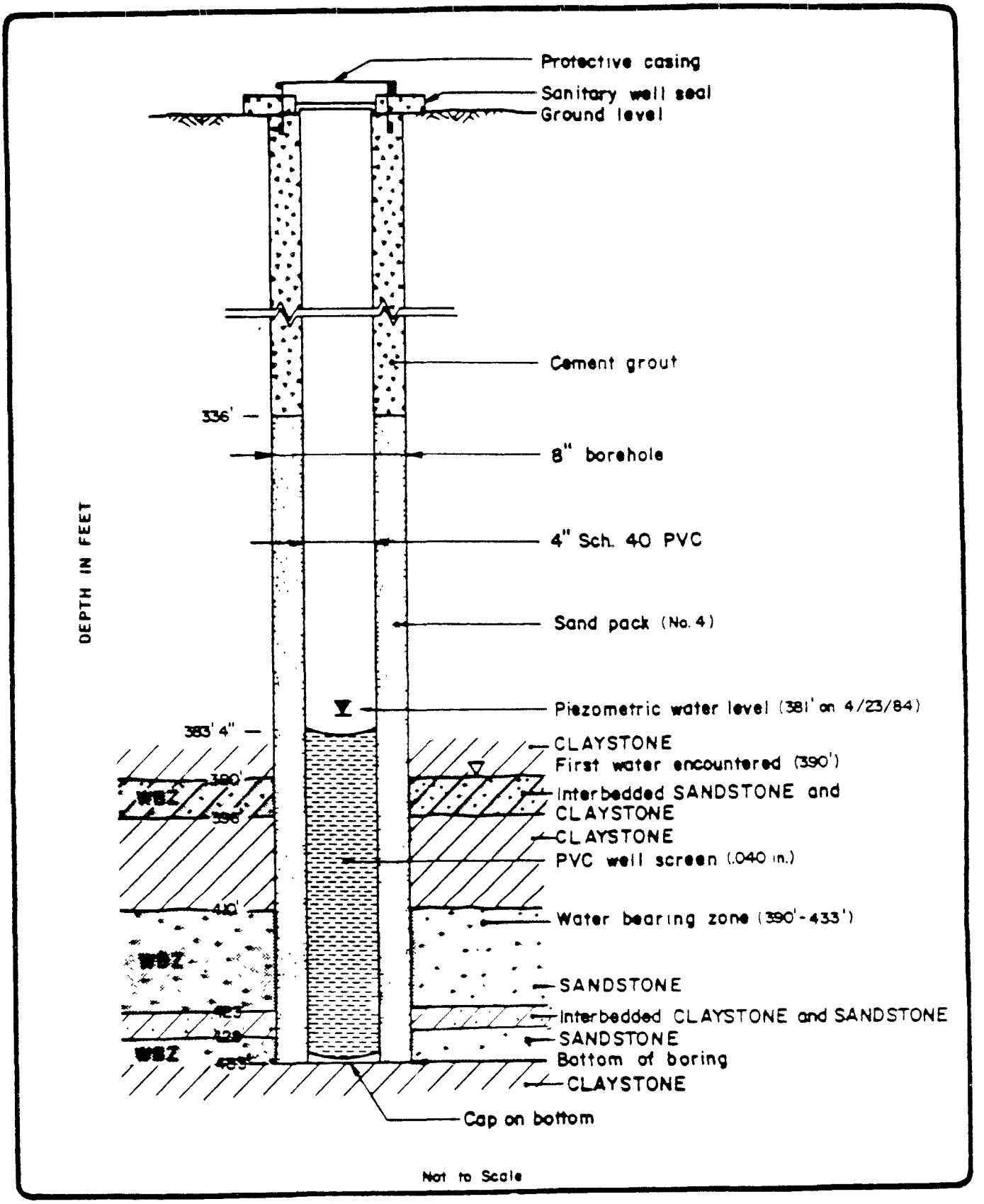
The condition of the wellhead assembly and security was adequate for most wells. A newly-drilled well, K-6, was not yet complete or secure, although casing and pump had been installed. The annular space near the surface had not been grouted nor had any secure box been installed.

Table 13

COMPANY DESIGNATED MONITORING WELLS
KETTLEMAN HILLS FACILITY

Well Identification Number	Date Installed	Total Casing Length (ft)	Screened Length (ft)	Screen Openings (in)	Sand Pack Interval (ft)	Sand Pack Length
K-1	02/29/84	428	20	0.040	390-428	38
K-2	03/26/84	429	20	0.040	390-429	39
K-3	04/30/84*	433	50	0.040	336-433	97
K-4	05/21/84*	313	20	0.040	260-313	53
K-5	06/14/84*	520	40	0.040	459-520	61
K-6	06/30/85*	452	30	0.013	412-468	56
K-8	09/11/84*	464	20	0.013	435-464	29
K-9	10/15/84	455	20	0 013	421-455	34
K-10	07/12/84	469	10	0 040	439-469	30
K-11	08/15/84	459	60	0.013	335-459	124
K-12	07/14/85	510	70	0.013	432-510	78
K-13	07/11/84*	466	20	0 013	439-475	36
K-14	07/30-84	598	30	0 010	535-598	63
K-15	08/28/84	503	30	0.013	455-503	48
K-16	07/31/84	365	70	0.040	275-365	90
K-17	09/10/84*	435	50	0.013	375-440	65
K-18	07/20/85*	160	110	0 013	490-629	130
K-20	07/18/85*	529	50	0.013	462-520	58
K-23	Not reported	675	95	0 013	567-678	111
K-28	07/21/85*	447	70	0 013	367-455	88
K-30			No Data Provided			
A-1	01/09/85*	369	30	0.013	331-374	43
A-2	Not reported	484	38	0.010	436-500	64
A-3	Not reported	460	30	0 010	420-460	40
A-4	Not reported	502	10	0 010	482-505	23

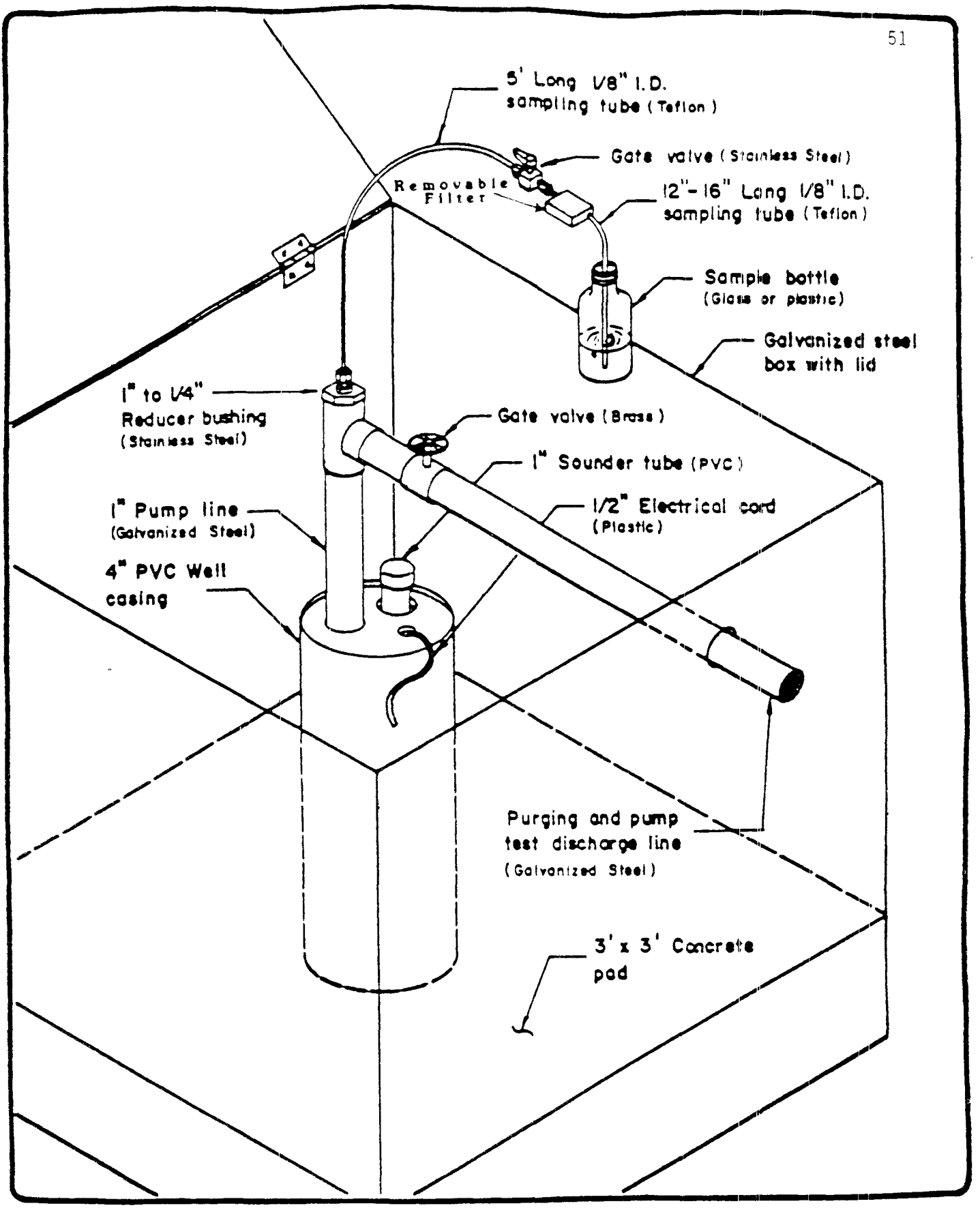
* *Date is last day of boring*



TYPICAL WELL COMPLETION

Figure 4

(from EMCON Associates)



TYPICAL WELL HEAD SAMPLING APPARATUS

Figure 5

(from EMCON Associates)

Well completion diagrams were provided for each well except K-30, but detailed logs on the well construction were not provided by CWM, as previously discussed. These logs should be evaluated before the wells are accepted by EPA, especially in view of the location problems described.

Sand pack and screen lengths on wells within a monitored unit vary widely [Table 14] and may be contributing to problems in determining hydraulic gradients and ground-water flow directions. Within saturated strata, natural vertical hydraulic (pressure) gradients exist. Generally, the water level measured in a well represents the average pressure over the length of the sand pack where the level is above the pack. Where the level is below the top of the sand pack, the water level in the well represents the average pressure from the bottom of the pack to the top of saturated materials within the bed or beds monitored.

Where wells are installed to monitor a single bed or group of beds for determining gradients and flow directions, they should be at the same depth within the bed and the sand packs should be approximately the same length. Otherwise, the wells would not be monitoring corresponding pressure gradient intervals, which could result in erroneous predictions of ground-water flow directions. When vertical gradients are high or unknown, uniform sand pack lengths and well depths into the bed are critical factors in the design of the monitoring well network.

Reports provided to Task Force personnel contain no information on vertical gradients within monitored beds and intervals, yet screen and sand pack lengths are not uniform within them. For example, of the six wells monitoring the Neverita B interval, which includes contaminated well K-4*, sand pack lengths vary from 43 to 60 feet and screen length varies from 20 to 44 feet. Of the four wells in the Acila A interval, which crops out in the proposed facility expansion area, sand pack lengths range from 62 to 124 feet and screen lengths range from 46 to 95 feet.

---

* *See Table 13.*

Table 14

SAND PACK AND SCREEN LENGTH IN WELLS
WITHIN REPORTED HYDROLOGIC INTERVALS
KETTLEMAN HILLS FACILITY[a]

Well Number	Hydrologic Interval	Sand Pack Length (ft)	Screen Length (ft)	Water Level Below top of Sand Pack
K-12	Neverita A	78	70	
K-12	Neverita A	90	70	Yes
K-17	Neverita A	65	50	Yes
K-19	Neverita A	85	70	
K-28	Neverita A	88	70	
K-29	Neverita A	90	69	Yes
K-4	Neverita B	53	20	Yes
K-6	Neverita B	56	30	
K-27	Neverita B	60	35	Yes
A-1	Neverita B	43	30	Yes
A-2	Neverita B	64	38	
A-2A	Neverita B	53	44	
K-1	Tuffaceous A	38	20	
K-24	Tuffaceous A	51	40	
K-26	Tuffaceous A	30	20	
K-2	Tuffaceous B	39	20	
K-5	Tuffaceous B	61	40	
K-25	Tuffaceous B	47	30	
K-10	Pecten A	30	10	
K-13	Pecten A	36	20	
K-11	Acila A	124	60	Yes
K-21	Acila A	62	46	
K-22	Acila A	100	70[b]	
K-23	Acila A	111	95	

a *Source: CWM RCRA Part B Application, Additional Information Requirements, November 8, 1986*

b *Includes four 10-foot sections and three 10-foot blanks*

Even if the problems in identifying the zones actually being monitored by the wells are resolved, the wells may still not yield enough corresponding water level data to determine gradients and flow directions because of the widely variable sand pack lengths.

MONITORING DATA ANALYSIS FOR INDICATIONS OF WASTE RELEASE

This section presents an analysis of both Task Force and CWM monitoring data regarding indications of apparent or potential leakage from the waste management units. Field and laboratory analytical results from samples collected by Task Force personnel are presented in Appendix C, together with the analytical methods.

Task Force data indicate the presence of organic hazardous waste constituents in three wells [Table 15]. The compounds are identified as waste constituents because receiving logs and limited preacceptance information indicate that, except for 2-nitrophenol, they were present in incoming waste loads.* Most of the waste constituents detected in well K-4 have been previously detected and confirmed by CWM, as shown on Table 16.

CWM has not previously reported detecting organic compounds in well K-8. The presence of chemicals in this well is suggested by vapor monitoring at the wellhead with an HNU meter before sampling.** Vapor readings of 5 to 10 ppm were detected at well K-8, whereas none was detected at the other eight wells. Manufacturer's specifications for the HNU meter report a high sensitivity to the compounds detected (carbon disulfide and toluene).

CWM also has not previously reported detecting organic compounds in well K-13. The presence of the compound identified (1,1,1-trichloroethane) is supported by the purgeable organic halide (POX) data. POX analysis results indicate the presence of volatile organic compounds containing the halogens chlorine, bromine and/or iodine (e.g., trichloroethane). The POX concentration is essentially the same as the trichloroethane concentration, which accounts for that halogenated volatile organic compound.

Zinc concentrations in the monitoring well samples suggest dissolution of the galvanized riser pipe in wells equipped with Grundfos pumps. As a

---

* *Records obtained during 1984 NEIC investigation*

** *See Investigation Methods section.*

Table 15

ORGANIC COMPOUNDS DETECTED IN GROUND-WATER SAMPLES
Kettleman Hills Facility

Compound	Value (a)	Value	Value
Carbon disulfide		BMDL-5	
Toluene	8	BMDL-5	
1,1,-Trichloroethane	BMDL-5		BMDL-5
Chlorobenzene	670		
Methylene Chloride	110		
Benzene	41		
1,1-Dichloroethane	49		
Chloroform	39		
Tetrachloroethene	11		
Total xylenes	13		
Trichloroethene	16		
1,1-Dichloroethene	BMDL-5		
2-Nitrophenol	150		

a = *Concentrations are reported in ug/ℓ.*
BMDL = *Present Below Method Detection Limit, number is Method Detection Limit*

Table 16

Organic Compounds Detected In Well K-4 By CWM

Source:	CWM	CWM	CWM	CWM	CWM	CWM	CWM	CWM	CWM	EPA-AUG 85	
Sampling Date:	JUN 84	JUN 84	AUG 84	NOV 84	FEB 85	MAR 85	JUN 85	JUL 85	AUG 85	GWTF	NEIC
Compound	VALUE(a)	VALUE	VALUE	VALUE	VALUE	VALUE	VALUE	VALUE	VALUE	VALUE	VALUE
Carbon Disulfide						<50					
Toluene	110		<1			BMDL-10	<60	15	11	8	10^{-4}
1,1,1-Trichloroethane	<1		3			BMDL-10				BMDL-5	
Chlorobenzene	360	635	510			1412	1370	1400	1060	670	530
Methylene Chloride	<1	12				55	210	166	98	110	120
Benzene	32	65	29			86	90	71	51	41	40
1,1-Dichloroethane	12	46	27			122	140	112	89	49	40
Chloroform	64	133	90			76	50	63	54	39	40
Tetrachloroethene	<1	10	3			<10	<41	20	20	11	10
Total Xylenes	<1		7			NA				13	10
Trichloroethene	<1	30	11			<10	45	32	26	16	BMDL-20
1,1-Dichloroethene	<1	21	6			14	<28	8	6	BMDL-5	
2-Nitrophenol	<2		NA			<25	<3.7	87	NA	150	170
4-Nitrophenol							<2.5	49	NA		
Naphthalene							78	<2			
Pyrene							2	<2			
Bis(2-ethylhexyl)phthalate	70					<10					
Di-n-octyl phthalate	60					<10					
Di-n-butyl phthalate						BMDL-10					
1,2-Dichlorobenzene						BMDL-10					
Diethyl phthalate						BMDL-10					
alpha-BHC						BLDL-10					
2,4-D			9.0	9.6	140.	BMDL-50				NA	NA

a = Concentrations are reported in ug/L.
NA = Not Analyzed
BMDL = Present Below Method Detection Limit, number is Method Detection Limit
<X = Not Detected at a detection limit of X or present but below the method detection limit of X;
= Not Detected for JUN 84 data
GWTF = Ground-Water Task Force contract laboratory data

result, they may not be representative of ground-water quality. Galvanized pipes are coated with zinc by hot dipping or electroplating processes to increase corrosion resistance. However, corrosion products include zinc, iron and manganese (and trace cadmium).[3] The range of zinc concentrations in samples from wells with galvanized riser pipe is 590 to 18,100 μg/ℓ. Well K-6, installed just before the Task Force inspection began, had the lowest concentration; well K-4 had the highest. By contrast, the sample from well K-13, which is equipped with a teflon pump assembly and a polypropylene riser tube, contained less than detectable concentrations of zinc (<120 μg/ℓ).

REFERENCES

1. U. S. Environmental Protection Agency, March 1979, *"Methods for Chemical Analysis of Water and Wastes"*, EPA-600/4-79-020, p. METALS-5.

2. Houghton, R. L. and Berger, M. E., May 1984, *"Effects of Well-Casing Composition and Sampling Method on Apparent Quality of Ground Water"*, proceedings of the Fourth National Symposium and Exposition on Aquifer Restoration and Ground-Water Monitoring sponsored by the National Water Well Association and EPA, pp. 203-213.

3. Barcelona, M. J., Gibb, J. P. and Miller, R. A., August 1983, Illinois State Water Survey Report 327: *"A Guide to the Selection of Materials for Monitoring Well Construction and Ground-Water Sampling"*, Contract No. EPA CR-809966-01.

APPENDICES

A CONSENT AGREEMENT
B DESCRIPTION OF STRATIGRAPHIC INTERVALS
C ANALYTICAL RESULTS FOR TASK FORCE SAMPLES

APPENDIX A

CONSENT AGREEMENT

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION 9

IN RE:	)	Docket Nos. RCRA-09-84-0037, TSCA-09-84-0009
CHEMICAL WASTE MANAGEMENT, INC.,	)	
Respondent.	)	CONSENT AGREEMENT AND FINAL ORDER

I. These actions were instituted by a Determination of Violation, Compliance Order and Notice of Opportunity to Request a Hearing issued by the United States Environmental Protection Agency ("EPA" or "Complainant") on July 3, 1984 ("Original RCRA Complaint") and an Amended Determination of Violation, Compliance Order and Notice of Opportunity to Request a Hearing issued on June 6, 1985 ("Amended RCRA Complaint") under the Resource Conservation and Recovery Act, ("RCRA"), 42 USC §6901 et seq., and a Complaint and Notice of Opportunity for Hearing ("TSCA Complaint") issued on June 6, 1985, under the Toxic Substances Control Act ("TSCA") 15 USC § 2615.

II. The Amended RCRA Complaint alleges that Chemical Waste Management, Inc. ("Respondent") was in violation of Sections 3004, 3005 and 3006 of the Resource Conservation and Recovery Act ("RCRA"), 42 USC §§6924 and 6926; 40 CFR Part 265, regulations promulgated by the Administrator, United States Environmental Protection Agency, to implement those sections of RCRA, and Sections 25159.6 and 25200.5(b)(3) of the Health and Safety Code, State of California, at Respondent's facility located in Kettleman Hills, California, EPA ID Number CAT000646117 ("the Facility"). The Facility is an existing hazardous waste management facility as defined in 40 CFR §260.10. The State of California, Department of Health Services ("Intervenor" or "DOHS") is a party to the proceeding instituted under RCRA. Respondent filed an Answer to the Amended RCRA Complaint on August 29, 1985 which denied the allegations of the Amended RCRA Complaint.

III. The TSCA Complaint alleges that Chemical Waste Management, Inc. ("Respondent") was in violation of Section 15 of TSCA, 15 USC §2614, and 40 CFR Part 761, regulations promulgated by the Administrator, United States Environmental Protection Agency, to implement that section of TSCA at Respondent's Facility. Respondent filed an Answer to the TSCA Complaint on July 30, 1985, which denied the allegations of the TSCA Complaint.

IV. The EPA Regional Administrator has jurisdiction over the subject matter of the actions commenced pursuant to Section

3008 of RCRA, 42 USC §6928, and 40 CFR §§22.04(a) and 22.37, and Section 16(a) of TSCA, 15 USC 2615(a) and personal jurisdiction over the parties consenting hereto.

V. In settlement of the above described TSCA and RCRA actions, Complainant, Respondent and Intervenor have agreed to the entry of this Consent Agreement and Final Order ("Final Order") prior to the presentation of any testimony or evidence and without adjudication of any issue of law or fact. For the purpose of this Consent Agreement and Final Order, Respondent neither admits nor denies the specific factual allegations set forth in the Original RCRA Complaint, Amended RCRA Complaint and TSCA Complaint. Complainant, Respondent and Intervenor agree to waive any right to a hearing on the Original RCRA Complaint, Amended RCRA Complaint and TSCA Complaint and consent to the issuance of this Final Order without adjudication. Nothing in this Final Order shall be construed as an admission by Respondent of any violation or any issue of law or fact, nor shall this Final Order be used against Respondent as evidence of any violation or as an admission against interest, nor shall it prejudice or impair any right, remedy or defense Respondent may have in any other or future legal proceeding. This Final Order supersedes the previous RCRA compliance orders issued on July 3, 1984 and June 6, 1985.

VI. Except as specified herein, nothing in this Final Order shall be binding on any agency office, department, or board of the State of California except the Department of

Health Services and any successor agency thereto. It is the intent of the Parties that nothing in this Final Order is inconsistent with the provisions of the California Porter-Cologne Water Quality Control Act and regulations promulgated thereto.

VII. All days set forth in this agreement shall run consecutively from the effective date of this Final Order.

VIII. Respondent shall undertake the following tasks enumerated below:

A. ENVIRONMENTAL AUDIT

Within forty-five (45) days after the effective date of this Final Order, Respondent shall submit to EPA and DOHS the scope of work for the services of a third-party consultant who shall be expert in environmental auditing, auditing environmental management systems and auditing RCRA and TSCA waste management operations. The scope of work and consultant both shall be agreed upon by EPA, DOHS, and Respondent in writing prior to the consultant commencing the performance of the professional services as more fully set forth herein below. The consultant shall be retained and the scope of work shall be designed to audit waste operations and environmental management systems at the Facility and in the Respondent's corporate Environmental Management Department as they affect RCRA and TSCA compliance at the Facility.

1. Within one year after written agreement upon the scope of work and the consultant, said third-party consultant shall

submit separate written reports to Respondent regarding RCRA and TSCA compliance at the Facility. These reports shall:

a. Identify and describe the existing Facility waste management operations. Identify and describe Respondent's Environmental Management Department, environmental management systems, and policies and prevailing practices as they affect RCRA and TSCA compliance at the Facility.

b. Evaluate such operations, systems, practices and policies and identify and describe fully the perceived strengths and any weaknesses in such operations, systems, practices and policies, to the extent practicable, regarding their ability to promote compliance with applicable RCRA and TSCA requirements. The consultant shall apply its expertise and judgment to the foregoing data base, utilizing such factors as the consultant believes to be relevant and necessary to achieve compliance with RCRA, TSCA, and DOHS regulations implementing RCRA.

c. Based on the evaluation required in paragraph A.1.a. and b. above, the consultant shall identify and describe fully, with supporting rationales, the perceived areas, if any, where Respondent's waste management operations and environmental management systems, practices and policies may be significantly improved to achieve RCRA and TSCA compliance listing specific options for any improvements at the Facility in the following specific areas:

(1) compliance and waste management operation, staffing, education and experience requirements;

(2) compliance management, lines of authority, Respondent's corporate Environmental Management Department and relationship to the operating facility manager;

(3) personnel training for individual employees, compliance obligations and emergency spill response;

(4) Operations and Maintenance ("O & M") procedures for pollution prevention and waste management equipment;

(5) evaluation of interim stabilization units for ability to physically and chemically stabilize liquid wastes as compared to EPA's draft Statutory Interpretive Guidance, "Prohibition on the Disposal of Bulk Liquid Hazardous Waste in Landfills," (May 6, 1985).

(6) preparation of Quality Assurance and Quality Control programs for sampling and analysis and for environmental testing procedures, including Facility laboratories and contract laboratories for the Facility;

(7) preparation and review of Incident Reports with specific recommendations for corrective steps and preventive O&M, along with reporting procedures for these recommendations to corporate headquarters.

2. Respondent shall notify EPA upon receipt of said reports, and within ninety (90) days after receipt of final reports, Respondent shall submit to EPA and DOHS the portion of

the reports containing findings and recommendations of the consultant, together with Respondent's evaluation of each option it has selected for adoption and the reasons for rejecting other options. The report by Respondent shall set forth the specific actions the company shall take and a schedule for implementation of the recommendations adopted by Respondent.

3. All documents submitted to EPA and DOHS pursuant to paragraph A are considered to be "voluntarily submitted information" as defined in 40 C.F.R. §2.201(i) and will be treated as confidential to the extent authorized by law including without limitation such protection as is allowed by TSCA (for the TSCA report) and RCRA (for the RCRA report).

4. EPA and the State agree that such documents shall not be used to initiate an enforcement action or as direct evidence of a violation, but may be used as evidence of the existence of any violation which may remain uncorrected beyond six months after the delivery of the Audit Report and as evidence of knowledge or duration of a violation, provided, however, that Respondent does not waive any legal rights it may have to object to the admissibility of such evidence. It is intended that documents prepared for Respondent pursuant to paragraph A are not required by law or regulation.

B. GROUND WATER MONITORING

1. Hydrogeologic Site Investigation

a. Respondent shall have submitted a Report to EPA and DOHS by October 31, 1985, which summarizes the results of the hydrogeologic investigation of the site conducted to date by the Respondent's independent consultants. The Report shall present all data received or collected since the August 1985 data submission to EPA. This shall include, but not be limited to, the following:

1. geophysical logs
2. lithologic logs
3. construction details on all new wells
4. final geologic maps
5. water level readings from all existing monitoring wells
6. data from packer and pump tests

b. The Report shall also present the results of the K-4 ground water quality assessment program which meets the requirements of 40 C.F.R. § 265.93(d). The Report shall include the following data:

(1) Analytical data from well K-4 for the constituents listed in 40 CFR Part 261, Appendix VIII.

(2) Analytical data from monthly sampling for three months of wells A-2 and K-4 and two months for well A-1 for all of the parameters specified in the August 15, 1984, report submitted by Respondent entitled

Groundwater Quality Assessment Program plus all of the 40 CFR Part 261, Appendix VIII parameters detected in well K-4.

(3) Results of hydraulic tests of wells A-1, A-2, K-4, and wells directly above and below the water bearing zone of K-4.

(4) Ground water flow rate and direction for the K-4 water bearing zone in the vicinity of well K-4 based upon piezometric data obtained from (at least) wells A-1, A-2, and K-4.

(5) Unless otherwise requested by EPA or DOHS Respondent shall continue to monitor and assess the K-4 area in accordance with 40 C.F.R. §265.93(d)(7).

c. Respondent agrees to supplement the Report to include analytical data for monthly sampling for three months for well K-6 and one month for well A-1 (for the same parameters cited in subparagraph B(1)(b)(2) above) to be performed and submitted to EPA and DOHS in accordance with the schedule set forth in subparagraph B.2.b.(5)(a)-(c) below.

d. Respondent shall extract ground water from the K-4 water bearing zone which has elevated levels of chemical constituents. Any ground water extracted from the K-4 water bearing zone shall be to discharged only to lined surface impoundments at the Facility.

e. Within 30 days of the effective date of this Final Order, the Respondent shall submit to EPA and DOHS a

supplemental report which shall present the results of Respondent's assessment of the source of toluene detected in various samples extracted from monitoring wells at the Facility. If the supplemental report does not indicate that the toluene is due to causes such as well installation, well sampling, sample analysis, or natural sources, the Respondent shall develop and initiate an assessment program required by 40 C.F.R. 265.93(d) for determining whether toluene is present in ground water.

f. The Report shall include a site-specific ground water sampling and analytical protocol for the Facility. The sampling protocol shall be used by Respondent and all other parties whenever samples are taken from monitoring wells at the Facility. The protocol shall include the following items:

(1) Well evacuation procedures that will be employed for each well. The equipment, purging rate and purging volume that will be employed for each well shall be included. To the extent feasible, all wells must be purged in the same manner. If dewatering is a problem, then lower purging rates shall be used or Respondent shall document that inflowing water cascading down the screen will not be significantly affected in terms of the concentration of constituents of concern (e.g. volatile organics). The use of stabilized pH or specific conductance to indicate adequate purging volumes shall not be used.

(2) Sampling equipment that will be employed. To the extent feasible, each well shall be sampled in the same manner.

(3) Description of the materials of construction of the sampling and purging assembly. Such materials shall not significantly change the concentration of the constituents of concern.

(4) Sample preservation and handling techniques including provisions for field titration of samples as appropriate.

(5) Procedures for decontaminating sampling equipment between sampling events.

(6) Procedures for measuring ground water elevations at each sampling event.

(7) Chain-of-custody procedures to be used for all phases of sample management.

(8) Laboratory analytical techniques including quality assurance/quality control procedures and EPA-approved analytical methods referenced in subparagraph 2.b(3) below.

g. The Report shall include the details of the types and formats of ground water quality data that will be submitted in the future.

2. Ground Water Monitoring Program.

a. On or before November 8, 1985, Respondent shall assess and certify its compliance with the requirements of 40 C.F.R. Part 265, Subpart F.

b. Respondent also agrees to complete the following tasks:

(1) Respondent shall submit by November 8, 1985 a map which identifies the number and location of all interim status ground water monitoring wells at the facility.

(2) Respondent shall arrange to make available for review upon request by EPA and DOHS at the offices of Respondent's consultants driller logs and field notes relating to the Facility.

(3) Respondent shall take water level measurements and sample for ground water quality. Such samples shall be analyzed for the following parameters utilizing the procedures established by SW-846:

(a) Volatile organics (Method 8240)

(b) Cyanides (Method 9010)

(c) Parameters required by 40 C.F.R. 265.92(b). The first round of samples from all monitoring wells shall be collected no later than November 8, 1985.

(4) Respondent's first four rounds of sampling shall include four replicate measurements of the indicator parameters at upgradient (background) wells.

(5) The sampling and analysis required by subparagraph B.2.b.(3) shall be repeated according to the following schedule:

(a) Second round of sampling shall be completed by December 8, 1985;

(b) Third round of sampling shall be completed by January 8, 1986;

(c) Fourth round of sampling shall be completed by February 8, 1986;

(d) First round of semi-annual sampling shall be completed by March 8, 1986;

(e) Second round of semi-annual and annual sampling shall be completed by April 8, 1986;

(f) Respondent's semi-annual sampling shall include four replicate measurements of the indicator parameters in all wells;

(g) Respondent shall submit the analytical results of sampling within 60 days of sample collection.

(h) Respondent shall submit the statistical evaluations for the first two rounds of semi-annual sampling within 75 days of sample collection.

(6) Thereafter, subsequent sampling and analyses shall be performed in accordance with 40 C.F.R. 265.92(d) for the parameters set forth in 40 C.F.R. 265.92(b).

c. Respondent further agrees to install a groundwater monitoring well for each PCB landfill. The monitoring wells shall be sited such that they monitor the most permeable water-bearing zone for B-14 and the Neverita B sand for B-16 which underly each PCB landfill. To the extent feasible, the Respondent shall use the site specific RCRA ground water sampling and analytical protocol for sampling these wells. Respondent shall take water elevation measurements and sample for ground water quality quarterly, and provide the sampling results to EPA and DOHS within 60 days of sample collection. Respondent shall analyze for PCBs and any other constituents found as a result of the analysis required by subparagraph D.13 below.

C. <u>LIQUID DISPOSAL</u>

1. Respondent asserts that it has not treated or disposed of waste at the Facility by means of land spreading since April 1984. Respondent shall not treat or dispose of waste through land treatment at the Facility in the future unless it obtains a final RCRA permit for such treatment meeting the requirements of 40 CFR Part 264 and applicable state regulations. Closure of former land spreading areas S-1 through S-6 shall take place in accordance with Paragraph D of this section.

2. Respondent asserts that it has not treated or disposed of waste in unit S-3 since March 15, 1985 and in S-5 since April 1984. Respondent shall not treat or dispose of waste in units S-3 or S-5 in the future except as otherwise provided in Paragraph D below or unless authorized under interim status or by a final RCRA permit issued pursuant to 40 CFR Part 264.

3. Respondent asserts that it has been using lined stabilization bins for the treatment of bulk and containerized liquid waste at the Facility since May 8, 1985. Respondent shall not place liquid wastes in trenches at the Facility prior to stabilization. Respondent shall continue to physically and chemically stabilize liquid waste, intended for landfill disposal, in lined stabilization bins, as approved by DOHS letter of January 17, 1985 or subsequent permit, in accordance with EPA Draft Statutory Interpretive Guidance, "Prohibition on the Disposal of Bulk Liquid Hazardous Waste in Landfills," (May 6, 1985). Respondent shall confirm the elimination of free liquids through the use of the paint filter test on a sample of the waste prior to disposal of the material. Respondent shall document such stabilization by fully completing and maintaining its "Stabilization Evaluation Test" records prior to stabilization for each batch entering the stabilization bins. Records of the paint filter test and "Stabilization Evaluation Test" shall be maintained as part of the facility operating records.

D. CLOSURE AND SUBSTANTIAL MODIFICATIONS TO FACILITY

1. Respondent shall within 60 days of the effective date of this Order amend the closure plan for the Facility submitted to EPA on October 7, 1985, to set forth a closure plan for each of the following waste management units not previously covered by said closure plan:

a. P-1 through P-20
b. B-1 through B-16
c. S-1 through S-6
d. Drum decant unit
e. Cyanide treatment unit
f. PCB flushing/storage unit
g. Interim drum storage unit
h. Interim stabilization unit

2. All of the units set forth in subparagraph D.1. shall be closed with a cover design that meets the requirements of 40 C.F.R. Part 265, Subpart G.

3. Except as set forth herein, Respondent shall immediately cease discharging waste to waste management units designated as surface impoundments P-4 1/2, P-4C, P-12A, P-13, P-18 and landfills B-6, B-8, B-10, B-11, B-15 and units S-2, S-3 and S-5. Respondent shall cease discharging waste to surface impoundment P-12 no later than January 1, 1986. The closure plan for each of these units shall set forth a schedule of closure of these units. Respondent shall not commence closure of a waste management unit without obtaining prior DOHS approval of the partial closure plan. Units P-18, S-5 and S-6 (excluding the area of P-19 and P-20) shall be closed upon closure of B-19. Units P-1, P-2, P-3, P-4, P-4 1/2, P-4C, S-1,

B-1, B-4, B-5, B-6, B-8, original B-9, B-9 extension, B-10, B-11 and B-15 shall be closed in accordance with the schedule set forth in Table B. Units P-12, P-12A, P-13, S-2, P-5, and S-3 shall be closed in accordance with the closure plan for such units and in accordance with the schedule set forth in Table B. The closure of units P-12, P-12A, P-13, S-2, P-5, and S-3 shall not preclude the use of the closed area for future waste management activities. The parties agree that Respondent may continue to use the existing interim drum storage unit and interim stabilization units in their present locations, until closure of the B-9 expansion. The area of the existing interim drum storage unit and interim stabilization units shall be closed and the units shall be relocated upon DOHS approval upon closure of B-9 expansion.

4.a. Respondent shall submit to EPA and DOHS no later than the dates specified in column A of Tables A and B a sampling plan for determining the extent of residual contamination beneath surface impoundments designated as P-9, P-12, P-12A, P-13, P-14, P-16, P-18, and P-19. The sampling plan for these impoundments shall be similar to that set forth in Attachment A.

b. By December 31, 1985, Respondent shall submit detailed plans and specifications for P-19 to meet the minimum technological standards established by EPA's Minimum Technology Guidance Manual on Double Liner Systems (May 24, 1985) pursuant to the Hazardous and Solid Waste Amendments of 1984. P-19 is

approved by DOHS and EPA for operation and retrofit provided the design, plans and specifications for P-19 conform to the plans and specifications for P-9 (as modified by Attachment B) and further provided that Respondent submits to EPA and DOHS the sampling results and certification required by Paragraphs 4.a. and 4.d., respectively.

c. Each of the surface impoundments P-9, P-14, and P-16, is approved by DOHS and EPA for operation and retrofit in accordance with Respondent's plans and specifications submitted to EPA on August 9, 1985 (as modified by Attachment B) upon submission to EPA and DOHS of the sampling results and certification required by Paragraphs 4.a. and 4.d. respectively.

d. For P-9, P-14, P-16, and P-19, Respondent, prior to retrofitting an impoundment, shall submit certification by a registered engineer or a certified engineering geologist that the surface impoundment to be retrofitted has a foundation or a base capable of providing support for the structure and capable of withstanding hydraulic pressure gradients to prevent failure due to settlement, compression or uplift.

e. Column A, Submittal of Plans and Specifications to EPA and DOHS, in Table A, specifies the date by which Respondent shall submit plans and specifications, including proposed sampling plans and construction site safety plans for units proposed for retrofitting. The construction site safety plan included for each unit must clearly identify the procedures which will be used by the Respondent and its

contractors to insure the health and safety of anyone working at or having access to the construction site during retrofitting. Column B, Transfer of Pond Contents, in Table A, specifies the date by which pond content transfer must be made. Column C, Result of Sampling Plan to DOHS/EPA, in Table A, specifies the date by which Respondent shall submit the results of the sampling plan to DOHS/EPA prior to obtaining DOHS approval to retrofit as specified in Paragraph 4.c. of this section. Column D, Completion of Retrofit, in Table A, specifies the date by which Respondent shall complete retrofit of the unit.

5. Respondent shall complete cleanout of Pond P-12 no later than March 15, 1986. Respondent shall complete cleanout of ponds P-13 and P-18 in accordance with Table B not later than February 1, 1987 and March 1, 1987, respectively. Ponds P-13 and P-18 may only receive liquid waste contents transferred from ponds P-12, P-15, and P-19. Prior to transferring the contents of any pond, Respondent shall conduct compatibility tests in accordance with Respondent's applicable Waste Analysis Plan to assure that the transferred pond contents are compatible with the contents of the pond receiving the waste and are not restricted hazardous wastes as defined in Section 25122.7 of the California Health & Safety Code.

6. DOHS will place no restrictions on the transfer of liquid waste from P-15 (which received restricted waste as defined by Article 15, Title 22, California Administrative

Code, Chapter 30), provided that (a) the transferred pond contents are not restricted wastes as determined by a sampling program approved by DOHS, and (b) the transfer does not exceed one million gallons, and (c) the transfer occurs before April 1, 1986. DOHS hereby grants a variance for surface impoundment P-15 from those specific provisions of Title 22, California Administrative Code, Chapter 30, which require that ponds receiving restricted waste must be cleaned on at least an annual basis. This variance is conditioned on the adherence by the Respondent to the schedules established in Table A for unit P-15.

7. Respondent may continue to operate lined surface impoundments P-15 and P-20 in accordance with the schedule set forth in Table A until November 8, 1988, prior to retrofit as specified in Table A, unless the structural integrity of the liner is impaired or the pond is cleaned prior to that date.

8. a. Respondent shall implement the sampling program developed for units S-3 and S-5 attached to this Final Order as Attachment A to determine the vertical extent of residual contamination beneath these units. Respondent shall complete implementation of the sampling plan for the S-5 unit no later than October 31, 1985, and shall complete the sampling plan for unit S-3 no later than November 30, 1985. Respondent shall submit the results of such sampling plus any pre-existing sampling data for these units by December 31, 1985. Closure of

S-3 shall be completed by August 1, 1986 in accordance with Table B.

b. Respondent shall submit to EPA and DOHS within 30 days of the date of this Final Order detailed plans and specifications for construction of a double lined landfill to be located in the area of S-5, S-6 and surface impoundment P-18, which shall be designated as the B-19 landfill. Such plans and specifications shall meet the criteria of EPA's Minimum Technology Guidance Manual on Double Liner Systems (May 24, 1985). EPA and DOHS agree to expedite their review of the plans and specifications for B-19 and agree to approve the proposed design and operation of B-19 within 60 days of the date of receipt of detailed plans and specifications from the Respondent if such plans comply with the technical criteria of EPA's minimum Technology Guidance Manual on Double Liner Systems (May 24, 1985).

c. Upon receipt of approval of the B-19 landfill from DOHS and any other appropriate governmental agencies, Respondent may proceed with excavation and construction of said landfill. Significantly contaminated soil has been correlated with visually contaminated soils in the S-5 sampling plan. Respondent shall dispose of all visibly contaminated soil removed from the B-19 area into B-9, B-13, or the double-lined portion of B-19. All other remaining soil from the B-19 area may be stockpiled adjacent to the area as designated in the plans and specifications for B-19. This stockpile area shall

be bermed to provide for total control and containment of run-on and run-off as long as the area is used for storage of soil excavated from the B-19 area. Prior to the use of any other cover material, the stockpiled soil removed from the B-19 area shall be used as daily cover material in the B-9 expansion, B-13, or the double-lined portion of B-19, or for foundation material in preparation for final clay cover of P-12, P-12A, P-13, P-5, S-2, and S-3 areas.

d. Within thirty (30) days of this Final Order Respondent shall submit its B-19 plans for EPA and DOHS approval which plans shall specify the size, height and location of Phase I of B-19. The parties agree that Respondent may continue to use the existing B-9 expansion landfill unit until the Phase I portion of the B-19 landfill begins operation, subject to the following limitations:

(1) No later than December 15, 1985, Respondent shall submit the following with respect to B-19:

(i) an application to DOHS for a modification under interim status;

(ii) an application to the Regional Water Quality Control Board for waste discharge requirements;

(iii) an application to Kings County for a conditional use permit.

(iv) an application to Kings County Air Pollution Control District for an air permit.

(2) Except as set forth in paragraph 8.d.(3) and (4) below, use of the B-9 expansion unit shall be discontinued either (i) after disposal of waste in the B-9 expansion has reached the level which would require the unit to exceed the final elevation shown on the detailed plans set forth in Attachment C, taking into account closure and capping requirements, or (ii) by October 31, 1986, whichever occurs first.

(3) If Respondent determines that B-19 cannot be operated by the date for discontinuing the B-9 expansion specified in subparagraph 8.d.(2), Respondent no later than thirty (30) days prior to such date, shall notify EPA and DOHS. The notification shall include the reasons B-19 cannot be operated, the reasons waste for B-9 cannot be disposed in any other landfills at the Facility until B-19 is completed, and a proposed date by which the use of B-9 Expansion will be discontinued. Within fifteen (15) days of such notification, the parties shall meet to consider the matters raised in Respondent's notification, and shall modify this Final Order if a modification is agreed to by the parties. EPA and DOHS shall not unreasonably refuse to agree to a modification. If the parties cannot agree to modify this Final Order, within fifteen (15)

days of the meeting, Respondent may file a petition with the Administrative Law Judge setting forth the matter in dispute and, if such a petition is filed in good faith, the discontinuance of the use of the B-9 expansion shall be stayed until the Administrative Law Judge issues his decision and, if action is taken in U.S. District Court, until the matter is decided. EPA and DOHS shall have fifteen (15) days to respond to such petition. In making his determination, the Administrative Law Judge may consider any relevant facts relating to the B-9 expansion and B-19. The parties agree that they will jointly petition the Administrative Law Judge to issue a decision within thirty (30) days of the date on which the matter in dispute is submitted to the Administrative Law Judge. The parties agree that the decision of the Administrative Law Judge shall constitute final agency action ripe for judicial review.

(4) EPA and DOHS further agree that, after the date for discontinuing the B-9 expansion specified in subparagraph 8.d.(2), Respondent may temporarily stockpile hazardous waste within B-9 Expansion until Phase I of the B-19 area is available and approved for hazardous waste

disposal. Stockpiled waste shall be placed only upon an area where a three foot (3') thick compacted clay liner has been installed. When B-19 is available and approved for hazardous waste disposal, all stockpiled waste shall be removed from B-9 Expansion, as expeditiously as reasonably possible, and disposed of in the double-lined portion of B-19, except that any stockpiled waste which does not exceed the grade level for the B-9 Expansion as described in Attachment C need not be removed and Respondent may close B-9 Expansion to such level. If EPA and DOHS do not agree to the in-place disposal of material stockpiled above the level shown in Attachment C, such decision shall be unreviewable under subparagraph 8.d.(3). In no case shall the Final Order result in stockpiled waste being moved off-site.

e. Notwithstanding paragraph D.8.d. above, as soon as Phase I of the B-19 landfill is available for use, Respondent shall immediately cease the disposal of commercial waste in the B-9 expansion landfill and shall promptly close it, in accordance with its approved partial closure plan for the B-9 expansion landfill, with on-site contaminated soil or clean soil as appropriate to assure adequate closure of the unit. Closure shall be completed by the time provided in the closure

plan. After closure of the B-9 expansion, the parties agree that this portion of the Facility shall be closed to any waste disposal.

9. The parties agree that Respondent may continue to use landfill unit B-13 for the disposal of compatible wastes until completion of the unit as set forth in the closure plan submitted to EPA and DOHS on October 7, 1985. Respondent shall close B-13 in accordance with its approved partial closure plan.

10. Respondent shall submit to EPA and DOHS within 30 days of the effective date of this Order a revised Part A permit application which sets forth the design capacity of each of the following units: P-9, P-10, P-11, P-14, P-15, P-16, P-19, P-20, limited B-9 expansion, B-13 and B-19 as authorized by this Final Order.

11. Future replacement and expansion of landfills and surface impoundments which will receive hazardous wastes after May 8, 1985 must be designed and constructed to meet the minimum technological requirements in Section 202 of Hazardous and Solid Waste Amendments 1984.

12. Effective immediately, any proposed increases in design capacity or changes in processes for the treatment, storage or disposal of hazardous waste beyond those specified in Paragraph 10 above, must be submitted in writing to DOHS for approval, as a revised Part A or Part B permit application, with a copy to EPA. Respondent must receive written approval prior to implementing such changes. All proposed increases in

capacity or changes in processes shall include a demonstration that the proposed changes do not amount to reconstruction of the facility as defined in 40 CFR §270.72(e). If this demonstration cannot be made, Respondent may submit a Part B permit application for approval. DOHS agrees to expedite its review and decision on any such permit application.

13. Respondent shall conduct representative sampling of the liner for PCB landfill B-16 within 90 days of the date of this Final Order. The sampling shall be limited to those areas where the liner is exposed such that the sampling device will not come into contact with PCB waste placed in landfill cells. Respondent shall analyze for PCBs and priority pollutants. Results of the analysis shall be submitted to EPA and DOHS within 90 days of sample collection.

E. WASTE ANALYSIS PLAN

1. Respondent shall follow the procedures set forth in its Waste Analysis Plan dated February 15, 1985, as revised August 20, 1985, for all wastes received at the Facility. Where specified by the Facility Waste Analysis Plan, Respondent shall assure that all four components of Respondent's pre-acceptance package (Generator's Waste Profile Sheet; Certificate of Representative Sample Sheet; Special Waste Analysis Report; and Special Waste Disposal Decision Sheet) are fully satisfied prior to acceptance of each applicable incoming waste stream. Unless approved by EPA and DOHS, all four components of Respondent's pre-acceptance package required by

the present Facility Waste Analysis Plan (as revised August 20, 1985) shall be completed and retained until closure of the Facility and, after retention of paper records for a period of three years, such records may be maintained on microfiche or equivalent. Where each of these components of the pre-acceptance package is not required for a particular waste stream, Respondent shall assure that all applicable requirements of the Waste Analysis Plan are met for that waste stream. Respondent may modify its Waste Analysis Plan provided such plan remains in compliance with 40 C.F.R. 265.13.

2. Respondent shall perform all analyses required by the Facility Waste Analysis Plan for each incoming waste load. Respondent shall conduct PCB analyses on all incoming manifested PCB-contaminated soils that are to be disposed of in a non-TSCA approved landfill unit and on all oily liquid wastes of unknown PCB concentration.

3. Respondent shall continue to follow the Waste Analysis Plan dated February 15, 1985, as revised August 20, 1985, until it is formally amended, revised, or altered by Respondent. Within fifteen days of any amendment, revision or alteration of the Facility Waste Analysis Plan, Respondent shall submit a copy of the revised Waste Analysis Plan to EPA and DOHS.

F. <u>OPERATING RECORDS</u>

1. a. Within 180 days of the effective date of this Order, Respondent shall develop and implement a computerized system for the management of operating records at the

Facility. The computerized system shall apply to both TSCA waste and RCRA waste. Upon implementation, Respondent shall submit a report describing how the system is constructed and operated. The system shall be capable at a minimum of recording waste fingerprint analyses, internal waste transfers, wastes generated at the main truck wash station, waste generated at the PCB flushing/storage unit, the contents and the location of wastes deposited within each landfill cell, and the method, location and date(s) of intermediate and ultimate treatment, storage or disposal for each hazardous waste received at the Facility. Each waste shall be cross referenced to waste manifests and waste profile numbers. Decant shall be deemed an intermediate treatment. In addition, records of all waste analyses and trial tests shall also be maintained on site. The computerized operating record system shall be applicable to all wastes received at the Facility after April 1, 1986. In addition to the computerized system, the Facility's manual recordkeeping shall be maintained. After retention of paper records for a period of three years, such records may be maintained on microfiche or equivalent.

b. All operating records required by RCRA shall be made available as quickly as reasonably possible to State and Federal inspectors, but no later than 24 hours after the request.

2. Complainant shall review the Potential Release Report submitted by Respondent for the Facility dated September 8, 1985. Within 30 days of this Final Order, Complainant shall

provide Respondent an itemized listing of specific areas where further information or clarification is required. Respondent shall transmit a report to EPA and DOHS addressing such items within 60 days of receipt of Complainant's list. For each area outside of existing or previous waste management units listed in a Part A permit application identified as having received a deposit of hazardous waste, Respondent shall submit a revised closure plan within 90 days of the date of this Final Order to include such area, unless included in the closure plans identified in subparagraph D.1 above.

G. LIQUID DISPOSAL IN LANDFILLS

Effective immediately, Respondent shall fully comply with the requirements of Sections X.4(a) and X.4(b) of its interim permit in that Respondent will not place liquid wastes in a landfill without keeping permanent operating records indicating that these wastes were treated or stabilized outside the disposal unit so that free liquids were no longer present. A paint filter test must be performed and documented upon each stabilization prior to land disposal. Respondent shall fully complete and retain its "Stabilization Evaluation Test" records for each waste batch entering the stabilization units until closure of the Facility. Such records may be maintained on microfiche or equivalent after retention of paper records for a period of three years.

H. IGNITABLE OR REACTIVE WASTES

Respondent shall fully comply with Section X.6 of its interim permit by not placing ignitable or reactive wastes in landfills without indicating in its operating records the results of analyses required by the Facility Waste Analysis Plan that these wastes were treated, rendered or mixed to make them non-ignitable or nonreactive, provided that Respondent may dispose of ignitable or reactive wastes in accordance with 40 C.F.R. §265.312(b) or 265.316.

I. CLOSURE/POST CLOSURE COST ESTIMATES

Respondent shall submit to EPA and DOHS within 60 days of the effective date of this Final Order revised closure and post closure cost estimates in accordance with the revised closure plans submitted by Respondent pursuant to Paragraph D above.

J. POST CLOSURE GROUND WATER MONITORING

Respondent shall submit to EPA and DOHS within 60 days of the effective date of this Final Order revised post closure plans which include ground water monitoring to be conducted after closure or partial closure of the Facility.

K. EARTHEN DIKES

Respondent shall submit to EPA and DOHS within 60 days of the effective date of this Final Order a plan to control wind and water erosion at surface impoundment earthen dikes. The plan shall be implemented within 60 days of approval.

L. SURFACE IMPOUNDMENT INCOMPATIBILITY

Effective immediately, CWM shall not discharge new waste streams into surface impoundments unless prior trial treatment tests have been conducted in accordance with Respondent's applicable Waste Analysis Plan which confirm compatibility of new wastes proposed to be mixed.

M. DRUM DECANT OPERATION PLAN

Effective immediately, Respondent's Drum Decant Operation Plan shall be maintained at the Facility and shall be made available upon request to Federal and State inspectors.

N. PART B PERMIT REVISION

Respondent shall submit to EPA and DOHS within 120 days of the effective date of this Final Order a revision to Tables TR-1 and TR-2 of the Part B Permit application to accurately reflect chronologies of the use of all hazardous waste management units at the site. This revision must be accompanied by the signatory statement and submitted as a revision to Respondent's Part B application. This revision shall be based on the Potential Release Report submitted to EPA dated September 8, 1985.

O. COMPLIANCE WITH PERMIT REQUIREMENTS

Respondent shall demonstrate compliance with all applicable requirements of the permits issued to the Facility by DOHS relating to inspections, site security, and maintenance of two feet of freeboard and 40 C.F.R. 265.14, 265.15, and 265.222 by submission of inspection logs for the Facility for

the period November 15-30, 1985. Respondent shall submit to EPA and DOHS within 30 days of the effective date of this Final Order a revised inspection schedule and inspection record for the Facility.

P. NOTICE

All submissions and notices required by this Final Order shall be sent to:

EPA:

Chief, Waste Programs Branch
EPA Region 9 (T-2)
215 Fremont Street
San Francisco, CA 94105

DOHS:

Section Chief, Northern California Section
Toxic Substances Control Division
Department of Health Services
4250 Power Inn Road
Sacramento, CA

Respondent:

Vice President
Chemical Waste Management, Inc.
715 Comstock Street
Santa Clara, CA 95054

After December 15, 1985, notice to Respondent shall be sent to:

Vice President
Chemical Waste Management, Inc.
39899 Balentine Drive
Newark, CA 94560

Q. AGREED CIVIL PENALTY

Respondent hereby consents to the assessment of a civil penalty in the amount of Two Million One Hundred Three Thousand Dollars ($2,103,000)

Complainant acknowledges EPA is in receipt of partial payment of $108,250.00 leaving a balance of One Million Nine Hundred Ninety-four Thousand Seven Hundred and Fifty Dollars ($1,994,750).

Within thirty (30) days of the effective date of this Final Order, Respondent shall submit a cashier's check or certified check payable to "Treasurer, United States of America," in the amount of One Million Nine Hundred Ninety-four Thousand Seven Hundred and Fifty Dollars ($1,994,750). Payment should be made by sending the check with cover letter to EPA's lockbox address at the Mellon Bank in Pittsburgh, Pennsylvania, with a copy to the Regional Hearing Clerk. The addresses are as follows:

Environmental Protection Agency
Region 9 (Hearing Clerk)
P. O. Box 360863M
Pittsburg, PA 15251

Regional Hearing Clerk
EPA Region 9
215 Fremont Street
San Francisco, CA 94105

R. Respondent shall pay the sum of One Hundred Ten Thousand Dollars ($110,000) per year to the California Department of Health Services or its successor agency for a period of ten years for the purpose of reimbursing DOHS for its costs of enforcement and oversight to monitor compliance with applicable regulations implementing RCRA and/or hazardous waste enforcement and response training. Such payments shall be made payable to a special account in the Hazardous Waste Control Account in the General Fund of the State of California. The

first payment shall be made on or before January 1, 1986. The remaining installments shall be paid annually no later than January 1 of each subsequent year. Expenditures from this special account may be subject to approval by the legislature of the State of California.

S. Respondent's implementation of the soil sampling (paragraph VIII.D.), environmental audit (paragraph VIII.A.), computerized record keeping (paragraph VIII.F.), and other requirements under this Final Order represent a combined environmental monetary commitment by Respondent of approximately Seven Hundred Ninety-Seven Thousand Dollars ($797,000).

T. Complainant, Intervenor and Respondent consent to the entry of this Final Order without further notice.

U. For the performance of the requirements specified herein, Respondent shall perform such activities within the time limits set forth, unless the performance is prevented or delayed by circumstances which constitute a force majeure. For the purposes of this Order, a force majeure is defined as any circumstance arising from causes beyond the reasonable control of Respondent despite Respondent's due diligence and good faith efforts. Financial inability of Respondent to comply with these requirements shall not be considered a force majeure. In the event of a force majeure, the time for performance of the activity delayed by the force majeure shall be extended for the time period of the delay attributable to the force majeure.

The time for performance of any activity dependent on the delayed activity shall be similarly extended, except to the extent that such dependent activity can be reasonably implemented without completion of the delayed activity.

Respondent shall notify EPA and DOHS in writing as soon as reasonably possible but no later than 30 days after it becomes aware of a circumstance which may delay or prevent performance of an obligation. Such notice shall state the anticipated length of delay, the cause of the delay, the measures to be taken by Respondent to prevent or minimize delay, and the timetable by which those measures will be implemented.

Respondent shall also notify EPA and DOHS in writing of the fact of a delay in performance within 30 days after it becomes aware of such delay and failure to so notify shall constitute a waiver of a force majeure defense based on such delay. Failure of EPA or DOHS to notify Respondent in writing of any objection to such notice within 30 days after receipt of Respondent's notice shall constitute a waiver of any objection by DOHS or EPA, respectively, to a force majeure defense based on the delay.

In any proceeding where Respondent raises a force majeure as a defense to performance of a requirement, the burden of proof shall be on Respondent to prove the existence of force majeure, its consequences and the reasonableness of the delay resulting therefrom.

If a force majeure completely precludes performance of an activity or dependent activity rather than merely delaying it, Respondent, EPA and DOHS shall mutually agree upon a substitute activity. If the parties have not agreed upon a substitute activity, the parties reserve all rights they may have to petition the administrative law judge or United States District Court to resolve the dispute regarding selection of an appropriate substitute activity.

This subparagraph T. does not apply to enforcement actions which are not brought to enforce this Final Order.

V. Covenant Not To Sue

1. In consideration of Respondent's consent to this Consent Agreement and Final Order, EPA and DOHS hereby covenant not to initiate or maintain any civil claim or civil cause of action under the Federal Resources Conservation and Recovery Act, Federal Toxic Substances Control Act, or California Hazardous Waste Control Act against Respondent, its parent, subsidiaries, or present or former directors, officers, employees, or agents thereof, with respect to the Kettleman Hills facility based on facts or circumstances known by EPA or DOHS or their employees as of October 15, 1985.

2. Notwithstanding subparagraph V.1. or any other provision of this Agreement, EPA and DOHS may take (a) any action against Respondent regarding surface impoundment P-17; (b) any action to abate, prevent, or order the abatement of any condition which now or hereafter may present an imminent and

substantial endangerment; (c) an action under section 3008(h) of the Resources Conservation and Recovery Act; and/or (d) a non-penalty action under 3008(a)(1), 3013 of RCRA or section 25187 of the Health & Safety Code with respect to facts which were not previously known by EPA or DOHS and which were newly discovered by the EPA National Ground Water Monitoring Task Force inspection of the Facility in August and September, 1985, provided that Respondent shall be given a reasonable time to comply with any 3008(a)(1) or 3013 order.

3. Respondent agrees that EPA or DOHS may properly bring an action to compel compliance with the terms and conditions contained herein in United States District Court. By signing this Agreement, Respondent does not prejudice and specifically preserves any right, remedy or defense it may have with respect to any action related or unrelated to the subject matter of this document, provided, however, that in any action brought by EPA or DOHS to compel compliance with the terms of this Consent Agreement and Final Order, Respondent shall be limited to the defenses of force majeure, compliance with this Consent Agreement and Final Order, physical impossibility, and defenses under the United States and State of California constitutions.

4. In consideration of consent by EPA and DOHS to the entry of this Final Order, Respondent agrees as follows:

(a) Within one (1) working day of the effective date of this Order, EPA, DOHS and Respondent agree to stipulate to a dismissal of Respondent's action, Chemical Waste

Management, Inc. v. United States of America, et al., No. C-85-4215 (JPV) (N.D. Cal.) without prejudice.

(b) Respondent agrees to withdraw all of its pending requests relating to the Kettleman Hills Facility for information, and appeals of denials of requests for information, under the Freedom of Information Act.

(c) Respondent waives all claims that all operating records of the Facility previously submitted by Respondent to EPA are subject to TSCA Confidential Business Information claims, except for customer lists or documents from which customer lists may be compiled. However, Respondent does not waive confidentiality claims under other statutes or regulations with respect to such documents.

5. Except as noted above, this Final Order shall not operate to release, waive, limit or impair in any way claims, rights, remedies or defenses of the United States of America (including EPA), the State of California (including DOHS), or Respondent, against any person or entity not a party hereto.

6. No agency, office, department, or board of the State of California is party to the TSCA proceeding, therefore, notwithstanding subparagraph V.(1), DOHS reserves any rights it may have to bring an action with respect to PCB disposal at the Kettleman facility.

W. This Consent Agreement may be modified upon written approval of all parties hereto.

X. This Consent Agreement and Final Order shall apply to and be binding upon all parties to this Consent Agreement and Final Order, their directors, officers, employees, agents and all persons or entities acting under or for them. Each signatory to this Consent Agreement and Final Order certifies that he/she is fully authorized by the party or parties whom he/she represents to enter into this Consent Agreement and Final Order, to execute it on behalf of the party represented and to legally bind such party.

11-7-85
Date

Respondent
Chemical Waste Management, Inc.

11-7-85
Date

Complainant
Harry Seraydarian
Director, Toxics & Waste Management Division
EPA, Region 9

11/7/85
Date

Intervenor
California Department of Health Services
Reed Sato
Deputy Attorney General
Attorney for Intervenor
California Department of Health Services

IT IS HEREBY ORDERED that this Final Order (Docket Nos. RCRA-09-84-0037 and TSCA-09-84-0009) be entered. This Order shall become effective immediately.

11-07-85
Date

JUDITH E. AYRES
Regional Administrator
Region 9

TABLE A

POND RETROFIT

	A. Submittal of Plans and Specs to EPA/DOHS	B. Transfer of Pond Contents by	C. Results of Sampling Plan to DOHS/EPA	D. Completion of Retrofit
P-9	submitted*	N/A	†	120 days following receipt of necessary approvals
P-14	submitted*	N/A	†	"
P-15	9/1/88	11/8/88	N/A	"
P-16	submitted*	N/A	†	"
P-19	90 days before P-9 completion	To P-9 when P-9 completed	120 days after liquid transfer	"
P-20	9/1/88	11/8/88	N/A	"

* Sampling and safety plans due 15 days after effective date of Order.

† Results of sampling due 60 days after sample collection.

TABLE B

	Submittal of Plans & Specs	Transfer of Pond Contents	Cleaning Completed	Results of Sampling Plan to DOHS/EPA	Closure Construction Schedule
P-12 P-12a	12/31/85	Start 01/15/86	03/15/86	05/15/86	5/15/86 - 7/15/86
P-13	12/31/85	Start 11/1/86	02/1/87	04/1/87	4/1/87 - 6/1/87
P-18	12/31/85	Start 11/1/86	03/1/87	05/1/87	Closure via B-19 Phase II
S-3	11/1/85	N/A	N/A	2/1/86	2/1/86 - 8/1/86
P-5	2/15/85	N/A	N/A	N/A	5/15/86 - 7/15/86
S-2	2/15/85	N/A	N/A	N/A	5/15/86 - 7/15/86
B-16	Previously submitted	N/A	N/A	N/A	When closure contours (minus the final cap) are reached.
B-14	N/A	N/A	N/A	N/A	Closure Complete
B-2	*11/15/85	N/A	1/1/86	3/1/86	Area backfilled for construction of Drum Storage Building
B-3	*11/15/85	N/A	1/1/86	3/1/86	Area backfilled for construction of Drum Storage Building
P-6	3/1/86	N/A	N/A	N/A	6/1/86 - 12/1/86
P-7	3/1/86	N/A	N/A	N/A	6/1/86 - 12/1/86
P-8	3/1/86	N/A	N/A	N/A	6/1/86 - 12/1/86

	Submittal of Plans & Specs	Transfer of Pond Contents	Cleaning Completed	Results of Sampling Plan to DOHS/EPA	Closure Construction Schedule
P-1	8/1/86	N/A	N/A	N/A	11/1/86 - 5/1/87
P-2	8/1/86	N/A	N/A	N/A	11/1/86 - 5/1/87
P-3	8/1/86	N/A	N/A	N/A	11/1/86 - 5/1/87
P-4	8/1/86	N/A	N/A	N/A	11/1/86 - 5/1/87
P-4-1/2	8/1/86	N/A	N/A	N/A	11/1/86 - 5/1/87
P-4c	8/1/86	N/A	N/A	N/A	11/1/86 - 5/1/87
S-1	8/1/86	N/A	N/A	N/A	11/1/86 - 5/1/87
B-10	8/1/86	N/A	N/A	N/A	11/1/86 - 5/1/87
B-11	8/1/86	N/A	N/A	N/A	11/1/86 - 5/1/87
B-9	8/1/86	N/A	N/A	N/A	11/1/86 - 5/1/87
B-9 Ext	8/1/86	N/A	N/A	N/A	11/1/86 - 5/1/87
B-9 Exp	8/1/86	N/A	N/A	N/A	11/1/86 - 5/1/87
B-15	11/1/86	N/A	N/A	N/A	2/1/87 - 8/1/87
B-1	2/1/87	N/A	N/A	N/A	5/1/87 - 11/1/87
B-4	2/1/87	N/A	N/A	N/A	5/1/87 - 11/1/87
B-5	2/1/87	N/A	N/A	N/A	5/1/87 - 11/1/87
B-6	2/1/87	N/A	N/A	N/A	5/1/87 - 11/1/87

* Removal previously approved by DOHS
Must submit excavation plan as required in approval

ATTACHMENT A

SOIL SAMPLING PLAN
KETTLEMAN HILLS FACILITY

The purpose of sampling in this investigation is to document the character and extent of contaminated soil or bedrock in the areas beneath P-9, P-14, S-3 and S-5. Additionally, location of areas which contain little or no contamination will allow for more efficient planning and sequencing of construction activities.

Sampling will take place in three parts:

1. Samples taken in trenches dug through disposal areas,

2. Samples taken through the use of a hollow-stem auger and "U" type sampler in disposal areas, and

3. Samples taken in a boring located off-site so as to document background levels of compounds.

1.0 Drilling Methodology

Subsurface conditions at the facility are described in previous reports by Woodring (1940) and Emcon and Associates (1979 through 1985). The compacted fills consist of cobble size and smaller material comprising sands, silts and clays. The fill material is underlain by dipping, interbedded sandstones, siltstones and claystones. Because of the relatively low hardness of the materials expected to be encountered underlying the site, a hollow-stem auger type drilling procedure was chosen for the job.

2.0 Sample Locations

2.1 Trench Locations

Shallow backhoe trenches will be dug into the represent bottom of P-9 and P-14, so as to freshly expose lithologic units. Two exploratory trenches are proposed in the S-5 area, where removal of overburden will make use of a bulldozer or belly scraper. The trenches are located such that all stratigraphic units underlying the disposal areas will be exposed. This exposure is necessary in order to locate significant strata with the physical characteristics amendable to contaminant migration. Location of trenches P9T, P14T, S5B and S5C should make use of available geologic maps to develop a complete stratigraphic sequence. The trenches will be mapped in detail, physical samples taken from all units, surveyed with an O.V.A. or HNu and sampled, using this information, for chemical

analysis. Samples of representative lithotypes will be taken, with an emphasis on permeable sand units. Samples will also be taken from an obviously contaminated zone and from colluvium immediately below the contaminated stratum.

2.2 Boring Locations

Approximately 15 boring are proposed for the S-5 and S-3 areas, two in P-9 and two in P-14. Boring and sampling locations will be chosen using the following parameters:

- Geology - Information from exploratory trenches, geologic mapping, and boring data in and around the disposal areas.
- Past Use - Including air photo interpretation of 1978, 1979, 1981 and 1984 discharge and concentrations (ponding) with consideration of slope of surface activity (discing) and depth of fill in S-3 and S-5.
- Consultation with site staff - Including confirmation of past use, facility records and use of topographic maps and aerial photos from 1978 through 1985 summarizing fill activities.

Samples will be taken at intervals using the above information as guidelines.

Areas to be evaluated include:

- S-5 Area (10 holes)
  Areas of ponding and distribution spreading zones 1979-1984
  Major transgressive sandstones.
  Major claystones with possible secondary permeability.
- S-3 Area (5 holes)
  Areas of past use (spreading, solidification)
  Major transgressive sandstones
  Major claystones
- P-9 Area
  Major transgressive sandstone units
  Thin coarse-grained sandstones
  Claystones
- P-14 Area
  Major transgressive sandstones
  Claystones

2.3 Off-site Investigation

One or more boring locations will be chosen off-site in units that are the same or similar to units encountered in the S-5 and S-3 areas. Each different lithologic unit intercepted will be sampled for chemical and physical testing. Results from these analyses will be used as a base or background for comparison with results obtained from on-site exploratory borings.

3.0 Procedures

3.1 Boring and Sampling Procedures

Drilling is to be performed using 8-inch O.D. hollow-stem auger equipment. Representative relatively undisturbed samples will be obtained by lowering a "U" Type Sampler into the hollow-stem auger and driving it 18 inches or to refusal (more than 100 blows for 6") with a 140 pound hammer falling 30 inches. Hammer blow counts will be recorded every 6 inches over the 18-inch sampling interval. The sampler will be fitted with three 3-inch stainless steel rings for chemical sampling or a 6-inch thin-wall ring for physical testing.

Upon retrieval, the sampler is opened and the sampler rings are separated using clean stainless steel sample knife. Immediately an O.V.A. reading will be taken and recorded on the boring log. Two of the three stainless steel rings used for chemical sampling are then marked, logged and either removed from the rings at the time, put into glass sample containers and stored in ice cooled shuttles, or sealed in the 3-inch rings and stored in ice chests cooled with ice to be removed later. The six-inch sample ring is marked, logged, sealed in a plastic bag, put in a plastic container and sealed with electrical tape until the time of testing. The sampling equipment will be decontaminated after each sample. Equipment will be disassembled and washed with a diluted soap solution, rinsed with de-ionized water, sprayed with methanol and air-dried. The sampler will then be re-assembled with clean or new rings in order to minimize the possibility of contamination of samples. The hollow-stem auger will be steam-cleaned between borings.

A geologist will be present during drilling operations to assist in obtaining relatively undisturbed samples of sub-surface materials, to maintain a continuous log of the borings and to make detailed observations of the site conditions.

3.2 Soil/Bedrock Sampling Procedure in Trenches

Unconsolidated soil samples are to be taken from the walls of trenches S5B and S5C. These samples will be taken with a new wooden spoon and deposited directly into a sample container. The sample containers are then stored in ice cooler, foam insulated shuttles for shipping.

Samples taken from trench bottoms will be taken with a hand sampler. The hand sampler will be fitted with either a 3-inch ring for chemical sampling or a 3-inch or 6-inch ring for physical testing. Upon retrieval chemical sample rings are cleaned on the outside, sealed on both ends with a teflon membrane, capped on both ends and then sealed with electrical tape for transport in ice filled containers. Physical samples are cleaned, sealed in plastic bags, placed in plastic tubes, capped and sealed with electrical tape.

Chain of custody records will be maintained during the field program. Chain of custody records will accompany sealed shuttles upon transfer of samples to the analytical laboratories.

3.3 Chemical testing

Soil bedrock samples will be analyzed for priority pollutants, phenols, cyanides and metals.

3.4 Physical Testing

Physical testing will be performed on selected soil samples representative of the various soil/bedrock types recovered during sampling activity. The testing will include moisture and density test; Atterberg limits, grain size distribution, and permeability tests will also be run on selected samples. This information will be used for classification of bedrock lithology, assessing the bedrock permeability, and evaluating possible contaminant migration. Care will be taken to run physical tests on samples judged to be equivalent to those taken for chemical analysis.

ATTACHMENT B

Supplemental Technical Criteria For Surface Impoundment Retrofit

The design, plans, and specifications for P-9, P-14, P-16, and P-19 must meet the following supplemental technical criteria:

1) Submittal of a construction site safety plan which addresses the provisions of Article 18, 19, 20 (22 CAC, Division 4, Chapter 30) relative to hazardous conditions which may be encountered during construction activities. In submitting such a site safety plan, CWM may make reference to appropriate information previously submitted to the Department.
2) Resubmittal of plans and specifications showing the following modifications or clarifications:
   (a) Maintenance of 2 feet (2') of freeboard below the lowest point of the proposed diking system having double liner protection. CMW may submit a proposal justifying maintenance of less freeboard pursuant to the requirements of Section 67281(f), CAC, and 40 CFR §265.222(b).

(b) Geomembrane which may come into direct contact with drainage rock shall be protected by a geotextile fabric.

(c) Specification of the criteria used to select a particular geotextile fabric (8 oz./sq. yd.) used in the design.

(d) Specification of the criteria used to select the four inch (4") drainage/riser pipe and demonstration that PVC pipe will be compatible with materials or substances with which it may come into contact.

(e) Specification of the installation procedures which will be followed to ensure that the riser/drainage pipe perforation location in the geomembrane will be properly sealed/seamed.

(f) Specification of the mechanisms and procedures which will be used to detect liquids in the drainage system and to remove liquids from the drainage system for evaluation and analysis.

(g) Specification of the seaming method to be used on the geomembrane, including testing criteria to ensure quality control of the seaming process.

(h) Specification of the criteria to be used to monitor and control crack length, width, and depth during the installation of the clay liners.

3) During construction of the unit, a tensiometer shall be available in the field at all times to conduct peel and shear tests on the geomembrane seams as may be required.

4) The Construction Quality Assurance program recommended by EPA's draft Minimum Technology Requirements guidance of May 24, 1985 shall be incorporated into the specifications for surface impoundment retrofits. In accordance with these procedures, CWM shall maintain an up to date single organized file of all Quality Control (QC) documents generated during construction. CWM shall maintain this file at the site for ready inspection by the EPA, the Regional Water Quality Control Board, the DOHS or their authorized agents.

5) Prior to the discharge of waste, submit plans and specifications for incorporation as part of the Facility Part B application describing the unit in accordance with the conditions set forth herein. CWM may revise and submit only those portions of the Part B application which describe or refer to the design and operations of this particular unit.

6) Prior to the discharge of waste, submit as-built drawings to the DOHS substantiating that the unit was constructed in accordance with submitted plans and specifications as modified herein and has received

APPENDIX B

DESCRIPTION OF STRATIGRAPHIC INTERVALS WITHIN THE SAN JOAQUIN FORMATION

Appendix B

DESCRIPTION OF STRATIGRAPHIC INTERVALS* WITHIN THE SAN JOAQUIN FORMATION

- Cascajo Interval

The Cascajo interval occurs at the base of the San Joaquin Formation and extends from the contact with the underlying Etchegoin Formation to the base of the overlying Neverita A bed. Thick claystones typify the Cascajo Interval. Portions of this interval are exposed beneath surface impoundments P-14, P-15, P-16 and P-17, however, the thick sandstones are absent.

- Neverita Interval

The Neverita Interval extends from the base of Neverita A sandstone to the base of the overlying Mya Sandstone Interval. Three thick (20-95 feet) sandstone beds compose the Neverita Interval (from lowermost to uppermost) including the Neverita A, Neverita B and Tuffaceous Sandstone.

The Neverita A sandstone ranges from 65 to 95 feet thick. It outcrops beneath waste disposal units B-9 expansion (B-1, B-4, B-5, B-6 inclusive), B-7, B-16, P-7 and S-5. The Neverita A includes a thick, poorly consolidated sand layer and a coarse-grained consolidated sandstone. The sandstone is generally fine-to medium-grained, clayey and contains discontinuous silty stringers.

The Neverita B sandstone ranges from 20 to 40 feet thick. It outcrops beneath B-9 expansion (B-4 inclusive), B-16, P-6, P-8, P-12 and S-5. It is fine-to medium-grained and has claystone stringers. Above the Neverita B sandstone is a 120-foot-thick sequence of interbedded strata. These strata include claystone and sandstone beds ranging from 5 to 40 feet in thickness.

---

* *From lowermost to uppermost*

Above the interbedded strata is the Tuffaceous Sandstone. It ranges from 45 to 90 feet in thickness and outcrops beneath the B-9 expansion area (P-1, P-2, P-4, S-1 inclusive), B-15, P-13, P-20, S-3 and S-6.

- Mya Sandstone Interval

The Mya Sandstone Interval overlies the Tuffaceous Sandstone of the Neverita Interval and is overlain by the Pecten-Mya Interval. It ranges from 150 to 200 feet in thickness, much of which is claystone.

The lower part of the Mya Sandstone Interval is predominantly claystone and a clayey interbedded sequence ranging from 100 to 150 feet thick. This sequence includes two thin, shell-bearing layers containing casts of Mya (bivalve mollusk). These thin layers are continuous across the site.

Near the top of the interval is the thick Mya A Sandstone, ranging from 50 to 100 feet in thickness. This massive sandstone is typically dark gray, fine-grained, and contains intermittent calcariously cemented fossiliferous lenses. It is laterally continuous across the site.

Mya A outcrops beneath the B-9 expansion (B-9 and B-10 inclusive), the B-13 expansion (B-13 inclusive), B-15 and P-19. A second sandstone, Mya B, occurs on the north end of the site, but does not appear to be continuous across the site as a separate bed. The consultants to CWM group the Mya B sandstone as part of the overlying Pecten-Mya Interval.

- Pecten-Mya Interval

The Pecten-Mya Interval extends from the top of the Mya A Sandstone of the Mya Sandstone Interval to the base of the overlying Pecten Marker Bed. This interval ranges from 200 to 250 feet in thickness.

Sandstone and interbedded strata dominate the Pecten-Mya Interval. The interbedded strata consist of siltstones and claystones interfingering with relatively thin (<20 feet) sandstone beds. The thin sandstones are generally silty, fine-grained and poorly consolidated. Two thick sandstone beds are described by the CWM consultant as slightly silty, very coarse sandstone and silty, very fine sandstone. The Pecten-Mya Interval includes Pecten A Sandstone and the Mya B Sandstone. The sandstones of the Pecten-Mya Interval outcrop beneath the B-9 expansion (B-9 and B-11 inclusive), P-9, P-10 and P-11.

- Pecten Interval

The Pecten Interval is approximately 150 to 200 feet thick and extends from the base of the Pecten Marker Bed to the base of the overlying Trachycardium Marker Bed of the Trachycardium Interval. The Pecten Marker Bed, at the base of the interval, is a fossiliferous bed that is easily identifiable and aids stratigraphic correlation across the site. The Pecten Claystone occupies the lower portion of the Pecten Interval and is 70 to 100 feet thick. It is a silty claystone ranging from massive to thinly bedded with silty partings and sandstone stringers.

A sandy interbedded sequence overlies the Pecten Claystone. Within this interbedded sequence are two major sandstone units, including the Pecten B Sandstone. Sandstones of the Pecten Interval outcrop beneath the areas proposed for B-17 and B-18. The Trachycardium Marker Bed overlies the Pecten Interval.

- Trachycardium Interval

The Trachycardium Interval extends from the base of the Trachycardium Marker Bed to the base of the overlying Acila A Sandstone of the Acila Interval. It is about 100 to 150 feet thick. Two major sandstone beds (10 to 40 feet thick), separated by clayey interbedded zones, occur in the middle of the interval. Beds in this interval outcrop beneath the areas proposed for B-17 and B-18.

Acila Interval

The Acila Interval extends from the base of the Acila A sandstone to the top of the San Joaquin Formation (to the contact with the overlying Tulare Formation). It ranges from 450 to 500 feet in thickness. Six thick sandstones (>20 feet) and numerous interbedded sandstones and claystones occur in this interval. The thick sandstones are silty, fine-grained, and poorly consolidated.

The poorly consolidated Acila A sandstone is 30 to 60 feet thick. The Acila A and some of the overlying sandstones of the Acila Interval outcrop beneath the areas proposed for B-17 and B-18.

APPENDIX C

ANALYTICAL RESULTS FOR TASK FORCE SAMPLES

Appendix C

ANALYTICAL TECHNIQUES AND RESULTS FOR TASK FORCE SAMPLES KETTLEMAN HILLS FACILITY

INTRODUCTION

The following paragraphs discuss analytical techniques, methods and results for ground-water samples collected by the Ground-Water Task Force at the Kettleman Hills facility.

Field measurements on ground-water samples, including conductance, pH and turbidity, were made by the EPA sampling contractor at the time of sampling. Laboratory analysis results were obtained from two EPA contractor laboratories (CL) participating in the Contract Laboratory Program (CLP). California Analytical Laboratories analyzed the samples for specified organic compounds while Rocky Mountain Analytical Laboratories analyzed for metals and other parameters.

Standard quality control measures were taken including: (1) the analysis of field and laboratory blanks to allow determination of possible contamination due to sample handling, (2) analysis of laboratory spiked samples and performance evaluation samples to estimate accuracy, (3) analysis of laboratory duplicates and field triplicates to estimate precision, and (4) the review and interpretation of the results of these control measures. The performance evaluation samples were samples of known analyte concentrations prepared by the EPA Environmental Monitoring Systems Laboratory, Cincinnati, Ohio. NEIC and the CL analyzed split samples from well K-4.

Table C-1 provides a summary, by parameter, of the analytical techniques used and the reference methods for the ground-water sample analyses.

Analysis Results

Specific Organic Analysis Results

Table C-2 lists the organic compounds which can be reported as being present in the ground-water samples for the identified wells. None of the

organic compounds determined were detected above blank levels in the other well samples. The compounds reported in the samples for wells K-8 and K-13 were present at concentrations below 5 µg/L which is the limit of quantitation for these compounds. The identifications are supported by mass spectra and there was no indication of the presence of these compounds in either laboratory or field blanks.

Table C-3 contains the estimated limits of quantitation (LOQs) for the analyses of the volatiles, semivolatiles and pesticides organic compounds. These limits can be considered reliable to within a few parts per billion for the volatiles and to within factors of two to twenty for the semivolatiles and pesticides for most of the samples. The LOQs for the semivolatiles for the analysis of the well K-7 sample are twice those listed in Table C-3. Instead of the usual 1000 milliter aliquot, only 500 milliters of the well K-7 sample was extracted.

Phenol and the chlorinated and methylated phenol derivatives should be considered to have been "not analyzed" for the well K-4 sample. The CL surrogate spike recoveries for D5-phonol, fluorophenol and tribromophenol were very low or zero. NEIC spiked many of the phenolic compounds listed in Table C-3 and obtained very low or essentially nonexistent recoveries for D6-phenol, fluorophenol, 4-chloro-3-methylphenol, 2,4-dichlorophenol, 2-methylphenol and 2,4-dimethylphenol. NEIC's analyses confirm both the CL identification and quantification results reported in Table C-2 for the well K-4 sample.

Metals Analysis Results

The dissolved and total metals results for the well samples are reported in Table C-4. The accuracy of each detectable value is footnoted in the table.

The dissolved elemental concentrations for many of the samples are biased high. Mismatching of the calibration standards acid matrix to the dissolved preserved sample matrix was the cause of bias. Comparison of the

CL dissolved values to NEIC's for well K-4 and comparison to the CL total values indicates that the dissolved values could be biased high by as much as 18%. Many of the samples were diluted prior to analysis because of the adverse effects of the high dissolved content on the analysis technique. Detection limits have been increased proportional to the dilutions.

The high dissolved solids of the samples caused uncertainty in the reliability of detectable results for arsenic, lead, selenium and thallium because of the inability of the instrumentation to correct for background spectral interference. Therefore, detection limits were raised to preclude reporting false positives due to insufficient instrumental background correction capability. The inability to correct the spectral background due to the high solids at times prevented estimation of a detection limit and the data table indicates that such values were not quantified.

No total values are reported for silver because the lower 99% confidence limits for the spike recoveries for this element was below zero. The digestion in combination with the sample matrix apparently caused precipitation of the silver. Similarly, a low total barium spike recovery was obtained. However, this low barium spike recovery was not considered representative of the accuracy achieved for the sample analyses. The barium spike level exceeded the solubility allowed by the sulfate while the unspiked sample concentration would not. Tin spike recoveries for both the dissolved and total analyses were between 60 and 70%. No tin was detected and the tin detection limits have been raised to reflect the low spike recovery.

General Analysis Results

The field measurements and the results of other analytical testing the well samples are reported in Table C-5. Although analyses were performed for conductance, TOX and nitrate, the results were determined to be unreliable and thus no results are reported. The performance evaluation sample result and comparison of conductance values to the dissolved solids indicate the conductance values were unreliable. Large variation in field triplicate results and the perfomrance evaluation sample result indicate that the TOX

results were unreliable. Samples collected for nitrate analyses were perserved with sulfuric acid which is appropriate only when determination between nitrate and nitrite is not needed. The reliability of the detectable values for the other parameters are footnoted in the table.

Table C-1

Sample Analysis Techniques and Methods

Parameter	Analytical Technique	Method Reference
Conductance	Electrometric	No reference
pH	Potentiometry	No reference
POX	Combustion of purgable fraction, Microcoulometry Detection	EPA 600/4-84-008
TOX	Carbon absorption, combustion, Microcoulometry Detection	Method 9020 (a)
POC	Combustion of purgable fraction, Non-dispersive Infrared Detection	No reference
NPOC	Acidify, Purge, Combustion of liquid, Non-dispersive Infrared Detection	Method 415.1 (b)
Chloride	Mercuric Precipitation Titration	Method 9252 (a)
Nitrate	Brucine Sulfate Colorimetry	Method 9200 (a)
Sulfate	Barium Sulfate Turbidimetry	Method 9038 (a)
Ammonia	Phenolate Colorimetry	Method 350.1 (b)
Cyanide	Distillation, Colorimetry	CLP Method (c)
Phenol	Distillation, Colorimetry	Method 420.1 (a)
Dissolved and Total Hg	Wet digestion for dissolved and total, Cold Vapor AAS	CLP Method
As, Pb, Se and Tl	Acid digestion for total, Furnace AAS	CLP Method
Other Elements	Acid digestion for total, ICAP-OES	CLP Method
Volatiles	Purge and trap GC-MS and direct injection GC-MS or GC-FID	CLP Method
Semi-volatiles	Methylene Chloride extraction, GC-MS	CLP Method
Pesticides/PCB	Methylene Chloride extraction, GC-EC	CLP Method

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

Table C-2

Organic Compounds Detected In Ground-Water Samples
Kettleman Hills Facility

Compound	WELL K-4 Value (a)	WELL K-8 Value	WELL K-13 Value
Carbon Disulfide		BMDL-5	
Toluene	8	BMDL-5	
1,1,1-Trichloroethane	BMDL-5		BMDL-5
Chlorobenzene	670		
Methylene Chloride	110		
Benzene	41		
1,1-Dichloroethane	49		
Chloroform	39		
Tetrachloroethene	11		
Total Xylenes	13		
Trichloroethene	16		
1,1-Dichloroethene	BMDL-5		
2-Nitrophenol	150		

a = Concentrations are reported in ug/L.
BMDL = Present Below Method Detection Limit, number is Method Detection Limit

Table C-3

LIMITS OF QUANTITATION FOR ORGANIC COMPOUNDS[a]
KETTLEMAN HILLS
Kings County, California

Volatile Compounds	Limit of Quantitation (µg/L)
Bromomethane	10
Chloromethane	10
1,2-Dibromoethane	20
Bromodichloromethane	5
Dibromochloromethane	5
Bromoform	5
Chloroform	5
Carbon tetrachloride	5
Carbon disulfide	5
Chloroethane	10
1,1-Dichloroethene	5
1,2-Dichloroethane	5
1,1,1-Trichloroethane	5
1,1,2-Trichloroethane	5
1,1,2,2-Tetrachloroethane	5
1,1-Dichloroethane	5
trans-1,2-Dichloroethene	5
Trichloroethene	5
Tetrachloroethene	5
Methylene chloride	5
Vinyl chloride	10
1,2-Dichloropropane	5
1,2-Dibromo-3-chloropropane	20
cis-1,3-Dichloropropene	5
trans-1,3-Dichloropropene	5
Benzene	5
Chlorobenzene	5
Ethylbenzene	5
Toluene	5
Xylenes	5
Acetone	50
2-Butanone	20
2-Hexanone	20
4-Methyl-2-pentanone	20
Acrolein	500
Acrylonitrile	500
2-Chloroethylvinylether	40
Tetrahydrofuran	NA
Pyridine	100
1,4-Dioxane	500
Styrene	5
Vinyl acetate	40

Base/Neutral Compounds	Limit of Quantitation (µg/L)
Aniline	10
p-Chloroaniline	100
2-Nitroaniline	100
3-Nitroaniline	100
4-Nitroaniline	100
Benzidine	NA[a]
3,3'-Dichlorobenzidine	100
Benzyl alcohol	20
Benzyl chloride	10
1,2-Dichlorobenzene	10
1,3-Dichlorobenzene	10
1,4-Dichlorobenzene	10
1,2,4-Trichlorobenzene	10
1,2,4,5-Tetrachlorobenzene	10
1,2,3,4-Tetrachlorobenzene	10
Pentachlorobenzene	10
Hexachlorobenzene	10
Pentachloronitrobenzene	10
Nitrobenzene	10
2,4-Dinitrotoluene	10
2,6-Dinitrotoluene	10
N-Nitrosodimethylamine	NA
N-Nitrosodiphenylamine[b]	40
N-Nitrosodipropylamine	20
bis(2-Chloroethyl) ether	10
4-Chlorophenyl phenyl ether	10
4-Bromophenyl phenyl ether	10
bis(2-Chloroisopropyl) ether	10
bis(2-Chloroethoxy) methane	10
Hexachloroethane	10
Hexachlorobutadiene	10
Hexachlorocyclopentadiene	20
bis(2-Ethylhexyl) phthalate	40
Butyl benzyl phthalate	10
di-n-Butylphthalate	10
di-n-Octylphthalate	10
Diethylphthalate	10
Dimethylphthalate	10
Acenaphthene	10
Acenaphthylene	10
Anthracene	10
Benzo(a)anthracene	10
Benzo(b)fluoranthene and/or Benzo(k)fluoranthene	10
Benzo(g,h,i)perylene	10
Benzo(a)pyrene	10
Chrysene	10
Dibenzo(a,h)anthracene	10
Dibenzofuran	10
Fluoranthene	10
Fluorene	10
Indeno(1,2,3-c,d)pyrene	10
Isophorone	10
Naphthalene	10
2-Chloronaphthalene	10
2-Methylnaphthalene	10
Phenanthrene	10
Pyrene	10

Acid Compounds	Limit of Quantitation (µg/L)
Benzoic acid	50
Phenol	10
2-Chlorophenol	10
2,4-Dichlorophenol	10
2,4,5-Trichlorophenol	50
2,4,6-Trichlorophenol	10
Pentachlorophenol	50
4-Chloro-3-methylphenol	20
2-Methylphenol	10
4-Methylphenol	10
2,4-Dimethylphenol	10
4,6-Dinitro-3-methylphenol	50
2-Nitrophenol	10
4-Nitrophenol	50
2,4-Dinitrophenol	50

Pesticides/PCBs	
Aldrin	0.05
alpha-BHC	0.05
beta-BHC	0.05
gamma-BHC	0.05
delta-BHC	0.05
Chlordane	0.5
4,4'-DDD	0.1
4,4'-DDE	0.1
4,4'-DDT	0.1
Dieldrin	0.1
Endosulfan I	0.05
Endosulfan II	0.1
Endosulfan sulfate	0.1
Endrin	0.1
Endrin aldehyde	0.1
Heptachlor	0.05
Heptachlor epoxide	0.05
Toxaphene	1
Methoxychlor	0.5
Endrin ketone	0.1
PCB-1016	0.5
PCB-1221	1
PCB-1232	1
PCB-1242	0.5
PCB-1248	0.5
PCB-1254	1
PCB-1260	1

a *Some compounds in wells K-4 and K-7 have higher limits of quantitation than shown, see text*
b *Not Analyzed*
c *Measured as diphenylamine*

Table C-4

Dissolved and Total Metal Analysis Results
Kettleman Hills Facility

Element	WELL A-2 Dissolved Value (a)	WELL A-2 Total Value	WELL A-4 Dissolved Value	WELL A-4 Total Value	WELL K-3 Dissolved Value	WELL K-3 Total Value
Al	< 94. b	836. c	< 94.	< 130.	< 470.	880. c
Sb	< 120.	< 120.	< 120.	< 120.	< 600.	< 600.
As	< 7.	< 63.	< 16.	< 20.	< 48.	< 81.
Ba	< 58.	< 58.	< 58.	< 58.	< 290.	< 290.
Be	< 2.	< 2.	< 2.	< 2.	< 10.	< 10.
Cd	< 10.	< 11.	< 10.	< 11.	< 50.	< 55.
Ca	91,000. d	159,000. c	132,000. d	120,000. c	122,000. d	249,000. c
Cr	< 16.	< 24.	< 16.	< 24.	< 80.	< 120.
Co	< 18.	< 28.	< 18.	< 28.	< 90.	< 140.
Cu	< 9.	47. c	< 9.	< 20.	< 45.	< 100.
Fe	< 33.	1,190. d	< 33.	364. d	< 170.	2,420. d
Pb	< 5.	< 10.	< 14.	< 15.	< 12.	< 16.
Mg	167,000. d	287,000. d	142,000. d	121,000. d	303,000. d	594,000. d
Mn	119. d	e	219. d	e	< 120. d	e
Hg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ni	< 27.	< 30.	< 27.	< 30.	< 140.	< 150.
K	13,400. c	e	17,400. c	e	17,300. c	e
Se	< 130.	< 150.	< 4.	< 28.	< 130.	< 140.
Ag	< 11.	e	< 11.	e	< 55.	e
Na	429,000. d	742,000. c	704,000. d	658,000. c	1,190,000. d	2,380,000. c
Tl	< 11.	< 150.	< 9.	< 18.	< 15.	e
Sn	< 160.	< 160.	< 160.	< 160.	< 800.	< 800.
V	< 10.	< 11.	< 10.	< 11.	< 50.	< 55.
Zn	619. d	1,120. c	804. d	987. c	689. d	1,760. c

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

Table C-4 (continued)

Dissolved and Total Metal Analysis Results
Kettleman Hills Facility

Element	WELL K-4 Dissolved Value (a)	WELL K-4 Total Value	WELL K-5 Dissolved Value	WELL K-5 Total Value	WELL K-6 Dissolved Value	WELL K-6 Total Value
Al	< 470. b	< 625.	< 470.	< 625.	< 94.	< 625.
Sb	< 600.	< 600.	< 600.	< 600.	< 120.	< 120.
As	< 18.	< 24.	< 59.	< 78.	< 22.	< 26.
Ba	< 290.	< 290.	< 290.	< 290.	< 58.	< 58.
Be	< 10.	< 10.	< 10.	< 10.	< 2.	< 2.
Cd	< 50.	< 55.	< 50.	< 55.	< 10.	< 11.
Ca	939,000. d	874,000. c	285,000. d	286,000. c	79,500. d	71,900. c
Cr	< 80.	< 120.	< 80.	< 120.	< 16.	< 24.
Co	< 90.	< 140.	< 90.	< 140.	< 18.	< 28.
Cu	< 45.	< 100.	< 45.	< 100.	< 9.	< 20.
Fe	< 170.	< 700.	< 170.	< 700.	< 170.	1,260. d
Pb	< 13.	< 140.	< 13.	< 14.	< 9.	< 13.
Mg	2,600,000. d	2,294,000. d	935,000. d	926,000. d	174,000. d	149,000. d
Mn	274. d	e	< 120.	e	125. d	e
Hg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ni	30. c	49. c	< 140.	< 150.	< 27.	< 30.
K	47,800. c	e	26,600. c	e	14,000. c	e
Se	e	e	< 120.	< 150.	< 10.	< 10.
Ag	< 55.	e	< 55.	e	< 11.	e
Na	1,120,000. d	1,090,000. c	1,940,000. d	1,960,000. c	324,000. d	298,000. c
Tl	e	e	< 180.	e	< 10.	< 16.
Sn	< 800.	< 800.	< 800.	< 800.	< 160.	< 160.
V	< 50.	< 55.	< 50.	< 55.	< 10.	< 11.
Zn	16,900. d	18,100. c	2,150. d	2,360. c	550. d	590. c

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

Table C-4 (continued)

Dissolved and Total Metal Analysis Results
Kettleman Hills Facility

Element	WELL K-8 Dissolved Value (a)	WELL K-8 Total Value	WELL K-13 Dissolved Value	WELL K-13 Total Value	WELL K-17 Dissolved Value	WELL K-17 Total Value
Al	< 470. b	< 625.	< 470.	< 625.	< 94.	1140. c
Sb	< 600.	< 600.	< 600.	< 600.	< 120.	< 600.
As	< 65.	< 84.	< 55.	< 81.	< 10.	< 65.
Ba	< 290.	< 290.	< 290.	< 290.	< 58.	< 290.
Be	< 10.	< 10.	< 10.	< 10.	< 2.	< 10.
Cd	< 50.	< 55.	< 50.	< 55.	< 10.	< 50.
Ca	225,000. d	229,000. c	327,000. d	332,000. c	83,400. d	184,000. c
Cr	< 80.	< 120.	< 80.	< 120.	< 16.	< 120.
Co	< 90.	< 140.	< 90.	< 140.	< 18.	< 140.
Cu	< 45.	< 100.	< 45.	< 100.	< 9.	< 100.
Fe	< 170.	962. d	288. d	909. d	< 170.	1,480. d
Pb	< 18.	e	< 140.	< 120.	< 11.	e
Mg	682,000. d	682,000. d	828,000. d	824,000. d	236,000. d	503,000. d
Mn	231. d	e	285. d	e	48. d	e
Hg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ni	< 140.	< 150.	< 140.	< 150.	< 27.	< 150.
K	21,900. c	e	29,000. c	e	17,000. c	e
Se	< 170.	e	e	e	< 110.	< 120.
Ag	< 55.	e	< 55.	e	< 11.	e
Na	3,210,000. d	3,250,000. c	4,040,000. d	4,080,000. c	740,000. d	1,600,000. c
Tl	< 190.	e	< 170.	e	< 160.	< 62.
Sn	< 800.	< 800.	< 800.	< 800.	< 160.	< 800.
V	< 50.	< 55.	< 50.	< 55.	< 10.	< 55.
Zn	9,280. d	10,400. c	< 50.	< 120.	939. d	2,300. c

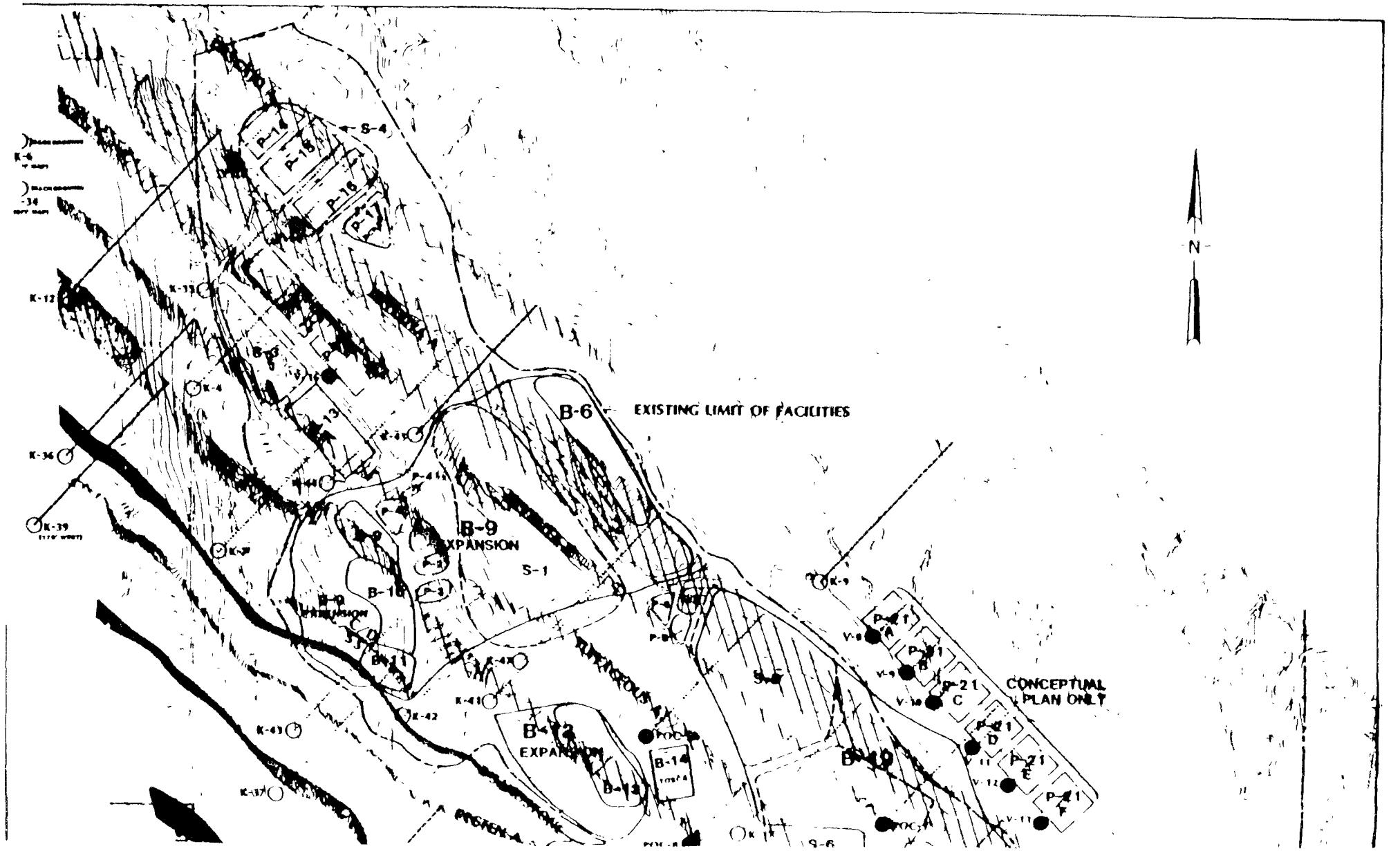
a = Concentrations are reported in ug/L.
b = Sample concentration is less than X at 99% confidence.
c = Control measures indicate value is within 75% to 125% of actual concentration at 95% confidence and dissolved concentrations are often biased high.
d = Control measures indicate value is within 50%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

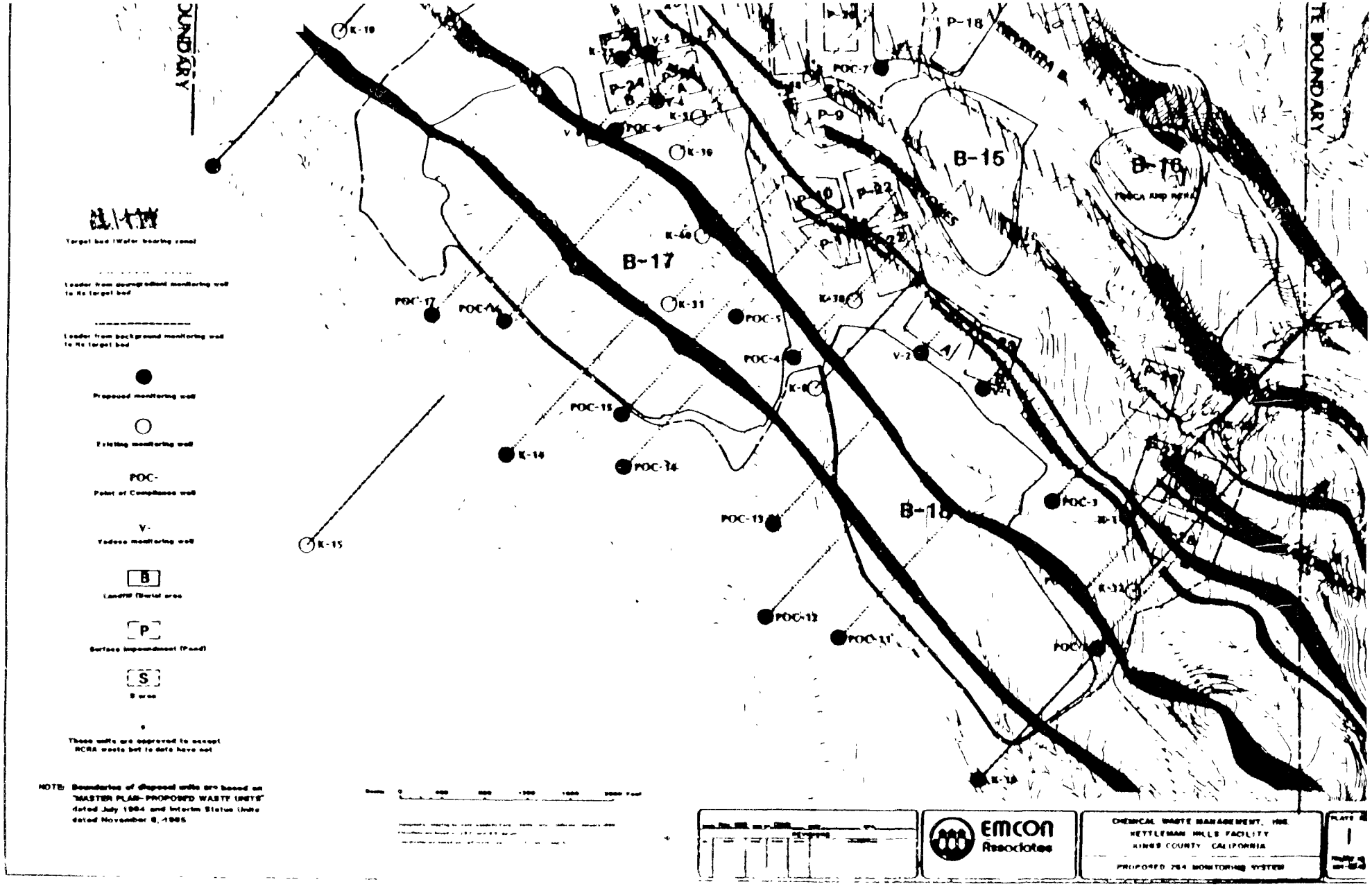
Table C-5

Field Measurement and General Constituent Analysis Results
Kettleman Hills Facility

PARAMETER	UNITS	WELL A-2 VALUE	WELL A-4 VALUE	WELL K-3 VALUE	WELL K-4 VALUE	WELL K-5 VALUE	WELL K-6 VALUE	WELL K-8 VALUE	WELL K-13 VALUE	WELL K-17 VALUE
pH (a)	Units	7.6	7.8	7.6	6.9	7.3	8.1	7.0	7.8	7.7
TURBIDITY (b)	NTU	5.	0.2	6.	2.	20.	0.5	15.	10.	6.
POX (c)	ug/L Cl	< 5. d	< 5.	< 5.	410.	< 5.	< 5.	< 5.	5.	< 5.
POC (e)	mg/L C	< 0.1	< 0.1	< 0.1	0.82	< 0.1	0.11	< 0.1	< 0.1	< 0.1
NPOC (e,f)	mg/L C	1.3	2.0	2.5	90.	2.1	1.5	2.2	11.	3.5
AMMONIA (g)	mg/L N	3.7	4.3	7.2	0.37	12.	2.1	13.	15.	4.3
CHLORIDE (c)	mg/L Cl-	143.	189.	225.	6410.	335.	108.	417.	713.	221.
SULFATE (h)	mg/L SO4=	1450.	2170.	3200.	5400.	9300.	1200.	11000.	12500.	920.
CYANIDE (i)	ug/L CN-	< 10.	< 10.	< 10.	146.	< 10.	< 10.	< 10.	< 10.	< 10.
PHENOL	ug/L	< 40.	< 40.	< 40.	< 40.	< 40.	< 40.	< 40.	< 40.	< 40.

a = Control measures indicate values are within 0.5 units.
b = Values are of unkown reliability because of lack of control measures.
c = Control measures indicate detectable values are within 90% to 110% of the actual concentrations.
d = Sample concentration is less than X at 99% confidence.
e = Values are of questionable reliability because of the lack of field blanks.
f = Values are of questionable reliability because of a large variability in the field triplicate sample values.
g = Values are of questionable reliability because of the lack of agreement between split sample analyses.
h = Control measures indicate values are biased high by as much as 25%.
i = Control measures indicate detectable values are within 75% to 125% of the actual concentrations.


N
B-6
EXISTING LIMIT OF FACILITIES
B-9
EXPANSION
S-1
S-4
P-15
P-16
P-17
K-12
K-36
K-39
K-4
K-9
K-37
K-41
K-42
K-43
K-44
B-10
B-11
B-12
B-13
B-14
B-16
P-21
C
D
E
F
CONCEPTUAL
PLAN ONLY


B-15
B-16
B-17
B-18
P-18
P-9
P-24
POC-7
POC-17
POC-16
POC-15
POC-14
POC-13
POC-12
POC-11
POC-5
POC-4
POC-3
K-10
K-14
K-15
K-18
K-31
K-32
K-38
V-2
Target bed (Water bearing zone)
Proposed monitoring well
Existing monitoring well
POC-
Point of Compliance well
V-
Vadose monitoring well
B
Landfill (Burial area)
P
Surface Impoundment (Pond)
S
Spray
These wells are approved to accept RCRA waste but to date have not
NOTE: Boundaries of disposed wells are based on "MASTER PLAN- PROPOSED WASTE UNITS" dated July 1984 and Interim Status Units dated November 8, 1985
EMCON Associates
CHEMICAL WASTE MANAGEMENT, INC.
KETTLEMAN HILLS FACILITY
KINGS COUNTY CALIFORNIA
PROPOSED TSD MONITORING SYSTEM

U.S. Environmental Protection Agency
Region 5, Library (PL-12J)
77 West Jackson Boulevard, 12th Floor
Chicago, IL 60604-3590