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Hazardous Waste Ground-Water Task Force

Evaluation of U.S. Pollution Control, Inc. Grassy Mountain Facility Utah

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

UTAH DEPARTMENT OF HEALTH

BUREAU OF SOLID AND HAZARDOUS WASTE

UPDATE OF THE HAZARDOUS WASTE GROUND-WATER TASK FORCE
EVALUATION OF U.S. POLLUTION CONTROL, INC.
GRASSY MOUNTAIN FACILITY

May 12, 1988

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The Hazardous Waste Ground-Water Task Force (Task Force) of the United States Environmental Protection Agency (EPA), in conjunction with the Utah Department of Health Bureau of Solid and Hazardous Waste (UDH), conducted an evaluation of the ground-water monitoring program at the U.S. Pollution Control Incorporated (USPCI) Grassy Mountain hazardous waste treatment, storage and disposal facility. The Grassy Mountain facility is located approximately 80 miles west of Salt Lake City, Utah in the Great Salt Lake Desert. The onsite field inspection was conducted during the period June 23 through 17, 1986 and July 9 through 11, 1986.

USPCI is one of 58 facilities evaluated by the Task Force for compliance with applicable State and Federal ground-water monitoring requirements. The Task Force effort originated in light of concerns as to whether operations of hazardous waste treatment, storage and disposal facilities are complying with State and Federal ground-water monitoring requirements.

The objectives of the Task Force evaluation were to:

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

The Task Force prepared the accompanying report on its evaluation, which revealed a number of deficiencies in the ground-water monitoring program at the Grassy Mountain facility. EPA Region VIII and UDH personnel had previously identified many of the deficiencies that are discussed in the Task Force report. In the process of writing a RCRA permit for the facility, the

regulatory agencies have tried to address those deficiencies and develop an appropriate ground-water monitoring program at Grassy Mountain.

The major deficiencies have been addressed through requiring modification of operations through the permitting process. The RCRA draft permit for the USPCI Grassy Mountain facility has been written and is undergoing modification prior to final permit issuance in 1988.

Determine Compliance with the Ground-Water Monitoring Requirements of 40 CFR, Part 265 and the Equivalent State Requirements

The Task Force evaluation revealed that USPCI was not in full compliance with the ground-water monitoring requirements of 40 CFR, Part 265 and the equivalent State requirements in the Utah Hazardous Waste Rules 7.13. Deficiencies were found in the sampling and analysis plan and the implementation of that plan, sample analyses, the assessment monitoring plan and the monitoring system.

The Task Force found that several monitoring wells included in the sampling plan for Grassy Mountain may have settled, causing changes in the elevations of the surveyed measuring points on the wells. Since the Task Force inspection, USPCI has extended most of the wells an additional 2.5 feet above ground. The extensions were accomplished in March 1987 and were resurveyed at that time. The final RCRA facility permit will require an annual survey of all well elevation measuring points.

The highly saline (greater than 70,000 ppm) ground water beneath the Grassy Mountain facility has created problems with standard analyses for the indicator parameters required by 40 CFR 265.92 and for metals and inorganics. The Task Force recommendations for changes to sampling and analytical protocols will be incorporated into the final USPCI RCRA permit and will require USPCI to monitor for specific volatile and semivolatile organics parameters in lieu of TOX as an indicator parameter.

USPCI completed over a year of quarterly assessment monitoring in 1986 and 1987, using GC/MS analysis for volatile and semivolatile Appendix IX constituents as well as analyses for metals and other inorganics. In addition to the two sampling periods prior to the Task Force inspection, USPCI completed four subsequent quarterly samplings and associated analyses. EPA, the State and USPCI agreed that after assessment, USPCI would continue to do quarterly interim status monitoring until issuance of the RCRA permit, using the same parameters and analytical methods as those used for assessment monitoring.

Following a meeting between EPA, the State and USPCI on March 30 and 31, 1987, USPCI was instructed by EPA Region VIII to complete a report on the results of the ground-water assessment monitoring program, as required by 40 CFR 265.93(d)(5). USPCI submitted the assessment monitoring results to UDH in May 1987. A decision on how to proceed with ground-water monitoring

will be made by UDH, pending the final results from an April 1988 Compliance Monitoring Evaluation (CME).

With respect to sample analysis, the NAL laboratory has been instructed by EPA Region VIII to identify specifically which compounds it is capable of analyzing. In addition, the USPCI RCRA permit specifies which Appendix IX and other GC/MS parameters will be monitored during the term of the permit.

The Task Force report identifies critical deficiencies in the documentation of the initial well monitoring system MW-1 through MW-8. Following the State-USPCI Consent Agreement of October 1985, monitoring wells MW-9 through MW-25 were installed. These wells met regulatory objectives. Additional wells have been installed since 1986 which also meet the regulatory objectives. MW-1 and MW-2 will continue as upgradient wells (new wells MW-9 and MW-20 are used also). MW-5 will continue as one of four downgradient monitoring wells at the land treatment area; MW-6 may be used for a nonregulated unit or may be replaced. Without any of the initial monitoring wells, the remaining wells are considered adequate for monitoring needs. This monitoring system will remain in effect for the duration of interim status and for the term of the permit; wells may be added as disposal operations expand.

Evaluation of the Ground-Water Monitoring Program Described in the RCRA Part B for Compliance with 40 CFR 270.14(c) and the Equivalent State Requirements

The RCRA permit will require detection monitoring under 40 CFR 264, modified to include the GC/MS methods for volatile and semivolatile organic parameters (108 constituents) as detection monitoring parameters. Metals and inorganic parameters will also be simultaneously collected semiannually, although the regulatory agencies recognize that the reliability of these measurements is limited as a result of the naturally high salinity of the ground water.

The permit contains a specific statistical evaluation protocol for the monitored chemical constituents. USPCI has not submitted statistical comparisons during interim status, however, based on the April 1988 CME, USPCI was requested to submit a statistical comparison on all future monitoring events.

Determine if the Ground Water Beneath the Facility Contains Hazardous Waste or Hazardous Waste Constituents

Analyses of ground-water samples have not shown that hazardous waste or hazardous waste constituents have entered the ground water beneath the facility.

Provide Information to Assist the Agency in Determining if the TSDF is Suitable for Receipt of CERCLA Waste

EPA Region VIII has determined that the USPCI Grassy Mountain Facility may receive CERCLA waste.

This update completes the Task Force evaluation of the USPCI Grassy Mountain facility.

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

EPA-330/2-88-036

GROUND-WATER MONITORING EVALUATION
U.S. POLLUTION CONTROL, INC.
Grassy Mountain Facility
Clive, Utah

April 1988

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EXECUTIVE SUMMARY

INTRODUCTION

Concerns have 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 EPA Office of Solid Waste and Emergency Response, Office of Enforcement and Compliance Monitoring, National Enforcement Investigations Center (NEIC), Regional Offices and State regulatory agencies.

The first TSD facility the Task Force inspected in EPA Region VIII was the U.S. Pollution Control, Inc. (USPCI), Grassy Mountain Facility, Clive, Utah located in the Great Salt Lake Desert about 80 miles west of Salt Lake City, Utah [Figure 1]. The onsite inspection was coordinated by personnel from NEIC, a field component of the EPA Office of Enforcement and Compliance Monitoring, during the period June 23 through June 27, 1986 and July 9 through July 11, 1986. Personnel from the State of Utah Department of Health, Bureau of Solid and Hazardous Waste, and EPA Region VIII also participated. The objectives of this investigation were similar to those of other Task Force investigations, namely:

- Determine compliance with interim status ground-water monitoring requirements of Title 40 of the Code of Federal Regulations Part 265 Subpart F (40 CFR Part 265), as promulgated under RCRA and the equivalent Utah Hazardous Waste Rules (UHWR 7.13)

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

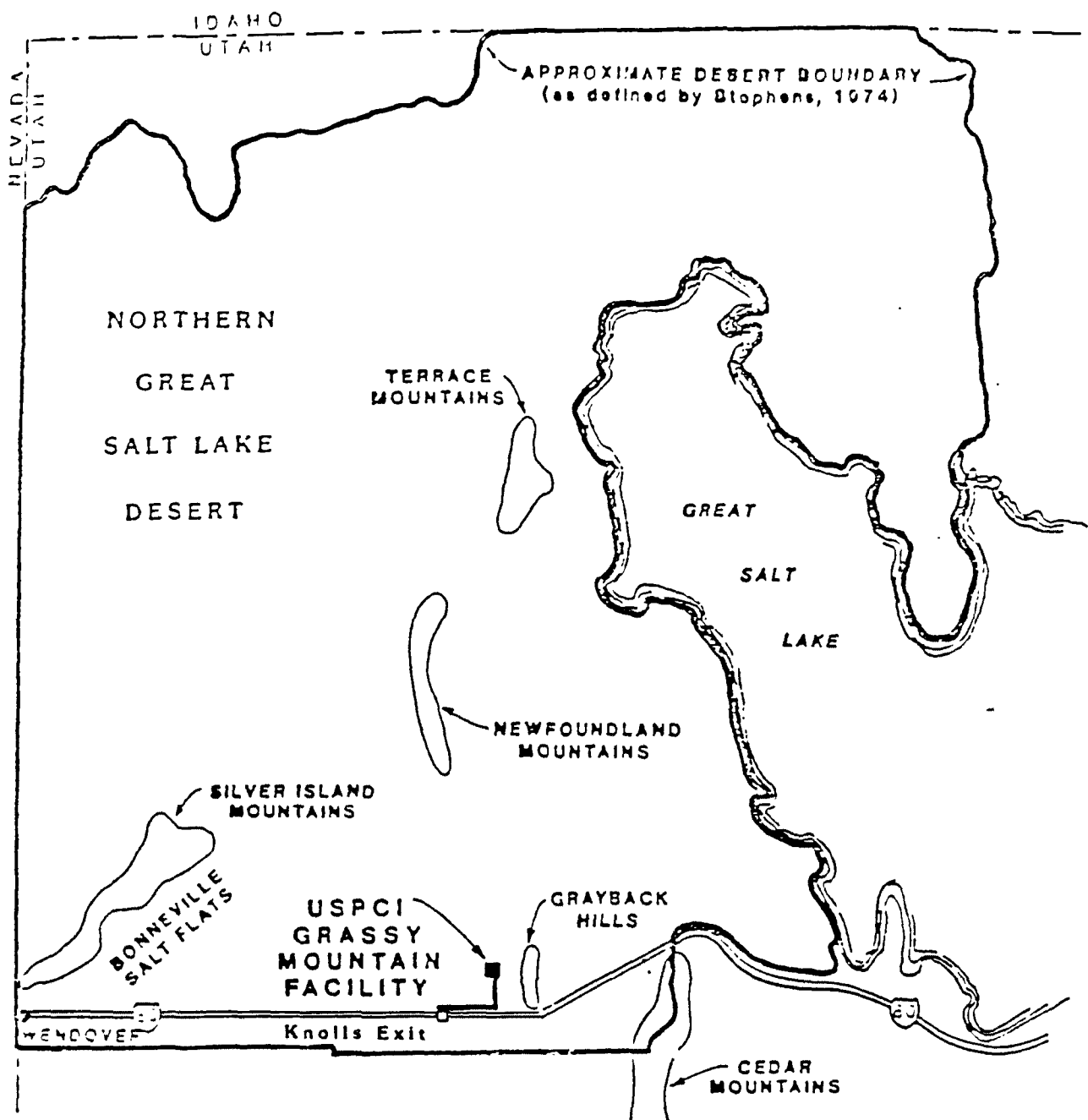


Figure 1.

USPCI GRASSY MOUNTAIN
FACILITY LOCATION MAP

- Evaluate the ground-water monitoring program described in the RCRA Part B permit application, submitted by the facility, for compliance with 40 CFR Part 270.14(c) and UHWR 3.3.2(c)
- Determine if the ground water beneath the facility contains hazardous waste or hazardous waste constituents
- Provide information to assist the Agency in determining if the TSDF meets EPA ground-water monitoring requirements for waste management facilities receiving waste from response actions conducted under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended*

To address these objectives, this Task Force evaluation determined if:

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

The land surrounding the Grassy Mountain facility is undeveloped desert belonging to the U.S. Bureau of Land Management. A Hill Air Force Base bombing range is located just north of the site. This area has no residential population.

* EPA policy, stated in 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.

In 1981, USPCI leased the approximately 1-square-mile tract (643 acres) from Khosrow Semnani, who attempted to develop a metals reclamation/recovery operation. Semnani had acquired, but not set up, some processing equipment. Some test drilling had been completed in the area and two gondolas (roll-off boxes) of "waste" had been brought to the site. These activities occurred in what became a 206-acre land treatment area. For purposes of RCRA interim status ground-water monitoring, eight wells were installed at the site in 1981.

USPCI submitted a RCRA Part A application in December 1981 and began hazardous waste management activities at the Grassy Mountain facility in March 1982. Initial operations were limited to storage and landfilling of waste. Land treatment began in April 1982. Liquid waste neutralization and sulfide treatment began in 1985. Landfilling of polychlorinated biphenyls (PCBs) began in April 1986. PPM, Inc., a subsidiary of USPCI, began operating a liquid PCB treatment system at the Grassy Mountain site in 1986. All of the above activities were ongoing during the Task Force inspection.

The Grassy Mountain facility has been regulated by State waste disposal requirements since operations began. Currently, the site is operated pursuant to interim status regulations promulgated under the Utah Code Annotated Title 26 - Health Chapter 14 rules (UC 26-14).^{*} The Utah Department of Health (UDH) received RCRA interim authorization in December 1980 and final authorization in September 1984. EPA administers regulatory programs pursuant to the Hazardous and Solid Waste Amendments of 1984 and the Toxic Substances Control Act (TSCA).

USPCI currently operates as an interim status facility under EPA Identification Number UTD991301748. The Company initially submitted a RCRA Part B permit application to EPA Region VIII and UDH in August 1983; a revised Part B was submitted in July 1984.

^{*} *The State equivalent of RCRA is the Utah Code Annotated Title 26 - Health Chapter 14 rules (UC 26-14). The State equivalents of Title 40 Code of Federal Regulations, Parts 260-265 are the Utah Hazardous Waste Rules (UHWR).*

Upon receipt and review of the revised Part B, UDH and EPA Region VIII determined that, among other things, the ground-water monitoring system was deficient. In August 1985, the UDH sent a stipulation and consent order to the Company requiring them to upgrade the existing ground-water monitoring system. A complaint paralleling the State action was filed by EPA in September 1985. On October 2, 1985, the Company signed a stipulation and consent order to install a new ground-water monitoring system by November 8, 1985.

Ground-water monitoring data from October 1984 samples showed a statistically significant increase of total organic carbon (TOC) in ground-water monitoring well 3 (MW-3). On October 31, 1985, USPCI was ordered to initiate an assessment monitoring program by the Utah Department of Health. Therefore, the facility was in ground-water assessment monitoring under Utah Hazardous Waste Rules 7.13.4 (UHWR 7.13.4) and 40 CFR 265.93 during the Task Force inspection. The assessment monitoring consisted of sampling and analyzing for an increased number of parameters for all the ground-water monitoring wells as well as increased sampling for MW-3.

Waste management operations for the nonhazardous USPCI industrial landfill are regulated by Utah Solid Waste Management Regulations. There were no State or Federal permits for air emissions or water discharges, but the State will issue an air permit in 1988. A TSCA permit for treatment and disposal of PCB waste was issued to the Company by EPA on November 26, 1985. Additional permits include a Tooele County Conditional Use Permit (number 100-81) issued on February 11, 1981 and amended August 12, 1981; and a right-of-way permit from the United States Bureau of Land Management (number U-47260) issued October 23, 1986.

SUMMARY OF FINDINGS AND CONCLUSIONS

The findings and conclusions presented in this report reflect conditions existing at the facility in June 1986. Actions taken by the State, EPA Region VIII and USPCI subsequent to June are summarized in the accompanying update.

Task Force personnel inspected the Grassy Mountain facility from June 23 through June 27, 1986. From July 9 through July 11, 1986, Task Force personnel observed quarterly ground-water sampling to verify that a new sampling and analysis plan was being implemented.

The interim status ground-water monitoring program was evaluated for compliance on the basis of the Utah Hazardous Waste Rules (UHWR 7.13), which are equivalent to the Federal Regulations (40 CFR Part 265, Subpart F). The UHWR have governed the development of the ground-water monitoring program since the beginning of hazardous disposal operations at the facility in March 1982. No hazardous waste disposal permit had been issued by the State by the end of the onsite inspection.

The inspection revealed that the USPCI interim status ground-water monitoring program was inadequate from the beginning of waste disposal operations in 1982. The Task Force found that as of July 1986, the interim status ground-water monitoring program components, including the ground-water sampling and analysis plan, the ground-water assessment program and assessment program outline, did not comply with State of Utah and RCRA requirements. Most ground-water quality data obtained prior to the Task Force inspection were not reliable. These findings are summarized here and are detailed further in the technical report.

GROUND-WATER MONITORING PROGRAM DURING INTERIM STATUS

Major ground-water problems facing USPCI during interim status include characterizing the ground-water quality at Grassy Mountain and implementing a monitoring program that ensures adequate coverage of disposal units and reliable analytical results. The reliability of water quality data from 1981 (when USPCI leased the property) through 1985 is suspect because of both analytical

deficiencies and interferences from the naturally high concentration of salts in the ground water. As a result, the true character of background ground-water quality is not well understood. Throughout this period, USPCI continued quarterly monitoring with some analytical revisions in an effort to define background water quality.

In 1986, USPCI began a new effort to characterize the ground water using more wells and expanded analyses. This effort coincided with the initiation of assessment monitoring triggered by elevated levels of total organic carbon (TOC) in MW-3. At the request of EPA Region VIII and the State, the expanded analyses included additional organic parameters. The early 1986 water quality data, although showing improvement over previous years, continued to be deficient because of analytical problems. The result is a shortage of reliable data characterizing background ground-water quality at Grassy Mountain as of mid-1986.

Ground-Water Sampling and Analysis Plan

The ground-water sampling and analysis plan submitted in November 1985, in response to an October 1985 stipulation and consent order issued by UDH, is inadequate. The sampling and analysis plan includes wells (MW-4, MW-6, MW-7 and MW-8) that are no longer used. The sampling and analysis plan also includes a four-page unreferenced list of Appendix VIII components; the laboratory does not analyze for each of the listed parameters, neither does the plan indicate which of these parameters are analyzed. Only the list of parameters for which analyses actually are done should appear in the plan and USPCI should follow the plan by analyzing for all the compounds listed. More than one analytical method is listed for some parameters. The plan needs to be revised to reflect which analytical methods are actually used.

Methods in the plan for measuring static water levels, are acceptable except for the provision that measurement accuracy be obtained within $1/32$ of an inch (approximately 0.003 feet). This accuracy is unrealistic and cannot be obtained with the electric water level indicator used by the facility.

The plan provisions for field sampling are generally acceptable with the exception of waiting until all the wells are purged before sampling begins. Some lag times may be necessary for slowly recharging wells; however, those that recharge quickly should be sampled as soon as possible.

The provisions for collecting field blanks need to state that field blanks be preserved or not preserved, according to what is done for the corresponding sample. Otherwise the method for field blanks is acceptable.

The provisions for preservatives, chain-of-custody and shipping are also acceptable.

Monitoring Wells

Prior to 1986, the interim status ground-water monitoring system at Grassy Mountain consisted of eight wells, MW-1 through MW-8. In early 1986, 12 new wells (MW-9 through MW-20) became part of the monitoring program at Grassy Mountain. These new wells were constructed in response to the October 2, 1985 stipulation and consent order. Wells MW-21 through MW-25 also were added in 1986.

The monitoring well network being used during the Task Force inspection, included 23 (MW-1 through MW-23) of the 25 wells [Figure 2]. Two additional wells (MW-24 and MW-25) were under construction at that time. Exactly which of these wells were being sampled for interim status ground-water monitoring was unclear because Company personnel contradicted both one another and their sampling and analysis plan on this subject.

In 1986, some of the older wells sampled prior to 1986 were dropped from the sampling program. Sampling records for 1986 were inconsistent and did not show the same wells sampled each time. As a result, USPCI personnel appeared not to know which of the earlier wells were still included for interim status monitoring.

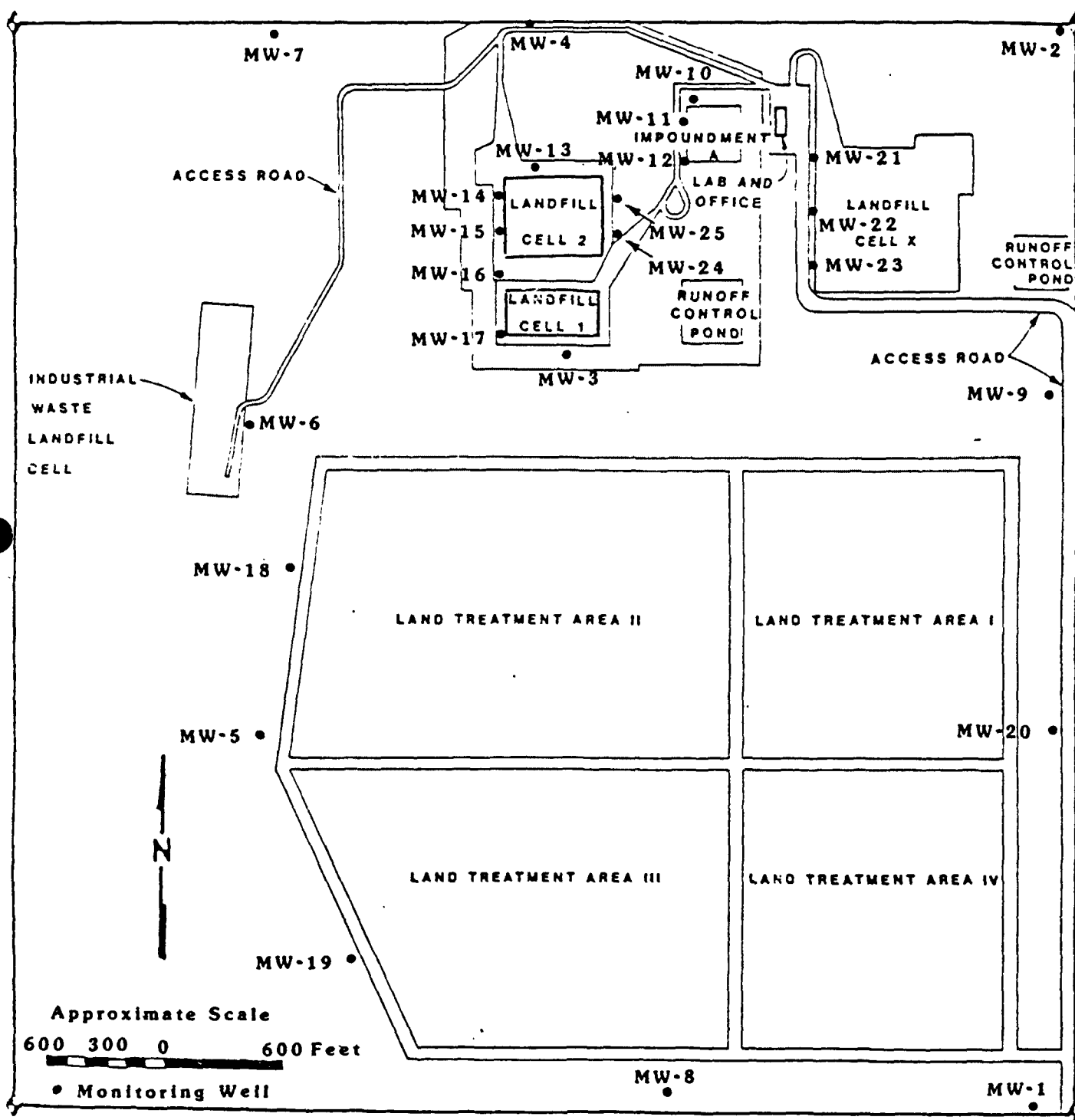


Figure 2. Monitoring Well Locations
June 1986

Information available to the Task Force was insufficient to determine whether monitoring wells MW-1 through MW-8 were properly constructed for compliance with UHWR 7.13.2 (40 CFR 265.91). If the information does not exist, then USPCI cannot demonstrate that these wells were properly constructed for ground-water monitoring purposes and meet regulatory requirements. The construction design and material for the new monitoring wells (MW-9 through MW-23) are acceptable.

The number and location of the wells in the network were determined to be adequate to detect any statistically significant amounts of hazardous waste constituents migrating to the uppermost aquifer from the waste management units in place at the time of the Task Force inspection. Additional wells will be required as the facility expands the hazardous waste operations.

USPCI Sample Collection and Handling Procedures

USPCI personnel did not follow their sampling and analysis plan with respect to: (1) pH standardization, (2) preservatives and (3) immediate sample shipment. By not following the plan, USPCI was out of compliance with UHWR 7.13.3 (40 CFR 265.92). Sampling procedures in the field were careless and could potentially compromise sample integrity. Water level measurements were inaccurate because of changing baseline elevations resulting from wells sinking and lack of precision in measuring water levels.

The pH of ground water beneath the facility ranges from 7.1 to 7.5. In standardizing the pH meter, the standard at 7.4 and then the standard at 10.4 were checked. The meter should be rechecked with the pH 7.4 standard to ensure the instrument has not drifted in the 10.4 standard adjustments. Also, in order to follow the sampling and analysis plan, a standard in the pH range of 4.0 to 5.0 should be added to the calibration procedure. Measurements for pH and specific conductance are temperature-dependent. Reported pH and specific conductance results need to be corrected adequately for the temperature of the sample at the time of measurement.

The shipping forms and labels on the sample bottles for phenols from National Analytical Laboratory (NAL) list phosphoric acid/cupric sulfate

($\text{HPO}_3/\text{CUSO}_4$) as the preservatives.* The sampling and analysis plan specifies H_2SO_4 as the preservative for phenols. Better communication between the facility and the laboratory is needed to ensure that the plan matches the laboratory practices. Additionally, the plan needs to state that field blanks poured for sample parameters requiring preservatives should be preserved in a like manner to completely verify laboratory results.

Sampling the monitoring wells requires more than 1 day. Samples are preserved and packed each day but are held for shipping up to 1 day and 1 night until sampling is completed. No samples were held longer than prescribed in EPA guidelines (including shipping time); however, the sampling and analysis plan directs shipping immediately after collection and packing.

USPCI personnel demonstrated their well purging techniques and water level measurement techniques during the June 1986 Task Force inspection. During the July 1986 site visit by the Task Force, USPCI personnel also demonstrated their sample collection techniques. During the July 1986 visit, new USPCI personnel were being trained in the sampling and handling procedures.

At the time of the June and July 1986 site visits, USPCI personnel made water level measurements in the monitoring wells using an electric water level indicator. The electric water level indicator (ACTAT Olympic Well Probe,[®] Model 150) did not measure water levels with consistent accuracy. Task Force personnel repeatedly observed sequential measurements in the same well that differed by as much as ± 0.2 feet (measured with a tape measure). This margin of error is unacceptable for accurate water-level analysis in conditions of a shallow hydraulic gradient such as the one at Grassy Mountain.

Each well was equipped with a dedicated Well Wizard[®] bladder pump and wellhead assembly for purging and sampling. For sampling required by UHWR 7.13.3 (40 CFR 265.92), USPCI personnel purged all monitoring wells

* NAL (Tulsa, Oklahoma) has done most of the ground-water analyses for the USPCI Grassy Mountain Facility.

[®] Olympic Well Probe and Well Wizard are registered trademarks and will appear hereafter without ®.

24 hours or more before sampling began. Sampling should be performed immediately on any well that recharges rapidly in order to obtain fresh water from the aquifer. Otherwise, chemical reactions may occur in water that stagnates in the well casing. Wells that recharge slowly need to be sampled as soon as a sufficient volume is available for sampling parameters.* Although an error in the sampling and analysis plan on procedures for computing the purge volumes was noted by Task Force personnel, correct volumes were purged. The USPCI sampling personnel wore latex surgical gloves that were discarded upon contact with foreign substances and upon completing sampling of a well; however, the inside of the sample containers and bottle caps were sometimes touched by the samplers. Anytime the inside of a sampling container is possibly contaminated by contact with a foreign substance or a sampler's finger, the container needs to be replaced by a clean one.

Dedicated Teflon® sampling tubing was stored inside most wellhead assemblies. At any well without dedicated tubing, the samplers utilized spare tubing from their supplies. In at least two cases, this tubing was reused without rinsing between wells. The possibility of cross-well contamination is increased greatly by this practice and should be discontinued.

Samples Analysis and Data Quality Evaluation

The Task Force inspection revealed analytical inadequacies and found that much of the ground-water monitoring between 1982 and June 1986 was not performed properly. Most of the analytical inadequacies stem from improper sample handling or calibration procedures, the lack of quality control measures, and/or not accounting for the high dissolved solids content of the sample. The high levels of dissolved solids can introduce variability to the data and thereby have adversely affected the reliability of data in establishing background levels or in detecting releases into ground water.

* RCRA Ground-Water Monitoring Technical Enforcement Guidance Document (TEGD), EPA, 1986, OSWER 9950.1

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Ground-Water Analysis, 1982 through 1985

Ground-water monitoring for background water quality in 1982 was incomplete. The quadruplicate measurements for the four indicator parameters required by UHWR 7.13.3 (40 CFR 265.92) were not reported. Background monitoring results for the required pesticides, herbicides and radio-chemical parameters were not reported (UHWR 7.13.3, 40 CFR 265.92). Several constituents were not reported in one or more quarters [e.g., fluoride, nitrate, pH, total organic carbon (TOC), total organic halogens (TOX), coliform, silver and chromium].

Long holding times for pH resulted because USPCI shipped samples from Utah to a laboratory in Oklahoma before measuring pH (prior to 1984, EPA recommended holding times of not more than 2 hours for wastewater and, since that time, recommended measuring pH immediately).^{*} Measurement of pH should be done in the field at the time of sampling.

Specific conductance results for 1982 through 1985 are suspect because cell constant corrections were not made for the measurements. Standards to establish the cell constant were not within the same range as the samples.

Total organic halogens results for this period are unreliable. TOX measurements using the standard method and instrumentation for ground water containing such high levels of dissolved salts and suspended solids cannot serve as an indicator of low level contamination of halogenated organics. Purgeable organic halogens (POX) could serve as an indicator of low level contamination of volatile halogenated organics (see Appendix A).

Total organic carbon results for this period were actually measurements of nonpurgeable organic carbon. The method of acidifying and purging samples prior to analysis eliminates purgeable organic carbon.

*
(1) 40 CFR 136, Table II
(2) TEGD
(3) Procedures Manual for Groundwater Monitoring at Solid Waste Disposal Facilities, PB 84-17480
(4) Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020

Many of the determinations for metals prior to 1985 are unreliable because the high dissolved solids content of the ground-water samples has caused serious interferences with the analytical methods (atomic absorption spectroscopy techniques). In 1985, the laboratory began using Inductively Coupled Argon Plasma Optical Emission Spectroscopy (ICP) which is also subject to interferences from high dissolved solids. Neither method attained detection limits low enough to establish background levels reliable for ground water.

A number of records for metals and pesticides determinations that were performed on ground-water samples could not be found by the laboratory personnel. The absence of these records prevented the Task Force from evaluating the data quality for these parameters.

Data reported for the phenoxy acid herbicides 2,4-D and Silvex are not reliable, as the method used would not detect the herbicides present in the ester form. In addition, gross alpha and gross beta data are unreliable because levels are reported below what can be measured reliably in samples containing percent levels of dissolved solids.

Ground-Water Analysis Commencing January 1986

Certain ground-water monitoring data for the first two quarters of 1986 were absent. No results were available for MW-5 during the first quarter. According to the Utah Department of Health, only volatile and semivolatile organic compounds were reported for the second quarter for all the wells.

Most of the laboratory findings applicable to the period prior to 1986 (discussed above) are also applicable to 1986 data, as most of the methods did not change. Determinations still lacked adequate quality control measures.

Volatile and semivolatile organic results for the first two quarters of 1986 are unreliable. The methods used (EPA Methods 624 and 625) were not properly followed. Accuracy and precision control measures required by the methods were not properly implemented or evaluated.

Ground-Water Quality Assessment Program

Statistically significant elevated levels of total organic carbon (TOC) were measured in MW-3 on November 13, 1985. A letter sent on December 12, 1985 by UDH notified USPCI that their ground-water quality assessment plan should have been submitted 15 days after the initial notification, as required by UHWR 7.13.4 (40 CFR 265.93). USPCI only resubmitted the sampling and analysis plan, which had been submitted in November 1985. The sampling and analysis plan does not meet the requirements of a ground-water quality assessment plan or programs, as required by UHWR 7.13.4 (40 CFR 265.93). The plan does not:

- Specify for which organic compounds samples will be analyzed
- Identify the specific methods of analysis for organic compounds
- List and identify detection limits that NAL is able to achieve for each parameter analyzed
- Include any evaluation procedures for the ground-water monitoring data, including analytical and water level data
- Make provisions for determining the rate and extent of migrations of the hazardous waste or constituents in the ground water
- Include complete and legible well construction specifications

The Grassy Mountain facility began a year of quarterly assessment monitoring in the first quarter of 1986 but was not following an approved assessment monitoring plan.

GROUND-WATER MONITORING PROGRAM PROPOSED FOR FINAL PERMIT

In May 1986, USPCI submitted a hydrogeologic characterization report for the Grassy Mountain facility to UDH and EPA. The report was written to satisfy the Part B ground-water requirements detailed in UHWR Part III (40 CFR 270.14). Although the report addresses the requirements, it is

inadequate in detail and revisions to the proposed ground-water monitoring program will be necessary for the final RCRA permit.

The report outlines a detection monitoring program pursuant to UHWR 8.6.9 (40 CFR 264.98) for the uppermost aquifer and describes the proposed monitoring well network, monitoring parameters, sample analyses, sample collection and data evaluation. The Task Force considers detection monitoring to be appropriate at Grassy Mountain.

As USPCI expands operations, the number of wells in the detection monitoring program probably will increase. For the October 1985 Stipulation and Consent Order, UDH and EPA Region VIII proposed dedicating wells to monitor each regulated unit rather than monitoring all the units as a group. The regulatory agencies also propose placement of monitoring wells so that they circumscribe the landfill cells (as opposed to downgradient only) in order to provide radial detection coverage of ground-water mounds induced by landfill loading. This approach optimizes the chances of detecting leakage from individual units.

Wells MW-4, MW-6 and MW-7 are several hundred feet from waste management units and cannot provide immediate detection of leakage. These wells are not suitable to be included in the regular ground-water monitoring program proposed for the permit, however they may provide useful water level data and periodic ground-water quality data. For reasons stated in the section entitled "Well Construction," USPCI was unable to demonstrate that monitoring wells MW-1 through MW-8 were in compliance with UHWR 7.13.2 (40 CFR 265.91).

For the land treatment areas, the existing downgradient monitoring wells in the saturated zone combined with the 16 lysimeters in the unsaturated zone should be adequate for compliance with 40 CFR 264.278 (UHWR 8.13.9, when written, will be the State's corresponding regulation for unsaturated zone monitoring beneath a land treatment area), and UHWR 8.6.8 and 8.6.9 (40 CFR 264.97 and 264.98).

The Task Force agrees with the identification of the "shallow brine aquifer" as the uppermost aquifer, as defined by UHWR Part 1 (40 CFR 260.10). The proposed design for future monitoring well construction is acceptable.

Leakage of hazardous waste or hazardous waste constituents to the ground water has not been substantiated; however, analyses of leachate samples drawn from between two synthetic liners of cell 2 indicate the upper liner has failed. USPCI must be prepared to implement a compliance monitoring program under UHWR 8.6.10 (40 CFR 264.99) in case the second, lower liner of cell 2 or liners of other units fail.

The list of proposed analytical parameters is too comprehensive and includes compounds that are not analyzable by GC/MS. USPCI needs to develop a list of parameters they can analyze and provide attainable detection limits with each parameter listed.

The analytical procedures used to date by NAL have been judged by the Task Force to be incapable of accurately measuring hazardous constituents in ground-water samples or of providing a reliable indication of ground-water quality. For the permit, personnel from the NAL laboratory should assess the laboratory capabilities and protocols and propose analytical methods they can do properly.

The inconsistent sampling procedures that existed prior to the Task Force inspection cannot ensure monitoring results that provide a reliable indication of ground-water quality. USPCI needs to ensure consistent sampling and analytical procedures to comply with UHWR 8.6.8 (40 CFR 264.97).

USPCI has proposed to evaluate ground-water analytical data statistically using the Chemical Manufacturers' Association (CMA) standard t-test. This procedure is inappropriate for the Grassy Mountain facility as it does not account for variables such as the naturally high salts in the ground water and the apparently natural fluctuations in ground-water quality.

TASK FORCE SAMPLING AND MONITORING DATA EVALUATION

During the June 1986 onsite inspection, samples were collected by Task Force contractors from 10 monitoring wells and 6 leachate collection sumps to determine if the ground water contained hazardous waste constituents or other indicators of contamination. Water levels were measured and samples were drawn from the wells and sumps by USPCI personnel using their standard procedures.

Analytical data for the Task Force samples from the monitoring wells do not indicate the presence of hazardous constituents in the ground water beneath the site. Previously, statistically elevated levels of total organic carbon were found in well MW-3 by NAL; however, these elevated levels were not substantiated by the Task Force sampling nor by additional monitoring by the Company.

Task Force data for the leachate detection sump samples from landfill cell 2 indicated a leak of the upper synthetic landfill liner. Data collected by USPCI confirm that in landfill cell 2, such a leak has occurred. Ground-water data, however, show no indication that the lower synthetic liner has leaked.

SUITABILITY FOR RECEIVING WASTES FROM CERCLA ACTIONS

Under current EPA policy, if an offsite TSDF is used for land disposal of waste from a CERCLA site, that site must be in compliance with the applicable technical requirements of RCRA. During the Task Force inspection, the ground-water monitoring program at the Grassy Mountain facility was being conducted pursuant to the October 1985 Stipulation and Consent Order prior to issuance of the final RCRA permit by the State.

At the time of the Task Force inspection, the facility did not meet all the technical requirements for a RCRA ground-water monitoring program. USPCI was acting under State and EPA orders, however, to develop a monitoring program that conforms to State and Federal permit requirements (Parts 8.6 and 264, respectively).

TECHNICAL REPORT

INVESTIGATION METHODS

The Task Force evaluation of USPCI consisted of:

- Review and evaluation of records and documents from EPA Region VIII, UDH and USPCI
- Facility onsite inspection conducted June 23 through 27 and July 9 through 11, 1986
- Offsite analytical laboratory evaluation
- Sampling and subsequent analysis and data evaluation for selected ground-water and leachate monitoring systems

RECORDS/DOCUMENT REVIEW

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

Specific documents and records reviewed and evaluated included the ground-water sampling and analysis plan (SAP), a ground-water quality assessment plan, analytical results from past ground-water sampling, monitoring well construction data and logs, site geologic reports, site operations plans, facility permits, unit design and operation reports, and operating records showing the general types and quantities of wastes disposed of at the facility and the disposal locations.

FACILITY INSPECTION

The facility inspection included identifying waste management units, waste management operations and pollution control practices, and verifying the location of ground-water monitoring wells and leachate collection sumps.

Company representatives were interviewed to identify records and documents of interest, answer questions about the documents, and explain: (1) facility operations (past and present), (2) site hydrogeology, (3) the ground-water monitoring system, (4) the ground-water sampling and analysis plan, (5) company procedures for assessment, and (6) laboratory procedures for obtaining data on ground-water quality. Laboratory personnel from an offsite laboratory that analyzed ground-water samples for USPCI were interviewed regarding sample handling, analysis and document control.

LABORATORY EVALUATION

The USPCI-owned National Analytical Laboratory (NAL) in Tulsa, Oklahoma, was evaluated regarding responsibilities for analysis of ground-water samples from the Grassy Mountain facility. Analytical equipment and methods, quality assurance procedures and documentation were examined for adequacy. Laboratory records were inspected for completeness, accuracy and for compliance with State and Federal requirements. The ability of NAL to produce quality data for the required analyses was evaluated.

GROUND-WATER AND LEACHATE SAMPLING AND ANALYSIS

During the inspection, Task Force personnel collected samples for analysis from 10 ground-water monitoring wells and 6 leachate collection sumps [Tables 1 and 2] to determine if the ground water contained hazardous waste constituents or other indicators of contamination. The sampling results were used in evaluating previous Company data. Wells were selected for sampling either in areas where records suggest that ground-water quality may be or may have been affected by hazardous waste management activities. Other wells were selected to confirm background ground-water quality.

Table 1
SAMPLE COLLECTION AND LOCATION DESCRIPTION
MONITORING WELL DATA

Monitoring Well	Depth to Water (ft.)	Water Volume in Casing (gal.)	Purge		Sampling		Remarks
			Date	Time	Date	Time	
MW-3	11.75	4.0	6/26	0923-1120	6/26	1328	Water cloudy; strong sulfide odor; triplicate sample
MW-7	19.7	8.6	6/24	0950-1104 1440-1510	6/25	0932	Water grey in color; strong sulfide odor
MW-9	5.7	1.6	6/26	1547-1549	6/26	1632	Water clear
MW-10	10.6	1.4	6/24	1209-1218	6/24	1546	Water slightly turbid; grey
MW-11	10.7	1.5	6/24	1232-1244	6/24	1337	Water clear
MW-13	29.4	1.8	6/25	1234-1253	6/25	1400	Sulfide odor
MW-14	29.1	1.8	6/25	1040-1045	6/25	1125	Water clear; NEIC split; field blank collected
MW-15	29.0	2.0	6/25	1644-1800	6/26	1156	Water clear; sulfide odor; field blank collected; no nitrate sample
MW-16	28.6	1.8	6/27	1003-1020	6/27	1038	Water clear; sulfide odor
MW-17	30.1	1.7	6/27	0858-0918	6/27	0934	Water clear; sulfide odor; only 1 1/2 qt. of extractable organics collected; no TOX sample

Leachate sumps were sampled to the extent that sufficient liquid was present for the samples. Duplicate volatile organic samples and splits of all other samples were provided to USPCI personnel.

Table 2
LEACHATE SAMPLE DESCRIPTION AND COLLECTION LOCATION

Leachate Sump	Location	Date	Time	Remarks
Cell 1	Southern end of cell 1	6/24	1040	Sample dark straw/amber color with black sediment; oily sheen on surface
Cell 2				
1B	Northeast corner	6/23	1501	Sample clear; NEIC split
2B	Southeast corner	6/24	0914	Containers omitted: phenols sulfate/chloride, nitrate, ammonia, sulfides
3B	Southwest corner	6/23	1348	Sample light straw color
4B	Northwest corner	6/23	1138	Sample grey in color
Surface Impoundment	West end	6/24	1223	Sample grey in color; sediment present; collected only three TOC* containers

* *Total Organic Carbon*

Each of the monitoring wells was equipped with a dedicated Well Wizard sampling pump, which was operated by USPCI personnel. Samples were collected from these wells by the following procedure. Additional details of USPCI sampling procedures are described in the section on Ground-Water Monitoring Program During Interim Status.

1. Company personnel determined depth to ground water using an ACTAT Olympic Well Probe, Model 150.
2. Company personnel calculated the height of the water column from depth to water measurement and well depth (from construction records).
3. Company personnel determined the water column volume using the formula:
$$\text{volume} = \pi (\text{radius})^2 (\text{height of water column})$$
4. Company personnel purged three water column volumes.
5. After recharge, EPA contractor monitored open well head for chemical vapors (HNU) and radiation.
6. EPA contractor collected sample aliquot and measured water temperature and pH.
7. EPA contractor filled sample containers in the order shown in Table 3, alternating between filling a sample aliquot for the Company and one for the EPA contract laboratory. When NEIC samples were collected, the above protocol was modified to include filling a sample aliquot for NEIC after filling one for the EPA contractor.
8. Samples were placed on ice in an insulated container.

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

Table 3
PREFERRED ORDER OF SAMPLE COLLECTION, BOTTLE TYPE AND
PRESERVATIVE LIST

Parameter	Bottle	Preservative
1. Volatile organic analysis (VOA)		
Purge and trap	Two 60-ml VOA vials	
Direct inject	Two 60-ml VOA vials	
2. Purgeable organic carbon (POC)	One 60-ml VOA vial	
3. Purgeable organic, halogens (POX)	One 60-ml VOA vial	
4. Extractable organics	Four 1-qt. amber glass	
5. Total metals	1-qt. plastic	HNO ₃
6. Total organic carbon (TOC)	4-oz. glass	H ₂ SO ₄
7. Total organic halogens (TOX)	1-qt. amber glass	
8. Phenols	1-qt. amber glass	H ₂ SO ₄
9. Cyanide	1-qt. plastic	NaOH
10. Nitrate/ammonia	1-qt. plastic	H ₂ SO
11. Sulfate/chloride	1-qt. plastic	
12. Radionuclides (NEIC only)	Four 1-qt. amber glass	
13. Sulfides		0.2 ml of 2N acetate* solution and 0.2 ml NaOH

* 2 Normal Acetate Solution: 220 g Zn (C₂H₃O₂)₂·2H₂O in 870 ml H₂O

Leachate was collected at sumps below the operating landfills 1 and 2, and below the surface impoundment. All leachate samples were collected prior to collecting ground-water samples to prevent possible cross-contamination between the two. The EPA contractor collected composite samples in gallon glass jugs then transferred the leachate to sample containers provided by the EPA contractor. Leachate samples were not preserved.

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

At two sampling locations (MW-14 and MW-15), the EPA contractor prepared field blanks for each analytical parameter group (e.g., volatiles, organics, metals) by pouring high pressure liquid chromatography (HPLC) water of known quality into sample containers. One set of trip blanks for each parameter group was also prepared and submitted during the inspection. The blanks were submitted to the laboratories with no distinguishing labeling or markings.

Samples were analyzed by the EPA contractor laboratories for the parameter groups shown on Table 3 minus the groups indicated on Tables 1 and 2. NEIC received and analyzed split samples for one ground-water monitoring well (MW-14) and one leachate sump (cell 2, sump 1B).

WASTE MANAGEMENT UNITS AND FACILITY OPERATIONS

WASTE MANAGEMENT UNITS

The Grassy Mountain facility handles both hazardous waste, as defined by the Utah Hazardous Waste Rules pursuant to the Utah Code Annotated Title 26 - Health Chapter 14 (UC 26-14) and regulated by the UDH and EPA, and PCB waste, as defined in 40 CFR 761 and regulated by EPA. The Task Force identified waste handling units and operations to determine where waste constituents handled at Grassy Mountain might enter the ground water. This section describes the waste management units at the Grassy Mountain facility.

During the Task Force inspection, USPCI was using the following management units/areas for the treatment, storage and/or disposal of hazardous waste:

- One surface impoundment - storage
- Four landfills*- disposal
- Nine tanks - storage and treatment
- One drum storage area - container storage
- Four land treatment areas - disposal

No waste handling operations existed prior to the enactment of RCRA, as the site has accepted hazardous wastes only since 1982. At the time of the Task Force inspection, all operations and units ever used by USPCI were still active [Figure 3], although landfill cell 1 was nearly full and expected to close soon. Hazardous wastes accepted by USPCI in 1985 are presented in Table 4.

* Only two landfills were used for hazardous waste disposal. The other two landfills were used for PCBs or nonhazardous industrial waste and were not evaluated for compliance with Subpart F.

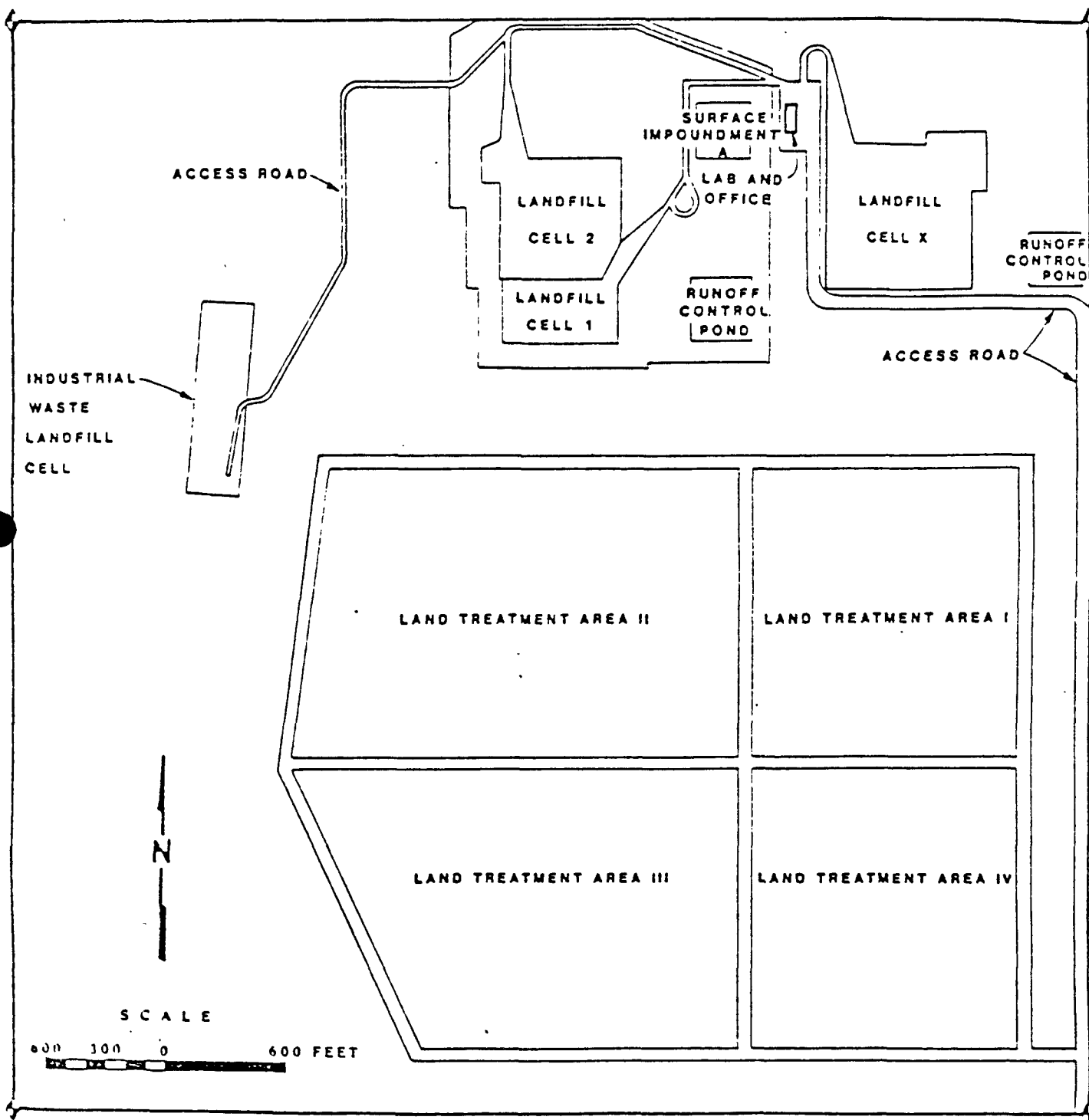


Figure 3
DISPOSAL UNITS AT USPCI

Table 4
HAZARDOUS WASTE DISPOSED AT USPCI, GRASSY MOUNTAIN, 1985

EPA Hazardous Waste Number	Description of Waste	Amount (pounds)		
		Landfilled	Tank Treatment	Land Application
D000	Miscellaneous hazardous waste	109,624		
D001	Ignitable waste	745,042	399,835	
D002	Corrosive waste	4,155,313	1,448	2,033,998
D003	Reactive waste	273,826		
D003/K049/K051	Reactive plus petroleum refining waste			9,806,450
D004	Arsenic waste	11,782,274		
D005	Barium waste	35,996		
D006	Cadmium waste	1,757,595	54,330	
D007 EP Toxic	Chromium waste	3,145,664	13,195	
D008 Waste	Lead waste	701,601		
D009	Mercury waste	9,320		
D012	Endrin waste	4,119,067		
D013	Lindane waste	333		
D016	2,4-D waste	42,858		
F001/F002	Spent halogenated solvents	172,817	187,317	
F003/F004/F005	Spent nonhalogenated solvents	262,496	822,264	
F006/F008	Treatment sludges/solutions	929,108		
F009/F019				
K001	Wood preservation waste	809,697		
K037	Pesticide waste	543,140		
K048/K049/K050	Petroleum refining waste	16,853,317	20,086	9,470,441
K051/K052				
K061/K062	Iron and steel waste	9,563,800		338,760
K087	Coking waste	705,702		
U007	Acrylamide	225		
U036	Chlordane	508		
U044	Chloroform	959		
U051	Creosote	486,615		
U092	Dimethylamine	2,020		
U151	Mercury	500		
U188	Phenol	9,200		
U220	Toluene	617		
U223	Benzene	500		
U230	2,4,6-Trichlorophenol	19		
U239	Xylene	3,073		
U240	2,4-D	2,524		
U242	Pentachlorophenol		500	
P012	Arsenic trioxide	1,022		

Source: 1985 Annual Report

PCB waste processing and disposal operations included storage, treatment and disposal. Any storage and treatment of liquid PCBs is operated by PPM, Inc., a subsidiary of USPCI. PCB liquids are detoxified and shipped offsite as a fuel oil blend. As a result of the detoxification process, a spent caustic solution is generated that is used by USPCI for waste neutralization. PCB solids (transformer carcasses, contaminated debris, etc.) are landfilled onsite.

Surface Impoundment

USPCI uses the surface impoundment for liquid hazardous waste storage prior to land treatment. USPCI stores waste water from refinery processes in the impoundment and removes oil from the top, as necessary. The surface impoundment storage capacity is about 6.2 acre-feet (about 2 million gallons).^{*} The surface impoundment is subject to the ground-water monitoring requirements of the UHWR interim status regulations.

The USPCI site is underlain by lakebed sediments (primarily silty clay). The surface impoundment is mostly above grade with the bottom about 2 feet below grade. USPCI constructed the embankment in 1982 from soil obtained from a nearby ridge consisting of a mixture of sands, silts and clays. The Company added and tested a 3-foot clay liner, leachate detection system and synthetic liner in 1984 and 1985.

The clay liner was constructed with clay from borrow areas on the northwest portion of the property. The clay was compacted, but no permeability tests were done.

The leachate detection system was constructed by placing 8-inch-diameter pipe with 1/4-inch holes on 1-foot centers in a gravel sump [Figure 4]. This system was originally designed as a gravel relief vent system and was modified for use as a leachate detection system.

^{*} As reported in a USPCI September 28, 1984 transmittal regarding Surface Impoundment A, Exhibit C

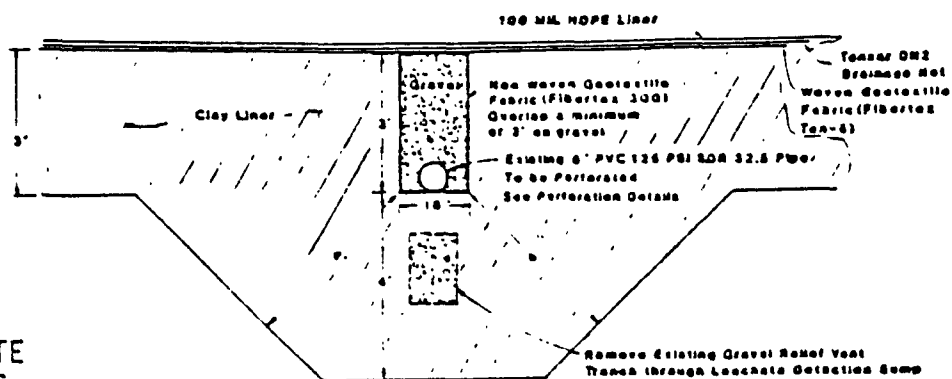
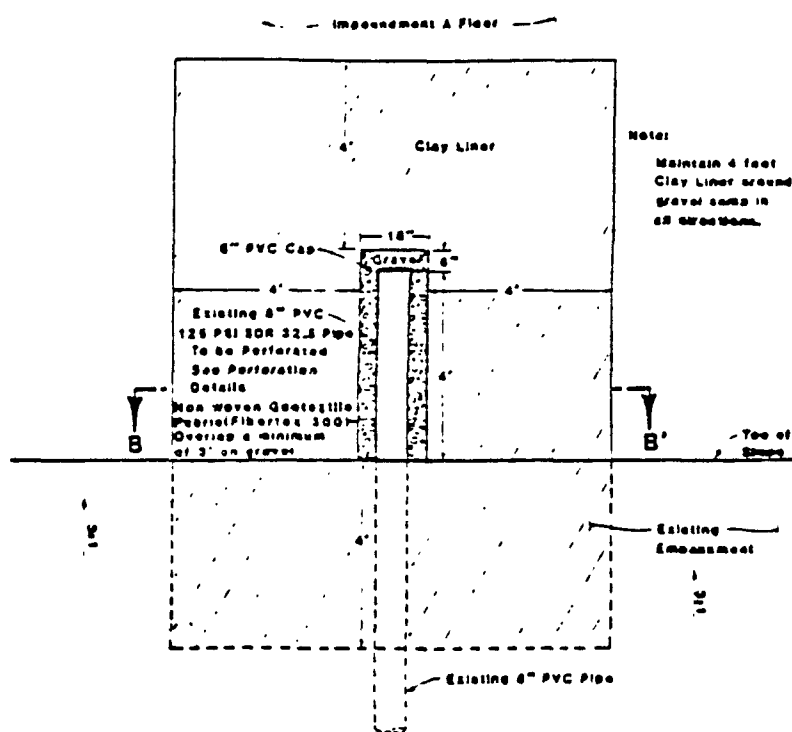
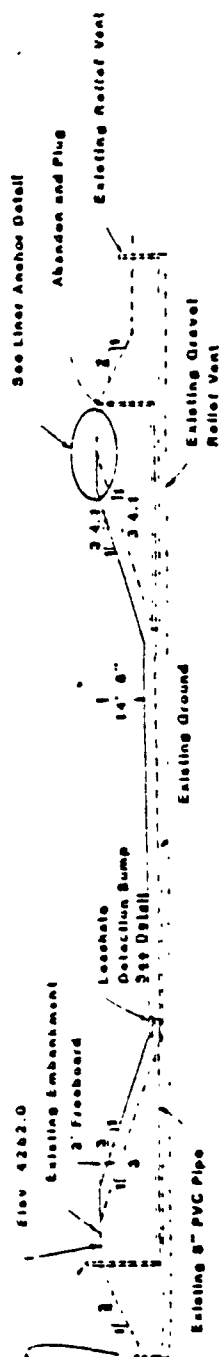
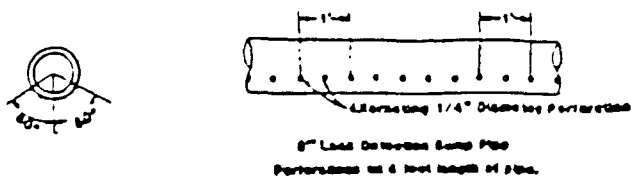


Figure 4
SURFACE IMPOUNDMENT LEACHATE
DETECTION SYSTEM DETAILS

The synthetic liner is 100 mil High Density Polyethylene (HDPE). Compatibility testing conducted by consultants indicated the HDPE liner was compatible with solutions similar to refinery wastewater; USPCI proposed impounding refinery wastewater (EPA hazardous waste numbers K048-K051) in this impoundment. The State approved of this impoundment for storage of petroleum refinery wastes on April 2, 1985.

The impoundment is square with a finished bottom width of 115 feet, 3:1 side slopes and a total depth of 14 feet (2 feet of freeboard are required, thus, useable depth is 12 feet). The dike crest is about 14 feet wide and the outer embankment has a 2:1 slope. The dike top and outer embankment were covered with a minimum of 4 inches of gravel. The impoundment bottom is sloped toward the leachate collection system. Waste levels in the impoundment are mostly above ground and always above the water table.

The surface impoundment has been in service since mid-1985. During the Task Force inspection, more than a 2-foot freeboard was observed. Freeboard measurements are referenced by marks on a pump track for raising or lowering the pump used to remove liquid from the impoundment.

Landfills

Although there were four landfills at the USPCI site, only two were hazardous waste landfills (landfill cells 1 and 2) and subject to the RCRA interim status ground-water requirements. One landfill (industrial waste landfill cell) was used for burial of non-RCRA industrial waste and one landfill (landfill cell X) was used for burial of PCB solid waste.* Total capacity for the four existing landfills was approximately 275 acre-feet.

USPCI operates the landfills using a progressive slope or ramp method of landfilling where each layer is completed and compacted and the landfill is filled from the bottom up. Each landfill cell will be closed and capped after the cell is full. Landfill cell 1 was almost full at the time of the inspection. The first

* A fifth landfill cell (landfill cell 3), for burial of hazardous waste, was under construction during the Task Force inspection.

waste was placed in landfill cell 1 in March 1982; all other landfills went into service after that date.

Landfill Cell 1

Landfill cell 1 is located in the middle of the northern half of the USPCI facility. The landfill was completed and began accepting waste in March 1982. The landfill was expanded in 1984 by adding 10 feet in height to the cell. Total capacity of the expanded cell is about 29 acre-feet.

The landfill was constructed so that all waste is buried above grade. Existing soil (5 feet) was excavated for later replacement with compacted clay. At the bottom of the excavation, three gas relief trenches were dug. These trenches transect the landfill cell under the clay liner. The trenches consist of gravel surrounded with geotextile fabric and vented by vertical riser pipe. The embankment was constructed with material taken from the same ridge of sands, silts and clays, as for the surface impoundment. A 5-foot clay liner and a gravel layer for leachate collection and removal were installed after the embankment was constructed.

The ground surface to receive embankment material was scarified to a depth of about 8 inches and recompacted. Embankment and backfill material were monitored for moisture content before compaction. Moisture content varied more than original design specifications, but desired compaction densities (95% Standard Proctor) were almost always achieved.

The clay liner was constructed with clay from a nearby borrow area that complied with the Unified Soil Classification of CL materials with an additional requirement that at least 80% of the material pass through a No. 200 sieve. Liner material moisture content also varied but desired compaction densities were achieved except for one test which indicated 94% instead of 95% of Standard Proctor. Clay used for the cell 1 liner may not have met permeability standards. Although permeability tests conducted on two laboratory samples indicated the clay liner has a permeability less than 1×10^{-7} cm/sec, more comprehensive field and laboratory testing on clay from the same area indicated permeability was greater than 1×10^{-7} cm/sec and sodium

hexametaphosphate had to be added to the clay to meet permeability standards.

The top of the clay liner (bottom of the landfill) was crowned 6 inches to provide drainage to the edges for removal of rainfall. A 6-inch-thick layer of uniform size gravel was placed over the clay liner to serve as a leachate collection and removal system; however, no sumps or risers were installed to facilitate leachate removal.

Landfill cell 1 is rectangular with finished bottom dimensions of 100 feet by 300 feet, 3:1 side slopes and a total depth of 22 feet. The dike top is about 18 feet wide and the outer embankment has a 2:1 slope. The dike top and outer embankment are covered with gravel.

Landfill cell 1 has received various solid, semi-solid and sludge type waste. Table 4 presents waste placed in both landfill cells 1 and 2. During the Task Force inspection, landfill cell 1 was almost full. USPCI officials indicated they were waiting for an appropriate waste such as contaminated soil to completely fill landfill cell 1 and provide a suitable base for the cap to be installed during closure of the unit.

Landfill Cell 2

Landfill cell 2 is located directly north of landfill cell 1 and shares a common side. The landfill was completed in 1984 and 1985. Waste was landfilled in cell 2 beginning in September 1985. Total capacity of landfill cell 2 is about 62 acre-feet.

The landfill was constructed so that all waste is buried above grade. The natural ground surface was scarified to a depth of 8 inches and recompact. The new embankment was benched into the existing embankment where landfill cell 2 abuts landfill cell 1. The embankment was constructed similarly to the landfill cell 1 embankment with material from a nearby borrow area. The liner, in ascending order, consists of a 2-foot compacted clay liner, a 60-mil HDPE liner, drainage net, a 60-mil HDPE liner, drainage net, non-woven geotextile fabric and a 2-foot protective sand layer. The leachate

collection/detection system consists of pipes and four secondary or detection sumps between the synthetic liners and pipes, and four primary or collection sumps on top of the synthetic liners [Figures 5 and 6].

The clay liner was constructed with clay from a nearby borrow area. To meet permeability requirements of 1×10^{-7} cm/sec or less, sodium hexameta-phosphate was added to the clay. Permeability tests in the field (7.6×10^{-9} to 7.6×10^{-8} cm/sec) and laboratory (2.1×10^{-8} to 4.5×10^{-8} cm/sec) indicated the clay liner has permeability less than 1×10^{-7} cm/sec.

The top of the clay liner is sloped radially to the four leachate collection sumps. The primary leachate collection system is designed to collect any leachate reaching the bottom of the cell. The secondary leachate detection system is designed to collect any leachate that has breached the uppermost synthetic liner. Any leachate collected in the secondary/detection system would indicate a failure of the uppermost synthetic liner.

Landfill cell 2 is rectangular with finished bottom dimensions of 340 feet by 375 feet, 3:1 side slopes and a total depth of 16 feet. The dike top is about 12 feet wide and the outer embankment has a 2:1 slope. The dike top and outer embankment are covered with gravel.

USPCI has placed various waste into landfill cell 2 [Table 4]. During the Task Force inspection, landfill cell 2 was in service and USPCI was concerned that leachate had been collected from the secondary leachate detection system indicating a failure of the upper synthetic liner. The Task Force collected samples from the secondary leachate detection system for analysis to investigate this concern.

PCB Landfill Cell X

The PCB landfill cell X is located east of the office in the northeast quadrant of the USPCI facility. The unit was built in 1985-86 and began accepting waste in April 1986. The unit is regulated by Federal TSCA regulations (40 CFR 761) and does not receive hazardous waste. Total capacity of the unit is 150,000 cubic yards or about 93 acre-feet.

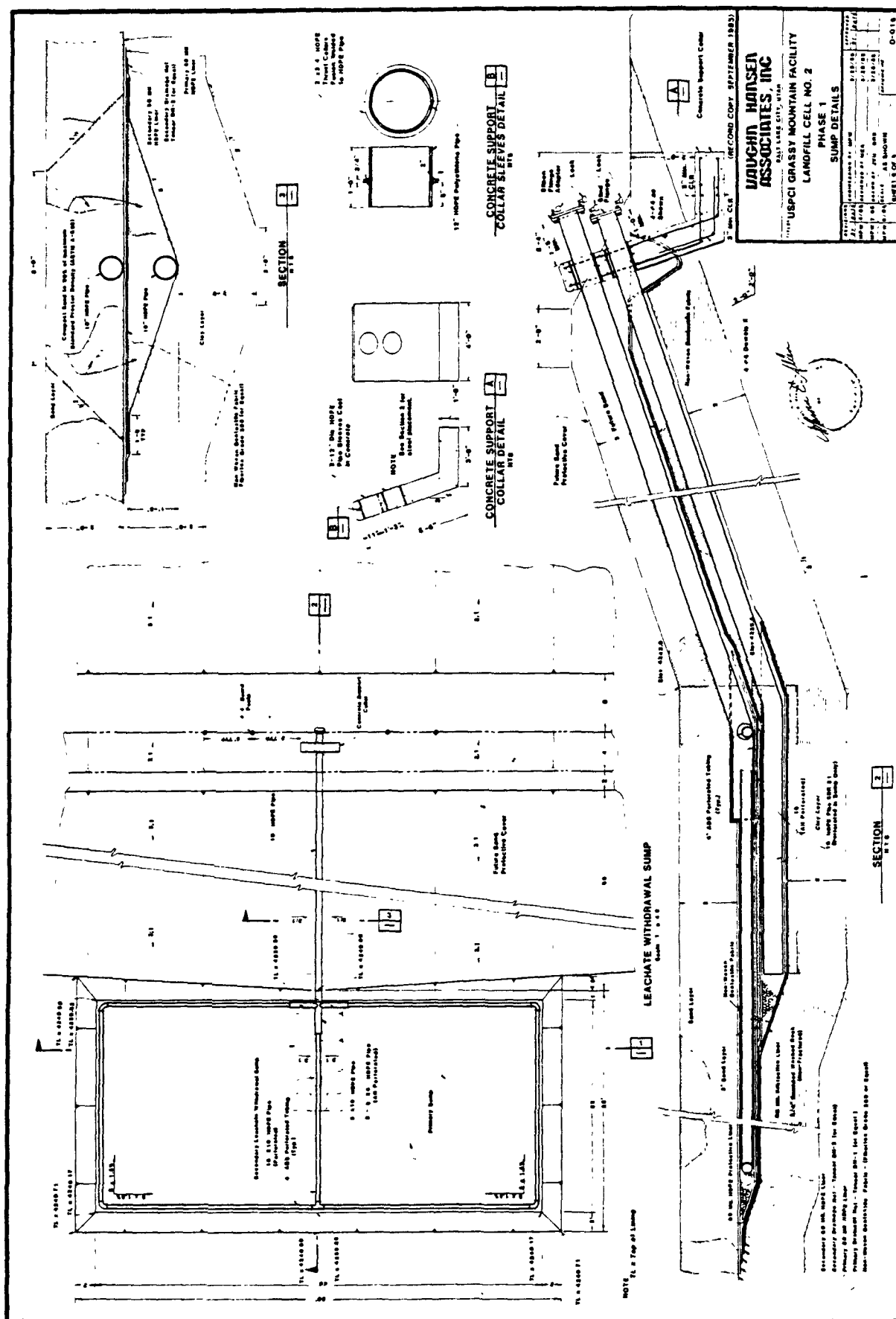


Figure 5. Landfill Cell 2 Leachate Sump Details

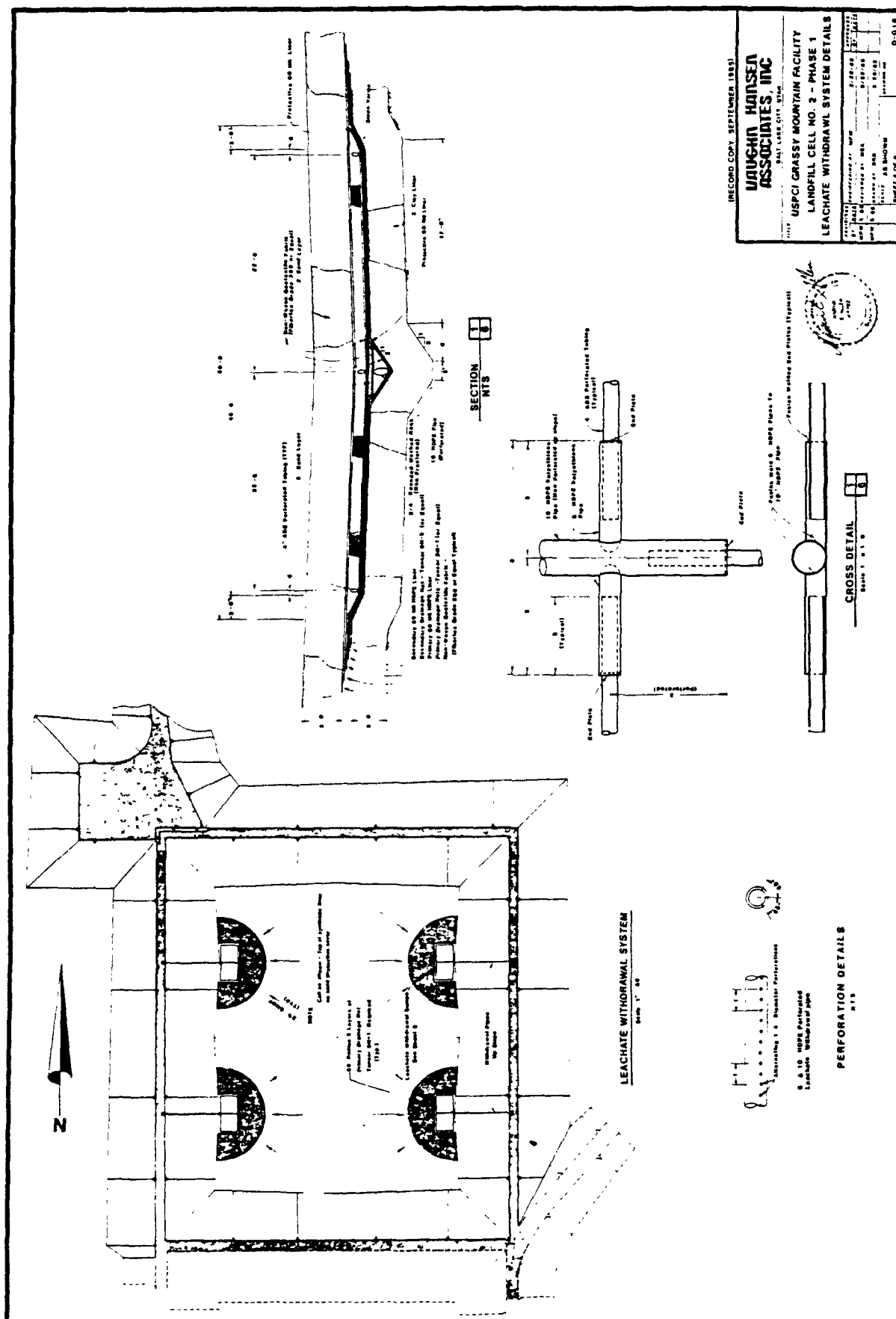


Figure 6. Landfill Cell 2 Leachate Withdrawal System Details

The landfill was constructed so that all waste is buried above grade. The design is similar to landfill cell 2, however cell X has a 3-foot compacted clay liner. Most of the waste for cell X comes from PPM, Inc. and includes PCB solids, transformers and debris. During the Task Force inspection, this unit was in service.

Industrial Waste Landfill Cell

The industrial waste landfill cell is located near the northwest corner of the Grassy Mountain facility. The unit was built in 1985 and began accepting waste in August 1985. The unit is regulated by Utah Solid Waste Regulations and does not accept hazardous waste. Non-PCB transformers, empty drums, debris and other non-RCRA waste are landfilled in this unit. No municipal waste has been accepted to date, but would be if a customer desired. The rectangular cell has finished bottom dimensions of approximately 150 feet by 1,050 feet. The cell has a single liner and two sumps for collection of fluids. During the Task Force inspection, the unit was in service and UDH inspections indicated there was a lot of fluid in this landfill.

Tanks

USPCI operates nine tanks for storage and treatment of RCRA waste. PPM, Inc. operates another seven tanks for storage and treatment of PCBs at the Grassy Mountain facility. The RCRA tanks are within the processing area and surrounded by a clay containment dike. Any leakage from the tanks, piping and waste transfer operations is collected in runoff control ponds (oil/caustic storage tanks) or sumps (solvent tanks, acid tank and reaction tank). Tank pads are either compacted clay or concrete. The processing area has natural underlying silty clay soil. The PCB tanks are within a smaller separate area with a clay containment dike. Any leakage from the three storage and three treatment tanks, piping and waste transfer operations is collected in sumps on the concrete tank pads. The one "clean" tank for treated oil (sold offsite) is located off the concrete pads. A list of existing RCRA tanks, capacity and types of waste stored is presented in Table 5.

Table 5
EXISTING RCRA TANKS, CAPACITY AND TYPES OF WASTE STORED*

Tank Name	Number of Tanks	Dimensions	Type/Construction Materials	Capacity (Gallons)
Waste oil/caustic storage tanks (Tanks 1-5)	5	12'D x 20'H	VA/C.S	16,000 ea
Waste solvent storage tanks (Tanks ST1 and ST2)	2	8'D x 21'H 10'D x 33'H	HA/C.S.	7,500** 18,000**
Acid waste storage tanks	1	10'D x 16'H	VA/FRP	10,000
Neutralization/ reaction tank	1	12'D x 20'H	VACB/C.S. with epoxy liner	16,000

* According to the RCRA Part B permit application

** Calculated from dimensions listed on design drawings

Note:

D = Diameter

H = Height

VA = Vertical above ground

HA = Horizontal above ground

VACB = Vertical above ground with cone bottom

C.S. = Carbon steel

FRP = Fiberglass reinforced plastic

Drum Storage Area

The drum storage area consists of two pads with interconnected curbs. One pad has a partial roof. The pads are 2400- and 7200-square-feet and were built in 1982 and 1985, respectively. The pads have 8-inch curbs and concrete floors, which slope to concrete sumps. The RCRA Part B application lists the capacity of the pads at 250 and 800 55-gallon drums.

Land Treatment Areas

USPCI operates four land treatment areas for treatment of oily waste sludges from petroleum refineries and other industries. The four land treatment areas are designated Areas I through IV and have surface areas of 41, 68, 57 and 40 acres, respectively. A 2-foot dike surrounds the entire land treatment portion of the Grassy Mountain facility. USPCI installed lysimeters in the unsaturated zone to monitor soil moisture and four monitoring wells to monitor ground water. USPCI also collects soil cores to monitor leaching from the land treatment area.

FACILITY OPERATIONS

Task Force personnel reviewed records of facility operations to identify any activities that might result in waste releases to ground water. Pre-acceptance records were evaluated to determine how adequately waste constituents have been identified in incoming waste loads. Waste tracking records were evaluated to determine how wastes were handled and whether waste disposal locations have been properly recorded. These records required by both State and Federal interim status regulations enable identification of hazardous waste constituents that could potentially be released from individual waste handling units.

Surface Impoundment

Two waste streams from petroleum refineries are stored in the USPCI surface impoundment prior to land treatment. Oil is periodically pumped off the top of the surface impoundment. Stored waste is pumped to a spreader prior to

land treatment. Freeboard reference marks for the surface impoundment are on the pump track on the inner face of the surface impoundment. As of December 31, 1985, the surface impoundment was about half full, containing about 1 million gallons of waste. During the Task Force inspection, the impoundment still appeared to be about half full.

Landfills

The present grid system for locating where hazardous waste is buried began about June 1984. Large maps of the grid system are on the hall walls in the office/lab building. The drum dock supervisor provides coordinates for buried drums. Lab personnel and landfill operators cooperate in providing coordinates for bulk loads.

Waste containing any free liquids is solidified prior to landfilling. USPCI has used oil field mud tanks, cement mixers and currently uses gondola cars (like a large dumpster or roll-off box) to mix waste and absorbent material prior to landfilling. USPCI switched to using gondola cars as mix tanks after the State complained in a November 14, 1985 memo that cement mixers did not meet RCRA definition of a tank.

Normally, USPCI uses solidified material and bulk solids for packing around drums in the progressive slope or ramp method of landfilling used at the site. With a large contract to landfill over 76,000 drums, USPCI contracted with another firm to provide a lime slurry to fill spaces around the drums. Old solidification tanks were used as forms for the lime slurry.

Tanks

Waste is directed to tanks based on the type of waste. Oil and caustic liquid waste is usually placed in tanks 1 through 5 with caustic waste usually placed in tank 5 and sometimes in tanks 3 and 4. Oil field wastes for land treatment are usually stored in tanks 1 through 4 or the surface impoundment. Acid waste is stored in the acid tank and mixed solvent waste is usually stored in the solvent tanks (tanks ST1 and ST2). Solvents are usually shipped offsite for fuel blending. The reaction tank is used for neutralization of acids/bases and

treatment of sulfides. Freeboard in the oil and caustic tanks is manually measured with a tape measure once a day and after loads are pumped to the tanks. The solvent tanks are measured before and after each load. The acid and reaction tanks are not measured directly but a log of specific gravity and volumes received is kept.

USPCI claims not to have ever had a major spill and that any small spills or leaks were cleaned up and the debris landfilled. The State did order USPCI to fix one tank that had settling problems and USPCI complied.

Drum Storage Area

Drummed waste is off-loaded directly to the drum storage area after the manifest has been checked, a piece count made and manifest information logged into the computer. The drums are sampled after off-loading at the drum storage area. Normally, more than 20% of the drums from each waste stream are sampled. Each drum is checked for free liquids and volume of waste. Disposition of each drum is recorded on drum disposal logs.

The drum storage area is loosely organized and no attempt is made to assign a specific location to each drum. Flammable liquids are kept on the covered drum dock, thus providing shade for these drums. Caustics and organics are stored on one side of the drum pad and acids are stored on the other as a method of keeping incompatibles separated.

Acids can be pumped directly to the acid tank. Caustics and solvents are usually transferred to their respective tanks via a tractor-pulled spreader tank. Solids and drums containing liquids to be solidified are transferred to the landfill via front-end loader. Large volumes of liquids may occasionally be pumped to a USPCI tanker truck for transfer to the designated tank.

Material accumulating in the drum storage area sumps is analyzed for organic chlorides and usually solidified and landfilled. Records indicate no previous incidents resulting in potential ground-water contamination from operation of the drum storage area.

Land Treatment Areas

Oily waste sludges from petroleum refineries and other industries are applied to land treatment areas by a tractor-pulled spreader. Solids are usually applied to area 1 by a paddle wheel cart similar to home grass seed or fertilizer spreaders, only much larger. Unless there is a concern about concentration, most applications are sequential (e.g., row 1, then row 2, then row 3). A computer program is used to keep track of amounts applied and cumulative concentrations of oil and metals.

Wastes have been applied to the treatment areas since April 1982. Wastes destined for land treatment are usually placed in the surface impoundment or tanks 1 through 4 prior to application. Gravity separation of oil is accomplished in the surface impoundment or tanks. Oil is reclaimed from the tanks/surface impoundments as possible. The USPCI RCRA Part B permit application specifies the oil content of the residues for land application is generally 15% by weight or lower. The residue is pumped to the spreader and applied to the designated row and tilled into the top 7 to 8 inches of soil. A spring tooth type tiller is used to reduce fines and blowing dust. The land treatment areas are retilled periodically to aerate the soil and promote microbial action on the oily waste.

SITE HYDROGEOLOGY

The USPCI Grassy Mountain Facility lies in the Northern Great Salt Lake Desert in northwest Utah. The Great Salt Lake Desert has been the subject of numerous regional geologic and hydrologic investigations done by universities, the State of Utah and the United States Geological Survey. In addition, USPCI has initiated onsite geotechnical investigations at the Grassy Mountain facility to characterize the site hydrogeology. These investigations primarily have been done by USPCI consultants, Vaughn Hansen and Associates of Salt Lake City, Utah and Chen and Associates of Denver, Colorado. The investigations include exploratory drilling, geologic coring, lineament analysis, seismic studies, aquifer testing and water level analysis.

During the inspection, Task Force personnel interviewed a representative of Vaughn Hansen and Associates regarding a hydrogeologic characterization report prepared by his firm, which was submitted by USPCI to the State and EPA in May 1986.* This report was prepared, as required by UDH for the Part B application. The following information is largely derived from the interview and the report.

Salt flats, lake beds of the former Lake Bonneville, alluvial material (stream deposits) from surrounding mountains and wind-blown sand compose the sediments of the Great Salt Lake Desert. At the USPCI site, the exposed sediments are Pleistocene Lake Bonneville and younger sediments. These sediments consist of calcareous (calcium carbonate) clays, silts and fine to medium-grained sands. The lakebed sediments are more than 300 feet thick beneath the Grassy Mountain Facility. The Grayback Hills are east of the facility. Alluvial deposits from the Grayback Hills coalesce with the younger lakebed sediments at the base of the Hills. At the western edge of the site, wind action has formed sand dunes on the surface near some topographic low spots hereafter referred to as mudflats. These sediment features may affect local ground-water flow patterns.

* USPCI, May 1986. "Response to Federal Ground Water Regulations 40 CFR 270.14(c) Regarding Grassy Mountain Facility Near Knolls, Utah," Volumes 1 through 3.

Geologic core analyses on two 100-foot and one 300-foot exploratory borings indicate that quartz and calcareous sands compose most of the layered sands and silts beneath the ground surface. The May 1986 hydrogeologic report details each of the sands, silts and clays and the original depositional environments (e.g., open fresh water, shallow fresh water, saline shallow or shoreline or paleosoil).

Subsurface profiles, developed from geologic coring information indicate the upper silty sand (dune) deposits are not continuous across the site. Various subsurface profiles developed from drilling logs suggest that some of the deeper sand units do appear to be continuous or nearly continuous across the site, while other units appear to be discontinuous. The continuous materials exhibit a slightly westward dip in slope. Some of these layered units apparently undergo gradational grain-size and compositional changes as they extend across the site.

HYDROGEOLOGIC UNITS

The upper 25 feet of the deposits contain an unconfined, principal aquifer, known as the shallow brine aquifer. The elevation of the water table in the shallow brine aquifer was about 4,229 to 4,233 feet above mean sea level at the time of the Task Force inspection. Depth to ground water beneath the facility ranged from about 10 to 30 feet from land surface, depending upon surface topography.

USPCI consultants state that the shallow brine aquifer contains many dessication cracks that may be up to 1 inch in width, as close as 1 foot apart, and as deep as 25 feet. The consultants contend that these cracks substantially increase hydraulic conductivity within the aquifer and increase its water yield. The hydraulic conductivity and water yield in the shallow brine aquifer are greater through the dessication cracks than in the underlying sediments that do not contain cracks. The consultants state the increased hydraulic conductivity as the reason this aquifer is identified as the "uppermost aquifer" for regulatory purposes. Below the upper 25 feet, the dessication cracks are absent or less prevalent, thus, they are less a factor in water movement.

The May 1986 hydrogeologic characterization report states that regional recharge to the shallow brine aquifer occurs primarily through lateral ground-water flow from adjacent sediments near the Grayback Hills and upward flow from deeper sediments. To a much lesser extent, recharge may occur through infiltration from precipitation and storm runoff.

The sediments below the shallow brine aquifer have poor water yield and variable water quality depending upon the chemical composition of the depositional layer, the original depositional environment and patterns of ground-water discharge. USPCI personnel measured specific conductance values on the order of 90,000 to 100,000 micromhos per centimeter ($\mu\text{mhos/cm}$) during the July 1986 sampling. None of this ground water is used as a drinking water supply, and it has not been classified under the Safe Drinking Water Act.*

GROUND-WATER FLOW DIRECTION AND RATES

The hydraulic gradient in the shallow brine aquifer across the site has a very shallow apparent slope to the west.** Ground water flows westward from the Grayback Hills toward the sand dunes and mudflats. Consultants' piezometric (water level) contour data indicate that in the vicinity of the sand dunes (located just east of the western mudflats) the gradient in the shallow brine aquifer steepens as ground water flows beneath the dunes toward a western mudflat. Near the Grassy Mountain Facility, the flow direction diverges toward each of three major depressional mudflats located to the south, west and northwest of the facility. Historical piezometric data suggest that locally there is decreasing hydraulic head with depth (net downward flow) beneath the facility and increasing head with depth (net upward flow) beneath the sand dunes and western mudflats.

USPCI consultants' estimation of ground-water flow velocity may be lower than the actual ground-water flow velocities as a result of overestimating porosity. They report the rate of ground-water flow across the site to be about

* The Safe Drinking Water Act (42 U.S.C.A. § 300f et seq.) defines an underground source of drinking water to be an underground water which supplies or can reasonably be expected to supply any public water system.

** Based on June 1986 measured water levels (see Figure 6).

0.6 feet per year.* The formula used by the consultants to compute ground-water flow velocity was:

$$V = \frac{KI}{n} \text{ where}$$

V = velocity of ground-water flow

K = hydraulic conductivity

I = hydraulic gradient

n = porosity of the porous media

The consultants used porosity values of 30% and 66%, water level contours developed in January 1986 for the hydraulic gradient, and values for hydraulic conductivity from field and laboratory testing. The porosity values of 30% and 66% are within published porosity ranges for sands and clays [Table 6].

Table 6
RANGE OF VALUES OF
POROSITY IN
UNCONSOLIDATED SEDIMENTS*

	Porosity $n(\%)$
Gravel	25-40
Sand	25-50
Silt	35-50
Clay	40-70

* Source: Freeze and Cherry, 1979

The consultants values used for computing ground-water flow velocity are presented in Table 7. The 66% used to compute the flow rate of about 0.3 feet per year is too high because it represents total porosity, not all of which would be available for fluid flow. Using total porosity results in an underestimated value for ground-water flow velocity.

* May 1986 Hydrogeologic Characterization Report

Table 7
GROUND-WATER FLOW VELOCITY COMPUTED
BY USPCI CONSULTANTS

K ft./sec.	I %	n %	V ft./year
4.1×10^{-5}	0.014	30	.6
4.1×10^{-5}	0.014	66	.27

Several qualifiers apply to the computation in Table 7. First, the K value used is the average of K values measured in six wells, some of which are nearly a mile apart. Second, the K values were derived from single-hole slug tests in each well and at best, represent ground-water conditions within a few feet of the well tested rather than over a broad area. Third, a steeper gradient would increase flow velocity. The Task Force computed a range of hydraulic gradients from 0.02 to 0.29%, using June 1986 water level data. A gradient as high as 0.2% would increase the computed flow velocities to about 9 and 4 feet per year for values of $n = .3$ and $n = .66$, respectively. Additionally, the desiccation cracks in the shallow brine aquifer and any sand lenses in the sediments would be preferential ground-water flow paths. The May 1986 hydrogeologic report does not calculate ground-water flow velocity using the effective porosity of sand (i.e., a lower value of porosity that represents a volume of void space actually available for ground-water flow).^{*} For all these reasons, the Task Force believes ground-water flow velocity at Grassy Mountain could range up to one and perhaps two orders of magnitude above the values in Table 7.

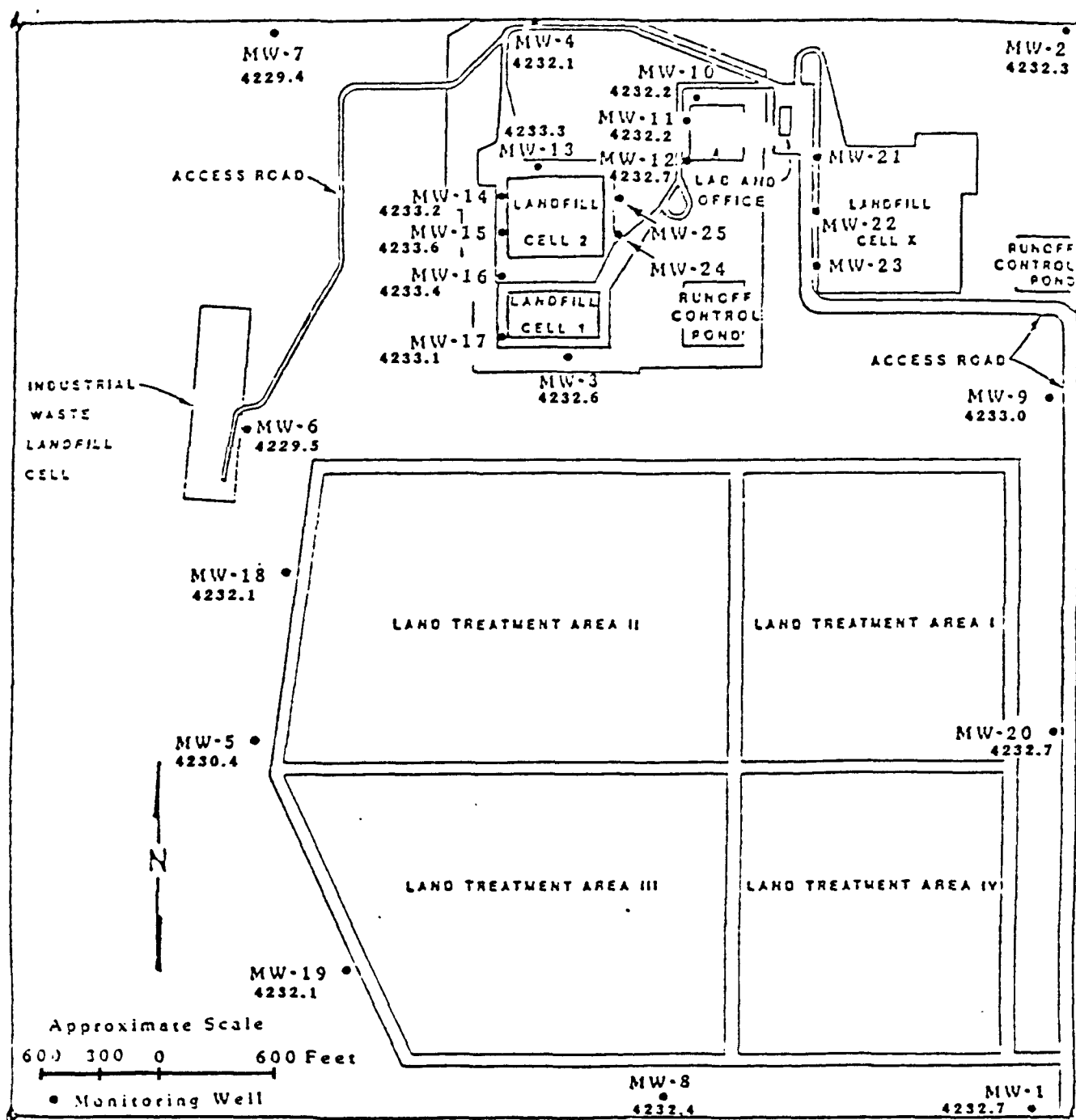
The loading activities of building the berms surrounding landfill cells 1 and 2 and filling the cells with waste materials appear to have altered the ground-water flow patterns in the vicinity of these disposal units. Consultants to USPCI state that the loading at the surface has caused sediment compaction immediately beneath the landfill cells, so that the dessication cracks seal under the weight and no longer serve as primary avenues of ground-water flow. As a

^{*} Some void space in earth materials is occupied by air and fluids held by surface tension. This void space is unavailable for transmitting fluids and should be subtracted from the porosity (total void space) value, leaving an estimate of what is known as "effective porosity" (i.e., that pore space in earth materials capable of transmitting fluids).

result, sediment permeability beneath the cells decreases. The Task Force agrees with this conclusion.

The loading of the landfill cells and resultant compaction has caused a rise in ground-water pore pressure beneath the cells. USPCI consultants contend that the rise in pore pressure is indicated by unusually high ground-water levels in the vicinity of the cells and normal levels elsewhere on the site. The effect of elevating the water table is the induction of a slightly steeper hydraulic gradient around the cells (i.e., a ground-water mounding effect). The "mounding" should not affect background wells at USPCI because the effect is slight and the background wells are several thousand feet away. The Task Force agrees that this effect should equilibrate and a shallow gradient should be restored once surface loading has ceased.

USPCI needs to survey the monitoring wells regularly to provide a basis for reliable water level measurements. The very shallow gradient necessitates careful piezometric analysis. The Task Force was unable to verify that water levels in monitoring wells MW-13 through MW-17 might be unusually high because these wells, constructed in the landfill berm, had settled and had not been resurveyed. Consequently, the accuracy of water levels measured in these wells is questionable. Water level elevations measured by the Company during the Task Force inspection appear in Figure 7.



**Figure 7. Water Level Elevations
(feet above mean sea level)
June 1986**

GROUND-WATER MONITORING PROGRAM DURING INTERIM STATUS

This section is an evaluation of the interim status monitoring program at Grassy Mountain between March 1982 and June 1986, the time of the Task Force inspection. Table 8 presents a brief regulatory history with respect to ground-water monitoring. The section also addresses the following topics:

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

Prior to 1986, the effort to collect background ground-water quality data identified continual problems stemming from the inadequacies in sampling and analysis, the nature of the saline aquifer, and the inappropriateness of certain analytical methods for saline ground-water samples. UDH had to re-evaluate the background water quality characterization several times in the period between 1982 and 1986 in an effort to obtain reliable ground-water quality data.

In 1983, UDH determined that previous ground-water quality analyses for the Grassy Mountain facility did not accurately depict background water quality conditions. UDH ordered the data collection for background water quality to be restarted. The continuing effort to obtain meaningful background data resulted in quarterly monitoring at Grassy Mountain through the end of 1985. In 1986, USPCI began a new period of data collection for background water quality comparisons using additional wells.*

As a result of triggering ground-water assessment under UHWR 7.13.4 (40 CFR 265.93) in October 1985, the Grassy Mountain Facility also began quarterly assessment monitoring during the first quarter of 1986. EPA and UDH requested that USPCI analyze for organic parameters in addition to those

* Phone conversation with Roy Murphy, USPCI, February 11, 1987

Table 8
REGULATORY AUTHORITY, REQUIREMENTS AND EVENTS DURING INTERIM STATUS

Date	Action
December 1980	Utah received RCRA interim authorization. The Utah Hazardous Waste Rules (UHWR) became effective December 12, 1980.
March 1982	Grassy Mountain Facility began waste management activities.
1983	Utah Department of Health (UDH) determined that previous ground-water analyses for the Grassy Mountain Facility did not accurately depict background water quality conditions. UDH ordered the data collection for background water quality to be restarted.
September 1984	Utah received final RCRA authorization, with exception of authorization for the Hazardous and Solid Waste Amendments of 1984 (HSWA). EPA administers HSWA in Utah.
February 5, 1985	UDH issued a Notice of Violation (NOV) and Order of Compliance (NOV/CO No. UTD9931301748) citing USPCI for having inadequate placement of monitoring wells and for not having an acceptable sampling and analysis plan.
March 5, 1985	USPCI agreed to: (1) prepare a hydrogeologic survey at the site, (2) locate new monitoring wells, (3) establish new ground-water monitoring procedures and (4) provide employee training on implementing the ground-water monitoring procedures.
June 19, 1985	USPCI submitted a proposed plan for the hydrogeologic investigation to EPA.
October 2, 1985	UDH and USPCI signed a Stipulation and Consent Order in which USPCI was ordered to install a mutually-agreed-upon ground-water monitoring system and develop and follow a sampling and analysis plan by November 8, 1985.
October 21, 1985	EPA notified UDH that total organic carbon (TOC) in well MW-3 showed a statistically significant increase. EPA determined that USPCI should be in assessment monitoring under UHWR 7.13 (40 CFR Part 265.93).
October 31, 1985	UDH told USPCI to submit a water quality assessment monitoring program.
November 6, 1985	USPCI submitted a sampling and analysis plan to UDH.
November 13, 1985	USPCI notified UDH that the Grassy Mountain facility would enter ground-water assessment monitoring in conjunction with the sampling and analysis plan. UDH formally requested the (overdue) ¹ assessment plan. USPCI did not submit the plan.

Table 8 (cont.)

REGULATORY AUTHORITY, REQUIREMENTS AND EVENTS DURING INTERIM STATUS

Date	Action
January 1986	USPCI restarted background ground-water quality monitoring, including newly-installed monitoring wells (MW-9 through MW-20). ²
February 21, 1986	UDH requested the assessment plan again. UDH also identified certain information related to ground water that should have been forthcoming in USPCI's Part B resubmission due in late March 1986. This information was specifically described in a letter from EPA to UDH dated February 4, 1986.
May 1986	USPCI submitted a hydrogeologic characterization report on Grassy Mountain Facility. ³ USPCI still had not submitted an assessment plan, as required by UHWR 7.13.4. ⁴

1 UHWR 7.13.4 (40 CFR 265.93) requires that the owner/operator develop and submit an assessment plan within 15 days of notifying the regulatory authority of a statistically significant increase in indicator parameters.

2 Phone conversation with Roy Murphy, USPCI, February 11, 1987.

3 USPCI, May 1986, "Response to Federal Ground-Water Regulations, 40 CFR 270.14(c), Regarding Grassy Mountain Facility Near Knolls, Utah," Volume 1-3.

4 EPA and Utah State Regulations are cross-referenced in Table 8.

parameters required by UHWR 7.13.3 (40 CFR 265.92). The 1986 quarterly sampling parameters appear later in this report in a section entitled, "USPCI Sample Collection and Handling Procedures."

Also in early 1986, USPCI began sampling a number of new monitoring wells installed in response to an October 1985 Stipulation and Consent Order from UDH. The existence of these new wells is one reason USPCI restarted background water quality monitoring in 1986.

EPA and UDH agreed to allow USPCI to submit the results of the hydrogeologic investigation as late as March 1986, so that USPCI could concentrate on installing monitoring wells in order to meet a statutory November 8, 1985 deadline for certifying ground-water compliance under 40 CFR Part 265. USPCI submitted the hydrogeologic characterization report to UDH in May 1986.

REGULATORY REQUIREMENTS

The State interim status ground-water monitoring requirements (UHWR 7.13) are equivalent to the RCRA interim status requirements contained in 40 CFR Part 265, Subpart F; there are no substantive differences. Regulation counterparts are shown in Table 9.

Table 9
STATE AND FEDERAL COUNTERPART
INTERIM STATUS REGULATIONS (1986)

Subpart Title*	UHWR	RCRA Regulation (40 CFR Part)
Applicability	7.13.1	265.90
Ground-Water Monitoring System	7.13.2	265.91
Sampling and Analysis	7.13.3	265.92
Preparation, Evaluation and Response	7.13.4	265.93
Recordkeeping and Reporting	7.13.5	265.94

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

GROUND-WATER SAMPLING AND ANALYSIS PLAN

This section evaluates the completeness and adequacy of the USPCI sampling and analysis plan. USPCI is required by interim status regulations in UHWR 7.13.3 (40 CFR 265.92) to develop and follow a sampling and analysis plan. This plan must contain procedures and techniques for: (1) sample collection, (2) sample preservation and shipment, (3) analytical procedures and (4) chain-of-custody control.

Prior to November 1985, USPCI did not have an interim status ground-water sampling and analysis plan at the Grassy Mountain facility, as required by UHWR 7.13.3. Prior to November 1985, USPCI had submitted a sampling and analysis plan with their Part B Application to UDH and EPA. Both agencies determined that the submitted plan was deficient and did not meet regulatory requirements for either interim status or the permit. USPCI submitted a November 1985 plan (the plan) to UDH and EPA in response to the October 1985 Stipulation and Consent Order issued by UDH. Company personnel told the Task Force that this November plan was the interim status sampling and analysis plan.

USPCI personnel also told the Task Force that they first used the November 1985 plan the first quarter of 1986. However, the individual responsible for sampling at the Grassy Mountain Facility during the first and second quarters of 1986, told Task Force personnel he had not seen that plan until commencement of the Task Force inspection (June 1986). No plan had been used at Grassy Mountain prior to that.

Elements of the USPCI Sampling and Analysis Plan

The November 1985 sampling and analysis plan contains procedures for the following elements:

- Measuring depth to water
- Well evacuation
- Sample collection and field measurements
- Collecting field blanks

- Preservatives
- Analytical procedures, including laboratory quality assurance and quality control
- Chain-of-custody
- Shipping

The methods in the plan for measuring static water levels are acceptable except for the provision that measurement accuracy be obtained within $\frac{1}{32}$ of an inch (about 0.003 feet). This accuracy is unrealistic and cannot be obtained with the electric water level indicator used by the facility. A more obtainable value is 0.01 foot with a steel tape or 0.1 foot with an electric tape.

Methods in the plan for purging the well are acceptable except for the example calculation on how to calculate purge volumes. This calculation is incorrect in that it indicates a 2-inch (inside diameter) pipe holds 11 milliliters (ml) of water per inch length of pipe. The correct volume is approximately 51 ml per inch.

The example table in the plan showing volume of water in MW-8 per inch of water column needs to be removed or corrected to reflect accurate numbers. If the table is retained, the total depth of MW-8 should appear so that total water-column volume may be calculated. Furthermore, using well MW-8 as an example for calculating purge volumes is inappropriate, as USPCI no longer samples this well.

The methods in the plan for field sampling are acceptable, with the exception of waiting until all the wells are purged before sampling begins. At the Grassy Mountain facility, purging all the wells takes 24 hours or more. Although some lag time may be necessary for slowly recharging wells, those that recharge quickly should be sampled as soon as possible in order to obtain as fresh a sample from the aquifer as possible. Allowing water in the well to recharge, stagnate and have prolonged contact time with air and the well casing needs to be avoided so that the sample is representative of the quality of water flowing through the aquifer.

The provisions in the plan for field blanks need to include instructions that blanks for sample parameters that are preserved in the field be preserved in the same manner. Otherwise the method for field blanks is acceptable.

The provisions in the plan for preservatives, chain-of-custody and shipping are also acceptable.

The plan includes a four-page, unreferenced list of Appendix VIII compounds. Laboratory* personnel were unable to explain the source of this list or the reason for it in the plan. The laboratory does not analyze for each of the parameters listed, neither does the plan indicate which of these parameters the laboratory does analyze. Only the list of compounds actually analyzed for should appear in the sampling and analysis plan.

The plan does not list appropriate analytical methods for specific organic analyses to be done. Only one analytical method for each compound should be listed in the plan and only that method should be followed, thereby allowing statistical comparison of analytical data.

The plan does not identify appropriate detection limits for all compounds which NAL is capable of achieving. Appropriate, achievable detection limits need to be presented.

Sampling Records During Interim Status

USPCI did not follow the November 1985 sampling and analysis plan with respect to sampling records in 1986. USPCI began keeping more thorough sampling records beginning with the first quarter of 1986, although not all of the sampling activities were done for every monitoring well. Task Force personnel were able to verify that water level measurements, quarterly sampling, replicate field measurements and wellhead inspections had been done during the first and second quarters of 1986, but not at every well for each sampling. Most of the field procedures were consistent with the 1985 sampling and analysis plan, even though the sampler had not seen that plan.

* National Analytical Laboratories (NAL), Tulsa, Oklahoma.

The sampling and analysis plan states that 19 monitoring wells (MW-1 through MW-7, MW-9 through MW-20) would be sampled quarterly for 1 year, beginning with the first quarter of 1986; however, field records for 1986 do not show that all 19 wells were sampled according to the prescribed schedule. USPCI no longer samples MW-4. Sampling records indicate that MW-7 and MW-6 were not sampled in the second quarter of 1986. USPCI indicated MW-7 would not have been sampled in June 1986 had the Task Force not selected it for sampling (USPCI credited split samples from the June Task Force inspection toward their third quarter sampling event). MW-3 was physically removed in August 1986 and replaced with a new well, MW-26.

The sampling and analysis plan also states that USPCI would measure water levels in the monitoring wells each month for 1 year, beginning December 1, 1985. Field sampling records for December 1985 and the first half of 1986 do not indicate that USPCI measured all the water levels according to the prescribed schedule [Table 10].

Table 10
WATER LEVEL MEASUREMENTS OMITTED
December 1985 - June 1986

Year	Month	Well
1985	December	MW-1 through MW6, MW-16, MW-18, MW19
1986	January	MW-9 through MW12, MW-17 through MW-20
	March	All Wells

Prior to the implementation of the interim status sampling and analysis plan in 1986, a few scattered and incomplete sampling records were found in Company files, but no complete continuous sampling records were found. USPCI indicated that several individuals had been doing the sampling and that there had been no continuity of personnel responsible for sampling. Company

records reflected this situation. As a result of this poor documentation, the Task Force was unable to verify the field sampling procedures prior to 1986 for the purpose of determining regulatory compliance. Records of analysis and water surface elevations required by UHWR 7.13.3 (40 CFR 265.92) must be maintained for compliance with UHWR 7.13.5 (40 CFR 265.94).

MONITORING WELLS

At the beginning of the inspection, USPCI personnel indicated which wells at Grassy Mountain were included in the interim status ground-water monitoring system. The monitoring system was evaluated for well construction and for numbers and locations of wells. Well construction for newer wells was determined to be acceptable, whereas, the complete construction details for older wells could not be determined due to insufficient information. Placement of some of the older wells was not satisfactory. The selected locations of newer wells MW-9 through MW-20 are satisfactory. These issues are discussed later in this section.

Evaluation of well construction included determining whether construction materials and well design met regulatory requirements in UHWR 7.13.2 (40 CFR 265.91). Evaluation of well locations included determining whether or not the monitoring system met requirements of UHWR 7.13.2.

At the time of the inspection, USPCI personnel could not identify precisely which wells were included in the interim status ground-water monitoring program and which wells were being used for other purposes. USPCI changed the list of wells they sample from those identified in the November 1985 sampling and analysis plan. The sampling and analysis plan needs to be updated to reflect any changes and USPCI needs to notify the State of any well additions or deletions. The USPCI hydrogeologic characterization report, submitted in May 1986, indicates that older wells MW-4, MW-6, MW-7 and MW-8 are no longer used for ground-water sampling but serve only to monitor piezometric surfaces. USPCI personnel indicated that only MW-4 and MW-8 are no longer sampled but did not say why.* The

* Telephone communication with Lee O'Laughlin, USPCI, November 5, 1986.

November 1985 sampling and analysis plan states that USPCI samples MW-4, MW-6 and MW-7. USPCI needs to clarify these discrepancies and notify UDH of which wells are included in interim status ground-water monitoring.

The entire ground-water monitoring system at the Grassy Mountain Facility consisted of 23 completed monitoring wells, designated as MW-1 through MW-23 [Table 11, Figure 8]. MW-1 through MW-8 were completed in 1981 and, until the first quarter of 1986, served as the only RCRA monitoring wells. USPCI ceased sampling MW-8 during the fourth quarter of 1985. MW-9 through MW-20 were completed in late 1985 and became part of the RCRA interim status monitoring system starting the first quarter of 1986.

In 1986, wells MW-21 through MW-23 were drilled in order to monitor the PCB landfill X regulated by the Toxic Substances and Control Act (TSCA) and EPA. USPCI samples MW-21 through MW-23 as part of the interim status monitoring program. Also in 1986, the State requested USPCI to install MW-24 and MW-25 at specific locations east of landfill cell 2 in order to confirm or refute the suspicion that landfill cell 2 was leaking. MW-24 and MW-25 were not in service in time for the Task Force inspection (June 1986).

Well Construction

The driller's construction summary is insufficient to determine that the old monitoring wells, MW-1 through MW-7, were properly constructed for compliance with UHWR 7.13.2 (40 CFR 265.91). The construction design and materials for the new monitoring wells MW-9 through MW-23 are acceptable. Information on well construction was derived primarily from the May 1986 hydrogeologic report which includes general summary descriptions from the drilling company for MW-1 through MW-7 and well design and construction specifications for MW-9 through MW-20. No construction specifications for MW-8 were provided. Information on MW-21 through MW-25 was obtained directly from USPCI. Well specifications for MW-1 through MW-25 appear in Table 12.

Table 11
USPCI INTERIM STATUS MONITORING WELLS
June 1986

Well Number	USPCI Designation	Waste Management Unit Monitored
MW-1	Upgradient	
MW-2	Upgradient	
MW-3	Downgradient	Landfill cell 1
MW-4*	Downgradient	
MW-5	Downgradient	Land treatment area
MW-6**		
MW-7*	Downgradient	
MW-8*	Downgradient	Land treatment area
MW-9	Upgradient	
MW-10	Downgradient	Surface impoundment
MW-11	Downgradient	Surface impoundment
MW-12	Downgradient	Surface impoundment
MW-13	Downgradient	Landfill cell 2
MW-14	Downgradient	Landfill cell 2
MW-15	Downgradient	Landfill cell 2
MW-16	Downgradient	Landfill cells 1 & 2
MW-17	Downgradient	Landfill cell 1
MW-18	Downgradient	Land treatment area
MW-19	Downgradient	Land treatment area
MW-20	Upgradient	
MW-21***	Downgradient	Landfill cell X
MW-22***	Downgradient	Landfill cell X
MW-23***	Downgradient	Landfill cell X

* In practice, USPCI does not sample MW-4, MW-7 and MW-8, but measures only water levels in these wells.

** MW-6 is downgradient from the land treatment area and upgradient from the industrial landfill.

*** Wells MW-21, MW-22 and MW-23 monitor a PCB landfill regulated by the Toxic Substances Control Act (TSCA), 40 CFR 761. These wells were sampled as part of the interim status program during the Task Force visit.

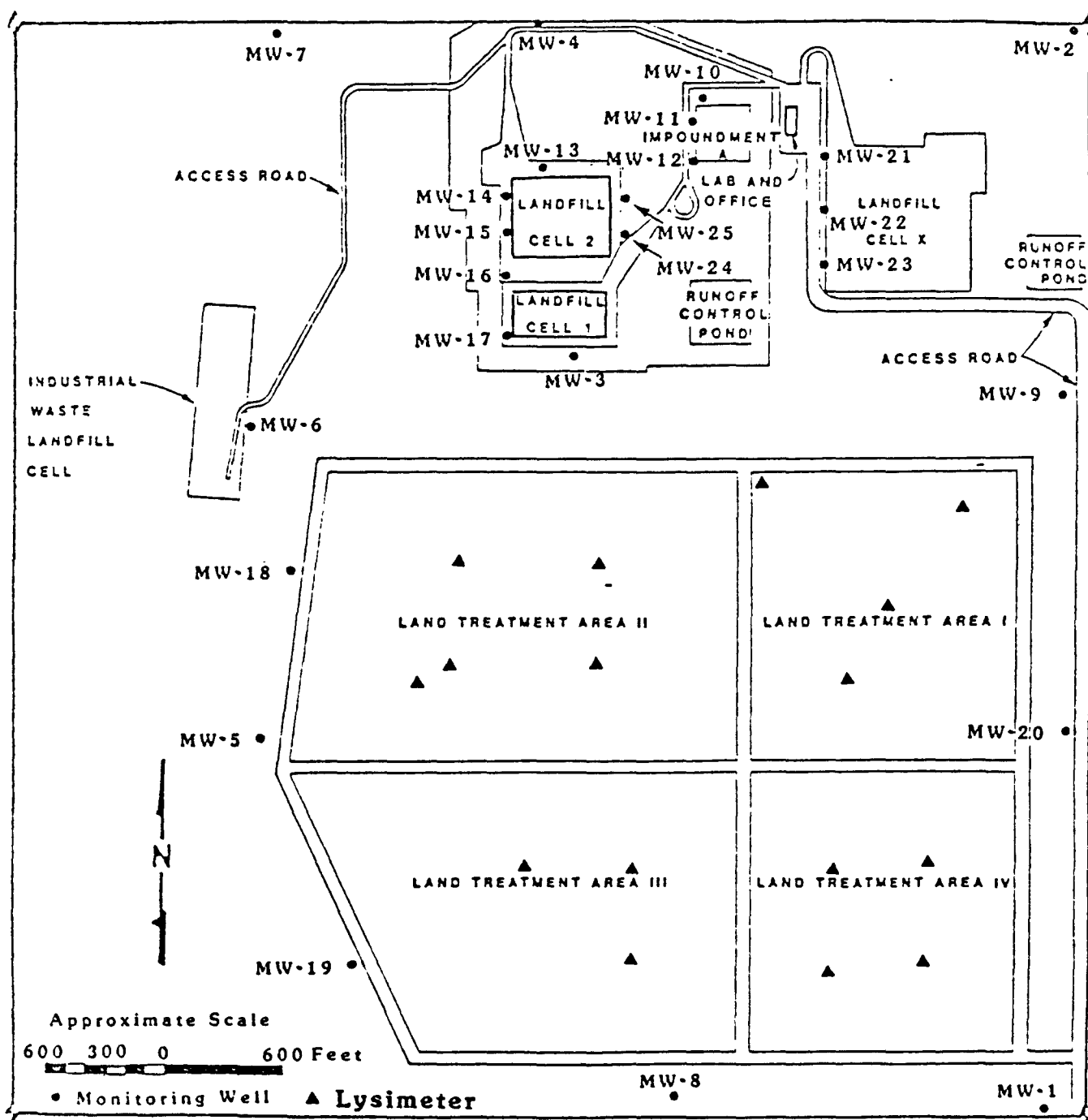


Figure 8. Monitoring Well and Lysimeter Locations
June 1986

Table 12
CONSTRUCTION SPECIFICATIONS FOR MONITORING WELLS
USPCI Grassy Mountain Facility

Well	As-Built Top of Casing Cap Elevation (ft. MSL) ¹	Depth to Water (ft.) ²	Static Water Level Elevation (ft. MSL) ³	Total Depth (ft.) ⁴	Approximate Perforated Interval (ft. to ft. MSL)	Bottom of Casing Elevation (ft. MSL)
MW-1	4240.03	7.3	4232.7	14	4236-4226	4226.03
MW-2	4240.76	8.5	4232.3	14	4237-4227	4226.76
MW-3	4244.35	11.8	4232.6	18	4236-4226	4226.35
MW-4 ⁵	4252.54	20.4	4232.1	40	4223-4213	4212.54
MW-5	4257.32	26.9	4230.4	30	4237-4227	4227.32
MW-6 ⁵	4262.34	32.8	4229.5	39	4233-4223	4223.34
MW-7 ⁵	4249.09	19.7	4229.4	34	4225-4215	4215.09
MW-8 ⁵	4244.04	11.6	4232.4			
MW-9	4238.65	5.7	4233.0	15.5	4234-4224	4223.15
MW-10	4242.82	10.6	4232.2	19.3	4234-4224	4223.52
MW-11	4242.94	10.7	4232.2	19.7	4234-4224	4223.24
MW-12	4243.26	10.6	4232.7	18.6 ⁶	4234-4224	4223.3
MW-13	4262.65	29.4	4233.3		4233-4223	4222.1
MW-14	4262.25	29.1	4233.2	40.3	4233-4223	4221.95
MW-15	4262.46	29.0	4233.6	41.2 ⁷	4232-4222	4221.26
MW-16	4262.03	28.6	4233.4	39.8	4233-4223	4222.23
MW-17	4263.18	30.1	4233.1	40.5	4234-4224	4222.68
MW-18	4249.57	17.5	4232.1	27.1 ⁶	4231-4221	4220.1
MW-19	4247.65	15.6	4232.1	26.4 ⁶	4232-4222	4220.6
MW-20	4238.16	5.5	4232.7	14.3 ⁶	4235-4225	4224.1
MW-21	4241.76	9.4	4232.4	18.8	4234-4224	4223.1
MW-22	4241.34	9.0	4232.3	18.5	4234-4224	4223.1
MW-23	4241.92	9.6	4232.3	18.9	4234-4224	4223.1
MW-24					4234-4224	4223.0
MW-25					4234-4224	4223.0

- 1 USPCI "Response to Federal Ground-Water Regulation, 40 CFR 270.14(c) Regarding Grassy Mountain Facility near Knolls, Utah," May 1986 submittal; feet above mean sea level.
- 2 Measured on June 23 through 24, 1986 during Hazardous Waste Ground-Water Task Force inspection; rounded to nearest 0.1 foot
- 3 Rounded to nearest 0.1 foot
- 4 Source: USPCI sampling personnel's field records; May 1986 submittal
- 5 Piezometric levels only
- 6 Back calculated from water level records
- 7 Back calculations from water level records indicate this well is 39.6 feet deep. USPCI was unable to provide an explanation for this discrepancy

The Task Force asked for and did not receive any detailed drilling or construction logs for monitoring wells MW-1 through MW-7. Well completion information from the driller's summary provided in the May 1986 hydrogeologic report was limited to drilled depth, casing length, perforated interval, gravel pack interval and casing materials. According to the driller's summary, wells MW-1 through MW-7 are each cased with 4-inch polyvinylchloride (PVC) casing that extends approximately 2 feet above the land surface. A 4-foot length of 8-inch steel casing protects the PVC casing at the wellhead and extends approximately 2.5 feet above ground surface. The gravel pack around the screen extends to a height of 2 feet above the screen. A bentonite pellet seal was placed in the annular space from the top of the gravel pack to ground surface. This information is insufficient to document compliance with UHWR 7.13.2 (40 CFR 265.91). Additional information that is needed includes, but is not limited to:

- The type and grain size distribution of the gravel pack
- The size of screen openings
- The casing joint fittings (i.e., are they flush-fitted screw joints, glued joints, etc.?)
- The total depth of the borehole
- Any plugged back depth of the borehole
- The borehole diameter
- The volume of gravel-pack bentonite used and the method of installation
- The well development technique

The May 1986 hydrogeologic report states that the general design specifications [Figure 9] for the casings and screens of the monitoring wells MW-9 through MW-20 are as follows (from bottom to top):

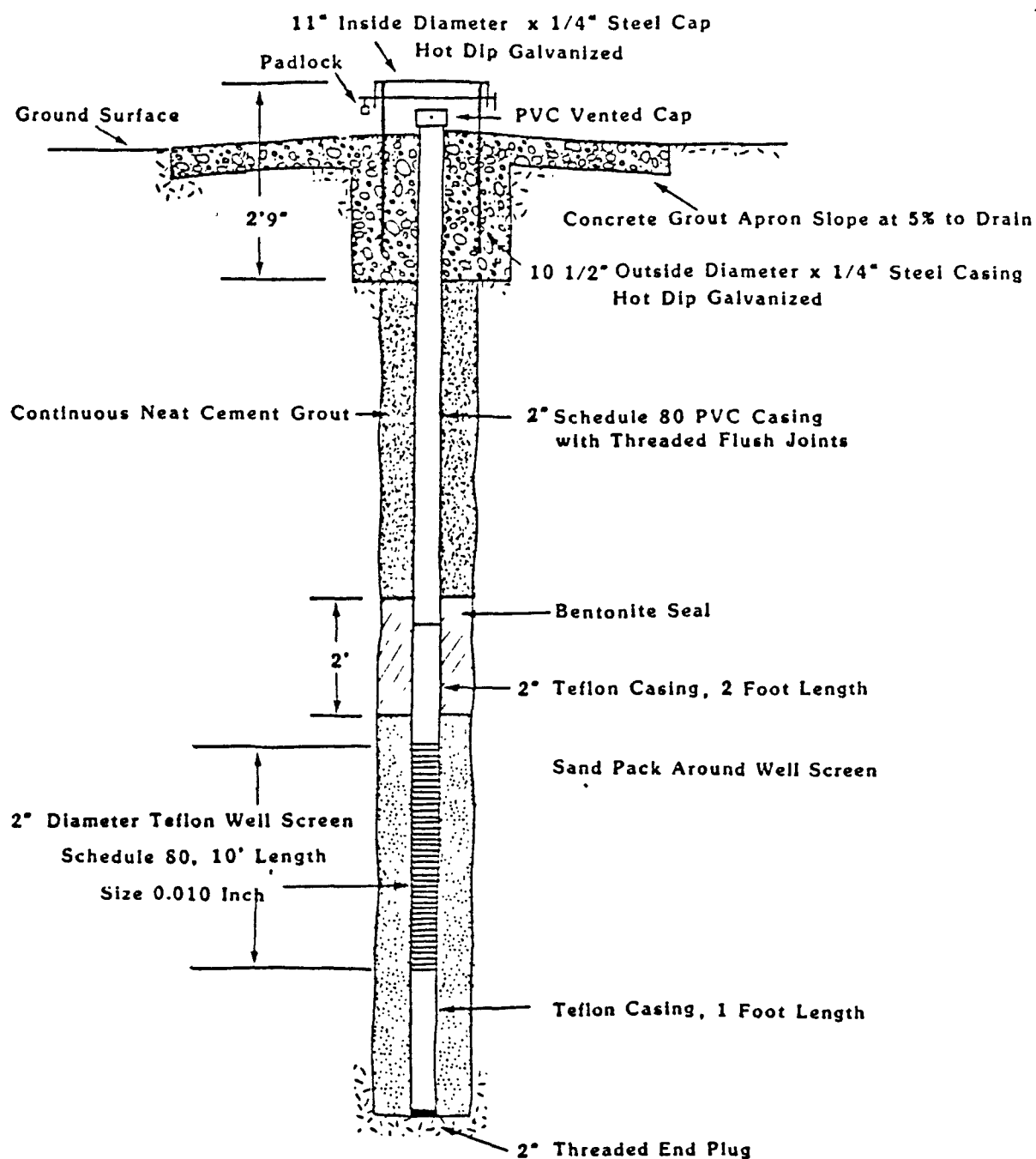


Figure 9. General Monitoring Well Construction (MW9 through MW25)

- A 1-foot blank length of Schedule 80, 2-inch diameter of Teflon casing
- A 10-foot length of Schedule 80, 2-inch diameter Teflon well screen with slot size of 0.01 inch
- A 2-foot length of Schedule 80, 2-inch diameter Teflon casing to a height of 1.5 feet above the projected high water table. The projected high water table was based upon historical piezometric data.
- A variable length (depending on the well) of Schedule 80 2-inch diameter PVC casing to a point above ground surface
- All casing/screen joints are threaded flush joints.

USPCI placed the well screens in MW-9 through MW-20 so that the open screen area would intersect the fluctuating water table.* The sand pack in the annular space opposite the well screen consists of a clean, quartz sand** placed from the bottom of the hole to a height approximately 0.5 feet above the well screen. A 1- to 2-foot sodium bentonite seal was placed in the annular space above the sand pack, followed by cement grout to within 2.5 feet of the surface. The remaining 2.5 feet of hole was enlarged and filled with cement grout that also created a concrete apron around the well at the surface. This apron both supports a lockable steel protective well covering and directs precipitation away from the well.

USPCI provided drilling construction details for MW-21 through MW-26 to the Task Force after the inspection. These wells are designed similarly to MW-9 through MW-20 (MW-26 was installed in August 1986).

* USPCI has noticed some settling of wells completed in the landfill berm (MW-13 through MW-17), so that the open screen area may no longer continuously intersect the fluctuating water table.

** Particle size gradation is provided in the May 1986 hydrogeologic report.

Well Locations

The locations of interim status ground-water monitoring wells MW-9 through MW-25 were decided by the Company and the regulatory agencies prior to installation.* The well locations were selected using guidance provided in the EPA Ground-Water Monitoring Technical Enforcement Guidance Document.¹ USPCI has not provided rationale for the locations of wells MW-1 through MW-8, however MW-1 and MW-2 provide useful background and piezometric data. MW-5 is useful for downgradient monitoring of the land treatment areas.

USPCI has located upgradient wells at a distance from waste management units so that they monitor background water quality unaffected by site activities. This conclusion is based upon the direction of the hydraulic gradient in the monitored aquifer and the distance of the upgradient wells from waste management units.

The Company has located three downgradient wells at the downgradient boundary of each waste management unit. In the cases of landfill cells 1 and 2, the surface impoundment, and PCB cell X, the downgradient wells are sufficiently close together (100 to 200 feet) to expect that they would intercept a contaminant plume issuing from the waste management unit.

The three wells downgradient from the land treatment area are approximately 1,000 feet apart. Closer spacing probably would not significantly enhance the capability to immediately detect a contaminant plume. Four lysimeters have been installed in each of the four land treatment areas to collect water samples from the unsaturated zone 36 to 48 inches below ground surface [Figure 7]. The water samples are analyzed for hazardous constituents. The lysimeters, together with soil cores, would detect these constituents long before the monitoring wells.

The 1986 hydrogeologic report provides information that suggests an aqueous plume would move slowly across the land treatment area and be

* *Stipulation and Consent Order between UDH and USPCI, October 2, 1985*

dispersed over a broad area prior to reaching the monitoring wells. For instance, the natural hydraulic gradient is very low, and the resulting potential velocity of ground-water movement is low (estimated at less than 0.1 to 10 feet per year). Much of the water beneath the land treatment area must travel a long distance to reach the monitoring wells. The land treatment area encompasses a broad area (206 acres) and is about three quarters of a mile across from east to west (the direction of ground-water movement).

As for the fate of the contaminants, piezometric data support the conclusion that net ground-water flow in the uppermost aquifer moves westward toward the mudflats, with slight diversion to the southwest and northwest toward mudflats located in those directions. These mudflats exist where ground water ultimately discharges from beneath the land treatment area. Some ground water may continue to flow beneath and beyond these mudflats.

The remote locations of monitoring wells MW-4, MW-6 and MW-7 render these wells incapable of providing immediate leak detection from any waste management units existing during the Task Force inspection. These well locations may eventually be useful for ground-water monitoring or for piezometric levels as additional waste management units become active.

USPCI SAMPLE COLLECTION AND HANDLING PROCEDURES

During the inspection, the Task Force evaluated sample collection and handling procedures practiced by USPCI personnel. The evaluation included observing water level measurements, well purging procedures, field data collection, and sample collection, preservation and shipment. USPCI procedures were evaluated for technical soundness and for compliance with the sampling and analysis plan, as required by UHWR 7.13.3 (40 CFR 265.92). The Task Force observed that in several instances, USPCI personnel did not follow the sampling and analysis plan.

The Task Force observed water level measurements during the initial onsite visit and well purging in June 1986. At this time, samples were collected from 10 wells by an EPA contractor but not by USPCI. The Task Force elected to observe routine sampling procedures by the Company during a subsequent

site visit July 9 through 11, 1986. In July, USPCI personnel did normal quarterly sampling at wells which had not been sampled by the Task Force in June. This section details procedures used by USPCI personnel during the July sampling.

At the time of the Task Force inspection, the Company was in the process of training personnel for the sampling responsibility. As a result, the field methods the Task Force observed during the July quarterly sampling were done by personnel not normally responsible for those duties and by personnel being trained for those duties.

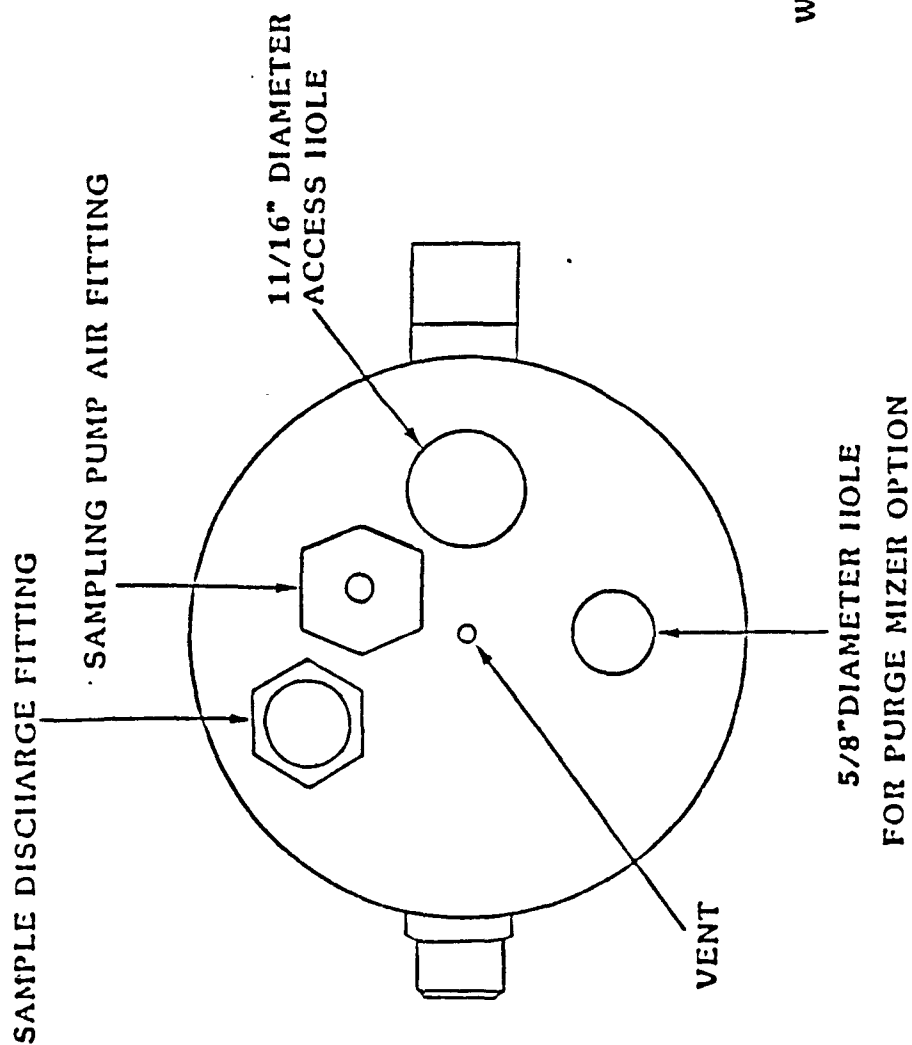
Water Level Measurements

At the wellhead, the first step USPCI followed in collecting samples was measuring depth to water using an electric water level indicator (ACTAT Olympic Well Probe, Model 150). The water level indicator consisted of a reel with electric cable and sensor equipped with a battery power supply and a buzzer. The cord had cylindrical metal weights attached below the sensor, so that the sensor was between the cord and the weights. There was no meter on the instrument and contact with water was signaled solely by the sensor activating the buzzer.

The water level indicator used was insufficient. Moisture in the well (above the water level) set off the buzzer by bridging across the sensor, thereby closing the electrical circuit and reading false water levels. The absence of an ammeter on the instrument prevented double checking the buzzer and determining whether the reading was a good one. Task Force personnel judged the accuracy of the water level measurements to be within ± 0.2 feet, based upon the repeatability of sequential measurements.

All the USPCI wells, except MW-8, had dedicated Well Wizard pumps, including a wellhead assembly from which the pumps were suspended. The wellhead assembly had an access port through which the water level sensor and cord were lowered [Figure 10]. Water levels were measured with reference to the top of the cap on the top of the well casing, which was a surveyed reference point.

a) PLAN VIEW



b) CROSS SECTION

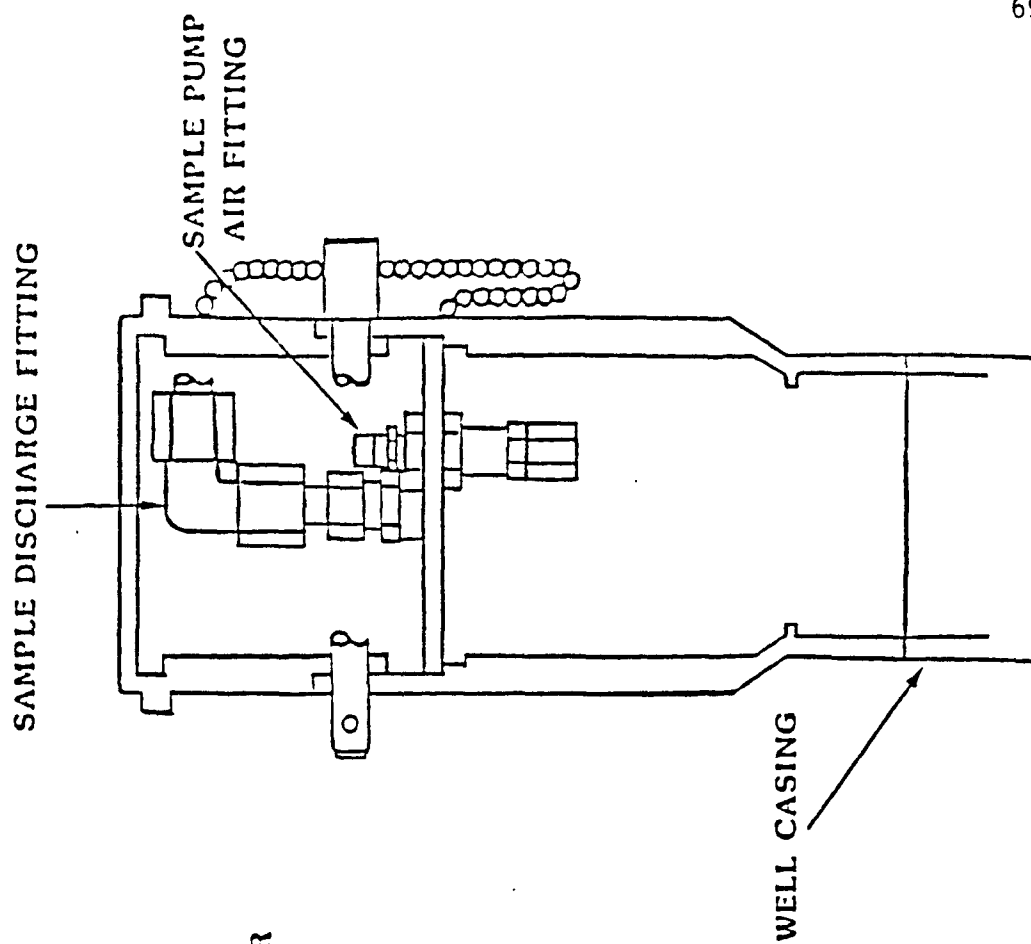


FIGURE 10. WELL CAP ASSEMBLY

The cord, which was marked in sequential 5-foot increments, was lowered into the well until the sensor reached the water, as indicated by the buzzer. The cord was then slowly raised and lowered until the point at which the sensor made contact was determined. The cord was then marked with chalk by the sampler adjacent to the lip of the access port, and the distance from the chalk mark to the next higher cord marker was measured with a measuring tape. Depth to water was calculated by subtracting the reading made with the measuring tape from the cord marker value. Water level measurements had to be repeated several times to ensure that electrical bridging across the sensor caused, for example, by humidity in the well, was not giving false readings.

Following the measurement, the entire length of cord that entered the well, the sensor and the metal weights were triple-rinsed with deionized water. The deionized water was sprayed from a squeeze bottle with a very thin spray. The thin spray was difficult to keep trained on the thin cord to the meter, thus, a triple rinse on the entire length took a long time to accomplish, and some segments of the cord may not have been adequately rinsed. A more efficient method of rinsing would ensure a better rinse.

Purging

USPCI personnel handled all wellhead equipment and purged each well during both the June Task Force inspection and the July quarterly sampling, as noted earlier. Each sampled well was equipped with a dedicated Well Wizard bladder pump and well head assembly.

The power source for operating the pumps was the 12-volt battery of one of the Company trucks attached to the Well Wizard control box with electrical jumper cables. During sampling, this truck with its attendant exhaust was positioned downwind from the wellhead. For two wells, MW-15 and MW-14, a portable generator served as the power source because there was no access available for the truck.

USPCI personnel correctly determined the volume of water in the well casing using the measured depth to water, total well depth and casing diameter (even though the sampling and analysis plan provides an incorrect method).

Total well depth data came from well construction records. Once the volume of the water column was calculated, USPCI personnel multiplied the volume by three to obtain the total amount of water to be evacuated.

Purge water was discharged into a graduated bucket in order to determine when the three water column volumes had been obtained. As the bucket filled, it was emptied into a large drum for subsequent disposal.

Field Data and Sample Collection

USPCI personnel first measured water levels in every well. They then purged all the wells. Finally they began sampling. In some cases, sampling commenced as much as 24 or more hours after purging stopped. This lag time is not necessary on all wells, as many of them recover rapidly from purging and could be sampled immediately upon completion of purging or at least within a few hours. If full recovery exceeds 2 hours, the Company needs to extract the sample as soon as sufficient volume is available for a sample for each parameter.*

During the July quarterly sampling, USPCI personnel began sampling by clearing the water line from the pump to the wellhead then collecting an aliquot of sample for making field measurements, including temperature, specific conductance and pH. USPCI had ordered a new conductance meter (YSI® Model 32) and was using it for the first time.

Both the conductance meter and the pH meter were standardized prior to making measurements on sample water. The conductance meter was calibrated with standards having specific conductance values of 24,820 and 111,900 $\mu\text{mhos/cm}$. These values are appropriate for the naturally high total dissolved solids (TDS) in ground water at this site. The pH meter was calibrated with standards having pHs in the range of 7.4 and 10.4.

* TEGD

® YSI is a registered trademark and will be shown hereafter without the ®.

For pH, the 7.4 standard was run first, then the 10.4 standard was run. The samplers did not return to the 7.4 range to double check that the instrument had not drifted after adjustment to 10.4. Since the ground water beneath the USPCI site typically has a pH around 7.1 to 7.5, the 7.4 standard should have been rechecked following the 10.4 standard.

Four replicate measurements were made for pH and specific conductance for each sample. The instrument probes were not rinsed between replicate measurements; however, the probes were rinsed with deionized water prior to replicate measuring and upon completion of replicate measuring. Specific conductance and pH are temperature-sensitive measurements.* In several instances, the sample was allowed to rest several minutes between pH and conductivity measurements and was not retested for temperature prior to the second set of measurements. Ambient temperature should be a consideration for frequent temperature correction when making temperature-sensitive field measurements of this sort.

Following field measurements, filling sample bottles commenced. USPCI 1986 quarterly sampling parameters appear in Table 13. Task Force personnel noticed the extremely rapid entry of water into the vials for volatile organics analysis (VOA). The resulting turbulence aerated the sample visibly. Aeration strips the volatile organic compounds from the sample and should be avoided to the extent possible. USPCI personnel later realized the error and reduced the rate of flow into subsequent VOA bottles.

USPCI sampling personnel wore latex surgical gloves to minimize the potential for sample contamination. These gloves were promptly changed upon contact with foreign surfaces; however, the Task Force observed that the samplers sometimes touched the inside surfaces of bottle caps with their gloves, including the septa inside the caps of the volatile organics bottles when the septa jarred loose from the cap. No effort was made to replace the caps or use a different bottle. The samplers need to take care not to touch the insides of the sampling containers with anything other than the sample itself in order to minimize contamination from outside sources.

* Standard Methods for the Examination of Water and Wastewater, 15th edition, 1980.

Table 13
USPCI QUARTERLY SAMPLING PARAMETERS*

Parameter	Container	Preservative
Volatile Organics	3 60-ml glass vials	Iced
Appendix VIII, TOX	1-gallon amber glass	
Total Organic Carbon/Hardness	250-ml clear glass	H ₂ SO ₄
Phenols	250-ml clear glass	H ₃ PO ₄ /CuSO ₄
Metals	1-liter plastic	HNO ₃
Total Dissolved Solids/Alkalinity/ Anions	1-liter plastic	

* Parameters sampled when the Task Force observed USPCI's quarterly sampling on July 9 and 10, 1986. USPCI sampled these parameters because they were in assessment monitoring during 1986. UDH and EPA Region VIII selected the parameters.

A number of the monitoring wells were equipped at the wellhead with dedicated Teflon sampling tubing; however, the Task Force noted that in at least two instances, a length of tubing was reused at consecutive wells without being decontaminated between wells. This practice introduces the possibility of cross-contamination between wells and should be discontinued. Sampling tubes should be either dedicated to the well or cleaned between wells.

In the final quarter of 1985, USPCI began keeping a bound logbook of each sampling event. This log contains information on weather conditions, wellhead conditions, field measurements and any extenuating circumstances that might affect sampling. The sampling log should also document the types of field instruments used and any changes in instrumentation. Documentation of early 1986 sampling was erratic. USPCI needs to establish a standard format

and completely document all sampling. Documentation of the July 1986 sampling was complete and correct.

Generally speaking, sampling practices at the USPCI facility are good, with the exception of the deficiencies mentioned above. In the future, sampling personnel need to pay close attention to the details of proper sample handling and maintaining sample integrity.

Shipping and Chain-of-Custody

Quarterly samples going to the USPCI-owned NAL laboratory in Tulsa, Oklahoma were preserved as necessary, placed in ice chests on ice and sealed for shipping. A chain-of-custody form and analytical request sheet accompanied each shipment. Copies of these completed documents are kept onsite. Copies of the chain-of-custody forms were provided to Task Force personnel. These forms contained spaces for the necessary information but were not always completed properly. Several lacked notations for the number of sample bottles in the shipment for each parameter. Sample bottle numbers, specific to each bottle, were not always recorded.

Sampling and Analysis Plan

Task Force personnel observed USPCI sampling procedures for adherence to the November 1985 sampling and analysis plan. USPCI samplers used the November 1985 sampling and analysis plan for the third quarter sampling in July 1986. Task Force personnel noticed that USPCI personnel did not follow the plan on several points, thereby failing to comply with UHWR 7.13.3 (40 CFR 265.92).

The samplers did not use a pH buffer in the 4.0 to 5.0 range of standard in the field, as indicated by the plan. The samplers did not return to pH 7.4 buffer after standardizing the meter at pH 10.4, as indicated by the plan, but instead standardized at 7.4 first.

The Company did not follow the plan with respect to the preservative for phenols. The plan states that phenols will be preserved with sulfuric acid

(H₂SO₄), but shipping forms and labels on sample bottles from the USPCI-NAL laboratory specify the use of phosphoric acid and cupric sulfate (HPO₃/CuSO₄). When asked about this discrepancy, USPCI personnel indicated they will follow laboratory instructions until the discrepancy is resolved in order to prevent laboratory error regarding analysis of samples and blanks. This temporary solution was acceptable, however, better communication with the laboratory needs to be established so that the sampling and analysis plan reflects what is actually done. In other words, follow the plan. Either preservative is acceptable; however, the preservative listed in the plan should either be changed to HPO₃/CuSO₄, or H₂SO₄ (as indicated in the plan) should be the preservative used for phenols.

USPCI allowed a day's samples to wait overnight and through the following day before shipment; thus, they did not follow the schedule for shipment in the plan. The plan states that samples will be shipped immediately after collection and packing.

SAMPLE ANALYSIS AND DATA QUALITY EVALUATION

The sample analysis and data quality evaluation for NAL are in Appendix A. The analyses and data evaluation for Task Force samples are in Appendix B.

GROUND-WATER QUALITY ASSESSMENT PROGRAM

The Grassy Mountain facility entered a year of ground-water assessment monitoring in the first quarter of 1986. The following summary provides details of events leading up to the initiation of assessment monitoring and following its implementation.

On November 13, 1985, USPCI notified the Utah Solid and Hazardous Waste Committee that they had measured statistically significant elevated levels of total organic carbon (TOC) in MW-3. USPCI also had measured elevated TOC in upgradient and other downgradient wells on an irregular basis, with no apparent pattern. Quarterly sampling data from December 9, 1985 showed continued elevated TOC in MW-3.

On December 12, 1985, UDH notified USPCI by letter that the ground-water quality assessment plan was overdue and should have been submitted within 15 days of the initial notification under UHWR 7.13.4 (40 CFR 265.93). UDH formally requested that USPCI submit the plan. USPCI responded by resubmitting their sampling and analysis plan on January 8, 1986.

The sampling and analysis plan does not meet the basic requirements for assessment monitoring under UHWR 7.13.4 (40 CFR 265.93). The plan does not:

- Specify clearly for which organic compounds samples will be analyzed
- Specify the appropriate methods of analysis for organic compounds
- List and identify detection limits that NAL is capable of achieving for the analyzable compounds
- Include any evaluation procedures for the ground-water monitoring data, including analytical and water level data
- Make provisions for determining the rate and extent of migration of the hazardous waste or hazardous waste constituents in the ground water
- Include complete and legible well construction specifications

In effect, the USPCI Grassy Mountain facility had no ground-water quality assessment plan, as required by UHWR 7.13.4 (40 CFR 265.93). Neither did the facility have an outline of a ground-water quality assessment program, as required by UHWR 7.13.4 (40 CFR 265.93).

USPCI did, however, comply with instructions from UDH and EPA to sample and analyze for selected* organic compounds quarterly during

* Organic compounds to be analyzed for were selected by UDH and EPA Region VIII.

assessment monitoring in 1986. In this respect, USPCI was following the agency directives for assessment monitoring.

GROUND-WATER MONITORING PROPOSED FOR FINAL PERMIT

This section presents an evaluation of the ground-water monitoring program at Grassy Mountain as proposed for the final permit under UHWR 8.6 (40 CFR 264 Subpart F). The section also includes proposed changes in the ground-water monitoring system associated with expansion of hazardous waste disposal activities at Grassy Mountain.

USPCI received two notices of deficiency for their Part B permit application from UDH. With the second one, UDH included a compliance schedule for the permitting process. The compliance schedule included submission of the hydrogeologic characterization report, which UDH received in May 1986. The three-volume report includes plans for a ground-water monitoring program proposed for the final permit and was intended to be part of the Part B application. Because of the remote locations of MW-4, MW-6 and MW-7, these wells may not provide useful monitoring coverage for those units existing during the Task Force inspection. The Task Force evaluated the ground-water program proposed in this report with UHWR Part III criteria (40 CFR 270).

The report outlines a detection monitoring program pursuant to UHWR 8.6.9 for the uppermost aquifer and describes the proposed monitoring well network, monitoring parameters, sample analysis, sample collection and data evaluation. The following discussion reflects the Task Force conclusions on these items.

PROPOSED MONITORING WELL NETWORK

As USPCI expands operations, the number of wells in the detection monitoring program, under the permit, will increase above that in the interim status monitoring program. UDH and EPA Region VIII propose that dedicating wells to monitor each regulated unit is preferable to monitoring all the units as a group. This approach optimizes the chances of detecting leakage from individual units. Considering the low hydraulic gradient, the regulatory agencies also propose the placement of monitoring wells so that they circumscribe the landfill cells (as opposed to downgradient only) in order to

provide better detection coverage radially in the event a leak occurs through a cell liner.

Wells MW-4, MW-6 and MW-7 are several hundred feet from waste management units and cannot provide immediate detection of leakage; however, they may provide useful water level data and periodic ground-water quality data. USPCI is justified in proposing to delete them from the required detection monitoring program under UHWR 8.6.9 (40 CFR 264.98) as long as expanded operations do not require these monitoring well locations and hazardous constituents have not been detected in wells located next to the waste management units.

For reasons stated in the section entitled "Well Construction," USPCI was unable to demonstrate that monitoring wells MW-1 through MW-8 were in compliance with UHWR 7.13.2 (40 CFR 265.91). Special consideration of the construction of these wells needs to be given by the regulatory agencies prior to including these wells in a ground-water monitoring program under the permit.

As for the land treatment areas, the existing, downgradient monitoring wells in the saturated zone combined with the total of 16 lysimeters in the unsaturated zone should be adequate for compliance with 40 CFR 264.278 (in lieu of UHWR 8.13.19 which, when written, will be the State's corresponding regulation for unsaturated zone monitoring beneath a land treatment area), and UHWR 8.6.8 and 8.6.9 (40 CFR 264.97 and 264.98).

The Task Force agrees with the identification of the "shallow brine aquifer" as the uppermost aquifer, as defined by UHWR Part 1 (40 CFR 260.10). Wells completed in appropriate locations in this aquifer would detect leakage earlier and more reliably than if they were completed in deeper, less permeable sediments.

The proposed design for future monitoring well construction is acceptable. USPCI should, however, provide to the State and EPA legible well construction diagrams that completely show the design and position of each well. The diagrams provided to the Task Force were not completely legible and complicated the verification of well specifications.

PROPOSED SAMPLING AND ANALYSIS PROGRAM

Although the facility was in assessment during the inspection, leakage to ground water from hazardous waste units has not been substantiated. Whether or not the bottom liner has leaked hazardous constituents to the ground water needs to be supported or refuted prior to selecting a ground-water monitoring program for the final permit.

Analysis of samples from the secondary leachate detection system, located between the two synthetic liners of landfill cell 2, indicates that the upper liner has failed. USPCI should be prepared to implement a compliance monitoring program under UHWR 8.6.10 (40 CFR 264.99) in case the second, lower liner of cell 2 or liners of other units fail.

The list of proposed analytical parameters is too comprehensive and includes some compounds that are not analyzable by GC/MS. USPCI should develop a list of parameters they can analyze.* Leachate analysis would provide guidance as to which chemical compounds or species USPCI should monitor in ground water. Detection limits that are attainable by the NAL laboratory need to appear with each analytical parameter listed.

The analytical procedures used to date by NAL have been judged by the Task Force to be incapable of accurately measuring hazardous constituents in ground-water samples or of providing a reliable indication of ground-water quality [Appendix A]. NAL personnel should assess their laboratory capabilities and protocols and propose analytical methods that they can do properly.

The inconsistent sampling procedures that existed prior to the Task Force inspection cannot ensure monitoring results that provide a reliable indication of ground-water quality. USPCI has taken steps to correct this problem by devising a sampling and analysis plan (the deficiencies in this plan have been discussed in the section entitled "Ground-Water Monitoring Program During

* EPA requires a list [Appendix IX] of compounds that can be analyzed (Federal Register, Vol. 52, No. 131, July 9, 1987, 25942).

Interim Status"). USPCI needs to ensure consistent sampling and analytical procedures to comply with UHWR 8.6.8 (40 CFR 264.97).

USPCI has proposed to evaluate ground-water analytical data statistically using the Chemical Manufacturers' Association (CMA) standard t-test. This procedure is inappropriate for USPCI as it does not take into account other variables at Grassy Mountain, such as the naturally high salts in the ground water and the apparently natural fluctuations in ground-water quality. USPCI should propose an evaluating method that accounts for this variability.

EVALUATION OF MONITORING DATA FOR INDICATIONS OF WASTE RELEASE

This section presents an analysis of the Task Force monitoring data regarding indications of apparent leakage from the waste management units. Analytical results from and methods used on samples collected by Task Force personnel are presented in Appendix B. Ground-water samples collected by the Task Force are identified in Table 14. Locations of leachate sumps sampled are described in Table 15.

Task Force data do not indicate the presence of organic compounds in the 10 wells sampled. The organic analyses do not detect ground-water contamination. The analytical results for inorganics may reflect interferences from the naturally high salts in the ground water, thereby making these results unreliable.

Collectively, both organic and inorganic chemical analyses of leachate provide evidence that the upper liner of landfill cell 2 has been breached in one or more places and that hazardous waste constituents have migrated between the two liners [Table 16]. In particular, leachate samples from sumps 3-B and 4-B show elevated concentrations of compounds one would not expect to see if the liner were an effective partition separating hazardous waste constituents from the leachate detection sumps. Followup sampling and analysis may be desirable to confirm or refute this conclusion.

The organic constituent analysis results of samples from the leachate detection system in cell 2 indicate the presence of elevated levels of several organic compounds. Methylene chloride was detected at 1200 µg/L in sump 3-B and 245 µg/L in 2-B, whereas concentrations in 1-B and 4-B were much lower at 36 and 31 µg/L, respectively. The compounds 2-butanone (970 µg/L) and acetone (270 µg/L) were detected in sump 4-B, but were not detected in the other sumps of cell 2.

Table 14
MONITORING WELLS SAMPLED BY
TASK FORCE

Well	Sample Number
MW-3	MQ0545
MW-7	MQ0539
MW-9	MQ0548
MW-10	MQ0537
MW-11	MQ0536
MW-13	MQ0541
MW-14	MQ0540
MW-15	MQ0543
MW-16	MQ0549
MQ-17	MQ0550

Table 15
LEACHATE SAMPLE LOCATION DESCRIPTIONS

Unit	Sump Designation	Location	Sample Number
Cell 1	Cell 1	Southern end of Cell 1	MQ0396
Cell 2	1-B	Northeast corner	MQ0394
Cell 2	2-B	Southeast corner	MQ0395
Cell 2	3-B	Southwest corner	MQ0393
Cell 2	4-B	Northwest corner	MQ0392
Surface Impoundment	----	West end	MQ0538

Table 16
SELECTED COMPOUNDS FOUND IN LEACHATE SAMPLES FROM THE
LEACHATE DETECTION SYSTEM OF CELL 2*

		Sumps			
Units**		1-B	2-B	3-B	4-B
<u>Organic Constituent Analysis</u>					
Methylene Chloride	µg/L	36	245	1200	31
2-Butanone	µg/L	ND	ND	ND	270
Tetrahydrofuran	µg/L	850	1100	240	7800
Phenol	µg/L	ND	ND	1500	ND
2-Methylphenol	µg/L	ND	ND	980	ND

<u>General Analysis</u>					
Purgeable Organic Halogens (POX)	mg/L Cl	27	34	840	160
Nonpurgeable Organic Carbon (POC)	mg/L C	43	57	223	91

<u>Metals Analysis</u>					
Chromium, Cr	µg/L	34	34	20,000	684
Iron, Fe	µg/L	67	37	280	13,200
Potassium, K	µg/L	259,000	221,000	1,560,000	240,000

* Complete analytical results appear in Appendix B.

** µg/L, micrograms per liter; mg/L, milligrams per liter; C, Carbon; Cl, Chloride.

Tetrahydrofuran was detected in each of the sumps of cell 2, ranging from 240 µg/L in sump 3-B to 7800 µg/L in sump 4-B. The presence of tetrahydrofuran in Task Force samples was confirmed by an independent NEIC laboratory analysis.

Phenol and 2-methylphenol were detected in sump 3-B at 1500 µg/L and 980 µg/L, respectively, but were not detected in sumps 1-B, 2-B and 4-B.

Leachate analyses for 3-B also indicate elevated purgeable organic halogens (POX) at 840 µg/L Cl and 160 µg/L in 4-B. The presence of POX beneath the upper liner is significant because most halogenated organics rarely

occur in nature.* Consequently, the Task Force concludes that the occurrence of purgeable organic halogens at such levels in the leachate detection system suggests that the upper liner in cell 2 has leaked.

The level of nonpurgeable organic carbon (NPOC) in sump 3-B (223 mg/L) exceeds those levels in 1-B (43 mg/L) and 2-B (57 mg/L) by about four times and is two times higher than the NPOC in 4-B (91 mg/L). The analytical results for NPOC show a similar pattern to that exhibited by POX, supporting the conclusion that the upper synthetic liner has been breached, probably somewhere in the western half of cell 2.

Task Force data indicated elevated chromium levels in leachate detection sump 3-B in the southwestern quadrant of cell 2 (20,000 µg/L) and in sump 4-B in the northwestern quadrant of cell 2 (684 µg/L). By contrast, analyses of leachate samples from the northeastern and southeastern quadrants (1-B and 2-B, respectively) each indicate chromium in a concentration of 34 µg/L. The leachate analysis for unlined cell 1 indicates chromium at 134 µg/L.

Iron in leachate sump 4-B was measured at 13,200 µg/L, 47 times the concentration of iron (Fe) in 3-B (280 µg/L) and more than 150 times the concentration of iron in 1-B and 2-B. The cause of elevated iron in 4-B is unknown.

The leachate sample from sump 3-B had a potassium concentration of 1,560,000 µg/L, which is seven times greater than in other sumps of cell 2. Although potassium is not listed in 40 CFR 261 as a toxic metal, the higher levels in 3-B suggest the leachate in that sump has been affected by potassium-bearing waste streams in the landfill cell.

Samples from ground-water monitoring wells near cell 2 do not show chemical evidence that the bottom liner has leaked.

* Takahashi, Y; Moore, R.T.; and Joyce, R.J., "Measurement of Total Organic Halides (TOX) and Purgeable Organic Halogens (POX) in Water Using Carbon Absorption and Microcoulometric Determination," *Chemistry in Water Reuse*, Volume 2, 1981

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4. USPCI, 1985 "*Grassy Mountain Facility, EPA Biennial Report*" (RCRA Annual Report).
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APPENDICES

- A USPCI SAMPLE ANALYSIS AND DATA QUALITY EVALUATION
 - B ANALYSIS AND DATA EVALUATION FOR TASK FORCE
SAMPLES
-

APPENDIX A
USPCI SAMPLE ANALYSIS AND DATA QUALITY EVALUATION

Appendix A

USPCI SAMPLE ANALYSIS AND DATA QUALITY EVALUATION

This section provides an evaluation of the quality and completeness of ground-water monitoring data gathered by USPCI between March 1982 and June 1986. Mideco Laboratories performed analyses for the first quarter of 1982 and Ford Laboratories provided analyses for the second quarter. National Analytical Laboratories (NAL) has been responsible for the analytical work for USPCI since August 1982. USPCI personnel at the site performed some measurements for specific conductance and pH. NAL was evaluated concurrently with the onsite inspection of the USPCI facility. During the laboratory evaluation, operating and analytical procedures, internal data reports, raw data and quality control records were reviewed and analytical equipment was examined.

The inspection revealed analytical inadequacies and found that much of the monitoring required in 1982 and 1986 has not been performed. Most analytical inadequacies stem from improper sample handling or calibration procedures, the lack of quality control measures, and/or not accounting for the high dissolved solids content of the sample. The initial year of required background quarterly monitoring conducted in 1982 was incomplete as was the monitoring conducted in 1986. These inadequacies adversely affected the reliability of data in establishing background levels or in detecting releases into the ground water. A detailed discussion of these inadequacies is given in the following sections.

Ground-Water Analysis, 1982 through 1985

UHWR 7.13.3 (40 CFR 265.92) requires quarterly monitoring of all wells during the initial year to establish background values. Quarterly monitoring of the upgradient wells must include quadruplicate measurements of the four parameters used as indicators of ground-water contamination (pH, specific conductance, TOC and TOX). In March 1982 USPCI initiated quarterly monitoring pursuant to 7.13.3.(c) on the RCRA well network. The network included upgradient wells 1 and 2 and downgradient wells 3 through 8. UDH

required USPCI to restart background monitoring at the beginning of 1983, because of the incompleteness and the poor data quality of the 1982 monitoring.

The first year of background water quality monitoring in 1982 was incomplete. The required quadruplicate measurements for the four indicator parameters for upgradient wells were not reported. Background monitoring results for the required pesticides, herbicides and the radiochemical parameters were not reported at all (UHWR 7.13.3 and 40 CFR Part 265.92). Fluoride, nitrate and pH were not reported for the fourth quarter. TOC and coliform were not reported for the first and second quarters and TOX was not reported for the third and fourth quarters. Silver was not reported in the fourth quarter of 1982 and chromium was not reported for the first quarter of 1983. Subsequent monitoring through 1985 monitoring was complete; all monitoring suffered analytical deficiencies.

Holding times for pH measurements were exceeded. Between November 1983 and August 1984, pH was measured after samples were shipped to NAL in Oklahoma rather than analyzed on site. Prior to 1984, the EPA-recommended holding time was 2 hours. Since 1984, EPA has recommended that samples be analyzed immediately. Due to the susceptibility of pH to change with time for ground water samples, the pH results for November 1983 to August 1984 are unreliable.

Specific conductance results are suspect. Cell constant corrections have not been made for the measurements. Further, standards to establish the cell constant were not within the same range as the samples. The lack of these measures causes bias in the results. A detailed explanation of cell corrections can be found in Standard Methods, 15th edition, and in the instruction manual for the particular instrument.

The standard TOX method can often achieve a detection limit of between 5 µg/L and 30 µg/L; however, the high chloride levels in the site ground-water samples would prevent such a detection limit from being achieved. High chloride levels can cause TOX results to be biased high. Typically 50 mg/L chloride could cause an apparent TOX of 1 mg/L. Some of the ground-water

samples have been found to contain as much as 50,000 mg/L chloride. Such samples could cause an apparent TOX of 1,000 µg/L.

Some of the samples also have a high turbidity which infers high suspended solids. In 1982, at least some of the samples were filtered prior to analyzing for TOX. Between 1982 and the beginning of 1986, records do not clearly indicate if samples were filtered or not. Filtering could cause TOX values to be biased low due to the loss of volatile organics and the sorption of dissolved organics. However, TOX could be biased high if the particulate matter contained chloride and it is not removed. Further, the high sodium content of these samples can cause the quartz furnace of the TOX analyzer to deteriorate resulting in a negative bias for TOX measurements.

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

TOC was determined by acidifying and purging samples prior to analysis. The results for this type of measurement are best termed nonpurgeable organic carbon (NPOC) as the purging not only eliminates inorganic carbon from the measurement but also purgeable organic carbon (POC). To indicate that NPOC results are equivalent to TOC results would require the measurement of POC to establish that POC does not contribute significantly to the TOC.

Mercury has been exclusively determined by cold vapor atomic absorption spectroscopy. Prior to 1983, NAL used sodium borohydride as the reductant. The EPA method uses stannous chloride. NAL personnel indicated that they started using stannous chloride as the reductant for the mercury determinations sometime in 1983.

Mercury was detected in only two quarters. In the last quarter of 1982, all well samples were reported to contain mercury at concentrations in excess of the drinking water standard of 2 µg/L. The reported values ranged from 3 µg/L to 6 µg/L. In the next sampling in March of 1983, five well samples were reported to contain mercury at concentrations ranging from 0.4 µg/L to 2.5 µg/L. Previous and subsequent to these two instances, mercury was not detected. The positive results observed for these two samplings are probably due to systematic error caused by the laboratory and probably do not represent actual concentrations in the well samples. The error may have been caused by the use of the sodium borohydride reductant or could possibly be introduced, as NAL did not take steps to eliminate interference due to the formation of chlorine from chloride during the oxidative digestion in the procedure.

Many of the determinations for the other metals or elements are unreliable because the high dissolved solids content of the ground-water samples have caused serious interference. Atomic absorption spectroscopy techniques were exclusively used for metals determinations, except barium, until 1985. The high salt concentration causes so much molecular background that the analyte atomic absorption signal cannot be distinguished reliably by the furnace background correction instrumentation. Further, ionization interference would have been severe for the flame technique.

In 1983, NAL started to use Zeeman background correction furnace atomic absorption spectroscopy for some of the metals determinations. The Zeeman technique can compensate for larger molecular interference than the continuum background correction system used previously. However, the implementation of the Zeeman technique did not resolve all the sample matrix effects and much of the data are unreliable.

In 1985, NAL started to use Inductively Coupled Argon Plasma Optical Emission Spectroscopy (ICP) instead of Atomic Absorption Spectroscopy for some of the other metals determinations. ICP is also subject to interferences due to high dissolved solids. The ICP background generally increases with increasing dissolved solids content and signal to concentration calibration changes with increasing dissolved solids which is partially due to changes in the sample introduction rate and changes in the plasma emission profiles of the

analytes. Apparently cognizant of the problems with high dissolved solids in ICP analyses, NAL analyzed dilutions of samples. Diluting the sample will help to eliminate interference but dilution compromises the detection limit. Typically, ICP can often achieve detection limits of 2 µg/L for cadmium and 30 µg/L for lead. At the 1:10 dilution used by NAL, the detection limits for cadmium and lead would at least have been 20 µg/L and 300 µg/L, respectively. Both detection limits exceed the respective drinking water standards for cadmium and lead and are not low enough to reliably establish background levels for ground water.

The ground-water sample matrices challenge many of the commonly used methods for metals determinations. Reliable results that established background levels have not been obtained using these methods. Methodology common to low level determinations in seawater could possibly provide such results. Extraction and coprecipitation isolation techniques are used prior to atomic absorption or ICP spectroscopic analysis. Direct analysis without the use of isolation techniques may prove successful. The method of standard additions in an ICP analysis for barium, cadmium, chromium, iron, sodium and silver would be a possibility. Alternately, exact matching of the calibration standards to the ground-water sample matrix for ICP analyses may be appropriate. ICP analysis of dilutions for barium, iron and sodium may be successful. Cadmium, chromium, lead and silver could probably be determined by furnace atomic absorption spectroscopy. The use of Zeeman background correction, the L'vov platform, matrix modifiers possibly including palladium and ascorbic acid, as well as appropriate dilutions should facilitate the furnace technique analyses. Arsenic and selenium could be determined by hydride generation atomic spectroscopy. Mercury should continue to be determined by cold vapor atomic absorption spectroscopy although purging of the digests prior to the addition of the reductant should be employed to circumvent possible interference due to the formation of chlorine. The use of any technique must be predicated on achieving detection limits well below the drinking water standards established in UHWR, Appendix E (40 CFR 265, Appendix III).

A number of laboratory records for metals and pesticides determinations that were performed for ground-water samples prior to and around mid-1985 could not be located by NAL personnel. A large turnover in both analysts and

managers at NAL has resulted in some discontinuity in the way samples have been processed at the lab since early 1983. The lack of records for the pesticide determinations prevented evaluation of the data quality for these parameters.

Data reported for the phenoxy acid herbicides, 2,4-D and Silvex, are not reliable. The method used would not detect the herbicides present in the ester form. A reliable method, such as the one recommended under the Safe Drinking Water Act, would detect the herbicides present in both the acid and ester forms. Problems with the method are illustrated when NAL failed to achieve acceptable results for 2,4-D in a State of Kansas performance evaluation for drinking water certification in 1984.

Gross alpha and gross beta activity measurements have been made subsequent to 1982. Many of the gross alpha values are reported as not detected at the maximum contaminant level of 2 pCi/L (40 CFR Part 265, Appendix III). This detection limit is achievable for samples containing low levels of dissolved solids, but not for samples containing percent levels of dissolved solids. Analytical methods require the use of smaller aliquots of samples containing high levels of dissolved solids resulting in increased detection limits. For samples containing 50,000 mg/L dissolved solids a detection limit of about 100 pCi/L gross alpha and 200 pCi/L gross beta would normally be achieved. Thus the gross alpha and gross beta data as reported are not reliable.

NAL personnel indicated that some of the resulting distillates from the phenol determinations were noticeably turbid. The colorimetric analysis of a turbid distillate could cause a high bias and may account for the anomalous detection of phenol in some of the samples. NAL was planning to use the chloroform extraction procedure which should circumvent the turbidity interference for future determinations.

Ground-water Analysis Commencing January 1986

USPCI restarted background ground-water quality monitoring at the beginning of 1986. The new sampling and analysis plan called for monitoring

wells 1 through 7 and wells 9 through 20. Parameters were added to those included in previous sections of this report. No results could be found for well 5 during the first quarter of 1986. According to UDH, only volatile and semivolatile organic compounds were reported for the second quarter of 1986 for all the wells. All other analyses required by the sampling and analysis plan were not reported (e.g., metals were not reported for the second quarter).

Most of the laboratory findings discussed in the previous section are also applicable to the 1986 data, as most of the methods did not change. Determinations still lacked adequate quality control measures. NAL used gas chromatography/mass spectrometry (GC/MS) methods for the pesticides determinations rather than the gas chromatography methods used previously. The GC/MS methodology cannot achieve detection limits below drinking water standards and thus can not reliably establish background levels. NAL was using a more appropriate method (including the ester form) for herbicide determinations at the time of the Task Force inspection.

The volatile and semivolatile organic results for the first two quarters of 1986 should be considered unreliable. Methods 624 and 625* were cited as being used, however, the cited methods were not properly followed. Accuracy and precision control measures required by the methods were not properly implemented or evaluated. For example, the mass spectrometer was not properly calibrated for the Method 624 analyses. Bromofluorobenzene (BFB) was not used to check the instrument calibration, as required. In addition, purgeable gases could not be detected at concentrations at least 20 times the normal method detection limit of 5 µg/L. Reported GC/MS detection limits should be considered an estimate as they were taken from the published method without having performed the actual determination required by the methods.

Reportedly, during 1986, TOX samples were not filtered as is proper. Other comments relative to TOX, as presented in the section above, continue to apply.

* 40 CFR Part 136

APPENDIX B

ANALYSIS AND DATA EVALUATION FOR TASK FORCE SAMPLES

II. Evaluation of Quality Control Data and Analytical Data

1.0 Metals

1.1 Performance Evaluation Standards

Metal analyte performance evaluation standards were not evaluated in conjunction with the samples collected from this facility.

1.2 Metals OC Evaluation

Total metal spike recoveries were calculated for twenty-three metals spiked into two ground-water samples (MQO539 and 546) and two leachate samples (MQO392 [graphite furnace metals only] and MQO393 [ICP metals and mercury only]). Six average spike recoveries from the ground-water samples and eight individual spike recoveries from the leachate samples were within the data quality objectives (DQOs) for this Program. Spike recoveries for four of the metals from the ground-water samples and seven of the metals from the leachate samples were not calculated because the sample concentrations were greater than four times the concentration of spike added. In the ground-water samples, the cadmium, lead, and selenium average spike recoveries were above DQO with values of 560, 3250, and 440 percent, respectively. The barium, beryllium, chromium, cobalt, copper, manganese, nickel, silver, thallium, and zinc average spike recoveries were below DQO with values of 18, 69, 70, 67, 45, 37, 66, 0, 26, and 69 percent, respectively. Various individual metal spike recoveries from the ground-water samples were also outside DQO. These are listed in Table 3-2a of Reference 2 as well as in the following Sections. In the leachate samples, arsenic, cadmium, lead, and manganese spike recoveries were above DQO with values of 240, 226, 444, and 188 percent, respectively. The barium, mercury, silver, and thallium spike recoveries were below DQO with values of 25, 16, 26, and 57 percent, respectively. Only one leachate sample was spiked for each metal. Sample MQO392 was spiked for the furnace metals and sample MQO393 was spiked for the ICP metals.

All reported laboratory control sample (LCS) recoveries and all calibration verification standard (CVS) recoveries were within Program DQOs.

The average relative percent differences (RPDs) for all metallic analytes in both ground water and leachate, except selenium in a leachate sample, were within the DQOs.

Required analyses were performed on all metals samples submitted to the laboratory.

No contamination was reported in the laboratory or sampling blanks.

1.3 Furnace Metals

The furnace metals (antimony, arsenic, cadmium, lead, selenium, and thallium) quality control, with a few exceptions, was acceptable. The traffic reports for samples MQO549 and 550 were not included in the data package from the laboratory.

B-2

All antimony results, with the exceptions of samples MQO394, 395, 545, 546, and 550, should be considered quantitative. Duplicate injection precision for antimony was outside DQO for samples MQO394, 395, 545, 546, and 550. Because of this, antimony results for samples MQO394 and 550 should be considered qualitative while those for samples MQO395, 545, and 546 should be considered unreliable.

The arsenic spike recoveries for samples MQO392 (leachate sample), 539 (ground-water sample), and 546 (ground-water sample) were outside DQO with recoveries of 240, 155, and 0 percent, respectively. The correlation coefficients for the method of standard addition analysis of two arsenic laboratory control standards (LCS#1 and LCS#2) were outside of DQO. Duplicate injection precision was outside DQO for arsenic in samples MQO547, 548, and 549. Arsenic results, with the exceptions listed below, should be considered unreliable due to the above problems. Arsenic results for samples MQO542, 544, and 551 should be considered semi-quantitative and results for samples MQO392 and 396 should be considered qualitative.

The cadmium spike recoveries for samples MQO392 (leachate sample), 539 (ground water), and 546 (ground water) were outside DQO with recoveries of 226, 50, and 1070 percent, respectively. Duplicate injection precision was outside DQO for cadmium in samples MQO546 and 547. Cadmium results, with the exceptions listed below, should be considered qualitative. Cadmium results for samples MQO542, 544, and 551 should be considered semi-quantitative and results for samples MQO546 and 547 should be considered unreliable.

The lead spike recoveries for samples MQO392 (leachate sample) and 546 (ground-water sample) were outside DQO with recoveries of 444 and 3250 percent, respectively. The correlation coefficients for the method of standard addition analysis of three lead samples (MQO393 and 395) were outside of DQO. Lead results, with the exceptions listed below, should be considered unreliable due to the above problems. Lead results for samples MQO542, 544, and 551 should be considered semi-quantitative.

The selenium spike recoveries for samples MQO392 (leachate sample) and 539 (ground-water sample) were outside DQO with recoveries of 0 and 440 percent, respectively. Duplicate injection precision was outside DQO for selenium in samples MQO541, 545, 546Dup, 549, and 550. A duplicate injection was not run for sample MQO539. Selenium results, with the exceptions mentioned below, should be considered unreliable due to the above problems. Selenium results for samples MQO542, 544, and 551 should be considered semi-quantitative and results for MQO393, 394, 396, 536, 537, 540, and 543 should be considered qualitative.

The thallium spike recoveries for samples MQO392 (leachate sample), 539 (ground-water sample), and 546 (ground-water sample) were outside DQO with recoveries of 57, 51, and 398 percent, respectively. Duplicate injection precision was outside DQO for thallium in sample MQO543. All thallium results should be considered qualitative.

All aluminum, calcium, magnesium, sodium, and vanadium results should be considered quantitative. All beryllium, chromium, cobalt, iron, nickel, and potassium results, as well as zinc results with the exceptions listed below, should be considered semi-quantitative. All barium, copper, and manganese results, as well as zinc results for samples MQO392, 393, 394, 395, and 396, should be considered qualitative. All silver results should be considered unreliable.

1.5 Mercury

Some samples which were analyzed for mercury required additional dilution. Mercury detection limits for these samples were raised and false negatives are a possibility.

The mercury spike recovery for the leachate spike (MQO393) was biased low by 84 percent (16 percent recovery). All non-detect mercury results for leachate samples are unreliable (high probability of false negatives). All positive mercury results in the leachate samples are qualitative.

All mercury results, with the exceptions of results for the leachate samples (MQO392, 393, 394, 395, and 396), should be considered quantitative with an acceptable probability of false negatives. Mercury results for leachate samples MQO393, 394, and 396 should be considered qualitative and results for MQO392 and 395 unreliable.

2.0 Inorganic and Indicator Analytes

2.1 Performance Evaluation Standard

Inorganic and indicator analyte performance evaluation standards were not evaluated in conjunction with the samples collected from this facility.

2.2 Inorganic and Indicator Analyte OC Evaluation

The average spike recoveries of all of the inorganic and indicator analytes, in both ground water and leachate, were within the accuracy DQOs (accuracy DQOs have not been established for bromide and nitrite nitrogen matrix spikes). This indicates acceptable recoveries for all inorganic and indicator analytes.

All LCS and CVS recoveries reported in the raw data for inorganic and indicator analytes were within Program DQOs.

Average RPDs for all inorganic and indicator analytes were within Program DQOs. Precision DQOs have not been established for bromide and nitrite nitrogen.

Requested analyses were performed on all samples for the inorganic and indicator analytes.

No laboratory blank contamination was reported for any inorganic or indicator analyte. Contamination involving POX, total phenols, and TDS was found in the sampling blanks (MQO542, 544, and 551) at levels above CRDL. ~~These contaminants~~ and their concentrations are listed below, as well as in Section 3.2.4 (page 3-2) of Reference 2.

2.3 Inorganic and Indicator Analyte Data

The quality control results for cyanide, sulfate, sulfide, chloride, and total dissolved solids (TDS) are acceptable. The results for these analytes should be considered quantitative.

The holding times for the nitrate nitrogen analyses ranged from six to eight days from receipt of samples which is longer than the recommended 48 hour holding time for unpreserved samples. The nitrate nitrogen results should be considered semi-quantitative with detection limits raised by a factor of 1000 due to dilutions required by the high concentrations of sulfate and chloride present in the samples.

The holding times for the nitrite nitrogen analyses ranged from six to eight days from receipt of samples which is longer than the recommended 48 hour holding time for unpreserved samples. The laboratory did not analyze an initial calibration verification (ICV) at the beginning of the nitrite nitrogen ion chromatography analytical batch, as required. The nitrite nitrogen results should be considered to be semi-quantitative with detection limits raised by a factor of 1000 due to dilutions required by the high concentrations of sulfate and chloride present in the samples.

The laboratory did not analyze an ICV at the beginning of the bromide ion chromatography analytical batch, as required. The bromide results should be considered to be semi-quantitative with detection limits raised by a factor of 1000 due to dilutions required by the high concentrations of sulfate and chloride present in the samples.

One of three ammonia nitrogen matrix spikes (into a ground-water sample) was above the DQO with a recovery of 114 percent (DQO range 90 to 110 percent). All ammonia nitrogen results should be considered semi-quantitative.

One of three total phenols matrix spike recoveries (into a leachate sample) was above the DQO with a recovery of 122 percent (DQO range 80 to 120 percent). Total phenol contamination was found in the trip and field blanks (MQO542, 544, and 551) at concentrations of 52, 20, and 520 ug/L. These values are above the total phenol CRDL of 10 ug/L. All total phenols results greater than 10 times the highest concentration of total phenols in the field-blanks or less than the detection limit are considered semi-quantitative. This includes samples MQO392, 393, 394, 395, 396, 540, 543, and 548. All other total phenols results are unreliable. Many of the total phenols samples were diluted by 2 to 20 times normal dilutions. This results in raised detection limits for the affected samples.

A final TOC calibration verification (CV) and final calibration blank (CB) were not analyzed for one of the analytical batches. Results for sample MQO393 and the spike analysis results for MQO396 were affected. The agreement of results between one of the field triplicates and the other two was poor with reported TOC concentrations of 1000 (an estimated concentration because 1000 ug/L is the detection limit), 8100, and 8500 ug/L. The comparative precision of the field triplicate results is not used in the evaluation of sample data as it is not possible to determine the source of this imprecision. Field triplicate precision is reported for informational purposes only. The 28 day TOC holding time was exceeded by one to three days. All TOC results should be considered semi-quantitative.

Initial calibration verification and continuing calibration verification (CCV) standards for POC were not analyzed. EPA needs to supply the inorganic laboratory with a POC calibration verification solution. Until then, the instrument calibration can not be assessed. The POC results should be considered qualitative.

A CCV and CCB were not run at the end of each days TOX analytical batches. Instrument calibration curve information for TOX was not provided in the raw data. High levels of chloride (above 200 mg/L) were found in all field samples. All samples had to be diluted by as much as 100,000 to 1 because of this interference. Most of the TOX results, except for the blanks, are unreliable with greatly increased detection limits. The TOX results for the sampling blanks should be considered quantitative.

Field blank MQO551 contained POX contamination at 20 ug/L which is above the CRDL. All POX results greater than 10 times the highest concentration of POX in the field blanks (samples MQO393 and 539) should be considered quantitative and all POX results greater than 4 times the blank concentration (samples MQO392) should be considered qualitative. The other POX results should be considered unreliable.

The field triplicate RSD was 41 percent for TDS which the data reviewers consider excessive. The comparative precision of the field triplicate results is not used in the evaluation of sample data as it is not possible to determine the source of this imprecision. Field triplicate precision is reported for informational purposes only. No laboratory blanks were analyzed for TDS. One field blank had TDS contamination of 4000 ug/L. This contamination level was so much lower than field sample results that it was felt to have no impact on the field sample results. As mentioned previously, the TDS data should be considered quantitative.

3.0 Organics and Pesticides

3.1 Performance Evaluation Standard

Organic performance evaluation standards were not evaluated in conjunction with the samples collected from this facility.

3.2 Organic QC Evaluation

All matrix spike average recoveries were within established Program DQOs for accuracy. Individual matrix spike recoveries which were outside the accuracy DQO will be discussed in the appropriate Section below. All surrogate spike average recoveries were also within DQOs for accuracy. Individual surrogate spike recoveries which were outside the accuracy DQO will be discussed in the appropriate Section below.

All matrix spike/matrix spike duplicate average RPDs were within Program DQOs for precision except those for phenol and 2-chlorophenol. Individual matrix spike RPDs which were outside the precision DQO will be discussed in the appropriate Section below. All average surrogate spike RPDs were also within DQOs for precision except those for phenol-D5, 2-fluorophenol, and dibutylchlorendate.

All organic analyses were performed as requested.

Laboratory blank contamination was reported for organics and is discussed in the appropriate Sections below.

Detection limits for the organic fractions are summarized in the appropriate Sections below.

3.3 Volatiles

Quality control data indicate that volatile organics were determined acceptably. The chromatograms appear acceptable. Initial and continuing calibrations, tunings and mass calibrations, blanks, matrix spikes, matrix spike duplicates, surrogate spikes, and holding times are all within acceptance limits.

Acetone was found in five laboratory blanks at values of 5 to 12 ug/L. The CRDL for acetone is 10 ug/L. Acetone results in this range should be considered unreliable.

Estimated method detection limits are CRDL for all samples except QO392 which is 10 times CRDL, QO393 which is 7.7 times CRDL, and QO396 which is 2.1 times CRDL.

The volatiles data are acceptable. The probability of false negative results for the volatiles is acceptable except for the three samples with raised detection limits. The volatile compound results should be considered quantitative.

3.4 Semivolatiles

Calibrations, tuning and mass calibrations, blanks, matrix spikes, matrix spike duplicates, surrogate spikes, holding times, and chromatograms were acceptable for the semivolatiles.

The matrix spike (but not matrix spike duplicate) recovery of 2-chlorophenol was 25 percent which is below the DQO of 27 to 123 percent. The matrix spike and matrix spike duplicate RPDs for phenol (72 percent) and 2-chlorophenol (77 percent) were above the DQO limits of 42 and 40 percent, respectively.

The surrogate percent recoveries for phenol-D5 in samples QO543RE (reextraction or reanalysis), 549, and 549RE, 2-fluorophenol in samples QO543, 543RE, 549, 549RE, and 550, and 2,4,6-tribromophenol in sample QO396 were below their DQOs. These low recoveries will adversely affect the usability of the acid fraction results.

The semivolatile data are acceptable and the results should be considered quantitative except for the acid fraction results for samples QO396, 543, 549, and 550 which should be considered unreliable due to poor surrogate recoveries. Estimated method detection limits are CRDL for all samples except QO393 which is 14 times CRDL, QO395 which is 3 times CRDL, and QO396 which is 100 times CRDL. The probability of false negatives is acceptable with the exception of the three samples with raised detection limits. False negatives are more likely in the samples where the detection limits were raised.

3.5 Pesticides

The initial and continuing calibrations, and chromatographic quality, with exceptions, for pesticides were acceptable. The matrix spike, matrix spike duplicate, surrogate spikes, and holding times were within acceptable limits.

Pesticide method blank chromatograms (samples 9206407 and 919403) show the presence of an unknown contaminant.

Seven of the 20 pesticide sample chromatograms were unusable due to poor chromatographic quality. A baseline was not obtained from 3 to 10 minutes into the run. Any early eluting pesticides peaks, if present, would have been obscured. Samples affected included QO539, 540, 542, 543, 546, 547, and 549. Results, especially for early eluting pesticides, for these samples should be considered suspect.

The estimated method detection limits for the pesticides fraction were CRDL for all samples except sample QO392 which is twice CRDL. The pesticides results should be considered qualitative for all samples except QO539, 540, 541, 543, 546, 547, and 549. There is a possible enhanced probability of false negatives for pesticides.

III. Data Usability Summary

4.0 Graphite Furnace Metals

Quantitative:	antimony results with exceptions
Semi-quantitative:	arsenic, cadmium, lead, and selenium results for samples MQO542, 544, and 551
Qualitative:	cadmium and thallium results, both with exceptions; arsenic results for samples MQO392 and 396; antimony results for samples MQO394 and 550; and selenium results for samples MQO393, 394, 396, 536, 537, 540, and 543
Unreliable:	arsenic, lead, and selenium results, all with exceptions; antimony results for MQO395, 545, and 546; cadmium results for MQO546 and 547

4.1 ICP Metals

Quantitative:	all aluminum, calcium, magnesium, sodium, and vanadium results
Semi-quantitative:	all beryllium, chromium, cobalt, iron, nickel, and potassium, results; zinc results with exceptions
Qualitative:	all barium, copper, and manganese results and zinc results for samples MQO392, 393, 394, 395, and 396
Unreliable:	all silver results

4.2 Mercury

Quantitative:	all mercury results with exceptions
Qualitative:	mercury results for samples MQO393, 394, and 396
Unreliable:	mercury results for samples MQO392 and 395

4.3 Inorganic and Indicator Analytes

Quantitative: all cyanide, sulfate, sulfide, chloride, and total dissolved solids results; TOX results for samples MQO542, 543, and 544; and POX results for samples MQO393 and 539

Semi-quantitative: all bromide, nitrate nitrogen, nitrite nitrogen, ammonia, and TOC results; and total phenol results for samples MQO392, 393, 394, 395, 396, 540, 543, and 548

Qualitative: all POC data; POX results for sample MQO392

Unreliable: total phenols, TOX, and POX results, all with exceptions

4.4 Organics

Quantitative: all volatiles results; semivolatiles results with exceptions

Qualitative: pesticides results with exceptions

Unreliable: semivolatile acid fraction results for samples QO396, 543, 549, and 550

Suspect: pesticides results for samples QO539, 540, 541, 543, 546, 547, and 549

IV. References

1. Organic Analyses: CompuChem Laboratories, Inc.
P.O. Box 12652
3308 Chapel Hill/Nelson Highway
Research Triangle Park, NC 27709
(919) 549-8263
- Inorganic and Indicator Analyses:
Centec Laboratories
P.O. Box 956
2160 Industrial Drive
Salem, VA 24153
(703) 387-3995
2. Quality Control Data Evaluation Report for USPCI, Utah, 10/17/1986, Prepared by Lockheed Engineering and Management Services Company, Inc., for the US EPA Hazardous Waste Ground-Water Task Force.
3. Draft Inorganic Data Usability Audit Report and Draft Organic Data Usability Report, for the USPCI, Utah site, Prepared by Laboratory Performance Monitoring Group, Lockheed Engineering and Management Services Co., Las Vegas, Nevada, for US EPA, EMSL/Las Vegas, 10/21/1986.

TABLE B-1

Sample Preparation and Analysis Techniques and Methods

Parameter	Preparation Technique	Analysis Technique	Method Reference
Specific Organic Constituents			
Volatiles	Purge and trap	Gas Chromatography - Mass Spectroscopy	CLP Method (a)
Semi-volatiles	Methylene chloride extraction	Gas Chromatography - Mass Spectroscopy	CLP Method
Pesticides/PCB	Methylene chloride/hexane extraction	Gas Chromatography with Electron Capture Detection	CLP Method
Herbicides	Diethylether extraction/methylation	Gas Chromatography with Electron Capture Detection	Method 8150 (b)
Elemental Constituents			
Mercury	Wet digestion for dissolved and total	Cold Vapor Atomic Absorption Spectroscopy	CLP Method
As, Pb, Se, Tl, Cd, Sb	Acid digestion for total	Furnace Atomic Absorption Spectroscopy	CLP Method
Other Elements	Acid digestion for total	Inductively Coupled Plasma Emission Spectroscopy	CLP Method
Field Measurements			
pH	None	Potentiometry	Method 150.1 (c)
Turbidity	None	Nephelometric	No reference
Non-specific Organic Parameters			
POX	None	Purgable combusted, Microcoulometry	EPA 600/4-84-008
TOX	Carbon absorption	Carbon combusted, Microcoulometry	Method 9020 (b)
POC	None	Purgable combusted, Non-dispersive Infrared	No reference
General Constituents			
Ammonia	Particulates settled	Ion Selective Potentiometry of supernatant	Method 350.3 (c)
Chloride	Particulates settled	Mercuric Precipitation Titration of supernatant	Method 9252 (b)
Nitrate	Particulates settled	Barium Sulfate Colorimetry of supernatant	Method 9200 (b)
Nitrite	Particulates settled	Ion Chromatography	Method 300.0 (c)
Sulfate	Particulates settled	Barium Sulfate Turbidimetry of supernatant	Method 9038 (b)
Sulfide	Particulates settled	Iodine Titration	Method 9030 (b)
Cyanide	Manual distillation	Pyridine Pyrazolone Colorimetry	CLP Method
Phenol	Automated distillation	Ferricyanide 4-Aminoantipyrine Auto-Colorimetry	Method 420.2 (c)
Bromide	Particulates settled	Ion Chromatography	Method 300.0 (c)
TDS	Filtration	Gravimetric	Method 160.1 (c)

a) Contract Laboratory Program, IFB methods.

b) Test Methods for Evaluating Solid Wastes, SW-846.

c) Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020.

C53METHOD.RNO OCS

TABLE B-2
ORGANIC CONSTITUENT ANALYSIS RESULTS
FOR THE LEACHATE SAMPLES
USPCI GRASSY MOUNTAIN, UTAH
CONCENTRATION UNITS ARE MICROGRAMS/LITER (UG/L)

COMPOUND	STA. NO. SMO. NO.	CELL 1 Q396	CELL 1B Q394	CELL 2B Q395	CELL 3B Q393	CELL 4B Q392
METHYLENE CHLORIDE		ND	36.	245.	1200.	31.
2-BUTANONE		ND	ND	ND	ND	970.
1,1,1-TRICHLOROETHANE		ND	ND	4. J	22. J	ND
TOLUENE		ND	ND	ND	9. J	ND
TRICHLOROETHENE		ND	7.	ND	ND	ND
4-METHYL-2-PENTANONE		ND	ND	ND	65. J	ND
ACETONE	2300.	ND	ND	ND	ND	270.
TETRAHYDROFURAN (A)		ND	850. (B)	1100. (C)	240. (C)	7800. (C)
2,6-DINITROTOLUENE		ND	8. J	ND	ND	ND
ISOPHORONE		ND	ND	ND	ND	4. J
2,4-DIMETHYLPHENOL		ND	ND	ND	ND	5. J
BENZOIC ACID	5500.	ND	ND	ND	ND	5. J
2-METHYLNAPHTHALENE		ND	ND	ND	ND	6. J
n-NITROSODIPHENYLAMINE		ND	ND	ND	ND	6. J
DI-N-BUTYLPHTHALATE		ND	ND	4. J	ND	9. J
BIS(2-ETHYLHEXYL)PHTHALATE		ND	ND	ND	ND	8. J
DI-N-OCTYLPHTHALATE		ND	3. J	ND	ND	3. J
PHENOL	16000.	ND	ND	ND	1500.	ND
2-METHYLPHENOL	2300.	ND	ND	ND	980.	ND
4-METHYLPHENOL	8700.	ND	ND	ND	41. J	ND
2,4-DIMETHYLPHENOL	660. J	ND	ND	ND	110. J	ND
PENTACHLOROPHENOL		ND	24. J	160.	52. J	ND
ALPHA BHC		ND	.3	ND	.3	.8
LOQ FACTORS						
VOLATILES	22.7X		1X	1X	7.7X	10X
SEMIVOLATILES	100X		2X	2.8X	13.8X	2X
PESTICIDES	1X		1X	1X	2X	2X

ND = NOT DETECTED

J = PRESENT BELOW THE LIMIT OF QUANTITATION; 1. (LOQ IS THE NUMBER SHOWN.

A = TETRAHYDROFURAN WAS REPORTED AS A TENTATIVE CL BUT PRESENCE CONFIRMED BY NEIC ANALYSIS.

B = QUANTITATION BY NEIC USING AUTHENTIC STANDARD

C = ESTIMATED CONCENTRATION BY CL.

ALL VALUES HAVE BEEN BLANK SUBTRACTED.

TABLE B-3
LIMITS OF QUANTITATION FOR ORGANIC COMPOUNDS
USPC1
Grassy Mountain Facility, Utah

B-11

Limit of Quantitation (µg/L)	Limit of Quantitation (µg/L)	Limit of Quantitation (µg/L)
Volatiles Compounds (Purge & Trap)	Semi-Volatile Compounds (cont.)	Pesticides/PCBs
Bromomethane 20	bis(2-Ethylhexyl) phthalate 20	Aldrin 0.05
Chloromethane 30	Butyl benzyl phthalate 20	alpha-BHC 0.05
Bromodichloromethane 20	di-n-Butylphthalate 20	beta-BHC 0.05
Dibromochloromethane 10	di-n-Octylphthalate 20	gamma-BHC 0.05
Bromoform 10	Diethylphthalate 20	delta-BHC 0.05
Chloroform 20	Dimethylphthalate 20	Chlordane 0.5
Carbon tetrachloride 10	Acenaphthene 20	4,4'-DDD 0.1
Carbon disulfide 20	Acenaphthylene 20	4,4'-DDE 0.1
Chloroethane 10	Anthracene 20	4,4'-DDT 0.1
1,1-Dichloroethene 20	Benzo(a)anthracene 20	Dieldrin 0.1
1,2-Dichloroethane 10	Benzo(b)fluoranthene and/or 20	Endosulfan I 0.05
1,1,1-Trichloroethane 20	Benzo(k)fluoranthene 40	Endosulfan II 0.1
1,1,2-Trichloroethane 10	Benzo(g,h,i)perylene 50	Endosulfan sulfate 0.2
1,1,2,2-Tetrachloroethane 20	Benzo(a)pyrene 20	Endrin 0.1
1,1-Dichloroethane 20	Chrysene 40	Heptachlor 0.05
trans-1,2-Dichloroethene 10	Dibenzo(a,h)anthracene 20	Heptachlor epoxide 0.05
Trichloroethene 10	Dibenzofuran 20	Toxaphene 1
Tetrachloroethene 10	Fluoranthene 20	Methoxychlor 0.5
Methylene chloride 20	Fluorene 40	Endrin ketone 0.2
Vinyl chloride 20	Indeno(1,2,3-c,d)pyrene 20	PCB-1016 0.5
1,2-Dichloropropane 20	Isophorone 20	PCB-1221 0.5
cis-1,3-Dichloropropene 10	Naphthalene 20	PCB-1232 0.5
trans-1,3-Dichloropropene 20	2-Chloronaphthalene 20	PCB-1242 0.5
Benzene 10	2-Methylnaphthalene 20	PCB-1248 0.5
Chlorobenzene 10	Phenanthrene 20	PCB-1254 1
Ethylbenzene 10	Pyrene 100	PCB-1260 1
Toluene 10	Benzoic acid 20	
m-Xylene 30	Phenol 20	
o & p-Xylene 10	2-Chlorophenol 20	
Acetone 20	2,4-Dichlorophenol 100	
2-Butanone 20	2,4,5-Trichlorophenol 20	
2-Hexanone 20	2,4,6-Trichlorophenol 100	
4-Methyl-2-pentanone 20	Pentachlorophenol 20	
2-Chloroethyl vinyl ether 10	4-Chloro-3-methylphenol 20	
Styrene 20	2-Methylphenol 20	
Vinyl acetate 20	4-Methylphenol 20	
	2,4-Dimethylphenol 100	
Semi-Volatile Compounds	4,6-Dinitro-2-methylphenol 20	
4-Chloroaniline 100	2-Nitrophenol 100	
2-Nitroaniline 100	4-Nitrophenol 100	
3-Nitroaniline 100	2,4-Dinitrophenol 100	
4-Nitroaniline 40		
3,3'-Dichlorobenzidine 20		
Benzyl alcohol 40		
1,2-Dichlorobenzene 20		
1,3-Dichlorobenzene 40		
1,4-Dichlorobenzene 20		
1,2,4-Trichlorobenzene 20		
Hexachlorobenzene 20		
Nitrobenzene 40		
2,4-Dinitrotoluene 20		
2,6-Dinitrotoluene 20		
N-Nitrosodiphenylamine ^a 20		
N-Nitrosodipropylamine 20		
bis(2-Chloroethyl) ether 20		
4-Chlorophenyl phenyl ether 20		
4-Bromophenyl phenyl ether 20		
bis(2-Chloroisopropyl) ether 20		
bis(2-Chloroethoxy) methane 20		
Hexachloroethane 20		
Hexachlorobutadiene 20		
Hexachlorocyclopentadiene 30		

^a Measured as diphenylamine

Table B-4
Laboratory Blanks
Organic Analysis Results

Date	Compounds Detected (ug/L)		LOQ		
	Acetone	SV	V0	PEST	
06/20/86	9.2	NA	1X	NA	
06/12/86	ND	NA	1X	NA	
06/30/86	5.4	NA	1X	NA	
07/01/86	6.6	2X	1X	1X	
07/01/86	7.3	2X	1X	1X	
07/01/86	12.	2X	1X	1X	
07/02/86	ND	2X	NA	1X	
07/03/86	ND	NA	NA	1X	
07/06/86	ND	2X	NA	1X	

ND = NOT DETECTED.

NA = NOT APPLICABLE.

TABLE B-5
Field Blanks
Organic Analysis Results

Station	Compounds Detected (ug/L)						LOQ		
	ACETONE	METHYLENE CHLORIDE	BENZENE	TOLUENE	2-BUTANONE	PHENOL	VOA	BNA	PEST
MW14	6.9	3.0	1.8	5.	ND	ND	2X	1X	1X
MW15	7.0	ND	1.0	ND	ND	ND	2X	1X	1X
Trip Blank	8.5	2.7	ND	ND	75.	6.	2X	1X	1X

* ND = NOT DETECTED.

TABLE B-6
ORGANIC CONSTITUENT ANALYSIS RESULTS
MONITOR WELL SAMPLES
USPCI GRASSY MOUNTAIN FACILITY, UTAH

CONCENTRATION UNITS ARE MICROGRAMS/LITER (UG/L)

COMPOUND	STA. NO.	MW 11
	SMO. NO.	Q0536

n-NITROSODIPHENYLAMINE

20. J

J= PRESENT BELOW THE LIMIT OF QUANTITATION; THE LOQ IS THE NUMBER SHOWN

TABLE B-7
Total Metals Analysis Results

Station: SMO No.:	Cell 1 MQ0396	Cell 2 1-8 MQ0394	Cell 2 2-8 MQ0395	Cell 2 3-8 MQ0393	Cell 2 4-8 MQ0392	Surf. Impd. MQ0538
Element	Value, ug/L	Value, ug/L	Value, ug/L	Value, ug/L	Value, ug/L	Value, ug/L
Al	2,500.	138.	< 99. a	326.	19,700.	NA b
Sb	207.	42.4	< 9.	62.5	55.	NA
As	194. c	15.0 c	12.0 c	10.2 c	28.6 c	NA
Ba	101. c	25. c	46. c	57. c	343. c	NA
Be	< 2.	< 2.	< 2.	< 2.	< 2.	NA
Cd	< 5. c	< 5. c	< 5. c	22. c	< 5. c	NA
Ca	113,000.	608,000.	697,000.	666,000.	934,000.	NA
Cr	134.	34.	34.	20,000.	684.	NA
Co	23.	< 13.	< 13.	31.	< 13.	NA
Cu	7,880.	< 11.	< 11.	212.	< 11.	NA
Fe	3,390.	67.	37.	280.	13,200.	NA
Pb	546. c	44. c	36.8 c	41.1 c	33.4 c	NA
Mg	25,900.	555,000.	304,000.	414,000.	561,000.	NA
Mn	250. c,d	357. c,d	841. c,d	579. c,d	1,530. c,d	NA
Hg	10. c	.8 c	< .4 c	1.2 c	< 1. c	NA
Ni	580.	< 28.	< 28.	520.	< 28.	NA
K	11,300,000.	259,000.	221,000.	1,560,000.	240,000.	NA
Se	1,104. c	58.5 c	< 15. c	41.6 c	< 15. c	NA
Ag	< 8. c	< 8. c	< 8. c	< 8. c	< 8. c	NA
Na	14,400,000.	5,320,000.	5,380,000.	9,240,000.	9,170,000.	NA
Tl	< 30. c	< 10. c	< 10. c	< 10. c	< 50. c	NA
V	< 18.	< 18.	< 18.	< 18.	< 18.	NA
Zn	4,470. d	845. d	1,840. d	1,040. d	1,520. d	NA

a) < X : Sample concentration was less than the given concentration.

b) NA : Not analyzed.

c) Batch spike sample recovery was not within control limits indicating possible bias.

d) Interference was detected in the analysis indicating possible bias.

TABLE B-7

Total Metals Analysis Results

Station: SMO No.:	Well MW-03 MQ0545	Well MW-03 MQ0546	Well MW-03 MQ0547	Well MW-07 MQ0539	Well MW-09 MQ0548	Well MW-10 MQ0537
Element	Value, ug/L	Value, ug/L	Value, ug/L	Value, ug/L	Value, ug/L	Value, ug/L
Al	18,600.	16,200.	13,700.	635.	< 99.	< 99.
Sb	< 30.	43.	< 30.	< 30.	< 30.	< 15.
As	49.6 c	63. c	< 250. c	< 40. c	< 100. c	< 12. c
Ba	762. c,d	617. c,d	707. c,d	38. c,d	28. c,d	39. c,d
Be	< 2. c	< 2. c	< 2. c	< 2. c	< 2. c	< 2. c
Cd	< 25. c	< 5. c	< 5. c	< 5. c	< 5. c	< 5. c
Ca	2,290,000.	1,960,000.	2,090,000.	1,430,000.	966,000.	1,190,000.
Cr	68. c	46. c	55. c	47. c	21. c	38. c
Co	< 13. c	< 13. c	< 13. c	< 13. c	< 13. c	< 13. c
Cu	< 11. c	< 11. c	< 11. c	< 11. c	< 11. c	< 11. c
Fe	18,700. d	15,000. d	14,000. d	654. d	50. d	306. d
Pb	< 10. c	14. c	< 25. c	164. c	< 25. c	< 25. c
Mg	1,420,000.	1,410,000.	1,360,000.	1,730,000.	1,070,000.	1,430,000.
Mn	1,450. c,d	1,140. c,d	1,260. c,d	332. c,d	328. c,d	928. c,d
Hg	< .8	< 4.	< 1.	< 2.	< 1.	< 1.
Ni	< 28. c	< 28. c	< 28. c	< 28. c	< 28. c	< 28. c
K	696,000. d	613,000. d	669,000. d	632,000. d	619,000. d	665,000. d
Se	134. c	< 375. c	< 50. c	< 50. c	< 25. c	< 50. c
Ag	< 8. c	< 8. c	< 8. c	< 8. c	< 8. c	< 8. c
Na	27,400,000.	27,400,000.	27,000,000.	27,200,000.	23,200,000.	28,000,000.
Tl	< 30. c	< 100. c	< 300. c	< 20. c	< 100. c	< 100. c
V	< 18.	< 18.	< 18.	< 18.	< 18.	< 18.
Zn	120. c	77. c	79. c	24. c	25. c	24. c

a) < X : Sample concentration was less than the given concentration.

b) NA : Not analyzed.

c) Batch spike sample recovery was not within control limits indicating possible bias.

d) Interference was detected in the analysis indicating possible bias.

TABLE B-7
Total Metals Analysis Results

Station: SMD No.:	Well MW-11 MQ0536	Well MW-13 MQ0541	Well MW-14 MQ0540	Well MW-15 MQ0543	Well MW-16 MQ0549	Well MW-17 MQ0550
Element	Value, ug/L	Value, ug/L	Value, ug/L	Value, ug/L	Value, ug/L	Value, ug/L
Al	< 99. a	< 99.	< 99.	< 99.	< 99.	< 99.
Sb	< 15.	< 30.	< 30.	< 30.	149.	135.
As	< 24. c	< 24. c	< 18. c	< 72. c	< 50. c	< 30. c
Ba	32. c,d	52. c,d	51. c,d	58. c,d	39. c,d	52. c,d
Be	< 2. c	< 2. c	< 2. c	< 2. c	< 2. c	< 2. c
Cd	< 5. c	< 5. c	< 5. c	< 5. c	< 25. c	< 5. c
Ca	1,450,000.	1,290,000.	1,370,000.	1,220,000.	1,150,000.	1,270,000.
Cr	25. c	16. c	37. c	13. c	< 10. c	19. c
Co	< 13. c	< 13. c	< 13. c	< 13. c	< 13. c	< 13. c
Cu	< 11. c	< 11. c	< 11. c	< 11. c	< 11. c	< 11. c
Fe	< 26. d	272. d	< 26. d	618. d	80. d	359. d
Pb	233. c	< 10. c	< 10. c	< 25. c	< 5. c	< 25. c
Hg	1,680,000.	1,410,000.	1,340,000.	1,310,000.	1,340,000.	1,260,000.
Mn	218. c,d	1,260. c,d	424. c,d	1,470. c,d	873. c,d	1,090. c,d
Hg	< 1.	< 1.	< 8.	1.5	< 1.	< 1.
Ni	< 28. c	< 28. c	< 28. c	< 28. c	< 28. c	< 28. c
K	843,000. d	562,000. d	711,000. d	650,000. d	688,000. d	624,000. d
Se	< 50. c	< 50. c	148. c	< 200. c	50. c	< 30. c
Ag	< 8. c	< 8. c	< 8. c	< 8. c	< 8. c	< 8. c
Na	29,400,000.	27,600,000.	28,200,000.	26,800,000.	27,600,000.	28,400,000.
Tl	< 40. c	< 30. c	< 150. c	< 50. c	< 50. c	< 30. c
V	< 18.	< 18.	< 18.	< 18.	< 18.	< 18.
Zn	17. c	14. c	20. c	15. c	25. c	23. c

a) < X : Sample concentration was less than the given concentration.

b) NA : Not analyzed.

c) Batch spike sample recovery was not within control limits indicating possible bias.

d) Interference was detected in the analysis indicating possible bias.

TABLE B-8
Field Measurements and General Analysis Results

Parameter	Station: SMD No.:	Cell 1 MQ0396	Cell 2 1-B MQ0394	Cell 2 2-B MQ0395	Cell 2 3-B MQ0393	Cell 2 4-B MQ0392	Surf. Impd. MQ0538
Units	Value	Value	Value	Value	Value	Value	Value
pH	Units	NA ^a	NA	NA	NA	NA	NA
Conductance	umhos/cm	NA	NA	NA	NA	NA	NA
Turbidity	NTU	NA	NA	NA	NA	NA	NA
POX	ug/L Cl	44.	27.	34.	840.	160.	NA
TOX	ug/L Cl	NA	< 500,000. b	< 500,000.	< 500,000.	< 500,000.	NA
POC	mg/L C	< .1	< .1	.17	< .1	1.4	NA
NPOC	mg/L C	1,590.	43.	57.	223.	91.	34.
Ammonia	mg/L N	2.6	16.	NA	3.5	.32	NA
Bromide	mg/L	124.	< 50.	NA	< 50.	< 50.	NA
Chloride	mg/L	15,800.	4,000.	NA	6,300.	6,600.	NA
Nitrate	mg/L N	< 50.	51.	NA	< 50.	< 50.	NA
Nitrite	mg/L N	< 50.	< 50.	NA	< 50.	< 50.	NA
Sulfate	mg/L SO4=	10,000.	5,750.	NA	7,800.	5,750.	NA
Cyanide	ug/L	140.	40.	< 20.	240.	< 20.	NA
Phenol	ug/L	65,000.	< 20.	NA	< 100.	7,700.	NA

a) NA : Not analyzed.

b) < X : Not detected at the given detection limit.

TABLE B-8
Field Measurements and General Analysis Results

Parameter	Station: SNO No.:	Well MW-03 MQ0545	Well MW-03 MQ0546	Well MW-03 MQ0547	Well MW-07 MQ0539	Well MW-09 MQ0548	Well MW-10 MQ0537
	Units	Value	Value	Value	Value	Value	Value
pH	Units	7.2	7.2	7.2	6.8	7.2	7.4
Conductance	umhos/cm	NA ^a	NA	NA	NA	NA	NA
Turbidity	NTU	760.	760.	760.	3.1	.90	3.4
POX	ug/L Cl	< 5. b	< 5.	< 5.	803.	< 5.	< 5.
TOX	ug/L Cl	< 500,000.	< 500,000.	< 500,000.	< 500,000.	< 500,000.	< 500,000.
POC	mg/L C	< .1	< .1	< .1	< .1	< .1	< .1
NPOC	mg/L C	< 1.	8.5	8.1	11.	2.2	6.6
Ammonia	mg/L N	1.2	1.	1.	2.9	.5	8.8
Bromide	mg/L	< 50.	< 50.	< 50.	< 50.	< 50.	< 50.
Chloride	mg/L	22,400.	22,900.	22,400.	23,000.	21,800.	23,000.
Nitrate	mg/L N	< 50.	< 50.	< 50.	< 50.	< 50.	< 50.
Nitrite	mg/L N	< 50.	< 50.	< 50.	< 50.	< 50.	< 50.
Sulfate	mg/L SO4=	4,400.	5,750.	5,900.	7,000.	5,200.	6,100.
Cyanide	ug/L	< 10.	< 10.	< 10.	< 10.	< 10.	< 10.
Phenol	ug/L	< 200.	< 100.	290.	380.	< 100.	360.

a) NA : Not analyzed.

b) < X : Not detected at the given detection limit.

TABLE B-8
Field Measurements and General Analysis Results

Parameter	Station: SMD No.:	Well MW-11 MQ0536	Well MW-13 MQ0541	Well MW-14 MQ0540	Well MW-15 MQ0543	Well MW-16 MQ0549	Well MW-17 MQ0550
	Units	Value	Value	Value	Value	Value	Value
pH	Units	7.2	7.2	7.3	7.1	7.1	7.2
Conductance	umhos/cm	NA ^a	NA	NA	NA	NA	NA
Turbidity	NTU	.79	3.7	.45	22.	16.	4.5
POX	ug/L Cl	< 5.	< 5.	< 5.	< 5.	< 5.	< 5.
TOX	ug/L Cl	< 500,000.	< 500,000.	< 500,000.	< 500,000.	< 500,000.	NA
POC	mg/L C	< .1	< .1	< .1	< .1	< .1	< .1
NPOC	mg/L C	11.	7.2	6.5	6.5	2.3	2.2
Ammonia	mg/L N	.25	1.	< .1	NA	< .1	NA
Bromide	mg/L	< 50.	< 50.	< 50.	NA	< 50.	NA
Chloride	mg/L	22,400.	23,800.	23,000.	NA	23,800.	NA
Nitrate	mg/L N	< 50.	< 50.	< 50.	NA	< 50.	NA
Nitrite	mg/L N	< 50.	< 50.	< 50.	NA	< 50.	NA
Sulfate	mg/L SO4=	6,100.	6,200.	6,500.	NA	7,300.	NA
Cyanide	ug/L	10.	< 10.	< 10.	< 10.	< 10.	< 10.
Phenol	ug/L	400.	400.	< 100.	< 200.	140.	440.

a) NA : Not analyzed.

b) < X : Not detected at the given detection limit.

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