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Document Number
KY/SUB/13B-97777C P-03/1991/1

RESULTS OF THE SITE INVESTIGATION, PHASE II

at the

Paducah Gaseous Diffusion Plant

Paducah, Kentucky

owned and operated by

U.S. Department of Energy

and managed by

Martin Marietta Energy Systems, Inc.

9207141 53

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April 1992

Volume 3 of 6

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ERRATA LIST - VOLUME 3

Page No.	Correction
1A-15	Under Subheading "WMUs 21 THROUGH 23A: C-611 WATER TREATMENT PLANT LAGOONS," beginning with line 3, change all "WMU 21" references to "WMU 23" and change all "WMU 23" references to "WMU 21."
1A-16	Under Subheading "WMU 24: C-750-D UNDERGROUND STORAGE TANKS," change last sentence to: "Potential releases associated with this tank will be addressed under the Hazardous and Solid Waste Amendments Permit and, therefore, no investigations were planned for Phase II."
1B-24	In the second paragraph, change the second sentence to read: "Five sets of grass samples taken over a 1-year period in 1978 and 1979 showed an average Tc-99 concentration of 37 pCi/g in grass (reported as dry weight) near the northern plant fence.
1B-25	Table 1B-12. For the heading "pCi/g," add a superscript "b". After the footnote [a], add footnote [b]: "Grass concentrations reported on a dry weight basis."
2A-6	In Box 2 of Figure 1, change "Plaged" to "Placed."
2A-37	Change the second-to-last sentence to read: "Notice to Proceed" (NTP) has been given by the client with an anticipated November 1 or 15, 1990, field startup."
1G-13	In Appendix 2B-1, TM No. 1G, under Subheading "Regional Gravel Aquifer," change the first sentence to read: "Figure 1G-2 shows the same north-northeast flow direction as observed in previous months, . . ."

PREFACE

This document presents the results of Phase II and summarizes the results of both Phase I and Phase II of the site investigation at the Paducah Gaseous Diffusion Plant in Paducah, Kentucky. The report is presented in five volumes:

Volume 1

Executive Summary	
Chapter 1	Introduction
Chapter 2	Summary of Site Investigation Activities
Chapter 3	Physical Characteristics of the Study Area

Volume 2

Chapter 4	Nature and Extent of Contamination
Chapter 5	Contaminant Fate and Transport
Chapter 6	Conclusions
Bibliography	

Volume 3	Appendices
Volume 4	Environmental Database Management System
Volume 5	Technical Memoranda

An additional volume will supplement this report and was submitted to EPA and the State of Kentucky on December 27, 1991:

Volume 6	Public Health and Ecological Assessment

Under separate cover, the Draft Evaluation of Potential Alternatives for Remediation of Offsite Contamination was submitted to EPA and the State of Kentucky in December 1991.

Volume 3 of this document consists of appendices to the report. Each appendix is given an alphanumeric designation indicating where it was cited in the report. For example, the lithologic database is the second appendix cited in Chapter 3, so the database appears in this volume as Appendix 3B. In some cases, appended material is cited in the report but is not included herein. For example, the first appended material cited in Chapter 4 is the EDMS database; because of its size, however, this database appears as a separate volume (Volume 4).

For consistency between the Phase I and Phase II reports, the appendices in both documents have been given the same alphanumeric designations. However, in certain cases material that had been appended to the Phase I report has been incorporated into the Phase II report. Thus, for example, the appendix dealing with flows in PGDP effluent ditches is cited on the contents page of this volume as Appendix 3A with a parenthetical note explaining that the discussion now appears in the body of the report rather than as an appendix.

VOLUME 3: APPENDICES

Appendix 1A	Descriptions of Waste Management Units
Appendix 1B	Summary of Environmental Data from Environmental Programs and Previous Investigations
Appendix 1C	Potential Chemical-Specific, Location-Specific, and Action-Specific ARARs (excluded from scope of this report)
Appendix 2A-1	Task Instructions for Sample Management during Phase II, Paducah Gaseous Diffusion Plant Site Investigation
Appendix 2A-2	Waste Management Instructions
Appendix 2B	Technical Memoranda (in Vol. 5 of this report)
Appendix 3A	Flows in PGDP Effluent Ditches (incorporated in Chapter 3 of this report)
Appendix 3B	Lithologic Database
Appendix 3C	Water Level Measurements (incorporated in TM No. 1 in Vol. 5 of this report)
Appendix 3D	Analysis of Water Level Data from Shawnee Steam Plant Well (incorporated in Appendix 3D of Phase I Report)
Appendix 3E	Major Ions in Groundwater
Appendix 4A	EDMS Database (in Vol. 4 of this report)
Appendix 4B	Sample Tracking Database
Appendix 4C	Summary of Energy Systems Groundwater Sampling Program
Appendix 4D	Summary of Analytical Groundwater Data (incorporated in Vol. 4 of this report and Phase I report)
Appendix 5	Not used in this report (no material appended to Chapter 5)
Appendix 6	Incorporated in Vol. 6 of this report

APPENDIX 1A
Descriptions of Waste Management Units

Appendix 1A
DESCRIPTIONS OF WASTE MANAGEMENT UNITS

This appendix presents descriptions of the WMUs that have been identified at the PGDP. The descriptions include a summary of the WMU history, contaminants potentially present, and size. Also included is the rationale for whether the unit was considered a major contributor to offsite contamination and was therefore targeted for further investigation during Phase II. Locations of the WMUs are shown on Figures 1A-1 through 1A-3 at the end of this appendix.

WMU 1: C-747-C OIL LANDFARM

The C-747-C Oil Landfarm is located in the extreme west central area of the site. The landfarm was used from 1975 to 1979 for the biodegradation of waste oils contaminated with TCE/trichloroethane (TCEA), uranium, and PCBs. Reportedly, PCB contamination levels in the waste oils ranged from nondetectable to 100,000+ ppm, but usually ranged from 25 to 10,000 ppm. Estimates are that at least 5,000 gal of waste oil were applied to the landfarm; oil was added at 3- to 4-month intervals. The sources of the waste oils applied to the landfarm were not reported, but it is assumed they were from all areas of the plant.

The oil landfarm consisted of two plots of about 1,125 ft^2 each. The area was plowed to a depth of 1 to 2 feet, and waste oil was spread. Periodically, lime and fertilizer were spread on the area and the surface was replowed. The landfarm was slightly depressed, causing the pits and troughs to fill with water at times. At some point, a layer of gravel was placed below the soil in the landfarm to improve drainage.

The areal extent of the WMU has been estimated to be 96,300 ft^2, since the exact locations of the two 1,125-ft^2 plots described above have not yet been defined. Target contaminant concentrations exceeding action levels are assumed to be no deeper than 2 feet below land surface (bls).

TCE concentrations as high as 190 μg/kg were detected in soil boring samples collected during Phase I at depths just below the reported base of the landfarm. PCBs Aroclor 1242 and Aroclor 1254 were detected in shallow samples at values reaching 1,400 μg/kg. Volatile organics, including benzene, toluene, ethelbenzene, and xylene (BTEX), were detected at low levels in the shallow samples. Other semivolatile organics (phenols and PAHs) were detected throughout the borings at levels as high as 1,800 μg/kg.

Low levels of U-234, U-238, Th-230, Pu-239, and Tc-99 were detected in the shallow borings. However, Tc-99 levels as high as 236.2J ± 8.7 pCi/g, and U-234 and U-238 concentrations as high as 15.7J ± 1.28 pCi/g were detected in some samples.

Because significant levels of TCE, PCBs, and Tc-99 contaminants were detected in Phase I, the Oil Landfarm was identified as a potential source contributing to offsite contamination of TCE and Tc-99 in groundwater and PCBs in surface drainages.

WMU 2: C-749 URANIUM BURIAL GROUND

The C-749 Uranium Burial Ground is located on the western edge of the C-404 Low-Level Radioactive Waste Burial Ground (WMU 3) in the western area of the site, north of Virginia Avenue. The burial ground, used primarily for uranium and uranium-contaminated waste, may have been in operation as early as 1951 and received waste until 1977.

The burial ground covers an area of roughly 32,000 ft^2 (about 160 feet by 200 feet). The site consisted of a pit excavated to a depth of 7 to 17 feet. Wastes were covered with 2 to 4 feet of soil as they were disposed of. The trenches occasionally filled with water during disposal activities. Fires reportedly occurred occasionally at the C-749 Uranium Burial Ground from oxidation of pyrophoric uranium, but no subsidence was observed that resulted from the fires. The burial ground was covered with a 6-inch clay cap in 1982.

The majority of the waste received at WMU 2 consisted of pyrophoric (i.e., spontaneously combustible) forms of uranium metal, such as machine shop turnings, shavings, and sawdust. Pyrophoric uranium metal was usually placed in 20-, 30-, or 55-gal drums and submerged in petroleum-based or synthetic oils to prevent rapid oxidation of the turnings. Other forms of uranium including oxides of uranium (solid and dissolved in aqueous solutions), uranyl fluoride solutions, uranium-zirconium alloy, slag, and UF_4 were buried in smaller quantities. Records indicate that fifteen 30-gal drums of contaminated TCE were also buried in WMU 2 in October 1959. Estimates are that 270 tons of uranium, 59,000 gal of oils, and 450 gal of TCE were disposed of in the C-749 Uranium Burial Ground. While there is no documentation of Tc-99 disposal at this unit, Tc-99's presence is suspected because of its association with uranium at the plant.

In August 1984, the area where the drums of TCE were reportedly disposed of was excavated because of concern about the integrity of the drums used to bury TCE after 25 years underground. Only four 30-gal drums (instead of the 15 expected) were recovered. Three of the drums were in such poor condition that the contents could not be determined; the fourth drum had no top, but was otherwise in good condition. Mud and sludge in this drum contained approximately 4.5 percent TCE and 20 percent uranium. Soil samples in the area showed <0.1 percent TCE.

In addition to the four 30-gal drums, approximately 36 plastic-lined, 55-gal drums were excavated. About 30 of these drums had good integrity and contained uranium-contaminated sludge; 5 drums were of poor integrity and the contents could not be analyzed; and 1 plastic-lined drum contained TCE-contaminated sludge. There had been no record of 55-gal drums being buried in the area excavated.

Several groundwater monitoring wells exist in the vicinity of this unit. Historical (1983-1988) analytical data for the wells closest to WMU 2 (MW-48 through MW-51, MW-57, MW-58, and MW-67) indicate some TCE and Tc-99 contamination. Recent samples were collected during Phase I for TCL, radionuclides, and major ions analysis. The analytical results of the spring and summer 1990 sampling of the shallow groundwater system revealed peak concentrations of Tc-99 at 747J pCi/l, U-234 at 1,860J pCi/l, and U-238 at 3,333 pCi/l.

Because TCE and Tc-99 have been detected, the C-749 Uranium Burial Ground was identified as a potential source of offsite groundwater contamination.

WMU 3: C-404 LOW-LEVEL RADIOACTIVE WASTE BURIAL GROUND

The C-404 Low-Level Radioactive Waste Burial Ground (LLWBG) is located on the eastern side of the C-749 Uranium Burial Ground (WMU 2) in the west-central area of the plant, north of Virginia Avenue. The burial ground surface area is approximately 53,200 ft^2 (140 feet by 380 feet). The burial ground was active from 1951 to 1986 and was closed with a multilayer cap under RCRA in 1987. Records indicate the C-404 LLWBG is a likely source of Tc-99 contamination.

The C-404 LLWBG was originally constructed as an aboveground holding pond with a tamped earth floor and 6-foot high clay dike walls. From 1952 through 1957, the holding pond served as a neutralization/sedimentation treatment facility for uranium-contaminated wastewater generated at the C-400 Cleaning Building. C-400 effluents were pumped through an underground vitrified clay pipe (WMU 26) to the eastern end of the impoundment. Water was decanted from the basin, through a weir at the southwest corner of the pond, to Big Bayou Creek. When a treatment system was installed in the C-400 Cleaning Building in 1957, use of the holding pond as a treatment facility was terminated and free liquids were removed from the impoundment.

An estimated 3,200 Ci of Tc-99 were discharged to surface water at a controlled rate from the Reactor Tails Program, primarily through effluents from the C-400 Cleaning Building (Energy Systems, 1986f). The largest discharges occurred in 1954, 1955, and 1956 when 440 Ci per year were released. Because the C-404 facility was operating as a neutralization/sedimentation treatment facility for

effluents from the C-400 facility during that period, most of the Tc-99 is assumed to have been released through the C-400 facility to the C-404 facility. Because Tc-99 is mobile in an aqueous environment, some fraction of the Tc-99 probably passed through the C-404 holding pond and discharged to Big Bayou Creek.

From 1957 through 1976, the impoundment was used for bulk disposal of solid waste contaminated with uranium. Uranium-contaminated magnesium-fluoride slag from the metal reduction plant and rejected UF_4 constituted much of the disposal volume. Magnesium fluoride traps contaminated with Tc-99 were also disposed of in the C-404 LLWBG. Until the C-404 facility was filled and covered, it collected rainwater, which was pumped and released at a controlled rate to the North-South Diversion Ditch. When the facility was filled with bulk solid waste to within 1 or 2 feet of the top of the original dikes, it was covered with compacted earth to the top of the original dikes and sloped to facilitate runoff. The exit weir was converted to an enclosed concrete basin for use as a leachate collection sump. Starting in 1977, the top of the filled-in pond area was used for burial of bulk and containerized uranium-contaminated solid waste. As wastes were placed on the upper portion of the facility, they were covered with earth. The upper tier of wastes reportedly included approximately 450 drums of EP toxic wastes (Cd, Se, Pb). In 1983, a partial clay cap was installed on the eastern end of the site; in 1987, the site was closed with a multilayer cap.

A groundwater monitoring plan was submitted to the Commonwealth of Kentucky with the Part B post-closure permit application for the facility. A release to groundwater was detected prior to approval of the post-closure permit application. DOE received a Notice of Violation on February 16, 1990, from the Commonwealth of Kentucky. This Notice of Violation required DOE to provide a description of the contaminant plume, a compliance monitoring plan, and a description of the actions that DOE will implement to address the release.

Numerous monitoring wells have been installed in the vicinity of WMU 3. Historical data (1983 through 1988) from the wells indicate total organic halogen, and alpha and beta, contamination in both up- and downgradient wells (reported concentrations are generally higher in the samples from the downgradient wells). Recent samples were collected as part of the Phase I site investigation activities; analytical results from the 1989-1990 effort indicate levels of Tc-99 reaching 2,175 pCi/l, TCE as high as 210 μg/l, and trace quantities of other radionuclides.

One deep soil boring was completed at WMU 3 during Phase I of the site investigation. The location of this boring (H008) was intended to penetrate a buried ramp constructed of Tc-99-contaminated materials. Composite soil samples were collected for analysis at each 6-foot boring interval. Analytical results of these samples detected no organic compounds, and low levels of radioactivity. A gross beta detection of 15.7 ± 1.9 pCi/g was found in the surficial fill material (0 to 8 feet

bls) but was probably the result of surface contamination by uranium oxide. The low levels of contamination detected in the soil samples from this borehole suggest that the boring did not fully intercept contaminants suspected to have been released to the soil from the C-404 LLWBG.

Because significant levels of TCE and Tc-99 contamination have been found at this unit, the C-404 LLWBG was identified as a potential source contributing to offsite groundwater contamination.

WMU 4: C-747 CONTAMINATED BURIAL YARD

The C-747 Contaminated Burial Yard is located south of the C-749 Uranium Burial Ground (WMU 2) and the C-404 LLWBG (WMU 3) in the western area of the plant, immediately south of Virginia Avenue. The burial yard consists of two pits (one 50 feet by 15 feet, and the other, 50 feet by 150 feet) that together cover an area of approximately 8,300 ft^2 and that were excavated to a depth of approximately 15 feet. C-747 was operated from 1951 to 1958.

The larger pit was used from the beginning of plant operation until about 1958 to bury both contaminated and uncontaminated trash and equipment, some of which was burned. When the yard was cleaned up and closed as a burial yard, the smaller pit was excavated to receive all the remaining scrap (primarily contaminated) that could not be sold. The waste area was covered with 2 to 3 feet of soil, and a 6-inch clay cap was placed over the area in 1982. Contamination of solid wastes disposed of at C-747 was largely associated with natural or slightly depleted uranium from the UF_6 feed plant (C-410). The C-747 Contaminated Burial Yard could be a source of Tc-99 from Tc-99-contaminated uranium disposed of there. There is no record of TCE disposal in the burial yard, and the quantity of waste disposed of in C-747 is unknown.

MW-77 is located east of this area, across 6th Street. The wells at WMU 2 and WMU 3, MW-46 through MW-49, and MW-93 through MW-95 provide some downgradient coverage for WMU 4. Historical analytical data for samples from these wells indicate both TCE and Tc-99 contamination, though other sources may be responsible for the contamination.

Because the C-747 Contaminated Burial Yard could contain Tc-99 in association with uranium buried there, the unit was identified as a potential source contributing to offsite groundwater contamination.

WMU 5: C-746-F CLASSIFIED BURIAL YARD

The C-746-F Classified Burial Yard is located in the northwest area of the plant site. The unit is an inactive landfill that had been used since approximately 1965 for the burial of security-classified scrap and some radionuclide-contaminated scrap.

The C-746-F Classified Burial Yard covers an area of approximately 168,000 ft^2 (840 feet by 200 feet). Disposal pits were excavated to a depth of 8 to 12 feet, and waste was covered with 2 to 3 feet of earth. The burial yard is a possible source of Tc-99 contamination because of Tc-99's association with uranium but is not a likely source of TCE contamination.

Three groundwater monitoring wells screened in the top of the gravel aquifer are situated adjacent to this unit: one on the south side (MW-52) and two on the north side (MW-53 and MW-54). Historical data from samples of these wells indicate some gross beta and total organic halogen, with generally higher concentrations reported for the wells on the north side.

Phase I site investigation activities included collection of samples from MW-52 through MW-54 for VOCs, BNA/Pest/PCB, metals/Cn, radionuclides, alkalinity, and major ions analyses. The results of these analyses indicated the presence of TCE, but no PCB or Tc-99.

In addition, a deep boring (H002) was drilled as part of Phase I activities south of the east central portion of WMU 5, along the KPDES 001 ditch. The analytical results of the boring samples revealed benzene concentrations as high as 980J μg/kg and some TCE in soil (9 μg/kg). Radionuclides were not detected.

Some Tc-99 contamination was suspected because of its association with uranium; therefore, the C-746-F Classified Burial Yard was identified as a potential source of offsite Tc-99 contamination in groundwater and uranium contamination in surface drainages.

WMU 6: C-747-B BURIAL GROUND

The C-747-B Burial Ground is located in the northwest area of the plant site, east of WMU 5. This burial ground was operated from 1960 to 1976 and was used for the burial of various types of solid metal scrap. The C-747-B Burial Ground covers about 5,200 ft^2 and is composed of 5 separate burial plots (Areas H, I, J, K, L), excavated to a depth of 6 to 8 feet. Records indicate that magnesium scrap, laboratory exhaust fans contaminated with perchloric acid fumes, contaminated aluminum scrap, and a single contaminated UF_6 modine trap were disposed of in WMU 6.

The only monitoring wells currently in the vicinity of this unit are those at WMU 5, to the west. The precise location of the burial plots is unclear. The area is flat and grassy, with no fencing.

Because no disposal of TCE-, PCB-, or Tc-99-contaminated materials has been reported at this unit, WMU 6 is not expected to be a significant contributor of contaminants of concern to offsite contamination. Therefore, no Phase II investigations were proposed for this area.

WMU 7: C-747-A BURIAL GROUND

The C-747-A Burial Ground is located in the northwest corner of the fenced security area, just east of WMU 30. The burial ground was operated from 1957 to 1979 and is composed of seven discrete areas, Areas A through G. Area A is the largest unit, covering 19,250 ft^2 (70 feet by 275 feet) and excavated to 10 to 12 feet. The remaining units were 6 to 7 feet deep. Area B is approximately 10,200 ft^2 (60 feet by 170 feet); Area C is about 9,600 ft^2 (60 feet by 160 feet); Area D is 2,100 ft^2 (15 feet by 140 feet); Area E is 1,500 ft^2 (15 feet by 100 feet); Area F is 7,400 ft^2 (four areas of about 30 feet by 60 feet each); and Area G is 3,600 ft^2 (30 feet by 120 feet). In general, the burial pits were excavated, filled with waste, and then covered with 3 feet of earth. As parts of Area A were used, they were routinely covered with 4 feet of compacted clay and gravel.

The C-747-A Burial Ground was used for the disposal of a large variety of contaminated and uncontaminated trash, equipment, and scrap metal. Area A was used for the disposal of noncombustible trash and some contaminated equipment. Areas B and C were used for the disposal of noncombustible contaminated and uncontaminated trash and equipment. Areas D and E were used for the disposal of contaminated concrete removed from the bases of the vibrating reactor trays in the C-410 Feed Plant in May and June 1960. Area F was used for the disposal of uranium-contaminated scrap metal and equipment. There is no record of the first discard in Area F, but it is believed to be a group of drums used to collect uranium powder scrap from the C-340 facility.

Because the C-747-A Burial Ground was used for the disposal of uranium-contaminated material, including uranium-contaminated material from the C-410 Feed Plant, this burial ground is suspected to be a source of Tc-99 contamination. Although there is no record of TCE disposal in C-747-A, this burial ground also is suspected to be a source of TCE contamination because it was evidently a "catch-all" burial ground for various wastes generated around the plant. Also, Well 66 adjacent to the northwest had shown the highest contamination of any onsite or offsite well, with up to 6,100 μg/l TCE and 3,195 pCi Tc-99 in historical monitoring by the PGDP.

The Phase I sampling effort included two rounds of sample collection from this monitoring well. Similar to past sampling events, MW-66 analytical results show TCE and Tc-99 concentrations as high as 5,300 μg/l and 2,830 pCi/l, respectively, during the Phase I sampling.

In addition, three deep borings were completed in the area of WMU 7 during Phase I. The results of these analyses showed no significant TCE contamination. Tc-99 was detected in two of the borings. The highest activity (up to 72.7 pCi/g) was detected in the uppermost samples. Aroclors 1254 and 1260 were detected in the shallow borings at concentrations as high as 730 μg/kg and 26 μg/kg, respectively.

Because TCE and Tc-99 have been found near the C-747-A Burial Ground, this unit was identified as a probable source contributing to offsite groundwater contamination. Because surface radiological contamination and PCB contamination were detected in Phase I, the unit also was identified as a potential source of offsite contamination in surface drainages.

WMU 8: C-746-K INACTIVE SANITARY LANDFILL

The C-746-K Inactive Sanitary Landfill is located southwest of the security area, immediately south of the C-611 Water Treatment Plant. This landfill, operated from about 1951 to 1982, is roughly rectangular and approximately 500 feet by 700 feet. The landfill was originally used for the above-grade disposal of steam plant flyash from coal burning. Ash was piled to a depth of about 20 feet in some cases. Until 1967, trenches were cut in the ash and used for burning trash. Since then, uncontaminated combustible waste and slightly contaminated rubbish have been buried but not burned. A clay cap was placed over the landfill in 1982. Although the C-746-K Inactive Sanitary Landfill is probably not a source of Tc-99, land-based disposal units that were active during the early years of plant operation are suspected in regard to TCE disposal.

MW-22 through MW-27, located in the vicinity of this unit, have been recommended for abandonment as a result of the plantwide well evaluation program. MW-23 and MW-27 were sampled during Phase I; no TCE or Tc-99 was detected.

Because TCE is suspected to be present and because the existing wells have been recommended for abandonment, the C-746-K Inactive Sanitary Landfill was identified as a potential source of offsite groundwater contamination. Some limited Phase II activities were conducted at this unit.

WMU 9: C-746-S RESIDENTIAL LANDFILL

The C-746-S Residential Landfill is located approximately 0.25 mile north of the plant security area, immediately south of WMU 10. C-746-S has been in operation since 1982 and is still active. The landfill has been used for disposal of trash and garbage contaminated with less than 110 ppm of uranium. The current disposal standard at this landfill is 17 pCi/g of uranium, which corresponds to 25 ppm of uranium at natural assay. All materials bound for the landfill from radiological areas are screened using a criterion of 100 counts per minute above background because there is no method for measuring the 17-pCi/g standard at present. No materials with detectable transuranics or Tc-99 are disposed of in the landfill.

The landfill is constructed on top of fill materials produced from soil excavation during plant construction. It is organized into six cells, each lined with 12 inches of clay covered with compacted soil. Trash is placed in a lined cell, compacted in place, and covered with soil. When a cell is filled, it is capped with clay and covered with soil. The areal extent of the WMU has been estimated to be roughly 700,000 ft^2. Because the waste cells in the landfill generally have been constructed on top of the natural land surface, the vertical extent of buried waste material is assumed to be 20 feet (height of landfill). The C-746-S Residential Landfill could be a source of Tc-99 contamination because this landfill has received trash and garbage contaminated with low levels of radionuclides. TCE contamination is also suspected because of its association with landfills.

MW-16 through MW-19 and MW-38 through MW-44 are located in the vicinity of WMUs 9 and 10, but all of these wells have been recommended for abandonment. Historical analysis (1983 to 1987) of samples from these wells indicates some beta activity and elevated total organic halogens. No PCBs were detected. Some of the wells were sampled during Phase I activities, and levels of TCE and Tc-99 as high as 21 μg/l and 83 pCi/l, respectively, were detected.

Because TCE and Tc-99 contamination has been detected, the C-746-S Residential Landfill was identified as a potential source of groundwater contamination.

WMU 10: C-746-T INERT (OLD CONSTRUCTION) LANDFILL

The C-746-T Inert Landfill is located approximately 0.25 mile north of the security area, adjacent to the north side of WMU 9. C-746-T has been in operation since plant construction began in 1950 and is still active. The landfill is used to dispose of construction debris, such as concrete, wood, and rock; steam plant flyash is also disposed of in this landfill. When the plant was under construction, TCE was used during various cleaning operations, especially at the Kellogg Building and C-400 Cleaning Building. These structures, two of the first buildings onsite, were used to

produce and clean the diffusion pipes for the cascade system then under construction.

The approximate boundary of the WMU is estimated to enclose approximately 900,500 ft^2. The waste cells in the landfill are assumed to be situated on top of the natural land surface. Therefore, the vertical extent of buried waste is estimated at 20 feet (height of landfill).

Because this was the first landfill in operation at the plant, some TCE may have been disposed of here. Information concerning Phase I activities at this WMU can be found in the discussions pertaining to WMU 9, above.

WMU 11: C-400 TRICHLOROETHYLENE LEAK SITE

The C-400 TCE Leak Site is associated with the operation of a degreaser located at the southeast corner of the C-400 Cleaning Building in the center of the plant. The general region of the spill consists of a fenced-in area containing a large aboveground TCE storage tank. The area surrounding the tank is congested with buildings, gravel-surfaced areas, and pavement that could affect the implementability of treatment alternatives. The leak site resulted from discharges to a storm sewer from a sump pump in the C-400 Cleaning Building degreaser area (WMU 98). The storm sewer extends east out of the C-400 Cleaning Building, then south along the C-400 parking lot, and then west parallel to the 008 outfall (WMU 68) to discharge into Big Bayou Creek. The storm sewer probably received TCE from the early 1950s until the discovery of the leak in June 1986.

The TCE leak was discovered during construction of a discharge line connection from the truck-unloading dock containment sump to a storm sewer in the vicinity. The discharge line from the containment sump was to be connected to the 24-inch-diameter storm sewer through a manhole. However, during excavation TCE was discovered to be leaking from the storm sewer. Subsequent investigations revealed that TCE had leaked through caulking at the joints of the underground concrete sewer into the soil.

Soil samples taken in the excavation in 1986 indicated TCE levels as high as 7,000 mg/kg near the sewer line. Approximately 310 ft^3 of contaminated soil containing an estimated 150 pounds of TCE were excavated and stored as hazardous waste. Some of the contaminated soil was left in place because of concern about the structural integrity of the C-400 Cleaning Building foundation and the roadway along 11th Street. At that time, a sampling program was initiated to define the vertical and horizontal extent of the contamination.

Soil core samples were obtained at locations north (groundwater downgradient), south (storm sewer downgradient), and east of the excavated area. Core samples

within 2 feet (laterally) of the sewer line indicated contamination to the depth of the borings (47.6 mg/kg TCE at 22 feet in the boring south of the excavation and 11.3 mg/kg TCE at 28 feet in the boring north of the excavation). The sample borings were grouted upon completion of sampling. A soil gas survey was also conducted on shallow soils in the area; however, the results of the survey were inconclusive.

MW-68 through MW-71 are located approximately 200 feet south of the storm sewer and are upgradient of the excavated leak site. In 1988, analyses of groundwater samples from MW-68 and MW-71 indicated some elevated (above reference) alpha and beta activity, total organic halogens, and Tc-99 and TCE, with generally higher levels of contamination indicated for MW-68 (this well is screened in the bottom portion of the gravel aquifer; MW-71 is screened in the upper portion).

In July 1989, MW-68 through MW-71 were sampled by the PGDP as part of a scheduled well evaluation. Elevated organic vapor analyzer (OVA) and lower explosive limit (LEL) readings were noted. As a result, the four wells were sampled for BTEX. MW-69 was determined to be contaminated; the contamination was traced back to the underground storage tanks at the C-750 Garage to the southwest. This problem is being handled under the underground storage tank program at the plant.

Phase I site investigation activities included collection of samples from all four wells at various times during 1989 and 1990. Results from these analyses revealed contaminants in the Regional Gravel Aquifer. Peak concentrations of TCE and Tc-99 were 33 μg/l and 177J pCi/l, respectively.

In addition, Phase I included installation of one deep boring (H007) at the leak site. Composite soil samples were collected and analyzed. The results of these analyses indicate that TCE is present in detectable concentrations in the soils beneath the area to the base of the Regional Gravel Aquifer (a depth of nearly 90 feet), with concentrations peaking at 220 μg/kg. No Tc-99 was detected in the soil.

The areal extent of possible soil contamination is assumed to encompass the approximate boundary of the WMU and has been estimated to be roughly 4,200 ft^2. Since TCE contamination is the main issue concerning this site, the vertical extent of affected vadose-zone soil is assumed to be to the shallow groundwater system, which is approximately 40 feet bls. TCE may be present in dense nonaqueous-phase liquid (DNAPL) form at this site.

Because TCE has been found in soils at the leak site, WMU 11 was identified as a probable source contributing to offsite groundwater contamination.

WMU 12: C-747-A UF_4 DRUM YARD

The C-747-A UF_4 Drum Yard is located in the northwest corner of the security area, east of WMU 7. C-747-A is an active aboveground metal scrap pile used for storing UF_4 drums that have been emptied, rinsed, and crushed. The WMU has been in use since 1979 and has a fenced-in area of approximately 165,000 ft^2, with a 20,000-ft^2 scrap pile situated within. Any residuals remaining in the drums may be a source of uranium and associated Tc-99.

Surface-soil contamination from uranium is suspected, and the unit may be a source of offsite contamination in surface drainages.

WMU 13: C-746-P CLEAN SCRAP YARD

The C-746-P Clean Scrap Yard is located in the northwest corner of the security area, between WMUs 5 and 6 (to the south), and WMUs 30 and 7 (to the north). This is an active scrap yard, in use since the 1950s for the accumulation of clean scrap metal prior to sale to metal scrap reclaimers. The dimensions of the yard are 290 feet by 1,076 feet (approximately 312,000 ft^2). After some scrap at the yard was determined to be radioactively contaminated, the area was separated into contaminated scrap at the east end and clean scrap at the west end of the yard.

Surface soil contamination from uranium is suspected, and the unit may be a source of offsite contamination in surface drainages.

WMU 14: C-746-E CONTAMINATED SCRAP YARD

The C-746-E Contaminated Scrap Yard is located in the northwest section of the security area, south of WMU 12. C-746-E has been in use since the 1950s for the aboveground storage of all types of uranium-contaminated scrap metal, including ferrous metals, copper and copper alloys, nickel-plated steel, Monel, and aluminum. C-746-E covers 165,000 ft^2 and contains approximately 2,600 yd^3 of contaminated scrap.

Surface-soil contamination from uranium is suspected, and WMU 14 may be a source of offsite contamination in surface drainages.

WMU 15: C-746-C SCRAP YARD

The C-746-C Scrap Yard is located in the northwest area of the plant site, east of WMUs 12 and 14 and south of the C-616 chromate reduction facility. C-746-C covers approximately 250,000 ft^2 and has served as an aboveground waste pile and storage area since the 1950s. Originally, this scrap yard was used for the storage of clean scrap metal for resale. Currently, uncontaminated scrap metal, metal turnings

from machine shop operations, and ingots from smelting operations are stored in the area.

The scrap yard is not suspected to contain uranium-contaminated scrap, but may be a source of other metal or organic contamination in surface drainages from the metal turnings or smelting ingots. The unit was investigated under Phase II, in conjunction with WMUs 12 and 14.

WMU 16: C-746-D CLASSIFIED SCRAP YARD

The C-746-D Classified Scrap Yard is located in the east-central portion of the security area, south of the C-360 Toll Transfer and Sampling Building, and occupies an area of 59,400 ft^2 (180 feet by 330 feet). It is an active yard, used since the 1950s for storage of clean scrap metal (including steel and nickel-plated steel) on a concrete pad. Currently, only clean scrap is stored at this pad.

Because no TCE, Tc-99, or PCBs are associated with this scrap yard, this WMU is not suspected to be a contributor to offsite contamination and was not included in the Phase II investigation. The pad is located on the former C-745 Kellogg Building site (WMU 99), which is considered a potential source based on previous operations.

WMU 17: C-616-E SLUDGE LAGOON

The C-616-E Sludge Lagoon is located north of the plant security area, along the north and east sides of WMU 18. C-616-E is an L-shaped surface impoundment constructed with a clay floor placed at ground level, and earth/clay walls. The impoundment covers 215,000 ft^2 and is approximately 12.5 feet deep. The lagoon contains sludge and sediment, from the C-616 chromate reduction facility, that averages about 6 feet in thickness. The sludge has been tested for EP toxicity and determined to contain chromium (Cr^{+3}).

One monitoring well is located in the vicinity of this lagoon (MW-21). Results of analyses spanning the 1989-1990 sampling event show detections of Tc-99 up to 4.9 pCi/l. No TCE was found.

In addition, deep soil borings along the north side of WMUs 17 and 18 were completed as part of Phase I. Composite soil samples were collected and analyzed; the results of these analyses show organic contamination consisting of toluene, TCE, chloroform, and chloromethane ranging from 1.0J to 34 μg/l. Radiological contamination above reporting levels included gross beta, Tc-99, U-238, and Pu-239 at values ranging from 0.05 $\pm$ 0.05 to 16 $\pm$ 1.7 pCi/g.

Because the lagoon contains chromium and because Tc-99, uranium, and TCE have been detected in soils, WMU 17 was identified as a potential source of offsite contamination in groundwater and surface drainages.

WMU 18: C-616-F FULL FLOW LAGOON

The C-616-F Full Flow Lagoon, in operation since 1977, is a rectangular aboveground surface impoundment located north of the plant security fence, just west of WMU 17. C-616-F is constructed with an at-grade clay floor and with above-grade dike walls that are 12 feet high. This lagoon serves as a settling pond for the North-South Diversion Ditch flow that is pumped to the lagoon by a lift station built in 1977. Sediment, including deposits which have settled out of incoming waste streams over time, is assumed to have an approximate average thickness of 3 feet. The lagoon receives much of the Tc-99 discharged from the plant because the North-South Diversion Ditch receives discharges from the C-400 Cleaning Building, the C-403 Neutralization Pit, and the C-410 Feed Plant effluents. The lagoon also receives the C-616-B clarifier effluent and overflow from the C-616-E Sludge Lagoon (WMU 17). C-616-F overflows to Big Bayou Creek through Outfall 001.

A single monitoring well (MW-22) is located on the northwest side of WMU 18. Samples were collected from this well during Phase I, and the results of the 1989-90 effort revealed TCE and Tc-99 concentrations as high as 22 μg/l and 76 pCi/l, respectively. Trace quantities of other radioisotopes were also detected.

In addition, deep soil borings were completed along the north side of WMUs 17 and 18 as part of Phase I. Composite soil samples were collected and analyzed; the results of these analyses show organic contamination consisting of toluene, TCE, chloroform, and chloromethane ranging from 1.0J to 34 μg/l. The only radioactivity detected above reporting levels was gross beta, Tc-99, U-238, and Pu-239 at values ranging from 0.05 ± 0.05 to 16 ± 1.7 pCi/g.

Because the lagoon receives Tc-99 discharges from the plant and because Tc-99, uranium, and TCE have been detected in soils and groundwater, WMU 18 was identified as a potential source of offsite contamination in groundwater and surface drainages.

WMU 19: C-410-B HF NEUTRALIZATION LAGOON

The C-410-B HF Neutralization Lagoon is a 1,940-ft^2 at-grade impoundment that is about 2 feet deep with an earth/clay floor and wire-reinforced grout walls, located north of the C-410 Feed Plant. This lagoon is an active unit, in use since the 1950s. It receives effluent from the C-410-C HF Neutralization Building. C-410-C is used for the lime neutralization of HF cell electrolyte from lead-acid batteries. The

electrolyte is neutralized in an adjacent tank (C-410-C Neutralization Tank) prior to discharge to the lagoon. In addition, trucks that transport flyash to the C-746-T Inert Landfill are rinsed into this impoundment.

Although none of the contaminants of concern are expected to be present in this impoundment, the presence of lead, arsenic, or other heavy metals is suspected on the basis of historical operations at the C-410 Feed Plant. This unit may be a potential source of these metals in offsite groundwater or in surface drainages.

WMU 20: C-410-E HF EMERGENCY HOLDING POND

The C-410-E HF Emergency Holding Pond is a 600-ft^2 below-grade impoundment with earth floor and wire-reinforced grout walls, located at the HF tank farm east of the C-410 Feed Plant. C-410-E was constructed in the 1950s as a holding pond for potential releases of HF, but has never received wastes. Because the unit has never received TCE, Tc-99, or PCBs, it is not considered a source of offsite contamination. As a result, no additional investigations have been conducted for this unit during Phase II. The sludge from the holding pond was analyzed in May 1991 by the PGDP for radionuclides, PCBs, TCLP metals, herbicides, pesticides, semivolatiles, and volatiles (Energy Systems, 1991c). Results indicated radioactivity in the sludge including Tc-99 (56 pCi/g), total uranium (381.8 pCi/g), and Np-237 (1.2 pCi/g). Nickel was detected in the TCLP extract at 201,600 μg/l. PCBs were detected in the sludge at 3,000 μg/kg.

WMUs 21 THROUGH 23A: C-611 WATER TREATMENT PLANT LAGOONS

The C-611 Water Treatment Plant lagoons (WMUs 21 through 23A) are located north-northeast of the C-611 plant, west of the plant security area. The original pond (C-611-V Sludge Lagoon, WMU 21) is a 64,000-ft^2 below-grade surface impoundment with earth walls and floor (approximately 12 feet deep). This pond has been used since 1967 to receive sludge produced by the lime-soda softening and ferric sulfate coagulation processes at the C-611 plant. The other three lagoons were constructed in 1980. C-611-Y Overflow Lagoon (WMU 22) is a 180,000-ft^2 impoundment that receives overflow from WMU 21. The C-611-W Sludge Lagoon (WMU 23) is a 9,000-ft^2 impoundment that is occasionally used to receive the C-611 sludge during cleaning operations, when WMU 21 is inoperative. WMU 23 also overflows to WMU 22. The C-611-4 Lagoon (WMU 23A) is used to hold the sludge dredged from WMU 21 during cleaning operations.

Because the materials in these impoundments are a result of raw water treatment, no TCE, Tc-99, or PCBs are expected to be present. The unit is not considered a potential source of offsite contamination. Therefore, no additional investigations have been planned for this site.

WMU 24: C-750-D UNDERGROUND STORAGE TANK

The C-750-D Underground Storage Tank is located about 50 feet west of the C-750 Garage. The tank was used from 1953 to 1982 to accumulate waste oils that were then sold to reclaimers. C-750-D is buried beneath a concrete pad and is of unknown origin and condition. Waste oils in the tank were contaminated with PCBs. In 1982, the tank was rinsed with TCE and left empty. No record of disposal of the TCE rinsate removed from the tank is available. Potential releases associated with this tank are being addressed under the PGDP UST Program and, therefore, no investigations were planned for Phase II.

WMU 25: C-750 1,000-GALLON UNDERGROUND WASTE OIL TANK

This 1,000-gal underground tank at the C-750 Garage has been in operation since 1952 for the storage of waste motor oil from vehicle maintenance activities prior to the oil's resale to reclaimers. Whether this tank potentially received PCB- or solvent-contaminated oils in the past is unknown. Potential releases associated with this tank are being addressed under the PGDP UST Program and, therefore, no investigations were planned for Phase II.

WMU 26: C-400 TO C-404 UNDERGROUND TRANSFER LINE

The C-400 to C-404 Underground Transfer Line was used from 1951 to 1956 to transfer waste solutions contaminated with uranium and other radionuclides from the C-400 Cleaning Building to the C-404 holding pond for settling prior to discharge. The transfer line is constructed of 4-inch-diameter vitrified clay and is approximately 1,500 feet long. No information is available on waste quantities or releases from the transfer line, but the pipeline is suspected of having leaked. Phase I activities included a soil gas survey along this line. Traces of VOCs were detected; however, the results were inconclusive.

The bedding material is suspected of containing TCE and Tc-99. Therefore, WMU 26 was identified as a potential source contributing to offsite contamination of groundwater.

WMU 27: C-722 ACID NEUTRALIZATION TANK

The C-722 Acid Neutralization Tank is located at the northeast corner of the C-720 Maintenance and Stores Building. C-722 is a 180-ft^3 underground concrete tank lined with an acid-resistant membrane and acid brick. Since the 1950s, it has served as a holding tank for the instrument shop cleaning rinsewater and may therefore contain TCE contamination. The unit was identified as a potential source contributing to offsite contamination in groundwater.

WMU 28: C-712 ACID NEUTRALIZATION TANK

The C-712 Acid Neutralization Tank is located at the southwest corner of the C-710 Technical Services Building. C-712 is an underground concrete tank that is 10.5 feet deep and is lined with an acid-resistant membrane and acid brick. The tank has been operating since 1950 for holdup of laboratory wastewater that includes wastes contaminated with organics, radionuclides, metals, and other materials. Discharges from WMU 28 are released into a sanitary sewer that flows to the C-615 Sewage Disposal Plant.

The tank was cleaned in 1986 and certified closed under RCRA interim status. The closure required certification that no hazardous wastes were present in the tank. The tank is currently exempt from permitting requirements under a Part 261 exclusion for documented flow through the tank at less than one percent of the flow of the receiving sanitary sewer. Because the unit was not found to contain hazardous materials during closure, it is not expected to be a contributor to offsite contamination; therefore, no additional investigation was conducted.

WMU 29: C-746-B TRU STORAGE AREA

The C-746-B TRU Storage Area is an active storage area located in the eastern section of the C-746-B South Warehouse, in the northwest area of the plant site. Solids and liquids containing TRU radionuclides, Tc-99, and uranium are drummed and placed on the concrete floor of the building. No spills or releases have been documented at the C-746-B TRU Storage Area, although contamination is suspected inside this building. Currently, this unit is not suspected of contributing to offsite contamination, and further investigations have not been scheduled.

WMU 30: C-747-A BURN AREA

The C-747-A Burn Area is located in the western section of the C-747-A Burial Ground, in the extreme northwest corner of the plant site, adjacent to WMU 7. The area was used from 1951 to 1970 for burning "combustible trash." The ash and burned material from the incinerator were buried here when the incinerator was closed. The approximate boundary of the WMU is estimated to encompass 128,000 ft^2.

MW-63 through MW-66 are located in the vicinity of this unit. MW-66, screened in the top of the Regional Gravel Aquifer, has shown higher levels of TCE and Tc-99 than any other onsite or offsite monitoring well. The Phase I sampling effort included two rounds of sample collection from these monitoring wells. As in past sampling events, MW-66 analytical results show TCE and Tc-99 concentrations as high as 5,300 μg/l and 2,830 pCi/l, respectively. Much lower levels of contamination have been found in MW-63 through MW-65, located just west of this unit.

In addition, one deep soil boring was completed in the area east of WMU 30 during Phase I. Results of these analyses showed no TCE contamination. Aroclors 1254 and 1260 were detected in the shallower samples, at concentrations as high as 120 μg/kg and 26 μg/kg, respectively. Surface radiological contamination was also reported.

Because TCE and Tc-99 have been detected near this unit, the C-747-A Burn Area was identified as a potential source contributing to offsite contamination of groundwater. In addition, because of the surface PCB and radiological contamination detected, this unit is a potential source of contamination in offsite drainages.

WMU 31: C-720 COMPRESSOR PIT WATER STORAGE TANK

The C-720 Compressor Pit Water Storage Tank is located at the northeast corner of the C-720 Maintenance and Stores Building, west of WMU 27. The WMU is a 1,000-gal-capacity cleaned UF_6 cylinder located on a cart in a concrete-block-diked area. The tank is used for storing wastewater containing uranium and possibly Tc-99 from the C-720-A Compressor Shop operations. The tank also received discharges from the sump beneath the TCE degreaser (WMU 141). Dates of operation are unknown. A leak from the tank occurred in 1985. The concrete-block dike was damaged and some material spilled to the ground. The relatively small volume of Tc-99 likely to have been released at this unit indicates that it is probably not a contributor to offsite contamination. On the basis of this information, no additional investigations were planned for this WMU.

WMU 32: C-728 CLEAN WASTE OIL TANKS

The C-728 Clean Waste Oil Tanks (two steel tanks) are located north of the C-720 Maintenance and Stores Building and east of the C-728 Motor Cleaning Facility (WMU 38). The cylindrical 8,000-gal and 4,000-gal tanks are currently used for storage of clean waste oils, but were previously used for storing motor cleaning solvents, particularly mineral spirits. The tanks are not expected to have contained TCE, PCBs, or radiological contaminants. However, because the tanks are located within the boundaries of the C-728 Motor Cleaning Facility, potential releases from the tanks will be explored in conjunction with the investigations of WMU 33.

WMU 33: C-728 MOTOR CLEANING FACILITY

The C-728 Motor Cleaning Facility is located north of the C-720 Maintenance and Stores Building and south of Tennessee Avenue. The facility has been active since 1957, when motors were cleaned here by dipping them in a tank containing mineral spirits. In 1975, this operation was discontinued and a steam-cleaning unit and a water treatment unit were installed. Wastes from this facility include mineral spirits

that contain grease, oil, and uranium, as well as aqueous solutions of uranium and sodium hydroxide. The facility is a possible source of Tc-99, PCB, and petroleum hydrocarbon contamination.

As part of Phase I activities, three shallow borings (H047, H048, and H049) were completed in drainage areas outside the facility. Composite soil samples were collected from the borings for analysis. The results revealed detections of PCBs and dioxins/furans at levels as high as 66,000 μg/kg and 3.29J μg/kg, respectively. VOCs--including benzene, ethylbenzene, and xylenes--were detected at concentrations as high as 210 μg/kg. In addition, semivolatile organics were found in concentrations as high as 1,300J μg/kg.

The motor cleaning facility was identified as a potential source of offsite PCB contamination in surface drainages.

WMUs 34 THROUGH 37, 39, AND 56 THROUGH 57: PCB WASTE STAGING AND STORAGE AREAS

The PCB waste staging and storage areas include the following WMUs:

- WMU 34: C-746-M PCB Waste Storage Area
- WMU 35: C-337 PCB Waste Storage Area
- WMU 36: C-337 PCB Waste Staging Area
- WMU 37: C-333 PCB Waste Staging Area
- WMU 39: C-746-B PCB Waste Storage Area
- WMU 56: C-540-A PCB Waste Staging Area
- WMU 57: C-541-A PCB Waste Staging Area

WMU 34 is a 24-foot-by-19-foot roofed building at 6th Street, between Tennessee and Virginia Avenues. Since 1976, containerized PCB wastes have been temporarily stored here on the diked concrete floor, which contains a collection sump for any spills that may occur. WMU 35 is a designated 24-foot-by-23-foot area within the C-337 Process Building that has been used for temporary storage of containerized PCB wastes since 1976.

WMUs 36 and 37 (both 20 feet by 20 feet) are located within the C-337 Process Building, on concrete flooring: WMU 36 in the southeast quadrant of the building; WMU 37 along the west side of the building. Each unit has been used for the temporary storage of containerized PCB wastes since 1976.

WMU 39 is a 2,650-ft^2 area inside the eastern section of the C-746-B South Warehouse that has been used for the temporary storage of containerized PCB and uranium/PCB wastes since 1980. To prevent release of spills, the area is diked and the concrete floor sealed.

WMUs 56 and 57 are 5-foot-by-10-foot diked staging areas located outside the C-540-A and C-541-A buildings, respectively. Each WMU has been used for the temporary storage of containerized PCB-contaminated oils and solids since 1976.

Because of the method of operation in controlled areas, the relatively recent date of startup, and the lack of spills documented for these units, the drum staging areas are not expected to be a source of release of PCBs. Therefore, no further investigations were scheduled for these WMUs under Phase II.

WMU 38: C-615 SEWAGE DISPOSAL PLANT

The C-615 Sewage Disposal Plant is located in the southwest corner of the plant security area and has been operated for the treatment of PGDP sanitary sewage since 1951. The treatment plant includes settling basins, a sludge digester, a trickling filter, and sludge drying beds. Historic analyses of the sludge indicated the presence of PCBs and uranium, probably resulting from past spills into the sewer system. The sludge is currently drummed annually and stored onsite.

Because PCBs and uranium may have been present in sludge at the sludge drying bed, this unit was considered a potential source of offsite contamination in surface drainages.

WMU 39: C-746-B PCB STORAGE AREA

See discussion for WMU 34, above.

WMU 40: C-403 NEUTRALIZATION TANK

The C-403 Neutralization Tank is located at the northeast corner of the C-400 Cleaning Building. The tank is an inground (18-foot-deep) acid-brick-lined concrete tank that has received effluents from the C-400 Cleaning Building since the 1950s. The tank is currently used for the collection of UF_6 cylinder hydrostatic test water and area runoff. It was previously used for the holdup/neutralization of uranium-bearing waste solutions. C-403 discharges to the North-South Diversion Ditch, where its flow is directed to the C-616-F Full Flow Lagoon, through the lift station. C-616 discharges to Big Bayou Creek through KPDES Outfall 001.

The C-403 Neutralization Tank may be a source of Tc-99 because it was used for the holdup/neutralization of uranium-bearing waste from the C-400 Cleaning Building. Estimates are that 3,200 Ci Tc-99 were discharged at a controlled rate from the plant to surface water, primarily through C-400 effluents. C-403 is also believed to have received TCE from the degreaser operation in the C-400 Cleaning Building via overflows, from other cleaning tanks and floor drains, north to the

C-403 Neutralization Tank (WMU 40), which drained to the North-South Diversion Ditch.

Because TCE and Tc-99 contamination is suspected at the facility, the C-403 Neutralization Tank was identified as a potential source contributing to groundwater contamination. Additional investigations were conducted under Phase II in conjunction with WMU 11, which is south of the tank area.

WMU 41: C-410-C NEUTRALIZATION TANK

The C-410-C Neutralization Tank is a below-grade cylindrical concrete tank lined with an acid-resistant liner and acid brick, and is 7 feet 8 inches in diameter and 9 feet 10 inches deep. This unit discharges to WMU 19 and is located at the north side of the C-410 Feed Plant. WMU 41 has been used since the 1950s for neutralization of waste fluorine cell electrolyte (HF) and battery acid. Neutralization of acids is the only process that is conducted; there is no demolition of batteries for lead recovery at this facility. Although none of the contaminants of concern are suspected at this site, the presence of lead, arsenic, or other heavy metals is suspected on the basis of historical operations at the C-410 Feed Plant. The unit is not considered a contributor to offsite contamination.

WMU 42: C-616 CHROMATE REDUCTION FACILITY

The C-616 Chromate Reduction Facility, active since 1977, is located in the northern section of the security area. This WMU is a wastewater treatment unit operated for the removal of hexavalent chromium from cooling water blowdown. Acid and ferrous sulfate are added to the water to reduce the chromium from hexavalent to trivalent. The trivalent chromium is then precipitated using lime and polymers. Two 128-foot-diameter clarifiers are used in the process. No spills have been reported for this facility. None of the contaminants of concern are expected to be present in the waste treated, and no additional investigations were conducted during Phase II.

WMUs 43 THROUGH 45, AND 46A: HAZARDOUS WASTE STORAGE AREAS

Several areas at the plant are interim status units in accordance with RCRA regulations for the storage of containerized RCRA wastes:

- WMU 43: C-746-B Waste Chemical Storage Area
- WMU 44: C-733 Hazardous Waste Storage Area
- WMU 45: C-746-R Waste Solvent Storage Area
- WMU 46A: C-746-Q Hazardous and Low-Level Waste Storage Building

WMU 43 occupies a diked area of 20 feet by 20 feet in the central section of the C-746-B South Warehouse and is currently inactive. A RCRA interim status closure is in progress at this unit, which has operated since 1982. WMU 44 is a 50-foot-by-100-foot roofed area located in the western section of the security area. The area is diked and has a concrete floor and containment sump.

WMU 45 has operated since 1976 and is a 54-foot-by-40-foot concrete pad with concrete block dikes located south of the C-333 Processing Building. The area is not roofed. WMU 46A is a 200-foot-by-500-foot metal frame building with a concrete floor and dike. This unit is located in the southeast area of the plant site, south of the C-333 Process Building. Since 1980, low-level radioactive wastes and other radioactive materials have been stored in this building, in addition to RCRA hazardous wastes.

Because these areas are operated according to RCRA requirements, no further investigations have been scheduled during Phase II.

WMU 46: C-409 HAZARDOUS WASTE PILOT PLANT

The C-409 Hazardous Waste Pilot Plant occupies approximately 5,000 ft^2 at the east end of the C-409 Stabilization Building. This WMU is an active unit, in use since 1980 for developing hazardous waste treatment processes. It is a RCRA interim status facility and therefore was not addressed during Phase II.

WMU 47: C-400 TECHNETIUM STORAGE TANK AREA

The C-400 Technetium Storage Tank was located on a concrete pad outside of the C-400 Cleaning Building, on the building's west side. The 4,000-gal storage tank was used in the early 1960s to store a waste solution containing Tc-99 and chromium. No spills had been documented, and the tank was removed in December 1986.

In December 1986, 13 concrete samples were collected from the concrete pad and composited, and 16 soil samples were taken from the area surrounding the pad and composited. The samples were collected over a uniform grid covering an area of 14 feet by 14 feet. Samples were analyzed for total chromium, uranium, and Tc-99. Results of the analyses showed 0.50 ppm Tc-99 in the soil and 0.08 ppm Tc-99 in the concrete. Total chromium detected was 10.1 ppm in soil and 17.2 ppm in concrete. Uranium was detected at 165 ppm in the soil and 28 ppm in the concrete.

Because of the nature of the former tank as a Tc-99 storage unit, the area was identified as a potential source contributing to contamination in offsite groundwater.

Because of the presence of uranium in soil, the area was identified as a potential source contributing to offsite surface-water contamination.

WMUs 48 THROUGH 54: C-400 STORAGE/TREATMENT UNITS

The following storage/treatment units are located inside the C-400 Cleaning Building:

- WMU 48: C-400-A Gold Dissolver Storage Tank
- WMU 49: C-400-B Waste Solution Storage Tank
- WMU 50: C-400-C Nickel Stripper Evaporation Unit
- WMU 51: C-400-D Lime Precipitation Unit
- WMU 52: C-400 Waste Decontamination Solution Storage Tanks
- WMU 53: C-400 NaOH Precipitation Unit
- WMU 54: C-400 Degreaser Solvent Recovery Unit

WMU 48 is an inactive 5,000-gal stainless-steel tank used from 1972 to 1985 for storage of gold-dissolver process waste containing acids and metals. This unit is elevated above a stainless-steel containment pan.

WMU 49 is a RCRA-permitted 5,000-gal stainless-steel tank located within a stainless-steel-lined concrete containment area. This unit was installed in 1986 but has not yet been used.

WMU 50 consists of a RCRA-permitted 100-gal stainless-steel tank and four 55-gal drums used since 1986 for treatment of nickel stripper waste solution through evaporation. Prior to tank installation, the evaporation took place in a polyethylene-lined steel drum.

WMU 51 is a RCRA-permitted 5,000-gal stainless-steel tank elevated above a stainless-steel-lined containment pan and has been in use since 1977. This WMU is a treatment unit for waste aqueous solutions containing metals and uranium.

WMU 52 is a storage area consisting of tanks used for storage of waste decontamination solutions containing uranium. The vertical tanks are located in a stainless-steel containment pan. Although the area has been in use since 1975, the current tanks were installed in 1982 and are currently being replaced.

WMU 53 is a 20-inch-diameter, 10-foot-tall, 640-gal stainless-steel tank and filtering unit used since the 1960s for treatment of waste solutions containing uranium. This unit is located in a stainless-steel containment pan.

WMU 54 is a solvent recovery unit located in the degreaser area of the building. This WMU is 2 feet wide by 4 feet long by 5 feet high and has a capacity of

300 gal. It is an active unit, in use since 1952. The solvents handled by the unit are spent trichloroethylene and 1,1,1-trichloroethane.

WMUs 48 through 53 are operated under RCRA permits, whereas WMU 54 is a totally enclosed treatment unit that is exempt from permit requirements. Because these units are controlled facilities, they are not suspected of contributing to offsite contamination. No investigations pertaining specifically to these units have been scheduled at this time. However, investigations were conducted during Phase II at WMU 11 and other areas surrounding the C-400 Cleaning Building.

WMU 55: C-405 INCINERATOR

The C-405 Incinerator was installed in the 1950s. It is located at the west side of the C-400 Cleaning Building, within a 600-ft^2 building. The unit incorporates two incinerators (one equipped with a potassium hydroxide scrubber system) and was used for the incineration of radionuclide-contaminated and uncontaminated wastes. The facility was used last in 1987 and 1989 to burn some out-of-date prescription drugs. Because the unit is not known to have handled TCE, PCBs, or Tc-99 wastes, it is not suspected of being a contributor to offsite contamination and was not investigated during Phase II.

WMUs 56 AND 57: C-540-A AND C-541-A PCB WASTE STAGING AREAS

These units are described with the other PCB waste staging areas. Refer to descriptions for WMUs 34 through 37, above.

WMUs 58 THROUGH 69: EFFLUENT DITCHES AND LITTLE/BIG BAYOU CREEKS

The following ditches and creeks have been identified as other areas of concern:

- WMU 58: North-South Ditch (outside plant security)
- WMU 59: North-South Ditch (inside plant security)
- WMU 60: C-375-E2 Effluent Ditch
- WMU 61: C-375-E5 Effluent Ditch
- WMU 62: C-375-S6 Southwest Ditch
- WMU 63: C-375-S7 Oil Skimmer Ditch
- WMU 64: Little Bayou Creek
- WMU 65: Big Bayou Creek
- WMU 66: C-375-E3 Effluent Ditch
- WMU 67: C-375-E4 Effluent Ditch
- WMU 68: C-375-W8 Effluent Ditch
- WMU 69: C-375-W9 Effluent Ditch

The WMU designations have been retained for administrative purposes only, since these areas are not used for the storage or management of wastes at the PGDP.

Big Bayou and Little Bayou Creeks flow along the western and eastern sides of the PGDP, respectively, before emptying into the Ohio River north of the facility. Both creeks receive wastewater and stormwater discharges from the PGDP via outfalls, such as the North-South Diversion Ditch.

The units listed above were identified as areas of concern because of the potential presence of contaminants released from the plant through runoff water and effluent discharges.

Phase I site investigation activities in the ditches, ponds, and creeks included the completion of shallow soil borings in the stream banks; a radiation walkover; and surface water/sediment sampling of Big Bayou and Little Bayou Creeks, outfall ditches (CDM, 1989b), and the North-South Diversion Ditch. Sampling tasks were performed both onsite and offsite. Phase I studies found radionuclide, PCB, Tc-99, and organic compound contamination in both the sediments and the surface water. The assessments that followed indicated a risk from exposure to contaminated creek bank sediments. The following reaches of the creeks/ditches are assumed to have contaminated sediments/soils, based on predicted action levels for the various contaminants of concern and results of Phase I:

- North/South Diversion Ditch: from plant to Little Bayou Creek (10,000 feet)
- Little Bayou Creek: from the plant Outfall 011 to the North/South Diversion Ditch (16,000 feet)
- Big Bayou Creek: from the plant Outfall 009 to New Water Line Road (3,000 feet)

Additional sediment and surface-water samples from Big Bayou and Little Bayou Creeks, the North-South Diversion Ditch, outfall ditches, and floodplain areas have been collected in Phase II to supplement information developed during the Phase I investigation.

WMUs 70 AND 71: VAPORIZERS

These units are active UF_6 vaporizers. WMU 70 is located south of the C-333 Process Building, and WMU 71 is located at the east side of the C-337 Process Building. The UF_6 cylinders are placed in autoclaves, and the UF_6 is vaporized by steam-heating. PCB-laden hydraulic oils were previously used at each unit, resulting in spills onto the concrete and possibly onto the soil. Some soil and concrete were

excavated at both units because of such a release. PCB-laden oils are no longer used at these units. Because of the completed excavation and the presumed low volume of release, these units are not likely to be contributors to offsite contamination. Therefore, no additional investigations were planned for these WMUs.

WMUs 72 AND 73: UNDERGROUND GASOLINE TANKS

WMUs 72 through 73 are inactive underground gasoline storage tanks. WMU 72 includes two tanks (one 200-gal and one 500-gal) installed in 1952 at the north side of the C-200 facility. One of the tanks was reportedly removed in 1983; one was reportedly filled with concrete in 1978. WMU 73 is a 200-gal tank installed in 1955 at the east side of the north-south wing of the C-710 Technical Services Building. This tank was emptied in 1986 and left in place.

Potential releases from underground gasoline storage tanks are being addressed under the PGDP UST program.

WMUs 74 AND 75, AND 78 THROUGH 81: PCB SPILL SITES

These units are PCB spill sites located in transformer areas. Some are releases that have occurred over the years; some are from specific transformer ruptures. The sites are at the following locations:

- WMU 74: C-340
- WMU 75: C-633
- WMU 78: C-420
- WMU 79: C-611
- WMU 80: C-540-A
- WMU 81: C-541-A

Releases of PCB oils potentially occurred at each of these units from the 1950s to the early 1970s. The exact dates of releases are unknown. The spill at WMU 78 resulted from a transformer rupture in 1967. Some of the soil was reportedly removed at that time and used as fill north of the C-331 Process Building. The fill area has been identified as WMU 92.

Phase I site investigation activities included shallow soil borings at the transformer spill sites. Analytical soil samples were collected from borings at WMUs 74, 75, 79, 80, and 81. The results are summarized for the individual PCB spill sites as follows:

WMU 74: Aroclor 1260 and dioxins were detected in every soil sample at levels as high as 2,974.8 μg/kg and 16 μg/kg, respectively. Gross beta readings at levels as high as 38.5 $\pm$ 2.1 pCi/g were also detected.

WMU 75: Aroclors 1254 and 1260 were detected in all of the samples at concentrations as high as 770 μg/kg. Dioxins and furans were detected in all the surface samples at levels as high as 230 μg/kg. Some radiation readings were recorded.

WMU 79: Aroclor 1260 and the dioxin, octochlorodibenzo-p-dioxin (OCDD), were detected at levels as high as 12,000 μg/kg and 8.69J μg/kg, respectively. Other organics (fluoranthene, pyrene, and some pesticides) were detected at concentrations as high as 80J μg/kg. Tc-99 and Pu-239 were also detected at levels as high as 1.0J pCi/g and 0.36 $\pm$ 0.17 pCi/g, respectively.

WMU 80: Aroclor 1260 and dioxins/furans were detected at concentrations as high as 150,000 μg/kg and 37.2 μg/kg, respectively. OCDD was detected at 8.3 μg/kg in one sample. Trace quantities of Tc-99 were also detected at levels as high as 1.9J $\pm$ 0.2 pCi/g.

WMU 81: Aroclor 1260 and dioxins/furans were detected at levels as high as 17,417 μg/kg and 12.63J μg/kg, respectively. OCDD was also detected at levels as high as 170 μg/kg. Radioactivity for the site was minimal. Traces of Tc-99, U-234, and U-238 were detected.

Because PCBs have been found at each of these units, the transformer spill sites have been identified as potential sources of offsite contamination in surface drainages. Phase II investigation activities were conducted at each area.

WMUs 76 AND 77: H_2SO_4 STORAGE TANKS

These units are 5,000-gal steel aboveground tanks used for storage of sulfuric acid. The C-632-B tank (WMU 76) is an active unit, located southwest of the C-631 cooling towers, within a diked area. The startup date for WMU 76 is unknown. The C-634-B tank (WMU 77) is an inactive unit, used from the 1950s until 1986. Before being removed, it was located west of the C-633 cooling towers. The concrete dikes remain in place. These tanks are listed as units because of potential spillage of sulfuric acid within the diked areas. None of the contaminants of concern are expected to have been present in these units; therefore, no investigations were performed.

WMUs 78 THROUGH 81: PCB SPILL SITES

These sites are described with the other PCB spill sites. Refer to descriptions for WMUs 74 and 75, above.

WMUs 82 THROUGH 85: ELECTRICAL SWITCHYARDS

The C-531 (WMU 82), C-533 (WMU 83), C-535 (WMU 84), and C-537 (WMU 85) switchyards are large electrical switchyards, associated with the corresponding C-331, C-333, C-335, and C-337 process buildings, respectively. The switchyards are potential sources of TCE and PCBs. C-531, C-533, and C-537 have been in use since 1951. Operation of C-535 began in 1953.

PCBs have been used as insulating fluids in transformers. PCB contamination also is potentially linked to an abandoned oil piping network. This network was used to circulate the oils to cool the transformers. Because of reported leaks and other maintenance problems, this underground system was replaced by an aboveground system.

TCE contamination is possible because this solvent was regularly used to clean external surfaces of electrical equipment. There are no records on how much TCE was used at the electrical switchyards or when equipment was cleaned. However, cleaning usually was done in the summer. During the earlier years of plant operations (pre-RCRA), maintenance employees would take a bucket of TCE to the switchyard, either splash it on the equipment or use a rag to apply it, wipe down the equipment, and dump the TCE remaining in the bucket on the ground when they were finished. Several hundred gallons of TCE are estimated to have been used per year per switchyard.

Phase I site investigation activities included shallow soil borings at the switchyards. Analytical soil samples were collected from borings at WMUs 82, 83, 84, and 85. The results of the Phase I activities are summarized for the individual PCB spill sites as follows:

WMU 82: Aroclor 1260 and OCDD were detected in surface samples at levels less than 112.9 μg/kg and 7.5J μg/kg, respectively. Gross beta readings at levels less than 21.7 $\pm$ 1.9 pCi/g also were detected.

WMU 83: Aroclor 1260 was detected in surface samples at concentrations less than 570 μg/kg. No other organics were detected. Radiological samples were not collected from this site.

WMU 84: Aroclor 1260 was detected in deep and shallow samples at levels less than 63 μg/kg. No other organics were detected in the samples collected. Radioactivity was not detected at this site.

WMU 85: Of the three soil borings completed at this site in Phase I, no TCE, Tc-99, or PCBs were detected in two. Chloromethane and total xylenes were

detected in Boring H-110 at concentrations of 480J μg/kg and 250J μg/kg, respectively.

PCB contamination was found at WMUs 82 and 83. These units were identified as potential sources of offsite contamination in surface drainages. Further investigation was planned for Phase II. Surface soil samples were collected at WMUs 82 and 83 to assess direct exposure risks and the potential for surface runoff to ditches leading offsite.

No PCB contamination was found at WMUs 84 or 85. Phase II investigations were not conducted at WMU 84 because contaminant levels detected during Phase I were considered insignificant. Limited investigation was conducted at WMU 85 to assess the potential for offsite migration of BTEX to groundwater.

WMUs 86 THROUGH 89: PUMPHOUSE AND COOLING TOWERS

These units are the concrete wet wells and pump station basins associated with each pumphouse and the induced-draft cooling tower used for cooling of recycled cooling water from process buildings. The wet wells are at the base of the towers and direct the water to the pump station basins in the pumphouses. The units are listed as follows:

- WMU 86: C-631 Pumphouse and Cooling Tower
- WMU 87: C-633 Pumphouse and Cooling Tower
- WMU 88: C-635 Pumphouse and Cooling Tower
- WMU 89: C-637 Pumphouse and Cooling Tower

WMU 86 includes one 633,312-gal wet well and two 1,873,048-gal basins that have been in operation since 1951. WMU 87 includes one 791,789-gallon wet well and two 4,045,767-gal basins that have been in operation since 1951. WMU 88 includes one 66,314-gallon wet well and two 1,769,648-gal basins that have been in operation since 1953. WMU 89 includes one 791,789-gal wet well and two 4,220,417-gal basins that have been in operation since 1953.

These units contain chromated water, but are not known to contain TCE, PCBs, or radionuclides. Because none of the contaminants of concern are expected to be present, no further investigations for these WMUs were conducted.

WMU 90: C-720 UNDERGROUND PETROLEUM NAPHTHA PIPE

This former pipeline stretched from the area of the C-600 Steam Plant to the C-728 Motor Cleaning Facility storage tanks. Where the line crossed Tennessee Avenue, it was raised above ground; the line has been removed, although pipe racks are still visible.

None of the contaminants of concern are expected to be present at this unit, so no Phase II investigations were planned for this WMU.

WMU 91: UF_6 CYLINDER DROP TEST AREA

The UF_6 Cylinder Drop Test Area, used in 1979, was located in the extreme west-central area of the plant on the southern edge of the C-745-B 10-Ton Cylinder Yard. The exact location of the test pit is unknown, but is likely to be within a crane's-arm length of the test pad. The drop test pad is still intact. A test pit, large enough to hold a 10-ton UF_6 cylinder, was lined with plastic and filled with TCE and dry ice. One end of the UF_6 cylinder was placed in the pit and allowed to freeze before the drop test. A crane was used to pick up the frozen UF_6 cylinder and drop it on a steel plate resting on the concrete test pad. The TCE was left in the pit for days before it was pumped out.

As part of Phase I site investigation activities, a deep boring (H003) was drilled in the vicinity of this unit to a total depth of 78 feet bls. Composite soil samples were collected, and the results of these analyses indicate that TCE is present to 24 feet bls in concentrations as high as 260 μg/kg. No above-background radiation readings were observed during drilling of this hole.

Because TCE contamination has been detected, the Cylinder Drop Test Area was identified as a potential source of offsite contamination in groundwater.

WMU 92: C-331 FILL AREA FOR DIRT FROM C-420 PCB SPILL SITE

This area is located in the grassy field north of the C-331 Process Building. When PCB-contaminated soils were removed from the C-420 transformer rupture site (WMU 78) in 1967, they were placed north of the C-331 Process Building as fill material. The exact location of the material is unknown, but is reported by plant personnel to be in the open field south of the water tower.

Because the soil contained PCBs, the area is a potential source of offsite contamination in surface drainages.

WMU 93: CONCRETE DISPOSAL AREA EAST OF PLANT SECURITY AREA

East of the plant security area, several pieces of concrete rubble have been disposed of on the east side of the road at the KPDES 013 discharge point. This concrete, particularly material in the expansion joints, may be contaminated with radioactivity. Because the amount of transferrable contamination from such a limited quantity of material is negligible, the unit is not expected to be a contributing source to offsite contamination. No further investigations were planned for this WMU.

WMUs 94 AND 95: OLD KENTUCKY ORDNANCE WORKS AREA

The KOW, located southwest of the PGDP, was used for the production of TNT from 1942 to 1946, when the plant was decommissioned. TNT was produced and boxed at the plant and sent to the U.S. Army Ordnance Plant at Milan, Tennessee. The KOW Trickling Filter and Leach Field (WMU 94) is located southwest of WMU 8. The abandoned trickling filter and leach field is the last visible structure of the former KOW Sewage Treatment Plant. A separate waste system was used for process wastes. Analyses of soil samples taken in 1988 from the leach field (U.S. Department of Energy, 1990) indicate PAH compounds at the ground surface at concentrations from 131 to 1,040 μg/kg. No high explosives, radionuclides, or contaminants of concern were detected. Therefore, the unit was not identified as a source of offsite contamination.

An area just outside the perimeter fence at the southwest corner of the PGDP (WMU 95, KOW Burn Area) was used by the KOW to burn combustible materials (e.g., conveying belts, shipping crates) contaminated with TNT. After the materials were burned, they were covered with a few inches of soil. Prior to 1978, surface subsidence was noted, indicating that material was disposed of in excavated pits or trenches. Because TCE is suspected to have been used in burn areas at that time, the unit was identified as a potential source of offsite contamination in groundwater.

WMU 96: COOLING TOWER SCRAP WOOD PILE

During the reconstruction of the plant cooling towers between 1988 and 1990, pressure-treated lumber removed from the towers was placed south of the C-333 Process Building on a concrete pad and covered with hypalon sheeting. Potential contaminants in pressure-treated wood include dioxins, furans, pentachlorophenol, copper, chromium, and arsenic. Because the WMU has only recently been in existence, past releases to the site from this unit are not possible. The unit is therefore being addressed under the PGDP HSWA program; a SWMU Assessment Report is to be submitted to the EPA by December 1991.

WMU 97: C-601 DIESEL SPILL

On March 9, 1979, a spill of approximately 17,000 gal of No. 2 fuel oil occurred at the C-601 fuel oil tank area during a valving operation. A combination of factors, such as incorrect valving changes and an uncapped pipe, that are due to a change in the piping system, contributed to the magnitude of the release. The reported routes of offsite migration were via the C-375-W7 Oil Skimmer Ditch (WMU 63) and the C-375-W8 Effluent Ditch, which discharge to Big Bayou Creek.

Containment booms were placed along Big Bayou Creek and the drainage ditches. A floating saucer skimmer pump, various portable pumps, absorbent pads and

pillows, bulk floating absorbent, and a vacuum tank truck (septic tank cleaner) were used to remove oil from the creek and from the permanent oil skimmer located at the west end of the C-375-S7 Oil Skimmer Ditch (WMU 63). The volume of fuel recovered was not provided in the spill report.

During drilling of boring H008 (located at the southeast corner of WMU 3) in the Phase I site investigation, diesel fuel constituents were observed. These constituents are suspected to be associated with the 1979 spill. The C-375-W8 Effluent Ditch that received fuel from the spill runs east-west just south of the WMU 4 area. In addition, a sheen of product (possibly from this spill) was noticed in monitoring wells in the C-404 area.

Because fuel constituents could be present in soils beneath the spill area, the unit was identified as a potential source for migration of contaminants to groundwater.

WMU 98: C-400 BASEMENT SUMP

This unit is located in the southeast portion of the basement of the C-400 Cleaning Building. The approximately 2-foot-diameter sump held the spent TCE from the C-400 degreaser prior to routing to the storm sewer, resulting in the leak site known as WMU 11. The precise construction of this unit is unknown, but is thought to be a vitrified clay pipe with poured concrete bottom and a single influent line. Average plant usages of TCE over the decades of plant operation are shown in Table 1A-1.

Table 1A-1
Average Plant Usages of TCE
PGDP Phase II Site Investigation

Decade	TCE Usage at the C-400 Cleaning Building
1960s	500 to 2,000 gal/month
1970s	>15,000 gal/month
1980s	1,000 to 2,000 gal/month
1990s	600 to 700 gal/month

Historically, the basement sump was used to collect (1) spilled TCE from a leaking old day storage tank, (2) TCE that leaked from the new day storage tank prior to the discovery of a broken sight glass, and (3) all leaks from the bottom of the 400-gal capacity degreaser.

Before the C-400 TCE Leak Site (WMU 11) was discovered, the sump pump in C-400 Cleaning Building was thought to discharge to the C-403 Neutralization Tank (WMU 40), but it may never have been connected. When the leak was discovered, the discharge line was rerouted to the C-407 TCE unloading facility sump. At present, material found in the sump is pumped into a 55-gal drum. Recent integrity tests of the sump indicate that it is not a source for continuing leaks.

Refer to the descriptions for WMU 11, above, for information pertaining to investigative work performed to date.

Because the unit contained TCE and some Tc-99 following degreasing and is located near the TCE Leak Site (WMU 11), the C-400 Basement Sump was identified as a potential source contributing to offsite groundwater contamination.

WMU 99: C-745 KELLOGG BUILDING SITE

During fabrication, the Kellogg Building was reportedly used for pipe cleaning with TCE at the beginning of plant operations. This process may have resulted in releases to the ground surface near this building. The building, located at the east side of the plant, has been removed, and a portion of the site is now occupied by WMU 16 (C-746-D Classified Scrap Yard) and a storage yard for UF_6 cylinders.

Waste TCE from the Kellogg Building may have been disposed of in the C-746-T Inert Landfill (WMU 10) but was also probably dumped or discharged outside the building.

Because TCE may have been released at this site, the unit was identified as a potential source contributing to offsite groundwater contamination.

WMU 100: FIRE TRAINING AREA

The PGDP Fire Training Area is located south of the C-747 Oil Landfarm (WMU 1) at the west side of 4th Street. Waste oils, solvents, and other combustible liquids may have been burned at this location for fire training exercises, and unburned materials may have been released to the ground. Because the unit may have received TCE- or PCB-contaminated liquids for use in training exercises, it was identified as a potential source of offsite contamination in groundwater and surface drainages.

WMU 101: C-340 HYDRAULIC SYSTEM

The hydraulic system within the C-340 building consists of an extensive small-diameter piping network with a reservoir capacity of approximately 50 gallons. WMU 101 was used in operating hydraulic rams and presses that were in turn used

in preparing powder for conversion to metal. This unit is being addressed under the PGDP HSWA program; a SWMU Assessment Report is to be submitted to EPA for this unit by December 1991. Therefore, no investigation was conducted during Phase II.

WMU 102: PLANT STORM SEWER

The plant storm-sewer system consists of a network of buried piping that collects surface drainage and building roof and floor drainage. The storm sewers discharge to Little Bayou and Big Bayou Creeks and the North-South Diversion Ditch via nine separate outfalls. The storm-sewer system is suspected of being a pathway for transport of PCB and radiological contamination from the plant process areas to the permitted outfalls. A storm-sewer evaluation survey was conducted as part of the Phase I investigation; however, sediment found in the pipes was insufficient for a sample to be collected. Therefore, potential releases from residual accumulated sediment were not identified as sources of offsite contamination. Continuing liquid discharges through the storm sewer are being addressed under another PGDP program.

WMUs 103 THROUGH 129: CONCRETE RUBBLE PILES 1 THROUGH 27

Construction and demolition rubble was disposed of by the PGDP in the past by piling the material offsite for use by local farmers and by WKWMA staff. The rubble was put to various uses, including fill, erosion control, bank stabilization, and dam building. Twenty-seven of these disposal sites for construction rubble have been identified around the PGDP.

A cursory radiological survey of the rubble piles was performed during Phase I and determined that radioactive contamination is present at many of the sites. Similar to WMU 93, this radioactive contamination is primarily associated with material in the expansion joints. Because the amount of transferrable contamination from such a limited quantity of material is expected to be negligible, the concrete rubble piles were not identified as sources contributing to offsite contamination in surface drainages. Therefore, no Phase II activities were conducted.

WMUs 130 THROUGH 134: C-611 UNDERGROUND STORAGE TANKS

The storage tanks comprising WMUs 130 through 134 are located in the area of the C-611 Water Treatment Plant and include the following:

- WMU 130: 550-Gallon Gas Tank (west of C-611)
- WMU 131: 50-Gallon Gas Tank (east of C-611)
- WMU 132: 2,000-Gallon Oil Tank (north of C-611)

- WMU 133: Unknown Size, Grouted Tank (south of C-611)
- WMU 134: 1,000-Gallon Diesel/Gas Tank (southeast of C-611)

These tanks are inactive, but were used between 1942 and 1955 for the storage of gas, oil, and other petroleum products. Potential releases from these underground storage tanks are being addressed under the PGDP UST program.

WMU 135: C-333 PCB SOIL CONTAMINATION

The C-333 PCB Soil Contamination area is located on the north side of the C-333 Process Building. The area is located near the ventilation duct intakes near the building where dust settles out and is treated with a dust palliative. Soil sampling by the PGDP prior to a pavement construction project indicated the presence of PCBs in the soil, therefore the paving project was postponed. The issue of contamination is being addressed under the PGDP HSWA program; a SWMU Assessment Report is to be submitted to EPA for this unit by December 1991. Therefore, no investigation was conducted during Phase II.

WMU 136: C-740 TCE SPILL SITE

The C-740 TCE Spill Site is located in the northwest corner of the C-740 concrete pad, which is used for the storage of chemical products, including TCE. In 1990, a drum containing TCE was found to have leaked onto the pad and into the soil surrounding the pad. The issue of contamination is being addressed under the HSWA program; a SWMU Assessment Report is to be submitted to EPA for this unit by December 1991. Therefore, no investigation was conducted during Phase II.

WMU 137 & C-746-A: INACTIVE PCB TRANSFORMER/SUMP

This unit is an inactive transformer known to have contained PCBs, but has had no known releases. Potential contamination is being addressed under the HSWA program; a SWMU Assessment Report is being prepared for submittal to EPA by December 1991. Therefore, no investigation was conducted during Phase II.

WMU 138: C-100 SOUTH SIDE LAWN

Sludge from the C-611 Water Treatment Plant and the C-615 Sewage Disposal Plant was used as fertilizer for the lawn area on the south side of the C-100 Administration Building. Sludge from the C-611 plant is not expected to contain hazardous constituents. Sludge from the C-615 plant has been determined in the past to contain PCBs and uranium (see description of WMU 38, above). Quantities of sludge used as fertilizer are expected to be limited; therefore, the WMU was not identified as a source of offsite contamination in surface drainages. The C-100 South Side Lawn area will be addressed under another PGDP program.

WMUs 139 THROUGH 140: C-746 UNDERGROUND STORAGE TANKS

The storage tanks comprising WMUs 139 through 140 have been used for the storage of petroleum products (gasoline or diesel fuel). Both WMU 139, the C-746-A1 tank and WMU 140, the C-746-A2 tank, are located at the C-746 North Warehouse. Potential releases from these underground storage tanks are being addressed under the PGDP HSWA program; SWMU Assessment Reports are to be submitted to EPA and the Commonwealth of Kentucky for these units by December 1991.

WMU 141: C-720 INACTIVE TCE DEGREASER

The TCE degreaser pit located within the C-720 Maintenance and Stores Building was used during the 1970s for cleaning machine parts and equipment. The degreaser is a below-grade steel tank that is approximately 10 feet by 10 feet in area, and approximately 20 feet deep. Located in a basement of the building, the tank is raised above the basement floor on stanchions. The tank was used to degrease machinery and equipment from the diffusion cascade before work was performed on the equipment. The degreaser is no longer used, has been drained, and is to be removed. A SWMU Assessment Report is to be submitted to EPA for this unit by December 1991. Because TCE has been used below ground at this unit, as it was in the C-400 Cleaning Building, releases are suspected to have occurred. Therefore, the degreaser was identified as a potential source of offsite contamination in groundwater.

WMUs 142 THROUGH 143: C-750 UNDERGROUND STORAGE TANKS

The storage tanks comprising WMUs 142 and 143 are located at the C-750 Garage. WMU 142 was the C-750-A gasoline tank, a 10,000-gal tank found to be leaking in 1989 and removed in early 1991. WMU 143 was the C-750-B 10,000-gal diesel fuel tank, found to be leaking in 1989 and removed in 1991. Contamination from these underground storage tanks is being addressed under the PGDP UST program.

WMU 144: C-746-A HAZARDOUS AND MIXED STORAGE FACILITY

The C-746-A facility has been added to the PGDP's state RCRA permit for storage of hazardous and mixed wastes generated at the PGDP. The facility has been used since 1990 for storage of PCB wastes and has a continuously welded metal floor for containment. Drums are stored in the building, with a permitted capacity of 10,200 drums. Because there have been no known releases from this facility and because it is being operated under RCRA, no investigation was conducted during Phase II.

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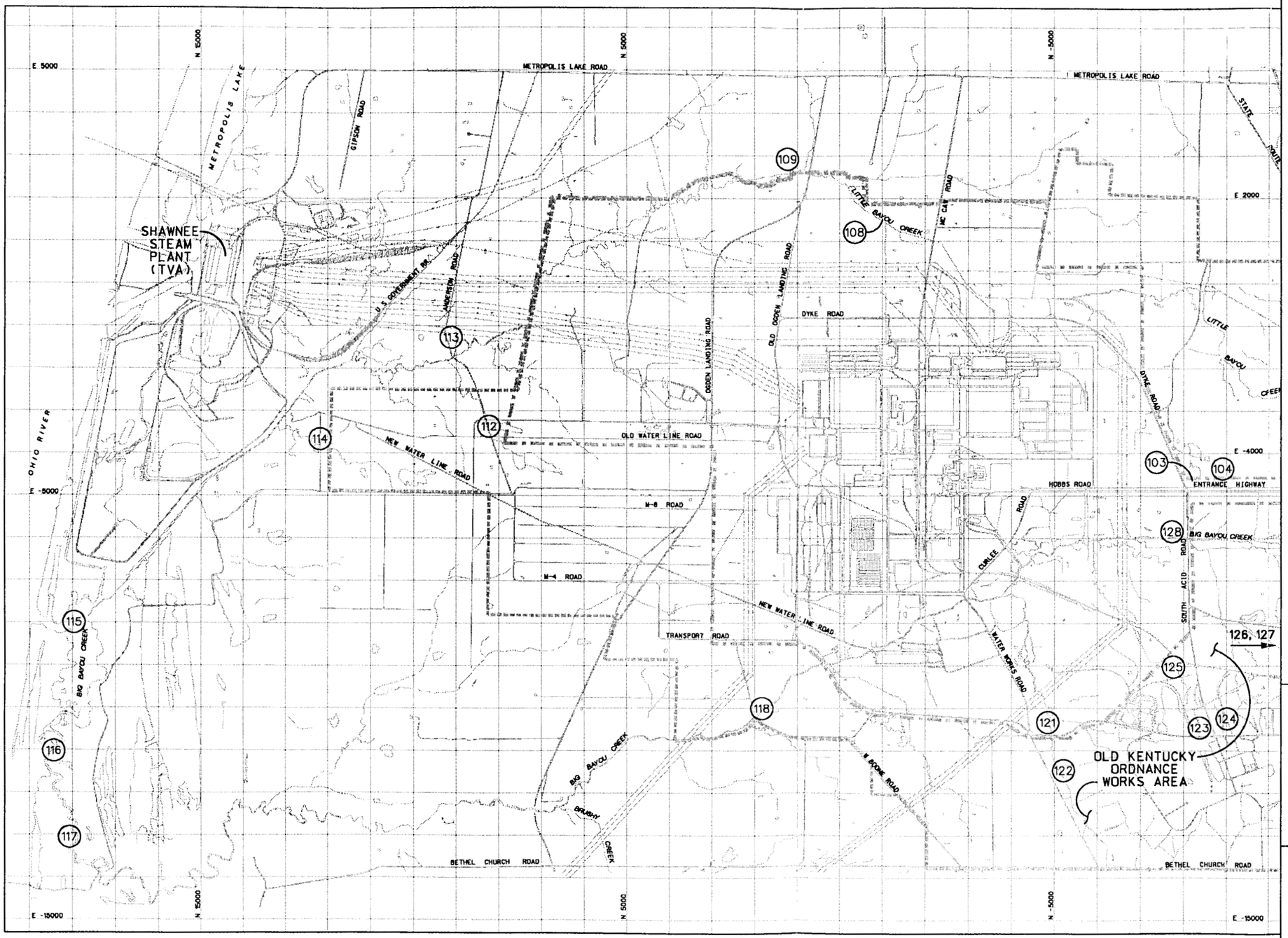
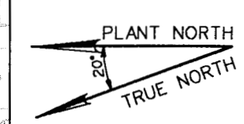


LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- WEST KENTUCKY WILDLIFE MANAGEMENT AREA BOUNDARY
- (103) WASTE MANAGEMENT UNIT LOCATION AND NUMBER (SEE TABLE 2-9 FOR A LIST OF WMUS)



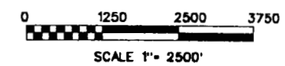


Figure 1A-3
WMUs 73 THROUGH 144
(Continued from Figure 1A-2)

PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

APPENDIX 1B

Summary of Environmental Data from Environmental Programs and Previous Investigations

Appendix 1B
SUMMARY OF ENVIRONMENTAL DATA FROM ENVIRONMENTAL PROGRAMS AND PREVIOUS INVESTIGATIONS

Since the PGDP began operating, environmental data have been collected at and around the plant as part of a continuing environmental surveillance program or as part of the environmental programs described in subsection 1.3.4 of the body of this report.

OFFSITE WELLS

In July 1988, after contamination was found in a residential well that had been sampled at the request of the owner, personnel from the Purchase District Health Department collected groundwater samples from residential wells located around the perimeter of the PGDP. Samples from two wells located approximately 0.75 and 1.5 miles (sampling stations 2 and 17, respectively, in Table 1B-1) from the northwest corner of the PGDP contained gross beta activity. Further sampling and analysis by Energy Systems indicated that Tc-99 was the source of the elevated gross beta activity. The two wells are north (downgradient) of onsite well MW-66 in the northwest corner of the site (shown in Figure 1B-5 in the Phase I report [CH2M HILL, 1991]). Sampling since November 1987 has shown that well MW-66 contains among the highest levels of TCE and Tc-99 in groundwater underlying the PGDP. Well MW-66 is completed in the aquifer that is commonly referred to as the Regional Gravel Aquifer (RGA).

On the basis of these findings, DOE/Energy Systems expanded their groundwater and surface-water sampling of ponds, creeks, private wells, and monitoring wells at the TVA Shawnee steam plant. By March 1, 1989, over 227 sampling locations (Figure 1B-1 in the Phase I report [CH2M HILL, 1991])--including over 144 residential wells, 23 TVA monitoring wells, and several locations in the creeks and ponds--had been sampled at least once by DOE/Energy Systems and had been analyzed for TCE and Tc-99. Additional analyses for RCRA Appendix IX constituents were performed for one of the contaminated residential wells (location 2, RW-2) and for MW-66 (location 1) in August 1988. The RCRA Appendix IX analyses of the residential well sample did not reveal contaminants other than TCE and trans-1,2-dichloroethene, a TCE degradation product, at levels exceeding the analytical detection limits. For MW-66, the only VOCs detected above the analytical detection limits were TCE, trans-1,2-dichloroethene, tetrachloroethane, carbon tetrachloride, and chloroform.

The results of sampling performed in December 1988, presented in Table 1B-1, showed 12 offsite wells with contamination (see also Figure 1-5 in the Phase I report [CH2M HILL, 1991]). Seven of the wells had only TCE contamination, which was measured at

Table 1B-1
Summary of Tc-99 and TCE Concentrations Detected in Offsite Wells as of December 15, 1988
PGDP Phase II Site Investigation

Sampling Station Number[a]	Well Designation	Range in Concentration[b]	
		TCE µg/l	Tc-99 pCi/l
2-Residence[c]	RW-2	623 to 960	342 to 408
3-Outbuilding	RW-3	450 to 834	298 to 343
4-Outbuilding	RW-4	17 to 43	<25 to 51
5-Residence	RW-5	3 to 5	<25
17-Residence	RW-17	40 to 51	69 to 83
18-Residence	RW-18	<1 to 1.5	<25
27-Residence	RW-27	<1 to 1	<25
113-Residence	RW-113	7 to 20	<25
156-TVA Well D-3	TVA-3	1	<25
157-TVA Well D-4	TVA-4	3 to 5	<25
172-TVA Well D-14	TVA-14	1	<25
173-TVA Well D-27	TVA-27	<1	175 to 205

[a]Locations are shown in Figure 1B-1 in the Phase I report (CH2M HILL, 1991).
[b]<1 indicates not detected in sample at given detection limit (1 µg/l for TCE and 25 pCi/l for Tc-99).
[c]This sample was also analyzed for RCRA Appendix IX constituents. The results of these analyses are included in Appendix A of the PGDP site investigation work plan (CH2M HILL, 1989).

Source: Energy Systems, 1988u

OROPAD1/014.51

concentrations greater than the analytical detection limit of 1 μg/l (ppb). Four wells had TCE concentrations greater than 1 μg/l and Tc-99 levels greater than the analytical detection limit of 25 pCi/l. One TVA monitoring well had only Tc-99, at concentrations greater than 25 pCi/l. Six wells, two of them residential, had TCE concentrations greater than 5 μg/l, which is the MCL established by the Safe Drinking Water Act for TCE in drinking water. None of the offsite wells had Tc-99 levels greater than 900 pCi/l, which is the calculated regulatory criterion for Tc-99 in drinking water.

The highest concentration of TCE measured in offsite wells (location 2, RW-2) as of December 1988 was 960 μg/l; the highest Tc-99 concentration measured was 408 pCi/l, also at location 2. Concentrations in the onsite wells were higher (see Table 1B-2). At some locations in the creeks, sediment and surface water were found to be contaminated.

After confirming the results of the July 1988 sampling by the Purchase District Health Department, DOE/Energy Systems, in conjunction with personnel from McCracken County Disaster and Emergency Services, contacted the affected residents to advise them not to use their wells. Bottled water was immediately supplied to the residents. DOE/Energy Systems soon provided the affected residents with an interim water-supply system consisting of 1,000-gallon tanks with pumping systems. Work began on extending the water line. In November 1988, the extension from the West McCracken Water District to five residences was completed, replacing four wells used for drinking water. The line is large enough to accommodate additional users in the future.

ONSITE WELLS

Beginning in the 1960s, onsite wells were installed at the PGDP. The locations of onsite wells are shown in Figures 2-15 and 2-16 in the Phase I report (CH2M HILL, 1991). The figures show PGDP-assigned "MW" numbers for wells installed before Phase I of the site investigation and indicate if wells were abandoned, are recommended for abandonment, or are expected to remain in place (see Appendix 2B-1, "Onsite Well Evaluation and Development").

Historical monitoring data (1964-1988) on levels of radioactivity have been obtained from PGDP well MW-1 (location shown in Figure 2-15 in the Phase I Report [CH2M HILL, 1991]) and offsite well location 4 (Figure 1B-1 in the Phase I report). Nothing is known about the construction of these wells, and the collection and analytical methods are not documented. The data were considered useful only for scoping. Fluctuations, not trends, are indicated by the data on total beta activity before 1972, dissolved and suspended beta activity from 1972 through 1988, and dissolved and suspended alpha activity from 1975 through June 1991. Table 1B-3 summarizes annual maximum levels in these two wells.

Table 1B-2
Summary of Analytical Data from Onsite Wells[a]
PGDP Phase II Site Investigation

PGDP Well No.[b]	Tc-99 (pCi/l)[c]	TCE (μg/l)[c]	Rn-222 (pCi/l)[d]	Approximate Total Depth (ft)	Aquifer Monitored
21	<25 to 71	<1	--	Unknown	Unknown
22	<25	<1 to 1	--	Unknown	Unknown
38	<25	2 to 6	304 to 358	74	Unknown
41	<25	18	--	73	Regional Gravel Aquifer
43	<25	<1 to 1	236 to 280	47	Unknown
44	<25	14 to 32	173 to 211	98	Unknown
47	<25	26 to 31	--	33	Continental sand lens
50	<25	3	--	73	Continental
57	<25 to 48	6 to 10	--	41	Sand lens
66	2,149 to 3,195	4,200 to 6,100	290	60	Regional Gravel Aquifer (u)
68	104 to 121	30 to 45	--	102	Regional Gravel Aquifer (l)
71	<25	12	--	72	Regional Gravel Aquifer (u)
84	694	<1	--	76	Regional Gravel Aquifer (u)
85	208	<1	--	40	Sand lens
88	716	125	--	40	Sand lens
91	<25	6	--	40	Sand lens
94	527	43	--	40	Sand lens

[a]Well-construction data are not available for wells MW-21, MW-22, MW-38, MW-41, MW-43, and MW-44.
[b]Well locations are shown in Figures 2-15 and 2-16 in the Phase I report (CH2M HILL, 1991).
[c]Analytical results are for samples collected from August through December 15, 1988 (Energy Systems, 1988t).
[d]EPA averages published for LaCenter, Kentucky, and Metropolis, Illinois, are 391 pCi/l and 550 pCi/l, respectively. None of the onsite wells showed significant levels of uranium (Energy Systems, 1988v).

NOTES:

u = upper
l = lower

OROPAD1/015.51

Table 1B-3
Summary of Annual Maximum Radiological Data for PGDP Well MW-1 and Offsite Well Location 4 (1964 through 1991)[a]
PGDP Phase II Site Investigation
(page 1 of 3)

Year	Well MW-1[b] Beta (pCi/l)			Well MW-1 Alpha (pCi/l)			Well Location 4[c] Beta (pCi/l)			Well Location 4 Alpha (pCi/l)		
	Tot.	Dis-solved	Suspended	Tot.	Dis-solved	Suspended	Tot.	Dis-solved	Suspended	Tot.	Dis-solved	Suspended
1964	NT[d]	NT	NT	NT	NT	NT	170	NT	NT	NT	NT	NT
1965	70	NT	NT	NT	NT	NT	60	NT	NT	NT	NT	NT
1966	40	NT	NT	NT	NT	NT	50	NT	NT	NT	NT	NT
1967	90	NT	NT	NT	NT	NT	70	NT	NT	NT	NT	NT
1968	50	NT	NT	NT	NT	NT	60	NT	NT	NT	NT	NT
1969	30	NT	NT	NT	NT	NT	80	NT	NT	NT	NT	NT
1970	<10	NT	NT	NT	NT	NT	<10	NT	NT	NT	NT	NT
1971	350	NT	NT	NT	NT	NT	170	NT	NT	NT	NT	NT
1972	NT	41	63	NT	NT	NT	NT	45	18	NT	NT	NT
1973	NT	63	58	NT	NT	NT	NT	63	72	NT	NT	NT
1974	NT	68	59	NT	NT	NT	NT	45	59	NT	NT	NT
1975	NT	27	45	NT	7	9	NT	55	36	NT	12	13
1976	NT	27	45	NT	5	10	NT	82	64	NT	22	21
1977	NT	136	145	NT	46	20	NT	100	54	NT	20	19
1978	NT	36	41	NT	5	10	NT	54	37	NT	5	13

Table 1B-3
Summary of Annual Maximum Radiological Data for PGDP Well MW-1 and Offsite Well Location 4 (1964 through 1991)[a]
PGDP Phase II Site Investigation
(page 2 of 3)

Year	Well MW-1[b] Beta (pCi/l)			Well MW-1 Alpha (pCi/l)			Well Location 4[c] Beta (pCi/l)			Well Location 4 Alpha (pCi/l)		
	Tot.	Dis-solved	Suspended	Tot.	Dis-solved	Suspended	Tot.	Dis-solved	Suspended	Tot.	Dis-solved	Suspended
1979	NT	45	55	NT	5	34	NT	41	55	NT	5	490
1980	NT	2(avg)	31(avg)	NT	9(avg)	NT	NT	141	185	NT	7	22
1981	NT	NT	NT	NT	NT	NT	NT	45(avg)	5(avg)	NT	6(avg)	<5(avg)
1982	NT	NT	NT	NT	NT	NT	NT	18(avg)	5(avg)	NT	4(avg)	5(avg)
1983	NT	NT	NT	NT	NT	NT	NT	164 (avg)	32(avg)	NT	5(avg)	1(avg)
1984	NT	NT	NT	NT	NT	NT	NT	18(avg)	9(avg)	NT	9(avg)	1(avg)
1985	NT	NT	NT	NT	NT	NT	NT	159 (avg)	5(avg)	NT	5(avg)	1(avg)
1986	NT	NT	NT	NT	NT	NT	NT	5(avg)	5(avg)	NT	1(avg)	1(avg)
1987	NT	NT	NT	NT	NT	NT	NT	18	5	NT	4	5
1988	NT	NT	NT	NT	NT	NT	NT	116	15	NT	13	5

Table 1B-3
Summary of Annual Maximum Radiological Data for PGDP Well MW-1 and Offsite Well Location 4 (1964 through 1991)[a]
PGDP Phase II Site Investigation
(page 3 of 3)

Year	Well MW-1[b] Beta (pCi/l)			Well MW-1 Alpha (pCi/l)			Well Location 4[c] Beta (pCi/l)			Well Location 4 Alpha (pCi/l)		
	Tot.	Dis-solved	Suspended	Tot.	Dis-solved	Suspended	Tot.	Dis-solved	Suspended	Tot.	Dis-solved	Suspended
1989[d]	5968	NT	NT	8.6	NT	NT	85	NT	NT	12.1	NT	NT
1990[d]	3106	NT	NT	118.4	NT	NT	96	NT	NT	8.6	NT	NT
1991[d]	3931	NT	NT	15.5	NT	NT	213	NT	NT	9	NT	NT

[a]Well-construction data and methods of sample collection and analysis are not available for these wells and samples.
[b]Well location 1 is shown on Figure 1B-1 in the Phase I report (CH2M HILL, 1991).
[c]Well location 4 is shown on Figure 1B-1 in the Phase I report (CH2M HILL, 1991).
[d]1989-June 1991 data taken from Energy Systems Q&TSD sampling results (Energy Systems, 1991).

NOTES:

avg = Average value reported
NT = Not tested

Source: Energy Systems, 1988o

Analytical data are available for other onsite wells for 1983 through 1989. Data indicative of Tc-99 (dissolved and suspended beta), TCE (total organic halogens [TOX]), and PCBs are summarized by WMU area in Table 1B-4, for 1983 through 1987; and Table 1B-5, for 1988 and 1989. Well classifications of upgradient and downgradient wells are as stated in the referenced reports; generally, downgradient wells are located between the PGDP and the Ohio River. Shallow wells around the C-404 and C-749 burial grounds show the highest levels of contamination.

As part of the well sampling conducted by DOE/Energy Systems before December 15, 1988, to characterize the offsite contamination plume, 49 onsite wells were sampled. TCE or Tc-99 or both were detected in 17 of the onsite wells; radon was detected in four wells. Table 1B-2 indicates the levels of TCE, Tc-99, and radon detected in each well. One sample from MW-66 was also analyzed for RCRA Appendix IX constituents. Trans-1,2-dichloroethene, carbon tetrachloride, and tetrachloroethene were found in concentrations above the analytical detection limit but two orders of magnitude lower than the concentration of TCE.

MW-63 through MW-68 and MW-71 have been monitored approximately quarterly since the fall of 1987. The locations of these wells are shown in Figures 2-15 and 2-16 in the Phase I report (CH2M HILL, 1991). A summary of 1988 analytical data on Tc-99, TCE, and PCBs for these wells is presented in Table 1B-6. Before Phase I of the site investigation, 57 wells were monitored regularly: 11 were sampled annually, and 46 were sampled quarterly.

MW-63 through MW-68 and MW-71 are constructed as follows: MW-63, MW-66, MW-67, and MW-71 are completed in the top of the RGA; MW-65 and MW-68 are completed in the bottom of the RGA; and MW-64 is completed in a sand lens above the RGA. MW-63 and MW-66 are located approximately 125 feet apart and are screened at similar depths. In general, however, the level of contamination detected in MW-63 is substantially lower (one or more orders of magnitude) than the level of contamination detected in MW-66.

AQUIFER CHARACTERIZATION

The predominant hydrogeologic feature in the vicinity of the PGDP is the RGA. The RGA was first studied in the mid-1960s by the USGS. The results of this early study concluded that the RGA was saturated where it exists beneath the PGDP, and that the RGA's yield is typically between 50 and 395 gallons per minute (gpm), but that it is capable of 985 gpm (Davis et al., 1987).

Slug tests in 1983 and 1987 and an aquifer pump test in 1989 were conducted to evaluate the hydraulic conductivity of the geologic units beneath the C-404 Low-Level

Table 1B-4
Summary of Analytical Data from Groups of Onsite Wells (1983 through 1987)[a]
PGDP Phase II Site Investigation
(page 1 of 4)

	Deep Upgradient Wells		Shallow Upgradient Wells		Deep Downgradient Wells		Shallow Downgradient Wells	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
C-746-F BURIAL AREA								
	Well MW-52				Wells MW-53, MW-54			
Dissolved Beta (pCi/l)								
1983	59	72	No shallow wells were tested.		<5	240	No shallow wells were tested.	
1984	5	5			<.5	14		
1985	<5	27			<5	23		
1986	<5	<5			<5	23		
1987	5	32			5	18		
Suspended Beta (pCi/l)								
1983	27	32	No shallow wells were tested.		<5	45	No shallow wells were tested.	
1984	5	23			<.5	18		
1985	<5	27			<5	45		
1986	9	18			<5	14		
1987	32	32			1	32		
Total Organic Halogens (μg/l)								
1987	<5	38	No shallow wells were tested.		<5	75	No shallow wells were tested.	
PCBs (μg/l)								
1987	<.5	0.1	No shallow wells were tested.		<.1	0.2	No shallow wells were tested.	

Table 1B-4
Summary of Analytical Data from Groups of Onsite Wells (1983 through 1987)[a]
PGDP Phase II Site Investigation
(page 2 of 4)

	Deep Upgradient Wells		Shallow Upgradient Wells		Deep Downgradient Wells		Shallow Downgradient Wells	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
SANITARY AND INERT LANDFILLS								
	Wells MW-38, MW-43, MW-44		Well MW-16		Wells MW-39, MW-40, MW-41, MW-42		Wells MW-17, MW-18, MW-19	
Dissolved Beta (pCi/l)								
1983	<5	99	NT	NT	<5	32	NT	NT
1984	<.5	68	9	27	<.5	54	<.5	27
1985	5	41	9	45	<5	27	<5	45
1986	<5	27	<.2	<.2	<5	14	0.2	1
1987	1	9	0	41	3	77	0	23
Suspended Beta (pCi/l)								
1983	<5	126	NT	NT	<5	50	NT	NT
1984	<.5	41	<.5	41	<.5	27	<.5	54
1985	<5	54	<5	45	<5	45	<5	45
1986	<5	27	0.4	1	<5	27	<.2	5
1987	9	37	5	5	1	27	2	9
Total Organic Halogens (μg/l)								
1987	<5	54	7	42	<5	48	8	80
PCBs (μg/l)								
1987	<.1	<.5	<.1	<0.5	<0.5	<.1	<.1	<.5

Table 1B-4
Summary of Analytical Data from Groups of Onsite Wells (1983 through 1987)[a]
PGDP Phase II Site Investigation
(page 3 of 4)

	Deep Upgradient Wells		Shallow Upgradient Wells		Deep Downgradient Wells		Shallow Downgradient Wells	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
C-404/C-749 BURIAL GROUNDS								
	Wells MW-68, MW-71				Wells MW-63, MW-65, MW-66		Well MW-64	
Dissolved Beta (pCi/l)								
1987	NR	76.58	No shallow wells were tested.		NR	1018	0.14	0.14
Suspended Beta (pCi/l)								
1987	NR	13.51	No shallow wells were tested.		0	103.6	108.11	108.11
Total Organic Halogens (μg/l)								
1987	41	87	No shallow wells were tested.		<5	802	6	9
PCBs (μg/l)								
1987	<.5	<.5	No shallow wells were tested.		<.5	<.5	<.5	<.5
	Wells MW-45, MW-46, MW-48		Wells MW-6, MW-47, MW-49		Wells MW-50, MW-51, MW-52		Wells MW-2, MW-3, MW-4, MW-55, MW-56, MW-57, MW-58	
Dissolved Beta (pCi/l)								
1983	5	104	8	171	27	86	5	891
1984	5	27	27	131	<5	63	<.5	64
1985	<5	23	<5	90	<5	45	<5	90
1986	<5	45	<.2	7	<5	45	<.2	113
1987	1	59	32	32	3	6	0.9	189

Table 1B-4
Summary of Analytical Data from Groups of Onsite Wells (1983 through 1987)[a]
PGDP Phase II Site Investigation
(page 4 of 4)

	Deep Upgradient Wells		Shallow Upgradient Wells		Deep Downgradient Wells		Shallow Downgradient Wells	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
C-404/C-749 BURIAL GROUNDS								
Suspended Beta (pCi/l)								
1983	<5	23	9	131	<5	63	<5	612
1984	5	27	<.5	104	<5	36	<.5	190
1985	<5	45	<5	90	<5	18	<5	563
1986	<5	9	<.2	3	<5	9	<.2	473
1987	9	14	1	1	14	32	0	59
Total Organic Halogens (μg/l)								
1987	<5	100	68	126	<5	93	15	94
PCBs (μg/l)								
1987	<.1	<.5	<.1	<.5	<.1	<.5	<.1	0.6

[a]Well-construction data are not available for the following monitoring wells: MW-2 through MW-6, MW-16 through MW-19, and MW-38 through MW-44. MW-2 through MW-6, and MW-45, MW-55, and MW-56 have been abandoned. Well locations are shown in Figures 2-15 and 2-16 in the Phase I report (CH2M HILL, 1991). Data reported in this table have been rounded.

NOTES:

NR = Not reported. Analytical results showed "negative" values for radiological constituents.
NT = Not tested

Sources: Union Carbide/Energy Systems, 1984 through 1986; Energy Systems, 1987n, 1988y

Table 1B-5
Summary of Analytical Data from Groups of Wells (1988 and 1989)
PGDP Phase II Site Investigation

Location/Wells	Year	Dissolved Beta		Suspended Beta		TOX		PCBs	
		Min (pCi/l)	Max (pCi/l)	Min (pCi/l)	Max (pCi/l)	Min (µg/l)	Max (µg/l)	Min (µg/l)	Max (µg/l)
Horse barn/ MW-20	1988 1989	11.0 14.0	116.0 37.0	NR NR	5.0 4.0	14.0 19.0	41.0 78.0	<0.5 <.5	<0.5 <.5
C-616/ MW-21, MW-22	1988 1989	7.0 NR	164.0 42.0	9.0 NR	81.0 11.0	8.0 <5	56.0 62.0	<0.5 <0.5	<0.5 <1.0
C404, C749/ MW-2 through MW-6, MW-46 through MW-51, MW-57, MW-58	1988 1989	NR NR	177.0 271.0	NR NR	203.0 83.0	<5 <5	1,080 82.0	<0.5 <0.5	<0.5 <0.5
C-746-S, C-746-T/ MW-16 through MW-19, MW-38 through MW-44	1988 1989	NR NR	174.0 42.0	NR NR	44.0 35.0	<5 <5	51.0 56.0	<0.5 <0.5	<0.5 <0.5
C-746/ MW-63 through MW-66	1988 1989	NR NR	2,460.0 2,518.0	NR NR	57.0 33.0	<5 <5	2,610 3,126	<0.5 <0.5	<0.5 <0.5
C-400/ MW-68, MW-69, MW-71	1988 1989	18.0 14.0	155.0 93.0	NR NR	57.0 0	18.0 12.0	57.0 41.0	<0.5 <0.5	<0.5 <0.5
C-404/ MW-84 through MW-95, MW-79	1988 1989	10.0 NT	10.0 NT	.3 NT	.3 <5	<5 130.0	136.0 NT	<0.5 NT	<0.5 NT
C-746-F/ MW-52 through MW-54	1988 1989	NR NR	87.0 8.0	NR NR	9.0 8.0	<5 <5	15.0 12.0	<0.5 <0.5	<0.5 <0.5
C-746-K/ MW-23 through MW-30, MW-32, MW-36, MW-37	1988 1989	9.0 NR	36.0 14.0	NR NR	27.0 10.0	9.0 9.0	79.0 69.0	<0.5 <0.5	<0.5 <0.5

NOTES:

NR = Not reported or negative value reported
NT = Not tested

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Table 1B-6
Results of Analyses (1988) for Plant Wells MW-63 Through MW-68, and MW-71[a]
PGDP Phase II Site Investigation

Parameters	Units	MW-63		MW-64		MW-65		MW-66		MW-67		MW-68		MW-71	
		Feb. 3	May 11	Feb. 3	May 12	Feb. 3	May 11	Feb. 4	May 12	Feb. 18	May 12	Feb. 18	May 12	Feb. 18	May 12
TOX[b]	μg/l	7	9	5	9	5	<5	945	2,209	<5	7	46	46	20	28
Dissolved Alpha	pCi/l	-1.8	38.2	9.4	6.8	4.4	0.2	111	43.2	5.6	-1.9	5.7	13.2	16.7	2.6
Dissolved Beta	pCi/l	8	33	3	-1.7	21	18	2,027	1,261	-2	-9	81	155	18	19
Suspended Alpha	pCi/l	0	0.9	22.5	2.5	-1.8	-0.7	-0.2	2.7	0.7	2.2	10.6	-1.6	-3.1	-4.7
Suspended Beta	pCi/l	10	30	57	23	3	-7	3	4	-2	4	57	26	-8	-10
PCB	μg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

[a]Well locations are shown in Figures 2-15 and 2-16 in the Phase I report (CH2M HILL, 1991). The following monitoring wells were sampled regularly.

Quarterly: 16, 17, 18, 19, 20, 21, 22, 37, 38, 39, 40, 41, 42, 43, 44, 46, 47, 48, 49, 50, 51, 52, 53, 54, 57, 58, 63, 64, 65, 66, 67, 68, 69, 71, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95.
Annually: 23, 24, 25, 26, 27, 28, 29, 30, 32, 35, 36.

[b]TOX = Total organic halogens.

Source: Energy Systems, 1991

Radioactive Waste Burial Ground (C-404) at the PGDP. The RGA was of specific interest. The results of these tests are presented in Table (1B-7). From these results and using a hydraulic gradient of 0.2 percent, an average linear velocity of groundwater of 4 to 5 feet per year is approximated for the RGA beneath the C-404 area.

Along with field permeability tests, a downhole geophysical logging program was implemented to aid in determining the profile of the RGA. Twenty-five wells, both on- and offsite, were logged using four types of geophysical tools. Caliper, natural gamma ray, thermal neutron, and gamma-gamma density logs were performed. Gravel and transition units were delineated within the RGA. The logs were also used to distinguish zones of differing porosities within the RGA. The differing porosities suggest the presence of cobble beds within the gravel unit.

SURFACE WATER

The PGDP has monitored surface water for contamination since 1958 (Baker and Brown, 1959). Initially, samples were taken by DOE/Energy Systems from three points in Big Bayou Creek, one point in Little Bayou Creek, and one point in the Ohio River near Barlow, Kentucky.

Samples consisted of 1-quart grab samples taken at midstream. Sampling frequency varied from weekly (at locations where streams extend away from the plant boundary) to yearly (plant effluents). The surface-water samples were analyzed for uranium, fluoride, pH, chromate, nitrate, and gross beta activity, listed as UX (thorium-234) and UX_2 (protactinium-234). Figure 1B-2 in the Phase I report (CH2M HILL, 1991) shows the water-sampling points that were used beginning in 1958. In 1962 and 1963, other sampling points were added in the Ohio River, and sampling frequency increased to weekly for streams near the plant and monthly for the river. From 1958 through 1974, monitoring results indicated that releases of uranium and beta emitters were all well below applicable standards. The levels of beta activity and uranium measured at sampling station 17--Little Bayou Creek near the crossover of the raw-water line, downstream of the confluence with the North-South Diversion Ditch--were typically an order of magnitude greater than the levels measured at any other sampling point.

In 1975, the PGDP began reporting the number of Ci of uranium and Tc-99 discharged to surface water. In 1975, discharges of 0.06 Ci of uranium (0.00001 percent U-234, 0.22 percent U-235, and 99.79 percent U-238) and 6.4 Ci of Tc-99 were reported. This is the first separate report of Tc-99 releases. Concentrations of uranium and beta emitters were within permissible release limits; amounts measured at station 17 were one to two orders of magnitude higher than at other sampling points.

Table 1B-7 Measured Hydraulic Conductivity Values from Slug Test and Aquifer Pump Test in C-404 Vicinity for the RGA PGDP Phase II Site Investigation			
Well/Boring	**Source**	**Type of Test**	**Hydraulic Conductivity K (cm/s)**
MW-57	D'Appolonia, 1983	Slug	2×10^{-5}
MW-48	D'Appolonia, 1983	Slug	3×10^{-3}
MW-56	D'Appolonia, 1983	Slug	1×10^{-3}
MW-46	Edge, 1987	Slug	1.19×10^{-3} to 2.4×10^{-4}
MW-51	Edge, 1987	Slug	1.2×10^{-4} to 1.5×10^{-4}
MW-79	Terran, 1990	Aquifer pump	2.25×10^{-2} to 4.5×10^{-2}
Source: Adapted from Table 6 in Douthitts, 1990			

OROPAD1/029.51

The Commonwealth of Kentucky has classified Big Bayou Creek and Little Bayou Creek for all-water use--that is, the quality of the water must be suitable for aquatic life and, where applicable, for withdrawal of drinking water and industrial water (Union Carbide/Energy Systems, 1959 through 1971, 1972 through 1985). In 1975, EPA issued an NPDES permit to the PGDP, designating sampling stations 3 (Big Bayou Creek, SW5 in Figure 1B-2 in the Phase I Report [CH2M HILL, 1991]) and 17 (Little Bayou Creek) as two of the six NPDES monitoring points. In 1986, the NPDES permit was replaced by a KPDES permit issued by the Kentucky Division of Water. The KPDES permit was adjudicated in 1986 and was replaced by an Agreed Order in 1987. The locations of the NPDES and KPDES outfalls are shown in Figure 1B-3 in the Phase I report (CH2M HILL, 1991).

Except for chromium and pH, all parameters measured under the NPDES permit "appeared to be environmentally acceptable" (Union Carbide/Energy Systems, 1959 through 1971, 1972 through 1985). During 1977, the two sampling points showed similar average concentrations of uranium in the water. Station 17 (Figure 1B-2 in the Phase I report [CH2M HILL, 1991]) showed higher concentrations of dissolved and suspended alpha emitters, and station 3 showed higher levels of dissolved and suspended beta emitters.

During 1977, 1.1 Ci of uranium (0.003 percent U-234, 0.48 percent U-235, and 99.5 percent U-238) and 10.3 Ci of Tc-99 were discharged to surface streams, primarily Little Bayou Creek (Union Carbide/Energy Systems, 1959 through 1971, 1972 through 1985). Table 1B-8 summarizes data on uranium, alpha and beta emitter concentrations, and total released radioactivity for the years 1978 through 1986.

When the KPDES permit became effective on October 22, 1987, the NPDES monitoring stations on Big Bayou and Little Bayou Creeks were replaced by monitoring stations on all effluent ditches leaving the plant (Figure 1B-3 in the Phase I report [CH2M HILL, 1991]). In 1987, 0.013 Ci of uranium and 0.67 Ci of technetium were released to surface water (Rogers and Ashburn, 1988). An accurate comparison with previous data on uranium and on alpha and beta emitters cannot be made.

Because of the discovery of offsite contamination, several samples of surface water were analyzed for TCE and Tc-99 from August through December 1988. The results are shown in Table 1B-9.

The interim KPDES limits for PGDP effluents specify a maximum of 0.1 μg/l PCBs at Outfalls 001 through 003, 008 through 012, and 015 through 017. The remaining KPDES outfalls do not have a discharge limit for PCBs. From October 1987 through December 1989, water samples analyzed for PCBs under the KPDES permit contained less than the detection limit of 0.5 μg/l PCBs, except for one sample collected at

Table 1B-8
Average Concentrations of Selected Water-Quality Parameters and Total Amounts of Radioactivity Released to Surface Water from the PGDP, 1978 Through 1986[a]
PGDP Phase II Site Investigation

Year	Location	Concentration					Amount Released (Ci)	
		Uranium (mg/l)	Alpha (pCi/l)		Beta (pCi/l)		Uranium[b]	Tc-99[b]
			Dissolved	Suspended	Dissolved[c]	Suspended[c]		
1978	Station 3[d] Station 17[e]	0.2 ± 0.06 0.05 ± 0.02	93 ± 20 <29 ± 10	20 ± 10 8 ± 2	930 ± 190 <30 ± 10	70 ± 20 <30 ± 10	1.0	9.2
1979	Station 3 Station 17	0.02 ± 0.04 0.04 ± 0.07	56 ± 11 26 ± 5	16 ± 6 <13 ± 5	670 ± 150 190 ± 50	<50 ± 8 <30 ± 6	0.5	7.5
1980	Station 3 Station 17	0.1 ± 0.02 0.05 ± 0.008	61 ± 21 40 ± 18	14 ± 4 17 ± 11	980 ± 220 <230 ± 180	140 ± 110 <40 ± 30	0.3	7.9
1981	Station 5[f] Station 10[f]	0.070 ± 0.020 0.060 ± 0.030	39 ± 8 28 ± 17	46 ± 6 <16 ± 9	300 ± 70 <100 ± 50	<80 ± 40 <80 ± 60	0.2	2.8
1982	Station 5 Station 10	0.039 ± 0.011 0.038 ± 0.006	26 ± 13 19 ± 6	<5 ± 1 <4 ± 1	<110 ± 30 <20 ± 10	<2 ± 10 <2 ± 10	0.1	0.7
1983	Station 5 Station 10	0.038 ± 0.009 0.025 ± 0.004	<6 ± 3 <5 ± 2	24 ± 3 <17 ± 3	<40 ± 20 <50 ± 30	<160 ± 40 <50 ± 20	0.12	0.68
1984	Station 5 Station 10	<0.025 ± 0.027 <0.034 ± 0.038	22 ± 6 <4 ± 3	<5 ± 2 <4 ± 2	<160 ± 50 <60 ± 60	<40 ± 10 <50 ± 40	0.08/ 148 kg[g]	0.71/ 0.042 kg[g]
1985	Station 5 Station 10	<0.024 ± 0.017 0.027 ± 0.003	14 ± 3 <13 ± 2	<5 ± 1 <4 ± 1	<60 ± 10 <20 ± 10	<10 ± 10 <10 ± 10	0.05/ 75 kg[g]	0.40/ 0.024 kg[g]
1986	Station 5 Station 10	<0.017 <0.019	13 <14	<5 <5	<40 20	<10 <10	0.04/ 66kg[g]	0.04/ 0.021 kg[g]

[a]Information in this table was obtained from the yearly reports on environmental surveillance.
[b]Primarily released to Big Bayou Creek.
[c]Isotopic analysis showed Tc-99 as primary contributor to beta activity.
[d]Station 3 is on Big Bayou Creek (see Figure 1B-2 in the Phase I report [CH2M HILL, 1991]).
[e]Station 17 is on Little Bayou Creek, but further upstream than the station 17 discussed for the years 1958 through 1961, or 1961 through 1977 (see Figure IB-2 in the Phase I report [CH2M HILL, 1991]).
[f]In 1981, station 17 was redesignated as station 10; station 3 was redesignated as station 5.
[g]Indicates total amount in kilograms discharged for year.

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Table 1B-9
Summary of Analysis for Tc-99 and TCE in Surface-Water Samples, 1988
PGDP Phase II Site Investigation

Location Number	Location, Date[a]	TCE (μg/l)[b]	Tc-99 (pCi/l)[b]
146	North and South Gravel Pit Pond, 9/02/88	<1	<25
150	North Side of Pond at Residence 17, 9/02/88	<1	--[c]
151	Big Bayou Creek at L-5 Sampling Point, 9/08/88	<1	<25
152	Rossington Bridge over Big Bayou Creek, 9/08/88	<1	30
153	"3/4 Bridge" over Big Bayou Creek, 9/08/88	<1	43
177	Cattle Pond at Residence 16, 9/18/88	<1	--[c]
178	Pig Pond at Residence 16, 9/18/88	<1	--[c]
185	TVA Chemical Treatment Pond, 9/21/88	<1	<25
186	TVA Coal Pile Runoff Pond, 9/21/88	<1	<25
187	TVA South Boundary Pond, 9/21/88	<1	<25
188	TVA Ash Pond, 9/21/88	<1	<25
189	Metropolis Lake, 9/21/88	<1	<25

[a]Locations are shown on Figure 1B-1 in the Phase I report (CH2M HILL, 1991).
[b]< indicates not detected in sample at given detection limit (1 μg/l for TCE and 25 pCi/l for Tc-99).
[c]Sample was not analyzed for Tc-99.

OROPAD1/031.51

Outfall 011 in October 1987. That sample contained 1.7 μg/l of PCBs (Shell, 1988b). No data on PCB concentrations in water were reported before 1987.

SOIL AND SEDIMENT

Samples of shallow soil are collected annually at 10 locations around the PGDP: north, east, south, and west at the plant boundary; at sampling locations 5 miles beyond the plant boundary; and at two remote (background) locations 8.1 to 11.2 miles from the PGDP. Soil sampling locations are shown in Figure 1B-4 in the Phase I report (CH2M HILL, 1991).

Soil samples were taken at sample sites that did not appear to have been disturbed over the previous year. The samples were taken over two 11-ft^2 areas, 10 feet apart, to a depth of 2 inches, and were composited.

Concentrations of uranium in soil around the PGDP have been reported approximately annually from 1958 to the present in environmental monitoring and surveillance documents published by Union Carbide and Energy Systems. Table 1B-10 summarizes the data from 1983 through 1989. Tc-99 in soil has been measured but not reported in the PGDP environmental surveillance documents because no discernible annual differences in concentrations of Tc-99 have been noted at any of the regular soil-sampling locations (Energy Systems, 1986f). Concentrations of uranium in the soil samples typically ranged from 1 to 2 mg/kg at background locations. Concentrations of uranium were highest at the plant boundary where they ranged from 1.4 to 6 mg/kg from 1983 through 1989.

The results of analyses of sediment samples are available dating back to 1977 for Tc-99 and other radioisotope concentrations in sediment (Energy Systems, 1986f). Regular sampling and reporting of the data in the PGDP environmental surveillance documents began in 1983. Sediment samples were analyzed for PCBs, uranium, U-235 assay, Tc-99, Np-237, Pu-239, and Th-230. Currently, sediment samples are taken annually from 28 locations in Big Bayou Creek and Little Bayou Creek, PGDP drainage ditches, and PGDP surface impoundments. Sediment sampling locations are also shown in Figure 1B-4 in the Phase I report (CH2M HILL, 1991). At each sampling location, a sampling scoop was used to gather material from the bottom of the stream or reservoir. Samples were obtained from quiet pools where only minimal sediment scouring is expected (Energy Systems, 1988g).

Historically within the PGDP's active area, samples having the highest Tc-99 activity were taken from the North-South Diversion Ditch, sediment-sampling location SS3; the C-616-F Full Flow Lagoon, sediment-sampling location SS5; and the digester sludge from the C-615 Sewage Treatment Plant, sediment-sampling location SS7 (Energy Systems, 1986f)--see Figure 1B-4 in the Phase I report (CH2M HILL, 1991). The

Table 1B-10
Concentration of Uranium in Soil, 1983 through 1989[a]
PGDP Phase II Site Investigation

Location[b]	1983	1984	1985	1986	1987	1988	1989
Property Boundary							
S1 (north)	4	2	5	6	4.8	4.9	2.2
S2 (east)	3	3	3	5	3.4	4.6	2.4
S3 (south)	4	2	2	6	5.5	4.3	5.6
S4 (west)	3	4	3	3	2.5	2.2	1.4
8 km from Plant							
S5 (north)	4	4	3	4	3.9	4.2	2.2
S6 (east)	2	1	2	3	2.6	2.3	1.1
S7 (south)	3	1	3	4	2.7	2.5	1.2
S8 (west)	4	1	2	4	2.8	3.4	1.2
13 to 15 km from Plant							
S9 (south)	2	1	1	2	2.4	2.5	0.8
S10 (west)	2	1	2	3	2.9	2.1	0.7

[a]Measured in mg/kg.
[b]Locations are shown in Figure 1B-4 in the Phase I report (CH2M HILL, 1991).

References: Energy Systems, 1988y, 1990

OROPAD1/032.51

digester sludge is placed in drums for annual disposal. Documentation from Union Carbide/Energy Systems (1984 through 1986) and Energy Systems (1987n, 1988y, 1990) contain the following findings:

- The level of Tc-99 in the North-South Diversion Ditch has decreased from a reading of 12,400 pCi/g in 1977 to 143 pCi/g in 1987.

- Concentrations in the C-616-F Full Flow Lagoon have ranged from 90 pCi/g to 780 pCi/g from 1978 to the present; no upward or downward trend in concentrations is evident.

- Concentrations of Tc-99 in the digester sludge from the C-615 Sewage Treatment Plant have fluctuated widely (from 13.5 pCi/g in 1989 to 1,550 pCi/g in 1980) since measurements were first made at that location, in 1980.

As part of the sampling performed because of the discovery of offsite groundwater contamination in the vicinity of the PGDP, Energy Systems personnel sampled sediment at three locations in Big Bayou Creek. (See sampling locations 151, 152, and 153 in Figure 1B-1 in the Phase I report [CH2M HILL, 1991]). The results of the analyses indicated that Tc-99 activity in the creek sediment is essentially constant along the reach of Big Bayou Creek, starting just downstream of plant effluents and extending to a point about 1 mile upstream of the confluence of Big Bayou and Little Bayou Creeks. Activities in the samples, beginning with the sampling point closest to the plant, were about 31.3 pCi/g, 28.3 pCi/g, and 27.5 pCi/g, respectively.

Sediment samples have been collected at the plant and analyzed for PCBs since 1982. Table 1B-11 lists PCB concentrations in sediment samples collected from 1982 through 1989. Sediment sampling locations in the table correspond to the sediment sampling locations shown in Figure 1B-4 in the Phase I report (CH2M HILL, 1991).

On the basis of the 1982 sampling results, which showed PCB levels higher than 50 ppm in the C-340 ditch at KPDES Outfall 011, further sampling was performed in that ditch in early 1983. Sediment was sampled from the plant security fence to the underflow dam. PCB levels in the samples ranged up to 1,100 ppm, and uranium levels ranged up to 15,000 mg/kg. Because of the high levels of PCB contamination, the sediment was excavated in 1983 until analyses showed that PCB levels in the ditch were less than 50 ppm. The excavated sediment was placed in approximately 1,600 55-gallon drums. The drums are stored on the site, pending disposal.

Table 1B-11
PCB Sediment Data[a]
PGDP Phase II Site Investigation

	Location[b]	1982	1983	1984	1985	1986	1987	1988	1989
SS1	(9) Big Bayou Creek	<5	<5	<5	<1	0.6	<0.1	<3.0	<1.0
SS2	(5) Little Bayou Creek	<5	<5	<5	<1	0.1	2.2	<1.0	0.4
SS3	L-13	<5	<5	<5	<1	0.9	4.9	<1.0	0.3
SS4	(2) C-340 Ditch, KPDES 011	79	<5	6	9	11	<0.1	16	5.1
SS5	(8) C-616 Full Flow Lagoon	<5	<5	<5	<1	<0.1	<0.1	<1.0	<0.1
SS6	(7) C-616 Sludge Lagoon	<5	<5	<5	<1	<0.1	<0.1	<1.0	4.2
SS7	(13) C-615 Digester Drying Beds	60	17	56	69	130	24	24	96
SS8	(10) C-335 Ditch, KPDES 001		<5	6	<1	0.2	<0.1	<1.0	0.1
SS9	(6) North-South Diversion Ditch, KPDES 003		<5	<5	1.2	0.2	<0.1	.2	0.5
SS10	(4) C-337 Ditch, KPDES 002		<5	<5	7	0.5	<0.1	<.1	<0.1
SS11	(3) KPDES 010		<5	<5	<1	<0.1	<0.1	<1.0	0.1
SS12	(1) C-333 Ditch, KPDES 012		<5	<5	<1	0.8	<0.1	<1.0	<0.1
SS13	(14) Southwest Ditch, KPDES 009		<5	<5	<1	<0.1	1.5	2.8	<0.1
SS14	(12) Oil Skimmer Ditch, KPDES 008		<5	<5	<1	2	<0.1	<.1	1.1
SS15	(11) West Ditch, KPDES 015		<5	<5	<1	<0.1	1.1	<1.0	<0.1
SS16	C-720 Parking Lot into Southwest Ditch					1	<0.1	.2	0.4
SS17	C-333 Ditch into Southwest Ditch					<0.1	<0.1	<1.0	0.1
SS18	C-611 Sludge					<0.1	<0.1	<5.0	<0.1
SS19	Upstream Big Bayou Creek, Wooden Bridge					<0.1	<0.1	<1.0	<0.1
SS20	(15) Upstream Big Bayou Creek, L-I Location				<1	<0.1	<0.1	<1.0	0.1
SS21	(16) Upstream Little Bayou Creek				<1	<0.1	<0.1	<3.0	<0.1

[a]Measurements are in $\mu g/g$; a blank indicates no sample taken at that location in that year.
[b]Locations are shown in Figure 1B-7.

NOTE: ( ) = Old location number, before 1986

Sources: Union Carbide/Energy Systems, 1982-1986; Energy Systems, 1987n, 1988y, 1989, 1990

BIOTA

Biological sampling has been conducted at the PGDP since 1955. The results have been reported in the annual environmental surveillance report since 1958. The program has consisted of sampling grasses at 16 to 18 locations near the plant boundary and at points 1 mile and 5 miles from the plant (see Figure 1B-5 in the Phase I report [CH2M HILL, 1991]). The grass samples were analyzed for fluorides to determine compliance with Commonwealth of Kentucky requirements for fluoride concentrations in grass consumed by grazing animals. Other biological monitoring was performed sporadically until 1986, but the samples were not routinely analyzed for Tc-99, TCE, or PCBs.

Grass samples were first measured for Tc-99 in 1978. Five sets of grass samples taken over a 1-year period in 1978 and 1979 showed an average Tc-99 concentration of 37 pCi/g in grass near the northern plant fence. Samples collected in 1980 and 1981 indicated a concentration of 23 pCi/g at the same location. A grass sample taken in the same vicinity in 1983 showed a Tc-99 concentration of 12 pCi/g (Energy Systems, 1986f). In 1983, grass samples were collected from each of the 18 regularly sampled locations and were analyzed for Tc-99. The results of the analysis are shown in Table 1B-12. A summary of biological sampling at the PGDP is shown in Table 1B-13.

From 1986 through 1989, DOE/Energy Systems personnel sampled various food sources found inside and outside the property boundary for Tc-99 and other radionuclides. The results are shown on Table 1B-14 and Table 1B-15, respectively. Sampling locations are shown in Figure 1B-6 in the Phase I report (CH2M HILL, 1991).

Biological monitoring at the PGDP has been expanded by the BMP. The BMP began in the summer of 1987. The study involved 16 effluent ditches (numbered according to KPDES outfalls 001 through 016; see Figure 1B-6 in the Phase I report [CH2M HILL, 1991]) discharging to Big Bayou and Little Bayou Creeks. The findings of the 1988 through 1990 BMP draft annual reports (Birge et al., 1987a, 1988d, 1989, 1990) are summarized as follows:

- Substantial replenishment of fish populations has occurred in the drainage compared with the results of a previous study in 1978.

- Although some downstream recovery has occurred, effects on macro-invertebrate populations exist for some sections of the Little Bayou Creek and Big Bayou Creek drainage system compared with the results of the study in 1978. This was most evident in the effluent-receiving section of Big Bayou Creek.

Table 1B-12
Tc-99 in Grass, 1983
PGDP Phase II Site Investigation

Location (Station Numbers[a])	pCi/g
Plant North (G1)	12
Plant East (G2)	5
Plant South (G3)	<2
Plant West (G4)	<2
Boundary North (G5)	<2
Boundary East (G6)	14
1 Mile North (G7)	4
1 Mile Northeast (G8)	<2
1 Mile East (G9)	<2
1 Mile East-Southeast (G10)	<2
1 Mile South (G11)	<2
1 Mile Southeast (G12)	<2
1 Mile West (G13)	<2
1 Mile Northwest (G14)	<2
5 Miles Northeast (G15)	<2
5 Miles Southeast (G16)	<2
5 Miles Southwest (G17)	<2
5 Miles Northwest (G18)	<2

[a]Station number shown in Figure 1B-5 in the Phase I report (CH2M HILL, 1991).

Source: Energy Systems, 1986e

OROPAD1/034.51

Table 1B-13
Flora and Fauna Sampling at the PGDP
PGDP Phase II Site Investigation
(page 1 of 3)

Year	Grass	Fauna	Flora/Crops	Milk
1958	16 locations; sampled monthly; for fluorides only[a]	NA	NA	NA
1959	As above	NA	NA	NA
1960	As above	NA	NA	NA
1961	As above	NA	NA	NA
1962	As above[b]	NA	NA	NA
1963	16 locations, corresponding to air sampling points; sampled monthly; for fluorides only[c]	NA	NA	NA
1964	As above	NA	NA	NA
1965	As above	NA	NA	NA
1966	As above	NA	NA	NA
1967	As above	NA	NA	NA
1968	As above	NA	NA	NA
1969	Collected every 2 months; air dried 15-20 days	NA	NA	NA
1970	As above	NA	NA	NA
1971	As above	No abnormalities found in rabbits[d]	No typical fumigation damage found[e]	NA
1972	As above	NA	As above	NA
1973	As above	NA	As above	NA
1974	As above	NA	NA	NA
1975	Only samples taken	NA	NA	NA
1976	16 locations, corresponding to air sampling points; for fluorides only[c]	NA	NA	NA
1977	6 samples; one station added	NA[f]	NA	NA
1978	As above	NA	NA	NA
1979	Station added; 18 in all	NA	NA	NA
1980	As above	Bream and carp sampled but not measured for Tc-99[g]	Apples sampled but not measured for Tc-99[g]	1 sample; no Tc-99 measurement[g]
1981	As above	Bass, bluegill, and muskrat; no Tc-99 analysis[h]	Beans, tomatoes, corn, and sweet potatoes; no Tc-99 analysis[h]	NA

Table 1B-13
Flora and Fauna Sampling at the PGDP
PGDP Phase II Site Investigation
(page 2 of 3)

Year	Grass	Fauna	Flora/Crops	Milk
1982	As above	Rabbit, raccoon, fish, and muskrat; no Tc-99 analysis[l]	Beans, corn, tomatoes, peas, apples, and asparagus; no Tc-99[l]	NA
1983	As above	Fish, rabbit, squirrel; no Tc-99 analysis[j]	Several crops; no Tc-99 analysis[j]	NA
1984	As above	Groundhog and rabbit; no Tc-99 analysis[k]	Several crops; no Tc-99 analysis[k]	NA
1985	4 samples taken at each of 18 locations	Rabbit, squirrel, and deer; no Tc-99 analysis[l]	Several crops; no Tc-99 analysis[l]	NA
1986	As above	Tc-99: low of <0.66 pCi/g in raccoon and deer; high of 7.92 pCi/g in fish[m]	Tc-99: low of <0.22 pCi/g in lima beans to a high of 0.44 pCi/g in berries, squash, and beans[m]	NA
1987	As above	Tc-99: low of 0.046 pCi/g in rabbits to 0.73 pCi/g in fish[n]	Tc-99: low of not detectable (<0.06 pCi/g) in persimmons to 0.6 pCi/g in apples[n]	NA
1988	As above	Tc-99: low of 0.03 pCi/g in deer to 1.95 in fish[o]	Tc-99: low of 0 in persimmons, plums and apples to .43 in mulberries[o]	NA
1989	As above	Tc-99: low of 0.35 in racoons to 1.54 in fish[p]	Tc-99: low of 0.54 in potatoes and green beans to 1.35 in okra[p]	NA

[a]Stations were located at the eight compass points, 0.5 mile and 1 mile from the plant midpoint. Vegetation (a broad-leafed grass) was collected in a 1-pound ointment jar, air-dried for 3 to 5 days, then pulverized and analyzed for fluoride content.
[b]Air-drying time increased to 5 to 7 days.
[c]Vegetation-sampling stations were moved to correspond generally to plant air-sampling locations at the four cardinal compass points on the fenceline, at eight points 1 mile from plant midpoint (compass points N, NE, E, ESE, S, SE, W, and NW), and at four points 5 miles from plant midpoint (compass points NE, SE, SW, and NW).
[d]From the 1971 *Environmental Monitoring Report* (Union Carbide/Energy Systems, 1972): "According to Wildlife Area management, game taken and checked through the control station appears to have been healthy and no abnormalities were found in a number of rabbits submitted to a state laboratory for examination."
[e]Leaves and grasses were checked for fluoride-fumigation damage: none was found off the reservation.
[f]A rabbit, a deer, and a turtle were collected in the vicinity of the plant and were analyzed (methodology unknown) for U-234, U-238, Th-228, Th-230, Th-232, Np-237, and Tc-99. The 1977 *Environmental Monitoring Report* (Union Carbide/Energy Systems, 1978) stated, "Dose commitments from the other radionuclides (Tc-99) were each less than 0.01 millirem for the critical organs of exposure."

Table 1B-13
Flora and Fauna Sampling at the PGDP
PGDP Phase II Site Investigation
(page 3 of 3)

[g]Bream and bass were taken from a C-616 lagoon, carp from Big Bayou Creek, milk from the nearest dairy farm, and apples from wild trees growing near the west perimeter fence; the deer was a road kill near the south perimeter fence. No data are available on methodology. Samples were analyzed for Pu-239, U-234, U-235, U-238, Th-230, and Np-237.
[h]Samples were taken from the nearest residence (beans, tomatoes) and "background" residences (beans, tomatoes, and corn). Wildlife consisted of bass, bluegill, and muskrat from a C-616 lagoon; muskrat from a C-611 lagoon; and rabbit. Samples were analyzed for U-234, U-235, U-238, Th-230, and Np-237.
[i]Samples were taken from the nearest community (beans, corn, tomatoes, peas), near the old Ordnance Works (apples and asparagus), and background residences (tomatoes). Wildlife included fish from a C-616 lagoon, muskrat from a C-611 lagoon, a rabbit, and a raccoon. Samples were analyzed for U-234, U-235, U-238, and Th-230.
[j]Samples were taken from the nearest residence (corn, okra, and persimmons), the nearest community (apples, cantaloupes, corn, okra, sweet potatoes, and tomatoes), near the old Ordnance Works (apples and pears), a C-616 lagoon (fish--unspecified species), and the plant vicinity (rabbit and squirrel). Samples were analyzed for U-234, U-235, U-238, and Th-230.
[k]Samples were taken from the nearest residence (turnips and greens), the nearest community (apples, corn, peas, peppers, tomatoes, and turnip greens), near the old Ordnance Works (apples, crab apples, pears, and persimmons), and the plant vicinity (groundhog and rabbit). Samples were analyzed for U-234, U-235, U-238, and Th-230.
[l]Samples were taken from the site (bass and bream), the nearest community (lima beans, peas, peppers, and tomatoes), the plant boundary (apples and a squirrel), 0.5 miles from the plant (deer, apples, corn, peas, peppers, squash, and tomatoes). Samples were analyzed for U-234, U-235, U-238, Np-237, Pu-239, and Th-230.
[m]Sampling locations were not clearly specified in the 1986 environmental surveillance report (Energy Systems, 1987n); samples were taken of plums, raccoon, corn, lima beans, potatoes, berries, squash, apples, beans, cucumbers, deer, persimmons, tomatoes, and fish (from a C-616 lagoon). Samples were analyzed for plutonium, uranium, and technetium. See text for full analytical results.
[n]Sampling locations were not clearly specified in the 1987 environmental surveillance report (Energy Systems, 1988y). Samples were taken of fish (from a C-616 lagoon), deer, rabbit, persimmons, okra, corn, peppers, shelly beans, peas, green beans, squash, tomatoes, apples, and plums.
[o]Sampling stations not clearly specified in the 1988 environmental surveillance report (Energy Systems, 1989). Samples were taken at 17 locations for apples, plums, tomatoes, corn, pears, persimmons, mulberries, rabbit, deer, squirrel, and fish.
[p]Sampling stations not clearly specified in the 1989 environmental surveillance report (Energy Systems, 1990). Samples were taken at 29 locations for persimmons, sweet corn, field corn, tomatoes, shelly beans, hot peppers, potatoes, purple hull peas, okra, apples, fish, squirrel, raccoon, grey squirrel, rabbit, deer.

NOTE:

NA = Not applicable

OROPAD1/035.51

Table 1B-14 Vegetation and Tissue Analyses at the PGDP, 1986 PGDP Phase II Site Investigation	
Sample Description and Number	**Tc-99 (pCi/g)**
Plums-DDF (5NE)	<0.44
Raccoon-NW-1 Mi	<0.66
Corn-7/11/86	<0.22
Lima beans-DDF	<0.22
Potatoes-DDF	0.22
Berries-BW	0.44
Squash-6/24/86	<0.44
Squash-7/11/86	0.44
Plums-5E	<0.44
Tomatoes-7/11	<0.44
Tomatoes-6/24DD	<0.66
Apples-DDF	0.22
Beans-7/11	0.44
Cucumbers-7/11	0.22
Raccoon-6/26	<0.88
Deer 1/4-South	<0.66
Fish-C616	7.92
Persimmons-BN	<0.22
Source: Energy Systems, 1987n	

OROPAD1/036.51

Table 1B-15
Vegetation and Tissue Analyses at the PGDP 1987, 1988, and 1989[a]
PGDP Phase II Site Investigation

Location	1987		1988		1989	
	Sample Type	Tc-99 (pCi/g)	Sample Type	Tc-99 (pCi/g)	Sample Type	Tc-99 (pCi/g)
V1	Apples	0	Apples	0 ± 0.038	Deer	-0.054 ± 0.703
V2	Plums	0.10 ± 0.038	Plums	0.014 ± 0.049	Rabbit	0.757 ± 0.703
V3	Apples	0.65 ± .11	Plums	0 ± 0.049	Raccoon	0.059 ± 0.757
V4	Corn	0.12 ± .065	Tomatoes	0.170 ± 0.249	Grey Squirrel	0.811 ± 0.946
V5	Tomatoes	0.078 ± 0.065	Corn	0.030 ± 0.049	Raccoon	0.351 ± 0.622
V6	Squash	0.007 ± 0.014	Pears	0.081 ± 0.095	Squirrel	-0.054 ± 0.595
V7	Green Beans	0.30 ± 0.14	Persimmons	0 ± 0.043	Fish	1.541 ± 1.378
V8	Peas	0.130 ± 0.08	Persimmons	0 ± 0.035	Apples	-0.054 ± 0.622
V9	Shelly Beans	0	Mulberries	0.432 ± 0.243	Field Corn	1.351 ± 1.568
V10	Corn	0.032 ± 0.022	Rabbit	0.595 ± 0.324	Okra	0.054 ± 1.946
V11	Peppers	0.13 ± 0.086	Deer	0.030 ± 0.062	Green Beans	0.189 ± 1.324
V12	Okra	0.016 ± 0.027	Squirrel	0.297 ± 0.351	Lima Beans	-0.270 ± 2.973
V13	Persimmons	0.024 ± 0.022	Squirrel	0 ± 0.146	Tomatoes	0.108 ± 0.892
V14	Persimmons	0	Fish	1.946 ± 0.649	Purple Hull Peas	0.054 ± 0.919
V15	Rabbit	0.046 ± 0.065	N/A	N/A	Potatoes	0.729 ± 1.189
V16	Deer	0.190 ± 0.12	N/A	N/A	Hot Peppers	-0.729 ± 1.324
V17	Fish (C-616 lagoon)	0.730 ± 0.14	N/A	N/A	Sweet Corn	0.081 ± 0.459

[a]The 1988 study did not sample V15, V16, and V17; the 1989 study also sampled V18 through V29, which are not listed in this report.

NOTE:

NA = Not applicable

Source: Modified from 1987, 1988, and 1989 PGDP environmental reports (Energy Systems, 1988y, 1989, 1990)

OROPAD1/037.51

- Invertebrates and fish from the affected sections of Big Bayou Creek sometimes contained higher concentrations of certain metals (whole-body concentrations of copper, cadmium, chromium, iron, aluminum, nickel, and zinc) compared with concentrations found in organisms taken from below the effluent-affected sections of Big Bayou Creek. The same suites of metals were detected in the corresponding effluents (from effluent Outfalls 001, 006, 008, and 009) at concentrations that exceeded KPDES limits or freshwater criteria for chronic effects.

- The toxicity of effluents was considered a factor contributing to the suppressed biotic conditions observed for Big Bayou Creek.

- The toxicity of the effluents was traceable to total residual chlorine.

- The effluents from the four PGDP effluent outfalls that provide continuous flow to Little Bayou Creek (002, 010, 011, and 012) exhibited moderate but measurable toxicity and also contained combinations of metals and other chemicals listed in the KPDES permits.

- The magnitude and variability of effluent flow to Big Bayou Creek appeared to affect the creek's hydrology and general conditions within the system and, to some extent, may have directly affected resident biota or the concentrations of effluent chemicals.

- PCB contamination, in concentrations ranging from 1.00 mg/kg Aroclor 1248 (the predominant PCB) to 12.33 mg/kg Aroclor 1248, was detected in fish from the creek drainage, particularly in outfall 011 (see Figure 1B-6 in the Phase I report [CH2M HILL, 1991]) and contiguous sections of Little Bayou Creek; further study was recommended.

- PGDP outfalls contribute approximately 3.96 and 0.48 mgd of effluent to Big Bayou Creek and Little Bayou Creek, respectively. During dry periods, these discharges provide the majority of flow within the Bayou drainage.

- Metals (e.g., Al, Cd, Cr, Cu, Fe, Pb, Zn) were detected in PGDP effluents at concentrations that could be toxic.

- Intermittent effluent outfalls (e.g., 003, 013, 015, 017) appear to exert some effects on the Little Bayou Creek and Big Bayou Creek drainage by contributing metals (e.g., Al, Fe) and TSS.

- Drainage from an inactive flyash landfill adjacent to station BB2 may augment metal contamination (e.g., Al and Fe) in the effluent receiving section of Big Bayou Creek near station BB3.

- The metal profile of PGDP effluents was generally consistent with increased metal residues found in biota from effluent-receiving sections of Big Bayou Creek.

- Total suspended solids from effluents from outfalls 001 and 006 may exert some effect on periphyton and filter-feeding animals, but TSS also appears to absorb instream metals (e.g., Al, Fe).

- The pH of effluent from outfall 006 frequently exceeded the KPDES criterion for freshwater biota, but Big Bayou Creek pH remained within recommended guidelines.

- Temperature, dissolved oxygen, and hardness were not adversely affected by the effluent outfalls, but alkalinity sometimes was reduced in Big Bayou Creek by effluent from Outfall 001.

- TRC was found to be a toxic component of effluent from Outfalls 004 and 008, and possibly other waste streams.

- PCB contamination was detected on occasion in PGDP effluents from Outfalls 001, 004, 008, 011, and 012.

- Effluent from the waste treatment facility (Outfall 004) was found to contain TRC, ammonia, and PCBs.

- Of the PGDP effluents, only those from Outfall 004 were found to be consistently and highly toxic.

- For the fathead minnow and *C. dubia* tests combined, chronic toxicity was detected in 43 of 111 onsite effluent tests.

- The frequency of moderate, chronic toxicity observed for the PGDP effluents appeared to be proportional to the magnitude of ecological effects in the effluent-receiving portion of Big Bayou Creek.

- Effluent toxicity was not persistent and often was not measurable after 36 to 48 hours of storage time.

- Intermittent effluents were toxic to the fathead minnow, but *C. dubia* was less affected.

In December 1988, the first results of the BMP's analyses of fish samples for PCBs were made available to Energy Systems and DOE. Available results are presented in Table 1B-16 and Table 1B-17; Figure 1B-7 in the Phase I report (CH2M HILL, 1991) shows the locations of fish-sampling stations. The data show the concentrations of the PCB mixtures Aroclor 1248, Aroclor 1254, and Aroclor 1260 in fish taken from Little Bayou Creek, Big Bayou Creek, and the C-340 ditch (KPDES Outfall 011) during October 1987 to July 1989.

Results were available for 76 fish from Little Bayou Creek (see results for stations starting with "LB" in Table 1B-17), 160 fish from Big Bayou Creek (see results for stations starting with "BB" in Table 1B-17), and 3 fish from onsite drainage ditch 011 (see results for station 011 in Table 1B-16).

Of the 239 fish sampled and analyzed, 42 contained total PCBs in muscle tissue in excess of 2 ppm, the current FDA tolerance limit for the edible portion of freshwater fish. The tolerance limit, based on health effects studies, is also the action level. This is the level above which the FDA would remove a food product from the market. (Note: In April 1989, the Commonwealth of Kentucky posted Little Bayou Creek, warning against fish consumption.)

Table 1B-16
PCB Analyses of Green Sunfish Collected at PGDP, December 1987
PGDP Phase II Site Investigation

Location[b]	Fish I.D. No.	Age	Whole Wet Wt. (g)	Tissue Type	Tissue Wet Wt. (g)	Fat Wt. (mg/g Tissue)	Aroclor Concentration[a] (mg PCB/kg tissue)		
							1248	1254	1260
BB4	1	3+	34.72	Muscle	2.74	3.60	<0.07	0.16	0.08
	2	3+	16.38	Muscle	2.31	4.16	<0.09	0.47	0.10
	3	2+	17.12	Muscle	2.05	3.83	<0.10	0.57	0.15
	4	2+	12.45	Muscle	1.51	4.11	<0.13	0.86	1.17
011	1	4+	40.92	Muscle	5.21	3.08	7.04	9.46	4.03
	2	3+	10.01	Muscle	1.44	5.38	9.19	8.88	4.93
	3	1+	10.66	Muscle	1.29	7.71	3.17	4.56	2.59
BB4	1			G.I.	2.28	14.93	0.88	0.52	0.23
	2			G.I.	0.91	48.96	6.19	1.97	1.70
	3			G.I.	1.06	18.30	3.58	1.43	0.90
	4			G.I.	0.80	37.73	1.49	0.43	0.33
011	1			G.I.	1.92	37.73	98.65	101.07	66.13
	2			G.I.	0.35	33.86	51.86	35.89	21.80
	3			G.I.	0.57	57.54	260.12	324.70	185.81
BB4	1			Liver	0.1302	37.25	9.14	4.61	4.46
	2			Liver	0.0918	33.86	10.68	5.23	12.75
	3			Liver	0.0918	42.48	<2.18	7.52	6.75
	4			Liver	0.0520	29.81	13.46	6.54	<3.85
011	1			Liver	0.2064	36.34	88.13	63.91	50.44
	2			Liver	0.0584	35.96	43.49	29.97	19.69
	3			Liver	0.0929	89.34	70.72	18.41	39.29
BB4	1			Gills	1.55	7.48	1.69	0.63	0.45
	2			Gills	0.43	44.19	8.07	0.47	1.58
	3			Gills	0.61	10.00	2.71	1.21	1.20
	4			Gills	0.48	17.50	2.65	2.21	3.38
011	1			Gills	1.92	21.22	80.86	68.78	34.69
	2			Gills	0.56	15.63	19.04	16.79	11.34
	3			Gills	0.46	41.15	50.67	16.96	27.67

[a]Commonwealth of Kentucky limit for PCB concentration in edible fish tissue is 2 μg/g (2 ppm).
[b]Locations are shown in Figure 1B-7 in the Phase I report (CH2M HILL, 1991).
Source: Birge et al., 1988d

Table 1B-17
PCB Muscle Residues in Fish Collected from Big Bayou (BB) and Little Bayou (LB) Creeks, McCracken County, Kentucky, through July 1989
PGDP Phase II Site Investigation
(page 1 of 17)

							Aroclor Concentration (μg PCB/g muscle)[a]		
Stream Station	**Fish Species and No.**	**Collection Date**	**Otolith Age (yrs)**	**Length (mm)**	**Wet wt. (g)**	**Muscle Lipid (mg/g)[b]**	**1248**	**1254**	**1260**
BB1	Green Sunfish-1	12/15/88	2+	123.0	32.11	4.16	<0.05	0.21	0.16
	Green Sunfish-2	12/15/88	2+	113.0	22.52	5.03	<0.08	<0.08	<0.08
	Bluegill-1	12/15/88	2+	93.8	10.53	3.58	<0.17	<0.17	0.30
	Bluegill-2	12/15/88	1+	75.4	7.62	5.42	<0.23	<0.23	<0.23
	Longear Sunfish-1	12/15/88	2+	117.0	28.05	4.99	0.74	0.81	0.33
	Longear Sunfish-2	12/15/88	2+	115.2	24.43	3.95	<0.07	1.09	0.42
	Longear Sunfish-3	12/15/88	1+	106.7	21.06	10.91	0.44	0.54	0.15
	Longear Sunfish-4	12/15/88	1+	99.0	15.48	5.93	<0.12	0.25	<0.12
	Longear Sunfish-5	12/15/88	1+	103.0	20.51	5.61	<0.09	0.35	0.18
	Redhorse Sucker-1	12/15/88	---	130.7	23.61	9.37	<0.07	0.09	0.09
	Redhorse Sucker-2	12/15/88	---	151.5	39.16	10.98	<0.04	0.13	0.11
	Redhorse Sucker-3	12/15/88	---	140.9	36.38	14.17	<0.04	0.10	0.07
	Green Sunfish-1	2/09/89	2+	146.0	56.34	4.84	<0.04	0.21	0.13
	Green Sunfish-1	3/30/89	3+	126.0	26.84	3.96	<0.07	0.10	0.08
	Green Sunfish-2	3/30/89	3+	131.0	39.59	4.13	0.36	0.25	0.24

Table 1B-17
PCB Muscle Residues in Fish Collected from Big Bayou (BB) and Little Bayou (LB) Creeks, McCracken County, Kentucky, through July 1989
PGDP Phase II Site Investigation
(page 2 of 17)

							Aroclor Concentration (μg PCB/g muscle)[a]		
Stream Station	**Fish Species and No.**	**Collection Date**	**Otolith Age (yrs)**	**Length (mm)**	**Wet wt. (g)**	**Muscle Lipid (mg/g)[b]**	**1248**	**1254**	**1260**
BB1 (cont.)	Green Sunfish-3	3/30/89	3+	143.0	49.18	6.46	0.10	0.11	0.05
	Green Sunfish-4	3/30/89	3+	166.0	78.05	4.88	0.09	0.06	<0.04
	Bluegill-1	3/30/89	2+	109.0	19.42	5.95	<0.10	0.42	0.64
	Longear Sunfish-1	3/30/89	1	85.0	10.52	5.94	<0.10	0.47	0.40
	Longear Sunfish-2	3/30/89	1+	86.0	11.31	7.25	<0.10	<0.10	<0.10
	Longear Sunfish-3	3/30/89	2	99.0	15.38	5.16	<0.07	<0.07	0.17
	Longear Sunfish-4	3/30/89	2+	101.0	17.44	4.41	<0.8	0.11	0.08
BB2	Green Sunfish-1	3/30/89	3+	119.0	31.36	5.75	<0.06	0.08	<0.06
	Green Sunfish-2	3/30/89	3+	113.0	23.91	4.52	<0.09	<0.09	<0.09
	Longear Sunfish-1	3/30/89	1+	107.0	20.28	5.56	<0.10	0.38	0.18
	Longear Sunfish-2	3/30/89	2	95.0	15.49	6.19	<0.07	<0.07	0.10
	Yellow Bullhead-1	3/30/89	---	135.0	30.82	4.64	<0.09	<0.09	<0.09
	Yellow Bullhead-2	3/30/89	---	197.0	102.19	2.40	<0.05	<0.05	0.14
	Green Sunfish-1	7/20/89	4+	131.0	42	3.31	<0.06	0.10	0.10
	Green Sunfish-2	7/20/89	4+	163.0	70	2.17	<0.06	0.06	0.06

Table 1B-17
PCB Muscle Residues in Fish Collected from Big Bayou (BB) and Little Bayou (LB) Creeks, McCracken County, Kentucky, through July 1989
PGDP Phase II Site Investigation
(page 3 of 17)

							Aroclor Concentration (μg PCB/g muscle)[a]		
Stream Station	**Fish Species and No.**	**Collection Date**	**Otolith Age (yrs)**	**Length (mm)**	**Wet wt. (g)**	**Muscle Lipid (mg/g)[b]**	**1248**	**1254**	**1260**
BB2 (cont.)	Green Sunfish-3	7/20/89	4+	171.0	73	2.59	<0.07	0.19	0.14
	Bluegill-1	7/20/89	3+	89.0	9	3.38	<0.13	0.35	0.28
	Bluegill-2	7/20/89	3+	131.0	42	7.11	0.22	0.09	<0.04
	Longear Sunfish-1	7/20/89	3+	114.0	33	3.95	<0.06	0.06	<0.06
	Longear Sunfish-2	7/20/89	3+	121.0	32	3.09	<0.07	0.14	0.32
	Longear Sunfish-3	7/20/89	2+	106.0	24	3.19	<0.09	0.21	0.12
	Longear Sunfish-4	7/20/89	3	97.0	19	4.00	<0.11	<0.11	<0.11
	Yellow Bullhead-1	7/20/89	---	239.0	147	2.06	<0.04	0.24	0.48
BB3	Green Sunfish-1	3/30/89	3+	123.0	33.76	4.23	<0.06	0.11	0.06
	Green Sunfish-2	3/30/89	2+	88.0	12.57	6.57	<0.09	0.56	0.24
	Longear Sunfish-1	3/30/89	2	105.0	21.82	2.75	<0.09	0.17	0.25
	Longear Sunfish-2	3/30/89	2	110.0	24.20	4.15	<0.07	<0.07	<0.07
	Longear Sunfish-3	3/30/89	1+	118.0	30.29	4.87	0.38	0.05	0.18
	Longear Sunfish-4	3/30/89	3	121.0	41.31	3.37	<0.05	<0.05	<0.06
	Longear Sunfish-5	3/30/89	3	130.0	47.08	3.43	<0.04	0.06	0.08

Table 1B-17
PCB Muscle Residues in Fish Collected from Big Bayou (BB) and Little Bayou (LB) Creeks, McCracken County, Kentucky, through July 1989
PGDP Phase II Site Investigation
(page 4 of 17)

							Aroclor Concentration (μg PCB/g muscle)[a]		
Stream Station	**Fish Species and No.**	**Collection Date**	**Otolith Age (yrs)**	**Length (mm)**	**Wet wt. (g)**	**Muscle Lipid (mg/g)[b]**	**1248**	**1254**	**1260**
BB3 (cont.)	Yellow Bullhead-1	3/30/89	---	172.0	72.61	4.32	<0.04	0.19	0.17
	Spotted Bass-1	3/30/89	2+	131.0	28.69	4.61	<0.06	0.34	0.30
	Green Sunfish-1	7/20/89	4+	156.0	72	3.32	<0.05	0.07	0.05
	Green Sunfish-2	7/20/89	4+	127.0	42	7.47	<0.06	0.06	<0.06
	Bluegill-1	7/20/89	3+	91.0	12	4.54	<0.08	0.15	0.14
	Bluegill-2	7/20/89	3+	86.0	9	4.92	<0.13	<0.13	0.13
	Bluegill-3	7/20/89	3+	83.0	9	5.31	<0.12	0.12	0.20
	Longear Sunfish-1	7/20/89	3+	125.0	37	4.20	<0.05	0.05	<0.05
	Longear Sunfish-2	7/20/89	3+	129.0	41	3.60	<0.06	0.07	0.09
	Longear Sunfish-3	7/20/89	4+	121.0	37	3.83	<0.06	0.09	0.28
	Yellow Bullhead-1	7/20/89	---	211.0	106	4.63	<0.06	0.08	0.07
	Yellow Bullhead-2	7/20/89	---	206.0	150	5.18	<0.04	0.13	0.10
BB4	Green Sunfish-1	12/16/87	2+	128.0	34.72	3.60	<0.07	0.16	0.08
	Green Sunfish-2	12/16/87	2+	100.0	16.38	4.16	<0.09	0.47	0.10
	Green Sunfish-3	12/16/87	2+	105.0	17.12	3.83	<0.10	0.57	0.15

Table 1B-17
PCB Muscle Residues in Fish Collected from Big Bayou (BB) and Little Bayou (LB) Creeks, McCracken County, Kentucky, through July 1989
PGDP Phase II Site Investigation
(page 5 of 17)

							Aroclor Concentration (μg PCB/g muscle)[a]		
Stream Station	**Fish Species and No.**	**Collection Date**	**Otolith Age (yrs)**	**Length (mm)**	**Wet wt. (g)**	**Muscle Lipid (mg/g)[b]**	**1248**	**1254**	**1260**
BB4 (cont.)	Green Sunfish-4	12/16/87	1+	95.0	12.45	4.11	<0.13	0.86	1.17*
	Green Sunfish-1	12/15/88	3+	147.0	48.21	4.03	<0.04	0.24	0.25
	Green Sunfish-2	12/15/88	2+	139.0	43.00	4.82	2.24	2.00	0.47
	Green Sunfish-3	12/15/88	3+	141.0	45.10	0.77	<0.05	0.06	<0.05
	Green Sunfish-4	12/15/88	2+	124.0	29.69	4.78	<0.07	0.21	0.10
	Bluegill-1	12/15/88	1+	80.0	8	8.22	<0.11	0.44	0.20
	Longear Sunfish-1	12/15/88	2+	130.0	34.37	5.46	<0.06	0.23	0.21
	Longear Sunfish-2	12/15/88	3+	119.0	30.64	5.35	<0.06	0.45	0.36
	Longear Sunfish-3	12/15/88	2+	118.0	23.49	5.91	<0.08	0.26	0.10
	Yellow Bullhead-1	12/15/88	---	144.0	29.77	6.05	<0.10	0.34	0.34
	Green Sunfish-1	2/09/89	3+	134.0	35.60	4.33	<0.07	0.11	0.12
	Longear Sunfish-1	2/09/89	2+	113.0	24.27	5.46	<0.08	0.52	0.34
	Longear Sunfish-2	2/09/89	2+	108.0	22.46	4.73	<0.10	0.40	0.25
BB5	Green Sunfish-1	3/29/89	2+	118.0	28.48	5.61	<0.07	0.25	0.17
	Green Sunfish-2	3/29/89	1+	117.0	25.39	6.22	<0.07	0.26	0.14

Table 1B-17
PCB Muscle Residues in Fish Collected from Big Bayou (BB) and Little Bayou (LB) Creeks, McCracken County, Kentucky, through July 1989
PGDP Phase II Site Investigation
(page 6 of 17)

							Aroclor Concentration (μg PCB/g muscle)[a]		
Stream Station	**Fish Species and No.**	**Collection Date**	**Otolith Age (yrs)**	**Length (mm)**	**Wet wt. (g)**	**Muscle Lipid (mg/g)[b]**	**1248**	**1254**	**1260**
BB5 (cont.)	Green Sunfish-3	3/29/89	3	129.0	35.24	4.35	<0.06	0.16	0.08
	Green Sunfish-4	3/29/89	2+	155.0	62.85	4.69	<0.04	0.45	0.39
	Green Sunfish-5	3/29/89	2+	152.0	59.35	4.79	<0.04	0.17	0.08
	Longear Sunfish-1	3/29/89	1+	118.0	35.42	6.52	<0.05	0.30	0.18
	Longear Sunfish-2	3/29/89	3	136.0	50.94	2.77	<0.04	0.82	0.32
	Longear Sunfish-3	3/29/89	2	133.0	49.81	3.23	<0.04	0.26	0.41
	Longear Sunfish-4	3/29/89	4	134.0	49.28	3.03	<0.04	0.26	1.16
	Yellow Bullhead-1	3/29/89	---	215.0	148.94	3.83	<0.04	0.32	0.15
	Spotted Bass-1	3/29/89	1+	216.0	128.81	4.40	<0.04	0.66	0.27
	Redear Sunfish-1	3/29/89	2+	144.0	48.81	3.94	<0.03	0.16	0.13
	Bluegill-1	7/20/89	3+	86.0	11	6.67	<0.09	<0.09	0.23
	Bluegill-2	7/20/89	3+	87.0	12	4.90	<0.08	0.08	0.21
	Bluegill-3	7/20/89	3+	89.0	9	4.55	<0.12	0.12	0.31
	Longear Sunfish-1	7/20/89	4+	133.0	45	3.57	<0.06	0.28	0.24
	Yellow Bullhead-1	7/20/89	---	179.0	73	4.21	<0.06	0.24	0.22

Table 1B-17
PCB Muscle Residues in Fish Collected from Big Bayou (BB) and Little Bayou (LB) Creeks, McCracken County, Kentucky, through July 1989
PGDP Phase II Site Investigation
(page 7 of 17)

							Aroclor Concentration (μg PCB/g muscle)[a]		
Stream Station	**Fish Species and No.**	**Collection Date**	**Otolith Age (yrs)**	**Length (mm)**	**Wet wt. (g)**	**Muscle Lipid (mg/g)[b]**	**1248**	**1254**	**1260**
BB5 (cont.)	Yellow Bullhead-2	7/20/89	---	212.0	125	4.72	<0.06	0.12	0.26
	Spotted Bass-1	7/20/89	2+	157.0	50	5.57	<0.06	0.13	0.09
BB6	Green Sunfish-1	12/15/88	2+	147.0	48.87	3.57	1.54	1.40	0.16*
	Green Sunfish-2	12/15/88	3+	126.0	28.04	2.08	0.39	0.17	0.13
	Green Sunfish-3	12/15/88	2+	121.0	26.67	4.27	0.77	0.34	0.16
	Green Sunfish-4	12/15/88	2+	120.0	26.48	3.34	<0.09	2.30	2.41*
	Longear Sunfish-1	12/15/88	3+	140.0	41.84	4.44	<0.05	0.73	0.37
	Green Sunfish-1	3/29/89	3+	106.0	20.11	5.28	<0.10	0.55	0.49
	Green Sunfish-2	3/29/89	2+	115.0	24.44	4.48	0.25	<0.08	0.24
	Green Sunfish-3	3/29/89	3+	122.0	27.55	4.53	0.62	0.51	0.55
	Green Sunfish-4	3/29/89	2+	126.0	31.53	4.43	1.49	1.27	0.56*
	Green Sunfish-5	3/29/89	3+	153.0	50.60	3.61	<0.05	0.23	0.38
	Longear Sunfish-1	3/29/89	3	102.0	20.75	4.87	<0.09	0.49	0.20
	Longear Sunfish-2	3/29/89	1+	114.0	25.94	5.31	1.02	1.21	0.33*
	Spotted Bass-1	3/29/89	1+	160.0	47.00	3.97	<0.04	0.20	0.21

Table 1B-17
PCB Muscle Residues in Fish Collected from Big Bayou (BB) and Little Bayou (LB) Creeks, McCracken County, Kentucky, through July 1989
PGDP Phase II Site Investigation
(page 8 of 17)

							Aroclor Concentration (μg PCB/g muscle)[a]		
Stream Station	**Fish Species and No.**	**Collection Date**	**Otolith Age (yrs)**	**Length (mm)**	**Wet wt. (g)**	**Muscle Lipid (mg/g)[b]**	**1248**	**1254**	**1260**
BB6 (cont.)	Bluegill-1	7/20/89	3+	96.0	14	3.80	0.19	0.15	0.08
	Bluegill-2	7/20/89	3+	143.0	67	4.45	0.26	0.25	0.07
	Longear Sunfish-1	7/20/89	3+	137.0	58	3.85	0.53	0.47	0.19
	Longear Sunfish-2	7/20/89	3+	132.0	49	3.56	1.83	0.96	0.68*
	Yellow Bullhead-1	7/20/89	---	134.0	26	3.40	<0.06	0.24	0.13
	Largemouth Bass-1	7/20/89	4+	183.0	80	4.74	0.27	0.21	0.11
BB7	Green Sunfish-1	12/15/88	3+	158.0	57.56	3.99	<0.04	1.25	0.61
	Longear Sunfish-1	12/15/88	2+	133.0	55.01	6.17	<0.04	0.59	0.15
	Longear Sunfish-2	12/15/88	2+	131.0	41.38	4.67	<0.05	0.71	0.21
	Longear Sunfish-3	12/15/88	2+	140.0	54.35	4.30	0.71	0.23	0.10
	Longear Sunfish-4	12/15/88	3+	134.0	40.73	3.90	<0.05	0.67	0.57
	Longear Sunfish-5	12/15/88	1+	119.0	33.09	8.68	0.43	0.23	0.10
	Longear Sunfish-6	12/15/88	1+	123.0	33.85	5.79	0.34	0.17	0.08
	Green Sunfish-1	3/29/89	1+	107.0	22.97	5.04	0.34	0.26	0.13
	Green Sunfish-2	3/29/89	3+	134.0	42.50	3.15	0.30	0.33	0.25

Table 1B-17
PCB Muscle Residues in Fish Collected from Big Bayou (BB) and Little Bayou (LB) Creeks, McCracken County, Kentucky, through July 1989
PGDP Phase II Site Investigation
(page 9 of 17)

							Aroclor Concentration (μg PCB/g muscle)[a]		
Stream Station	**Fish Species and No.**	**Collection Date**	**Otolith Age (yrs)**	**Length (mm)**	**Wet wt. (g)**	**Muscle Lipid (mg/g)[b]**	**1248**	**1254**	**1260**
BB7 (cont.)	Green Sunfish-3	3/29/89	3+	138.0	44.07	3.93	0.36	0.80	0.37
	Green Sunfish-4	3/29/89	2+	140.0	54.38	6.19	0.30	0.40	0.13
	Longear Sunfish-1	3/29/89	1+	109.0	23.17	4.82	0.40	0.61	0.18
	Longear Sunfish-2	3/29/89	2+	119.0	32.23	6.78	0.76	0.73	0.24
	Longear Sunfish-3	3/29/89	3	109.0	21.87	3.96	<0.09	0.66	0.56
	Longear Sunfish-4	3/29/89	2+	133.0	55.20	5.76	0.57	0.63	0.17
	Spotted Bass-1	3/29/89	1+	207.0	120.59	4.44	<0.04	0.73	0.38
BB8	Green Sunfish-1	2/09/89	2+	141.0	45.45	4.10	<0.05	0.15	0.07
	Longear Sunfish-1	2/09/89	2+	130.0	37.63	3.95	<0.07	0.40	0.66
	Longear Sunfish-2	2/09/89	2+	128.0	45.97	4.80	<0.05	0.14	0.14
	Longear Sunfish-3	2/09/89	2+	126.0	39.83	2.26	<0.06	0.11	<0.06
	Longear Sunfish-4	2/09/89	2+	122.0	36.01	2.40	<0.06	0.22	0.06
	Longear Sunfish-5	2/09/89	2+	123.0	25.61	2.22	<0.12	0.20	0.32
	Bluegill-1	3/29/89	3+	162.0	80.98	3.89	0.15	0.10	0.07
	Bluegill-2	3/29/89	3+	173.0	106.60	3.73	0.16	0.17	0.07

Table 1B-17
PCB Muscle Residues in Fish Collected from Big Bayou (BB) and Little Bayou (LB) Creeks, McCracken County, Kentucky, through July 1989
PGDP Phase II Site Investigation
(page 10 of 17)

							Aroclor Concentration (μg PCB/g muscle)[a]		
Stream Station	**Fish Species and No.**	**Collection Date**	**Otolith Age (yrs)**	**Length (mm)**	**Wet wt. (g)**	**Muscle Lipid (mg/g)[b]**	**1248**	**1254**	**1260**
BB8 (cont.)	Longear Sunfish-1	3/29/89	4	151.0	79.09	7.81	0.25	0.28	0.14
	Longear Sunfish-2	3/29/89	3+	131.0	44.65	5.46	<0.05	0.14	0.17
	Longear Sunfish-3	3/29/89	3	124.0	44.26	4.76	0.25	0.32	0.16
	Longear Sunfish-4	3/29/89	2+	110.0	30.54	8.33	0.18	0.14	0.09
	Spotted Bass-1	3/29/89	1+	150.0	39.51	4.28	0.23	0.26	0.24
	Spotted Bass-2	3/29/89	2+	240.0	171.17	4.01	<0.04	0.40	0.34
	Redhorse Sucker-1	3/29/89	---	325.0	437.24	9.98	0.23	0.25	0.14
	White Sucker-1	3/29/89	---	293.0	320.55	7.16	0.27	0.34	0.11
BB9	Bluegill-1	3/30/89	2	92.0	16.88	7.80	<0.11	<0.11	<0.11
	Bluegill-2	3/30/89	1+	103.0	21.49	7.70	<0.09	<0.09	<0.09
	Longear Sunfish-1	3/30/89	3+	106.0	25.64	8.37	<0.08	0.10	<0.08
	Spotted Bass-1	3/30/89	1+	193.0	107.92	7.00	<0.08	0.16	0.12
	Spotted Bass-2	3/30/89	2+	287.0	306.64	5.35	<0.04	0.16	0.04
	Spotted Bass-3	3/30/89	2+	294.0	397.38	4.86	<0.04	0.09	0.05
	Carp-1	3/30/89	---	565.0	2,419.00	74.74	<0.04	3.60	0.46*

Table 1B-17
PCB Muscle Residues in Fish Collected from Big Bayou (BB) and Little Bayou (LB) Creeks, McCracken County, Kentucky, through July 1989
PGDP Phase II Site Investigation
(page 11 of 17)

							Aroclor Concentration (μg PCB/g muscle)[a]		
Stream Station	**Fish Species and No.**	**Collection Date**	**Otolith Age (yrs)**	**Length (mm)**	**Wet wt. (g)**	**Muscle Lipid (mg/g)[b]**	**1248**	**1254**	**1260**
BB9 (cont.)	Longear Sunfish-1	7/20/89	3+	104.0	23	5.49	<0.09	<0.09	<0.09
	Longear Sunfish-2	7/20/89	2+	90.0	14	5.74	<0.08	0.08	<0.08
	Longear Sunfish-3	7/20/89	1+	96.0	21	11.72	<0.08	<0.08	<0.08
	Longear Sunfish-4	7/20/89	3+	106.0	27	11.53	<0.07	0.11	<0.07
	Longear Sunfish-5	7/20/89	4+	113.0	30	8.34	<0.07	<0.07	<0.07
	Longear Sunfish-6	7/20/89	4+	132.0	41	4.05	<0.05	0.15	0.12
	Longear Sunfish-7	7/20/89	3+	114.0	30	8.23	<0.07	<0.07	<0.07
	Longear Sunfish-8	7/20/89	4+	126.0	44	3.70	<0.07	0.11	0.07
	Spotted Bass-1	7/20/89	2+	227	178	5.61	<0.06	0.18	0.08
011	Green Sunfish-1	12/16/87	2+	137.0	40.92	3.08	7.04	9.46	4.03*
	Green Sunfish-2	12/16/87	1+	88.0	10.01	5.38	9.19	8.88	4.93*
	Green Sunfish-3	12/16/87	1+	94.0	10.66	7.71	3.17	4.56	2.59*
LB2A	Green Sunfish-1	12/15/88	0+	59.4	3.15	16.93	3.52	<0.57	1.32*
	Green Sunfish-2	12/15/88	1+	91.6	12.15	6.27	1.33	0.47	<0.16
	Bluegill-1	12/15/88	1+	101.2	16.06	4.96	4.63	2.54	0.49*

Table 1B-17
PCB Muscle Residues in Fish Collected from Big Bayou (BB) and Little Bayou (LB) Creeks, McCracken County, Kentucky, through July 1989
PGDP Phase II Site Investigation
(page 12 of 17)

							Aroclor Concentration (μg PCB/g muscle)[a]		
Stream Station	**Fish Species and No.**	**Collection Date**	**Otolith Age (yrs)**	**Length (mm)**	**Wet wt. (g)**	**Muscle Lipid (mg/g)[b]**	**1248**	**1254**	**1260**
LB2A (cont.)	Bluegill-2	12/15/88	1+	93.8	13.44	5.81	3.65	2.89	0.63*
	Bluegill-3	12/15/88	0+	94.3	14.05	11.84	0.65	11.64	1.93*
	Bluegill-4	12/15/88	0+	70	5.97	28.49	2.88	<0.40	1.28*
	Longear Sunfish-1	12/15/88	2+	130	45.39	2.32	0.53	<0.03	0.09
	Longear Sunfish-2	12/15/88	2+	123.4	29.41	3.13	<1.19	4.39	1.48*
	Longear Sunfish-3	12/15/88	2+	126	32.12	3.89	<0.62	15.81	4.45*
	Largemouth Bass-1	12/15/88	0+	147	41.51	4.26	0.42	1.82	0.70*
	Bluegill-1	7/20/89	3+	170	97	3.55	1.50	1.24	0.27*
	Longear Sunfish-1	7/20/89	4+	195	142	3.70	1.46	1.15	0.53*
	Longear Sunfish-2	7/20/89	3+	152	64	2.41	7.64	5.54	1.97*
	Longear Sunfish-3	7/20/89	4+	180	142	11.37	0.20	0.20	0.07
	Largemouth Bass-1	7/20/89	2+	194	112	7.57	3.85	4.38	1.48*
LB2	Green Sunfish-1	12/15/88	2+	143.0	51.69	4.05	0.89	0.34	0.09
	Green Sunfish-2	12/15/88	2+	137.2	39.85	4.59	1.75	1.03	0.49*
	Green Sunfish-3	12/15/88	2+	123.0	29.36	5.23	3.04	3.15	0.80*

Table 1B-17
PCB Muscle Residues in Fish Collected from Big Bayou (BB) and Little Bayou (LB) Creeks, McCracken County, Kentucky, through July 1989
PGDP Phase II Site Investigation
(page 13 of 17)

							Aroclor Concentration (μg PCB/g muscle)[a]		
Stream Station	**Fish Species and No.**	**Collection Date**	**Otolith Age (yrs)**	**Length (mm)**	**Wet wt. (g)**	**Muscle Lipid (mg/g)[b]**	**1248**	**1254**	**1260**
LB2 (cont.)	Green Sunfish-4	12/15/88	1+	117.0	27.03	5.95	4.01	4.17	0.89*
	Bluegill-1	12/15/88	3+	171.0	96.7	4.53	2.04	0.84	0.59*
	Bluegill-2	12/15/88	4+	166.0	84.9	4.62	2.26	1.08	0.33*
	Bluegill-3	12/15/88	2+	142.0	54.61	2.82	0.25	<0.04	0.19
	Bluegill-4	12/15/88	3+	154.0	65.12	2.02	3.41	3.01	0.75*
	Longear Sunfish-1	12/15/88	3+	152.0	82.4	7.61	2.97	<0.42	0.42*
	Longear Sunfish-2	12/15/88	2+	143.3	58.01	4.22	2.03	1.13	0.31*
	Longear Sunfish-3	12/15/88	2+	134.0	44.83	6.09	2.33	1.51	0.36*
	Largemouth Bass-1	12/15/88	2+	301.0	374.2	4.65	4.49	<0.41	1.07*
	Largemouth Bass-2	12/15/88	2+	291.0	312.1	1.51	2.98	1.63	0.52*
	Largemouth Bass-3	12/15/88	0+	174.0	47.7	4.07	<0.29	0.42	0.45
	Black Bullhead-1	12/15/88	---	79.4	5.53	4.05	2.84	1.68	0.60*
	Green Sunfish-1	3/20/89	1+	72.0	6.36	6.71	1.85	1.57	0.61*
	Green Sunfish-2	3/20/89	1	82.0	7.95	5.75	3.73	3.37	0.53*
	Green Sunfish-3	3/20/89	1+	83.0	9.53	5.24	2.82	3.96	1.64*

Table 1B-17
PCB Muscle Residues in Fish Collected from Big Bayou (BB) and Little Bayou (LB) Creeks, McCracken County, Kentucky, through July 1989
PGDP Phase II Site Investigation
(page 14 of 17)

							Aroclor Concentration (μg PCB/g muscle)[a]		
Stream Station	**Fish Species and No.**	**Collection Date**	**Otolith Age (yrs)**	**Length (mm)**	**Wet wt. (g)**	**Muscle Lipid (mg/g)[b]**	**1248**	**1254**	**1260**
LB2 (cont.)	Green Sunfish-4	3/30/89	2+	87.0	10.55	5.77	1.16	1.64	0.69*
	Longear Sunfish-1	3/30/89	1+	82.0	10.04	6.68	3.26	4.41	1.43*
	Longear Sunfish-2	3/30/89	2	86.0	11.34	5.03	1.04	2.33	0.78*
	Longear Sunfish-3	3/30/89	2+	96.0	15.52	5.17	2.26	5.60	2.55*
	Longear Sunfish-4	3/30/89	2+	115.0	25.64	3.68	2.33	4.89	2.18*
LB3	Green Sunfish-1	12/15/88	2+	93.0	11.63	4.26	2.60	0.98	0.78*
	Green Sunfish-2	12/15/88	3+	130.8	34.77	2.87	0.69	<0.05	0.39
	Bluegill-1	12/15/88	0+	64.5	3.77	6.50	1.97	1.57	0.53*
	Longear Sunfish-1	12/15/88	2+	98.8	15.92	5.70	<0.10	7.32	2.18*
	Longear Sunfish-2	12/15/88	1+	88.7	13.63	5.18	0.41	1.22	0.60*
	Creek Chub-1	12/15/88	---	122.8	18.55	11.33	0.28	<0.09	0.13
	Creek Chub-2	12/15/88	---	97.6	9.79	17.73	1.61	<0.15	0.38
	Creek Chub-3	12/15/88	---	91.0	7.60	16.81	0.31	0.37	0.24
	Creek Chub-4	12/15/88	---	98.4	9.99	12.68	0.45	0.38	0.21
	Green Sunfish-1	3/30/89	1+	89.0	11.13	5.93	0.55	0.61	0.29

Table 1B-17
PCB Muscle Residues in Fish Collected from Big Bayou (BB) and Little Bayou (LB) Creeks, McCracken County, Kentucky, through July 1989
PGDP Phase II Site Investigation
(page 15 of 17)

							Aroclor Concentration (μg PCB/g muscle)[a]		
Stream Station	**Fish Species and No.**	**Collection Date**	**Otolith Age (yrs)**	**Length (mm)**	**Wet wt. (g)**	**Muscle Lipid (mg/g)[b]**	**1248**	**1254**	**1260**
LB3 (cont.)	Green Sunfish-2	3/30/89	1+	86.0	11.09	6.82	3.21	3.15	0.65*
	Green Sunfish-3	3/30/89	1+	95.0	16.14	5.56	1.25	1.61	0.44*
	Green Sunfish-4	3/30/89	2+	124.0	34.48	4.31	0.37	0.44	0.15
	Bluegill-1	3/30/89	2+	110.0	23.69	3.46	0.48	0.49	0.21
	Longear Sunfish-1	3/30/89	1+	86.0	12.41	6.32	1.58	1.92	0.38*
	Longear Sunfish-2	3/30/89	1+	89.0	14.27	6.05	0.59	0.86	0.22
	Longear Sunfish-3	3/30/89	2	96.0	17.37	4.67	0.86	0.91	0.38
	Yellow Bullhead-1	3/30/89	---	195.0	85.68	4.00	0.92	0.81	0.17
	Yellow Bullhead-2	3/30/89	---	151.0	39.76	4.12	0.78	0.53	0.30
LB4	Green Sunfish-1	12/15/88	1+	69.9	4.80	9.05	<0.40	0.46	0.44
	Green Sunfish-2	12/15/88	2+	91.0	9.46	7.67	<0.28	0.50	0.72
	Longear Sunfish-1	12/15/88	0+	65.6	4.46	7.54	<0.42	<0.42	0.44
	Longear Sunfish-2	12/15/88	0+	67.7	4.12	8.04	<0.49	<0.49	<0.49
	Common Carp-1	12/15/88	---	128.7	29.30	19.66	<0.07	0.24	0.18
	Creek Chub-1	12/15/88	---	132.5	24.81	10.78	<0.07	0.15	0.09

Table 1B-17
PCB Muscle Residues in Fish Collected from Big Bayou (BB) and Little Bayou (LB) Creeks, McCracken County, Kentucky, through July 1989
PGDP Phase II Site Investigation
(page 16 of 17)

							Aroclor Concentration (μg PCB/g muscle)[a]		
Stream Station	**Fish Species and No.**	**Collection Date**	**Otolith Age (yrs)**	**Length (mm)**	**Wet wt. (g)**	**Muscle Lipid (mg/g)[b]**	**1248**	**1254**	**1260**
LB4 (cont.)	Creek Chub-2	12/15/88	---	103.3	11.90	12.50	<0.14	<0.14	<0.14
	Creek Chub-3	12/15/88	---	103.8	11.93	15.78	<0.14	0.24	<0.14
	Creek Chub-4	12/15/88	---	129.3	20.69	5.41	<0.09	0.12	0.17
	Creek Chub-5	12/15/88	---	124.3	20.82	11.35	<0.08	0.10	<0.08
	Green Sunfish-1	3/30/89	3+	113.0	22.18	5.31	<0.09	0.30	0.23
	Green Sunfish-2	3/30/89	3+	104.0	13.94	4.79	<0.09	0.24	0.38
	Green Sunfish-3	3/30/89	3+	83.0	8.38	4.79	<0.14	0.34	0.29
	Green Sunfish-4	3/30/89	2	124.0	34.81	5.33	<0.05	0.13	0.06
	Green Sunfish-5	3/30/89	3+	98.0	12.29	2.96	<0.10	0.48	0.78
	Longear Sunfish-1	3/30/89	1+	74.0	6.80	5.05	<0.15	0.18	<0.15

Table 1B-17
PCB Muscle Residues in Fish Collected from Big Bayou (BB) and Little Bayou (LB) Creeks, McCracken County, Kentucky, through July 1989
PGDP Phase II Site Investigation
(page 17 of 17)

							Aroclor Concentration (μg PCB/g muscle)[a]		
Stream Station	**Fish Species and No.**	**Collection Date**	**Otolith Age (yrs)**	**Length (mm)**	**Wet wt. (g)**	**Muscle Lipid (mg/g)[b]**	**1248**	**1254**	**1260**
LB4 (cont.)	Longear Sunfish-2	3/30/89	1+	76.0	8.22	5.72	<0.12	0.29	0.13
	Longear Sunfish-3	3/30/89	3	90.0	13.29	4.35	<0.09	0.33	0.51
	Longear Sunfish-4	3/30/89	4+	180.0	97.35	4.12	<0.04	0.22	0.21

[a]Asterisks denote Aroclor concentration totaling 2 μg/g or more.
[b]Shift decimal point one place to the left for percent lipid.

NOTES:

BB = Big Bayou Creek
LB = Little Bayou Creek

Source: Birge et al., 1988d

MEMORANDUM CH2M HILL

TO: Distribution

COPIES: Rick Doane/Eberline/Health Physics Field Support/615-576-0320
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Craig Morrison/Eberline/HP Manager/615-576-0320

FROM: Lynn Sichelstiel/CH2M HILL/ORO/Sample Management Task Order Manager

DATE: January 25, 1991

SUBJECT: Task Instructions for Sample Management During Phase II Paducah Gaseous Diffusion Plant Site Investigation

PROJECT: ORO30888.SM

1.0 SUMMARY AND OBJECTIVES

Sample management for the Paducah Gaseous Diffusion Plant (PGDP) Site Investigation (SI) will involve the tracking of various media, waste, and treatability testing samples from the time the samples are obtained through data analysis and report generation as well as providing quality control (QC) and continuity for the sampling program.

These sample management project instructions discuss the responsibilities of sample management and describe the path of the environmental media, investigation derived waste, and treatability testing samples from the time of sampling through to disposal of sample residuals. Information regarding sample numbers by media, numbers and types of containers, sample storage, sample tracking, shipment to offsite laboratories, and procedures for completing labels and chain-of-custody forms are also provided.

This document should be used in conjunction with other task-specific project instructions that address specific sampling procedures for various media (i.e., soil boring, groundwater sampling, etc.) at PGDP.

Sample Management Personnel Responsibilities

Responsibilities of sample management personnel is briefly discussed below. Specific responsibilities for these personnel are described in greater detail in Section 3.1.

The field sample manager (FSM) is responsible for obtaining the appropriate number and type of sample containers; handling, storing, and shipping samples properly;

determining that sample labels and chain-of-custody forms are filled out completely, correctly, and consistently; rectifying sampling documentation discrepancies; field and laboratory quality assurance (QA)/QC; sample tracking; and submitting samples to the onsite Field Support Laboratory (FSL) and offsite laboratories correctly and on time.

The sampling task order manager (TOM) is responsible for overall QC; overseeing field sample management personnel; tracking samples through the analytical, validation, and data entry stages; aiding in maintaining the sample data base; and providing reports on sample status and analytical results for the project manager, task managers, and other team members, as appropriate.

2.0 APPLICABLE FIELD PROCEDURES

The Energy Systems Environmental Surveillance (ESES) Procedures (Publication ESH/Sub/87/21706/1) listed below apply to this work effort. Each sampling team will has a copy of the appropriate procedures available for reference at the site. Each team member will read the procedures and sign a statement of understanding regarding the procedures prior to startup of the work.

Method ESP-100, "Introduction"
Methods ESP-307, "Field Measurement Procedures"
Method ESP-400, "Field Quality Control"
Method ESP-500, "Manual Chain-of-Custody Procedures"
Method ESP-701, "Sample Preservation and Container Materials"
Method ESP-800, "Packing Environmental Samples for Transportation"
Method ESP-900, "Cleaning and Decontaminating Sample Containers and Sampling Devices"
Method ESP-1000, "Waste Management"

Other applicable information for sample management/handling includes protocols and memoranda such as:

"User's Guide to the Contract Laboratory Program," U.S. Environmental Protection Agency (EPA), Office of Emergency and Remedial Response, Document Number 9240.0-1, December 1988.

Memorandum from George Stephens/ORO, dated September 7, 1990, "Project Instructions for Shipping "Limited Quantity" Radioactive Samples" (Revision 1).

Memorandum from George Stephens/ORO, dated March 13, 1990, "PGDP Field Support Laboratory (FSL) Radiological Analyses Capabilities."

Memorandum from George Stephens/ORO, dated January 29, 1990, "Shipment of PGDP Samples to MGM."

Memorandum from George Stephens/ORO, dated December 20, 1989, "Issues Concerning Paducah Gaseous Diffusion Plant (PGDP) Environmental Samples."

"Protocol for Screening Samples from PGDP for Radioactivity."

Those methods/memorandums particular pertinent to sample management are provided as Attachment A at the end of these project instructions.

3.0 ONSITE PERSONNEL

CH2M HILL Personnel

Field Activities Coordinator: Dan Marion

Task Managers: Bill Avolio (subsurface), Tom Simpson (surface)

Field Sampling Crew: Waste Management--Jim Emery; Other sampling task personnel--to be assigned for each sampling event.

Sample Manager: Russ Goff

Waste Manager: Jim Emery

Field QC: Russ Goff

QC for Sample Management: Lynn Sichelstiel

QC for Waste Management: Lynn Sichelstiel

TMA/Eberline Personnel

Industrial Hygiene/Health Physics (IH/HP) Technicians: Personnel assigned to sampling crew.

Personnel filling these positions will be documented on daily sign-in sheets and in the CH2M HILL site logbooks.

3.1 RESPONSIBILITIES

Sample management responsibilities will continue throughout the entire length of the PGDP Phase II project. Field sample management, however, will be discontinued prior to this. It is anticipated that field sampling may continue until May 1, 1991; however, field sample management will continue past this date depending on waste management activities. Work responsibilities of the FSM (Russ Goff) will include but not be limited to:

- obtaining and keeping the appropriate number and type of sample containers and labels at the site to meet sampling needs;
- tracking and assigning collection of daily QA samples;
- ensuring that QC analytical samples (field blanks, duplicates, etc.) are obtained;
- participating in chain-of-custody procedures for collected samples;
- securing storage for samples and maintaining sample custody until they are sent to appropriate laboratories;
- determining laboratories to which the samples will be sent;
- rectifying sampling documentation discrepancies;
- submitting samples to the onsite FSL;
- packing and submitting samples for transport to offsite laboratories properly and on time;
- management of sample residuals returned from the offsite laboratories and transfer of this waste to the Field Waste Manager; and
- submitting sample tracking paperwork daily to the sample management TOM in ORO.

If field team members are not completing paperwork (i.e., labels, chain-of-custody forms, etc.) in an accurate and/or acceptable manner, the FSM should immediately notify the field technician and appropriate task manager in the field to correct the discrepancy and the way in which team members are completing them.

The sampling TOM (Lynn Sichelstiel) is responsible for overall QC and tracking of samples from the time samples are obtained through to report generation. Other responsibilities include but may not be limited to:

- overseeing field sample management personnel;
- ensuring the proper documentation is current and correct; and
- aiding in maintaining the sample data base.

The sample management project assistant (PA) is responsible for the administration of technical information generated during PGDP Phase II. Responsibilities include but may not be limited to:

- data entry and maintenance of the sample tracking data base (SAMPTRAK);
- providing reports on sample status and analytical results for the project and task managers and other team members, as appropriate;
- maintaining sample management/tracking files; and
- routing of technical information to appropriate personnel.

Laboratory analysis, data validation, and data management, as well as field tasks, are directly related to sample management. Communication between these task managers and other personnel whenever possible should ensure the coordination of the project effort.

4.0 METHODS

Sample management will be performed to provide continuity, tracking, and QC throughout Phase II sampling work. This will be especially important because of the large volume of samples from various media expected to be generated. Sample flow, QC, sample tracking requirements, QC samples, and supplies needed for sample management are discussed in the sections that follow.

4.1 SAMPLE FLOW--ENVIRONMENTAL, FIELD QC, AND GEOTECHNICAL SAMPLES

The path of environmental and field QC samples from the point at which the samples are taken in the field through to the management of the sample residuals and data entry and validation is discussed in the section below and illustrated in Figure 1.

1. An environmental sample is taken by field crews at the sampling site (borehole, stream, well, etc.) within the work zone, and the sample is composited, filtered, or otherwise processed, as required, according to the specific project instructions for that particular sampling task. As the sample is collected, it is field-screened for volatiles and radioactivity with an HNu and/or

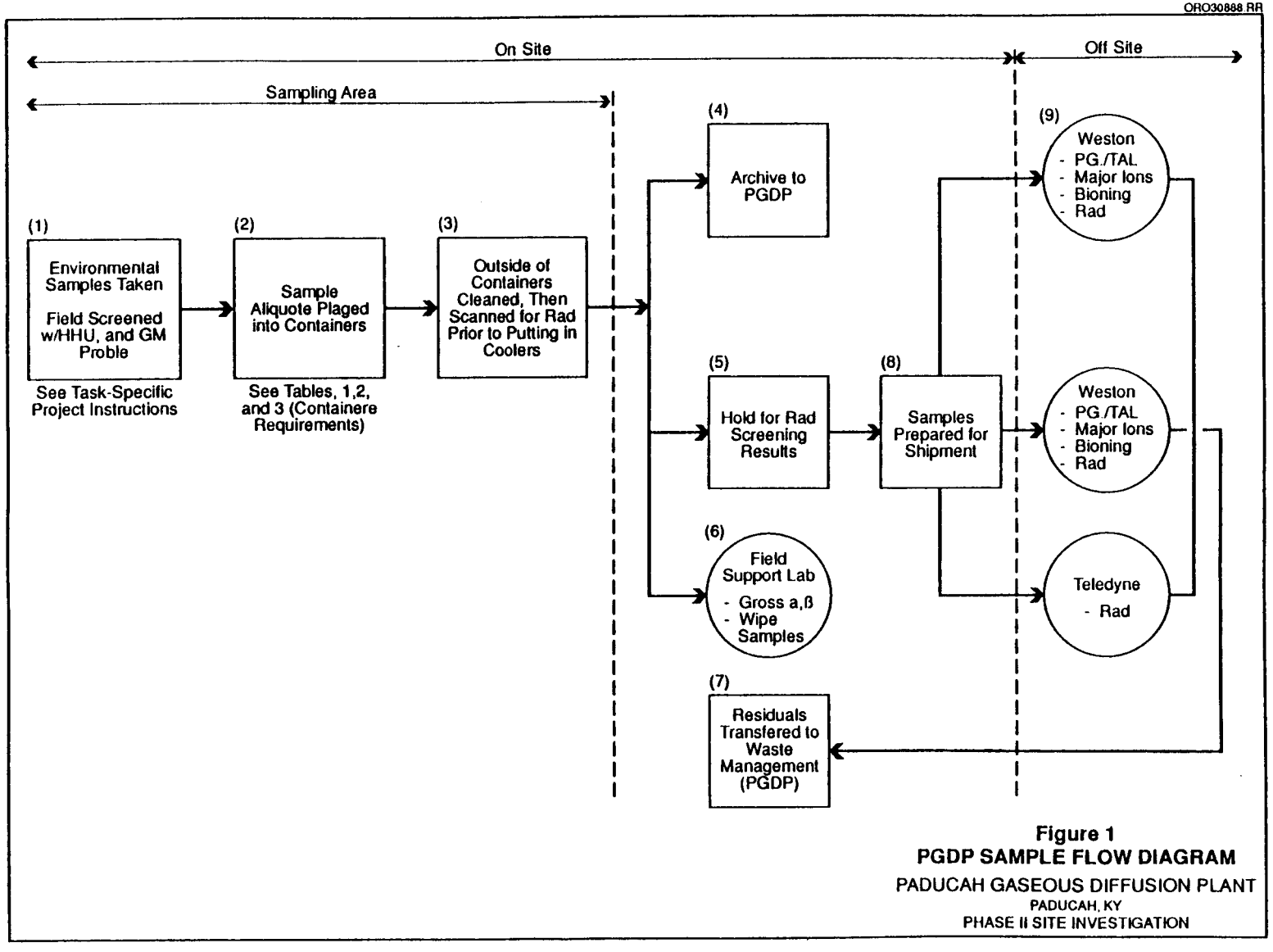


Figure 1
PGDP SAMPLE FLOW DIAGRAM
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION

an OVA and a GM probe, respectively, and the screening results noted in field logbooks.

2. Sample aliquots are placed in the appropriate sample containers in accordance with task-specific project instructions. Field QC samples, such as sample duplicates, matrix spike/matrix spike duplicates (MS/MSD), and equipment (rinsate) blanks, are also taken or prepared at this point. Specific sample container requirements and field QC samples are discussed below. When an insufficient amount of sample is available for all of the required analyses, the priority of analyses listed on Table 1 will be followed.

3. Field crews are responsible for completing the sampling tracking forms (Figures 2 and 3), chain-of-custody records (Figure 4), and labels provided to them by the FSM for all environmental, waste, or geotechnical samples taken.

4. After sample containers have been filled, sealed, and labels completed, the outside surfaces of each sample container are cleaned to remove any material that may have spilled onto the outside of it. The sample containers are then scanned for radioactive surface contamination by the IH/HP technician. If there is surface contamination in excess of the limits established in the Site Safety Plan (SSP), the sample containers will be recleaned until the contamination is removed. Once clean, containers can then be taken out of the sampling area.

   Clean sample containers will be placed in cushioned coolers with the lids locked or secured with tape for transport out of the sampling area and to the FSL, located outside of Building 730.

   Samples will only be picked up using CH2M HILL-owned or leased vehicles. Private vehicles shall not be used.

   The samples will be transferred from the field samplers to the sample manager at the FSL, where the samples will be "checked in." Chain-of-custody transfer of the samples will be made when the samples are surrendered by the sampling team. The sample manager will confirm that the samples are preserved, if required. Tables 2 and 3 present the preservative requirements.

5. One aliquot per soil sample will be submitted to the FSL for PGDP archival. This container will be labeled "PGDP's Radiologic Archive." Archive samples will be surrendered to PGDP following FSL screening and will be held with the

Table 1
Priority of Analyses

Analysis	Water	Non-PCB Solids	PCB Solids
Radiation Screening	1	1	1
TCL VOC	2	2	5
TCL BNA	4	4	6
TCL Pesticides/PCBs	5	5	2
TAL Metals	6	6	7
TCL Cyanide (CN)	7	7	8
Radioisotopes	3	3	4
Dioxins/Furans	NR	NR	3
Major Ions	8	NR	NR
Radioisotope Archive	9	8	9

TAL Target Analyte List
TCL Target Compound List
NR Not Required

Figure 2

ENVIRONMENTAL SAMPLE TRACKING INFORMATION

Rev.1/24/91

Sample # _____ Project # ORO 30888.____ Station # _____
Sample Matrix _____ Sample Type _____ Field VOC Reading _____
Date Sampled / / Time Sampled ____:____ Field Rad Reading _____
Logbook # _____ Page # _____
Name of Sampler _____

Sample Description _____
Additional Groundwater Information Onsite Offsite Upgradient Downgradient (Circle One)

FSL Results: Gross Alpha pCi/L pCi/g (Circle One)
Gross Beta/Gamma pCi/L pCi/g
ARE THESE RESULTS ABOVE MGM LIMITS? YES NO
Liquid Limits - Alpha = 30 pCi/L, Beta = 500 pCi/L
Solid Limits - Alpha = 15 pCi/g, Beta = 50 pCi/g

Analytical Fraction	Number of Containers	SDG #	Lab QC Sample	Container Lot #	LAB	Date Shipped	Airbill #	Requested Turnaround
PGDPRAD								
FSLRAD								
TCLVOC								
TCLBNA								
TCLPEST								
TALMET								
TALCN								
MAJION								
DIOX								
GROSS								
GROSSF								
RADISO								
RADISOF								
GEOTECH								

THE SHADED AREA SHOULD BE FILLED OUT BY THE FSM. THE FIELD SAMPLING CREW SHOULD FILL OUT THE REMAINDER OF THE FORM PRIOR TO SAMPLE DELIVERY TO THE FSM.

WASTE SAMPLE TRACKING INFORMATION Rev.1/22/91

Sample # _____ Project # ORO30888.FF Station # _____
Sample Matrix _____ Sample Type _____ Field VOC Reading _____
Date Sampled ____/____/____ Time Sampled ____:____ Field Rad Reading _____
Logbook # _____ Page # _____
Name of Sampler _____

FSL Results: Gross Alpha pCi/L pCi/g (Circle One)
Gross Beta/Gamma pCi/L pCi/g
ARE THESE RESULTS ABOVE DOT LIMITS? YES NO
Liquid and Solid Limits - 2000 pCi/L or pCi/g

Analytical Fraction	Number of Containers	Lab QC Sample	Laboratory	Date Shipped	Airbill Number	Requested Turnaround
FSLRAD						
WWTCE						
WWPCB						
WWMET						
WWRAD						
WWGWC						
SWORG						
SWMET						
SWTCLP						
SWRAD						
SWGWC						

THE SHADED AREA SHOULD BE FILLED OUT BY THE FSM. THE FIELD SAMPLING CREW AND THE FWM SHOULD FILL OUT THE REMAINDER OF THE FORM PRIOR TO SAMPLE DELIVERY TO THE FSM.

Figure 4

CHAIN OF CUSTODY RECORD

PROJECT NUMBER	PROJECT NAME
CLIENT NAME	
PROJECT MANAGER	COPY TO:
REQUESTED COMP. DATE	SAMPLING REQUIREMENTS: SDWA ☐ NPDES ☐ RCRA ☐ OTHER ____

CLIENT ADDRESS AND PHONE NUMBER

ANALYSES REQUESTED

FOR LAB USE ONLY	
LAB#	
LAB#	
PROJECT NO.	
ACK	VERIFIED
QUOTE#	BS
NO. OF SAMP	PG / OF

STA NO.	DATE	TIME	COMP	GRAB	SOIL	SAMPLE DESCRIPTIONS (12 CHARACTERS)	# OF CONTAINERS											LAB ID	REMARKS

SAMPLED BY AND TITLE	DATE/TIME	RELINQUISHED BY	DATE/TIME	HAZWRAP/NEESA Y N	
				QC LEVEL 1 2 3	
RECEIVED BY:	DATE/TIME	RELINQUISHED BY:	DATE/TIME	COC	ICE
				ANA REQ	TEMP
RECEIVED BY:	DATE/TIME	RELINQUISHED BY:	DATE/TIME	CUST SEAL	Ph
				SAMPLE COND.	
RECEIVED BY LAB:	DATE/TIME	SAMPLE SHIPPED VIA UPS BUS FED-EX HAND OTHER ____	AIR BILL#		
REMARKS				ENTERED INTO LIMS ____	COC REVIEWED ____

REV 6/89 FORM 340

Table 2
Aliquot and Container Requirements for Water Samples

ANALYSIS	CONTAINER TYPE (a)	REGULAR SAMPLE REQUIRED	ADDITIONAL QC SAMPLES (b)	PRESERVATIVES/ STORAGE REQUIREMENTS	MAXIMUM HOLDING TIME
Field Screening Laboratory					
Radioactivity (gross alpha/beta)	500-ml plastic	1	1	none	48 hours
Offsite Laboratories					
TCL Organics (VOC)	40-ml VOA vial (c)	1-preserved 1-unpreserved	1-preserved 1-unpreserved	5 drops of HCl in 1/2 of	7 days w/o HCl
TCL Semivolatiles (BNA)	2-liter amber glass (c)	1	1	containers (d); 4 deg. C 4 deg. C	14 days w/HCl 7 days to extraction
TCL Pesticides/PCBs	2-liter amber glass (c)	1	1	4 deg. C	40 days after extraction
TAL Metals	1-liter plastic	1	1	HNO3 to pH<2	180 days (Hg 26 days)
TAL Cyanide (CN)	1-liter plastic	1	1	NaOH to pH>12	14 days
Alkalinity, Chloride, Sulfate	1-liter plastic	1	1	4 deg. C	14 days-alkalinity, 28 days-chloride and sulfate
Sulfide	50-ml plastic	1	1	zinc acetate and NaOH to pH>9; 4 deg. C	7 days
Nitrate	500-ml plastic	1	1	H2SO4 to pH<2 4 deg. C	28 days
Dioxins and Furans	1-liter amber glass	1	1	4 deg. C	Indefinite
Radioisotopes (e)	2-gallon container	1	1	HNO3 to pH<2	6 months
Gross Alpha/Beta (filtered)	1-liter plastic	1	1	HNO3 to pH<2	6 months

TCL Target Compound List
TAL Target Analyte List
NA Not Applicable
(a) Container Substitutions
4-liter or 1 gallon
2-liter or 80 ounces
1-liter or 1-quart
500-ml or 1 pint

(b) Lab QC samples taken every 20 samples per matrix
(c) teflon lined caps
(d) clearly mark preserved vials
(e) double the regular number of samples when filtering is required

Table 3
Aliquot and Container Requirements for Soil Samples

ANALYSIS	CONTAINER TYPE (a)	REGULAR SAMPLE REQUIRED	ADDITIONAL QC SAMPLES (b)	PRESERVATIVES/ STORAGE REQUIREMENTS	MAXIMUM HOLDING TIME
Field Screening Laboratory					
Radioactivity (gross alpha/beta)	60-ml glass jar (c)	1	1	none	48 hours
Offsite Laboratories					
TCL Organics	120-ml glass jar or 40-ml glass vial (c)	2	2	4 deg. C; protect from light	14 days
TCL Semivolatiles (BNA)/ TCL Pesticides/PCBs	250-ml wide-mouth amber glass jar (c)	1	1	4 deg. C; protect from light	10 days to extraction, 40 days after extraction
TAL Metals/ TAL Cyanide (CN)	250-ml wide-mouth amber glass jar (c)	1	1	4 deg. C; protect from light	180 days (Hg 26 days) 14 days-cyanide
Dioxins and Furans	250-ml wide-mouth amber glass jar (c)	1	1	4 deg. C	Indefinite
Radioisotopes	600-ml in 1-gallon plastic jar	1	1	none	6 months
Archive					
Radiological Archive	500-ml plastic or glass jar	1	NA	none	Indefinite

TCL Target Compound List
TAL Target Analyte List
NA Not Applicable
(a) Container Substitutions
500-ml or 16 ounces or 1-pint
250-ml or 8 ounces

(b) Lab QC samples taken every 20 samples per matrix
(c) teflon lined caps

other archive aliquots until transferred. Tables 2 and 3 present container requirements for this and other aliquots.

6. One aliquot per sample for each media will also be submitted to the FSL for gross alpha/beta screening analysis on the same day that the samples are taken. These FSL sample aliquots will be labeled "FSL alpha/beta" or "rad screening." Chain-of-custody transfer will be used when submitting samples to the FSL. A separate chain-of-custody form, generated by the FSM, will be used for FSL radiological screening. Field radiological screening results will be placed in the remarks section of the chain-of-custody forms for FSL information purposes. This form should be retained by the FSM as project documentation. Once the samples have been counted and their activity recorded, the sample aliquots will be returned to the FSM. Written results from the FSL of the sample activity levels will be submitted to the FSM at that time to determine sample destinations to the appropriate laboratory. The rad screening aliquot will then be placed in a container to await transfer to and disposal by the waste manager.

   All FSL screening positives and 10% of all negatives will be shipped offsite for analysis by analytical laboratories.

7. Once the aliquots for the PGDP and FSL have been separated, the remainder of the sample containers will be immediately transferred to the sample management refrigerator (or freezer). The sample, which will consist of multiple containers, will be kept together while being stored--preferably in a box with the sample number written on it for easier identification. Once this has been accomplished, the sample will be logged into the field sample management notebook/logbook and on an "in-out" log on the refrigerator door. Sample number and date/time "in" and "out" will be prominently recorded on the door. The refrigerator will be kept locked with only the sample manager (or his designee) and field activity coordinator carrying keys. (Note: If refrigerator space is inadequate, the sample manager may store sample aliquots that do not require refrigeration in a secured locker in the sample management facility.)

8. The sample manager will turn over the FSL sample residuals and those sample containers that do not require analysis by an offsite laboratory to the waste manager for proper storage. In addition, sample residuals from the offsite laboratories will be returned to the waste manager through the sample manager for compositing, storage, and later release to PGDP for disposal (see waste management project instructions).

9. The appropriate samples will be prepared by the FSM for shipment to offsite laboratories. Attachment B shows the decision process to be followed for further sample analysis based on FSL results. Samples, individually bagged in Ziplocs™, will be placed in the coolers with bubble packing and/or vermiculite to protect the samples from breakage. Ziploc™ bags of ice or blocks of "blue ice" will also be placed in the coolers to keep the samples cold. Other items that need to accompany each sample cooler are the chain-of-custody forms (with the Federal Express airbill number on it and our copy removed) and the FSL radiological screening results documentation. This documentation should also be placed in a Ziploc™ bag to protect them from moisture. Table 4 lists the offsite laboratories, the analysis they will perform, laboratory contacts, phone numbers, and addresses.

   Sample coolers will be scanned, along with other routine scanning, by an IH/HP technician following ESES Procedure Method ESP 308-02. Table 5 and the SSP contain information on acceptable limits for release. After the samples and coolers are cleared, they will be packaged for shipment according to ESES Procedure Method ESP 800. Where possible, swipe samples will be taken of the coolers in addition to or instead of scanning. Coolers must be dry prior to taking the swipe, as moisture will interfere with the FSL counting.

   Once coolers are packed with samples, ice, bubble packing/vermiculite, and documentation, they will be closed securely; wrapped with strapping tape; and custody seals dated, signed, and placed over one of the back hinges and the front middle closure. If the coolers need to be reopened prior to shipment, custody seals will have to be replaced and signed.

10. Coolers of samples for analyses will be shipped to the offsite laboratories by the sample manager through Federal Express (cooler pick up at the FSL) to the Montgomery (MGM), Weston, Teledyne, NUS, or Law Engineering laboratories. Figure 5 shows an example Federal Express shipping label. Coolers may also have an additional mailing label as backup or other transportation labeling. FSL screening results will determine these requirements. The sample manager will notify the laboratories on the day that samples are shipped that sample delivery is pending.

4.2 SAMPLE FLOW--WASTE SAMPLES

This section addresses the sample management of waste samples to be sent for waste characterization analysis. The waste management project instructions provide details

Table 4
Offsite Laboratory Information

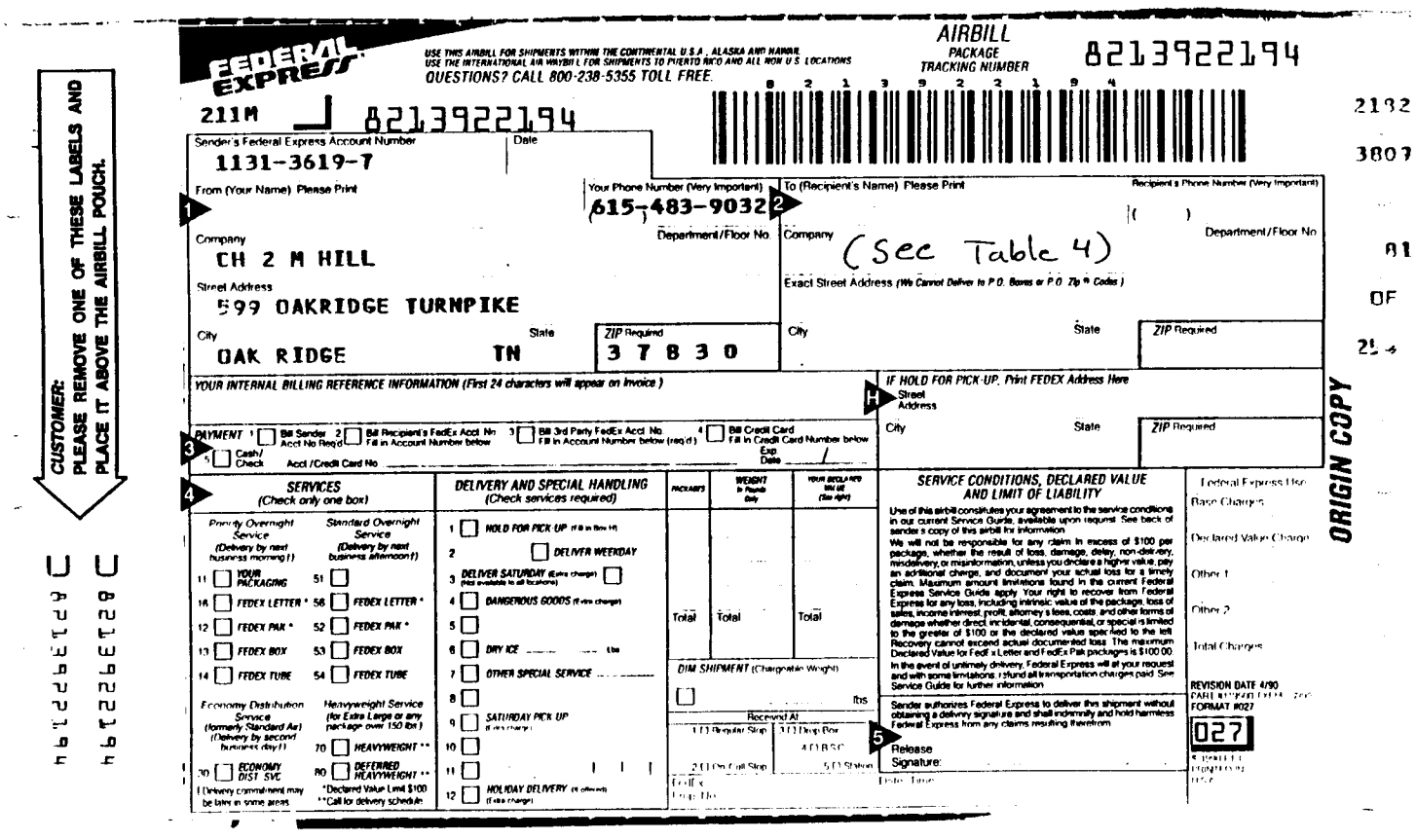
Laboratory	Analyses	Contact	Phone Number	Address
CH2M HILL-MGM	TCL organics TAL inorganics Major ions	Susan Garner Spencer Hamil	(205) 271-1445	CH2M HILL Laboratory 2567 Fairlane Drive Montgomery, AL 36116 Attn.: Susan Garner
Teledyne	Radioisotopes	Al Hogan David Martin	(201) 664-7070	Teledyne Isotopes 50 Van Buren Avenue Westwood, NJ 07675 Attn.: Al Hogan
Weston	TCL organics TAL inorganics Major ions Dioxins/furans	John Richardson Peg Geiger Ben Shapiro	(215) 524-7360	Weston Laboratories 208 Welsh Pool Road Pickering Creek Industrial Park Lionville, PA 19353
NUS	TCLP Waste characterization criteria Radioisotopes	Pat Lynch Mary Beth Bartolovic	(412) 747-2500	NUS Corporation Laboratory Services Group 5350 Campbells Run Road Pittsburgh, PA 15205
Law Engineering	Geotechnical parameters	Dennis Schooley David Bourne	(615) 832-0513	Law Engineering, Inc. 445 Metroplex Drive Nashville, TN 37211 Attn.: Dennis Schooley

Table 5
Radioactive Sample Release Limits

	Alpha	Beta
Montgomery		
Liquid[a]	30	500
Solid[b]	15	50
DOT Shipping Limit		
Liquid and Solid	Less than 2,000 total	Less than 2,000 total

[a]Values given in pCi/l.
[b]Values given in pCi/g.
DOT Department of Transportation.

Figure 5


FEDERAL EXPRESS
USE THIS AIRBILL FOR SHIPMENTS WITHIN THE CONTINENTAL U.S.A., ALASKA AND HAWAII.
USE THE INTERNATIONAL AIR WAYBILL FOR SHIPMENTS TO PUERTO RICO AND ALL NON U.S. LOCATIONS
QUESTIONS? CALL 800-238-5355 TOLL FREE.
AIRBILL
PACKAGE TRACKING NUMBER
8213922194
211M
8213922194
2132
3807
81
OF
Sender's Federal Express Account Number
1131-3619-7
Date
From (Your Name) Please Print
Your Phone Number (Very Important)
615-483-9032
To (Recipient's Name) Please Print
Recipient's Phone Number (Very Important)
Company
CH 2 M HILL
Department/Floor No.
Company
(See Table 4)
Department/Floor No.
Street Address
599 OAKRIDGE TURNPIKE
Exact Street Address (We Cannot Deliver to P.O. Boxes or P.O. Zip Codes)
City
OAK RIDGE
State
TN
ZIP Required
37830
YOUR INTERNAL BILLING REFERENCE INFORMATION (First 24 characters will appear on invoice)
IF HOLD FOR PICK-UP, Print FEDEX Address Here
Street Address
City
State
ZIP Required
PAYMENT
Bill Sender Acct No Req'd
Bill Recipient's FedEx Acct No Fill in Account Number below
Bill 3rd Party FedEx Acct No Fill in Account Number below (req'd)
Bill Credit Card Fill in Credit Card Number below
Cash/Check
Acct/Credit Card No
Exp Date
SERVICES (Check only one box)
Priority Overnight Service (Delivery by next business morning)
Standard Overnight Service (Delivery by next business afternoon)
YOUR PACKAGING
FEDEX LETTER *
FEDEX PAK *
FEDEX BOX
FEDEX TUBE
Economy Distribution Service (formerly Standard Air) (Delivery by second business day)
Heavyweight Service (for Extra Large or any package over 150 lbs)
ECONOMY DIST SVC
HEAVYWEIGHT **
DEFERRED HEAVYWEIGHT **
Delivery commitment may be later in some areas
*Declared Value Limit $100
**Call for delivery schedule
DELIVERY AND SPECIAL HANDLING (Check services required)
HOLD FOR PICK UP
DELIVER WEEKDAY
DELIVER SATURDAY (Extra charge)
DANGEROUS GOODS (Extra charge)
DRY ICE
OTHER SPECIAL SERVICE
SATURDAY PICK UP
HOLIDAY DELIVERY
PACKAGES
WEIGHT
Total
DIM SHIPMENT (Chargeable Weight)
lbs
Received At
Regular Stop
Drop Box
On Call Stop
Station
SERVICE CONDITIONS, DECLARED VALUE AND LIMIT OF LIABILITY
Use of this airbill constitutes your agreement to the service conditions in our current Service Guide, available upon request. See back of sender's copy of this airbill for information.
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on the different types of SI-derived waste materials and how they will be managed. Figure 6 shows the path of waste samples from the point of sampling through disposal of sample residuals following laboratory analysis, and follows the description.

1. Wastes such as drilling cuttings will be composited and sampled at the area of investigation (well site). These cuttings will then be transported to the waste management area for storage until characterized. Liquid wastes such as purge water will be transported to waste storage tanks and sampled. These samples are taken according to the waste management project instructions and will be handled under chain-of-custody procedures.

2. The sample is composited or otherwise processed as required by the waste management project instructions, and the appropriate sample containers are filled with aliquots of the sample. Tables 6 and 7 list the number and type of containers to be filled for liquid and solid waste samples.

3. After sample containers have been filled, sealed, and labels completed, the outside surfaces of each sample container are cleaned to remove any material that may have spilled onto the outside of it. The sample containers are scanned for radioactive surface contamination by the IH/HP technician. If there is surface contamination in excess of the limits established in the SSP, the sample containers will be recleaned until the contamination is removed. Once clean, containers can then be taken out of the sampling area.

   Clean sample containers will be placed in cushioned coolers with the lids locked or secured with tape for transport out of the sampling area and to the FSL, located outside of Building 730.

   Samples will only be picked up using CH2M HILL-owned or leased vehicles. Private vehicles shall not be used.

   The samples will be transferred from the field sampler to the sample manager at the FSL, where the samples will be "checked in." Chain-of-custody transfer of the samples will be made when the samples are surrendered by the sampling team. The sample manager will confirm that the samples are preserved, if required. Tables 6 and 7 present preservation requirement.

4. One aliquot per waste sample will also be taken by/submitted to the FSL for gross alpha/beta screening analysis on the same day that the samples are

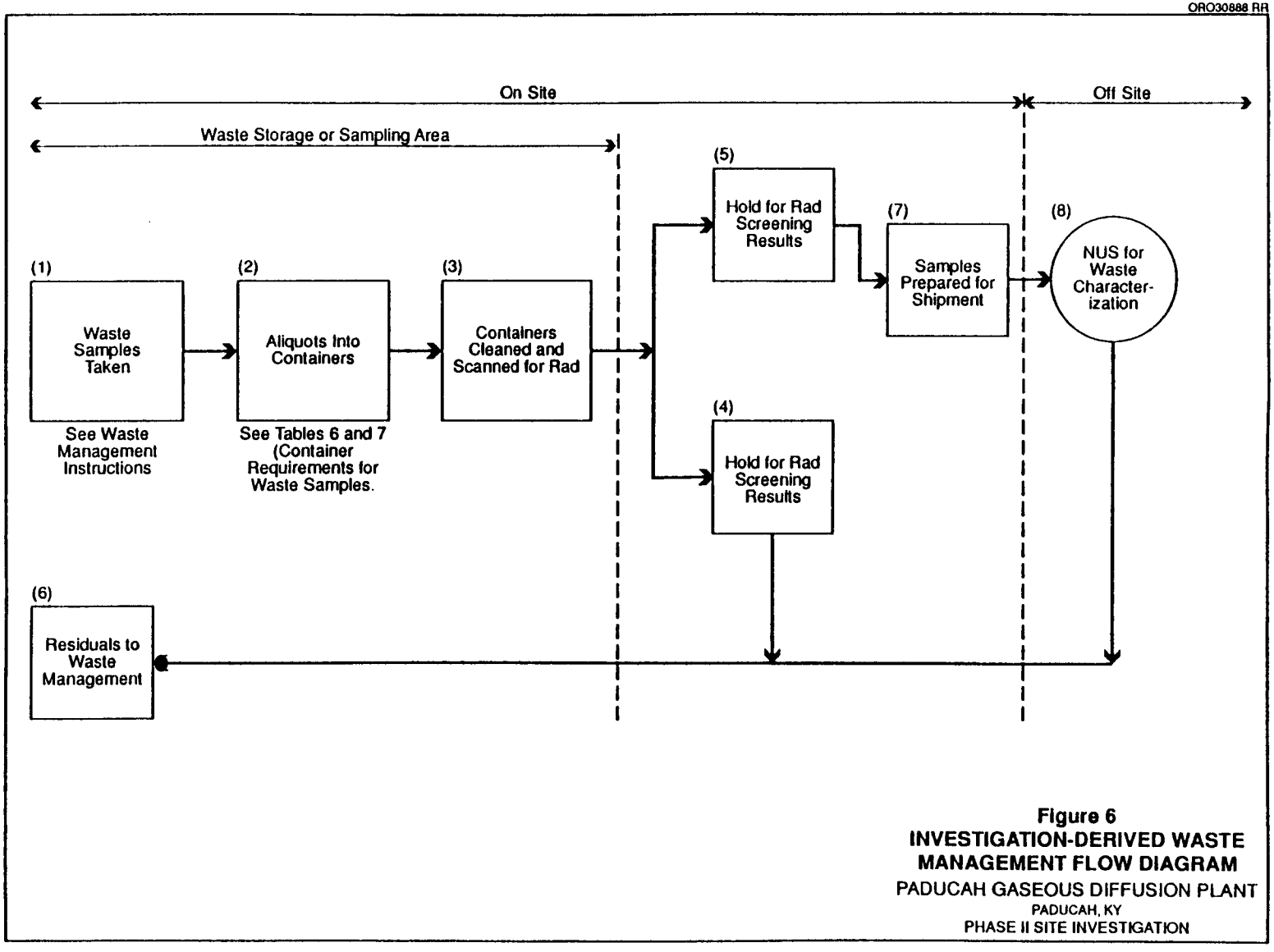

Figure 6
INVESTIGATION-DERIVED WASTE MANAGEMENT FLOW DIAGRAM
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION

TABLE 6
Container Requirements for Liquid Waste Samples

ANALYSIS	CONTAINER TYPE AND VOLUME	PRESERVATIVES/ STORAGE REQUIREMENTS	MAXIMUM HOLDING TIME
Field Screening Laboratory			
Radioactivity (gross alpha/beta)	1-500 ml plastic	none	48 hours
NUS Laboratory			
VOAs	2-40 ml glass vials with Teflon-lined septum	4 degrees C	14 days
PCBs	1-half-gallon glass with Teflon-lined cap	4 degrees C	extraction 7 days, 40 days after extraction
Metals	1-1 liter polyethylene bottle	nitric acid to pH <2	6 months, Hg-28 days
Radiochemistry	1-1 gallon (approx. 4 liters) polyethylene	nitric acid to pH <2	6 months
General Waste Characteristics (Fluorine, Chlorine, Sulfur, Physical parameters)	1-1 liter polyethylene bottle	4 degrees C	28 days

TABLE 7
Container Requirements for Solid Waste Samples

ANALYSIS	CONTAINER TYPE AND VOLUME	PRESERVATIVES/ STORAGE REQUIREMENTS	MAXIMUM HOLDING TIME
Field Screening Laboratory			
Radioactivity (gross alpha/beta)	1-60 ml glass jar	none	48 hours
NUS Laboratory			
VOAs	6-32 oz. (quart) wide-mouth glass jars with teflon-lined lids	4 degrees C	14 days
TCLP			extraction 14 days, 28 days after extraction
TCLP Metals			6 months, Hg-28 days
PCBs/Pentachlorophenol			extraction 14 days, 40 days after extraction
Radioisotopes			6 months
General Waste Characteristics			28 days

taken. These FSL sample aliquots will be labeled "FSL alpha/beta." Chain-of-custody transfer will be performed when submitting samples to the FSL. Tables 6 and 7 present the waste media aliquot size and container requirements. Once the samples have been counted and their activity recorded, the sample aliquots will be turned over to the sample manager. The sample manager will receive written results of the sample activity levels at that time for inclusion with shipments to NUS, Teledyne, or Weston laboratories.

5. Once the aliquot for the FSL has been separated out, the remainder of the sample containers will be immediately transferred to the sample management refrigerator (or freezer). The sample, which will consist of multiple containers, will be kept together while being stored--preferably in a box with the sample written on it for easier identification. Once this has been accomplished, the sample will be logged into the field sample management notebook/logbook and on an "in-out" log on the refrigerator door. Sample number and date/time "in" and "out" will be prominently recorded on the door. The refrigerator will be kept locked with only the sample manager or his designee and field activity coordinator carrying keys. (Note: If refrigerator space is inadequate, the sample manager may store sample aliquots that do not require refrigeration in a secured locker in the sample management facility.)

6. FSL and offsite laboratories sample residuals will be returned to the FSL/sample manager or the waste manager for compositing, storage, and later release to PDGP for disposal (see waste management project instructions).

7. The waste samples will be prepared by the FSM for shipment to offsite laboratories once the FSL screening has been performed and the sample destination determined. Samples will be prepared for shipment as stated in Section 4.1.9. Table 4 lists the offsite laboratories, the analysis they will perform, laboratory contacts, phone numbers, and addresses. The work plan calls for all FSL screening positives and 10% of all negatives to go offsite for analysis.

   Sample coolers will be scanned along with other routine scanning by an IH/HP technician following ESES Procedure Method ESP 308-02. Reference the SSP for acceptable limits for release. After the samples and coolers are cleared, they will be packaged for shipment according to ESES Procedure Method ESP 800.

8. Coolers of waste samples for characterization will be shipped to the offsite laboratories by the sample manager through Federal Express (cooler pick up at the FSL) to the NUS laboratory. Figure 5 shows an example Federal

Express shipping label. Coolers may also have an additional mailing label as backup. Other transportation labeling may also be required. FSL screening results will determine these requirements. The sample manager will notify the laboratories on the day that samples are shipped that sample delivery is pending.

4.3 GEOTECHNICAL SAMPLES

Soil samples for geotechnical parameters will be taken during the deep boring soil sampling task. These parameters include Atterberg limits, grain size analysis, natural moisture content, cation exchange capacity, total organic carbon unit weight, and triaxial permeability. Both disturbed and undisturbed samples will be obtained as described in the deep soil boring task instructions. Volume, container, and preservative requirements for these samples are included in Table 8. Geotechnical sample fractions will be handled similarly to chemical and radiological samples using sampling tracking, FSL screening, and chain-of-custody forms. FSL results will be included in the sample cooler with the chain-of-custody forms. Please note that an FSL aliquot is required if the geotechnical samples are taken independent of an environmental sample. Normal QA/QC samples will not be required for geotechnical samples, and holding times are not applicable. Aliquots designated for moisture content must be sealed tightly, and all aliquots should be labeled similarly to environmental samples with desired analyses stated on the label. Shelby tubes should be bagged in Ziploc™ bags for protection.

4.4 MONTHLY MONITORING SAMPLES

Deionized/organic-free water and tap water (aqueous samples) from Building C-730 will be sampled on a monthly basis and analyzed for the total suite of constituents of concern. This sampling is required as trip blanks and decontamination water are drawn from the water purification system. Samples are to be collected and handled in the same manner as other PGDP environmental samples.

4.5 SAMPLE TRACKING

Samples will be tracked from the time they are put into sample containers until receipt of validated laboratory data and final transfer of the sample residuals to PGDP. Sample tracking will be accomplished through the use of unique sample

Table 8
Requirements for Geotechnical Samples

Analysis	Container	Sample Number	Preservative Requirement
Field Screening Sample (FSL)*	250-ml glass jar	1	None
Disturbed Sample			
Total Organic Carbon Cation Exchange Capacity	4-oz glass jar	1	4°C
Atterberg Limits (including moisture content) Grain Size Analysis	1,000-gm container	1	None
Undisturbed Sample			
Total Organic Carbon Cation Exchange Capacity Atterberg Limits (including moisture content) Grain Size Analysis Unit Weight Triaxial Permeability	Shelby tube	1	None

*This aliquot is required if a geotechnical sample is taken independent of an environmental sample.

numbers, sample tracking forms, sample container labels, field notebooks, chain-of-custody forms (ESES Procedure Method 500), custody seals (evidence tape), sample delivery group (SDG) numbers, and a computer data base (SAMPTRAK).

4.5.1 Sample Numbers

Unique, sequential 5-digit numbers will be assigned to each sample prior to or at the time of sampling. All environmental, field QC [trip blanks, duplicates, equipment (rinsate) blanks, etc.], and waste samples will be assigned unique sample numbers. Blocks of numbers will be reserved for the different sampling tasks, as follows:

Groundwater and water supplies: 10001 to 10999
Surface water: 11000 to 11999
Sediments: 12000 to 12999
Subsurface soil (deep borings): 13000 to 13999
Surface and near-surface soil (0-5 ft: 14000 to 14999
Liquid waste: 15000 to 15999
Solid waste: 16000 to 16999
Monthly aqueous monitoring: 17000 to 17020
Equipment blanks: 17021 to 17500

New blocks will be reserved and documented by sample management as needed.

The FSM will track the sample numbers that have been assigned and inform the sampling team leaders of the sample numbers that are available. Prior to each day's sampling, the task leaders will inform the sampling team of the range of numbers assigned to samples taken on that day. Generally, all sample numbers assigned on a given day will be higher than any number assigned on previous days. This may result in gaps in the numbering sequence (i.e., some potential sample numbers will never be assigned to a sample). This is to prevent non-unique sample numbers. Under no circumstances will a sample number be assigned to more than one sample. There are up to 99,999 potential sample numbers (as the data base is currently formatted), so a shortage of unique numbers is unlikely.

4.5.2 Container Labels

Sample teams will be responsible for obtaining labels from the FSM and completing them as appropriate. Figure 7 shows the label that will be used on the sample containers. The following information will be recorded on the container label:

Figure 7

LABORATORY I.D. #

CH2M HILL

PH. (205) 271-1444
Montgomery Laboratory
2567 Fairlane Drive
Montgomery, Alabama 36116

CLIENT PGDP
SAMPLE NO. 03025
LOCATION —

ANALYSIS TCL Volatiles
-MS/MSD

PRESERVATIVE

DATE 0945/11-23-89 BY MS

- Client (PGDP)
- Sample number
- Analysis
- A lab QC designator (if extra volume is collected for lab QC requirements)
- Preservative
- Date of sampling
- Time of sampling
- Name of sampler (or initials)
- Container lot number (lot number may also be applied with a separate I-Chem label)

Sample location and field QC samples will not be identified on container labels.

After radiation screening but prior to packing coolers for transfer to the FSM, each container label will be covered with clear tape by the field sampling crew to prevent smearing or loss.

4.5.3 Field Notebooks for Sample Management

The following information will be recorded in the field logbooks by the sampling team at the time of sampling (see also Method ESP 500 and/or the task-specific project instructions):

1. Sampling activity and sample number

2. Volume of sample and analytical aliquots taken (i.e., 2 VOA, 1 pest/PCB/BNA, etc.)

3. Name of sampler and others present

4. Date and time of collection

5. Sample media (i.e., water, soil, etc.)

6. Designation of QC samples (blanks, splits, duplicates MS/MSD)

4.5.4 Chain-of-Custody Forms

Sample custody will be documented and maintained from the time the sample is collected to the time of final disposal. Documentation will accompany samples and will aid in tracking samples during collection, transportation, analyses, and final storage. "Custody" of a sample is defined by any of the following four conditions if it is:

- in the physical possession of an individual;
- within view of an individual after being in the physical possession of the individual;
- secured/locked by an individual who has possession of it; or
- placed in a designated secured area by the individual who has possession.

Sample custody procedures will be in accordance with ESES Procedure Method ESP-500, "Manual Chain-of-Custody Procedures."

Figure 4 shows an example chain-of-custody form. This form will be filled out by the sampling team on the same day as sample collection and prior to submission of samples to the FSM. Requested analyses, applicable QA/QC designators (trip blank, MS/MSD, etc.), and sample filtration will be indicated on the form. The Federal Express airbill number will also be marked on the chain-of-custody form by the FSM. Although the identity of MS/MSD and trip blank samples will also be indicated on the chain-of-custody form for the laboratory's information, no other QC samples will be identified. Laboratory QC samples with the exception of MS/MSD samples will be sent "blind" to the FSL and offsite laboratories to serve as QC checks. Field QC samples serve as a check on the field sampling and decontamination methods. The identity of all QC samples will be tracked by the sample manager. Custody seals (evidence tape) will be placed on coolers prior to shipment of samples.

4.5.5 SDG Numbers

A unique SDG number is assigned to each batch of samples shipped to one laboratory. A "batch" is defined as no more than 20 samples of the same matrix taken over a 14-day period. Each batch of samples will include at least one lab QC sample (a sample with sufficient volume for any required lab QC, e.g., MS/MSD or spike and duplicate analysis). These SDG numbers apply only to samples shipped to the CH2M HILL-Montgomery and Weston laboratories. One batch of samples could include

samples shipped to a lab over a period of several days until a total of 20 samples are shipped. All field QC samples will be included in the SDG.

4.5.6 Computer Data Base

The sample tracking forms, as shown in Figures 2 and 3, will be filled out by the FSM and the field crews for each sample or analytical fraction that will be archived, analyzed by the FSL, and/or sent offsite for laboratory analysis. These forms will be submitted to the sample management TOM (in ORO) on a daily basis for entry into the sample management data base by the PGDP PA. The sample management TOM will be responsible for overseeing that information is entered into the data base for each environmental, waste, or QC sample. Geotechnical data will not be entered into the data base, but will be tracked by other means. The FSM will provide a weekly update of samples taken in the field to the TOM. The sample manager will provide periodic reports on the status of any samples taken to-date to those task managers as requested. Instructions for entering the sample tracking data are presented in Attachment C.

4.6 FIELD QC/QA SAMPLES

Field QA/QC samples such as equipment (rinsate) blanks, trip blanks, and monthly aqueous monitoring samples will be taken/accompany samples during the PGDP Phase II project. Sample duplicates, which will be taken every 20 samples for the same medium/matrix, as well as other QA/QC samples, such as laboratory blanks, may also be required. Attachment D and the Quality Assurance Program Plan (QAPP) discuss other Field QC and MS/MSD samples.

4.6.1 Trip Blanks

Trip Blanks are used to detect contamination by volatile organic compounds (VOCs) during sample shipping and handling. Trip blanks are 40-mL volatile organic analysis (VOA) vials of deionized/organic-free water that are filled in the field laboratory, transported to the sampling site, and returned to the laboratory with (VOA) samples. Trip blanks are not to be opened in the field. One trip blank is to accompany each cooler containing VOA samples. Each trip blank is stored at the laboratory with associated samples and analyzed with those samples. Trip blanks are only analyzed for VOCs. Trip blanks are also sent with soil samples; however, because the blanks cannot be analyzed by soil methods, they are analyzed and reported as water samples.

4.6.2 Equipment (Rinsates) Blanks

Equipment (rinsates) blanks are samples of deionized/organic-free water passed through decontaminated sampling equipment. They are used to determine the effectiveness of decontamination process. Equipment rinsates are collected at a rate of 10% of the samples collected per matrix (i.e., 1 to 10 samples collected equals 1 equipment rinsate; 11 to 20 samples collected = 2 equipment rinsates). Matrixes for this purpose are considered to be groundwater, surface water, soil, etc. A rinsate blank must be collected from each piece of equipment. For example, if groundwater samples are collected by both bailer and pump, a rinsate blank must be submitted for each. Equipment rinsates are analyzed for the same analytes as samples collected that day. Equipment rinsates are reported as water samples.

4.6.3 Field Duplicates/Splits

Soil sample duplicates/splits are collected and homogenized before being split. Field duplicates for water samples will be collected simultaneously. Field duplicates will be collected at a frequency of 10% of the samples collected per matrix (soil, groundwater, etc., i.e., 1 to 10 samples collected equals 1 field duplicate; 11 to 20 samples collected equals 2 field duplicates). QC samples will normally be used as a duplicate/MS combination or a MS/MSD by the laboratory. MS/MSD samples are collected at a 1 to 20 frequency. The FSM will notify when to take these samples.

4.7 SAMPLE MANAGEMENT SUPPLIES

The more important supplies that will be required for sample management are described in this section. Other supplies needed for this task are listed under Section 7.0.

4.7.1 Sample Containers

Sample containers will be ordered, as required, by the sample manager. This can be done either by sending a container request form to the lab or by requesting containers over the phone. The estimated volume of samples for Phase II is presented in Tables 9, 10, and 11. It will not always be possible to return a container full of sample back to the original lab from which the container came. However, the number of samples containers being sent to a given lab for analysis should be approximately equal to the number of new containers being supplied by that lab. Unused sample containers will be stored in a clean, secure area.

Table 9
Summary of Proposed Samples

	Sample Type	Number of Samples[a]								
		Major Ions	TCL	TAL	Filtered TAL	Gross Alpha Gross Beta	Radionuclides	Dioxins/ Furans	Geotech/ Geochem	Waste Analysis
Stage A	Groundwater	115	115	115	115	115	115			
	Deep soil borings		327	30		327	327		14	
	Shallow soil borings		50	17		50	50	5		
	Well installation		53	53		53	53			
	Test pits		11	11		11	11		4	
	Sediments		5	5		5	5	1		
	Surface water		8	8		8	8			
	Solid waste									69
	Liquid waste									61
	Total	**115**	**569**	**239**	**115**	**569**	**569**	**6**	**18**	**130**
Stage B	Groundwater	132	132	132	132	132	132			
	Soil		106	52		145	106		29	
	Sediments		33	33		33	33			
	Solid Waste									22
	Liquid Waste									73
	Total	**132**	**271**	**217**	**132**	**310**	**271**	**0**	**29**	**95**
Total	Water	247	255	255	247	255	255	0	0	0
	Soil/sediment	0	585	201	0	624	585	6	47	0
	Solid waste	0	0	0	0	0	0	0	0	91
	Liquid waste	0	0	0	0	0	0	0	0	134
	All Samples	**247**	**840**	**456**	**247**	**879**	**840**	**6**	**47**	**225**

[a]Includes field QC.

Table 10
Summary of Waste Samples

Waste Source	Phase	Number of Samples
Stage A		
Well drilling cuttings	Solid	34
Development water	Liquid	25
Groundwater sampling	Liquid	30
Deep soil borings	Solid	27
Shallow soil boring	Solid	1
Sediments	Solid	0
Surface water	Liquid	0
Personal protective equipment		0
Field QC	Solid	7
	Liquid	6
Total	**Solid**	**69**
	Liquid	**61**
Stage B		
Well drilling cuttings	Solid	16
Development water	Liquid	12
Groundwater sampling	Liquid	35
Aquifer pumping test	Liquid	18
Shallow soil borings	Solid	4
Personal protective equipment		0
Field QC	Solid	2
	Liquid	7
Total	**Solid**	**22**
	Liquid	**72**
Total (Stages A and B)	Solid	91
	Liquid	133

Table 11
Summary of Treatability Test Samples

Task	Purpose	Sample Medium	Number of Samples
Sample Characterization[a]	Groundwater samples	Water	3
	Soil samples[b]	Soil	3
Bench Scale Characterization[c]	Air Stripper Effluent	Water	14
	GAC Effluent	Water	14
	Oil/Water Separation	Oil	14
	Oil/Water Separation	Water	14
	Iron Precipitation Initial	Water	14
	Iron Precipitation Final	Water	14
	Iron Precipitation Final	Solids	14
	Manganese Precip. Initial	Water	14
	Manganese Precip. Final	Water	14
	Manganese Precip. Final	Solids	14
	Ion Exchange Initial	Water	14
	Ion Exchange Final	Water	14
	PCB Solidif./Leachate	Water	14
	Tc-99 Solidif./Leachate	Water	14
	Leachate/Ion Exchange	Water	14
Total			216

[a]Number of samples includes 1 duplicate sample.
[b]Number of samples includes 2 duplicate samples.
[c]Soil samples obtained from composited, containerized drilling cuttings.

Sample containers for Target Compound List (TCL) and Target Analyte List (TAL) analyses (presented in Attachment E) will have a cleaning lot number provided by the laboratory. This number will be recorded on the container label prior to submitting containers to the sampling crews and on the sampling tracking form. Containers provided by the Montgomery (MGM) lab will also have cleaning certificates accompanying them. These certificates will be kept on file in the sample management area.

4.7.2 Preservatives

If preservatives are required, they will be added by the sample manager or field sampling team prior to or immediately after sample collection, as appropriate. Preservatives used will be recorded on both the sample container label and on chain-of-custody forms. The sample manager will order preservative reagents, as required, and will retain the Material Safety Data Sheets (MSDSs) in the FSL. Acids will be kept in a locked acid cabinet in the FSL when not in use.

5.0 DECONTAMINATION

ESES Procedure Method ESP-900 is the applicable procedure to be followed for decontamination. Other task instructions will contain decontamination procedures applicable to those tasks. This procedure is included as Attachment A.

6.0 HEALTH AND SAFETY

The CH2M HILL SSP for PGDP Phase II work will be in effect during the project. Health and safety monitoring will include use of a combustible gas/oxygen detector, an HNu, and GM and scintillation radiation survey meters for CH2M HILL employees.

7.0 CHECKLIST

The equipment list represents those items that may be used during field sample management task at PGDP. Personnel and safety gear,

_____ Project/task instructions
_____ ESH/Sub/87-21706/1 Procedures Manual
_____ EPA Document 9240.0-1
_____ SSP
_____ Health and Safety Plan
_____ QAPP
_____ Applicable phone numbers

_____ Sampling event-specific project instructions
_____ Indelible markers
_____ Pens (indelible black)
_____ Sample labels (small and large)
_____ Cooler labels
_____ Department of Transportation shipping labels
_____ Chain-of-custody forms
_____ Federal Express airbills
_____ Colored labeling tape
_____ Custody seals (evidence tape)
_____ Field notebooks
_____ Sample tracking forms
_____ Personal Protective Equipment (APR, gloves, safety glasses, steel toe boots)
_____ Boxes
_____ Clear tape (2-in.) for sample labels
_____ Ziploc™ bags (2 sizes) for sample containment
_____ Duct tape
_____ Strapping tape
_____ Sample containers (see Tables 1, 2, 6, and 7)
_____ Preservatives
_____ Pipettes
_____ pH paper
_____ Thermometers
_____ Metal cans (paint cans) with lids
_____ Coolers
_____ Ice/Blue Ice
_____ Vermiculite
_____ Bubble packing
_____ Plastic sheeting
_____ Garbage bags
_____ Razor knife

8.0 RECORDS

Records that must be kept by the FSM include, but are not limited to field logbook; container cleaning certificates; completed chain-of-custody forms; sample tracking forms; QC sample documentation; phone conversation logs; FSL screening results; chain-of-custody forms from FSL rad screening sample transfer; PGDP archive submission list; MSDSs; sample number assignments; SDG number assignments; sample "log in/log out" list; and weekly reports.

9.0 DELIVERABLES

Project deliverables include such information as:

- weekly reports--FSM;
- completed sample tracking and chain-of-custody forms--FSM;
- monthly progress reports--sample management TOM; and
- weekly data summaries--PA.

10.0 SCHEDULE

The sample management task is expected to last the entire length of the PGDP Phase II project with field work continuing past May 1, 1991. "Notice to Proceed" (NTP) has been given by the client with an anticipated November 1 or 15, 1991, field startup. Additional information on the schedule is pending.

MEMORANDUM CH2M HILL

TO: Distribution

FROM: Lynn Sichelstiel

DATE: January 25, 1991

SUBJECT: Reissuance of Paducah Gaseous Diffusion Plant (PGDP) Phase II Sample Management Task Instructions

PROJECT: ORO30888.SM

An updated version of the PGDP Phase II Sample Management Task Instructions is attached. As the sample management task is ongoing throughout the project, the instructions for this part of the Phase II effort are like a "living document." Many amendments, addenda, and changes have been made already based on the requirements of new tasks starting in the field. This document incorporates these. If you have any questions, suggestions, or changes you anticipate for your upcoming task, please do not hesitate to call me in Oak Ridge at extension 542. Thanks.

ATTACHMENT A

ENVIRONMENTAL SURVEILLANCE PROCEDURES

The following Environmental Surveillance Procedures were sent to Energy Systems as part of Attachment A:

- ESP-400, Field Quality Control
- ESP-500, Manual Chain of Custody Procedures
- ESP-701, Sample Preservation and Container Materials
- ESP-800, Packaging Environmental Samples for Transportation
- ESP-900, Cleaning and Decontaminating Sample Containers and Sampling Devices
- ESP-1000, Waste Management

OROR3/001.51

CH2M HILL

MEMORANDUM

TO: Jim Moore/ORO
Don Taylor/PGDP
Jack Aeby/PGDP

COPIES: Mary Wisdom/MGM
Virginia Powers/ORO

FROM: George Stephens/ORO

DATE: March 13, 1990

SUBJECT: PGDP Field Support Laboratory (FSL) Radiological Analyses Capabilities

PROJECT: SED28178.FC

SUMMARY

This memo summarizes the capabilities and limitations of the CH2M HILL PGDP project FSL, and provides documentation of the technical judgments used to define data reporting procedures. Based on the results outlined in this report, the PGDP FSL can detect radioactivity concentrations in samples at or below the limits specified for shipment of samples to the CH2M HILL MGM lab.

BACKGROUND INFORMATION

The PGDP FSL was established to screen samples from PGDP for gross radioactivity prior to shipment off-site. Initially, the primary objective for the FSL was to screen samples to the Department of Transportation (DOT) shipping limit of less than 2,000 pCi/g total radioactivity per sample. A secondary objective was to establish procedures to analyze samples to the limits specified for shipment to the CH2M HILL MGM lab. The MGM sample limits are very conservative, and are designed essentially to eliminate the possibility of having detectable radioactive contamination in the MGM lab.

The MGM limits are:

Solids:	Gross $\alpha \leq 15$ pCi/g
	Gross $\beta \leq 50$ pCi/g
Liquids:	Gross $\alpha \leq 30$ pCi/l
	Gross $\beta \leq 500$ pCi/l

OROC2088.50

Considerable effort has been made by TMA/Eberline FSL personnel to establish that the FSL procedures allow activity to be detected at the MGM shipment limit levels. They have established that the FSL will be able to easily meet the MGM limits for gross alpha and gross beta analyses of liquids, and for gross beta analyses of solids. Analyses of solids for gross alpha has caused some concern due to the variabilities associated with sample preparation and self-absorption of alpha particles by sample media.

Results of testing at the FSL show that the lower limit of detection (LLD) for gross alpha analyses of solids (soils and sediments) ranges from approximately 5 pCi/g to 26 pCi/g, depending on sample preparation technique, media used for sample mounting, and background value used for calculating LLD. The lower values for LLD are obtained when machine background values are used in the LLD calculation. The higher values are obtained using background soil supplied by the PGDP labs, mounted in either stainless steel (SS) or aluminum planchets.

Considerable debate exists among health physicists and radiochemists as to exactly how the LLD values should be established and reported for different types of analyses. Some laboratories report LLDs based on machine background values, while others report LLDs based on background sample values. Values for LLD may be reported as an *a priori* or pre-measurement estimate of a systems detection capabilities based on knowledge of average performance characteristics and sample parameters. Alternatively, LLD may be reported as an *a posteriori* or post-measurement value based on actual instrument and sample parameters at the time of counting.

Because no regulatory agency has published specific guidance on this issue, each lab must make professional judgments as to how they will report sample results as well as LLD for each type of analysis. The technical justification for those judgments should be documented as part of the laboratory's QA program. The following section provides technical information on the PGDP FSL data reporting methodology.

FSL REPORTING CRITERIA

- FSL LLD values will be reported as *a priori* or pre-measurement estimates of the detection capability for each type of sample. Average values for background have been determined, and will be updated periodically for use in the LLD calculations. Sample mass and volume are carefully controlled for each type of sample so that the *a priori* LLD calculation is valid.

- For solids and sediment sample analyses, a background value based on an off-site (uncontaminated area) soil sample will be subtracted from each sample result. This background value will also be used for calculation of LLD for gross alpha and gross beta solids analyses. The background sample material used is the same sample material used by the Energy Systems lab, PGDP background soil SPI 2155-89. This sample was obtained from a site located 15 miles south of PGDP. This location has no history of contamination from PGDP operations, and the natural levels of radioactivity in this sample are assumed to be representative of the area. The background sample is mounted on a SS planchet using the same FSL procedure used for preparing routine soil and sediment samples. This configuration was chosen for the following reasons:

  - Background sample SPI 2155-89 mounted on a SS planchet gives the lowest background count rate of all configurations tested; thus, use of this background value would result in more conservative (higher) net activity values for each sample.

  - Tests using the aluminum planchet configuration showed large variabilities in counting efficiencies for alpha analyses. This may be a result of the acidic uranium standard solution interacting with the aluminum, or sample preparation technique. In either case, the variability is too large to use the aluminum planchet results at this time.

  Based on the criteria listed above, the FSL LLDs for solids analyses are:

  Gross alpha 14.0 pCi/g
  Gross beta 13.4 pCi/g

- For liquid sample analyses, deionized (DI) water is processed using the FSL liquid sample preparation procedures. The DI water is evaporated on a SS planchet and counted to determine a background value for liquid samples. The FSL LLDs for liquid sample analyses are:

  Gross alpha 12.0 pCi/l
  Gross beta 11.6 pCi/l

- The PGDP FSL procedures specify use of the LLD definition described by the Nuclear Regulatory Commission (NRC) in Regulatory Guide 8.30,

"Health Physics Surveys in Uranium Mills." This definition is consistent with the LLD definition described by EPA in EPA-600/4-80-032, "Prescribed Procedures for Measurement of Radioactivity in Drinking Water." The formula used for calculating LLD is shown below:

$$LLD = \frac{4.66\ Sb}{(E)(V)(2.22)}$$

where:

LLD =	Lower Limit of Detection in pCi/l for liquids, and pCi/g for solids
E =	counting efficiency (cpm/dpm)
V =	sample volume or mass (liters for liquids, or grams for solids)
2.22 =	factor to convert dpm to pCi (2.22 dpm = 1 pCi)
Sb =	the standard deviation of the background count rate as shown below:

$$Sb^2 = \frac{1}{n-1} \sum_{i=1}^{n} (BR_i - \overline{BR})^2$$

where:

$\overline{BR}$ =	average background count rate (cpm)
BR_i =	background count rate (cpm) for sample i

Using this definition of LLD, we can say that we have a 95% probability of detecting activity in concentrations greater than the LLD. We also accept 5% probability that activity above the LLD will not be detected.

- FSL sample results are calculated using the following formula:

$$C = \frac{SR - BR}{(E)(V)(2.22)}$$

where:

C =	sample concentration in pCi/l for liquids or pCi/g for solids
SR =	sample gross count rate (cpm)
BR =	background count rate (cpm)
E =	counting efficiency (cpm/dpm)
V =	sample volume or mass (liter for liquids, grams for solids)
2.22 =	factor to convert dpm to pCi (2.22 dpm = 1 pCi)

- FSL sample results will be reported as calculated without truncation or other modifications (except for rounding). This means that results less than the LLD and less than zero can be reported. Results of radiological analyses of samples with background concentrations of radioactive materials are expected to show a statistical distribution around zero. Results less than zero simply indicate that the sample contains natural radioactivity in concentrations approximately the same or less than the background sample.

CONCLUSIONS

The PGDP FSL is a radiological screening laboratory. The primary purpose of this lab is to screen samples for gross levels of radioactivity prior to shipment to the CH2M HILL MGM lab. The objective of the FSL screening analyses is to provide a reasonable level of confidence that analyses of samples from PGDP could not result in detectable radioactive contamination in the MGM lab. In order to provide this level of confidence, FSL personnel have established detailed procedures for analyses of samples to very low levels of radioactivity. While specific LLD values will vary depending on how and when background count rate is determined, the quality of the results will be determined by the analyses procedures. It is my judgment that the current FSL procedures are more than adequate for determining if sample activity is low enough for shipment to MGM or other CH2M HILL labs.

CH2M HILL

MEMORANDUM

TO: Jim Moore/ORO
Cliff Thompson/MGM
Craig Vinson/MGM
Ray Prettyman/RDD

COPIES: Mike Adams/ORO
Mary Wisdom/MGM

FROM: George Stephens/ORO

DATE: December 20, 1989

SUBJECT: Issues Concerning Paducah Gaseous Diffusion Plant (PGDP) Environmental Samples

PROJECT: EAD28178.FC

INTRODUCTION

In order to ship environmental samples from PGDP to CH2M HILL laboratories, the samples must be screened to very low levels of radioactivity. The CH2M HILL labs are not equipped to handle true radiological samples, so the following limits on gross radioactivity levels have been recommended as sample acceptance criteria:

Solids: Gross α - 15 pCi/g
Gross β - 50 pCi/g

Liquids: Gross α - 30 pCi/l
Gross β - 500 pCi/l

These limits apply only to PGDP samples. They are based on the following criteria:

1) Sample activity levels must remain below the "exempt" levels for a radioactive materials license in the states of Alabama or California.

2) Sample activity levels must be low enough so that if concentrated by the greatest degree reasonable, the sample would not represent a health hazard to lab personnel if spilled and the activity ingested or inhaled.

3) Sample activity must be low enough so that if concentrated by the greatest degree reasonable, the sample would not represent a source of detectable contamination if spilled.

4) Sample activity limits must be high enough to be within the detection limits of standard gross α and gross ß counting systems (using reasonable count times and sample volumes).

DEVELOPMENT OF LIMITS

Currently, there is no official "de minimus" or below regulatory concern (BRC) level of radioactivity or radiation exposure that can be used for the CH2M HILL labs. There are, however, some Ad Hoc criteria which have been found acceptable to EPA in the past. These include the current drinking water criteria and the Formerly Utilized Sites Remedial Action Program (FUSRAP) criteria. The laboratory limits were established by using the EPA drinking water guides (for liquids) and DOE FUSRAP guides (for solids) as a starting or reference point and then increasing (or decreasing) these guides to optimize the four criteria listed above. The following sections summarize this process.

Lab Licensing

Because of the low limits established for samples destined for MGM, lab licensing should not be an issue. The Alabama "Rules of State Board of Health, Environmental, and Facilities Standards Administration Radiation Control" set standards for exempt quantities of radioactive material, below which a license is not required. In addition, Aubrey Godwyn of the Alabama Department of Public Health was contacted for additional information and clarification. Licensing is not expected to be an issue in Alabama as long as the quantities of radioactivity and number of samples are tightly controlled. The California state license for the Redding lab must be reviewed prior to shipping samples from PGDP to RDD.

Health Hazards

Detailed analysis have been performed to show that at the levels listed above, lab personnel exposures will remain well below the DOE and NRC criteria of 100 mrem/yr whole body exposure to the general public. Special consideration was given to a worst case situation in which 30 soil samples containing 15 pCi/g alpha activity (80% U, 20% Pu-239) are analyzed each day by destruction of 1 g of sample in an atomic absorption (AA) unit. Based on 4 room air turnovers/hr in the MGM lab AA room, and assuming no activity removal by the AA unit hoods, the average air concentration would remain well below the Alabama Maximum Permissible Concentration (MPC) guides for the general public. A similar analysis will be performed for the RDD lab if necessary.

Lab Contamination

Because the CH2M HILL labs have limited health physics monitoring capabilities, lab contamination is an obvious concern. It is possible during digestion for metals analysis to concentrate the activity in a 1-liter sample to 1 milliliter. Assuming 1 ml of concentrated sample (at the limits of 30 pCi/l α, 500 pCi/l $\beta\gamma$) were spilled and dried with minimal losses over an area of approximately 100 cm^2, the resulting contamination would be approximately 66 dpm/ 100 cm^2 α and 1,110 dpm/100 cm^2 $\beta\gamma$. If this activity remained transferable or "smearable," it is possible that it could be detected during routine transferable contamination control surveys. It most likely would not be detectable using routine direct survey techniques.

Lower Limits of Detection (LLD)

The Lower Limit of Detection (LLD) is defined as the smallest amount of sample activity that will yield a net count for which there is confidence at a predetermined level that activity is present. The mathematical procedures used by the PGDP Field Support Laboratory (FSL) are based on procedures used by the EPA in EPA-600/4-80-032, "Prescribed Procedures for Measurement of Radioactivity in Drinking Water." These procedures are based on the concept of a 95% confidence interval. That is, we accept a 5% probability of false detection, and a 5% probability of false non-detection. Another way to look at this is that we have 95% confidence that we can detect activity above the LLD. We also accept 5% probability that activity above the LLD will not be detected.

The sample parameters that determine LLD are sample size, instrument efficiency, counting time, and background. Testing at the PGDP FSL has shown that the LLDs for gross α and gross β analyses in solids and liquids are below the limits specified for shipment to CH2M HILL laboratories.

DATA QUALITY

The PGDP FSL is a screening lab. It does not have the equipment or personnel required to perform detailed radiological analyses. The numbers generated by the FSL should be treated as Level II quality data. The two main sources of error in these numbers are in counting and sample preparation. It is fairly simple to quantify the counting precision, as discussed in the section on LLDs. While we are accepting a 5% probability of not detecting activity when it is present, samples with high level activity (several times the LLD) would be easily detected with much higher probability than 95%.

It is much more difficult to quantify potential sources of error due to sample preparation. Assumptions regarding sample preparation include:

- Activity is uniformly distributed throughout the composite depth (5 ft).
- Activity is deposited on the surface of solid samples.
- The radiological screening aliquot is representative of the entire composite sample.

The precision of the FSL related to sample preparation can be estimated over time using blank, duplicate, and spiked samples as part of the QA/QC program. It is not possible at this time to provide a good quantitative estimate of precision, as the FSL has only been operational for two weeks.

PROTECTION OF PERSONNEL AND FACILITIES

Because of potential risks involved with handling samples from DOE facilities, it is reasonable for the labs to take additional precautions--at least until the program has an established safety record. These precautions include:

- Provide basic radiation safety training to personnel who will handle PGDP samples. Provide a general overview (brown-bag) to other lab personnel so that fears regarding "radioactive samples" can be minimized.
- Routinely screen coolers and samples from PGDP with radiation detection instruments. Analyze 10% of the samples received from PGDP as a QA check on the FSL. These checks will require training in the procedures for use of the instruments and analyses techniques. It is estimated that providing these screening checks will require approximately 2 hours per day for one individual. The rental rate for instruments to perform these checks is approximately $450 per month. Training on the instruments and procedures will require 1-2 days. (Basic radiation safety training can be included in this time period.)

POTENTIAL LIABILITY ISSUES

Two major liability issues that could impact acceptance of PGDP samples have been identified. The first issue concerns the results of inadvertently accepting a radioactive sample, contaminating a lab, and potentially exposing personnel. The consequences of such an event could be severe, and this is why very conservative limits have been established. If established procedures are strictly followed at PGDP and at the receiving lab, the chances of accepting a sample which contains enough activity to contaminate the lab are very low.

The other liability issue is more a problem of perception. Both the MGM lab and the RDD lab hold state radioactive materials licenses; thus, they are subject to inspection by state radiological health officials at any time. It is possible that a state official could question the reason for radiation detection instruments in the lab when the radioactive materials license does not require them. If not carefully handled, the official may get the impression that the lab is handling true radioactive samples in violation of the license. This liability issue can be avoided by honestly (and carefully) answering the official's questions.

RECOMMENDATIONS

This memorandum summarizes the major issues associated with accepting samples from PGDP. These issues have been outlined in detail so that laboratory management will be able to make an informed decision over whether or not to accept such samples. My recommendation is that we implement the limits and additional precautions outlined in this memo, and proceed with the program to accept PGDP samples at CH2M HILL laboratories. This program should be re-evaluated after approximately two months of continuous operation. We should be able to more quantitatively assess FSL performance at that time. Any changes in lab monitoring should be based on this re-evaluation.

MEMORANDUM CH2M HILL

TO: Craig Morrison/Energy Systems/PGDP
Jack Aeby/Energy Systems/PGDP
Keith Johnson/Energy Systems/PGDP
Donna Connery/CH2M HILL/ORO
Mary Wisdom/CH2M HILL/MGM
Don Taylor//Energy Systems/PGDP

FROM: George Stephens/CH2M HILL/ORO

DATE: January 29, 1990

SUBJECT: Shipment of PGDP Samples to MGM

PROJECT: SED28178.FC

Environmental samples from PGDP will be shipped to MGM for analyses beginning on (or after) Thursday, February 1, 1990. In order for samples from PGDP to be shipped to MGM, the following steps must be completed:

1. Sample containers will be checked for radioactive contamination. Survey results will meet the CH2M HILL/PGDP unrestricted release criteria:

   - Direct Survey — $<2{,}000$ DPM/100 cm^2 $\beta\gamma$; <200 DPM/100 cm^2 α
   - Transferrable Survey — <500 DPM/100 cm^2 $\beta\gamma$; <20 DPM/100 cm^2 α

   A copy of the CH2M HILL equipment and materials release form (signed by the SSC) must accompany each statement.

2. Samples will be screened by the FSL to the following levels of radioactivity:

   - Solids — Gross $\alpha \leq 15$ pCi/g; Gross $\beta \leq 50$ pCi/g
   - Liquids — Gross $\alpha \leq 30$ pCi/l; Gross $\beta \leq 500$ pCi/l

   A copy of the CH2M HILL FSL Radiochemical Analysis Report must accompany each shipment.

C ; 'HILL

EQUIPMENT AND MATERIALS RELEASE FORM

ITEM: SAMPLE CONTAINERS

DATE _____ SITE PGDP	BETA-GAMMA: DIRECT	ALPHA: DIRECT	ALPHA: TRANSFERABLE	BETA-GAMMA: TRANSFERABL
SURVEY NUMBER PGDP-	PROBE HP-210 BKG. _____ (CPM)	PROBE AC-3 BKG. _____ (CPM)	DETECTOR SAC-4	DETECTOR BC-4
SURVEYORS NAME _____	EFF. _____ % MDA: _____ dpm/100cm²	EFF. _____ % MDA: _____ dpm/100cm²	BKG. _____ (CPM)	BKG. _____ (CPM)
			EFF. _____ % *	EFF. _____ % **

ITEM SURVEYED FOR RELEASE (AREA)	DIRECT: ALPHA		DIRECT: BATA-GAMMA		TRANSFERABLE: ALPHA		TRANSFERABLE: BETA-GAMMA		CERTIFIED AS MEETING CRITERIA (%)			COMMENTS
	CPM	DPM/100 cm²	CPM	DPM/100 cm²	CPM	DPM/100 cm²	CPM	DPM/100 cm²	YES	NO	INITIALS	
												* MDA: dpm
												** MDA: dpm
												ALL READINGS ARE
												FROM THE OUTSIDE
												OF THE CONTAIN
												& ARE $\bar{X}$ READIN
												FOR ALL SAMPL
												FROM THE DEP
												INDICATED. (C
												* DENOTES RMAX VA

INSTRUMENT / SERIAL NO.

( ) / HP-210 ( )

( ) / AC-3 ( )

SAC-4 ( ) / BC-4 (687)

APPROVAL

I HAVE REVIEWED THE ABOVE DATA AND, EXCEPT: WHERE NOTED UNDER COMMENTS, AL MEASUREMENTS CONFORM TO GUIDELINES FO UNRESTRICTED RELEASE.

SSC/SITE M

CH2M HILL FIELD SUPPORT LABORATORY
PGDP SITE INVESTIGATION
PADUCAH, KY
RADIOCHEMICAL ANALYSIS REPORT
(Screening Analysis)

QF1

SAMPLE ORIGINATOR _____

SAMPLE TYPE _____

CH2M HILL SAMPLE No	GROSS ALPHA ACTIVITY pCi/gm/liter	GROSS BETA ACTIVITY pCi/gm/liter

Alpha Soil LLD	Beta Soil LLD	Alpha Water LLD	Beta Water LLD

COMMENTS _____

PROTOCOL FOR SCREENING SAMPLES FROM PGDP FOR RADIOACTIVITY

This protocol addresses sample handling procedures for potentially radioactive samples (PGDP samples in particular). Recently, a small number of samples received from PGDP have shown elevated concentrations of naturally occurring radioactive material (radon and radon daughter products). Concerns have been expressed that procedures established for handling radioactive samples were modified to accommodate these samples. This is not the case. The limits for shipment of samples to MGM are based on radioactivity concentrations above natural background, and do not apply to radon or radon daughter products. This protocol includes procedures to confirm that elevated activity is or is not due to natural radionuclides, and addresses methods for handling the sample after this determination has been made.

The following steps should be completed when samples potentially contaminated with radioactive material are received from PGDP.

1. Check the paperwork associated with the shipment of samples. In addition to the chain of custody, there should be two forms attached which provide information on the radiological condition of the samples as shown below:

   A. Field Support Lab (FSL) Radiochemical Analysis Report. The FSL Radiochemical Analysis Report lists results of the gross alpha, gross beta screening of the samples shipped to MGM. These results should be less than or equal to the values listed below:

   - Liquids — gross alpha $\leq$ 30 pCi/l; gross beta $\leq$ 500 pCi/l
   - Solids — gross alpha $\leq$ 15 pCi/g; gross beta $\leq$ 50 pCi/g

   B. Equipment and Materials Release Form. Results for fixed and transferable contamination on the coolers and sample containers are reported on the Equipment and Materials Release Form. These results should be less than or equal to the values listed below:

- Transferable

alpha	$\leq$ 20 dpm/100 cm^2
beta-gamma	$\leq$ 500 dpm/100 cm^2

- Fixed plus transferable (direct survey)

alpha	$\leq$ 200 dpm/100 cm^2
beta-gamma	$\leq$ 2,000 dpm/100 cm^2

Check the results from both forms carefully prior to removing samples from the shipment. If all results fall below the listed criteria, proceed to Step 2.

2. Using the portable G.M. instrument, survey the accessible surfaces inside and outside the cooler(s) using Radiation Safety Manual (RSM) Procedure RP-06, "Fixed and Removable Surface Contamination Surveys." If count rate remains below two times background (approximately 100 cpm), remove samples from the cooler and survey the outer surface of each container. After samples have been removed, spot check for alpha contamination using the alpha survey instrument. Take a representative number of "smears" from the sample containers and count the smears in the alpha and beta-gamma scaler systems. Calculate fixed and transferable contamination levels using RSM Procedure HP-06, and HP-07, "Evaluation of Surface Contamination on Articles to be Released for Unrestricted Use." Record all results on the appropriate form and file.

IF COUNT RATE EXCEEDS 100 CPM PERFORM THE FOLLOWING:

A. Determine the location of highest activity. If activity exceeds 1,000 cpm, close the cooler, seal with tape, and survey lab area and other items in contact with the cooler for fixed and transferable contamination. Contact George Stephens in ORO at 615-483-9032.

B. If activity is greater than 100 cpm but less than 1,000 cpm, determine if transferable contamination is present in the cooler (using gloves). Survey the lab surfaces around the cooler for fixed and transferable contamination. Contact George Stephens in ORO.

3. For approximately one sample per shipment (liquid or solid), perform a gross alpha, gross beta analysis using the procedure titled "Screening Analysis of Liquids and Solids for Gross Alpha and Gross Beta-Gamma Activity." Be sure that sample volume is sufficient to allow analytical chemistry analyses after an aliquot is taken for radiological screening.

Contact the PGDP Project Manager if there is doubt concerning the sample volume needed for hazardous waste analyses. Results from this analysis should show activity less than or equal to the limits specified in Step 1.

IMPORTANT NOTE:

The limits for sample activity are expressed as concentration of radioactivity above natural background. For solid samples, a non-contaminated background soil sample value is subtracted from each sample result. For liquids, a deionized water background or blank planchet background is subtracted from each sample result.

One naturally occurring radionuclide that can cause interferences with gross screening analyses is radon (and radon daughter products). Radon is a short-lived radioactive gas which is present in all buildings. It results from the decay of uranium which is present in small quantities in all soils. Certain environmental conditions, such as low pressure systems, can often result in elevated radon and radon daughter product activity. (The gas is literally pulled out of the concrete blocks in walls.) Radon daughters are usually charged species and may "plate out" on metal or plastic surfaces, particularly if static charges have been generated on these surfaces. Radon daughters have been measured on hands of workers after handling plastic objects such as a hard hat or plastic steering wheel during periods of high radon concentrations. Radon daughter products can often result in very high initial count rates. For this reason, most nuclear facilities hold environmental air samples 24 to 48 hours before counting to allow the interfering radon daughters to decay away.

When radon daughter interferences are suspected in MGM samples (any time an initial count exceeds the MGM limits), follow the procedure listed below:

A. Recount the sample approximately 10-20 minutes after the initial count for both alpha and beta-gamma. Record all count start times and results.

B. Perform a second recount approximately 30-45 minutes after the initial count. If the data from the two recounts shows significant decay, hold the sample planchets for a third recount at approximately 2 hours after the initial count. If no decay is seen in 30-45 minutes, treat the sample as a contaminated sample and notify George Stephens in ORO.

If after 30-45 minutes the sample has decayed to less than the MGM limits, a 2 hour recount will not be necessary. The sample may be treated as uncontaminated based on the latest recount data. It should be noted that the MGM limits apply to radioactivity greater than natural background. Therefore, these limits do not apply to radon or radon daughter products.

4. Perform routine contamination control surveys once each week in the following locations:

   - Sample custody/receiving area
   - Old engineering lab area
   - Extraction lab

   These surveys will be performed using RSM Procedure RP-06. Record the results on the appropriate form and file.

The four steps listed above apply to samples from PGDP which are potentially contaminated with radioactive material. There will be cases where data is available that shows that certain samples are not contaminated (as defined in Section 1). Samples from media which has been previously characterized as non-contaminated may not be required to go through the complete screening process. An example of such samples would be water samples taken from homeowner drinking water wells which have been previously analyzed and found to be free of radioactive contamination. In a case like this, PGDP project personnel will discuss the situation with laboratory management prior to sample shipment. If all parties agree that the samples do not require full screening, then the samples will be shipped as a normal sample shipment (without paperwork on screening results).

OROR9/047.50

TO: Jesse Tremaine/CH2M HILL/ORO
Kathy Anhalt/CH2M HILL/PAH
Craig Morrison/TMA-Eberline/PAH
Shane Fitzgerald/TMA-Eberline/PAH
Rusty Anderson/CH2M HILL/ORO

COPIES: Jim Moore/CH2M HILL/ORO
Bruce Haas/CH2M HILL/ORO
Mike Adams/CH2M HILL/ORO
Pat Scofield/CH2M HILL/ORO
Dan Marion/CH2M HILL/PAH

FROM: George Stephens/CH2M HILL/ORO

DATE: September 7, 1990

SUBJECT: Project Instructions for Shipping "Limited Quantity" Radioactive Samples (Revision 1)

PROJECT: SED28178.RP

The following procedure must be followed in order to ship PGDP samples which exceed 2,000 pCi/g total radioactivity (gross alpha plus gross beta).

1. Determine the total radioactivity for the package (cooler) using the FSL screening results and the formula shown below:

$$PA\alpha = (SC\alpha)(SM)/10^6$$

$$PA\beta = (SC\beta)(SM)/10^6$$

where:

$PA\alpha$, $PA\beta$ = Package activity alpha, and package activity beta (uCi)
$SC\alpha$, $SC\beta$ = FSL results for sample gross alpha concentration, and sample gross beta concentration (pCi/g)
SM = Mass of the sample (g). (This value does not include mass of the sample jars or cooler.)
10^6 = Conversion from pCi to uCi (10^6 pCi = 1 uCi).

2. The material package limits for shipment of "limited quantity" radioactive samples from PGDP are listed below:

Solids - Alpha limit = 2 uCi
Beta gamma limit = 400 uCi

Liquids - Alpha limit = 0.2 uCi
Beta gamma limit = 40 uCi

These values are based on conservative assumptions specified in 49 CFR 173.433 for unknown mixtures of radionuclides.

Compare the values calculated for $PA\alpha$ and $PA\beta$ to the material package limits.

For Solids -

If $PA\alpha < 2$ uCi and

$PA\beta < 400$ uCi,

For Liquids -

If $PA\alpha < 0.2$ uCi and

$PA\beta < 40$ uCi

then the samples may be shipped as a "limited" quantity shipment. Continue to Step 3.

If either $PA\alpha$ or $PA\beta$ exceed the limits specified above, contact the Site Safety Coordinator (SSC), label the samples as "radioactive," and store them together in a refrigerator. Contact Jesse Tremaine/ORO or George Stephens/ORO for further instructions.

3. Label the sample bottles with a "radioactive" label. (Can be obtained from the TMA/Eberline IH/HP personnel.)

4. Package the samples in a strong, tight package that will not leak any of the materials during normal shipping conditions (e.g., normal packaging in a cooler).

5. Contact the Eberline IH/HP team leader and request a radiological survey of the package.

6. Verify that the radiation level at any point on the outer surface of the package does not exceed 0.5 mrem/hr. If that level is exceeded, the IH/HP team leader will evaluate the situation and either decontaminate or repackage the container.

7. Verify that radioactive contamination on the outer surface of the inner package (bottles) and outer package (cooler), does not exceed the levels listed below:

Fixed	Removable
$\alpha < 200$ dpm/100 cm^2	$\alpha < 20$ dpm/100 cm^2
$\beta\gamma \leq 2{,}000$ dpm/100 cm^2	$\beta\gamma < 500$ dpm/100 cm^2

8. Include the following documentation in the cooler:

   - Shipper's declaration statement (attached).
   - FSL screening lab results.
   - Radioactive contamination survey results.

9. Securely seal the package, label it, complete the airbill, and present to Federal Express.

10. Call the receiving laboratory and inform them of the nature of the shipment, expected arrival date, and airbill number. Request the receiving laboratory to call as soon as the package is received. If the laboratory has not called within 24 hr of the time they were to have received the sample, call them.

Engineers
Planners
Economists
Scientists

_____

Date

SHIPPER'S DECLARATION FOR EXCEPTED RADIOACTIVE MATERIALS, INSTRUMENTS, AND ARTICLES

This package conforms to the conditions and limitations specified in 49 CFR 173.421 for excepted radioactive material, limited quantity, N.O.S., UN2910.

The materials are packaged in a string, tight package; the radiation level on the surface of the package does not exceed 0.5 mR/hr; the outer surfaces of the package do not have transferrable contamination exceeding the limits specified in 49 CFR 173.44(a); and the outside of the inner package is labeled with a sticker that reads "Radioactive."

No other labels are required.

Shipped To:

_____
_____
_____
_____
_____

Contact for Information:

_____

George Stephens
Radiation Health Officer
CH2M HILL, Inc.
Oak Ridge Office
615/483-9032 (O)
615/694-4109 (H)

ATTACHMENT B

Attachment B
RATIONALE FOR DETERMINING CHEMICAL AND RADIOLOGICAL ANALYSES

Offsite laboratory analyses planned for PGDP SI samples include the EPA's Target Compound List (TCL) organics and inorganics, major ions, radionuclides, and dioxins and furans. These analyses will be performed by a combination of three offsite laboratories: CH2M HILL's lab (MGM) in Montgomery, Alabama; Weston Laboratories, Lionville, Pennsylvania; Teledyne Isotopes, Westwood, New Jersey; and NUS Laboratory in Pittsburgh, Pennsylvania.

The sample will be screened in the field for the presence of beta/gamma radiation and analyzed in the FSL for alpha and beta radiation. Limits for FSL rad screening are as follows:

	Gross Alpha	**Gross Beta/Gamma**
Liquid Samples	30 pCi/l	500 pCi/l
Solid Samples	15 pCi/g	50 pCi/g

Environmental samples with screening results above any of these limits will be sent to Weston for TCL organics, TAL inorganics, radioisotopes, major ions, dioxins/furans, and TCLP waste classification criteria. All waste samples will by sent to the NUS laboratory. Samples with screening results below both of the radionuclide limits will be sent to MGM for TCL organics, TAL inorganics, and major ion analysis. Ten percent of the negatives (on a daily basis) will be sent to Teledyne for radiologic analysis, as a QC check on the field analyses. QC samples will be sent on for radiologic analysis in any case.

OROR17/057.51

ATTACHMENT C

Attachment C
INSTRUCTIONS FOR SAMPLE TRACKING DATA BASE

Figure C-1 shows the format that will be used in the sample tracking data base. Each item to be entered is explained below:

1. Sample Number: Enter the number assigned to the sample, up to 5 digits.

2. Project Number: Enter project number for the current sampling event, e.g., SED30888.XX.

3. Station Number: Enter the station number corresponding to the sample location. This is 2 letters followed by a 3-digit number, e.g., MW006. Station numbers will be assigned by the sampling task leaders, and they will maintain a master list of station numbers at the FSL.

4. Sample Matrix: Enter 2-letter code for the sample matrix, as follows:

   Water:

Groundwater	GW
Surface Water	SW
Deionized/Organic-Free Water (monthly monitoring, equipment)	AQ

   Soils:

Sediment	SD
Soil Boring (subsurface soil)	SB
Surface or Near-Surface Soil	SS

   Waste:

Liquid Waste	WL
Solid Waste	WS

   For trip blanks, enter the matrix of the type of environmental samples being collected.

Figure C-1
PGDP Sample Tracking Format

Parameter	Format	Examples
Sample Information		
1. Sample number	(5N)	10001 - 99999
2. Project number	(14A)	SED30888.FF
3. Station number	(6A)	MW017, PD027
4. Sample matrix	(2A)	GW, SW, SD, WS, WL
5. Sample type	(5A)	Comp., Grab, Trblk
6. Date sample collected	(__/__/__)	Mo/day/yr
7. Time sample collected	(__:__)	24-hr time
8. Name of sampler	(15A)	K. Ries, B. Souza
9. Sample description/location	(40A)	- Boring No. 13, 5-10 ft - Midstream, 13 ft south of bridge - Onsite, offsite - Upgradient, downgradient
10. FSL results: gross alpha	(10A)	27 pCi/l, 16 pCi/g
11. FSL results: gross beta/gamma	(10A)	27 pCi/l, 16 pCi/g
12. Is sample above rad screening limits?*	(3A)	Yes, no, NR
Sample Analysis Tracking Information		
13. Analysis	(12A)	MAJION, TCLVOC, TCLBNA, RADCHEM, DIOX, WWCC, TALMET, TALCN, FSLRAD
14. SDG (sample delivery group)	(6A)	SDG 001, SDG 002
15. QC sample	(8A)	MS/MSD, SP/DUP, SP, DUP
16. Container lot number(s)	(15N)	
17. Laboratory	(3A)	MGM, TEL, WTN, NUS, FSL, PGD
18. Date shipped to lab	(__/__/__)	
19. Airbill number	(10N)	
20. VTSR (verified time of sample receipt)	(__/__/__.__:__)	
21. Requested turnaround time (calendar days)	(3A)	7d, 14d, 28d, 48h, 24h
22. Date sample results received	(__/__/__)	
23. Date QC results received	(__/__/__)	
24. Date complete package received	(__/__/__)	
25. Date validated results received	(__/__/__)	
26. Date of residuals transfer	(__/__/__)	
27. Date sent for data base input	(__/__/__)	
28. Date sent to validator	(__/__/__)	
29. Date received from validator	(__/__/__)	
30. Comments		

OROR17/055.51

5. Sample Type: Enter 5-letter code for the type of sample, as follows:

Composited Environmental Sample	COMPE
Grab Environmental Sample	GRABE
Equipment Blank	EQBLK
Duplicate Environmental Composite	DUPCE
Duplicate Environmental Grab	DUPGE
Trip Blank	TRBLK
Composited Waste Sample	COMPW
Grab Waste Sample	GRABW
Duplicate Waste Composite	DUPCW
Duplicate Waste Grab	DUPGW
Blind EPA QC Sample	EPAQC
Monthly Aqueous Grab	MONAQ

6. Date Sample Collected: Enter month/day/year (should be the same as chain-of-custody form).

7. Time Sample Collected: Enter time in 24-hr military format (e.g., 21:53) (should be the same as chain-of-custody form).

8. Name of Sampler: Enter name of sampler (first initial, last name).

9. Sample Description: Enter any additional description of the sample that is necessary to identify the sample. For soil and groundwater, enter the depth of the sample interval. The format should be kept as consistent as possible (i.e., do not switch from "5-10 ft" to "5 to 10 ft" to "5 to 10 feet" for different samples). Additional descriptions include onsite, offsite, upgradient, downgradient.

10. FSL Results: Gross Alpha: Enter the FSL screening results. Units for liquids should be pCi/l; units for solids should be pCi/g.

11. FSL Results: Gross Beta/Gamma: Enter the FSL screening results (units same as in Number 10).

12. Is Sample Above Rad Screening Limits?: Limits are listed below:

	Gross Alpha	**Gross Beta/Gamma**
Solids	15 pCi/g	50 pCi/g
Liquids	30 pCi/l	500 pCi/l

If the sample is above any of the limits, the sample cannot be shipped to the Montgomery (MGM) lab.

If rad screening was not required and not performed (e.g., on trip blanks), enter NR.

13. Analysis: Enter code for requested analysis, as follows:

PGDP Rad Screening	PGDPRAD
FSL Rad Screening	FSLRAD
TCL VOC Analysis	TCLVOC
TCL Semivolatiles (BNAs)	TCLBNA
TCL Pesticides/PCBs	TCLPest
TCL (TAL) Metals*	TALMET
TAL Cyanides	TALCN
Radioisotope Analysis*	RADISO
Gross Alpha/Beta*	GROSS
Dioxins/Furans	DIOX
Major Ions (alkalinity, sulfate, chloride, sulfide, calcium, magnesium, potassium, sodium, and nitrate)	MAJION
Solid Waste Classification Criteria	SWCC
Waste Water Classification Criteria	WWCC
General Solid Waste Analysis	GWS
General Liquid Waste Analysis	GWL
*Any Filtered Sample	Add "F" at end (e.g., TALMETF)

14. SDG (Sample Delivery Group) Number: Starting with SDG 001, enter the SDG number for each "batch" of samples sent to an offsite lab. A "batch" is defined as 20 samples of the same matrix sent over a 14-day period. This should also be written on the chain-of-custody form. This number is only used in CH2M HILL-MGM and Weston laboratories.

15. QC Sample: If extra sample volume is collected for laboratory QC, enter a code for the QC as follows:

Matrix Spike/Matrix Spike Duplicate	MS/MSD
Spike and Duplicate	SP/DUP
Spike	SP
Duplicate	DUP

16. Container Lot Number(s): Enter the lot number(s) (provided by the laboratory with container shipments) for container(s) used for the analysis listed above (see Number 13). This should be written on the container label when the containers are first removed from their shipping containers prior to being sent into field. I-Chem provides labels with printed lot numbers; these labels may be used on containers instead of writing lot numbers on CH2M HILL labels. However, CH2M HILL labels should always be used to record sample information.

17. Laboratory:

PGD	PGDP Rad Screening
FSL	Field Support Laboratory
WTN	Weston Laboratory
TEL	Teledyne Isotopes
NUS	NUS Laboratory
MGM	CH2M HILL's Montgomery Laboratory

18. Date Shipped to Lab: Enter month/day/year.

19. Airbill Number: Enter airbill number from Fed-Ex label used for shipping the sample cooler to an offsite lab if Fed-Ex was used for shipment.

20. VTSR (Verified Time of Sample Receipt): Enter month/day/year and time (if available). This information will be provided by the lab.

21. Requested Turnaround Time: Enter turnaround time requested (28 days is standard; 14 or 7 days for faster turnaround; 48 hours for FSL). This should also be written on the chain-of-custody form.

22. Date Sample Results Received: Enter date sample results are first received by CH2M HILL.

23. Date QC Results Received: Enter date all required QC summary forms/QC results are received by CH2M HILL (from offsite lab).

24. Date Complete Package Received: Enter the date that all data package deliverables are received by CH2M HILL (from offsite lab).

25. Date Validated Results Received: Enter the date the validated results are received by CH2M HILL from the data validation subcontractor.

26. Date of Residuals Disposal: Enter the date the sample residuals are submitted to the waste manager.

27. Date Sent for Data Base Input: Enter the date the validated sampling results were input into the WDC-EDMS system.

28. Date Sent to Validator: Enter the date the data package was given or sent to the data validator. A 14-day due date for receipt of the data package from the validator will automatically be calculated.

29. Date Received from Validator: Enter the date the validated data package was received.

30. Comments: Enter any comments about the sample not covered by the information entered above, especially any problems encountered.

OROR17/053.51

ATTACHMENT D

Attachment D
FIELD QC AND MS/MSD SAMPLES

The sample manager will track QC samples that have been taken or prepared and have been submitted for analysis. The field sample manager (FSM) and the task order manager will be responsible for ensuring that the appropriate type and number of QC samples are taken, as indicated by the work plan, QAPP, and task-specific project instructions.

Field QC

Sample duplicates, equipment blanks, and trip blanks will be prepared by the sampling team and the FSM. The analytical results obtained for these samples will be used to assess the quality of the field sampling effort. The types of field QC samples to be collected are discussed below.

Field duplicate samples will be collected at a 10 percent frequency or one for every 10 samples collected. The duplicate samples will consist of the same aliquots as the analytical sample. These samples will be collected at the same time, using the same procedures, the same equipment, and in the same types of containers as required for the samples. They will also be preserved in the same manner and submitted for the same analyses as required for the samples. Field duplicates are submitted to the laboratory as if they were two unique samples. They are not the same as laboratory duplicates, which are prepared in the laboratory from a single sample.

Equipment blanks will be used on the basis of one per cleaning lot for (1) sample collection equipment during the cleaning of equipment prior to use in the field, and (2) sample glassware, if commercially cleaned glassware is not used. In the field, an equipment blank will be collected and analyzed when reusable collection equipment is decontaminated. Equipment blanks are collected by rinsing cleaned equipment with deionized/organic-free water prior to sample collection and collecting the rinsate as a sample. Equipment blanks will be submitted with groundwater and surface water samples at the rate of one per 20 samples for a given matrix.

Trip blanks consisting of deionized/organic-free water will be used on the basis of one per day and analyzed for TCL organic analytical fractions. Trip blanks will either be supplied by the offsite laboratories or prepared at the FSL; they will be transported to the sampling area and submitted to the laboratories along with the environmental samples.

Other field blanks, such as container blanks or deionized water blanks, will be prepared as deemed necessary by QC or task leaders.

Laboratory QC

One MS/MSD QC sample will be collected for every 20 samples of similar matrix (water, soil, etc.), or one for every 14 calendar day period, whichever is more frequent. QC for several analytical fractions requires that an extra amount of sample is submitted. This type of lab QC sample will be chosen by CH2M HILL in the field rather than by the lab, so that the extra sample amount is required for only 1/20 of the samples, rather than all samples. Tables 2, 3, 6, and 7 list the sample container requirements for samples to have adequate volume for these laboratory QC analyses. Both the sample container labels and chain-of-custody forms will identify the samples selected for laboratory QC.

OROR17/054.51

APPENDIX 2A-2

Waste Management Instructions

M E M O R A N D U M

TO: Jim Emery/PAH/CH2M HILL/Waste Manager/502-441-6255
Russ Goff/GVN/CH2M HILL/Sample Manager/904-331-2442
Bruce Haas/ORO/CH2M HILL Project Manager/615-483-9032
Sam Shannon/ORO/CH2M HILL/Assistant PM/615-483-9032
Dan Marion/PAH/CH2M HILL/Field Activities Coordinator/502-441-6255
George Stephens/ORO/CH2M HILL/Health Physics Task Manager/615-483-9032
Bob Nash/ORO/CH2M HILL/Health and Safety Coordinator/615-483-9032
Bill Avolio/PAH/CH2M HILL/Subsurface Investigations Task Manager/502-441-6255
Tom Simpson/ATL/CH2M HILL/Surface Investigation Task Manager/404-523-0300
Jesse Tremaine/ORO/CH2M HILL/Analytical Support Manager/615-483-9032
Charlie Krough/DEN/CH2M HILL/Review Team Leader/Quality Control/303-771-0952
Kevin Cange/ORO/CH2M HILL/Test Pit Task Manager/615-483-9032
Leslie Shannon/ORO/CH2M HILL/Soil Sampling Task Manager/615-483-9032
Kim Ries/PAH/CH2M HILL/Hydrogeology Task Manager/502-441-6255
Rusty Anderson/ORO/CH2M HILL/Laboratory Task Manager/615-483-9032

COPIES: Rick Doane/Eberline/Health Physics Field Support/615-576-0320
Steve Wagner/PGDP/PGDP Project Manager/502-441-6395
Jim Elliott/PGDP/PGDP Engineering/502-441-6236
Craig Morrison/Eberline/Health Physics Manager/615-576-0320

FROM: Lynn Sichelstiel/ORO/CH2M HILL/Waste Management Task Manager

DATE: November 15, 1990

SUBJECT: Task Instructions for Waste Management During Phase II Paducah Gaseous Diffusion Plant (PGDP) Site Investigation

PROJECT: SED30888.FF

1.0 SUMMARY

These project instructions apply to site investigation (SI)-derived wastes that are generated during the Paducah Gaseous Diffusion Plant (PGDP) SI. The waste types that are expected

to be generated include drill cuttings, purge and development water, drilling muds, decontamination waste water, and disposable personal protective equipment (PPE). The project instructions list procedures that may apply to SI-derived wastes, describe general requirements and responsibilities for waste management, and provide a method for implementing the waste management requirements.

Each member of a sampling team and drill crew is responsible for adhering to the waste management project instructions and following good housekeeping practices during the PGDP SI. Specific responsibilities are assigned to the Waste Manager (WM), the Sampling Team Leader (STL) at a worksite, and the drilling subcontractor.

2.0 APPLICABLE PROCEDURES

The Energy Systems Environmental Surveillance Procedures (ESP procedures) and the PGDP Standard Practice and Policy Procedures (ESH procedures) listed below apply to managing SI-derived waste. Each sampling team will have a copy of the appropriate procedures available for reference at a worksite. Each team member will read the procedures and sign a statement of understanding regarding the procedures prior to startup of the work.

- Method ESP-100, "Introduction"
- Method ESP-308-1, "Composite Procedures"
- Method ESP-308-3, "Container Sampling: Drums and Tanks"
- Method ESP-400, "Field Quality Control"
- Method ESP-701, "Sample Preservation and Container Materials"
- Method ESP-900, "Cleaning and Decontaminating Sample Containers and Sampling Devices"
- Method ESP-1000, "Waste Management" (with specific direction by PGDP)
- Method ESP-1200, "Terms and Definitions"
- Method ESH-28, "On-site Handling and Disposal of Waste"
- Method ESH-514, "Reporting, Controlling, and Cleanup of Oil and Hazardous Materials Spills"

3.0 ON-SITE PERSONNEL

Field Activities Coordinator: Dan Marion

Task Managers: Bill Avolio (drilling, soils, groundwater)
Tom Simpson (surface water, sediment, shallow soils)

Field Sampling Crew(s): To be assigned for each sampling event

Industrial Hygiene/Health Physicist (IH/HP) Technicians: Assigned to field sampling crew

Waste Manager (WM): Jim Emery

Sample Manager (SM): Russ Goff

Field Quality Control (QC): Charlie Krough

QC for Sample Management: Lynn Sichelstiel

QC for Waste Management: Lynn Sichelstiel

4.0 GENERAL REQUIREMENTS

4.1 Site Classification

Sites will be classified as "Potentially Contaminated" or "No Evidence of Contamination" based on the location of the site and available data. SI-derived wastes from either site classification will be handled and contained as though they are potentially contaminated. The site classification will determine the level of waste characterization required, as discussed in Section 4.2.

Sites which are suspected or known to have soil or groundwater contamination present must be designated as "Potentially Contaminated." Sites which are known to not have surface contamination and lie outside the estimated boundaries of the contaminated portion of the gravel aquifer may be designated as "No Evidence of Contamination." Based on currently available data, the only sites that may be classified as "No Evidence of Contamination" are sites upgradient from the PGDP that will be sampled for background data.

4.2 Characterization and Classification

With the exception of field decontamination waste water, wastes collected at sites classified as "No Evidence of Contamination" will not require further characterization (beyond field monitoring and FSL screening). Field decontamination waste water will require further characterization since it could contain TSP, isopropanol, low levels of nitric acid, oils and grease, etc.

With the exception of disposable PPE, wastes collected at worksites classified as "Potentially Contaminated" will be sampled as described in Section 4.4. Samples will be handled in accordance with "Project Instructions for Sample Management during the Phase I PGDP Site Investigation." Solid wastes, including soil cuttings and drilling mud, will be characterized according to the general analytical requirements and waste classification requirements presented in the PGDP Waste Classification and Management Plan (7.2 and 8.1 of Attach-

ment A). Waste water, including well development and purge water and field decontamination waste water, will be analyzed for the constituents listed in (7.1 of Attachment A). Containers of PPE will be characterized by the PGDP, however, CH2M HILL will generate the RFD.

CH2M HILL will be responsible for sampling and characterizing decontamination water generated at the PGDP decontamination pad. The PGDP is also responsible for removing solids from the sump at the decontamination pad, sampling the solids, and submitting the samples to CH2M HILL for analysis.

Wastes will be classified by PGDP following receipt of analytical characterization data, typically some 28 days after sampling solid wastes, and 15 days after sampling waste waters.

4.3 Waste Containment, Handling, and Segregation

All investigation-derived wastes will be contained until the waste is characterized and classified.

The drilling subcontractor is responsible for handling wastes generated at drill sites. The STL is responsible for handling wastes generated at surface water, sediment, and shallow soil sampling locations. Waste handling activities include transferring empty or partially filled waste containers to the worksite, placing waste materials in the appropriate containers, and transferring the waste containers from the worksites to the PGDP secure storage area (SSA).

Drill cuttings will be segregated by well or borehole. Drilling muds will be segregated by cluster. Well development and purge water will be segregated by worksite and/or site classification and composited into 1,200 gal storage tanks at the PGDP SSA. Liquid waste will be segregated as "dirty" and "uncharacterized" water. If field monitoring instruments indicate a change in the degree of contamination of a media (such as encountering a "hot spot" with depth while drilling), wastes will be segregated to the extent possible and practicable, as determined by the STL. Wastes from soil sampling events will be segregated and composited according to the specific areas being sampled (i.e., areal sampling, railroads and pipeline bedding sampling, and creekbed sampling). Wastes from sediment samples will not be segregated according to the specific areas being sampled (pond bottoms versus creek beds) due to the small quantity of waste expected to be generated during sampling. Field decontamination waste water will not be segregated by worksite due to the small quantity of waste expected to be generated at different sampling locations. Notably contaminated wastes will not be composited with relatively "clean" wastes, as determined by the STL and/or WM.

4.4 Sampling

The following general waste sampling requirements apply only to wastes collected from sites designated as "Potentially Contaminated." Solid waste sampling will occur at a worksite prior to transfer of solid waste containers from a worksite to a PGDP SSA. The STL will sample the solid waste at the job site locations. Waste waters will be sampled after they are transferred to a PGDP SSA. Specific sampling methods are discussed in Section 5.

At worksites within the PGDP security fence (on-site locations), one composite sample of drill cuttings will be collected for each well or borehole. A few spoonfuls of cuttings from each auger flight (one every five feet) will placed into a stainless steel bowl, mixed, and sampled. Duplicate samples will be collected on the basis of one for every ten samples collected.

Liquid waste from the borehole (drilling fluids) will be pumped into tanks by the drilling subcontractor instead on drums and transported to the waste holding tanks. This is especially the case from deep holes. Solid and liquid will be allowed to settle, then the liquid waste will be pumped off into the waste water tanks and the solids sampled.

At worksites outside the PGDP security fence (off-site locations), one sample of drill cuttings will be collected from the deepest well in the cluster for each well cluster.

One sample of drilling mud will be collected for each cluster (regardless of onsite or offsite). The sample will be collected from the mud tub prior to pumping the mud into drums. Drilling mud will be analyzed for the same parameters as soil cuttings. Duplicate samples will be collected on the basis of one for every ten samples collected.

One sample of well development or purge water from wells will be collected per 1,200 gal of waste water (when a storage tank at the SSA reaches capacity). Duplicate samples will be collected on the basis of one for every ten samples collected.

One sample of field decontamination waste water will be collected per 1,200 gal. Duplicate samples will be collected on the basis of one for every ten samples collected.

One sample per drum will be collected for other sampling events (i.e., sediment, and shallow soil sampling).

The following blocks of sample numbers are reserved for waste samples:

- Waste water samples: 15,000-15,999

- Solid waste samples: 16,000-16,999

The WM is responsible for assigning sample numbers to waste samples and collecting duplicate samples.

4.5 Packaging and Labeling

The PGDP designates the types of waste packaging to be used and supplies the packaging materials, including outer containers such as drums, and inner containers such as plastic liners. According to the "Waste Classification and Management Plan" prepared by PGDP, solid wastes, including drill cuttings, drilling mud, and PPE will be placed in open-top, 55-gal steel 17C DOT-approved drums lined with plastic liners supplied by MMES. Liquid wastes (not including field decontamination waste water or well development or purge water) will be placed in closed-top 55-gal steel 17E DOT-approved drums or approved equal.

PGDP is supplying reusable truck or forklift transportable plastic tanks for containing waste groundwater (well development and purge water).

Waste containers will be securely closed (i.e., drum rings closed and fastened or tank valves closed) when they are filled or at the end of each day. Waste waters, including field decontamination waste water and well development and purge water will be segregated and pumped from the containers in which they were collected in the field (i.e., open-top drums or transportable plastic tanks) to stationary 1,200 gal storage tanks at the PGDP SSA. The drilling subcontractor is responsible for pumping the waste waters into the stationary tanks.

CH2M HILL will label each clean waste container (i.e., open- or closed-top drums, but not plastic liners or transportable or stationary tanks) with an identification number before the waste container is transported to a worksite. No container will be transported to a worksite if it does not contain an identification number. At the worksite, waste containers will be labeled with waste container labels (Figure 1) by the sampling teams with the source of the waste including the location number, the site classification, the waste type, the date of generation, the CH2M HILL employee number of the STL, the field screening results, and the PGDP contact. When waste is transferred to the PGDP WMD, PGDP will label and manage the waste in accordance with applicable regulations and Energy systems or PGDP procedures.

4.6 Storage, Transportation, and Transfer

Solid wastes and field decontamination waste water generated at drill sites outside the PGDP security fence will be secured in a locked and enclosed truck or van until drilling at the

site is complete or until the capacity of the secure vehicle is reached. Transportable plastic tanks holding well development water or purge water at offsite locations will be transported by the driller to a central location at the PGDP at the end of each work day. The waste groundwater will not be transferred to the PGDP WMD and placed in a stationary container until the transportable tank is near full or full.

Wastes generated at drill sites within the PGDP security fence will be considered secure at the drill site until drilling at the site is complete. Drilling mud and drill cuttings will then be sampled by CH2M HILL and sealed and transported by the drilling subcontractor to a PGDP SSA. Drums of drilling cuts and pallets shall be externally clean (free of mud and caked soils) before transfer to the SSA.

Waste water will be transported by the drilling subcontractor to the PGDP SSA, segregated by type (i.e., field decontamination waste water versus waste groundwater) and/or worksite as described above, and pumped by the drilling subcontractor into stationary storage tanks. The stationary storage tanks will be sampled by CH2M HILL when the tanks are full. The drilling subcontractor will provide a forklift, if necessary, for transporting plastic tanks and configuring palleted drums in the SSA as the WM deems necessary. Drums containing liquids will not be completely filled but 6 to 10 inches from the top to allow for expansion in freezing conditions.

Wastes generated during other soil sampling or sediment sampling events will be sampled, sealed, and transported by CH2M HILL to a PGDP SSA when the sampling event is complete.

When waste containers are transferred to a PGDP SSA, they will be segregated to the extent possible, depending on the available space, according to worksite and/or waste type, double stacked, and placed in rows no less than 2 ft apart. Waste container labels and numbers will be visible from the aisle.

The PGDP will designate a storage area within the SSA for waste holding. Each lot of waste, as described above and in Section 4.3, will be accompanied by a PGDP Request for Disposal (RFD) as shown in Figure 4 or an approved equivalent form. An RFD may be completed for drums containing solid wastes when the drums are placed at the SSA and/or when the drums are sampled. RFDs are not required for reusable drums containing liquid wastes or for transportable tanks.

CH2M HILL will initiate the RFD or provide the information to complete the RFD to Elizabeth Krispen/PGDP or some other designated PGDP employee. (The RFD number will be marked on the exterior of all drums covered under the respective RFD.) The PGDP employee will be the requisitioner responsible for

signing the RFD prior to transfer. Richard Keuhn/PGDP will act as the waste disposal coordinator responsible for signing the RFD at final disposal. The waste disposal coordinator will not sign the RFD when waste is transferred to the PGDP, since characterization data and final disposition will not be known at that time.

At transfer, the PGDP WMD may inspect the RFD and the container. The PGDP could require repackaging of containers which do not meet specifications for type and condition. The PGDP WMD may refuse transfer until containers are labeled with the information described in Section 4.5.

Slurries, sludges, and/or very wet drilling spoils may be transferred to the PGDP WMD without absorbing or fixing the moisture.

4.7 Final Disposition of Wastes

The investigation-derived wastes will be stored at the SSA until they have been classified by PGDP (as non-hazardous or as one of the waste materials defined in Section 4.0 of the PGDP Waste Classification and Management Plan in Attachment A) and until a means of final disposal or discharge has been determined. Final disposal or discharge is the responsibility of the PGDP.

4.8 Waste Management Records

Empty drums received from the PGDP will be assigned and labeled with a sequential package identification number by the WM before being transported to a worksite. CH2M HILL-assigned package identification numbers will contain the prefix "SI-" so that wastes may be easily recognized as SI-derived wastes. A record of package identification will be kept by the WM in a bound waste management logbook. As a minimum, the record will include the package ID number, and the date the container or packaging was first used. When the container is transferred to PGDP, as a minimum, the WM will record the following in a bound waste management logbook: package ID number, RFD number, date and time of transfer, and the name of the PGDP employee receiving the waste.

The package identification number, package description, dates issued and transferred and by whom, and logbook cross references will be transferred from the logbook to a Waste Container Log Sheet, shown in Figure 2 or onto the waste management computer. The Waste Container Log Sheet or computer file will provide easily retrievable records of the final disposition of drums used during the SI.

The PGDP WMD will assign an identification number to reusable transportable tanks and stationary tanks. The PGDP-assigned identification numbers will not be entered in the Waste

Container Log Sheet, but the use of tanks will be tracked, as described below.

The WM will make daily rounds of the worksites to monitor waste management activities. As a minimum, the WM will record the worksite location and site classification or any changes to the site classification, waste package ID numbers (either CH2M HILL-assigned or PGDP-assigned), the type and source of waste, the date the waste was generated, and the name of the STL in a bound logbook. The WM will also record any waste conditions that may affect the waste classification or disposition (i.e., drill cuttings with free liquid, positive field radiation screening, etc.).

The STL is responsible for sampling solid wastes and labeling the drums with the information contained in Section 4.6. The STL will notify the WM when solid waste containers will be sampled and transferred to the PGDP SSA.

Waste waters placed in reusable drums or tanks will be sampled after transfer to a stationary container at the PGDP SSA. The STL will notify the WM when transportable tanks or drums containing waste water will be transferred to the PGDP storage pad. The WM will record the identification number of the stationary tank into which waste waters are emptied, and track the type of waste water being received by the stationary tanks. The WM will sample the stationary tanks when they are full. RFDs for stationary tanks will be completed by the PGDP requisitioner when the tanks are full.

The WM will keep a Preliminary Waste Classification Tracking Record for each worksite (for example, borehole or areal soil sampling event), as shown in Figure 3. The Tracking Record is an easily retrieved, simple, and concise record of a wastes known characteristics when it is transferred to the PGDP secure storage pad. The Preliminary Waste Classification Tracking Record will be used to track waste placed in drums, transportable storage tanks, and stationary storage tanks.

The Preliminary Waste Classification Tracking Record may be used to complete the PGDP RFD or may be attached to the RFD.

4.9 Releases of Waste

There will be no intentional releases of wastes by CH2M HILL or our subcontractors. CH2M HILL and the drilling subcontractor are responsible for the containment and cleanup of accidental releases of waste occurring prior to or during waste transportation to a secure PGDP storage pad. In accordance with ESH-514, "Reporting, Controlling, and Cleanup of Oil and Hazardous Materials Spills," a spill should be reported immediately to the PGDP Plant Emergency Director (the shift superintendent on duty). The PGDP may provide containment and cleanup support if required.

4.10 FSL Sample Residuals and Miscellaneous Laboratory Wastes

The FSL receives aliquots of environmental samples and waste management samples for radiation screening. Samples are screened prior to shipment to determine if they meet the DOT definition of a radioactive material (any material having a specific activity greater than 0.002 uCi/g).

All laboratory residuals will be temporarily stored for a period of 60 days prior to segregation and packing into waste drums. This will be done to facilitate easy access to the sample containers in the event resampling is necessary. At the end of the 60-day storage period, the WM will segregate all sample residuals into the following categories:

1) liquid, onsite, specific activity <0.002 uCi/ml
2) liquid, onsite, specific activity >0.002 uCi/ml
3) liquid, offsite, specific activity <0.002 uCi/ml
4) liquid, offsite, specific activity >0.002 uCi/ml
5) solid, onsite, specific activity <0.002 uCi/g
6) solid, onsite, specific activity >0.002 uCi/g
7) solid, offsite, specific activity <0.002 uCi/g
8) solid, offsite, specific activity >0.002 uCi/g

The WM will keep a log of sample numbers, FSL screening results, and the disposition of the sample residuals.

The WM will transfer the segregated sample residuals to the PGDP SSA. A group of eight drums, with package identification numbers, will be kept at the PGDP SSA for receiving sample residuals according to the categories described above. The drums will be lined, and the residuals will be packed in vermiculite.

The WM will track the drums receiving sample residuals. The WM will note a drum's package identification number, the type of waste being received (one of the eight categories listed above), and sample number of the residuals placed in the drums. When the drums are full, the WM will complete an RFD or provide the information to complete the RFD to the PGDP requisitioner.

Miscellaneous laboratory wastes, such as empty alcohol bottles, empty gas cylinders, and PPE, will be contained at the FSL. As necessary, the WM will transfer the miscellaneous laboratory wastes to the PGDP SSA, where it will be placed in a labeled drum dedicated to receiving laboratory wastes. The WM will track drums receiving laboratory wastes.

The PGDP requires that sample residuals from environmental samples sent to offsite analytical laboratories be returned to the plant. Laboratories have been directed to return the residuals to CH2M HILL's field office at the PGDP. Sample

residuals from offsite laboratories may be sorted and handled in the same manner as FSL sample residuals, described in Section 4.10.

4.11 Training

Personnel responsible for containing, segregating, packaging, transporting, and sampling waste materials are required to have project specific waste management training. According to the PGDP Waste Classification and Management Plan, as a minimum, the training will include:

- Waste containment and segregation
- Packaging requirements
- Classification requirements
- Waste management records, including RFDs

Each of these items are discussed in detail in these project instructions. The WM will instruct and direct STLs as to their role in waste management. These project instructions will serve as the basis of the waste management training program. In addition, one copy of these project instructions must be at each work site at all times.

5.0 METHOD

Preplanning

1. The PGDP has agreed that all worksites should be classified as "Potentially Contaminated," except sites upgradient from the PGDP that are being sampled for background data. Unless different direction is provided by the PGDP RAP, worksites, except background locations, will be classified as "Potentially Contaminated."

2. The PGDP will provide waste containers. Each week the WM will assess the number and type of containers available at the site support facilities, coordinate with the STLs to estimate the type and quantity of waste containers that will be required at the worksites the following week, and notify the PGDP of upcoming waste container needs. Contact Elizabeth Krispen, Extension 6401, or Richard Keuhn, Extension 6319, for waste containers.

3. The WM will inspect waste containers received from the PGDP WMD to see that they meet specifications for type and condition. Unacceptable containers will be returned to the PGDP WMD.

4. The WM will assign drums sequential package identification numbers beginning with SI-2000, SI-2001, etc., as discussed in Section 4.8. The package identification number will be stenciled or written with a paint stick on the side of the drum. The WM will record package

identification numbers as they are assigned in a bound logbook and on the Waste Container Log Sheet (Figure 1).

5. The PGDP will assign storage tanks identification numbers.

6. The WM will segregate waste containers that have been assigned an identification number from unmarked containers, to allow easy pickup by the drilling subcontractor and/or the sampling teams. No waste container will be transported to a worksite, unless it has a CH2M HILL-assigned or PGDP-assigned identification number.

7. The WM will take a weekly inventory of the drums that have been assigned a package identification number. If any drums are unaccounted for, the drum identification numbers will be reported to the PGDP, and a record of missing drums will be recorded in the waste management logbook and on the Waste Container Log Sheet (Figure 2).

Worksite Waste Management

1. See Section 8.0, Checklist, for equipment that may be required at a worksite for managing SI-derived waste.

2. The STL will notify the WM and the drilling team of the types and quantities of waste expected to be generated at a worksite. The WM will coordinate with PGDP (contact Elizabeth Krispen or Richard Keuhn) so that the necessary containers are available and labeled with a package identification number.

3. The drilling subcontractor is responsible for waste handling and providing their own waste handling equipment. The drilling subcontractor will pick up waste containers from the WM at the site support facilities and transport them to the worksite. When waste containers are filled or ready for transport to the PGDP SSA, the drilling contractor will load waste containers onto a driller-supplied vehicle and transport the containers, as required.

4. If plywood or other materials are necessary to provide a level route on which drum handling equipment may be used for transporting filled drums from the drill rig to the transport vehicle, those materials will be provided by the driller. Plywood will be disposed of in a location agreed upon by MMES and the WM.

5. Normal good-housekeeping practices, such as use of groundcovers, drill pans, or lugger boxes for containing drill cuttings or spoils or for limiting the extent of drill spills, will be followed.

6. Wastes generated at the worksites will be segregated and contained as discussed in Section 4.3. Drill cuttings, drilling mud, PPE, waste sediments, and other solid wastes will be segregated and placed in open-top, 55-gal steel 17C DOT-approved drums. Field decontamination waste water will be placed in open-top drums equipped with bungs or approved equal. Well development and purge water will be placed in transportable plastic tanks. The drilling subcontractor is responsible for loading wastes into containers.

7. The STL or designee is responsible for labeling each drum or tank with a waste container label (Figure 3) as the containers are filled with waste. Waste container labels will be completed using black indelible markers. As a minimum, waste containers will be labeled with the worksite location number, site classification, waste type, depth interval (as appropriate), date of generation, the employee number of the STL, and the PGDP contact (Brad Montgomery, Extension 6401). Actual levels of detection for positive field screening results should be recorded on the waste container label (i.e., HNu=300ppm, etc.).

8. The date of generation is the first date that waste was placed in a container. When wastes from more than one location are composited in a waste container, each of the worksite locations should be listed on the waste container label.

9. Waste container labels will be placed on one side of drums. The area where waste container labels will be placed should be cleared of soil or mud and dried before labeling. Labels should be visible from the aisle at the SSA.

10. After waste waters are pumped from transportable storage tanks into stationary tanks at the PGDP SSA, the transportable tanks will be cleaned at the PGDP decontamination pad. The insides of the tanks should be rinsed, but complete removal of sediments from the inside of the tank is not required by PGDP. After the transportable tanks have been rinsed, the waste container label should be voided by marking as "Rinsed" on a diagonal across the label. The next time the tanks are used, the waste container label should be removed or a new waste container label should be placed directly on top of the voided label.

11. The STL will notify the WM at least one day before waste is transported to the PGDP SSA. The WM is responsible for notifying Richard Keuhn or Elizabeth Krispen of the impending waste transfer.

<u>Waste Management Sampling</u>

1. Sampling of containerized investigation derived wastes such as drill cuttings, purge and development waters, drilling muds, soil borings, and decontamination wastes will be conducted to characterize and classify these wastes for proper laboratory handling, record keeping, transfer, storage, and disposal.

2. Waste sampling will only be performed on wastes generated from sites designated as "Potentially Contaminated."

3. Decontamination and cleaning of investigation-derived waste sampling equipment will be conducted in accordance with ESP-900, "Cleaning and Decontaminating Sample Containers and Sampling Devices," and ESP-901, "Equipment Decontamination."

4. Field compositing of investigation-derived waste samples will be in accordance with ESP-308-1, "Composite Procedures."

5. Routine sampling of investigation-derived wastes that are contained in drums and tanks will be in accordance with ESP-308-3, "Container Sampling: Drums and Tanks."

6. The STL will be responsible for sampling solid wastes before they are transferred to the PGDP. IH/HP coverage is required during all sampling events.

7. The WM will be responsible for collecting waste water samples from the stationary storage tanks containing waste groundwater or field decontamination waste water at the PGDP secure storage area. IH/HP coverage is required during sampling.

Waste Management Records and Waste Transfers

1. The WM will keep the waste management logbook, the Waste Container Log Sheet (Figure 2), and the Preliminary Waste Classification Tracking Record (Figure 3), as discussed in Section 4.8.

2. There will be no RFD, FSL results, or sampling date for reusable drums used to contain field decontamination water or for transportable storage tanks. The contents of these waste containers will be transferred into stationary tanks at the PGDP secure storage pad. Only stationary tanks are sampled. When tracking waste placed in reusable drums or transportable storage tanks, as a minimum, the WM should note the package ID number, the date generated, logbook references, and the stationary tank into which the waste water was placed.

3. The WM or designee will transfer wastes to the PGDP WMD. The WM will notify the PGDP WMD at least one day before

the waste transfer is to occur. It is anticipated that during some periods of the SI, waste transfers will occur daily.

4. Solid wastes will be sampled prior to transfer to the SSA by the STL. Waste water will be sampled at the PGDP secure storage pad when a stationary storage tank is full.

5. The WM will partially complete an RFD (see Attachment B) or provide the information to complete an RFD to Elizabeth Krispen/PGDP, or some other PGDP designee. Specifics required on the RFDs will be provided by MMES. No CH2M HILL employee will sign an RFD. The RFD must be signed by a PGDP employee to be acceptable.

6. Figure 4 is an example of a partially completed RFD that may be used for investigation-derived waste. If the WM completes an RFD, he or she should only complete the blocks indicated. The remainder of the information on the top half of the RFD should be completed by the PGDP requisitioner (Elizabeth Krispen). The bottom half of the RFD will be completed by the waste disposal coordinator (Richard Keuhn) when final disposition of the waste is determined.

7. Items that will vary with each RFD include material to be disposed, types of container, number of items, and hazards in handling and disposal (which includes package identification numbers).

8. Under "Hazards in Handling and Disposal", as i minimum, the following information should be included:

   - station number
   - sample number
   - date of generation, including the period from start to finish during which the lot of waste was generated
   - package identification numbers for each of the waste containers in the lot of waste

9. The WM will make a photocopy and keep a "suspense file" of RFDs signed by the PGDP requisitioner. The PGDP waste disposal coordinator will send the WM the blue copy from the RFD when the final disposition of the waste is determined and the RFD is completed.

6.0 DECONTAMINATION

Refer to Methods ESP 900 and ESP-901.

7.0 HEALTH AND SAFETY

Refer to Site Specific Safety Plan in the Phase II Site Investigation Work Plan.

8.0 CHECKLIST

_____ Procedures
_____ Task Instructions
_____ Health and Safety Plan
_____ Waste management logbook
_____ Field sampling logbook
_____ Health and safety logbook
_____ Black permanent markers
_____ Chemical resistant, exterior grade vinyl with pressure-sensitive backing waste container label
_____ Waste container log sheets
_____ Preliminary waste classification tracking records
_____ Paint pencils
_____ Open-top, 55-gal steel drums
_____ Closed-top, 55 gal steel drums or approved equal
_____ Transportable plastic tanks, up to 1200 gal
_____ Plastic liners
_____ Forklift, rated to 10,000 lb with load rating plate attached to the front end (provided dy the drilling subcontractor)
_____ Sampling equipment, including soil and water sample devices, stainless steel mixing bowls and spoons, etc.
_____ PPE
_____ Lab wipes
_____ Pump for transferring waste water between containers
_____ Drum handling equipment
_____ Vehicles for transporting waste containers (provided by the drilling subcontractors)
_____ Miscellaneous supplies such as plastic sheeting and funnels, tubing, shovels, et., for transferring waste to containers

Figure 1. Waste Container Label

Location _____

Site Classification _____

Depth Interval _____

Waste Type _____

Date _____

STL Employee Number _____

Notes _____

_____

PGDP Contact _____

OROR6/057.50

Figure 2

WASTE CONTAINER LOG SHEET

PACKAGE ID NO.	PACKAGE DESCRIPTION	DATE ISSUED	DATE TRANSFERRED	LOGBOOK REFERENCE

Fig 3

PRELIMINARY WASTE CLASSIFICATION TRACKING RECORD

WORKSITE _____

SITE CLASSIFICATION _____

WASTE TYPE _____

PACKAGE ID NO.	DATE GENERATED	FIELD SCREENING RESULTS		DATE SAMPLED	LOGBOOK REFERENCES	NOTES
		HNu and/or OVA	RADIOACTIVITY			

Figure 4

REQUEST FOR DISPOSAL OF WASTE MATERIALS AND EQUIPMENT

№ 22827

Material to be disposed *(One material per sheet — Must be identified by Requester)*

Date	Location of Material (Bldg.)	Room or Area

Type of Container *(If cylinder, give cylinder number)*	Condition of Container
Number of Items	Approx. weight or volume

Hazards in Handling and Disposal:

Suggested Method and Location of Disposal:

CHECK APPROPRIATE BLOCKS

☐ Classified ☐ Unclassified

HAZARDOUS

NO	YES	UNKNOWN

☐ Radioactive ☐ Nonradioactive

Nuclides	Curies

TECHNICAL CONTACTS

DEPARTMENT	PERSON CONTACTED	DATE
Safety		
Health Physics		
Env. Control		
Fire Protection		
Industrial Hygiene		
Other		

PROTECTIVE EQUIPMENT REQUIRED

Signed: *(Requisitioner)*	Date	Charge No.	Dept.	Building	Mail Stop	Phone

INFORMATION BELOW THIS LINE TO BE FILLED IN BY WASTE DISPOSAL COORDINATOR ONLY

ADDITIONAL INSTRUCTIONS FOR DISPOSAL:

DISPOSAL AREAS

- ☐ C-746F Classified Burial Ground
- ☐ C-747A Unclassified Burial Ground
- ☐ C-400 Decontamination Solution Treatment
- ☐ C-616 Clarifier
- ☐ C-410 Neutralization Pit
- ☐ Sanitary Landfill
- ☐ Chemical Burial Facility
- ☐ C-749 Burial Ground
- ☐ C-404 Burial Ground
- ☐ Other

Plant Waste Disposal Co-ordinator: *(Signature)*

Date

Disposal Completed by: *(Signature)*

Date	Department

Distribution after Disposal:
White Copy - Plant Disposal Coordinator
Blue Copy - Security Department (If marked Classified)
Green Copy - Requester
Yellow Copy - To be retained by the Disposer

UCN-12463A
(15 10-78)

MEMORANDUM CH2M HILL

TO: Distribution

FROM: Lynn Sichelstiel

DATE: January 24, 1991

SUBJECT: Addendum to Paducah Gaseous Diffusion Plant (PGDP) Phase II Waste Management Tank Instructions

PROJECT: ORO30888.FF

The PGDP Waste Management Task Instructions are being amended as field conditions have changed.

Decontamination pad sumps will now be sampled by the CH2M HILL Waste Manager. This is a change from the original instructions which stated that Energy Systems would be responsible for sampling the sumps and transferring sample custody for analysis to CH2M HILL. NUS Corporation, the waste subcontract laboratory, has stated that sump solids will be analyzed by decanting the supernate, calculating the percent moisture, and reporting the results on a dry weight basis. Chain-of-custody forms for these samples should stipulate that the analyses should be performed on the solid portion only. Therefore, the term "analyze solid portion only" should be written in the remarks section of each sump solid waste sample on both the field and laboratory chain-of-custody. Sump samples will be taken the same as other solid waste samples. This change does not impact the drillers' responsibility of cleaning out the sumps.

If you have any questions, please call me in Oak Ridge, at extension 542. Thank you.

ATTACHMENT A

WASTE CLASSIFICATION AND MANAGEMENT PLAN

1.0 PURPOSE

This plan provides definitions of waste categories, identifies waste classification parameters and contaminant levels, and describes classification procedures. Waste packaging, transfer and management procedures are outlined.

2.0 SCOPE

This plan applies to all PGDP RI/FS project field activities.

3.0 REFERENCES

DOE Order 5400.xx, (Draft, 3/18/88): Radiation Protection of the Public and the Environment

Resource Conservation and Recovery Act (RCRA), 40 CFR Parts 260 through 270

Toxic Substances Control Act (TSCA), 40 CFR Part 761

DOE Order 5420.2A (9/28/88), Hazardous and Radioactive Mixed Waste Management

DOE Order 5480.3 (Draft, 4/5/88): Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes

"Agreed Order Regarding Paducah Gaseous Diffusion Plant KPDES Permit", 9/87

Test Methods for Evaluating Solid Waste, EPA SW-846, 3rd ed.

29 CFR 1910, Hazardous Waste Operations and Emergency Response

4.0 DEFINITIONS

Hazardous Waste Material: Any solid, liquid, or gaseous material which is chemically reactive, toxic, flammable, corrosive, or is an EPA-listed hazardous waste, or which has been in contact with or is derived from a listed waste. Any material or empty chemical container which cannot be readily identified should be regarded as hazardous until determined otherwise.

Polychlorinated Biphenyl (PCB): Non flammable chlorinated hydrocarbon insulating liquid previously used in varying concentrations in transformers, hydraulic systems, static capacitors, etc. Trade names include Pyranol, Inerteen, Asbestol, Askarel, Chlorextol, No-Flamol, and Saf-T-Kuhl.

PCB Waste: Any material containing PCBs in a concentration equal to or exceeding 50 ppm by weight (50 mg/kg), or which results from the cleanup of a spill or release of material containing 50 ppm or more of PCBs.

Detectable PCB Waste : Any material containing PCBs in a concentration between the lower level of detection and 49 ppm by weight. The lower level of detection is dependant on the matrix of the material and is defined as 0.5 ppb for water, 1.0 ppm for solids, and 2.0 ppm for oil.

Low-Level Waste: Any waste containing no detectable PCBs and which is not designated as a hazardous waste or a transuranic waste containing depleted uranium above 17 pCi/g and any detectable level of neptunium, plutonium, technetium and/or thorium, or detectable quantities of enriched uranium.

Transuranic (TRU) Waste: Any material which, without regard to source or form, contains alpha-emitting radionuclides with an atomic number greater than that of uranium with long half-lives in concentrations greater than 100 nCi/gram.

Mixed Waste: Any material which has been classified as hazardous and/or PCB waste or PCB-contaminated waste which is also classified as low-level and/or TRU waste.

Representative Sample: As defined by the Environmental Protection Agency (EPA) a representative sample is a "sample of a universe or whole (e.g., waste pile, lagoon, drummed liquid or solid) which can be expected to exhibit the average properties of the universe or whole". Specific sampling techniques are outlined by EPA for obtaining representative samples.

Wastes Containing No Free Liquids: Wastes certified as having no liquid present as determined by the Paint Filter Test (EPA Method 9095, EPA SW-846).

Waste Water: Liquid waste consisting primarily of water without any other liquid phases present which results from ground water well installation, development and sampling activities or from the cleaning of well installation equipment.

5.0 GENERAL WASTE CLASSIFICATION AND MANAGEMENT PROCEDURES

5.1 Responsibilities

It is the responsibility of the Environmental Consultant (EC) to properly characterize, segregate, package and transfer waste materials generated during investigation processes as noted in this plan. Martin Marietta Energy Systems, Inc., (Energy Systems) will be responsible for the management and ultimate disposition of waste materials in accordance with all applicable regulations. The EC shall provide all required information as specified in this plan. Energy Systems shall designate the types of packaging to be used and will supply the packaging materials.

All waste materials will be secured at all times. Wastes may be secured by physical means (locked, fenced areas) or by guarding. Wastes placed within the PGDP security area shall be considered secure.

The EC, in conjunction with Energy Systems, shall perform a preliminary assessment, using existing data, on each site at which investigation actions are to be taken. The purpose of the assessment shall be to estimate the quantity and types of wastes which could be generated. The estimate will be used by Energy Systems to determine the types and numbers of waste containers to be supplied.

5.2 Waste Handling and Segregation

It is the policy of the company to contain all soil generated by sampling and well installation activities (including equipment cleaning) and all waste water generated by such activities until the waste is characterized and classified. The EC will be responsible for ensuring that all waste is properly contained, packaged and characterized in accordance with this procedure. In addition, the EC will be responsible for segregating waste materials to the greatest possible extent based on data obtained during field surveys and knowledge of the waste.

5.3 Waste Sampling

Waste materials will be sampled and classified on a batch basis immediately following drilling. Solid waste samples from soil borings should be collected in specified drums. At fixed depth intervals (to be established in the investigation plan), subsamples should be composited in a single drum representative of the full boring and analyzed in accordance with the characterization requirements. Waste materials from different soil borings will not be mixed so as to maintain the relationship between the waste material and the soil.

Water from well installation activities will be sampled and characterized on a container basis. One sample from a container shall be sufficient to characterize and classify the waste.

5.4 Waste Classification

All wastes will be analyzed in accordance with the Solid Waste Classification Requirements and the Waste Water Classification Requirements. These requirements list all parameters for which waste materials are to be analyzed and identify contaminant levels, the respective classification categories, and the type of storage disposal, and/or handling required. In addition to the formal classification requirements, all wastes will be analyzed for the parameters listed in the General Waste Analysis Requirements. These requirements supply the additional chemical and physical data needed for the proper management of the waste but do not affect the classification scheme.

Waste classification analyses will be completed within 45 days following sampling. The waste will be classified upon receipt of the required analytical data. Waste treatment, disposal, or placement in a suitable permanent storage area will occur as soon as possible after classification and within all regulatory guidelines.

5.5 Waste Packaging

All solid wastes shall be placed in open-top, 55-gal steel 17C DOT-approved drums lined with minimum 25-mil plastic liners as supplied by PGDP. Liquid,

non-aqueous wastes shall be placed in closed-top 55-gal steel 17E or 17C DOT-approved drums as supplied by PGDP. Waste water shall be placed in transportable plastic tanks not to exceed 1,200 gal (such as Duralife Economodel). Such containers shall be truck and/or forklift transportable and provided by the EC.

Waste containers will be securely closed when they are filled, cleaned, and labelled. Labels will be legible and will indicate on each container the source, generation date, type of material, approximate range of depth, and Request for Disposal (RFD) form number. Markers, such as UNI PAINT MARKER PX-20, in contrasting color, will be used to mark each container.

5.6 Waste Transfers

Each lot of waste from a given worksite will be accompanied by an RFD form. The completed RFD form will be forwarded to the PGDP Waste Management Department within 3 days following completion of sampling.

Waste containers will be delivered to the designated storage area and unloaded onto pallets (with 4 drums per pallet placed so that the label is visible from the aisle). Pallets will be positioned in rows with at least 2 ft of aisle space. Waste materials will be segregated according to construction site or type. All wastes shall be managed by the PGDP Waste Management Department. Following completion of the RFD by the EC, Waste Management will manage the waste in accordance with applicable regulations and PGDP procedures for ultimate disposition.

5.7 Sample Management

All samples will be returned to the EC for classification. Samples should be accumulated and transferred to Energy Systems in lots for management. All samples in any one container shall be similar in nature (i.e., all solid or all liquid with the same classification). One RFD will be generated for each container or drum of samples. Liquid and solid samples should be collected in DOT 17-C 55-gal steel drums with minimum 25-mil plastic liners, with laboratory containers packed in vermiculite.

6.0 GENERAL ANALYTICAL REQUIREMENTS

All waste analyses will be performed using EPA-approved procedures where possible. Analyses required for hazardous waste classification must reference EPA SW-846. Waste water analyses must reference Clean Water Act and/or Safe Drinking Water Act procedures. The use of other procedures will require prior approval by Energy Systems. Should more than one phase be present in any container each phase will be sampled and analyzed for the appropriate constituents.

Quality assurance requirements of specific analytical procedures shall apply. All sampling activities shall include chain-of-custody procedures. Quality assurance and chain-of-custody documentation shall be supplied with analytical data.

7.0 WASTE CLASSIFICATION CRITERIA

7.1 Waste Water Classification Criteria

7.1.1 Per instruction from PGDP (letter, S. Wagner to J. Moore, October 12, 1989), samples of field decontamination wastewater and well purge and development water will be analyzed only for the following constituents to characterize and classify the waste water:

Silver - total	Chromium - total	Uranium
Arsenic - total	Zinc - total	Trichloroethylene
Barium - total	Nickel - total	PCBs
Cadmium - total	Iron - total	Fluoride
Lead - total	Aluminum - total	Technetium
Mercury - total	Copper - total	
Selenium - total		

7.1.2 Additional Tests

The presence of potentially reactive constituents will require that the wastewater be characterized for reactivity.

7.1.3 Presence of Additional Phases

Should more than one phase be present in any wastewater sample each phase will require characterization. Organic phases will require characterization under the Solid Waste Classification Criteria (Section 7.2).

7.2 Solid Waste Classification Criteria

7.2.1 The following constituents will be used to characterize and classify solid waste constituents:

Neptunium-237
Plutonium-239
Thorium-230
Technetium-99
Uranium and assay (duplicate analyses required)
Polychlorinated biphenyls (PCBs)
Arsenic*
Barium*
Cadmium*
Chromium*
Lead*
Mercury*
Selenium*
Silver*
Trichloroethylene**
1,1,1-trichloroethane**
Cyanides*
Pentachlorophenol**

Xylene**
Acetone**
Toluene**
Methyl ethyl ketone**
Mineral spirits**
Laquer thinner**
Methanol**

**If more than one phase is present, each phase must be sampled and analyzed separately.

7.2.2 Analytical Requirements

7.2.2.1 Extraction Procedure Toxicity Testing

The metals identified with a "*" in section 7.2.1 are designated as toxic metals under 40CFR 261 (RCRA). A total metals analysis on the solid wastes (mg/kg of waste) is acceptable as a screening method. Should the total metals analysis exceed the following values the material must be subjected to the EP Toxicity Test (RCRA):

Arsenic - 75 mg/kg
Barium - 1500 mg/kg
Cadmium - 15 mg/kg
Chromium - 75 mg/kg
Lead - 75 mg/kg
Mercury - 3 mg/kg
Selenium - 15 mg/kg
Silver - 75 mg/kg

7.2.2.2 Toxicity Characteristic Leaching Procedure (TCLP) Testing

If any of the constituents identified in section 7.2.1 with a "**" are present the waste must be subjected to the TCLP test to determine further treatment requirements under 40 CFR Part 268.

7.2.2.3 Additional Tests

Should any of the following organic compounds be present in the solid waste the waste must be characterized for ignitability:

Xylene
Acetone
Toluene
Methyl ethyl ketone
Mineral spirits
Laquer thinner
Methanol

The presence of any other potentially flammable material will also require the ignitability test.

The presence of cyanides or any other potentially reactive material will require the characterization of the waste for reactivity.

8.0 GENERAL WASTE ANALYSIS REQUIREMENTS

8.1 Solid Waste Requirements

A. BTU content
B. Ash content
C. Moisture content
D. Chlorine (total and organic)
E. Sulfur (total and organic)
F. Fluorine (total and organic)
G. Sodium
H. Flash point (if ignitable solvents, etc. are present)
I. Beryllium
J. Toxicity Characteristic Leaching Procedure (TCLP) if any of the following organics are present:

1. Trichlorethylene
2. 1,1,1-trichloroethane
3. Pentachlorophenol (dioxin and furan analysis req.)
4. Sodium pentachlorophenate (dioxin and furan analysis req.)
5. Acetone
6. Xylene
7. Methyl ethyl ketone
8. Toluene
9. Mineral spirits
10. Lacquer thinner
11. Methanol

K. Aluminum
L. Iron
M. Lithium
N. Copper
O. Paint Filter Test
P. Size (Wt% $\leq$ 20 mesh)
Q. Manganese
R. Magnesium
S. Nickel
T. Titanium
U. Zinc

8.2 Liquid Waste Requirements (Including Waste Water)

A. BTU content
B. Ash content
C. Chlorine (total and organic)

D. Sulfur (total and organic)
E. Fluorine (total and organic)
F. Aluminum
G. Manganese
H. Phosphorous
I. Water (if non-aqueous)
J. Number of phases**
K. Magnesium
L. Lithium
M. Sodium
N. Copper
O. Beryllium
P. Viscosity
Q. Specific gravity
R. Titanium

9.0 TRAINING

Personnel responsible for containing, segregating, packaging; transporting and sampling waste materials will be provided specific waste management training. As a minimum the training will include the following:

- Waste containment and segregation
- Packaging requirements
- Classification requirements
- Waste management records, including RFDs

The training must meet the requirements of 40 CFR Parts 264 and 265 and 29 CFR 1910 for routine hazardous waste workers. The EC will be responsible for providing waste management training to EC and subcontractor personnel. Energy Systems will review the training program prior to implementation.

MEMORANDUM CH2M HILL

TO: Craig Morrison/Energy Systems/PGDP
Jack Aeby/Energy Systems/PGDP
Keith Johnson/Energy Systems/PGDP
Donna Connery/CH2M HILL/ORO
Mary Wisdom/CH2M HILL/MGM
Don Taylor//Energy Systems/PGDP

FROM: George Stephens/CH2M HILL/ORO

DATE: January 29, 1990

SUBJECT: Shipment of PGDP Samples to MGM

PROJECT: SED28178.FC

Environmental samples from PGDP will be shipped to MGM for analyses beginning on (or after) Thursday, February 1, 1990. In order for samples from PGDP to be shipped to MGM, the following steps must be completed:

1. Sample containers will be checked for radioactive contamination. Survey results will meet the CH2M HILL/PGDP unrestricted release criteria:

   - Direct Survey — $<2{,}000$ DPM/100 cm^2 $\beta\gamma$; <200 DPM/100 cm^2 α
   - Transferrable Survey — <500 DPM/100 cm^2 $\beta\gamma$; <20 DPM/100 cm^2 α

   A copy of the CH2M HILL equipment and materials release form (signed by the SSC) must accompany each statement.

2. Samples will be screened by the FSL to the following levels of radioactivity:

   - Solids — Gross $\alpha \leq 15$ pCi/g; Gross $\beta \leq 50$ pCi/g
   - Liquids — Gross $\alpha \leq 30$ pCi/l; Gross $\beta \leq 500$ pCi/l

   A copy of the CH2M HILL FSL Radiochemical Analysis Report must accompany each shipment.

C ; 4ILL

EQUIPMENT AND MATERIALS RELEASE FORM

ITEM: SAMPLE CONTAINERS

DATE _____ SITE PGDP SURVEY NUMBER PGDP- SURVEYORS NAME _____	BETA-GAMMA: DIRECT PROBE HP-210 BKG. _____ (CPM) EFF. _____ % MDA: _____ dpm/100cm²	ALPHA: DIRECT PROBE AC-3 BKG. _____ (CPM) EFF. _____ % MDA: _____ dpm/100cm²	ALPHA: TRANSFERABLE DETECTOR SAC-4 BKG. _____ (CPM) EFF. _____ % *	BETA-GAMMA: TRANSFERAB DETECTOR BC-4 BKG. _____ (CPM) EFF. _____ % *

ITEM SURVEYED FOR RELEASE (AREA)	DIRECT: ALPHA		DIRECT: BETA-GAMMA		TRANSFERABLE: ALPHA		TRANSFERABLE: BETA-GAMMA		CERTIFIED AS MEETING CRITERIA (%)			COMMENTS
	CPM	DPM/100 cm²	CPM	DPM/100 cm²	CPM	DPM/100 cm²	CPM	DPM/100 cm²	YES	NO	INITIALS	
												* MDA: dpm
												** MDA: dpm
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												* DENOTES RMAX VA

INSTRUMENT / SERIAL NO.

( ) / HP-210 ( )

( ) / AC-3 ( )

C-4 ( ) / BC-4 (687)

APPROVAL

_____ _____

I HAVE REVIEWED THE ABOVE DATA AND, EXCEPT: WHERE NOTED UNDER COMMENTS, AL MEASUREMENTS CONFORM TO GUIDELINES FO UNRESTRICTED RELEASE.

_____ _____

SSC/SITE M

CH2M HILL FIELD SUPPORT LABORATORY
PGDP SITE INVESTIGATION
PADUCAH, KY
RADIOCHEMICAL ANALYSIS REPORT
(Screening Analysis)

QF1

SAMPLE ORIGINATOR _____

SAMPLE TYPE _____

CH2M HILL SAMPLE No	GROSS ALPHA ACTIVITY pCi/gm/liter	GROSS BETA ACTIVITY pCi/gm/liter

Alpha Soil LLD	Beta Soil LLD	Alpha Water LLD	Beta Water LLD

COMMENTS _____

ENVIRONMENTAL SURVEILLANCE PROCEDURES

The following Environmental Surveillance Procedures were sent to Energy Systems as part of Attachment A:

- ESP-308-1, Composite Procedures
- ESP-308-3, Container Sampling: Drums and Tanks
- ESP-400, Field Quality Control
- ESP-900, Cleaning and Decontaminating Containers and Sampling Devices
- ESP-901, Equipment Decontamination

OROR3/002.51

ATTACHMENT B

REQUEST FOR DISPOSAL OF WASTE MATERIALS AND EQUIPMENT

№ 22827

Material to be disposed *(One material per sheet — Must be identified by Requester)*

Date	Location of Material (Bldg.)	Room or Area
Type of Container *(If cylinder, give cylinder number)*		Condition of Container
Number of Items		Approx. weight or volume

Hazards in Handling and Disposal:

Suggested Method and Location of Disposal:

CHECK APPROPRIATE BLOCKS

☐ Classified ☐ Unclassified

HAZARDOUS

NO	YES	UNKNOWN

☐ Radioactive ☐ Nonradioactive

Nuclides	Curies

TECHNICAL CONTACTS

DEPARTMENT	PERSON CONTACTED	DATE
Safety		
Health Physics		
Env. Control		
Fire Protection		
Industrial Hygiene		
Other		

PROTECTIVE EQUIPMENT REQUIRED

Signed: *(Requisitioner)*	Date	Charge No.	Dépt.	Building	Mail Stop	Phone

INFORMATION BELOW THIS LINE TO BE FILLED IN BY WASTE DISPOSAL COORDINATOR ONLY

ADDITIONAL INSTRUCTIONS FOR DISPOSAL:

DISPOSAL AREAS

- ☐ C-746F Classified Burial Ground
- ☐ C-747A Unclassified Burial Ground
- ☐ C-400 Decontamination Solution Treatment
- ☐ C-616 Clarifier
- ☐ C-410 Neutralization Pit
- ☐ Sanitary Landfill
- ☐ Chemical Burial Facility
- ☐ C-749 Burial Ground
- ☐ C-404 Burial Ground
- ☐ Other

Plant Waste Disposal Co-ordinator: *(Signature)*

Date

Disposal Completed by: *(Signature)*

Date	Department

Distribution after Disposal:
White Copy - Plant Disposal Coordinator
Blue Copy - Security Department (If marked Classified)
Green Copy - Requester
Yellow Copy - To be retained by the Disposer

UCN-12463A
(15 10-78)

APPENDIX 3B
Lithologic Database

Appendix 3B
LITHOLOGIC DATABASE

Appendix 3B includes two tables that provide information, from soil borings, on lithologies identified in the study area.

Table 3B-1 includes the elevations of the top of each of the major stratigraphic units, including the Clayton and McNairy Formations, Porters Creek Clay, Eocene sands, Lower Continental Deposits, and Upper Continental Deposits. The purpose of presenting this database is to identify the gross structure of the units under the region. For some borings, the elevation of the top of the Upper Continental Deposits is not identified because there is some uncertainty about the actual distribution of loess and the Upper Continental Deposits in these borings. For other borings, the elevation of the top of the Lower Continental Deposits is qualified with "UCD?," indicating uncertainty about whether the unit is the Lower Continental Deposits or a gravel or sand lens in the Upper Continental Deposits.

Table 3B-2 includes (for all borings) the lithologies and depth and elevation intervals for loess, the Upper Continental Deposits, and the Eocene sands. The purpose of this database is to identify layers within the Upper Continental Deposits, such as sand or gravel lenses, that may serve as preferred horizons for groundwater flow and to identify the thickness of possible confining units between the sand or gravel lenses in the Upper Continental Deposits and the gravels of the underlying Lower Continental Deposits. The interval with the lowest elevation in each boring is the lowest lithology encountered before the Lower Continental Deposits, the Porters Creek Clay, or the Clayton and McNairy Formations were encountered, depending on the location of the boring. In most cases, the uppermost layers are silt and clay, which may be fill, loess, or fine-grained units in the Upper Continental Deposits.

Unless the boring log specifically identified a silt unit as loess, all fine-grained materials were included under the category "cSurf," representing a possible confining unit at the surface. The designation "sUCD" indicates a layer in the Upper Continental Deposits that may serve as a preferred horizon for groundwater flow, and the designation "cUCD" indicates a layer in the Upper Continental Deposits that may serve as a confining unit. Typically, fine sand, silt, and clay were classified as "cUCD;" and sand, silty sand, gravel, silty gravel, and the like were classified as "sUCD." A lithologic description of fine sand or silty fine to medium sand may be classified as "sUCD" in some cases but classified as "cUCD" in others. This apparent discrepancy may be due to either information on the original boring log not included in Table 3B-2 or the presence of an adjacent coarser-grained layer that would probably conduct groundwater flow more readily than a more finely grained layer. When doubt existed about the detailed description of the lithology, such as the term "sand," the designation "sUCD" was used.

Table 3B-1
Stratigraphic Database
PGDP Phase II Site Investigation
(page 1 of 14)

Well/Boring Designation	Approx. Ground Surface Elev.	Upper Continental Deposits		Lower Continental Deposits		Eocene Sand		Porters Creek		McNairy Formation		Thickness of the LCD	Depth of Boring
		Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.		
CH2M HILL "H" SERIES BORINGS[a]													
H-1	369	21	348	60	309								70
H-2	369	19	350	60	309								73
H-3	367	20	347	65	302								78
H-4	369	16	353	59	310								70
H-5	368	17	351	53	315								64
H-6	368	10	358	52	316								62
H-7	379	21	358	57	322			92	287			35	93
H-8	373	17	356	66	307								76
H-9	372	16	356	57	315								66
H-10	370	18	352	59	311								70
H-11	371	21	350	60	311								72
H-12	371	19	352	60	311								70
H-201	371	19	352	64	307								80
H-202	373	15	358	60	313								60
H-203	371	19	352	66	305								75
H-206	378	20	358	55	323			95	283			41	100
H-207	379	20	359	69	310			97	282			28	110
H-208	371	10	361	60	311					113	258	53	125

Table 3B-1
Stratigraphic Database
PGDP Phase II Site Investigation
(page 2 of 14)

Well/Boring Designation	Approx. Ground Surface Elev.	Upper Continental Deposits		Lower Continental Deposits		Eocene Sand		Porters Creek		McNairy Formation		Thickness of the LCD	Depth of Boring
		Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.		
H-209	375	17	358	70	305								70
H-210	375	10	365	57	318								70
H-211	369	5	364										40
H-212	371	17	354										40
H-213	371	15	356										40
H-214	375	20	355										40
H-215	380	18	362										40
H-216	374	17	367										40
H-217	384	25	359										40
H-218	383	20	363										40
H-219	356	10	346	45	311			70	286			25	95
H-220	372	17	355										40
H-221	370	15	355										40
H-222	374	20	354										40
H-223	375	19	356										40
H-224	374	15	359										40
H-225	372	20	352										40
H-226	375	19	356										40
H-227	377	5	372										40

Table 3B-1
Stratigraphic Database
PGDP Phase II Site Investigation
(page 3 of 14)

Well/Boring Designation	Approx. Ground Surface Elev.	Upper Continental Deposits		Lower Continental Deposits		Eocene Sand		Porters Creek		McNairy Formation		Thickness of the LCD	Depth of Boring
		Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.		
H-266	366	15?	351?	67	299								75
H-267	371	18	353	72	299								90
H-268	367	25?	342?	65	302					89	278	24	90
H-270	361	20	341	55	306								60
H-271	365	25?	340?	61	304?								65
H-272	362	23	339	50	312								60
CH2M HILL WELLS[b]													
MW-97	365			57	308								93
MW-120	384	16	368					52	332				173
MW-120A	384	14	370					31	353				48
MW-121	372	14	358	58	314					88	284	30	210
MW-122	362	17	345	56	306			93	269			37	158
MW-132	360	16	344	55	305					79	281	24	90
MW-133	334	13	321	33	301					52	282	19	100
MW-134	366	14	352	57	309					96	270	39	98
MW-140	341	5	336	29	312					66	275	37	100
MW-144	378	23	355	80	298			117	261			37	127
MW-146	350	18	332	43	307					68	282	25	72
MW-148	371	45	326	63	308					91	280	28	92

Table 3B-1
Stratigraphic Database
PGDP Phase II Site Investigation
(page 4 of 14)

Well/Boring Designation	Approx. Ground Surface Elev.	Upper Continental Deposits		Lower Continental Deposits		Eocene Sand		Porters Creek		McNairy Formation		Thickness of the LCD	Depth of Boring
		Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.		
MW-150	374	48	326	62	312					98	276	36	102
MW-151	380	28	352					53	327				62
MW-152	351	28	323	48	303					73	278	25	91
MW-154	371												
MW-155	379	25	354	96	283								
MW-158	371			60	311			109	262			48	110
MW-159	371	15	356										35
MW-161	371	15	357	60	312								85
MW-163	383	26	357	85	298								100
MW-165	378	26	352	60	318								70
MW-168	375	16	359	65	310								70
MW-169	370	12	358	61	309								70
MW-171	372	19	353										25
MW-172	370	15	356										30
MW-173	371	16	355	51	320								60
MW-175	378	22	356	50	328								80
MW-178	376	23	353	59	317								69

Table 3B-1
Stratigraphic Database
PGDP Phase II Site Investigation
(page 5 of 14)

Well/Boring Designation	Approx. Ground Surface Elev.	Upper Continental Deposits		Lower Continental Deposits		Eocene Sand		Porters Creek		McNairy Formation		Thickness of the LCD	Depth of Boring
		Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.		
MW-179, MW-180, & MW-180A	356	10	346	45	311								59
MW-181	368	10	358	50	318								60
MW-183 & MW-184	369	10	359					11	358				70
MW-185	371	19	352	60	311								75
MW-187	370	21	349										40
MW-188	371	9	362	75	296								75
MW-190	371	8	363										25
MW-192	357	5	352	50	307								61
MW-193	366	19	347	63	303								70
MW-194	353	9	344	43	310								55
MW-195	354	10	344										20
MW-196	387	19	368										30
MW-197	366	15	351	51	315								65
MW-199	353	18	335										
MW-200	377	34	343	71	306								80
MW-203	375	12	363	63	312								80
MW-205	377	15	362	62	315								70

Table 3B-1
Stratigraphic Database
PGDP Phase II Site Investigation
(page 6 of 14)

Well/Boring Designation	Approx. Ground Surface Elev.	Upper Continental Deposits		Lower Continental Deposits		Eocene Sand		Porters Creek		McNairy Formation		Thickness of the LCD	Depth of Boring
		Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.		
MW-206	382	20	362	70	312								80
"S" SERIES BORINGS													
S-1	378	22	356	65	313					106	272	41	155
S-2	370			57	313					91	279	34	150
S-3	374	6	368	65	309					85	289	20	145
S-4	367	15	352	60	307					84	283	24	151
S-5	369	17	352	68	301			94	275			26	151
S-6	378	13	365	74	304			114	264			40	151
S-7	382	17	365	72	310			98	284	122	260	26	152
S-8	382	24	358	72	310			91	291	124	258	8	150
S-9	381	18	363					42	339				165
S-10	381	15	366					21	360	113	268		151
S-11	380	23	357					59	321				151
S-12	420	11	409			17	403	36	384				152
S-13	383	18	365			23	360	48	335				151
WEHRAN BORINGS													
MW-23 (B-1)	368	7	361					11	357				39
MW-24 (B-2)	373	9	364					13	360				40
MW-26 (B-3)	379	15	364					26	353				42

Table 3B-1
Stratigraphic Database
PGDP Phase II Site Investigation
(page 7 of 14)

Well/Boring Designation	Approx. Ground Surface Elev.	Upper Continental Deposits		Lower Continental Deposits		Eocene Sand		Porters Creek		McNairy Formation		Thickness of the LCD	Depth of Boring
		Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.		
MW-27 (B-4)	378	11	367					15	363				48
EDGe BORINGS[b]													
MW-66	370	18	352	54	316								63
MW-67	372	20	352	66	306								76
MW-72	371	20	351	63	308								87
MW-73	372			63	309								79
MW-74	372	18	354										42
MW-75	373	18	355										47
MW-76	373			67	306								79
MW-77	374	22	352	67	307								82
MW-79	373			64	309					86	287	22	91
MW-86	372	17	355	67	305					87	285	20	107
MW-89	372	17	355	64	308					88	284	24	97
MW-92	371	13	358	65	306					88	283	23	91
MW-95	374	17	357	68	306					88	286	20	102
D'APPOLONIA BORINGS[b]													
B-1	371	17	354	64	307								72
B-2	370	18	352	60	310								72
B-3	373	16	357	63	310								71

Table 3B-1
Stratigraphic Database
PGDP Phase II Site Investigation
(page 8 of 14)

Well/Boring Designation	Approx. Ground Surface Elev.	Upper Continental Deposits		Lower Continental Deposits		Eocene Sand		Porters Creek		McNairy Formation		Thickness of the LCD	Depth of Boring
		Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.		
B-4	374	18	356	67	307								76
B-5	374	19	355	65	309								74
B-6	373	21	352	64	309								74
B-7	371	19	352	63	308								74
B-8	371	18	353	63	308								75
B-9	371	22	349	61	310								69
B-10	369	13	356	60	309								70
MW-38 (5P)	382	30	352	62	320								75
MW-39 (3P)	379	35	344	62	317								75
MW-40 (4P)	379	35	344	62	317					97	282	35	105
MW-41 (2P)	376	30	346	62	314								70
MW-42 (N6P)	372	18	354	40	332								55
MW-43 (N7P)	361	20	341	60	301								75
MW-44 (1P)	400	20	380	85	315								100
REGION-WIDE BORINGS[c]													
5					287						278	9	47
28			350		317				294			23	92
30			351		299						277	22	102
110	435					43	392	79	356				133

Table 3B-1
Stratigraphic Database
PGDP Phase II Site Investigation
(page 9 of 14)

Well/Boring Designation	Approx. Ground Surface Elev.	Upper Continental Deposits		Lower Continental Deposits		Eocene Sand		Porters Creek		McNairy Formation		Thickness of the LCD	Depth of Boring
		Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.		
112	405	5	400			10	395	58	347				77
114	415	3	412			27	388	42	373				52
202	425					45	380						62
203	385					60	325						80
204	400	10	390			11	389	57	343				57
206	383	13	370			30	353	70	313				93
208	385							23	362				38
209	374			61	313			65	309			4	67
210	379	12	367					63	316				67
211	370	45	325	55	315					83	287	28	107
212	363			49	314					90	273	41	100
213	368	18	350	59	309					90	278	31	107
319	392	15	377					60	332				65
321	370	21	349					53	317				100
322	373	28	345	63	310			70	303			7	75
325	362	17	345	56	306			90	272			34	100
328	374	28	346	73	301			107	267			34	108
719 (21)	397	10	387					16	381				32
722/723 (22)	379	20	359					43	336	74	305		77

Table 3B-1
Stratigraphic Database
PGDP Phase II Site Investigation
(page 10 of 14)

Well/Boring Designation	Approx. Ground Surface Elev.	Upper Continental Deposits		Lower Continental Deposits		Eocene Sand		Porters Creek		McNairy Formation		Thickness of the LCD	Depth of Boring
		Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.		
806 (24)	351	9	342	35	316					75	276	40	87
807 (26)	372	10	362	58	314					83	289	25	97
809 (23)	361	8	353	50	311					82	279	32	92
810 (25)	358	16	342	53	305					73	285	20	85
811 (34)	362	20	342	51	311					76	286	25	87
812 (35)	363	43	320	63	300					69	294	6	82
814 (37)	365	20	345	57	308					83	282	26	95
815 (38)	351	24	327	52	299					88	263	36	100
816 (39)	321			7	314					35	286	28	50
817 (12)	359	15	344	45	314					75	284	30	87
818 (4)	322			32	290					35	287	3	42
910 (27)	365	21	344	59	306					91	274	32	102
912 (31)	364	21	343	56	308					74	290	18	92
914 (32)	345	15	330	36	309					50	295	14	62
918 (36)	348	11	337	43	305					82	266	39	97
1001									291				
1002									276				
1003							396						

Table 3B-1
Stratigraphic Database
PGDP Phase II Site Investigation
(page 11 of 14)

Well/Boring Designation	Approx. Ground Surface Elev.	Upper Continental Deposits		Lower Continental Deposits		Eocene Sand		Porters Creek		McNairy Formation		Thickness of the LCD	Depth of Boring
		Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.		
TVA BORINGS[c]													
40					294						271	23	
41					292						277	15	
42					287						276	11	
43					279						267	12	
44					285						270	15	
45					279						258	21	
46					286						269	17	
47					284						265	19	
48					291						267	24	
49					295						266	29	
50					296						266	30	
51					293						269	24	
52					300						282	18	
53					294						274	20	
54					295						264	31	
55					290						260	30	
56					283						262	21	
57					300						278	22	

Table 3B-1
Stratigraphic Database
PGDP Phase II Site Investigation
(page 12 of 14)

Well/Boring Designation	Approx. Ground Surface Elev.	Upper Continental Deposits		Lower Continental Deposits		Eocene Sand		Porters Creek		McNairy Formation		Thickness of the LCD	Depth of Boring
		Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.		
58					299						283	16	
59					304						279	25	
60					304						272	32	
61					300						275	25	
62					295						272	23	
63					283						262	21	
64					280						262	18	
65					299						270	29	
66					305						271	34	
ARMY CORPS OF ENGINEERS BORINGS													
9	379	13	366										40
11	368	21	347										40
12	371	9	362										40
17	376	16	360										40
20	381	15	366										40
22	376	14	362										40
23	378	18	360										40
26	375	20	355										40
28	384	23	361										40

Table 3B-1
Stratigraphic Database
PGDP Phase II Site Investigation
(page 13 of 14)

Well/Boring Designation	Approx. Ground Surface Elev.	Upper Continental Deposits		Lower Continental Deposits		Eocene Sand		Porters Creek		McNairy Formation		Thickness of the LCD	Depth of Boring
		Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.		
33	383	21	362										40
34	383	23	360										40
35	380	18	362										40
37	382	24	358										40
38	383	21	362										40
A-6	380	24	356										35
B-1	374	16	358										41
B-3	380	23	357										41
B-5-A	377	28	349										40
B-7	384												40
B-9	381	38	343										40
B-10B	378	31	347										40
FSAR BORINGS													
Z-1	380	15	365					29	351				129
Z-5	380	25	355	79	301			115	265			36	140

Table 3B-1
Stratigraphic Database
PGDP Phase II Site Investigation
(page 14 of 14)

Well/Boring Designation	Approx. Ground Surface Elev.	Upper Continental Deposits		Lower Continental Deposits		Eocene Sand		Porters Creek		McNairy Formation		Thickness of the LCD	Depth of Boring
		Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.		
Z-9	355	20	335	74	281					107	248	33	125
Z-14	372	18	354	64	308					100	272	36	134

[a]Elevations based on status report from Holt, 1990
[b]Elevations based on CH2M HILL internal communication (Gaibler, 1991)
[c]Elevations based on Finch (1967b)

NOTES:

All elevations are in feet above mean sea level of the top of the unit.
All depths are in feet below ground surface of the top of the unit.
E = Estimate elevation
Elev. = Elevation
UCD = Upper Continental Deposit Gravel
LCD = Lower Continental Deposits
PORTERSCRK = Porters Creek Clay
MCNAIRY = Clayton and McNairy formations
UCD? = Indicates uncertainty whether the material is UCD or LCD

Sources: CH2M HILL, 1991; MCI, 1986; EDGe, 1987b, 1988a, 1988b, 1990; Wehran Engineering, 1981a; D'Appolonia, 1982, 1983; Finch, 1967b; Geotek, 1979b, 1980; TVA, 1985, 1987, 1988; USGS 1964-1965, 1957-1965; Lindquist and Bohac, 1989.

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 1 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
CH2M HILL "H" SERIES BORINGS (CH2M HILL, 1990)								
H-1	369	Gravel fill	Fill	0	4	369	365	4
		Clay and silty clay	cSurf	4	21	365	348	17
		Fine sand	sUCD	21	23	348	346	2
		Sandy clay	cUCD	23	26	346	343	3
		Fine to medium sand	sUCD	26	30	343	339	4
		Clayey sand, clay, and sandy clay	cUCD	30	48	339	321	18
		Medium sand	sUCD	48	56	321	313	8
		No sample	--	56	60	313	309	4
H-2	369	Sandy silt, silt, and silty clay	cSurf	0	19	369	350	19
		Sandy silt, silty clay, and sandy clay	cUCD	19	35	350	334	16
		Silty fine to medium sand	sUCD	35	41	334	328	6
		Clay and silty clay	cUCD	41	46	328	323	5
		Fine sand with silt	cUCD	46	54	323	315	8
		Silty clay and sand with silt	cUCD	54	60	315	309	6
H-3	367	Clay and silty clay	cSurf	0	20	367	347	20
		Sandy gravel and gravelly sand	sUCD	20	24	347	343	4
		Clayey sand	cUCD	24	28	343	339	4

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 2 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
H-3 (cont.)	367	Medium to coarse sandy clay	cUCD	28	42	339	325	14
		Clayey fine to medium sand	cUCD	42	54	325	313	12
		Fine to medium sand and clayey sand	sUCD	54	58	313	309	4
		Fine to medium sand	sUCD	58	65	309	302	7
H-4	369	Silt, clay, clayey silt, and silty clay	cSurf	0	16	369	353	16
		Silty fine to medium sand	sUCD	16	24	353	345	8
		Silty clay and sandy clay	cUCD	24	30	345	339	6
		Silty fine to medium sand	sUCD	30	34	339	335	4
		Medium sand and coarse sandy gravel	sUCD	34	40	335	329	6
		No recovery	--	40	42	329	327	2
		Clay and silty clay	cUCD	42	48	327	321	6
		Fine to medium silty sand	sUCD	48	59	321	310	11
H-5	368	Silt	cSurf	0	17	368	351	17
		Silty fine to medium sand and gravel	sUCD	17	23	351	345	6
		Fine to medium sandy gravel	sUCD	23	25	345	343	2
		Silt, clayey silt, sandy silt, and silty sand	cUCD	25	32	343	336	7
		Silty fine to medium sand	sUCD	32	50	336	318	18
		Fine to medium sand	sUCD	50	53	318	315	3

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 3 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
H-6	368	Silt and silty clay	cSurf	0	10	368	358	10
		Silty fine to medium sand	sUCD	10	28	358	340	18
		Clayey fine to coarse sand	cUCD	28	36	340	332	8
		Silty medium sand	sUCD	36	39	332	329	3
		Clayey silt and silty clay	cUCD	39	52	329	316	13
H-7	379	Silt, silty clay, and clayey silt	cSurf	0	21	379	358	21
		Sandy silt, and silty sand and gravel	cUCD	21	29	358	350	8
		Medium to coarse sandy gravel	sUCD	29	33	350	346	4
		Gravelly and clayey coarse sand	sUCD	33	39	346	340	6
		Gravel	sUCD	39	45	340	334	6
		Silty fine to medium sand	cUCD	45	57	334	322	12
H-8	373	Silt and silty clay	cSurf	0	17	373	356	17
		Silty fine to medium sand and sandy	cUCD	17	23	356	350	6
		Silty and gravelly fine to coarse sand	sUCD	23	27	350	346	4
		Silty medium sand	sUCD	27	39	346	334	12
		Silt and clayey silt	cUCD	39	53	334	320	14
		Silty fine to medium sand and sandy	cUCD	53	61	320	312	8

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 4 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
H-8 (cont.)	373	Silt and clayey silt	cUCD	61	66	312	307	5
H-9	372	Clay and silty clay	cSurf	0	16	372	356	16
		Silty and clayey fine to medium sand	cUCD	16	19	356	353	3
		Coarse sand	sUCD	19	22	353	350	3
		No recovery	--	22	24	350	348	2
		Clay	cUCD	24	30	348	342	6
		Sandy clay with gravel	cUCD	30	40	342	332	10
		Fine sandy clay	cUCD	40	50	332	322	10
		Medium to coarse sand	sUCD	50	57	322	315	7
H-10	370	Clay and silty clay	cSurf	0	18	370	352	18
		Silty fine to coarse sandy gravel	sUCD	18	24	352	346	6
		No recovery	--	24	25	346	345	1
		Clay	cUCD	25	29	345	341	4
		Clayey fine to medium sand	cUCD	29	38	341	332	9
		Clay	cUCD	38	50	332	320	12
		No recovery	--	50	52	320	318	2
		Silt and coarse sandy silt	cUCD	52	56	318	314	4
		Silty fine to medium sand	sUCD	56	59	314	311	3

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 5 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
H-11	371	Silt and silty clay	cSurf	0	21	371	350	21
		Silty fine to medium sand	sUCD	21	50	350	321	29
		Silt and silty clay	cUCD	50	60	321	311	10
H-12	371	Silt and clayey silt	cSurf	0	19	371	352	19
		Silty fine to medium sand	cUCD	19	20	352	351	1
		Fine to medium sand	sUCD	20	22	351	349	2
		Sandy gravel	sUCD	22	23	349	348	1
		Silty sand and sandy silt	cUCD	23	25	348	346	2
		Silt and clayey silt	cUCD	25	28	346	343	3
		Sandy silt	cUCD	28	30	343	341	2
		Medium sand	sUCD	30	32	341	339	2
		Very fine sand	cUCD	32	36	339	335	4
		Silty coarse sand	sUCD	36	42	335	329	6
		Medium to coarse sand	sUCD	42	47	329	324	5
		Silty clay	cUCD	47	48	324	323	1
		Silty medium to coarse sand	sUCD	48	60	323	311	12
H-201	371	Clay and sandy clay	cSurf	0	19	371	353	18
		Gravel and sandy clay	sUCD	19	19	353	352	1

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 6 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
H-201 (cont.)	371	Sandy clay	cUCD	19	22	352	350	2
		Gravel	sUCD	22	25	350	346	4
		Sandy clay	cUCD	25	26	346	345	1
		Gravel and sandy clay	sUCD	26	27	345	345	0
		Sandy clay	cUCD	27	34	345	337	8
		Sand	sUCD	34	40	337	331	6
		Sandy clay	cUCD	40	50	331	321	10
		Well graded sand	sUCD	50	60	321	311	10
		Clay	cUCD	63	65	309	307	2
H-202	373	Clay	cSurf	0	15	373	358	15
		Sandy clay	cUCD	15	20	358	353	5
		Well graded gravel and clay	sUCD	21	25	352	348	4
		Clay and sandy clay	cUCD	25	35	348	338	10
		Fine to medium sand	sUCD	35	40	338	333	5
		Sandy clay	cUCD	40	50	333	323	10
		Fine to medium sand	sUCD	50	60	323	313	10
H-203	371	Medium gravel and clay	Fill	0	4	371	367	4
		Silt and clay	cSurf	4	19	367	352	15

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 7 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
H-203 (cont.)	371	Medium gravel and sandy clay	sUCD	19	22	352	349	3
		Clay	cUCD	22	27	349	344	5
		Gravel and fine sand	sUCD	27	29	344	342	2
		Clay	cUCD	29	33	342	338	4
		Sand and silt	sUCD	33	36	338	335	3
		Silt and clay	cUCD	36	54	335	317	18
		Sand and silt and clay	sUCD	54	66	317	305	12
H-206	378	Gravel and sandy silt	Fill	0	1	378	377	1
		Clay	cSurf	1	20	377	358	19
		Sandy clay	cUCD	20	29	358	349	9
		Gravel and sand	sUCD	29	30	349	348	1
		Sandy clay	cUCD	30	50	348	328	20
		Sand	sUCD	50	55	328	323	5
H-207	379	Gravel and sandy silt	F	0	6	379	373	6
		Clay	cSurf	6	20	373	359	14
		Gravel and sandy clay	sUCD	20	25	359	354	5
		Clay and sandy clay	cUCD	25	37	354	342	12
		Gravel and sand	sUCD	37	41	342	338	4

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 8 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
H-207 (cont.)	379	Clay and sandy clay	cUCD	41	69	338	310	28
H-208	371	Clay	cSurf	0	10	371	361	10
		Sandy clay	cUCD	10	15	361	356	5
		Gravel	sUCD	15	22	356	350	6
		Clay and sandy clay	cUCD	22	60	350	311	39
H-209	375	Clay	cSurf	0	17	375	358	17
		Sandy clay	cUCD	17	22	358	353	358
		Fine sand	sUCD	22	25	353	350	353
		Clay	cUCD	25	35	350	340	350
		Sand and clay	sUCD	35	45	340	330	340
		Clay	cUCD	45	53	330	322	330
		Sand	sUCD	53	55	322	320	322
		Clay	cUCD	55	57	320	318	320
		Sand	sUCD	57	60	318	315	318
		Sand and clay	cUCD	60	70	315	305	315
H-210	375	Clay	cSurf	0	10	375	365	375
		Sandy clay	cUCD	10	20	365	355	365
		Gravel and sandy clay	sUCD	20	27	355	348	355

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 9 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
H-210 (cont.)	375	Clay and sandy clay	cUCD	27	35	348	340	348
		Fine sand	sUCD	35	41	340	334	340
		Clay and sandy clay	cUCD	41	57	334	318	334
H-211	369	Gravel and sand	Fill	0	2	369	367	2
		Clay	cSurf	2	5	367	364	3
		Sandy clay	cUCD	5	15	364	354	10
		Gravel and clay	sUCD	15	16	354	353	1
		Clay	cUCD	16	18	353	351	2
		Gravel and clay	sUCD	18	20	351	349	2
		Sand and gravel	sUCD	20	30	349	339	10
		Sandy clay	cUCD	30	35	339	334	5
H-212	371	Gravel and clay	Fill	0	4	371	367	4
		Clay	cSurf	4	17	367	354	13
		Sandy clay	cUCD	17	20	354	351	3
		Gravel and sandy clay	sUCD	20	29	351	343	8
		Clay and sandy clay	cUCD	29	40	343	331	12
H-213	371	Clay	cSurf	0	15	371	356	15
		Silt and sandy silt	cUCD	15	20	356	351	5

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 10 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
H-213 (cont.)	371	Clay and sandy clay	cUCD	21	40	350	331	19
H-214	375	Clay	cSurf	0	20	375	355	20
		Gravel, sand, and clay	sUCD	20	30	355	345	10
		Sandy clay	cUCD	30	40	345	335	10
H-215	380	Clay	cSurf	0	18	380	363	17
		Sandy clay	cUCD	18	20	363	360	3
		Gravel and sandy clay	sUCD	20	22	360	358	2
		Clay	cUCD	22	29	358	351	7
		Gravel and sandy clay	sUCD	29	32	351	349	2
		Sandy clay	cUCD	32	40	349	340	9
H-216	374	Clay	cSurf	0	17	374	357	17
		Gravel and sandy clay	sUCD	17	25	357	349	8
		Sandy clay	cUCD	25	35	349	339	10
		Coarse sand	sUCD	35	37	339	337	2
		Sandy clay	cUCD	37	40	337	334	3
H-217	384	Fill	Fill	0	4	384	380	4
		Clay	cSurf	4	25	380	359	21
		Sandy clay	sUCD	25	40	359	344	15

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 11 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
H-218	383	Fill	Fill	0	5	383	378	5
		Silt and clay	cSurf	5	20	378	363	15
		Sandy clay		20	25	363	358	5
		Gravel and sandy clay	sUCD	25	32	358	352	6
		Clay	cUCD	32	40	352	343	9
H-219	356	Clay	cSurf	0	10	356	346	10
		Clay and sandy clay	cUCD	10	40	346	316	30
		Gravel and clay	sUCD	40	45	316	311	5
H-220	372	Fill	Fill	0	1	372	371	1
		Clay	cSurf	1	17	371	355	16
		Sandy clay	cUCD	17	20	355	352	3
		Gravel and sandy clay	sUCD	20	25	352	347	5
		Sandy clay	cUCD	25	40	347	332	15
H-221	370	Clay	cSurf	0	15	370	355	15
		Sandy clay	cUCD	15	32	355	338	17
		Medium sand	sUCD	32	37	338	333	5
		Clay	cUCD	37	40	333	330	3
H-222	374	Clay	cSurf	0	20	374	354	20

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 12 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
H-222 (cont.)	374	Gravel and sand and clay	sUCD	20	25	354	349	5
		Clay	cUCD	25	27	349	347	2
		Gravel and sand	sUCD	27	29	347	345	2
		Clay	cUCD	30	35	344	339	5
		Gravel and sandy clay	sUCD	35	40	339	334	5
H-223	375	Clay	cSurf	0	19	375	356	19
		Gravel and clay	sUCD	19	22	356	353	3
		Gravel and sand	sUCD	22	25	353	350	3
		Gravel and sandy clay	sUCD	25	30	350	345	5
		Sand	sUCD	30	35	345	340	5
		Gravel and sand	sUCD	35	40	340	335	5
H-224	374	Clay	cSurf	0	15	374	359	15
		Sandy clay	cUCD	15	20	359	354	5
		Gravel and sandy clay	sUCD	20	25	354	349	5
		Sandy clay	cUCD	25	35	349	339	10
		Gravel and sand	sUCD	35	38	339	336	3
		Clay	cUCD	38	40	336	334	2
H-225	372	Clay	cSurf	0	20	372	352	20

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 13 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
H-225 (cont.)	372	Medium gravel and fine sand	sUCD	20	25	352	347	5
		Sandy clay	cUCD	25	40	347	332	15
H-226	375	Clay	cSurf	0	19	375	356	19
		Gravel and sandy clay	sUCD	19	30	356	345	11
		Clay	cUCD	30	32	345	343	2
		Gravel and sandy clay	sUCD	32	39	343	337	6
		Sand	sUCD	39	40	337	335	2
H-227	377	Clay	cSurf	0	5	377	372	5
		Sand	sUCD	5	10	372	367	5
		Clay and sandy clay	cUCD	10	25	367	352	15
		Gravel and medium sand	sUCD	25	30	352	347	5
		Sandy clay	cUCD	30	35	347	342	5
		Medium and coarse sand	cUCD	35	40	342	337	5

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 14 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
H-270	361	Clay	cSurf	0	20	361	341	20
		Sandy clay	cUCD	20	55	341	306	35

[a]Notes:
cSurf = Fine-grained materials near surface, including fill, loess, and/or UCD
F = Fill
L = Loess
sUCD = Sand or gravel Upper Continental Deposits
cUDC = Fine-grained Upper Continental Deposits
UCD? = May be Lower Continental Deposits
All = Alluvium
Eoc = Eocene sands

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 15 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft)	Bottom (ft MSL)	
CH2M HILL WELLS (CH2M HILL, 1990a, 1990b, 1990c)								
MW-120	384	Silty clay	cSurf	0	16	384	368	16
		Silty fine sand	cUCD	16	18	368	366	2
		Fine sand	cUCD	18	30	366	354	12
		Fine to medium sandy silt	cUCD	30	33	354	351	3
		Fine sand	cUCD	33	36	351	348	3
		Medium to coarse sand with gravel	sUCD	36	39	348	345	3
		Clayey sand with gravel	cUCD	39	41	345	343	2
		Medium sand with gravel	sUCD	41	44	343	340	3
		Gravel and medium to coarse sand	sUCD?	44	52	340	332	8
MW-120A	384	Clay and silty clay	cSurf	0	14	384	370	14
		Fine sand	cUCD	14	18	370	366	4
		Medium sand with gravel	sUCD	18	20	366	364	2
		Clayey fine sand	cUCD	20	26	364	358	6
		Fine to medium sand	sUCD	26	27	358	357	1
		Fine to medium sand with gravel	sUCD	27	31	357	353	4
MW-121	372	Sandy clay	cSurf	0	14	372	358	14
		Silty clay	cUCD	14	52	358	320	38

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 16 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft)	Bottom (ft MSL)	
MW-121 (cont.)	372	Fine to coarse sand with silt	sUCD	52	56	320	316	4
		Sandy clay	cUCD	56	57	316	315	1
		Medium to coarse sand	sUCD	57	58	315	314	1
MW-122	362	Silty clay	cSurf	0	17	362	345	17
		Sandy clay	cUCD	17	22	345	340	5
		Silty clay	cUCD	22	28	340	334	6
		Fine sandy clay	cUCD	28	30	334	332	2
		Silty clay	cUCD	30	36	332	326	6
		Fine sandy clay	cUCD	36	40	326	322	4
		Silty clay	cUCD	40	52	322	310	12
		Fine sandy clay	cUCD	52	54	310	308	2
		Silty sand	sUCD	54	56	308	306	2
MW-132	360	Silt, clay, and silty clay	cSurf	0	16	360	344	16
		Silt with fine to medium sand	cUCD	16	26	344	334	10
		Silt and silty clay	cUCD	26	36	334	324	10
		Fine to medium sandy silt	cUCD	36	40	324	320	4
		Silty fine sand	cUCD	40	44	320	316	4
		Fine sandy silt	cUCD	44	48	316	312	4

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 17 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft)	Bottom (ft MSL)	
MW-132 (cont.)	360	Fine to medium sandy clay	cUCD	48	51	312	309	3
		Fine to medium sand	sUCD	51	53	309	307	2
		Clayey sand	cUCD	53	55	307	305	2
MW-133	334	Silty fine sand and fine sandy silt	cSurf	0	13	334	321	13
		Silt	cUCD	13	21	321	313	8
		Silt with fine sand	cUCD	21	23	313	311	2
	334	Silt	cUCD	23	29	311	305	6
		Silt with fine sand	cUCD	29	33	305	301	4
MW-134/97	366	Clayey silt	cSurf	0	14	366	352	14
		Silty very fine sand	cUCD	14	20	352	346	6
		Clayey fine sand	cUCD	20	22	346	344	2
		Clayey gravel	cUCD	22	24	344	342	2
		Clay	cUCD	24	32	342	334	8
		Clayey very fine sand	cUCD	32	36	334	330	4
		Clay	cUCD	36	46	330	320	10
		Clayey and silty very fine to fine sand	cUCD	36	52	330	314	16
		Fine to medium sand	sUCD	52	57	314	309	5

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 18 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft)	Bottom (ft MSL)	
MW-140	341	Silt	cSurf	0	5	341	336	5
		Fine to medium sand	sUCD	5	8	336	333	3
		No recovery	--	8	10	333	331	2
		Gravel with sand and silt	sUCD	10	15	331	326	5
		Clay and silty clay	cUCD	15	25	326	316	10
		Silty sand	cUCD	25	29	316	312	4
MW-144	378	Silt	cSurf	0	23	378	355	23
		Silty fine to medium sand	cUCD	23	28	355	350	5
		Clay and silt	cUCD	28	43	350	335	15
		Sandy clay	cUCD	43	48	335	330	5
		Clayey fine to medium sand	cUCD	48	80	330	298	32
MW-146	350	Clay	cSurf	0	18	350	332	18
		Clayey sand	cUCD	18	28	332	322	10
		Clay	cUCD	28	40	322	310	12
		Sand	sUCD	40	43	310	307	3
MW-148	371	Clay with sand	cSurf	0	45	371	326	45
		Sand	sUCD	45	63	326	308	18
MW-150	374	Silt and silty clay	cSurf	0	48	374	326	48
		Silt with gravel	sUCD	48	51	326	323	3

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 19 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft)	Bottom (ft MSL)	
MW-150 (cont.)	374	Silty sand	cUCD	51	52	323	322	1
		Clay	cUCD	52	56	322	318	4
		Medium to coarse sand	sUCD	56	62	318	312	6
MW-151	380	Lean clay	cSurf	0	28	380	352	28
		Silty fine sand	cUCD	28	33	352	347	5
		Fine sandy gravel	sUCD	33	38	347	342	5
		Silty coarse sand	sUCD	38	41	342	339	3
		Fine to medium sandy gravel	sUCD?	41	53	339	327	12
MW-152	351	Sandy clay and clayey sand	cSurf	0	28	351	323	28
		Silty sand	sUCD	28	31	323	320	3
		Sandy clay and silt	cUCD	31	38	320	313	7
		Silty sand	sUCD	38	41	313	310	3
		Sand	sUCD	41	48	310	303	7
MW-155	379	Fill	sSurf	0	4	379	375	4
		Silty Clay	cSurf	4	25	375	353	21
		Gravel and coarse sand	sUCD	25	37	353	341	12
		Clay	cUCD	37	39	341	339	2
		Clay and gravel	cUCD	39	41	339	337	2

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 20 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft)	Bottom (ft MSL)	
MW-155 (cont.)	379	Clay	cUCD	41	54	337	324	13
		Gravel	sUCD	54	93	324	285	39
		Sandy Clay	cUCD	93	95	285	283	2
MW-158	371	No sample	unknown	0	20	371	351	20
		Gravel and coarse sand	sUCD	20	25	351	346	5
		No sample	unknown	25	35	346	336	10
		Sandy clay	cUCD	35	50	336	321	15
		Fine sand	sUCD	50	60	321	311	10
MW-159	371	Clay	cSurf	0	15	371	356	15
		Sandy clay	cUCD	15	20	356	351	5
		Gravel and sandy clay	sUCD	20	25	351	346	5
		Sandy clay	cUCD	25	35	346	336	10
MW-161	371	Gravel and sandy clay	sSurf	0	5	371	366	5
		Clay	cSurf	5	15	366	356	10
		Gravel and sand and clay	sUCD	15	20	357	351	6
		No sample	unknown	20	25	351	346	5
		Clay and sandy clay	cUCD	25	50	346	321	25
		Gravel and sandy clay	sUCD	50	51	321	320	1

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 21 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft)	Bottom (ft MSL)	
MW-161 (cont.)	371	Sand	sUCD	51	55	320	316	4
		Sandy clay	cUCD	55	60	316	312	5
MW-163	383	Silt and clay	cSurf	0	15	383	368	15
		No sample		15	20	368	363	5
		Clay	cUCD	20	26	363	358	6
		Medium sand	sUCD	26	26	358	357	1
		Clay	cUCD	26	34	357	350	7
		Gravel and clay	sUCD	34	35	350	348	2
		Gravel and sand	sUCD	35	38	348	346	3
		Clay	cUCD	38	40	346	343	3
		Sand	sUCD	40	50	343	334	10
		Clay and sandy clay	cUCD	50	60	334	323	11
		Sand	sUCD	60	70	323	313	10
		Sandy clay	cUCD	70	80	313	304	10
		Sand	sUCD	80	85	304	298	6
MW-165	378	Clay	cSurf	0	26	378	352	26
		Clay and sandy clay	cUCD	26	55	352	323	29
		No sample	unknown	55	60	323	318	5

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 22 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft)	Bottom (ft MSL)	
MW-168	375	Clay	cSurf	0	16	375	359	16
		Gravel and sand	sUCD	16	26	359	350	10
		Clay and sandy clay	cUCD	26	35	350	340	10
		Gravel and sandy clay	sUCD	35	36	340	339	1
		Clay and sandy clay	cUCD	36	60	339	315	24
		Sand	sUCD	60	65	315	310	5
MW-169	370	Clay	cSurf	0	12	370	358	12
		Sandy clay	cUCD	12	16	358	354	4
		Gravel and sandy clay	sUCD	16	20	354	350	4
		Medium gravel	sUCD	20	21	350	349	1
		Sandy clay	cUCD	21	25	349	345	4
		Well graded sand	sUCD	25	27	345	343	2
		Sandy clay	cUCD	27	30	343	340	3
		Well graded sand	sUCD	30	33	340	337	3
		Clay	cUCD	33	50	337	320	17
		Well graded sand	sUCD	50	53	320	317	3
		Sandy clay	cUCD	53	57	317	313	4
		Well graded sand	sUCD	57	61	313	309	4

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 23 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft)	Bottom (ft MSL)	
MW-171	372	Clay	cSurf	0	19	372	354	19
		Sandy clay	cUCD	19	20	354	352	2
		Well graded gravel and sand	sUCD	20	25	352	347	5
MW-172	370	Clay	cSurf	0	15	370	355	15
		Sandy clay	cUCD	15	20	355	350	5
		Gravel and coarse sand	sUCD	20	25	350	345	5
		Clay and sandy clay	cUCD	25	30	345	341	5
MW-173	371	Clay and silt	cSurf	0	16	371	355	16
		Well graded sand	sUCD	16	17	355	354	1
		Clay and sandy clay	cUCD	17	21	354	350	4
		Well graded sand and gravel	sUCD	21	28	350	343	7
		Clay and sandy clay	cUCD	28	51	343	320	23
MW-175	378	Gravel and sandy clay	cSurf	0	6	378	372	6
		Clay	cSurf	6	22	372	356	16
		Medium gravel and well graded sand	sUCD	22	24	356	354	2
		Medium gravel and sandy clay	sUCD	24	39	354	339	15
		Sandy silt	cUCD	39	42	339	336	3
		Gravel and sand and clay	sUCD	42	47	336	331	5

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 24 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft)	Bottom (ft MSL)	
MW-175 (cont.)	378	Clay	cUCD	47	50	331	328	3
		Fine gravel	sUCD	50	52	328	326	2
MW-178	376	No sample	unknown	0	9	376	367	9
		Clay and sandy clay	cSurf	9	23	367	353	14
		Sand	sUCD	23	30	353	346	7
		Clay and sandy clay	cUCD	30	49	346	327	19
		No sample	unknown	49	50	327	326	1
		Well graded sand	sUCD	50	59	326	317	9
MW-179	356	No sample	unknown	0	40	356	356	0
		Gravel and sandy clay	sUCD	40	45	316	316	0
		Medium and coarse sand	sUCD	45	50	311	311	0
MW-180	356	Clay	cSurf	0	6	356	350	6
		Gravel and sandy clay	sUCD	6	14	350	342	8
		Medium sand	sUCD	14	15	342	341	1
		Clay and sandy clay	cUCD	15	30	341	326	15
MW-181	368	Gravel and clay	sSurf	0	10	368	358	10
		Sandy clay	cUCD	10	23	358	345	13
		Gravel and sand	sUCD	23	25	345	343	2

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 25 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft)	Bottom (ft MSL)	
MW-181 (cont.)	368	Clay and sandy clay	cUCD	25	40	343	328	15
		Fine medium sand	sUCD	40	50	328	318	10
		No sample	unknown	50	55	318	313	5
MW-183	369	Gravel, sand, clay, and Organics	sSurf	0	10	369	359	10
		Clay	cUCD	11	70	359	299	60
MW-185	371	Silt and clay	cSurf	0	19	371	352	19
		Well graded sand	sUCD	19	23	352	348	4
		Gravel and clay	sUCD	23	26	348	345	3
		Sandy clay	cUCD	26	42	345	329	16
		Well graded sand	sUCD	42	45	329	326	3
		Clay and sandy clay	cUCD	45	52	326	319	7
		Well graded sand	sUCD	52	53	319	318	1
		Sandy clay	cUCD	53	57	318	313	5
		Sand	sUCD	57	60	313	310	3
MW-187	370	Gravel and sandy clay	sSurf	0	5	370	365	5
		Clay	cSurf	5	21	365	349	16
		Gravel and sand	sUCD	21	24	349	346	3
		Sand	sUCD	24	26	346	344	2

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 26 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft)	Bottom (ft MSL)	
MW-187 (cont.)	370	Clay and silt	cUCD	26	34	344	336	8
		Sand	sUCD	34	35	336	335	1
		Clay	cUCD	35	38	335	332	3
		Sand	sUCD	38	39	332	332	1
		Clay	cUCD	39	40	332	330	2
MW-188	371	Clay	cSurf	0	9	371	362	9
		Sandy clay	cUCD	9	41	362	330	32
		Sand and clay	sUCD	41	43	330	328	2
		Sandy clay and sandy silt	sUCD	43	65	328	306	22
		Gravel and silt	sUCD	65	75	306	296	10
MW-190	371	Clay	cSurf	0	8	371	363	8
		Gravel and sandy clay	sUCD	8	25	363	346	17
MW-192	357	Clay	cSurf	0	5	357	352	5
		Sandy clay	cUCD	5	30	352	327	25
		Gravel and sandy clay	sUCD	30	35	327	323	5
		Sand	sUCD	35	43	323	314	9
		Gravel and sand	sUCD	43	44	314	314	1
		Clay and sandy clay	cUCD	44	50	314	307	7

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 27 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft)	Bottom (ft MSL)	
MW-193	366	Lean clay	cSurf	0	19	366	347	19
		Clay and sandy clay	cUCD	19	50	347	316	31
		Sand with clay	sUCD	50	63	316	303	13
MW-194	353	Clay and sandy silt	cSurf	0	9	353	345	9
		Sand	sUCD	9	13	345	340	4
		Well graded gravel and sand	sUCD	13	15	340	338	2
		Clay and sandy clay	cUCD	15	36	338	318	21
		Fine sand	sUCD	36	42	318	311	7
		Sandy clay	cUCD	42	43	311	310	1
MW-195	354	Clay and sandy silt	cSurf	0	10	354	344	10
		Well graded gravel and sand	sUCD	10	12	344	342	2
		Clay	cUCD	12	20	342	334	8
MW-196	387	Clay	cSurf	0	19	387	369	19
		Well graded gravel&well graded sand	sUCD	19	25	369	362	369
		Clay	cUCD	25	30	362	357	362
MW-197	366	Clay	cSurf	0	15	366	351	15
		Clay and sandy clay	cUCD	15	37	351	329	22

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 28 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft)	Bottom (ft MSL)	
MW-197 (cont.)	366	Coarse gravel and clay	sUCD	37	40	329	326	3
		Clay	cUCD	40	52	326	315	12
MW-200	377	Clay	cSurf	0	34	377	343	34
		Clay and sandy clay	cUCD	34	69	343	308	35
		Well graded gravel and sand	sUCD	69	71	308	306	2
		Gravel and clay	sUCD	71	72	306	305	1
MW-203	375	Clay	cSurf	0	12	375	363	12
		Clay and sandy clay	cUCD	12	21	363	355	9
		Gravel and well graded sand	sUCD	21	22	355	353	2
		Sandy clay	cUCD	22	25	353	350	3
		Gravel and sand and clay	sUCD	25	38	350	337	13
		Clay and sandy clay	cUCD	38	49	337	326	11
		Gravel and sand	sUCD	49	56	326	319	7
		Sandy clay	cUCD	56	64	319	312	8
MW-206	382	Clay	cSurf	0	20	382	362	20
		Clay	cUCD	20	38	362	344	18
		Sand	sUCD	38	44	344	338	6
		Clay	cUCD	44	47	338	335	3

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 29 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft)	Bottom (ft MSL)	
MW-206 (cont.)	382	Sand with clay	sUCD	47	60	335	322	13
		Clay	cUCD	60	62	322	320	2
		Sand	sUCD	62	70	320	312	8

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Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 30 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
"S" SERIES BORINGS (ERC, 1989)								
S-1	378	Silty clay	L/cUCD	0	22	378	356	22
		Silty fine to medium sand with	sUCD	22	31	356	347	9
		Silty fine to coarse and with gravel	sUCD	31	37	347	341	6
		Sandy and silty clay	cUCD	37	47	341	331	10
		Silty clay	cUCD	47	62	331	316	15
		Clay	cUCD	62	65	316	313	3
S-2	370	Silty clay	F/cUCD	0	21	370	349	21
		Silty fine to very fine sand	cUCD	21	27	349	343	6
		Medium to coarse sand	sUCD	27	33	343	337	6
		Silty clay	cUCD	33	48	337	322	15
		Silty fine sand	cUCD	48	57	322	313	9
S-3	374	Silt and clayey silt	F/L	0	6	374	368	6
		Clay and silty clay	cUCD	6	21	368	353	15
		Clayey and silty gravel	sUCD	21	26	353	348	5
		Silty clay	cUCD	26	27	348	347	1
		Silty medium sand	sUCD	27	28	347	346	1

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 31 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
S-3 (cont.)	374	Silty clay	cUCD	28	30	346	344	2
		Silty fine to very fine sand	cUCD	30	32	344	342	2
		Sandy clay	cUCD	32	34	342	340	2
		Sandy silt	cUCD	34	35	340	339	1
		Sandy gravel and clay	sUCD	35	39	339	335	4
		Silt and clayey silt	cUCD	39	55	335	319	16
		Silty fine to medium sand	sUCD	55	56	319	318	1
		Sandy silt	cUCD	56	61	318	313	5
		Fine to medium sand	sUCD	61	62	313	312	1
		Clay and silt	cUCD	62	64	312	310	2
		Fine to medium sand	sUCD	64	65	310	309	1
S-4	367	Clayey silt	L	0	15	367	352	15
		Silty fine sand	cUCD	15	27	352	340	12
		Silty clay	cUCD	27	60	340	307	33
S-5	369	Silty clay	L/cUCD	0	37	369	332	37
		Medium to coarse and	sUCD	37	43	332	326	6
		Silty fine to very fine sand	cUCD	43	53	326	316	10
		Very fine to fine sandy clay	cUCD	53	58	316	311	5

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 32 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
S-5 (cont.)	369	Fine to very fine sand	sUCD	58	68	311	301	10
S-6	378	Clay and silty clay	L/cUCD	0	38	378	340	38
		Silty very fine sand	cUCD	38	43	340	335	5
		Coarse sand	sUCD	43	48	335	330	5
		Clay	cUCD	48	64	330	314	16
		Silty very fine sand	cUCD	64	74	314	304	10
S-7	382	Clay and silty clay	L/cUCD	0	33	382	349	33
		Clayey and silty fine sand	cUCD	33	43	349	339	10
		Silty coarse to medium sand with	sUCD	43	49	339	333	6
		Silty fine to medium sand	sUCD	49	72	333	310	23
S-8	382	Clay and silt	F/L/cUCD	0	24	382	358	24
		Fine to medium sand with gravel	sUCD	24	30	358	352	6
		Silty and sandy clay	cUCD	30	33	352	349	3
		Silty and clayey gravel	sUCD	33	38	349	344	5
		Sandy and silty clay	cUCD	38	43	344	339	5
		Clayey and silty sand	cUCD	43	48	339	334	5
		Medium to coarse sand	sUCD	48	52	334	330	4

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 33 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
S-8 (cont.)	382	Clay and silty clay	cUCD	52	67	330	315	15
		Clayey and silty sand	cUCD	67	73	315	309	6
		Fine to medium sand	sUCD	73	83	309	299	10
S-9	381	Silty clay and clayey silt	L/cUCD	0	33	381	348	33
		Silty fine to coarse sandy gravel	sUCD?	33	38	348	343	5
		Fine to coarse sand	sUCD?	38	42	343	339	4
S-10	381	Clayey silt	L	0	15	381	366	15
		Clayey fine to coarse sand with	sUCD?	15	21	366	360	6
S-11	380	Silt and silty clay	L/cUCD	0	23	380	357	23
		Fine to medium sand	sUCD	23	33	357	347	10
		Medium to coarse sand with gravel	sUCD	33	36	347	344	3
		Medium to coarse sandy gravel	sUCD?	36	59	344	321	23
S-12	420	Silt, clay, and silty clay	L	0	13	420	407	13
		Sandy, silty, clayey gravel	sUCD?	13	17	407	403	4
		Very fine sand	Eoc	17	36	403	384	19
S-13	383	Silt and fine to medium sandy silt	L	0	18	383	365	18
		Medium to coarse sandy gravel	sUCD?	18	23	365	360	5

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 34 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
S-13 (cont.)	383	Fine to medium sand with gravel	Eoc	23	48	360	335	25
WEHRAN BORINGS (RUST, 1980)								
MW-23	368	Silt and clayey silt	F/All	0	7	368	361	7
		Gravelly medium to coarse sand	sUCD?	7	11	361	357	4
MW-24	373	Silty clay and clayey silt	F	0	9	373	364	9
		Silty clay and gravel	cUCD	9	11	364	362	2
		Silty clay and clay	cUCD	11	12	362	361	1
		Fine to coarse and with gravel	sUCD?	12	13	361	360	1
MW-26	377	Clayey silt and silty clay	F/cUCD	0	22	377	355	22
		Gravel	sUCD?	22	25	355	352	3
		Clay and silt with gravel	cUCD?	25	26	352	351	1
MW-27	378	Clayey silt and silty clay	F/L/cUCD	0	13	378	365	13
		Gravel	sUCD?	13	15	365	363	2
EDGe BORINGS (EDGe, 1989)								
MW-66	370	Clay and silty clay	F/L/cUCD	0	15	370	355	15
		Sandy clay	cUCD	15	19	355	351	4
		Silty fine to coarse sand	sUCD	19	29	351	351	10
		Silty fine to very fine sand	cUCD	29	32	351	338	3

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 35 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
MW-66 (cont.)	370	Clay and silty clay	cUCD	32	51	338	319	19
		Silty sand	sUCD	51	54	319	316	3
MW-67	372	Silt and silty clay	L/cUCD	0	20	372	352	20
		Silty clay with gravel	cUCD	20	29	352	343	9
		Sandy clay	cUCD	29	38	343	334	9
		Clay	cUCD	38	47	334	325	9
		Silty and clayey fine sand	cUCD	47	51	325	321	4
		Silty and sandy clay	cUCD	51	66	321	306	15
MW-72	371	Clayey silt and silty clay	L/cUCD	0	20	371	351	20
		Clayey fine to coarse sandy gravel	sUCD	20	23	351	348	3
		Clayey and silty medium sand	cUCD	23	25	348	346	2
		Silty fine sand	cUCD	25	36	346	335	11
		Clay and silt	cUCD	36	55	335	316	19
		Fine sand	sUCD	55	60	316	311	5
		Silty clay	cUCD	60	62	311	309	2
		Fine sand	sUCD	62	63	309	308	1
MW-74	372	Silty clay, silt, and clayey silt	L/cUCD	0	23	372	349	23
		Clayey medium sand	cUCD	23	29	349	343	6

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 36 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
MW-74 (cont.)	372	Silty clay	cUCD	29	33	343	339	4
		Medium to coarse sand	sUCD	33	38	339	334	5
		Silty clay	cUCD	38	40	334	332	2
		Fine sand	sUCD	40	41	332	331	1
		Clay	cUCD	41	42	331	330	1
MW-75	373	Clayey silt and clay	F/L/cUCD	0	18	373	355	18
		Silty fine sand	cUCD	18	19	355	354	1
		Clayey and sandy silt	cUCD	19	22	354	351	3
		Clayey fine to medium sand with	cUCD	22	25	351	348	3
		Clayey silt	cUCD	25	29	348	344	4
		Silty fine to medium sand	sUCD	29	34	344	339	5
		Sandy and clayey silt	cUCD	34	35	339	338	1
		Silty clay	cUCD	35	36	338	337	1
		Fine sand and clayey fine sand	cUCD	36	39	337	334	3
		Clay	cUCD	39	47	334	326	8
MW-77	374	Silt and clay	L/cUCD	0	27	374	347	27
		Silty and clayey fine sand	cUCD	27	34	347	340	7

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 37 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
MW-77 (cont.)	374	Silty clay	cUCD	34	36	340	338	2
		Silty fine to medium sand	sUCD	36	40	338	334	4
		Silty clay	cUCD	40	51	334	323	11
		Silty fine sand	cUCD	51	56	323	318	5
		Silty clay	cUCD	56	58	318	316	2
		Fine to medium sand	sUCD	58	67	316	307	9
MW-86	372	Silty clay and clayey silt	L	0	18	372	354	18
		Clayey gravel	sUCD	18	28	354	344	10
		Clayey and silty sand	cUCD	28	37	344	335	9
		Clay	cUCD	37	66	335	306	29
		Medium to coarse sand	sUCD	66	67	306	305	1
MW-89	372	Silty clay, clayey silt, silt, and clay	L/cUCD	0	59	372	313	59
		Silty fine sand	cUCD	59	64	313	308	5
MW-92	371	Silty clay, clay, and sandy clay	L/cUCD	0	54	371	317	54
		Fine to medium sand	sUCD	54	65	317	306	11
MW-95	374	Clay and clayey silt	L/cUCD	0	25	374	349	25
		Clayey and silty fine to medium	cUCD	25	33	349	341	8

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 38 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
MW-95 (cont.)	374	Medium to coarse sand	sUCD	33	39	341	335	6
		Silty clay	cUCD	39	51	335	323	12
		Clayey medium sand	cUCD	51	52	323	322	1
		Silty clay	cUCD	52	59	322	316	7
		Very fine to fine sand	cUCD	59	68	316	306	9
D'APPOLONIA BORINGS (D'APPOLONIA, 1983)								
B-1	371	Silt	cSurf	0	17	371	354	17
		Silty gravel to silty sand	sUCD	17	18	354	353	1
		Sandy silt and silty clay	cUCD	18	21	353	350	3
		Silty fine sand	cUCD	21	28	350	343	7
		Silty clay	cUCD	28	31	343	340	3
		Fine to medium sand	sUCD	31	38	340	333	7
		Silty clay	cUCD	38	39	333	332	1
		Silty gravel	sUCD	39	41	332	330	2
		Silty clay	cUCD	41	46	330	325	5
		Fine sand	cUCD	46	51	325	320	5
		Sandy silt	cUCD	51	54	320	317	3
		Fine to medium sand	sUCD	54	56	317	315	2

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 39 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
B-1 (cont.)	371	Sandy silt	cUCD	56	59	315	312	3
		Fine to medium sand	sUCD	59	64	312	307	5
B-2	370	Silt and silty clay	cSurf	0	18	370	352	18
		Fine to coarse sand	sUCD	18	20	352	350	2
		Silty clay	cUCD	20	32	350	338	12
		Fine sandy gravel	sUCD	32	36	338	334	4
		Fine to coarse sand	sUCD	36	38	334	332	2
		Silty clay	cUCD	38	47	332	323	9
		Silty fine sand	cUCD	47	54	323	316	7
		No recovery	--	54	55	316	315	1
		Fine sand	cUCD	55	57	315	313	2
		Silt and silty clay	cUCD	57	60	313	310	3
B-3	373	Silt and sandy silt	cSurf	0	16	373	357	16
		Fine to coarse sand	sUCD	16	20	357	353	4
		Silty clay	cUCD	20	31	353	342	11
		Fine to coarse sand	sUCD	31	36	342	337	5
		Silty clay	cUCD	36	43	337	330	7
		Silty fine sand	cUCD	43	45	330	328	2

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 40 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
B-3 (cont.)	373	Fine sand	cUCD	45	59	328	314	14
		Silty fine sand	cUCD	59	63	314	310	4
B-4	374	Silt, silty clay, and clayey silt	cSurf	0	18	374	356	18
		Silty fine to coarse sand	sUCD	18	23	356	351	5
		Silty clay	cUCD	23	33	351	341	10
		Fine sand	cUCD	33	38	341	336	5
		Silty clay	cUCD	38	49	336	325	11
		Fine to medium sand	sUCD	49	60	325	314	11
		Fine sand	cUCD	60	64	314	310	4
		Silty clay	cUCD	64	67	310	307	3
B-5	374	Silt and silty clay	cSurf	0	19	374	355	19
		Silty fine to medium sand	sUCD	19	21	355	353	2
		Silty clay	cUCD	21	31	353	343	10
		Silty fine to medium sand	sUCD	31	33	343	341	2
		Silty clay	cUCD	33	46	341	328	13
		Fine sand	cUCD	46	52	328	322	6
		Silty clay	cUCD	52	57	322	317	5
		Fine sand	cUCD	57	65	317	309	8

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 41 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
B-6	373	Silt and silty clay	cSurf	0	21	373	352	21
		Silty fine to coarse sand	sUCD	21	25	352	348	4
		Silty clay	cUCD	25	29	348	344	4
		Silty fine to medium sand	sUCD	29	36	344	337	7
		Sandy silt	cUCD	36	38	337	335	2
		Silty clay	cUCD	38	60	335	313	22
		Fine sand	cUCD	60	64	313	309	4
B-7	371	Silt and silty clay	cSurf	0	19	371	352	19
		Fine to coarse sand	sUCD	19	23	352	348	4
		Sandy silt	cUCD	23	26	348	345	3
		Silty fine to medium sand	sUCD	26	34	345	337	8
		Sandy silt	cUCD	34	36	337	335	2
		Silty clay	cUCD	36	54	335	317	18
		Fine sand	cUCD	54	63	317	308	9
B-8	371	Silt and silty clay	cSurf	0	18	371	353	18
		Fine to coarse sand	sUCD	18	23	353	348	5
		Silty clay	cUCD	23	60	348	311	37
		Fine sand	cUCD	60	63	311	308	3

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 42 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
B-9	371	Silty clay	cSurf	0	22	371	349	22
		Silty coarse sand	sUCD	22	25	349	346	3
		Silty clay	cUCD	25	34	346	337	9
		Silty fine sand	cUCD	34	44	337	327	10
		Silty clay	cUCD	44	52	327	319	8
		Silty fine sand	cUCD	52	61	319	310	9
B-10	369	Silt and silty clay	cSurf	0	13	369	356	13
		Coarse sand	sUCD	13	18	356	351	5
		Silty fine to coarse sand	sUCD	18	23	351	346	5
		Silty clay	cUCD	23	33	346	336	10
		Silty fine to coarse sand	sUCD	33	50	336	319	17
		Silty very fine to fine sand	cUCD	50	60	319	309	10
ARMY CORPS OF ENGINEERS BORINGS (CORPS OF ENGINEERS LOGS)								
9	379	Clay and silt	cSurf	0	13	379	366	13
		Sandy clay	cUCD	13	19	366	360	6
		Clayey sandy gravel	sUCD	19	23	360	356	4
		Clay	cUCD	23	29	356	350	6
		Clayey gravel	sUCD	29	30	350	349	1

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 43 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
9 (cont.)	379	Clay	cUCD	30	40	349	339	10
11	368	Silt	cSurf	0	8	368	360	8
		Clayey sandy gravel	sUCD	8	15	360	353	7
		Clay	cUCD	15	21	353	347	6
		Sandy clay	cUCD	21	40	347	328	19
12	371	Silt	cSurf	0	8	371	363	8
		Sandy gravel	sUCD	8	21	363	350	13
		Sandy clay	cUCD	21	23	350	348	2
		Sandy silt	cUCD	23	26	348	345	3
		Sandy clay	cUCD	26	40	345	331	14
17	376	Clay and silt	cSurf	0	15	376	361	15
		Gravelly sandy silt	cUCD	15	17	361	359	2
		Clayey gravelly sand	cUCD	17	21	359	355	4
		Silty sand	sUCD	21	23	355	353	2
		No recovery	--	23	24	353	352	1
		Sandy clay	cUCD	24	33	352	343	9
		Silty sand	sUCD	33	40	343	336	7

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 44 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
20	381	Silt and clay	cSurf	0	15	381	366	15
		Clayey gravelly sand	cUCD	15	26	366	355	11
		Sand	sUCD	26	28	355	353	2
		Silty sand	sUCD	28	30	353	351	2
		Clayey sandy gravel	sUCD	30	32	351	349	2
		Clayey sand	cUCD	32	34	349	347	2
		Clay	cUCD	34	35	347	346	1
		Sand	sUCD	35	40	346	341	5
22	376	Silt and clay	cSurf	0	19	376	357	19
		Sandy clay	cUCD	19	22	357	354	3
		Gravelly sandy clay	cUCD	22	39	354	337	17
		Sandy clay	cUCD	39	40	337	336	1
23	378	Clay and silt	cSurf	0	18	378	360	18
		Gravelly sandy clay	cUCD	18	19	360	359	1
		Sandy clay	cUCD	19	22	359	356	3
		Silty gravelly sand	sUCD	22	24	356	354	2
		Sandy clay	cUCD	24	31	354	347	7
		Clayey gravelly sand	cUCD	31	34	347	344	3
		Sandy clay	cUCD	34	40	344	338	6

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 45 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
26	375	Clay and silt	cSurf	0	19	375	356	19
		Clayey gravelly sand	cUCD	19	32	356	343	13
		Sand	sUCD	32	35	343	340	3
		Clayey gravelly sand	cUCD	35	39	340	336	4
		Sandy clay	cUCD	39	40	336	335	1
28	384	Clay and silt	cSurf	0	23	384	361	23
		Clayey gravelly sand	cUCD	23	26	361	358	3
		Clay	cUCD	26	28	358	356	2
		Gravelly clayey sand	cUCD	28	33	356	351	5
		Sandy clay	cUCD	33	37	351	347	4
		Clayey gravelly sand	cUCD	37	40	347	344	3
33	383	Clay	cSurf	0	20	383	363	20
		Sandy clay	cUCD	20	30	363	353	10
		Clayey sandy gravel	sUCD	30	31	353	352	1
		Sandy silt	cUCD	31	34	352	349	3
		Silty sand	sUCD	34	38	349	345	4
		Sandy clay	cUCD	38	40	345	343	2
34	383	Clay and silt	cSurf	0	23	383	360	23

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 46 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
34 (cont.)	383	Sandy gravel	sUCD	23	24	360	359	1
		Sandy clay	cUCD	24	31	359	352	7
		Clayey gravelly sand	cUCD	31	33	352	350	2
		Sandy clay	cUCD	33	40	350	343	7
35	380	Clay	cSurf	0	17	380	363	17
		Silty sand	sUCD	17	20	363	360	3
		Clay	cUCD	20	30	360	350	10
		Clayey gravelly sand	cUCD	30	32	350	348	2
		Clay	cUCD	32	40	348	340	8
37	382	Clay	cSurf	0	23	382	359	23
		Sandy clay	cUCD	23	26	359	356	3
		Gravelly clayey sand	sUCD	26	29	356	353	3
		Sandy clay	cUCD	29	31	353	351	2
		Clay	cUCD	31	40	351	342	9
38	383	Clay	cSurf	0	21	383	362	21
		Sandy clay	cUCD	21	23	362	360	2
		Sandy silt	cUCD	23	24	360	359	1
		Clayey gravelly sand	cUCD	24	26	359	357	2

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 47 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
38 (cont.)	383	Gravelly sandy clay	cUCD	26	30	357	353	4
		Clayey gravelly sand	cUCD	30	31	353	352	1
		Clayey sandy gravel	sUCD	31	32	352	351	1
		Sandy clay	cUCD	32	40	351	343	8
A-6	380	Clay	cSurf	0	24	380	356	24
		Sandy clay	cUCD	24	26	356	354	2
		Clayey sandy gravel	sUCD	26	28	354	352	2
		Clay	cUCD	28	30	352	350	2
		Sandy clay	cUCD	30	35	350	345	5
B-1	374	Clay	cSurf	0	16	374	358	16
		Sandy clay	cUCD	16	19	358	355	3
		Clayey sandy gravel	sUCD	19	21	355	353	2
		Gravelly sandy clay	cUCD	21	23	353	351	2
		Clayey gravelly sand	cUCD	23	27	351	347	4
		Sandy clay	cUCD	27	29	347	345	2
		Clayey gravelly sand	cUCD	29	31	345	343	2
		Sandy clay	cUCD	31	35	343	339	4
		Sandy gravel	sUCD	35	36	339	338	1

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 48 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
B-1 (cont.)	374	Sandy clay	cUCD	36	40	338	334	4
B-3	380	Clay	cSurf	0	23	380	357	23
		Sandy clay	cUCD	23	25	357	355	2
		Clayey sandy gravel	sUCD	25	27	355	353	2
		Sandy clay	cUCD	27	29	353	351	2
		Silty sand and clayey sandy gravel	sUCD	29	31	351	349	2
		Clayey gravelly sand	cUCD	31	33	349	347	2
		Sandy clay	cUCD	33	35	347	345	2
		Clayey sand	cUCD	35	40	345	340	5
B-5-A	377	Clay	cSurf	0	28	377	349	28
		Gravelly sandy clay	cUCD	28	31	349	346	3
		Clayey sand	cUCD	31	33	346	344	2
		Clayey sandy gravel and silty sand	sUCD	33	35	344	342	2
		Sandy clay	cUCD	35	40	342	337	5
B-7	384	Clay	cSurf	0	40	384	344	40
B-9	381	Clay	cSurf	0	38	381	343	38
		Clayey sand	cUCD	38	40	343	341	2
B-10B	378	Clay	cSurf	0	31	378	347	31

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 49 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
B-10B (cont.)	378	Clayey gravelly sand	cUCD	31	34	347	344	3
		Sandy clay	cUCD	34	36	344	342	2
		Sand	sUCD	36	38	342	340	2
		Clayey sand	cUCD	38	40	340	338	2
FSAR BORINGS (ERC, 1990)								
Z-1	380	Silty clay	cSurf	0	15	380	365	15
		Silty fine to coarse sand	sUCD?	15	18	365	362	3
		Silty fine sand	cUCD	18	26	362	354	8
Z-5	380	Silty clay	cSurf	0	25	380	355	25
		Silty fine to coarse sand	sUCD	25	27	355	353	2
		Silty clay	cUCD	27	29	353	351	2
		Silty fine sand	cUCD	29	39	351	341	10
		Silty clay and clayey silt	cUCD	39	49	341	331	10
		Silty and clayey fine sand	cUCD	49	50	331	330	1
		Silty clay and sandy silt	cUCD	50	64	330	316	14
		Silty fine sand	cUCD	64	65	316	315	1
		Sandy silt	cUCD	65	69	315	311	4
		Fine to medium sand	sUCD	69	70	311	310	1

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 50 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
Z-5 (cont.)	380	Sandy silt	cUCD	70	74	310	306	4
		Fine to coarse sand	sUCD	74	75	306	305	1
		Sandy and clayey silt	cUCD	75	79	305	301	4
Z-9	355	Silty clay	cSurf	0	20	355	335	20
		Silty fine to medium sand	sUCD	20	22	335	333	2
		Silty clay	cUCD	22	30	333	325	8
		Silty fine to medium sand	cUCD	30	32	325	323	2
		Silt and silty clay	cUCD	32	49	323	306	17
		Silty fine to coarse sand	sUCD	49	50	306	305	1
		Silty clay and clayey silt	cUCD	50	64	305	291	14
		Silty fine sand	cUCD	64	74	291	281	10
Z-14	372	Silty clay	cSurf	0	18	372	354	18
		Silty fine sand	cUCD	18	19	354	353	1
		Silty clay	cUCD	19	39	353	333	20
		Silty fine sand	cUCD	39	40	333	332	1
		Silty clay	cUCD	40	44	332	328	4
		Clayey fine sand	cUCD	44	47	328	325	3
		Silty clay	cUCD	47	49	325	323	2

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 51 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
Z-14 (cont.)	372	Clayey fine sand	cUCD	49	54	323	318	5
		Silty fine to medium sand	cUCD	54	55	318	317	1
		Clayey sand	cUCD	55	59	317	313	4
		Silty fine to coarse sand	sUCD	59	60	313	312	1
		Clayey sand	cUCD	60	64	312	308	4
REGION-WIDE BORINGS (OLIVE, 1966; FINCH, 1967; USGS LOGS)								
110	435	Topsoil and loess	L	0	15	435	420	15
		Gravelly clay and sand	sUCD?	15	43	420	392	28
		Sand	Eoc	43	79	392	356	36
112	405	Loess	L	0	8	405	397	8
		Gravel	sUCD?	8	10	397	395	2
		Sandy clay	Eoc	10	58	395	347	48
114	415	Gravel fill	F	0	3	415	412	3
		Silt	cUCD	3	16	412	399	13
		Gravel	sUCD?	16	27	399	388	11
		Sand	Eoc	27	42	388	373	15
202	425	Silt	cSurf	0	13	425	412	13
		Sandy silty gravel	sUCD?	13	45	412	380	32

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 52 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
202 (cont.)	425	Fine sand	Eoc	45	62	380	363	17
203	385	Silt	cSurf	0	30	385	355	30
		Gravel	sUCD?	30	60	355	325	30
		Fine to medium sand	Eoc	60	80	325	305	20
204	400	Fill and loess	F/L	0	10	400	390	10
		Gravel	sUCD?	10	11	390	389	1
		Sand	Eoc	11	57	389	343	46
206	383	Silt	cSurf	0	13	383	370	13
		Sandy silt	cUCD	13	30	370	353	17
		Silty sand	Eoc	30	35	353	348	5
		Gravelly sand	Eoc	35	70	348	313	35
208	385	Sandy silt	cSurf	0	17	385	368	17
		Clayey gravel	sUCD?	17	23	368	362	6
209	374	Sandy silt	cSurf	0	14	374	360	14
		Gravel	sUCD	14	21	360	353	7
		Silt	cUCD	21	23	353	351	2
		Gravel	sUCD	23	35	351	339	12
		Silty fine to coarse sand	sUCD	35	50	339	324	15

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 53 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
209 (cont.)	374	Gravel	sUCD	50	51	324	323	1
		Sand or silt	sUCD	51	61	323	313	10
210	379	Silt	cSurf	0	12	379	367	12
		Sandy silt	cUCD	12	23	367	356	11
		Gravel	sUCD	23	28	356	351	5
		Silty fine sand	cUCD	28	35	351	344	7
		Coarse gravel	sUCD?	35	63	344	316	28
211	370	Silt	cSurf	0	45	370	325	45
		Sandy silt	cUCD	45	55	325	315	10
212	363	Silt	cSurf	0	8	363	355	8
		Sandy gravel	sUCD	8	15	355	348	7
		Sandy silt	cUCD	15	34	348	329	19
		Clayey fine to medium sand	cUCD	34	49	329	314	15
213	368	Silt	cSurf	0	18	368	350	18
		Gravel	sUCD	18	27	350	341	9
		Silt	cUCD	27	59	341	309	32
319	392	Silt	cSurf	0	15	392	377	15
		Silty fine sand	cUCD	15	40	377	352	25

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 54 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
319 (cont.)	392	Gravel	sUCD?	40	60	352	332	20
321	370	Topsoil and loess	L	0	21	370	349	21
		Gravel and sand	sUCD	21	26	349	344	5
		Gravel and clay	cUCD	26	35	344	335	9
		Sand	sUCD	35	39	335	331	4
		Gravel and sand	sUCD?	39	53	331	317	14
322	373	Silt	cSurf	0	28	373	345	28
		Sandy silt	cUCD	28	41	345	332	13
		Gravel	sUCD	41	52	332	321	11
		Gravelly clayey silty fine to medium	cUCD	52	63	321	310	11
325	362	Silty clay	cSurf	0	12	362	350	12
		Clayey silt and fine sand	cUCD	12	17	350	345	5
		Silty clay	cUCD	17	56	345	306	39
328	374	Silt	cSurf	0	43	374	331	43
		Gravelly silty sand	sUCD	43	73	331	301	30
719(21)	397	Clayey silt	cSurf	0	10	397	387	10
		Sandy silt	cUCD	10	13	387	384	3

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 55 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
719(21) (cont.)	397	Gravel	sUCD?	13	16	384	381	3
722/723(22)	379	Clayey silt	cSurf	0	20	379	359	20
		Silty fine sand	cUCD	20	30	359	349	10
		Gravel	sUCD?	30	43	349	336	13
806(24)	351	Clayey silt	cSurf	0	8	351	343	8
		Gravel	sUCD	8	9	343	342	1
		Clayey and silty sand	cUCD	9	35	342	316	26
807(26)	372	Sandy silt	cSurf	0	37	372	335	37
		Clayey and silty fine to medium	cUCD	37	47	335	325	10
		Gravel	sUCD	47	48	325	324	1
		Clayey and silty fine to medium	cUCD	48	58	324	314	10
809(23)	361	Clayey silt	cSurf	0	8	361	353	8
		Sandy silt	cUCD	8	17	353	344	9
		Clayey fine to coarse sand	cUCD	17	37	344	324	20
		Silty and fine sandy clay	cUCD	37	50	324	311	13
810(25)	358	Silty clay	cSurf	0	16	358	342	16
		Sandy clay	cUCD	16	53	342	305	37

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 56 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
811(34)	362	Silty clay	cSurf	0	20	362	342	20
		Sandy clay	cUCD	20	32	342	330	12
		Clay	cUCD	32	33	330	329	1
		Silty clay	cUCD	33	51	329	311	18
812(35)	363	Silty clay	cSurf	0	43	363	320	43
		Clayey fine sand	cUCD	43	63	320	300	20
814(37)	365	Clayey silt	cSurf	0	20	365	345	20
		Clayey and coarse sandy silt	cUCD	20	27	345	338	7
		Fine to medium sandy silt	cUCD	27	57	338	308	30
815(38)	351	Silty clay	cSurf	0	24	351	327	24
		Silt and fine sand	cUCD	24	30	327	321	6
		Clayey silt	cUCD	30	45	321	306	15
		Clayey medium sandy silt	cUCD	45	52	306	299	7
816(39)	321	Clayey silt	cSurf	0	7	321	314	7
817(12)	359	Clayey silt	cSurf	0	22	359	337	22
		Clayey fine sand	cUCD	22	45	337	314	23
818(4)	322	Silty clay	cSurf	0	9	322	313	9
		Fine sandy clay	cUCD	9	32	313	290	23

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 57 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
910(27)	365	Clayey silt	cSurf	0	22	365	343	22
		Fine sandy silt	cUCD	22	27	343	338	5
		Clayey and silty fine to coarse sand	cUCD	27	59	338	306	32
912(31)	364	Silty clay and clayey silt	cSurf	0	26	364	338	26
		Clayey medium to coarse sand	cUCD	26	28	338	336	2
		Clayey silt and fine sand	cUCD	28	32	336	332	4
		Clayey fine sand	cUCD	32	56	332	308	24
914(32)	345	Clayey silt	cSurf	0	15	345	330	15
		Clayey medium to coarse sand	cUCD	15	36	330	309	21
918(36)	348	Clayey silt	cSurf	0	11	348	337	11
		Clayey and silty fine sand	cUCD	11	14	337	334	3
		Fine sand	sUCD	14	19	334	329	5
		Clayey and silty fine sand	cUCD	19	30	329	318	11
		Clayey and fine sandy silt	cUCD	30	43	318	305	13
GEOTEK BORINGS (1979)								
10(MW-7)	371	Silty clay	cSurf	0	22	371	349	22
		Sandy clay	cUCD	22	45	349	326	23
22(MW-8)	370	Silty clay	cSurf	0	24	370	346	24

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 58 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
22(MW-8) (cont.)	370	Sandy clay	cUCD	24	55	346	315	31
4(MW-9)	365	Clay	cSurf	0	16	365	349	16
		Sandy clay	cUCD	16	65	349	300	49
2(MW-11)	366	Clay	cSurf	0	36	366	330	36
		Silty clay	cUCD	36	40	330	326	4
		Clay	cUCD	40	45	326	321	5
1(MW-12)	366	Clay	cSurf	0	23	366	343	23
		Clay with sand	cUCD	23	55	343	311	32
11(MW-13)	365	Clay	cSurf	0	17	365	348	17
		Sandy clay	cUCD	17	45	348	320	28
28(MW-14)	368	Clay	cSurf	0	20	368	348	20
		Sandy clay	cUCD	20	50	348	318	30
29(MW-15)	372	Clay	cSurf	0	18	372	354	18
		Sandy clay	cUCD	18	65	354	307	47
D'APPOLONIA BORINGS (1982)								
B-101	381	Fill	cSurf	0	22	381	359	22
		Silty clay and clayey silt	cUCD	22	28	359	353	6
		Silty fine sand	cUCD	28	30	353	351	2

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 59 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
B-101 (cont.)	381	Clayey silt	cUCD	30	34	351	347	4
		Silt	cUCD	34	35	347	346	1
		Silty fine to medium sand	sUCD	35	39	346	342	4
		Silty clay	cUCD	39	40	342	341	1
B-102	388	Fill	cSurf	0	24	388	364	24
		Silty clay	cUCD	24	41	364	347	17
B-103	381	Fill	cSurf	0	18	381	363	18
		Silty clay	cUCD	18	36	363	345	18
B-104	389	Fill	cSurf	0	21	389	368	21
		Silty clay	cUCD	21	37	368	352	16
		Silt	cUCD	37	40	352	349	3
MW-44(1P)	400	Fill	cSurf	0	20	400	380	20
		Silty clay	cUCD	20	30	380	370	10
		Clay	cUCD	30	55	370	345	25
		Sand and gravel	sUCD	55	60	345	340	5
		Clay	cUCD	60	85	340	315	25
MW-41(2P)	376	Clay	cSurf	0	30	376	346	30

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 60 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
MW-41(2P)	376	Sand	sUCD	30	35	346	341	5
		Clay	cUCD	35	62	341	314	27
MW-39(3P)	379	Clay	cSurf	0	35	379	344	35
		Sand and gravel	sUCD	35	40	344	339	5
		Clay	cUCD	40	62	339	317	22
MW-40(4P)	379	Clay	cSurf	0	35	379	344	35
		Sand and gravel	sUCD	35	40	344	339	5
		Clay	cUCD	40	62	339	317	22
MW-38(5P)	382	Clay	cSurf	0	30	382	352	30
		Sand and gravel	sUCD	30	40	352	342	10
		Clay	cUCD	40	62	342	320	22
MW-42(N6P)	372	Clay	cSurf	0	18	372	354	18
		Sand	sUCD	18	25	354	347	7
		Clay	cUCD	25	40	347	332	15
MW-43(N7P)	361	Clay	cSurf	0	20	361	341	20
		Sand	sUCD	20	22	341	339	2
		Clay	cUCD	22	25	339	336	3

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 61 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
MW-43(N7P)	361	Sand and gravel	sUCD	25	30	336	331	5
		Clay	cUCD	30	60	331	301	30
GEOPHYSICAL LOG CONTACT PICKS (Dreier et al., 1990) (Note: These logs have not been reconciled with lithologic logs for the same borings provided								
MW-18	365	Loess	cSurf			365	355	10
		Silt	cUCD			355	345	10
		Sand	sUCD			345	337	8
		Silt	cUCD			337	335	2
		Clay	cUCD			335	327	8
		Silt	cUCD			327	314	13
		Sand	sUCD			314	307	7
MW-65	372	Fill	cSurf			372	366	6
		Silt	cUCD			366	355	11
		Sand	sUCD			355	341	14
		Silt	cUCD			341	332	9
		Clay	cUCD			332	320	12
		Sand	sUCD			320	310	10
MW-66	365	Fill	cSurf			370	365	5

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 62 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
MW-66 (cont.)	365	Silt	cUCD			365	350	15
		Sand	sUCD			350	330	20
		Clay	cUCD			328	315	13
		Sand	sUCD			315	310	5
MW-22	365	Loess	cSurf			365	355	10
		Silt	cUCD			355	350	5
		Sand	sUCD			350	330	20
		Clay	cUCD			330	315	15
		Sand	sUCD			315	310	5
MW-80	375	Fill	cSurf			375	362	13
		Loess	cUCD			362	358	4
		Sand	sUCD			358	338	20
		Silt	cUCD			338	335	3
		Clay	cUCD			335	325	10
		Silt	cUCD			325	320	5
		Sand	sUCD			320	310	10
MW-81	375	Fill	cSurf			375	370	5
		Loess	cUCD			370	365	5

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 63 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
MW-81 (cont.)	375	Silt	cUCD			365	355	10
		Sand	sUCD			355	340	15
		Silt	cUCD			340	335	5
		Clay	cUCD			335	321	14
		Sand	sUCD			321	307	14
MW-68	380	Fill	cSurf			380	373	7
		Loess	cUCD			373	370	3
		Silt	cUCD			370	355	15
		Sand	sUCD			355	338	17
		Silt	cUCD			338	320	18
		Clay	cUCD			320	308	12
LOC-2 (RW-2)	367	Fill	cSurf			367	365	2
		Loess	cUCD			365	358	7
		Silt	cUCD			358	340	18
		Clay	cUCD			340	335	5
		Silt	cUCD			335	330	5
		Clay	cUCD			330	323	7
		Silt	cUCD			323	315	8

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 64 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
LOC-2 (RW-2)	367	Sand	sUCD			315	308	
LOC-3 (RW-3)	363	Loess	cSurf			363	355	8
		Silt	cUCD			355	344	11
		Clay	cUCD			344	340	4
		Silt	cUCD			340	332	8
		Sand	sUCD			332	330	2
		Silt	cUCD			330	324	6
		Clay	cUCD			324	318	6
		Sand	sUCD			318	307	11
MW-39	381	Fill	cSurf			381	380	1
		Sand	sUCD			380	362	18
		Silt	cUCD			362	349	13
		Sand	sUCD			349	341	8
		Silt	cUCD			341	337	4
		Clay	cUCD			337	325	12
		Silt	cUCD			325	322	3
		Sand	sUCD			322	318	4

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 65 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
LOC-16 (RW-16)	372	Loess	cSurf			372	363	9
		Silt	cUCD			363	352	11
		Sand	sUCD			352	343	9
		Clay	cUCD			343	337	6
		Silt	cUCD			337	322	15
		Sand	sUCD			322	317	5
TVA-3	362	Fill	cSurf			362	357	5
		Loess	cUCD			357	350	7
		Silt	cUCD			350	338	12
		Clay	cUCD			338	330	8
		Silt	cUCD			330	322	8
		Sand	sUCD			322	316	6
TVA-1	358	Fill	cSurf			358	353	5
		Loess	cUCD			353	344	9
		Clay	cUCD			344	333	11
		Silt	cUCD			333	317	16
		Clay	cUCD			317	301	16
		Silt	cUCD			301	296	5

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 66 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
TVA-1 (cont.)	358	Sand	sUCD			296	288	8
MW-44	403	Fill	cSurf			403	392	11
		Silt	cUCD			392	384	8
		Sand	sUCD			384	376	8
		Silt	cUCD			376	345	31
		Sand	sUCD			345	339	6
		Silt	cUCD			339	337	2
		Clay	cUCD			337	325	8
		Silt	cUCD			325	323	8
		Sand	sUCD			323	317	8
TVA-4	337	Clay	cSurf			337	329	8
		Silt	cUCD			329	322	7
		Sand	sUCD			322	317	5
TVA-10	347	Fill	cSurf			347	338	9
		Clay	cUCD			338	330	8
		Silt	cUCD			330	321	9
		Sand	sUCD			321	315	6
MW-16	375	Fill	cSurf			375	363	12

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 67 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
MW-16 (cont.)	375	Sand	sUCD			363	359	4
		Silt	cUCD			359	342	17
		Clay	cUCD			342	332	10
MW-38	385	Fill	cSurf			385	375	10
		Sand	sUCD			375	365	10
		Silt	cUCD			365	347	18
		Sand	sUCD			347	342	5
		Silt	cUCD			342	340	2
		Clay	cUCD			340	328	12
		Silt	cUCD			328	322	6
		Sand	sUCD			322	318	4
MW-40	377	Sand	sSurf			377	362	15
		Silt	cUCD			362	347	15
		Sand	sUCD			347	342	5
		Silt	cUCD			342	340	2
		Clay	cUCD			340	327	13
		Silt	cUCD			327	321	6

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 68 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
MW-40	377	Sand	sUCD			321	317	4
MW-17	377	Fill	cSurf			377	365	12
		Loess	cUCD			365	362	3
		Sand	sUCD			362	360	2
		Silt	cUCD			360	345	15
		Sand	sUCD			345	339	6
		Silt	cUCD			339	335	4
		Clay	cUCD			335	327	8
		Silt	cUCD			327	322	5
		Sand	sUCD			322	316	6
MW-19	365	Fill	cSurf			365	355	10
		Silt	cUCD			355	342	13
		Sand	sUCD			342	333	9
		Clay	cUCD			333	324	9
		Silt	cUCD			324	320	4
		Sand	sUCD			320	317	3
MW-41	378	Fill	cSurf			378	371	7

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 69 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
MW-41 (cont.)	378	Sand	sUCD			371	360	11
		Silt	cUCD			360	345	15
		Sand	sUCD			345	340	5
		Silt	cUCD			340	335	5
		Clay	cUCD			335	326	9
		Silt	cUCD			326	320	6
		Sand	sUCD			320	313	7
MW-18	405	Fill	cSurf			405	396	9
		Sand	sUCD			396	365	31
		Silt	cUCD			365	357	8
		Sand	sUCD			357	348	9
MW-42	362	Fill	cSurf			362	347	15
		Sand	sUCD			347	330	17
		Silt	cUCD			330	325	5
		Clay	cUCD			325	323	2
		Silt	cUCD			323	319	4
		Sand	sUCD			319	316	3

Table 3B-2
Distribution of Lithologies--Loess, Upper Continental Deposits, and Eocene Sands
PGDP Phase II Site Investigation
(page 70 of 70)

Well/Boring Designation	Surface Elevation (ft MSL)	Lithology	Unit[a]	Interval Depth		Interval Elevation		Thickness (ft)
				Top (ft)	Bottom (ft)	Top (ft MSL)	Bottom (ft MSL)	
MW-43	372	Fill	cSurf			372	366	6
		Sand	sUCD			366	363	3
		Silt	cUCD			363	357	6
		Sand	sUCD			357	347	10
		Silt	cUCD			347	344	3
		Sand	sUCD			344	339	5
		Silt	cUCD			339	335	4
		Clay	cUCD			335	325	10
		Silt	cUCD			325	319	6
		Sand	sUCD			319	310	9

[a]Notes:
cSurf = Fine-grained materials near surface, including fill, loess, and/or UCD
F = Fill
L = Loess
sUCD = Sand or gravel Upper Continental Deposits
cUDC = Fine-grained Upper Continental Deposits
UCD? = May be Lower Continental Deposits
All = Alluvium
Eoc = Eocene sands

APPENDIX 3E
Major Ions in Groundwater

EDMS CHEMICAL SUMMARY STATISTICS
RGA AQUIFER UNIT
PHASE 2: WATER IONS (TOTAL FRACTIONS)
SAMPLE ANALYSIS: WATER IONS

Chem Code	Station ID	Chemical Name	Conc Units	Total Count	Detected Count	Detected Frequency	Detected Minimum	Detected Maximum	Detected Average	Standard Deviation
ALK	MW012	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	80,000.000	80,000.000	80,000.000	0.000
BIC	MW012	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	98,000.000	98,000.000	98,000.000	0.000
SO3	MW012	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW021	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	142,000.000	142,000.000	142,000.000	0.000
CL	MW021	CHLORIDE	UG/L	1	1	1.0000	195,000.000	195,000.000	195,000.000	0.000
N32	MW021	NITRATE/NITRITE-N	UG/L	1	1	1.0000	3,000.000	3,000.000	3,000.000	0.000
SO4	MW021	SULFATE	UG/L	1	1	1.0000	419,000.000	419,000.000	419,000.000	0.000
SO3	MW021	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW022	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	62,500.000	63,700.000	63,100.000	600.000
BIC	MW022	BICARBONATE (FROM ALKALINITY)	UG/L	2	2	1.0000	76,300.000	77,700.000	77,000.000	700.000
SO3	MW022	SULFIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW038	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	150,000.000	150,000.000	150,000.000	0.000
CL	MW038	CHLORIDE	UG/L	1	1	1.0000	44,100.000	44,100.000	44,100.000	0.000
NO3	MW038	NITRATE	UG/L	1	1	1.0000	9,300.000	9,300.000	9,300.000	0.000
SO4	MW038	SULFATE	UG/L	1	1	1.0000	9,500.000	9,500.000	9,500.000	0.000
SO3	MW038	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
CL	MW041	CHLORIDE	UG/L	1	1	1.0000	39,200.000	39,200.000	39,200.000	0.000
N32	MW041	NITRATE/NITRITE-N	UG/L	1	1	1.0000	610.000	610.000	610.000	0.000
SO4	MW041	SULFATE	UG/L	1	1	1.0000	10,900.000	10,900.000	10,900.000	0.000
CL	MW042	CHLORIDE	UG/L	1	1	1.0000	33,800.000	33,800.000	33,800.000	0.000
N32	MW042	NITRATE/NITRITE-N	UG/L	1	1	1.0000	650.000	650.000	650.000	0.000
SO4	MW042	SULFATE	UG/L	1	1	1.0000	164,000.000	164,000.000	164,000.000	0.000
ALK	MW043	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	87,000.000	87,000.000	87,000.000	0.000
BIC	MW043	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	106,000.000	106,000.000	106,000.000	0.000
CL	MW043	CHLORIDE	UG/L	1	1	1.0000	980.000	980.000	980.000	0.000
N32	MW043	NITRATE/NITRITE-N	UG/L	1	1	1.0000	32,300.000	32,300.000	32,300.000	0.000
SO4	MW043	SULFATE	UG/L	1	1	1.0000	14,600.000	14,600.000	14,600.000	0.000
SO3	MW043	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
CL	MW044	CHLORIDE	UG/L	1	1	1.0000	42,100.000	42,100.000	42,100.000	0.000
N32	MW044	NITRATE/NITRITE-N	UG/L	1	1	1.0000	760.000	760.000	760.000	0.000
SO4	MW044	SULFATE	UG/L	1	1	1.0000	14,300.000	14,300.000	14,300.000	0.000
ALK	MW048	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	50,000.000	50,000.000	50,000.000	0.000
CL	MW048	CHLORIDE	UG/L	1	1	1.0000	10,100.000	10,100.000	10,100.000	0.000
NO3	MW048	NITRATE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
SO4	MW048	SULFATE	UG/L	1	1	1.0000	9,300.000	9,300.000	9,300.000	0.000

*** Data missing from conversion tables. All units could not be converted.

REJECTED OBSERVATIONS ARE NOT INCLUDED IN ANY CALCULATIONS. DETECTED FREQUENCY = DETECTED COUNT/TOTAL COUNT.

EDMS CHEMICAL SUMMARY STATISTICS
RGA AQUIFER UNIT
PHASE 2: WATER IONS (TOTAL FRACTIONS)
SAMPLE ANALYSIS: WATER IONS

Chem Code	Station ID	Chemical Name	Conc Units	Total Count	Detected Count	Detected Frequency	Detected Minimum	Detected Maximum	Detected Average	Standard Deviation
SO3	MW048	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW053	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	75,000.000	75,000.000	75,000.000	0.000
BIC	MW053	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	92,000.000	92,000.000	92,000.000	0.000
CL	MW053	CHLORIDE	UG/L	1	1	1.0000	7,200.000	7,200.000	7,200.000	0.000
N32	MW053	NITRATE/NITRITE-N	UG/L	1	1	1.0000	1,670.000	1,670.000	1,670.000	0.000
SO4	MW053	SULFATE	UG/L	1	1	1.0000	4,900.000	4,900.000	4,900.000	0.000
SO3	MW053	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW054	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	90,000.000	90,000.000	90,000.000	0.000
BIC	MW054	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	110,000.000	110,000.000	110,000.000	0.000
CL	MW054	CHLORIDE	UG/L	1	1	1.0000	330.000	330.000	330.000	0.000
N32	MW054	NITRATE/NITRITE-N	UG/L	1	1	1.0000	9,900.000	9,900.000	9,900.000	0.000
SO4	MW054	SULFATE	UG/L	1	1	1.0000	9,300.000	9,300.000	9,300.000	0.000
SO3	MW054	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW063	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	86,400.000	86,400.000	86,400.000	0.000
BIC	MW063	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	105,000.000	105,000.000	105,000.000	0.000
CL	MW063	CHLORIDE	UG/L	1	1	1.0000	14,900.000	14,900.000	14,900.000	0.000
N32	MW063	NITRATE/NITRITE-N	UG/L	1	1	1.0000	470.000	470.000	470.000	0.000
SO4	MW063	SULFATE	UG/L	1	1	1.0000	6,600.000	6,600.000	6,600.000	0.000
SO3	MW063	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW065	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	67,800.000	67,800.000	67,800.000	0.000
BIC	MW065	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	82,700.000	82,700.000	82,700.000	0.000
CL	MW065	CHLORIDE	UG/L	1	1	1.0000	11,700.000	11,700.000	11,700.000	0.000
N32	MW065	NITRATE/NITRITE-N	UG/L	1	1	1.0000	230.000	230.000	230.000	0.000
SO4	MW065	SULFATE	UG/L	1	1	1.0000	5,480.000	5,480.000	5,480.000	0.000
SO3	MW065	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
AMM	MW066	AMMONIA	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW066	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	82,000.000	84,000.000	83,000.000	1,000.000
CL	MW066	CHLORIDE	mg/L	1	1	1.0000	42.100	42.100	42.100	0.000
CL	MW066	CHLORIDE	UG/L	1	1	1.0000	41,900.000	41,900.000	41,900.000	0.000
CN1	MW066	CYANIDE (WATER)	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
FL	MW066	FLUORIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
NO3	MW066	NITRATE	mg/L	1	1	1.0000	35.600	35.600	35.600	0.000
NO3	MW066	NITRATE	UG/L	1	1	1.0000	35,700.000	35,700.000	35,700.000	0.000
NNI	MW066	NITROGEN, NITRITE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
POS	MW066	PHOSPHATE(S)	UG/L	1	1	1.0000	33.000	33.000	33.000	0.000

*** Data missing from conversion tables. All units could not be converted.

REJECTED OBSERVATIONS ARE NOT INCLUDED IN ANY CALCULATIONS. DETECTED FREQUENCY = DETECTED COUNT/TOTAL COUNT.

EDMS CHEMICAL SUMMARY STATISTICS
RGA AQUIFER UNIT
PHASE 2: WATER IONS (TOTAL FRACTIONS)
SAMPLE ANALYSIS: WATER IONS

Chem Code	Station ID	Chemical Name	Conc Units	Total Count	Detected Count	Detected Frequency	Detected Minimum	Detected Maximum	Detected Average	Standard Deviation
RAS	MW066	REACTIVE SILICA	UG/L	1	1	1.0000	23,400.000	23,400.000	23,400.000	0.000
SC	MW066	SPECIFIC CONDUCTANCE	UMHOS	1	1	1.0000	343.000	343.000	343.000	0.000
SO4	MW066	SULFATE	mg/L	1	1	1.0000	11.400	11.400	11.400	0.000
SO4	MW066	SULFATE	UG/L	1	1	1.0000	10,800.000	10,800.000	10,800.000	0.000
SO3	MW066	SULFIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
TDS	MW066	TOTAL DISSOLVED SOLIDS	UG/L	1	1	1.0000	247,000.000	247,000.000	247,000.000	0.000
TOC	MW066	TOTAL ORGANIC CARBON	UG/L	1	1	1.0000	710.000	710.000	710.000	0.000
TUR	MW066	TURBIDITY	NTU	1	1	1.0000	2.100	2.100	2.100	0.000
ALK	MW067	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	61,600.000	62,600.000	62,100.000	500.000
BIC	MW067	BICARBONATE (FROM ALKALINITY)	UG/L	2	2	1.0000	75,200.000	76,400.000	75,800.000	600.000
CL	MW067	CHLORIDE	UG/L	2	2	1.0000	11,900.000	12,300.000	12,100.000	200.000
N32	MW067	NITRATE/NITRITE-N	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
SO4	MW067	SULFATE	UG/L	2	2	1.0000	8,490.000	8,490.000	8,490.000	0.000
SO3	MW067	SULFIDE	UG/L	2	1	0.5000	230.000	230.000	230.000	0.000
AMM	MW068	AMMONIA	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW068	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	66,000.000	66,000.000	66,000.000	0.000
CL	MW068	CHLORIDE	UG/L	1	1	1.0000	60,400.000	60,400.000	60,400.000	0.000
FL	MW068	FLUORIDE	UG/L	1	1	1.0000	140.000	140.000	140.000	0.000
NO3	MW068	NITRATE	UG/L	1	1	1.0000	6,700.000	6,700.000	6,700.000	0.000
POS	MW068	PHOSPHATE(S)	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
RAS	MW068	REACTIVE SILICA	UG/L	1	1	1.0000	18,400.000	18,400.000	18,400.000	0.000
SO4	MW068	SULFATE	UG/L	1	1	1.0000	12,300.000	12,300.000	12,300.000	0.000
SO3	MW068	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
TDS	MW068	TOTAL DISSOLVED SOLIDS	UG/L	1	1	1.0000	224,000.000	224,000.000	224,000.000	0.000
TOC	MW068	TOTAL ORGANIC CARBON	UG/L	1	1	1.0000	2,700.000	2,700.000	2,700.000	0.000
TSS	MW068	TOTAL SUSPENDED SOLIDS	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
TUR	MW068	TURBIDITY	NTU	1	1	1.0000	0.540	0.540	0.540	0.000
ALK	MW070	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	229,000.000	229,000.000	229,000.000	0.000
BIC	MW070	BICARBONATE (FROM ALKALINITY)	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
CL	MW070	CHLORIDE	UG/L	1	1	1.0000	36,100.000	36,100.000	36,100.000	0.000
N32	MW070	NITRATE/NITRITE-N	UG/L	1	1	1.0000	460.000	460.000	460.000	0.000
SO4	MW070	SULFATE	UG/L	1	1	1.0000	31,400.000	31,400.000	31,400.000	0.000
SO3	MW070	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW071	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	98,000.000	98,000.000	98,000.000	0.000
CL	MW071	CHLORIDE	UG/L	1	1	1.0000	98,500.000	98,500.000	98,500.000	0.000

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EDMS CHEMICAL SUMMARY STATISTICS
RGA AQUIFER UNIT
PHASE 2: WATER IONS (TOTAL FRACTIONS)
SAMPLE ANALYSIS: WATER IONS

Chem Code	Station ID	Chemical Name	Conc Units	Total Count	Detected Count	Detected Frequency	Detected Minimum	Detected Maximum	Detected Average	Standard Deviation
NO3	MW071	NITRATE	UG/L	1	1	1.0000	2,000.000	2,000.000	2,000.000	0.000
SO4	MW071	SULFATE	UG/L	1	1	1.0000	8,100.000	8,100.000	8,100.000	0.000
SO3	MW071	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
AMM	MW084	AMMONIA	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW084	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	88,000.000	88,000.000	88,000.000	0.000
CL	MW084	CHLORIDE	UG/L	1	1	1.0000	9,700.000	9,700.000	9,700.000	0.000
FL	MW084	FLUORIDE	UG/L	1	1	1.0000	120.000	120.000	120.000	0.000
NO3	MW084	NITRATE	UG/L	1	1	1.0000	1,700.000	1,700.000	1,700.000	0.000
POS	MW084	PHOSPHATE(S)	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
SO4	MW084	SULFATE	UG/L	1	1	1.0000	9,100.000	9,100.000	9,100.000	0.000
SO3	MW084	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
TOC	MW084	TOTAL ORGANIC CARBON	UG/L	1	1	1.0000	660.000	660.000	660.000	0.000
TUR	MW084	TURBIDITY	NTU	1	1	1.0000	0.340	0.340	0.340	0.000
ALK	MW086	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	96,000.000	102,000.000	99,000.000	3,000.000
BIC	MW086	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	124,000.000	124,000.000	124,000.000	0.000
CL	MW086	CHLORIDE	UG/L	1	1	1.0000	10,400.000	10,400.000	10,400.000	0.000
NO3	MW086	NITRATE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
SO4	MW086	SULFATE	UG/L	1	1	1.0000	12,000.000	12,000.000	12,000.000	0.000
SO3	MW086	SULFIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW087	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	112,000.000	112,000.000	112,000.000	0.000
CL	MW087	CHLORIDE	UG/L	1	1	1.0000	10,500.000	10,500.000	10,500.000	0.000
CN1	MW087	CYANIDE (WATER)	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
NO3	MW087	NITRATE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
SO4	MW087	SULFATE	UG/L	1	1	1.0000	13,000.000	13,000.000	13,000.000	0.000
SO3	MW087	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
AMM	MW089	AMMONIA	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW089	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	80,000.000	80,000.000	80,000.000	0.000
CL	MW089	CHLORIDE	UG/L	1	1	1.0000	12,500.000	12,500.000	12,500.000	0.000
CN1	MW089	CYANIDE (WATER)	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
NO3	MW089	NITRATE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
POS	MW089	PHOSPHATE(S)	UG/L	1	1	1.0000	320.000	320.000	320.000	0.000
SO4	MW089	SULFATE	UG/L	1	1	1.0000	15,000.000	15,000.000	15,000.000	0.000
SO3	MW089	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW090	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	94,000.000	94,000.000	94,000.000	0.000
CL	MW090	CHLORIDE	UG/L	1	1	1.0000	12,700.000	12,700.000	12,700.000	0.000

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REJECTED OBSERVATIONS ARE NOT INCLUDED IN ANY CALCULATIONS. DETECTED FREQUENCY = DETECTED COUNT/TOTAL COUNT.

EDMS CHEMICAL SUMMARY STATISTICS
RGA AQUIFER UNIT
PHASE 2: WATER IONS (TOTAL FRACTIONS)
SAMPLE ANALYSIS: WATER IONS

Chem Code	Station ID	Chemical Name	Conc Units	Total Count	Detected Count	Detected Frequency	Detected Minimum	Detected Maximum	Detected Average	Standard Deviation
CN1	MW090	CYANIDE (WATER)	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
NO3	MW090	NITRATE	UG/L	1	1	1.0000	5,200.000	5,200.000	5,200.000	0.000
SO4	MW090	SULFATE	UG/L	1	1	1.0000	9,600.000	9,600.000	9,600.000	0.000
SO3	MW090	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW092	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	60,000.000	60,000.000	60,000.000	0.000
CL	MW092	CHLORIDE	UG/L	1	1	1.0000	7,900.000	7,900.000	7,900.000	0.000
CN1	MW092	CYANIDE (WATER)	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
NO3	MW092	NITRATE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
SO4	MW092	SULFATE	UG/L	1	1	1.0000	8,700.000	8,700.000	8,700.000	0.000
SO3	MW092	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW093	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	64,000.000	83,000.000	73,500.000	9,500.000
BIC	MW093	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	101,000.000	101,000.000	101,000.000	0.000
CL	MW093	CHLORIDE	UG/L	1	1	1.0000	12,100.000	12,100.000	12,100.000	0.000
NO3	MW093	NITRATE	UG/L	1	1	1.0000	640.000	640.000	640.000	0.000
SO4	MW093	SULFATE	UG/L	1	1	1.0000	11,200.000	11,200.000	11,200.000	0.000
SO3	MW093	SULFIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW095	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	64,000.000	64,000.000	64,000.000	0.000
CL	MW095	CHLORIDE	UG/L	1	1	1.0000	12,700.000	12,700.000	12,700.000	0.000
CN1	MW095	CYANIDE (WATER)	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
NO3	MW095	NITRATE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
SO4	MW095	SULFATE	UG/L	1	1	1.0000	14,400.000	14,400.000	14,400.000	0.000
SO3	MW095	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
AMM	MW123	AMMONIA	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW123	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	136,000.000	136,000.000	136,000.000	0.000
CL	MW123	CHLORIDE	UG/L	1	1	1.0000	42,200.000	42,200.000	42,200.000	0.000
FL	MW123	FLUORIDE	UG/L	1	1	1.0000	220.000	220.000	220.000	0.000
NO3	MW123	NITRATE	UG/L	1	1	1.0000	4,600.000	4,600.000	4,600.000	0.000
POS	MW123	PHOSPHATE(S)	UG/L	1	1	1.0000	400.000	400.000	400.000	0.000
RAS	MW123	REACTIVE SILICA	UG/L	1	1	1.0000	18,800.000	18,800.000	18,800.000	0.000
SO4	MW123	SULFATE	UG/L	1	1	1.0000	11,100.000	11,100.000	11,100.000	0.000
SO3	MW123	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
TOC	MW123	TOTAL ORGANIC CARBON	UG/L	1	1	1.0000	5,000.000	5,000.000	5,000.000	0.000
TSS	MW123	TOTAL SUSPENDED SOLIDS	UG/L	1	1	1.0000	276,000.000	276,000.000	276,000.000	0.000
TUR	MW123	TURBIDITY	NTU	1	1	1.0000	420.000	420.000	420.000	0.000
AMM	MW124	AMMONIA	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000

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EDMS CHEMICAL SUMMARY STATISTICS
RGA AQUIFER UNIT
PHASE 2: WATER IONS (TOTAL FRACTIONS)
SAMPLE ANALYSIS: WATER IONS

Chem Code	Station ID	Chemical Name	Conc Units	Total Count	Detected Count	Detected Frequency	Detected Minimum	Detected Maximum	Detected Average	Standard Deviation
ALK	MW124	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	136,000.000	136,000.000	136,000.000	0.000
CL	MW124	CHLORIDE	UG/L	1	1	1.0000	68,000.000	68,000.000	68,000.000	0.000
FL	MW124	FLUORIDE	UG/L	1	1	1.0000	170.000	170.000	170.000	0.000
NO3	MW124	NITRATE	UG/L	1	1	1.0000	4,000.000	4,000.000	4,000.000	0.000
NNI	MW124	NITROGEN, NITRITE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
POS	MW124	PHOSPHATE(S)	UG/L	1	1	1.0000	210.000	210.000	210.000	0.000
RAS	MW124	REACTIVE SILICA	UG/L	1	1	1.0000	20,500.000	20,500.000	20,500.000	0.000
SC	MW124	SPECIFIC CONDUCTANCE	UNHOS	1	1	1.0000	497.000	497.000	497.000	0.000
SO4	MW124	SULFATE	UG/L	1	1	1.0000	11,700.000	11,700.000	11,700.000	0.000
SO3	MW124	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
TDS	MW124	TOTAL DISSOLVED SOLIDS	UG/L	1	1	1.0000	302,000.000	302,000.000	302,000.000	0.000
TOC	MW124	TOTAL ORGANIC CARBON	UG/L	1	1	1.0000	970.000	970.000	970.000	0.000
TSS	MW124	TOTAL SUSPENDED SOLIDS	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
TUR	MW124	TURBIDITY	NTU	1	1	1.0000	1.700	1.700	1.700	0.000
ALK	MW125	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	110,000.000	110,000.000	110,000.000	0.000
BIC	MW125	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	134,000.000	134,000.000	134,000.000	0.000
SO3	MW125	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW126	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	110,000.000	110,000.000	110,000.000	0.000
BIC	MW126	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	134,000.000	134,000.000	134,000.000	0.000
CL	MW126	CHLORIDE	UG/L	1	1	1.0000	429,000.000	429,000.000	429,000.000	0.000
N32	MW126	NITRATE/NITRITE-N	UG/L	1	1	1.0000	660.000	660.000	660.000	0.000
SO4	MW126	SULFATE	UG/L	1	1	1.0000	9,890.000	9,890.000	9,890.000	0.000
SO3	MW126	SULFIDE	UG/L	1	1	1.0000	330.000	330.000	330.000	0.000
ALK	MW132	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	110,000.000	111,000.000	110,500.000	500.000
BIC	MW132	BICARBONATE (FROM ALKALINITY)	UG/L	2	2	1.0000	134,000.000	135,000.000	134,500.000	500.000
SO3	MW132	SULFIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW133	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	200,000.000	200,000.000	200,000.000	0.000
BIC	MW133	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	244,000.000	244,000.000	244,000.000	0.000
CL	MW133	CHLORIDE	UG/L	1	1	1.0000	15,100.000	15,100.000	15,100.000	0.000
N32	MW133	NITRATE/NITRITE-N	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
SO4	MW133	SULFATE	UG/L	1	1	1.0000	17,700.000	17,700.000	17,700.000	0.000
SO3	MW133	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
AMM	MW134	AMMONIA	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW134	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	100,000.000	100,000.000	100,000.000	0.000
CL	MW134	CHLORIDE	UG/L	1	1	1.0000	27,100.000	27,100.000	27,100.000	0.000

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EDMS CHEMICAL SUMMARY STATISTICS
RGA AQUIFER UNIT
PHASE 2: WATER IONS (TOTAL FRACTIONS)
SAMPLE ANALYSIS: WATER IONS

Chem Code	Station ID	Chemical Name	Conc Units	Total Count	Detected Count	Detected Frequency	Detected Minimum	Detected Maximum	Detected Average	Standard Deviation
FL	MW134	FLUORIDE	UG/L	1	1	1.0000	140.000	140.000	140.000	0.000
NO3	MW134	NITRATE	UG/L	1	1	1.0000	6,800.000	6,800.000	6,800.000	0.000
POS	MW134	PHOSPHATE(S)	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
RAS	MW134	REACTIVE SILICA	UG/L	1	1	1.0000	16,300.000	16,300.000	16,300.000	0.000
SO4	MW134	SULFATE	UG/L	1	1	1.0000	12,300.000	12,300.000	12,300.000	0.000
SO3	MW134	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
TDS	MW134	TOTAL DISSOLVED SOLIDS	UG/L	1	1	1.0000	170,000.000	170,000.000	170,000.000	0.000
TOC	MW134	TOTAL ORGANIC CARBON	UG/L	1	1	1.0000	1,200.000	1,200.000	1,200.000	0.000
TSS	MW134	TOTAL SUSPENDED SOLIDS	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
TUR	MW134	TURBIDITY	ML/L	1	1	1.0000	0.390	0.390	0.390	0.000
ALK	MW135	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	113,000.000	113,000.000	113,000.000	0.000
BIC	MW135	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	138,000.000	138,000.000	138,000.000	0.000
CL	MW135	CHLORIDE	UG/L	1	1	1.0000	30,700.000	30,700.000	30,700.000	0.000
N32	MW135	NITRATE/NITRITE-N	UG/L	1	1	1.0000	860.000	860.000	860.000	0.000
SO4	MW135	SULFATE	UG/L	1	1	1.0000	17,400.000	17,400.000	17,400.000	0.000
SO3	MW135	SULFIDE	UG/L	1	1	1.0000	400.000	400.000	400.000	0.000
ALK	MW137	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	89,800.000	89,800.000	89,800.000	0.000
BIC	MW137	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	110,000.000	110,000.000	110,000.000	0.000
CL	MW137	CHLORIDE	UG/L	1	1	1.0000	33,000.000	33,000.000	33,000.000	0.000
N32	MW137	NITRATE/NITRITE-N	UG/L	1	1	1.0000	3,060.000	3,060.000	3,060.000	0.000
SO4	MW137	SULFATE	UG/L	1	1	1.0000	11,000.000	11,000.000	11,000.000	0.000
SO3	MW137	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW139	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	93,000.000	93,000.000	93,000.000	0.000
BIC	MW139	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	113,000.000	113,000.000	113,000.000	0.000
SO3	MW139	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW141	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	117,000.000	117,000.000	117,000.000	0.000
BIC	MW141	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	143,000.000	143,000.000	143,000.000	0.000
CL	MW141	CHLORIDE	UG/L	1	1	1.0000	37,500.000	37,500.000	37,500.000	0.000
N32	MW141	NITRATE/NITRITE-N	UG/L	1	1	1.0000	680.000	680.000	680.000	0.000
SO4	MW141	SULFATE	UG/L	1	1	1.0000	43,200.000	43,200.000	43,200.000	0.000
SO3	MW141	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW142	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	79,000.000	79,000.000	79,000.000	0.000
BIC	MW142	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	96,000.000	96,000.000	96,000.000	0.000
CL	MW142	CHLORIDE	UG/L	1	1	1.0000	50,300.000	50,300.000	50,300.000	0.000
N32	MW142	NITRATE/NITRITE-N	UG/L	1	1	1.0000	1,650.000	1,650.000	1,650.000	0.000

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EDMS CHEMICAL SUMMARY STATISTICS
RGA AQUIFER UNIT
PHASE 2: WATER IONS (TOTAL FRACTIONS)
SAMPLE ANALYSIS: WATER IONS

Chem Code	Station ID	Chemical Name	Conc Units	Total Count	Detected Count	Detected Frequency	Detected Minimum	Detected Maximum	Detected Average	Standard Deviation
SO4	MW142	SULFATE	UG/L	1	1	1.0000	6,540.000	6,540.000	6,540.000	0.000
SO3	MW142	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
AMM	MW144	AMMONIA	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
FL	MW144	FLUORIDE	UG/L	1	1	1.0000	140.000	140.000	140.000	0.000
NNI	MW144	NITROGEN, NITRITE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
POS	MW144	PHOSPHATE(S)	UG/L	1	1	1.0000	26.000	26.000	26.000	0.000
RAS	MW144	REACTIVE SILICA	UG/L	1	1	1.0000	18,000.000	18,000.000	18,000.000	0.000
SC	MW144	SPECIFIC CONDUCTANCE	UMHOS	1	1	1.0000	697.000	697.000	697.000	0.000
TDS	MW144	TOTAL DISSOLVED SOLIDS	UG/L	1	1	1.0000	417,000.000	417,000.000	417,000.000	0.000
TOC	MW144	TOTAL ORGANIC CARBON	UG/L	1	1	1.0000	1,200.000	1,200.000	1,200.000	0.000
TSS	MW144	TOTAL SUSPENDED SOLIDS	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
TUR	MW144	TURBIDITY	NTU	1	1	1.0000	0.410	0.410	0.410	0.000
ALK	MW145	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	130,000.000	130,000.000	130,000.000	0.000
BIC	MW145	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	159,000.000	159,000.000	159,000.000	0.000
CL	MW145	CHLORIDE	UG/L	1	1	1.0000	72,600.000	72,600.000	72,600.000	0.000
N32	MW145	NITRATE/NITRITE-N	UG/L	1	1	1.0000	860.000	860.000	860.000	0.000
SO4	MW145	SULFATE	UG/L	1	1	1.0000	14,000.000	14,000.000	14,000.000	0.000
SO3	MW145	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW146	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	97,000.000	97,000.000	97,000.000	0.000
BIC	MW146	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	118,000.000	118,000.000	118,000.000	0.000
CL	MW146	CHLORIDE	UG/L	1	1	1.0000	32,000.000	32,000.000	32,000.000	0.000
N32	MW146	NITRATE/NITRITE-N	UG/L	1	1	1.0000	820.000	820.000	820.000	0.000
SO4	MW146	SULFATE	UG/L	1	1	1.0000	7,930.000	7,930.000	7,930.000	0.000
SO3	MW146	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW147	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	94,000.000	94,000.000	94,000.000	0.000
BIC	MW147	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	115,000.000	115,000.000	115,000.000	0.000
CL	MW147	CHLORIDE	UG/L	1	1	1.0000	28,600.000	28,600.000	28,600.000	0.000
N32	MW147	NITRATE/NITRITE-N	UG/L	1	1	1.0000	1,900.000	1,900.000	1,900.000	0.000
SO4	MW147	SULFATE	UG/L	1	1	1.0000	7,370.000	7,370.000	7,370.000	0.000
SO3	MW147	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW148	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	134,000.000	135,000.000	134,500.000	500.000
BIC	MW148	BICARBONATE (FROM ALKALINITY)	UG/L	2	2	1.0000	163,000.000	165,000.000	164,000.000	1,000.000
SO3	MW148	SULFIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW149	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	144,000.000	144,000.000	144,000.000	0.000
BIC	MW149	BICARBONATE (FROM ALKALINITY)	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000

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REJECTED OBSERVATIONS ARE NOT INCLUDED IN ANY CALCULATIONS. DETECTED FREQUENCY = DETECTED COUNT/TOTAL COUNT.

EDMS CHEMICAL SUMMARY STATISTICS
RGA AQUIFER UNIT
PHASE 2: WATER IONS (TOTAL FRACTIONS)
SAMPLE ANALYSIS: WATER IONS

Chem Code	Station ID	Chemical Name	Conc Units	Total Count	Detected Count	Detected Frequency	Detected Minimum	Detected Maximum	Detected Average	Standard Deviation
SO3	MW149	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW150	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	136,000.000	136,000.000	136,000.000	0.000
BIC	MW150	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	166,000.000	166,000.000	166,000.000	0.000
SO3	MW150	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW152	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	91,000.000	91,000.000	91,000.000	0.000
BIC	MW152	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	111,000.000	111,000.000	111,000.000	0.000
SO3	MW152	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW155	Alkalinity as mg/l CaCO3	UG/L	3	3	1.0000	106,000.000	108,000.000	107,333.333	942.809
CL	MW155	CHLORIDE	UG/L	3	3	1.0000	93,100.000	104,000.000	100,366.667	5,138.309
NO3	MW155	NITRATE	UG/L	3	3	1.0000	2,900.000	7,600.000	4,466.667	2,215.601
SO4	MW155	SULFATE	UG/L	3	3	1.0000	980.000	12,300.000	4,753.333	5,336.299
SO3	MW155	SULFIDE	UG/L	3	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW156	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	72,000.000	78,000.000	75,000.000	3,000.000
BIC	MW156	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	95,000.000	95,000.000	95,000.000	0.000
CL	MW156	CHLORIDE	UG/L	2	2	1.0000	150,000.000	166,000.000	158,000.000	8,000.000
NO3	MW156	NITRATE	UG/L	1	1	1.0000	7,300.000	7,300.000	7,300.000	0.000
N32	MW156	NITRATE/NITRITE-N	UG/L	1	1	1.0000	450.000	450.000	450.000	0.000
SO4	MW156	SULFATE	UG/L	2	2	1.0000	15,200.000	16,500.000	15,850.000	650.000
SO3	MW156	SULFIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW158	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	110,000.000	112,000.000	111,000.000	1,000.000
CL	MW158	CHLORIDE	UG/L	3	3	1.0000	8,900.000	15,600.000	13,166.667	3,026.916
CN1	MW158	CYANIDE (WATER)	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
NO3	MW158	NITRATE	UG/L	2	2	1.0000	790.000	1,300.000	1,045.000	255.000
N32	MW158	NITRATE/NITRITE-N	UG/L	1	1	1.0000	290.000	290.000	290.000	0.000
SO4	MW158	SULFATE	UG/L	3	3	1.0000	6,200.000	10,800.000	8,633.333	1,887.385
SO3	MW158	SULFIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW159	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	140,000.000	146,000.000	143,000.000	3,000.000
BIC	MW159	BICARBONATE (FROM ALKALINITY)	UG/L	2	2	1.0000	171,000.000	178,000.000	174,500.000	3,500.000
CL	MW159	CHLORIDE	UG/L	2	2	1.0000	4,000.000	4,600.000	4,300.000	300.000
NO3	MW159	NITRATE	UG/L	1	1	1.0000	160.000	160.000	160.000	0.000
N32	MW159	NITRATE/NITRITE-N	UG/L	1	1	1.0000	80.000	80.000	80.000	0.000
SO4	MW159	SULFATE	UG/L	2	2	1.0000	6,200.000	8,770.000	7,485.000	1,285.000
SO3	MW159	SULFIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW161	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	70,000.000	72,000.000	71,000.000	1,000.000
BIC	MW161	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	85,400.000	85,400.000	85,400.000	0.000

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REJECTED OBSERVATIONS ARE NOT INCLUDED IN ANY CALCULATIONS. DETECTED FREQUENCY = DETECTED COUNT/TOTAL COUNT.

EDMS CHEMICAL SUMMARY STATISTICS
RGA AQUIFER UNIT
PHASE 2: WATER IONS (TOTAL FRACTIONS)
SAMPLE ANALYSIS: WATER IONS

Chem Code	Station ID	Chemical Name	Conc Units	Total Count	Detected Count	Detected Frequency	Detected Minimum	Detected Maximum	Detected Average	Standard Deviation
CL	MW161	CHLORIDE	UG/L	2	2	1.0000	28,500.000	31,900.000	30,200.000	1,700.000
NO3	MW161	NITRATE	UG/L	2	2	1.0000	450.000	2,200.000	1,325.000	875.000
SO4	MW161	SULFATE	UG/L	2	2	1.0000	5,700.000	5,800.000	5,750.000	50.000
SO3	MW161	SULFIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW163	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	164,000.000	173,000.000	168,500.000	4,500.000
BIC	MW163	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	211,000.000	211,000.000	211,000.000	0.000
CL	MW163	CHLORIDE	UG/L	1	1	1.0000	81,000.000	81,000.000	81,000.000	0.000
CN	MW163	CYANIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
NO3	MW163	NITRATE	UG/L	1	1	1.0000	4,500.000	4,500.000	4,500.000	0.000
SO4	MW163	SULFATE	UG/L	1	1	1.0000	11,300.000	11,300.000	11,300.000	0.000
SO3	MW163	SULFIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW165	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	177,000.000	224,000.000	200,500.000	23,500.000
BIC	MW165	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	216,000.000	216,000.000	216,000.000	0.000
CL	MW165	CHLORIDE	UG/L	1	1	1.0000	23,000.000	23,000.000	23,000.000	0.000
CN1	MW165	CYANIDE (WATER)	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
NO3	MW165	NITRATE	UG/L	1	1	1.0000	1,200.000	1,200.000	1,200.000	0.000
SO4	MW165	SULFATE	UG/L	1	1	1.0000	14,900.000	14,900.000	14,900.000	0.000
SO3	MW165	SULFIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW168	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	84,000.000	94,000.000	89,000.000	5,000.000
CL	MW168	CHLORIDE	UG/L	2	2	1.0000	39,100.000	45,700.000	42,400.000	3,300.000
NO3	MW168	NITRATE	UG/L	2	2	1.0000	7,300.000	10,000.000	8,650.000	1,350.000
SO4	MW168	SULFATE	UG/L	2	2	1.0000	4,700.000	5,200.000	4,950.000	250.000
SO3	MW168	SULFIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW169	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	86,000.000	88,000.000	87,000.000	1,000.000
CL	MW169	CHLORIDE	UG/L	2	2	1.0000	9,000.000	10,000.000	9,500.000	500.000
CN1	MW169	CYANIDE (WATER)	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
NO3	MW169	NITRATE	UG/L	2	2	1.0000	360.000	570.000	465.000	105.000
SO4	MW169	SULFATE	UG/L	2	2	1.0000	7,900.000	8,400.000	8,150.000	250.000
SO3	MW169	SULFIDE	UG/L	2	1	0.5000	110.000	110.000	110.000	0.000
ALK	MW173	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	114,000.000	210,000.000	162,000.000	48,000.000
BIC	MW173	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	256,000.000	256,000.000	256,000.000	0.000
CL	MW173	CHLORIDE	UG/L	2	1	0.5000	25,800.000	25,800.000	25,800.000	0.000
CN1	MW173	CYANIDE (WATER)	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
NO3	MW173	NITRATE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
N32	MW173	NITRATE/NITRITE-N	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000

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EDMS CHEMICAL SUMMARY STATISTICS
RGA AQUIFER UNIT
PHASE 2: WATER IONS (TOTAL FRACTIONS)
SAMPLE ANALYSIS: WATER IONS

Chem Code	Station ID	Chemical Name	Conc Units	Total Count	Detected Count	Detected Frequency	Detected Minimum	Detected Maximum	Detected Average	Standard Deviation
SO4	MW173	SULFATE	UG/L	2	2	1.0000	430.000	17,100.000	8,765.000	8,335.000
SO3	MW173	SULFIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW175	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	100,000.000	136,000.000	118,000.000	18,000.000
BIC	MW175	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	122,000.000	122,000.000	122,000.000	0.000
CL	MW175	CHLORIDE	UG/L	1	1	1.0000	7,900.000	7,900.000	7,900.000	0.000
NO3	MW175	NITRATE	UG/L	1	1	1.0000	8,000.000	8,000.000	8,000.000	0.000
SO4	MW175	SULFATE	UG/L	1	1	1.0000	10,200.000	10,200.000	10,200.000	0.000
SO3	MW175	SULFIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW178	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	94,000.000	110,000.000	102,000.000	8,000.000
CL	MW178	CHLORIDE	UG/L	2	2	1.0000	63,700.000	68,600.000	66,150.000	2,450.000
CN	MW178	CYANIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
NO3	MW178	NITRATE	UG/L	2	2	1.0000	4,700.000	5,400.000	5,050.000	350.000
SO4	MW178	SULFATE	UG/L	2	2	1.0000	6,700.000	64,700.000	35,700.000	29,000.000
SO3	MW178	SULFIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW179	Alkalinity as mg/l CaCO3	UG/L	4	4	1.0000	162,000.000	194,000.000	175,500.000	13,955.286
CL	MW179	CHLORIDE	mg/L	1	1	1.0000	42.700	42.700	42.700	0.000
CL	MW179	CHLORIDE	UG/L	3	3	1.0000	39,600.000	44,800.000	43,066.667	2,451.304
CN	MW179	CYANIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
NO3	MW179	NITRATE	mg/L	1	1	1.0000	5.300	5.300	5.300	0.000
NO3	MW179	NITRATE	UG/L	2	2	1.0000	3,500.000	6,200.000	4,850.000	1,350.000
N32	MW179	NITRATE/NITRITE-N	UG/L	1	1	1.0000	6,200.000	6,200.000	6,200.000	0.000
SO4	MW179	SULFATE	mg/L	1	1	1.0000	219.000	219.000	219.000	0.000
SO4	MW179	SULFATE	UG/L	1	1	1.0000	247,000.000	247,000.000	247,000.000	0.000
SO3	MW179	SULFIDE	UG/L	4	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW181	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	163,000.000	174,000.000	168,500.000	5,500.000
BIC	MW181	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	199,000.000	199,000.000	199,000.000	0.000
CL	MW181	CHLORIDE	mg/L	1	1	1.0000	58.300	58.300	58.300	0.000
CL	MW181	CHLORIDE	UG/L	1	1	1.0000	42,000.000	42,000.000	42,000.000	0.000
NO3	MW181	NITRATE	mg/L	1	1	1.0000	8.400	8.400	8.400	0.000
NO3	MW181	NITRATE	UG/L	1	1	1.0000	1,790.000	1,790.000	1,790.000	0.000
SO4	MW181	SULFATE	mg/L	1	1	1.0000	7.100	7.100	7.100	0.000
SO4	MW181	SULFATE	UG/L	1	1	1.0000	2,000.000	2,000.000	2,000.000	0.000
SO3	MW181	SULFIDE	mg/L	1	0	0.0000	0.000	0.000	0.000	0.000
SO3	MW181	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW185	Alkalinity as mg/l CaCO3	UG/L	3	3	1.0000	72,000.000	90,000.000	82,666.667	7,717.225

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REJECTED OBSERVATIONS ARE NOT INCLUDED IN ANY CALCULATIONS. DETECTED FREQUENCY = DETECTED COUNT/TOTAL COUNT.

EDMS CHEMICAL SUMMARY STATISTICS
RGA AQUIFER UNIT
PHASE 2: WATER IONS (TOTAL FRACTIONS)
SAMPLE ANALYSIS: WATER IONS

Chem Code	Station ID	Chemical Name	Conc Units	Total Count	Detected Count	Detected Frequency	Detected Minimum	Detected Maximum	Detected Average	Standard Deviation
CL	MW185	CHLORIDE	UG/L	3	3	1.0000	73,900.000	82,600.000	79,033.333	3,720.514
CN1	MW185	CYANIDE (WATER)	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
NO3	MW185	NITRATE	UG/L	1	1	1.0000	5,500.000	5,500.000	5,500.000	0.000
N32	MW185	NITRATE/NITRITE-N	UG/L	2	2	1.0000	6,300.000	6,800.000	6,550.000	250.000
SO4	MW185	SULFATE	UG/L	3	3	1.0000	2,900.000	7,900.000	6,166.667	2,311.325
SO3	MW185	SULFIDE	UG/L	3	2	0.6667	200.000	210.000	205.000	5.000
ALK	MW188	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	72,000.000	72,000.000	72,000.000	0.000
CL	MW188	CHLORIDE	UG/L	1	1	1.0000	30,000.000	30,000.000	30,000.000	0.000
NO3	MW188	NITRATE	UG/L	1	1	1.0000	3,300.000	3,300.000	3,300.000	0.000
SO4	MW188	SULFATE	UG/L	1	1	1.0000	3,300.000	3,300.000	3,300.000	0.000
SO3	MW188	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW191	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	104,000.000	108,000.000	106,000.000	2,000.000
CL	MW191	CHLORIDE	mg/L	1	1	1.0000	56.500	56.500	56.500	0.000
CL	MW191	CHLORIDE	UG/L	1	1	1.0000	62,500.000	62,500.000	62,500.000	0.000
NO3	MW191	NITRATE	mg/L	1	1	1.0000	11.100	11.100	11.100	0.000
NO3	MW191	NITRATE	UG/L	1	1	1.0000	12,700.000	12,700.000	12,700.000	0.000
SO4	MW191	SULFATE	mg/L	1	1	1.0000	6.100	6.100	6.100	0.000
SO4	MW191	SULFATE	UG/L	1	1	1.0000	5,500.000	5,500.000	5,500.000	0.000
SO3	MW191	SULFIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW193	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	222,000.000	451,000.000	336,500.000	114,500.000
BIC	MW193	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	477,000.000	477,000.000	477,000.000	0.000
CL	MW193	CHLORIDE	UG/L	2	2	1.0000	39,200.000	41,800.000	40,500.000	1,300.000
NO3	MW193	NITRATE	UG/L	2	2	1.0000	940.000	3,400.000	2,170.000	1,230.000
SO4	MW193	SULFATE	UG/L	2	2	1.0000	14,000.000	66,200.000	40,100.000	26,100.000
SO3	MW193	SULFIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW194	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	74,000.000	88,000.000	81,000.000	7,000.000
CL	MW194	CHLORIDE	UG/L	2	2	1.0000	20,500.000	22,000.000	21,250.000	750.000
CN	MW194	CYANIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
NO3	MW194	NITRATE	UG/L	2	2	1.0000	7,900.000	8,100.000	8,000.000	100.000
SO4	MW194	SULFATE	UG/L	2	2	1.0000	10,000.000	11,900.000	10,950.000	950.000
SO3	MW194	SULFIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW197	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	162,000.000	176,000.000	169,000.000	7,000.000
CL	MW197	CHLORIDE	mg/L	1	1	1.0000	53.800	53.800	53.800	0.000
CL	MW197	CHLORIDE	UG/L	1	1	1.0000	49,300.000	49,300.000	49,300.000	0.000
CN	MW197	CYANIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000

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EDMS CHEMICAL SUMMARY STATISTICS
RGA AQUIFER UNIT
PHASE 2: WATER IONS (TOTAL FRACTIONS)
SAMPLE ANALYSIS: WATER IONS

Chem Code	Station ID	Chemical Name	Conc Units	Total Count	Detected Count	Detected Frequency	Detected Minimum	Detected Maximum	Detected Average	Standard Deviation
CN1	MW197	CYANIDE (WATER)	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
NO3	MW197	NITRATE	mg/L	1	1	1.0000	2.600	2.600	2.600	0.000
NO3	MW197	NITRATE	UG/L	1	1	1.0000	2,900.000	2,900.000	2,900.000	0.000
SO4	MW197	SULFATE	mg/L	1	1	1.0000	7.000	7.000	7.000	0.000
SO4	MW197	SULFATE	UG/L	1	1	1.0000	12,700.000	12,700.000	12,700.000	0.000
SO3	MW197	SULFIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW199	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	140,000.000	140,000.000	140,000.000	0.000
CL	MW199	CHLORIDE	UG/L	1	1	1.0000	47,400.000	47,400.000	47,400.000	0.000
CN1	MW199	CYANIDE (WATER)	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
NO3	MW199	NITRATE	UG/L	1	1	1.0000	9,300.000	9,300.000	9,300.000	0.000
SO4	MW199	SULFATE	UG/L	1	1	1.0000	2,000.000	2,000.000	2,000.000	0.000
SO3	MW199	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW200	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	76,000.000	84,000.000	80,000.000	4,000.000
CL	MW200	CHLORIDE	mg/L	1	1	1.0000	59.400	59.400	59.400	0.000
CL	MW200	CHLORIDE	UG/L	1	1	1.0000	40,800.000	40,800.000	40,800.000	0.000
NO3	MW200	NITRATE	mg/L	1	1	1.0000	5.000	5.000	5.000	0.000
NO3	MW200	NITRATE	UG/L	1	1	1.0000	9,200.000	9,200.000	9,200.000	0.000
SO4	MW200	SULFATE	mg/L	1	1	1.0000	2.900	2.900	2.900	0.000
SO4	MW200	SULFATE	UG/L	1	1	1.0000	8,800.000	8,800.000	8,800.000	0.000
SO3	MW200	SULFIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW201	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	168,000.000	202,000.000	185,000.000	17,000.000
CL	MW201	CHLORIDE	UG/L	2	2	1.0000	44,000.000	45,500.000	44,750.000	750.000
CN1	MW201	CYANIDE (WATER)	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
NO3	MW201	NITRATE	UG/L	2	2	1.0000	5,500.000	7,200.000	6,350.000	850.000
SO4	MW201	SULFATE	UG/L	2	2	1.0000	15,300.000	15,500.000	15,400.000	100.000
SO3	MW201	SULFIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW202	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	92,000.000	100,000.000	96,000.000	4,000.000
CL	MW202	CHLORIDE	mg/L	1	1	1.0000	42.900	42.900	42.900	0.000
CL	MW202	CHLORIDE	UG/L	1	1	1.0000	27,600.000	27,600.000	27,600.000	0.000
CN	MW202	CYANIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
NO3	MW202	NITRATE	mg/L	1	1	1.0000	3.500	3.500	3.500	0.000
NO3	MW202	NITRATE	UG/L	1	1	1.0000	6,500.000	6,500.000	6,500.000	0.000
SO4	MW202	SULFATE	mg/L	1	0	0.0000	0.000	0.000	0.000	0.000
SO4	MW202	SULFATE	UG/L	1	1	1.0000	12,700.000	12,700.000	12,700.000	0.000
SO3	MW202	SULFIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000

*** Data missing from conversion tables. All units could not be converted.

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EDMS CHEMICAL SUMMARY STATISTICS
RGA AQUIFER UNIT
PHASE 2: WATER IONS (TOTAL FRACTIONS)
SAMPLE ANALYSIS: WATER IONS

Chem Code	Station ID	Chemical Name	Conc Units	Total Count	Detected Count	Detected Frequency	Detected Minimum	Detected Maximum	Detected Average	Standard Deviation
ALK	MW203	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	94,000.000	100,000.000	97,000.000	3,000.000
CL	MW203	CHLORIDE	UG/L	2	2	1.0000	50,700.000	54,600.000	52,650.000	1,950.000
CN	MW203	CYANIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
NO3	MW203	NITRATE	UG/L	2	2	1.0000	2,400.000	3,300.000	2,850.000	450.000
SO4	MW203	SULFATE	UG/L	2	2	1.0000	9,000.000	9,000.000	9,000.000	0.000
SO3	MW203	SULFIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW205	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	134,000.000	154,000.000	144,000.000	10,000.000
CL	MW205	CHLORIDE	UG/L	2	2	1.0000	44,800.000	50,200.000	47,500.000	2,700.000
CN1	MW205	CYANIDE (WATER)	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
NO3	MW205	NITRATE	UG/L	2	2	1.0000	2,100.000	2,500.000	2,300.000	200.000
SO4	MW205	SULFATE	UG/L	2	2	1.0000	1,000.000	1,200.000	1,100.000	100.000
SO3	MW205	SULFIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW206	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	152,000.000	222,000.000	187,000.000	35,000.000
CL	MW206	CHLORIDE	UG/L	2	2	1.0000	34,300.000	41,400.000	37,850.000	3,550.000
CN1	MW206	CYANIDE (WATER)	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000
NO3	MW206	NITRATE	UG/L	2	2	1.0000	2,500.000	3,200.000	2,850.000	350.000
SO4	MW206	SULFATE	UG/L	2	2	1.0000	153,000.000	160,000.000	156,500.000	3,500.000
SO3	MW206	SULFIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000

*** Data missing from conversion tables. All units could not be converted.

REJECTED OBSERVATIONS ARE NOT INCLUDED IN ANY CALCULATIONS. DETECTED FREQUENCY = DETECTED COUNT/TOTAL COUNT.

EDMS CHEMICAL SUMMARY STATISTICS
DGS AQUIFER UNIT
PHASE 2: WATER IONS (TOTAL FRACTIONS)
SAMPLE ANALYSIS: WATER IONS

Chem Code	Station ID	Chemical Name	Conc Units	Total Count	Detected Count	Detected Frequency	Detected Minimum	Detected Maximum	Detected Average	Standard Deviation
ALK	MW120	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	138,000.000	138,000.000	138,000.000	0.000
BIC	MW120	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	168,000.000	168,000.000	168,000.000	0.000
CL	MW120	CHLORIDE	UG/L	1	1	1.0000	54,900.000	54,900.000	54,900.000	0.000
N32	MW120	NITRATE/NITRITE-N	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
SO4	MW120	SULFATE	UG/L	1	1	1.0000	10,200.000	10,200.000	10,200.000	0.000
SO3	MW120	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW121	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	78,000.000	78,000.000	78,000.000	0.000
CL	MW121	CHLORIDE	UG/L	1	1	1.0000	15,800.000	15,800.000	15,800.000	0.000
NO3	MW121	NITRATE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
SO4	MW121	SULFATE	UG/L	1	1	1.0000	10,300.000	10,300.000	10,300.000	0.000
SO3	MW121	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW122	Alkalinity as mg/l CaCO3	UG/L	1	1	1.0000	150,000.000	150,000.000	150,000.000	0.000
BIC	MW122	BICARBONATE (FROM ALKALINITY)	UG/L	1	1	1.0000	183,000.000	183,000.000	183,000.000	0.000
CL	MW122	CHLORIDE	UG/L	1	1	1.0000	3,800.000	3,800.000	3,800.000	0.000
N32	MW122	NITRATE/NITRITE-N	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
SO4	MW122	SULFATE	UG/L	1	1	1.0000	5,610.000	5,610.000	5,610.000	0.000
SO3	MW122	SULFIDE	UG/L	1	0	0.0000	0.000	0.000	0.000	0.000
ALK	MW140	Alkalinity as mg/l CaCO3	UG/L	2	2	1.0000	35,000.000	137,000.000	86,000.000	51,000.000
BIC	MW140	BICARBONATE (FROM ALKALINITY)	UG/L	2	2	1.0000	165,000.000	167,000.000	166,000.000	1,000.000
CL	MW140	CHLORIDE	UG/L	2	2	1.0000	11,600.000	11,800.000	11,700.000	100.000
N32	MW140	NITRATE/NITRITE-N	UG/L	2	2	1.0000	30.000	40.000	35.000	5.000
SO4	MW140	SULFATE	UG/L	2	2	1.0000	38,400.000	38,900.000	38,650.000	250.000
SO3	MW140	SULFIDE	UG/L	2	0	0.0000	0.000	0.000	0.000	0.000

REJECTED OBSERVATIONS ARE NOT INCLUDED IN ANY CALCULATIONS. DETECTED FREQUENCY = DETECTED COUNT/TOTAL COUNT.

APPENDIX 4B
Sample Tracking Database

SAMPLING EPISODES REPORT LIST OF ABBREVIATIONS

MATRIX CODE TABLE

Matrix Code	Matrix	Rad Screening Limits Gross Alpha	Gross Beta/Gramma	Unit
AQ	MONTHLY AQUEOUS GRAB	30	500	PCI/L
GW	GROUNDWATER	30	500	PCI/L
SB	SOIL BORING (SUBSURFACE SOIL)	15	50	PCI/G
SD	SEDIMENT	15	50	PCI/G
SS	SURFACE OR NEAR SURFACE SOIL	30	500	PCI/G
SW	SURFACE WATER	30	500	PCI/L
WL	LIQUID WASTE	30	500	PCI/L
WS	SOLID WASTE	15	50	PCI/G

STATION CODE TABLE

Station Code	Station
BACKGRND	BACKGROUND
BBC	BIG BAYOU CREEK
LBC	LITTLE BAYOU CREEK
OFFST-DG	OFF-SITE DOWNGRADIENT
OFFST-UG	OFF-SITE UPGRADIENT
ONST-DG	ON-SITE DOWNGRADIENT
ONST-UG	ON-SITE UPGRADIENT
ONS-NSD	ON-SITE NORTH SOUTH DITCH
OFFS-NSD	OFF-SITE NORTH SOUTH DITCH
OUTFOFNS	OUTFALL NORTH SOUTH DITCH

OROPAD4/018.51

DATE: 09/30/91 SAMPLING EPISODES REPORT TIME: 13:42:54

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
BBC001	BACKGRND	SW	0.00	0.00	11011	04/19/91
		SD	0.00	0.00	12011	04/19/91
BBC002	BACKGRND	SW	0.00	0.00	11012	04/19/91
		SD	0.00	0.00	12012	04/19/91
BBC003	BACKGRND	SW	0.00	0.00	11013	04/19/91
		SW	0.00	0.00	11014	04/19/91
		SD	0.00	0.00	12013	04/19/91
		SD	0.00	0.00	12014	04/19/91
BBC004	BBC	SW	0.00	0.00	11015	04/22/91
		SD	0.00	0.00	12015	04/22/91
BBC005	BBC	SW	0.00	0.00	11016	04/19/91
		SD	0.00	0.00	12016	04/19/91
BBC006	BBC	SW	0.00	0.00	11017	04/22/91
		SD	0.00	0.00	12017	04/22/91
BBC007	BBC	SW	0.00	0.00	11018	04/22/91
		SD	0.00	0.00	12018	04/22/91
BBC008	BBC	SW	0.00	0.00	11019	04/16/91
		SD	0.00	0.00	12019	04/16/91
BBC009	OFF-SITE	SW	0.00	0.00	11020	04/22/91
		SD	0.00	0.00	12020	04/22/91
C730	OFF-SITE	AQ	0.00	0.00	10964	04/24/91
		AQ	0.00	0.00	10976	05/03/91
					10976 WS	
		AQ	0.00	0.00	11918	04/24/91
		AQ	0.00	0.00	12904	04/17/91
		AQ	0.00	0.00	12905	04/18/91
		AQ	0.00	0.00	12906	04/19/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
C730	OFF-SITE	AQ	0.00	0.00	12907	04/22/91
		AQ	0.00	0.00	12909	04/24/91
		AQ	0.00	0.00	12910	04/25/91
		AQ	0.00	0.00	14925	04/25/91
		AQ	0.00	0.00	14926	04/30/91
		AQ	0.00	0.00	14927	05/01/91
		AQ	0.00	0.00	14930	05/06/91
		AQ	0.00	0.00	17064	03/21/91
		AQ	0.00	0.00	17100	04/22/91
		AQ	0.00	0.00	17101	04/23/91
		AQ	0.00	0.00	17105	04/23/91
		AQ	0.00	0.00	17106	04/24/91
		AQ	0.00	0.00	17108	03/27/91
		AQ	0.00	0.00	17109	03/27/91
C7301	ON-SITE	AQ	0.00	0.00	17000	12/19/90
		AQ	0.00	0.00	17002	01/16/91
		AQ	0.00	0.00	17005	02/06/91
		AQ	0.00	0.00	17007	03/07/91
		AQ	0.00	0.00	17009	03/07/91
		AQ	0.00	0.00	17012	05/06/91
C7302	ON-SITE	AQ	0.00	0.00	10901	02/28/91
		AQ	0.00	0.00	10902	03/01/91
		AQ	0.00	0.00	10903	03/04/91
		AQ	0.00	0.00	10904	03/04/91
		AQ	0.00	0.00	10905	03/05/91
		AQ	0.00	0.00	10906	03/05/91
		AQ	0.00	0.00	10907	03/06/91
		AQ	0.00	0.00	10908	03/06/91
		AQ	0.00	0.00	10909	03/07/91
		AQ	0.00	0.00	10910	03/07/91
		AQ	0.00	0.00	10911	03/08/91
		AQ	0.00	0.00	10912	03/08/91
		AQ	0.00	0.00	10913	03/11/91
		AQ	0.00	0.00	10914	03/11/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
C7302	ON-SITE	AQ	0.00	0.00	10915	03/12/91
					10915 WS	
		AQ	0.00	0.00	10916	03/12/91
					10916 WS	
		AQ	0.00	0.00	10917	03/13/91
					10917 WS	
		AQ	0.00	0.00	10918	03/13/91
		AQ	0.00	0.00	10919	03/14/91
					10919 WS	
		AQ	0.00	0.00	10920	03/14/91
		AQ	0.00	0.00	10921	03/14/91
		AQ	0.00	0.00	10922	03/15/91
					10922 WS	
		AQ	0.00	0.00	10923	03/15/91
					10923 WS	
		AQ	0.00	0.00	10924	03/18/91
					10924 WS	
		AQ	0.00	0.00	10925	03/18/91
					10925 WS	
		AQ	0.00	0.00	10927	03/19/91
		AQ	0.00	0.00	10928	03/19/91
					10928 WS	
		AQ	0.00	0.00	10929	03/20/91
		AQ	0.00	0.00	10930	03/20/91
		AQ	0.00	0.00	10931	03/20/91
					10931 WS	
		AQ	0.00	0.00	10932	03/21/91
					10932 WS	
		AQ	0.00	0.00	10933	03/21/91
					10933 WS	
		AQ	0.00	0.00	10934	03/21/91
					10934 WS	
		AQ	0.00	0.00	10935	03/25/91
					10935 WS	
		AQ	0.00	0.00	10936	03/22/91
		AQ	0.00	0.00	10937	03/22/91
					10937 WS	

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
C7302	ON-SITE	AQ	0.00	0.00	10938	03/25/91
					10938 WS	
		AQ	0.00	0.00	10939	03/25/91
					10939 WS	
		AQ	0.00	0.00	10940	03/25/91
					10940 WS	
		AQ	0.00	0.00	10941	03/26/91
					10941 WS	
		AQ	0.00	0.00	10942	03/26/91
		AQ	0.00	0.00	10943	03/26/91
					10943 WS	
		AQ	0.00	0.00	10944	03/27/91
					10944 WS	
		AQ	0.00	0.00	10945	03/27/91
					10945 WS	
		AQ	0.00	0.00	10946	03/27/91
					10946 WS	
		AQ	0.00	0.00	10947	03/28/91
					10947 WS	
		AQ	0.00	0.00	10948	03/28/91
					10948 WS	
		AQ	0.00	0.00	10949	03/28/91
					10949 WS	
		AQ	0.00	0.00	10950	03/29/91
					10950 WS	
		AQ	0.00	0.00	10952	03/29/91
		AQ	0.00	0.00	10953	04/01/91
					10953 WS	
		AQ	0.00	0.00	10954	04/01/91
					10954 WS	
		AQ	0.00	0.00	10955	04/02/91
					10955 WS	
		AQ	0.00	0.00	10956	04/02/91
					10956 WS	
		AQ	0.00	0.00	10957	04/03/91
					10957 WS	

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
C7302	ON-SITE	AQ	0.00	0.00	10958	04/03/91
					10958 WS	
		AQ	0.00	0.00	10959	04/04/91
					10959 WS	
		AQ	0.00	0.00	10961	04/08/91
					10961 WS	
		AQ	0.00	0.00	10962	04/22/91
					10962 WS	
		AQ	0.00	0.00	10963	04/23/91
		AQ	0.00	0.00	10965	04/25/91
					10965 WS	
		AQ	0.00	0.00	10967	04/29/91
					10967 WS	
		AQ	0.00	0.00	10968	04/29/91
		AQ	0.00	0.00	10969	04/30/91
		AQ	0.00	0.00	10970	04/30/91
					10970 WS	
		AQ	0.00	0.00	10971	05/01/91
					10971 WS	
		AQ	0.00	0.00	10972	05/01/91
					10972 WS	
		AQ	0.00	0.00	10973	05/02/91
					10973 WS	
		AQ	0.00	0.00	10974	05/02/91
					10974 WS	
		AQ	0.00	0.00	10975	05/03/91
					10975 WS	
		AQ	0.00	0.00	10977	05/06/91
					10977 WS	
		AQ	0.00	0.00	10978	05/06/91
					10978 WS	
		AQ	0.00	0.00	10979	05/07/91
					10979 WS	
		AQ	0.00	0.00	10980	05/07/91
					10980 WS	
		AQ	0.00	0.00	10981	05/08/91
					10981 WS	

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
C7302	ON-SITE	AQ	0.00	0.00	10982	05/08/91
					10982 WS	
		AQ	0.00	0.00	10983	05/09/91
					10983 WS	
		AQ	0.00	0.00	10984	05/09/91
		GW	0.00	0.00	10985	05/10/91
					10985 WS	
		AQ	0.00	0.00	10986	05/10/91
					10986 WS	
		AQ	0.00	0.00	10987	05/13/91
					10987 WS	
		AQ	0.00	0.00	10988	05/13/91
					10988 WS	
		AQ	0.00	0.00	10989	05/11/91
		AQ	0.00	0.00	10990	05/11/91
		AQ	0.00	0.00	10991	05/14/91
		AQ	0.00	0.00	10992	05/15/91
					10992 WS	
		AQ	0.00	0.00	10993	05/21/91
					10993 WS	
		AQ	0.00	0.00	10994	05/22/91
					10994 WS	
		AQ	0.00	0.00	10995	05/29/91
					10995 WS	
		AQ	0.00	0.00	11902	03/01/91
					11902 WS	
		AQ	0.00	0.00	11910	03/26/91
					11910 WS	
		AQ	0.00	0.00	11911	03/27/91
		AQ	0.00	0.00	11912	04/16/91
					11912 WS	
		AQ	0.00	0.00	11913	04/17/91
					11913 WS	
		AQ	0.00	0.00	11914	04/18/91
					11914 WS	
		AQ	0.00	0.00	11915	04/19/91
					11915 WS	

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
C7302	ON-SITE	AQ	0.00	0.00	11916	04/22/91
					11916 WS	
		AQ	0.00	0.00	11917	04/23/91
					11917 WS	
		AQ	0.00	0.00	11919	04/25/91
		AQ	0.00	0.00	12902	03/01/91
					12902 WS	
		AQ	0.00	0.00	12903	04/16/91
		AQ	0.00	0.00	12908	04/23/91
		AQ	0.00	0.00	13900	11/29/90
		AQ	0.00	0.00	13901	12/06/90
		AQ	0.00	0.00	13902	12/06/90
		AQ	0.00	0.00	13904	12/11/90
		AQ	0.00	0.00	13906	12/19/90
		AQ	0.00	0.00	13907	12/20/90
		AQ	0.00	0.00	13908	01/02/91
		AQ	0.00	0.00	13909	01/04/91
		AQ	0.00	0.00	13910	01/08/91
		AQ	0.00	0.00	13911	01/09/91
					13911 WS	
		AQ	0.00	0.00	13912	01/09/91
					13912 WS	
		AQ	0.00	0.00	13913	01/17/91
					13913 DP	
		AQ	0.00	0.00	13914	01/17/91
					13914 WS	
		AQ	0.00	0.00	13915	01/17/91
					13915 WS	
		AQ	0.00	0.00	13916	01/18/91
		AQ	0.00	0.00	13917	01/22/91
		AQ	0.00	0.00	13918	01/23/91
					13918 WS	
		AQ	0.00	0.00	13919	01/24/91
		AQ	0.00	0.00	13920	01/24/91
		AQ	0.00	0.00	13922	01/28/91
		AQ	0.00	0.00	13923	01/28/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
C7302	ON-SITE	AQ	0.00	0.00	13925	01/29/91
		AQ	0.00	0.00	13926	01/30/91
					13926 WS	
		AQ	0.00	0.00	13927	02/01/91
		AQ	0.00	0.00	13928	02/01/91
		AQ	0.00	0.00	13929	02/04/91
		AQ	0.00	0.00	13930	02/06/91
					13930 WS	
		AQ	0.00	0.00	13931	02/05/91
		AQ	0.00	0.00	13934	02/07/91
					13934 WS	
		AQ	0.00	0.00	13935	02/08/91
					13935 WS	
		AQ	0.00	0.00	13936	02/11/91
					13936 WS	
		AQ	0.00	0.00	13937	02/11/91
					13937 WS	
		AQ	0.00	0.00	13938	02/12/91
					13938 WS	
		AQ	0.00	0.00	13939	02/13/91
					13939 WS	
		AQ	0.00	0.00	13940	02/13/91
					13940 WS	
		AQ	0.00	0.00	13941	02/14/91
					13941 WS	
		AQ	0.00	0.00	13942	02/18/91
		AQ	0.00	0.00	13943	02/18/91
					13943 WS	
		AQ	0.00	0.00	13944	02/19/91
					13944 WS	
		AQ	0.00	0.00	13945	02/19/91
					13945 WS	
		AQ	0.00	0.00	13946	02/19/91
					13946 WS	
		AQ	0.00	0.00	13947	02/20/91
					13947 WS	

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
C7302	ON-SITE	AQ	0.00	0.00	13948	02/21/91
					13948 WS	
		AQ	0.00	0.00	13949	02/21/91
					13949 WS	
		AQ	0.00	0.00	13951	02/22/91
					13951 WS	
		AQ	0.00	0.00	13952	02/22/91
					13952 WS	
		AQ	0.00	0.00	13953	02/22/91
					13953 WS	
		AQ	0.00	0.00	13954	02/26/91
		AQ	0.00	0.00	13955	02/25/91
					13955 WS	
		AQ	0.00	0.00	13956	02/26/91
		AQ	0.00	0.00	13957	02/27/91
					13957 WS	
		AQ	0.00	0.00	13960	02/27/91
					13960 WS	
		AQ	0.00	0.00	13961	02/27/91
					13961 WS	
		AQ	0.00	0.00	13962	02/27/91
					13962 WS	
		AQ	0.00	0.00	13963	02/28/91
					13963 WS	
		AQ	0.00	0.00	13964	02/28/91
					13964 WS	
		AQ	0.00	0.00	13965	02/28/91
					13965 WS	
		AQ	0.00	0.00	13968	03/01/91
					13968 WS	
		AQ	0.00	0.00	13969	03/04/91
					13969 WS	
		AQ	0.00	0.00	13970	03/04/91
					13970 WS	
		AQ	0.00	0.00	13971	03/05/91
					13971 WS	

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
C7302	ON-SITE	AQ	0.00	0.00	13972	03/05/91
					13972 WS	
		AQ	0.00	0.00	13973	03/06/91
					13973 WS	
		AQ	0.00	0.00	14900	03/07/91
					14900 WS	
		AQ	0.00	0.00	14901	03/07/91
		AQ	0.00	0.00	14902	03/08/91
					14902 WS	
		AQ	0.00	0.00	14903	03/08/91
					14903 WS	
		AQ	0.00	0.00	14904	03/11/91
					14904 WS	
		AQ	0.00	0.00	14905	03/11/91
					14905 WS	
		AQ	0.00	0.00	14906	03/12/91
					14906 WS	
		AQ	0.00	0.00	14907	03/12/91
					14907 WS	
		AQ	0.00	0.00	14908	03/13/91
					14908 WS	
		AQ	0.00	0.00	14910	03/14/91
					14910 WS	
		AQ	0.00	0.00	14911	03/15/91
					14911 WS	
		AQ	0.00	0.00	14912	03/28/91
		AQ	0.00	0.00	14913	03/28/91
		AQ	0.00	0.00	14914	04/01/91
		AQ	0.00	0.00	14915	04/01/91
		AQ	0.00	0.00	14919	04/03/91
		AQ	0.00	0.00	14920	04/04/91
		AQ	0.00	0.00	14921	04/08/91
		AQ	0.00	0.00	14922	04/10/91
		AQ	0.00	0.00	14923	04/11/91
		AQ	0.00	0.00	14931	05/21/91
		AQ	0.00	0.00	14932	05/22/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
C7302	ON-SITE	AQ	0.00	0.00	14933	05/22/91
		AQ	0.00	0.00	17001	12/20/90
		AQ	0.00	0.00	17003	01/16/91
		AQ	0.00	0.00	17004	02/06/91
		AQ	0.00	0.00	17006	02/20/91
		AQ	0.00	0.00	17008	03/07/91
		AQ	0.00	0.00	17010	04/08/91
		AQ	0.00	0.00	17011	04/08/91
		AQ	0.00	0.00	17013	05/06/91
		AQ	0.00	0.00	17060	03/01/91
		GW	0.00	0.00	17063	03/15/91
CH2M 2	ON-SITE	WL	0.00	0.00	15065	06/04/91
		WL	0.00	0.00	15068	06/04/91
DRI017	ON-SITE	AQ	0.00	0.00	17080	05/06/91
		AQ	0.00	0.00	17081	05/06/91
FP001	BBC	SD	0.00	0.00	12041	04/22/91
FP002	BBC	SD	0.00	0.00	12042	04/16/91
FP003	BBC	SD	0.00	0.00	12043	04/22/91
FP004	LBC	SD	0.00	0.00	12044	04/16/91
		SD	0.00	0.00	12045	04/16/91
FP005	LBC	SD	0.00	0.00	12047	04/22/91
FP006	LBC	SD	0.00	0.50	14134	04/29/91
FP007	LBC	SD	0.00	0.50	14135	04/29/91
FP008	OFF-SITE	SD	0.00	0.50	14136	04/29/91
FP009	OFF-SITE	SD	0.00	0.50	14137	04/29/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
FP010	OFFST-UG	SD	0.00	0.50	14177	05/07/91
H201A	ON-SITE	SB	0.00	5.00	13184	02/19/91
		SB	10.00	15.00	13185	02/19/91
		SB	15.00	20.00	13186	02/19/91
		SB	5.00	10.00	13187	02/19/91
		SB	20.00	25.00	13188	02/20/91
		SB	25.00	30.00	13189	02/20/91
		SB	25.00	30.00	13190	02/20/91
		SB	30.00	35.00	13191	02/20/91
		SB	40.00	45.00	13197	02/21/91
		SB	40.00	45.00	13198	02/21/91
		SB	45.00	50.00	13199	02/21/91
		SB	50.00	55.00	13200	02/21/91
		SB	55.00	60.00	13201	02/21/91
		SB	60.00	65.00	13202	02/21/91
		SB	65.00	70.00	13203	02/21/91
		WS	0.00	0.00	16033	02/21/91
		AQ	0.00	0.00	17040	02/21/91
H202	ON-SITE	SB	0.00	5.00	13248	02/25/91
		SB	5.00	10.00	13249	02/25/91
		SB	5.00	10.00	13250	02/25/91
		SB	10.00	15.00	13251	02/25/91
		SB	15.00	20.00	13252	02/25/91
		SB	20.00	25.00	13253	02/25/91
		SB	25.00	30.00	13254	02/25/91
		SB	30.00	35.00	13255	02/25/91
		SB	35.00	40.00	13286	02/27/91
		SB	40.00	45.00	13287	02/27/91
		SB	40.00	45.00	13288	02/27/91
		SB	45.00	50.00	13289	02/27/91
		SB	50.00	55.00	13290	02/27/91
		SB	55.00	60.00	13291	02/27/91
		WS	0.00	0.00	16044	02/27/91
		AQ	0.00	0.00	17045	02/22/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
H202	ON-SITE	AQ	0.00	0.00	17049	02/27/91
H203	ON-SITE	SB	0.00	5.00	13113	02/07/91
		SB	5.00	10.00	13114	02/05/91
		SB	10.00	15.00	13115	02/07/91
		SB	15.00	20.00	13116	02/07/91
		SB	20.00	25.00	13117	02/07/91
		SB	25.00	30.00	13118	02/07/91
		SB	30.00	35.00	13119	02/07/91
		SB	35.00	40.00	13120	02/07/91
		SB	35.00	40.00	13121	02/07/91
		SB	40.00	45.00	13125	02/08/91
		SB	45.00	50.00	13126	02/08/91
		SB	50.00	55.00	13127	02/08/91
		SB	55.00	60.00	13128	02/08/91
		SB	60.00	65.00	13129	02/08/91
		SB	65.00	70.00	13130	02/08/91
		SB	70.00	75.00	13131	02/08/91
		SB	70.00	75.00	13132	02/08/91
		WS	0.00	0.00	16025	02/08/91
		AQ	0.00	0.00	17032	02/07/91
		AQ	0.00	0.00	17033	02/08/91
H206	ON-SITE	SB	0.00	5.00	13301	02/28/91
		SB	5.00	10.00	13302	02/28/91
		SB	10.00	15.00	13303	02/28/91
		SB	10.00	15.00	13304	02/28/91
		SB	15.00	20.00	13305	02/28/91
		SB	20.00	25.00	13306	02/28/91
		SB	25.00	30.00	13307	02/28/91
		SB	30.00	35.00	13308	02/28/91
		SB	35.00	40.00	13309	02/28/91
		SB	40.00	45.00	13310	02/28/91
		SB	45.00	50.00	13311	02/28/91
		SB	50.00	55.00	13330	03/01/91
		SB	55.00	60.00	13331	03/05/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
H206	ON-SITE	SB	55.00	60.00	13332	03/05/91
		SB	60.00	65.00	13333	03/05/91
		SB	65.00	70.00	13334	03/05/91
		SB	70.00	75.00	13335	03/05/91
		SB	75.00	80.00	13336	03/05/91
		SB	80.00	85.00	13337	03/05/91
		SB	85.00	90.00	13338	03/05/91
		SB	95.00	100.00	13339	03/05/91
		WS	0.00	0.00	16049	03/05/91
H207	ON-SITE	SB	0.00	5.00	13256	02/26/91
		SB	5.00	10.00	13257	02/26/91
		SB	10.00	15.00	13258	02/26/91
		SB	15.00	20.00	13259	02/26/91
		SB	20.00	25.00	13260	02/26/91
		SB	25.00	30.00	13261	02/26/91
		SB	25.00	30.00	13262	02/26/91
		SB	30.00	35.00	13263	02/26/91
		SB	35.00	40.00	13264	02/26/91
		SB	40.00	45.00	13265	02/26/91
		SB	45.00	50.00	13266	02/26/91
		SB	50.00	55.00	13267	02/26/91
		SB	55.00	60.00	13277	02/27/91
		SB	60.00	65.00	13278	02/27/91
		SB	65.00	70.00	13279	02/27/91
		SB	70.00	75.00	13280	02/27/91
		SB	70.00	75.00	13281	02/27/91
		SB	75.00	80.00	13282	02/27/91
		SB	80.00	85.00	13283	02/27/91
		SB	85.00	90.00	13284	02/27/91
		SB	90.00	95.00	13285	02/27/91
		SB	95.00	100.00	13295	02/27/91
		SB	100.00	105.00	13296	02/28/91
		SB	105.00	110.00	13297	02/28/91
		WS	0.00	0.00	16045	02/28/91
		AQ	0.00	0.00	17046	02/26/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
H207	ON-SITE	AQ	0.00	0.00	17048	02/27/91
		AQ	0.00	0.00	17051	02/28/91
H208	ON-SITE	SB	5.00	10.00	13133	02/12/91
		SB	0.00	5.00	13135	02/12/91
		SB	10.00	15.00	13146	02/12/91
		SB	20.00	25.00	13147	02/13/91
		SB	25.00	30.00	13148	02/13/91
		SB	35.00	40.00	13165	02/18/91
		SB	30.00	35.00	13166	02/18/91
		SB	40.00	45.00	13167	02/19/91
		SB	50.00	55.00	13168	02/19/91
		SB	50.00	55.00	13169	02/19/91
		SB	65.00	70.00	13170	02/19/91
		SB	70.00	75.00	13171	02/19/91
		SB	60.00	65.00	13172	02/19/91
		SB	55.00	60.00	13173	02/19/91
		SB	45.00	50.00	13174	02/19/91
		SB	75.00	80.00	13192	02/21/91
		SB	80.00	85.00	13193	02/19/91
		SB	85.00	90.00	13194	02/19/91
		SB	90.00	95.00	13195	02/19/91
		SB	110.00	115.00	13215	02/21/91
		SB	115.00	120.00	13216	02/21/91
		SS	0.00	1.00	14091	04/03/91
		WS	0.00	0.00	16029	02/21/91
		AQ	0.00	0.00	17037	02/18/91
		AQ	0.00	0.00	17041	02/21/91
H209	ON-SITE	SB	0.00	5.00	13206	02/21/91
		SB	5.00	10.00	13207	02/21/91
		SB	10.00	15.00	13208	02/21/91
		SB	10.00	15.00	13209	02/21/91
		SB	15.00	20.00	13210	02/21/91
		SB	20.00	25.00	13211	02/21/91
		SB	25.00	30.00	13212	02/21/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
H209	ON-SITE	SB	30.00	35.00	13229	02/22/91
		SB	35.00	40.00	13230	02/22/91
		SB	40.00	45.00	13231	02/22/91
		SB	45.00	50.00	13232	02/22/91
		SB	45.00	50.00	13233	02/22/91
		SB	50.00	55.00	13234	02/22/91
		SB	55.00	60.00	13235	02/22/91
		SB	60.00	65.00	13236	02/22/91
		SB	65.00	70.00	13237	02/22/91
		SS	0.00	1.00	14089	04/03/91
		WS	0.00	0.00	16034	02/22/91
		AQ	0.00	0.00	17039	02/21/91
		AQ	0.00	0.00	17044	02/22/91
H210	ON-SITE	SB	0.00	5.00	13149	02/14/91
		SB	5.00	10.00	13150	02/14/91
		SB	12.00	15.00	13151	02/14/91
		SB	15.00	20.00	13152	02/14/91
		SB	20.00	25.00	13153	02/14/91
		SB	26.50	30.00	13154	02/14/91
		SB	30.00	35.00	13163	02/19/91
		SB	35.00	40.00	13164	02/19/91
		SB	40.00	45.00	13175	02/19/91
		SB	45.00	50.00	13176	02/19/91
		SB	45.00	50.00	13177	02/19/91
		SB	50.00	55.00	13178	02/19/91
		SB	57.00	60.00	13179	02/19/91
		SB	60.00	65.00	13180	02/19/91
		SB	65.00	70.00	13181	02/19/91
		SS	0.00	1.00	14090	04/03/91
		WS	0.00	0.00	16030	02/19/91
		AQ	0.00	0.00	17035	02/14/91
		AQ	0.00	0.00	17038	02/19/91
H211	ON-SITE	SB	15.00	20.00	13050	01/28/91
		SB	20.00	25.00	13051	01/23/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
H211	ON-SITE	SB	25.00	30.00	13052	01/23/91
		SB	30.00	35.00	13053	01/23/91
		SB	0.00	5.00	13054	01/23/91
		SB	10.00	15.00	13055	01/23/91
		SB	35.00	40.00	13056	01/23/91
		SB	5.00	10.00	13057	01/23/91
		SS	0.00	1.00	14102	04/10/91
		SS	0.00	1.00	14103	04/10/91
		WS	0.00	0.00	16015	01/23/91
		AQ	0.00	0.00	17026	01/23/91
		AQ	0.00	0.00	17072	04/10/91
H212	ON-SITE	SB	0.00	5.00	13071	01/28/91
		SB	5.00	10.00	13072	01/28/91
		SB	5.00	10.00	13073	01/28/91
		SB	12.00	15.00	13074	01/28/91
		SB	15.00	20.00	13075	01/28/91
		SB	20.00	25.00	13076	01/28/91
		SB	26.50	30.00	13077	01/28/91
		SB	32.00	35.00	13078	01/28/91
		SB	35.00	40.00	13079	01/28/91
		SS	0.00	1.00	14101	04/04/91
		WS	0.00	0.00	16019	01/28/91
		AQ	0.00	0.00	17029	01/28/91
H213	ON-SITE	SB	0.00	5.00	13085	01/29/91
		SB	5.00	10.00	13137	02/13/91
		SB	10.00	15.00	13138	02/13/91
		SB	15.00	20.00	13139	02/13/91
		SB	20.00	25.00	13140	02/13/91
		SB	25.00	30.00	13141	02/13/91
		SB	25.00	30.00	13142	02/13/91
		SB	30.00	35.00	13143	02/13/91
		SB	35.00	40.00	13144	02/13/91
		SS	0.00	1.00	14100	04/04/91
		WS	0.00	0.00	16020	01/31/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
H213	ON-SITE	WS	0.00	0.00	16028	02/13/91
		AQ	0.00	0.00	17071	04/04/91
H214	ON-SITE	SB	0.00	5.00	13136	02/11/91
		SB	5.00	10.00	13344	03/05/91
		SB	10.00	15.00	13345	03/05/91
		SB	15.00	20.00	13346	03/05/91
		SB	20.00	25.00	13347	03/05/91
		SB	25.00	30.00	13348	03/05/91
		SB	30.00	35.00	13349	03/05/91
		SB	35.00	40.00	13350	03/05/91
		SS	0.00	1.00	14104	04/10/91
		WS	0.00	0.00	16027	02/12/91
		WS	0.00	0.00	16051	03/05/91
		AQ	0.00	0.00	17034	02/11/91
		AQ	0.00	0.00	17054	03/05/91
H215	ON-SITE	SB	0.00	5.00	13238	02/26/91
		SB	5.00	10.00	13239	02/26/91
		SB	10.00	15.00	13240	02/26/91
		SB	10.00	15.00	13241	02/26/91
		SB	15.00	20.00	13242	02/26/91
		SB	20.00	25.00	13243	02/26/91
		SB	25.00	30.00	13244	02/26/91
		SB	30.00	35.00	13245	02/26/91
		SB	35.00	40.00	13246	02/26/91
		WS	0.00	0.00	16040	02/26/91
H216	ON-SITE	SB	0.00	5.00	13145	02/18/91
		SB	5.00	10.00	13155	02/18/91
		SB	10.00	15.00	13156	02/18/91
		SB	15.00	20.00	13157	02/18/91
		SB	20.00	25.00	13158	02/18/91
		SB	25.00	30.00	13159	02/18/91
		SB	25.00	30.00	13160	02/18/91
		SB	30.00	35.00	13161	02/18/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
H216	ON-SITE	SB	35.00	40.00	13162	02/18/91
		WS	0.00	0.00	16031	02/18/91
		AQ	0.00	0.00	17036	02/18/91
H217	ON-SITE	SB	0.00	5.00	13312	03/04/91
		SB	5.00	10.00	13313	03/04/91
		SB	12.00	15.00	13314	03/04/91
		SB	15.00	20.00	13315	03/04/91
		SB	15.00	20.00	13316	03/04/91
		SB	20.00	25.00	13317	03/04/91
		SB	25.00	30.00	13318	03/04/91
		SB	32.00	35.00	13319	03/04/91
		SB	36.50	40.00	13320	03/04/91
		WS	0.00	0.00	16047	03/04/91
		AQ	0.00	0.00	17053	03/04/91
H218	ON-SITE	SB	5.00	10.00	13321	03/04/91
		SB	5.00	10.00	13322	03/04/91
		SB	10.00	15.00	13323	03/04/91
		SB	15.00	20.00	13324	03/04/91
		SB	20.00	25.00	13325	03/04/91
		SB	25.00	30.00	13326	03/04/91
		SB	30.00	35.00	13327	03/04/91
		SB	35.00	40.00	13328	03/04/91
		WS	0.00	0.00	16048	03/04/91
		AQ	0.00	0.00	17052	03/04/91
H219	ON-SITE	SB	30.00	35.00	13058	01/24/91
		SB	25.00	30.00	13059	01/24/91
		SB	10.00	15.00	13060	01/24/91
		SB	15.00	20.00	13065	01/24/91
		SB	20.00	25.00	13066	01/24/91
		SB	0.00	5.00	13067	01/24/91
		SB	5.00	10.00	13068	01/24/91
		SB	35.00	40.00	13069	01/24/91
		SB	35.00	40.00	13070	01/24/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
H219	ON-SITE	SB	40.00	45.00	13080	01/28/91
		SB	65.00	70.00	13081	01/28/91
		SB	65.00	70.00	13082	01/28/91
		SB	45.00	50.00	13083	01/28/91
		SB	50.00	55.00	13084	01/28/91
		SB	85.00	90.00	13087	01/29/91
		WS	0.00	0.00	16018	01/29/91
		AQ	0.00	0.00	17027	01/24/91
H220	ON-SITE	SB	0.00	5.00	13086	02/01/91
		SB	5.00	10.00	13088	02/01/91
		SB	5.00	10.00	13089	02/01/91
		SB	10.00	15.00	13090	02/01/91
		SB	15.00	20.00	13091	02/01/91
		SB	20.00	25.00	13092	02/01/91
		SB	25.00	30.00	13093	02/01/91
		SB	30.00	35.00	13094	02/01/91
		SB	35.00	40.00	13095	02/01/91
		WS	0.00	0.00	16021	02/01/91
H221	ON-SITE	SB	0.00	5.00	13353	03/06/91
		SB	5.00	10.00	13354	03/06/91
		SB	10.00	15.00	13355	03/06/91
		SB	10.00	15.00	13356	03/06/91
		SB	15.00	20.00	13357	03/06/91
		SB	20.00	25.00	13358	03/06/91
		SB	25.00	30.00	13359	03/06/91
		SB	30.00	35.00	13360	03/06/91
		SB	35.00	40.00	13361	03/06/91
		WS	0.00	0.00	16050	03/06/91
		AQ	0.00	0.00	17055	03/06/91
H222	ON-SITE	SB	0.00	5.00	13064	02/04/91
		SB	5.00	10.00	13096	02/04/91
		SB	10.00	15.00	13097	02/04/91
		SB	15.00	20.00	13098	02/04/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
H222	ON-SITE	SB	20.00	25.00	13099	02/04/91
		SB	20.00	25.00	13100	02/04/91
		SB	25.00	30.00	13101	02/04/91
		SB	30.00	35.00	13102	02/04/91
		SB	35.00	40.00	13103	02/04/91
		WS	0.00	0.00	16023	02/04/91
		AQ	0.00	0.00	17030	02/04/91
H223	ON-SITE	SB	0.00	5.00	13220	02/22/91
		SB	5.00	10.00	13221	02/22/91
		SB	10.00	15.00	13222	02/22/91
		SB	10.00	15.00	13223	02/22/91
		SB	15.00	20.00	13224	02/22/91
		SB	20.00	25.00	13225	02/22/91
		SB	25.00	30.00	13226	02/22/91
		SB	30.00	35.00	13227	02/22/91
		SB	35.00	40.00	13228	02/22/91
		WS	0.00	0.00	16036	02/22/91
		AQ	0.00	0.00	17043	02/22/91
H224	ON-SITE	SB	0.00	5.00	13268	02/28/91
		SB	5.00	10.00	13274	02/28/91
		SB	10.00	15.00	13276	02/28/91
		SB	10.00	15.00	13292	02/28/91
		SB	15.00	20.00	13293	02/28/91
		SB	20.00	25.00	13294	02/28/91
		SB	25.00	30.00	13298	02/28/91
		SB	30.00	35.00	13299	02/28/91
		SB	35.00	40.00	13300	02/28/91
		WS	0.00	0.00	16046	02/28/91
		AQ	0.00	0.00	17050	02/28/91
H225	ON-SITE	SB	0.00	5.00	13104	02/05/91
		SB	5.00	10.00	13105	02/05/91
		SB	10.00	15.00	13106	02/05/91
		SB	15.00	20.00	13107	02/05/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
H225	ON-SITE	SB	15.00	20.00	13108	02/05/91
		SB	20.00	25.00	13109	02/05/91
		SB	25.00	30.00	13110	02/05/91
		SB	30.00	35.00	13111	02/05/91
		SB	35.00	40.00	13112	02/05/91
		WS	0.00	0.00	16024	02/05/91
		AQ	0.00	0.00	17031	02/05/91
H226	ON-SITE	SB	10.00	15.00	13182	02/22/91
		SB	10.00	15.00	13183	02/22/91
		SB	0.00	5.00	13204	02/22/91
		SB	5.00	10.00	13205	02/22/91
		SB	30.00	35.00	13213	02/22/91
		SB	35.00	40.00	13214	02/22/91
		SB	15.00	20.00	13217	02/22/91
		SB	20.00	25.00	13218	02/22/91
		SB	25.00	30.00	13219	02/22/91
		WS	0.00	0.00	16035	02/22/91
		AQ	0.00	0.00	17042	02/22/91
H227	ON-SITE	SB	0.00	5.00	13247	02/27/91
		SB	10.00	15.00	13269	02/27/91
		SB	10.00	15.00	13270	02/27/91
		SB	15.00	20.00	13271	02/27/91
		SB	20.00	25.00	13272	02/27/91
		SB	30.00	35.00	13273	02/27/91
		SB	35.00	40.00	13275	02/27/91
		WS	0.00	0.00	16041	02/27/91
		AQ	0.00	0.00	17047	02/27/91
H251	ON-SITE	SS	0.00	1.00	14006	03/07/91
		SS	2.00	4.00	14007	03/07/91
		SS	4.00	6.00	14008	03/07/91
H252	ON-SITE	SS	0.00	1.00	14016	03/08/91
		SS	2.00	4.00	14017	03/08/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
H252	ON-SITE	SS	4.00	6.00	14018	03/08/91
H253	ON-SITE	SS	0.00	1.00	14003	03/07/91
		SS	2.00	4.00	14004	03/07/91
		SS	4.00	6.00	14005	03/07/91
H254	ON-SITE	SS	0.00	1.00	14009	03/08/91
		SS	0.00	1.00	14010	03/08/91
		SS	2.00	4.00	14011	03/08/91
		SS	4.00	6.00	14012	03/08/91
H255	ON-SITE	SS	0.00	1.00	14000	03/07/91
		SS	2.00	4.00	14001	03/07/91
		SS	4.00	6.00	14002	03/07/91
H256	ON-SITE	SS	0.00	1.00	14029	03/11/91
		SS	2.00	4.00	14030	03/11/91
		SS	4.00	6.00	14031	03/11/91
		AQ	0.00	0.00	17058	03/11/91
H257	ON-SITE	SS	0.00	1.00	14019	03/11/91
		SS	0.00	1.00	14020	03/11/91
		SS	2.00	4.00	14021	03/11/91
		SS	4.00	6.00	14022	03/11/91
H258	ON-SITE	SS	0.00	1.00	14026	03/11/91
		SS	2.00	4.00	14027	03/11/91
		SS	4.00	6.00	14028	03/11/91
H259	ON-SITE	SS	1.00	2.00	14023	03/11/91
		SS	2.00	4.00	14024	03/11/91
		SS	4.00	6.00	14025	03/11/91
H260	ON-SITE	SS	0.00	1.00	14032	03/12/91
		SS	0.00	1.00	14033	03/12/91
		SS	2.00	4.00	14034	03/12/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
H260	ON-SITE	SS	4.00	6.00	14035	03/12/91
H261	ON-SITE	SS	0.00	1.00	14047	03/15/91
		SS	2.00	4.00	14048	03/15/91
		SS	4.00	6.00	14049	03/15/91
H262	ON-SITE	SS	0.00	1.00	14040	03/13/91
		SS	0.00	1.00	14041	03/13/91
		SS	2.00	4.00	14042	03/13/91
		SS	4.00	6.00	14043	03/13/91
		AQ	0.00	0.00	17062	03/13/91
H263	ON-SITE	SS	0.00	1.00	14044	03/14/91
		SS	2.00	4.00	14045	03/14/91
		SS	4.00	6.00	14046	03/14/91
H264	ON-SITE	SS	0.00	1.00	14013	03/08/91
		SS	2.00	4.00	14014	03/08/91
		SS	4.00	6.00	14015	03/08/91
		AQ	0.00	0.00	17056	03/08/91
H265	ON-SITE	SS	0.00	1.00	14036	03/12/91
		SS	2.00	4.00	14037	03/12/91
		SS	4.00	6.00	14038	03/12/91
		SS	6.00	9.00	14039	03/12/91
		AQ	0.00	0.00	17061	03/12/91
H266	ON-SITE	WS	0.00	0.00	16053	03/13/91
H267	ON-SITE	WS	0.00	0.00	16058	03/14/91
H268	ON-SITE	WS	0.00	0.00	16057	03/15/91
H270	ON-SITE	WS	0.00	60.00	16060	03/18/91
H271	ON-SITE	WS	0.00	0.00	16061	03/18/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
H272	ON-SITE	WS	0.00	0.00	16062	03/21/91
H301	ON-SITE	SS	0.00	5.00	14050	03/28/91
		SS	5.00	10.00	14051	03/28/91
		SS	13.00	15.00	14052	03/28/91
		WS	0.00	0.00	16067	03/28/91
H302	ON-SITE	SS	0.00	0.50	14112	04/11/91
H303	ON-SITE	SS	0.00	0.50	14117	04/25/91
H304	ON-SITE	SS	0.00	0.50	14115	04/11/91
		SS	0.00	0.50	14116	04/11/91
		AQ	0.00	0.00	17073	04/11/91
H305	ON-SITE	SS	0.00	0.50	14114	04/11/91
H306	ON-SITE	SS	0.00	0.50	14113	04/11/91
H307	ON-SITE	SS	0.00	5.00	14053	03/28/91
		SS	5.00	10.00	14054	03/28/91
		SS	5.00	10.00	14055	03/28/91
		SS	10.00	15.00	14056	03/28/91
		WS	0.00	0.00	16068	03/28/91
H308	ON-SITE	SS	0.00	0.50	14118	04/24/91
H309	ON-SITE	SS	0.00	0.50	14119	04/24/91
H310	ON-SITE	SS	0.00	0.50	14120	04/24/91
		AQ	0.00	0.00	17074	04/24/91
H311	ON-SITE	SS	0.00	0.50	14077	04/02/91
H312	ON-SITE	SS	0.00	0.50	14076	04/02/91
H313	ON-SITE	SS	3.00	5.00	14061	04/01/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
H313	ON-SITE	SS	8.00	10.00	14062	04/01/91
		SS	13.00	15.00	14063	04/01/91
		WS	0.00	0.00	16070	04/01/91
H314	ON-SITE	SS	0.00	0.50	14073	04/02/91
H315	ON-SITE	SS	0.00	0.50	14071	04/02/91
H316	ON-SITE	SS	0.00	0.50	14074	04/02/91
H317	ON-SITE	SS	0.00	0.50	14075	04/02/91
H318	ON-SITE	SS	0.00	0.50	14072	04/02/91
H320	ON-SITE	SS	0.00	0.50	14070	04/01/91
H321	ON-SITE	SS	0.00	0.50	14069	04/01/91
H322	ON-SITE	SS	0.00	0.50	14064	04/01/91
		AQ	0.00	0.00	17069	04/01/91
H325	ON-SITE	SS	0.00	0.50	14088	04/03/91
H326	ON-SITE	SS	0.00	0.50	14092	04/03/91
H327	ON-SITE	SS	0.00	0.50	14093	04/04/91
		SS	0.00	0.50	14094	04/04/91
		AQ	0.00	0.00	17070	04/04/91
H328	ON-SITE	SS	0.00	0.50	14087	04/03/91
H329	ON-SITE	SS	3.00	5.00	14057	03/27/91
		SS	8.00	10.00	14058	03/28/91
		SS	13.00	15.00	14059	03/28/91
		WS	0.00	0.00	16069	03/28/91
		AQ	0.00	0.00	17067	03/28/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
H330	ON-SITE	SS	0.00	0.50	14086	04/03/91
H331	ON-SITE	SS	3.00	5.00	14065	04/02/91
		SS	8.00	10.00	14066	04/02/91
		SS	13.00	15.00	14067	04/02/91
		SS	13.00	15.00	14068	04/02/91
		WS	0.00	0.00	16071	04/02/91
H332	ON-SITE	SS	0.00	0.50	14083	04/03/91
H333	ON-SITE	SS	0.00	0.50	14080	04/03/91
		SS	0.00	0.50	14081	04/03/91
H334	ON-SITE	SS	0.00	0.50	14082	04/03/91
H335	ON-SITE	SS	0.00	0.50	14084	04/03/91
H336	ON-SITE	SS	0.00	0.50	14085	04/03/91
H337	ON-SITE	SS	0.00	0.50	14126	04/25/91
H338	ON-SITE	SS	0.00	0.50	14127	04/25/91
H339	ON-SITE	SS	0.00	0.50	14060	04/01/91
H340	ON-SITE	SS	0.00	0.50	14171	05/06/91
H341	ON-SITE	SS	0.00	0.50	14172	05/06/91
H342	ON-SITE	SS	0.00	0.50	14095	04/04/91
H343	ON-SITE	SS	0.00	0.50	14125	04/25/91
H344	ON-SITE	SS	0.00	0.50	14124	04/25/91
H345	ON-SITE	SS	0.00	0.50	14123	04/25/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
H346	ON-SITE	SS	0.00	0.50	14121	04/25/91
H347	ON-SITE	SS	0.00	0.50	14122	04/25/91
H348	ON-SITE	SS	4.00	5.00	14105	04/08/91
		SS	9.00	10.00	14106	04/08/91
		SS	14.00	15.00	14107	04/08/91
		SS	14.00	15.00	14108	04/08/91
H350	ON-SITE	SS	0.00	1.00	14178	05/07/91
		SS	0.00	1.00	14179	05/07/91
		SS	4.00	5.00	14180	05/07/91
		SS	4.00	5.00	14181	05/07/91
		AQ	0.00	0.00	17082	05/07/91
		AQ	0.00	0.00	17083	05/07/91
H351	ON-SITE	SS	0.00	0.50	14165	05/06/91
		SS	0.00	0.50	14166	05/06/91
H352	ON-SITE	SS	0.00	0.50	14167	05/06/91
H353	ON-SITE	SS	0.00	0.50	14168	05/06/91
H354	ON-SITE	SS	0.00	0.50	14169	05/06/91
H355	ON-SITE	SS	0.00	0.50	14151	05/03/91
H356	ON-SITE	SS	0.00	0.50	14150	05/03/91
H357	ON-SITE	SS	0.00	0.50	14161	05/03/91
H358	ON-SITE	SS	0.00	0.50	14160	05/03/91
H361	ON-SITE	SS	0.00	0.50	14143	04/30/91
		SS	0.00	0.50	14144	04/30/91
H362	ON-SITE	SS	0.00	0.50	14145	04/30/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
H363	ON-SITE	SS	0.00	0.50	14146	05/01/91
H364	ON-SITE	SS	0.00	0.50	14139	04/30/91
H365	ON-SITE	SS	0.00	0.50	14140	04/30/91
H366	ON-SITE	SS	0.00	0.00	14141	04/30/91
		AQ	0.00	0.00	17077	04/30/91
H367	ON-SITE	SS	0.00	0.50	14147	05/01/91
H368	ON-SITE	SS	0.00	0.50	14149	05/01/91
H369	ON-SITE	SS	0.00	0.50	14158	05/06/91
H370	ON-SITE	SS	0.00	0.50	14156	05/06/91
H371	ON-SITE	SS	0.00	0.50	14157	05/06/91
H372	ON-SITE	SS	0.00	0.50	14159	05/06/91
		SS	0.00	0.50	14164	05/06/91
H373	ON-SITE	SS	0.00	0.50	14138	04/30/91
H374	ON-SITE	SS	0.00	0.50	14142	04/30/91
H375	ON-SITE	SS	0.00	0.50	14148	05/01/91
H380	ON-SITE	SS	5.00	6.00	14184	05/11/91
H381	ON-SITE	SS	5.00	6.00	14182	05/11/91
H382	ON-SITE	SS	3.00	4.00	14183	05/11/91
LBC001	BACKGRND	SW	0.00	0.00	11031	04/23/91
		SD	0.00	0.00	12031	04/23/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
LBC002	BACKGRND	SW	0.00	0.00	11022	04/24/91
		SD	0.00	0.00	12022	04/24/91
LBC003	LBC	SW	0.00	0.00	11023	04/23/91
		SD	0.00	0.00	12023	04/23/91
LBC004	LBC	SW	0.00	0.00	11024	04/23/91
		SW	0.00	0.00	11025	04/23/91
		SD	0.00	0.00	12024	04/23/91
		SD	0.00	0.00	12025	04/23/91
LBC005	LBC	SW	0.00	0.00	11026	04/24/91
		SD	0.00	0.00	12026	04/24/91
LBC006	LBC	SW	0.00	0.00	11027	04/24/91
		SD	0.00	0.00	12027	04/24/91
LBC007	LBC	SW	0.00	0.00	11028	04/24/91
		SD	0.00	0.00	12028	04/24/91
LBC008	LBC	SW	0.00	0.00	11029	04/25/91
		SD	0.00	0.00	12029	04/25/91
LBC009	LBC	SW	0.00	0.00	11021	04/22/91
		SD	0.00	0.00	12021	04/22/91
LBC010	LBC	SW	0.00	0.00	11032	04/25/91
		SD	0.00	0.00	12032	04/25/91
MET 2	OFFST-DG	GW	0.00	0.00	10157	03/27/91
MET 3	OFF-SITE	GW	0.00	0.00	10158	03/27/91
MW007	ON-SITE	GW	0.00	0.00	10067	04/02/91
MW012	OFF-SITE	GW	0.00	0.00	10068	03/26/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
MW021	OFF-SITE	GW	0.00	0.00	10069	03/26/91
MW022	OFFST-DG	GW	0.00	0.00	10070	03/29/91
		GW	0.00	0.00	10141	03/29/91
MW038	OFF-SITE	GW	0.00	0.00	10071	04/04/91
MW041	OFF-SITE	GW	0.00	0.00	10072	04/04/91
MW042	ON-SITE	GW	0.00	0.00	10073	04/04/91
		GW	0.00	0.00	10074	04/04/91
MW043	OFFST-UG	GW	0.00	0.00	10075	04/24/91
MW044	OFF-SITE	GW	0.00	0.00	10076	04/04/91
MW048	ON-SITE	GW	0.00	0.00	10077	04/03/91
MW049	ON-SITE	GW	0.00	0.00	10078	04/03/91
MW053	ON-SITE	GW	0.00	0.00	10082	04/23/91
MW054	ON-SITE	GW	0.00	0.00	10083	04/24/91
MW063	OFF-SITE	GW	0.00	0.00	10084	03/08/91
MW064	ON-SITE	GW	0.00	0.00	10085	03/12/91
MW065	OFF-SITE	GW	0.00	0.00	10086	03/08/91
MW066	ONST-DG	GW	0.00	0.00	10087	03/11/91
		GW	0.00	0.00	10899	04/08/91
MW067	ONST-DG	GW	0.00	0.00	10088	03/11/91
		GW	0.00	0.00	10089	03/11/91
MW068	ONSITE	GW	0.00	0.00	10090	03/14/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
MW070	ON-SITE	GW	0.00	0.00	10151	03/13/91
MW071	ON-SITE	GW	0.00	0.00	10152	03/25/91
MW074	ONST-DG	GW	0.00	0.00	10091	03/25/91
MW084	ON-SITE	GW	0.00	0.00	10092	03/19/91
					10092 IX	
MW085	ON-SITE	GW	0.00	0.00	10093	03/12/91
					10093 IX	
MW086	ON-SITE	GW	0.00	0.00	10094	03/19/91
					10094 IX	
		GW	0.00	0.00	10095	03/19/91
MW087	ON-SITE	GW	0.00	0.00	10096	03/20/91
					10096 IX	
MW088	ON-SITE	GW	0.00	0.00	10097	03/20/91
					10097 IX	
		GW	0.00	0.00	10098	03/20/91
					10098 IX	
MW089	ON-SITE	GW	0.00	0.00	10099	03/20/91
					10099 IX	
MW090	ON-SITE	GW	0.00	0.00	10100	03/21/91
					10100 IX	
MW091	ONST-DG	GW	0.00	0.00	10101	03/21/91
					10101 IX	
MW092	ONST-DG	GW	0.00	0.00	10102	03/21/91
					10102 IX	
MW093	ONST-UG	GW	0.00	0.00	10103	03/22/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
MW093	ONST-UG	GW	0.00	0.00	10103 IX	
		GW	0.00	0.00	10104	03/22/91
MW094	ON-SITE	GW	0.00	0.00	10105	03/21/91
					10105 IX	
MW095	ON-SITE	GW	0.00	0.00	10106	03/21/91
					10106 IX	
MW120	BACKGRND	GW	0.00	0.00	10107	02/28/91
MW121	OFF-SITE	GW	0.00	0.00	10001	03/25/91
		GW	0.00	0.00	10180	04/30/91
MW122	OFF-SITE	GW	0.00	0.00	10005	03/11/91
MW123	OFFST-DG	GW	0.00	0.00	10002	03/20/91
		GW	0.00	0.00	10181	04/29/91
MW124	OFF-SITE	GW	0.00	0.00	10006	03/25/91
MW125	OFFST-DG	GW	0.00	0.00	10003	03/20/91
		GW	0.00	0.00	10182	04/29/91
MW126	OFF-SITE	GW	0.00	0.00	10007	03/11/91
MW127	OFFST-DG	GW	0.00	0.00	10004	03/20/91
		GW	0.00	0.00	10183	04/30/91
MW128	OFF-SITE	GW	0.00	0.00	10008	03/11/91
		AQ	0.00	0.00	17059	03/12/91
MW129	BACKGRND	GW	0.00	0.00	10110	02/28/91
MW130	BACKGRND	GW	0.00	0.00	10108	02/28/91
MW131	BACKGRND	GW	0.00	0.00	10109	02/28/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
MW132	OFFST-DG	GW	0.00	0.00	10018	03/18/91
		GW	0.00	0.00	10019	03/18/91
MW133	OFF-SITE	GW	0.00	0.00	10014	03/01/91
MW134	OFFST-DG	GW	0.00	0.00	10023	03/18/91
MW135	OFF-SITE	GW	0.00	0.00	10015	03/01/91
MW137	OFF-SITE	GW	0.00	0.00	10016	03/01/91
MW138	OFF-SITE	GW	0.00	0.00	10017	03/13/91
MW139	OFFST-DG	GW	0.00	0.00	10020	03/18/91
MW140	BACKGRND	GW	0.00	0.00	10009	03/14/91
		GW	0.00	0.00	10010	03/14/91
MW141	BACKGRND	GW	0.00	0.00	10011	03/13/91
MW142	BACKGRND	GW	0.00	0.00	10012	03/14/91
MW143	BACKGRND	GW	0.00	0.00	10013	03/13/91
MW144	OFF-SITE	GW	0.00	0.00	10024	03/05/91
MW145	OFF-SITE	GW	0.00	0.00	10025	03/07/91
MW146	OFFST-DG	GW	0.00	0.00	10021	03/15/91
		GW	0.00	0.00	10184	05/02/91
MW147	OFFST-DG	GW	0.00	0.00	10022	03/15/91
		GW	0.00	0.00	10185	05/02/91
MW148	OFFST-DG	GW	0.00	0.00	10027	03/19/91
		GW	0.00	0.00	10028	03/19/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
MW148	OFFST-DG	GW	0.00	0.00	10186	05/09/91
MW149	OFFST-DG	GW	0.00	0.00	10029	03/19/91
		GW	0.00	0.00	10187	05/09/91
MW150	BACKGRND	GW	0.00	0.00	10030	03/21/91
MW151	BACKGRND	GW	0.00	0.00	10031	03/22/91
MW152	OFFST-DG	GW	0.00	0.00	10032	03/21/91
		GW	0.00	0.00	10188	05/09/91
		GW	0.00	0.00	10189	05/09/91
MW153	OFFST-DG	GW	0.00	0.00	10033	03/21/91
		GW	0.00	0.00	10190	05/12/91
MW154	ON-SITE	GW	0.00	0.00	10034	04/02/91
MW155	ON-SITE	GW	0.00	0.00	10111	03/13/91
		GW	0.00	0.00	10191	05/06/91
		SB	40.00	45.00	13011	12/06/90
		WS	0.00	0.00	16001	12/11/90
MW156	ON-SITE	GW	0.00	0.00	10112	03/15/91
		GW	0.00	0.00	10192	05/08/91
MW157	ON-SITE	GW	0.00	0.00	10113	03/15/91
		GW	0.00	0.00	10193	05/06/91
MW158	ON-SITE	GW	0.00	0.00	10114	03/28/91
		GW	0.00	0.00	10115	03/28/91
		GW	0.00	0.00	10194	05/10/91
		GW	0.00	0.00	10195	05/10/91
		WS	0.00	0.00	16000	12/07/90
MW159	ON-SITE	GW	0.00	0.00	10116	03/14/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
MW159	ON-SITE	GW	0.00	0.00	10196	05/10/91
MW160	ON-SITE	GW	0.00	0.00	10117	04/01/91
		GW	0.00	0.00	10197	05/10/91
MW161	ON-SITE	GW	0.00	0.00	10118	03/28/91
		GW	0.00	0.00	10198	05/08/91
		SB	30.00	35.00	13006	11/29/90
		SB	45.00	50.00	13007	12/06/90
		SB	50.00	55.00	13008	12/06/90
		WS	0.00	0.00	16004	12/06/90
MW162	ON-SITE	GW	0.00	0.00	10119	03/27/91
		GW	0.00	0.00	10120	03/27/91
		GW	0.00	0.00	10199	05/08/91
		GW	0.00	0.00	10200	05/08/91
MW163	ON-SITE	GW	0.00	0.00	10121	03/20/91
		GW	0.00	0.00	10201	05/09/91
		SB	5.00	10.00	13009	12/11/90
		SB	35.00	40.00	13010	12/11/90
		SB	50.00	55.00	13016	12/11/90
		WS	0.00	0.00	16002	12/14/90
MW164	ON-SITE	GW	0.00	0.00	10122	03/21/91
		GW	0.00	0.00	10251	05/30/91
		AQ	0.00	0.00	10996	05/30/91
					10996 WS	
MW165	ON-SITE	GW	0.00	0.00	10123	03/20/91
		GW	0.00	0.00	10252	05/29/91
		SB	5.00	10.00	13000	12/19/90
		SB	5.00	10.00	13001	12/19/90
		WS	0.00	0.00	16003	01/02/91
		AQ	0.00	0.00	17021	12/19/90
MW166	ON-SITE	GW	0.00	0.00	10124	03/20/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
MW166	ON-SITE	GW	0.00	0.00	10204	05/13/91
		AQ	0.00	0.00	17085	05/14/91
MW167	ON-SITE	GW	0.00	0.00	10125	03/25/91
		GW	0.00	0.00	10205	04/30/91
MW168	ON-SITE	GW	0.00	0.00	10127	03/21/91
		GW	0.00	0.00	10206	05/06/91
		GW	0.00	0.00	10207	05/06/91
		SB	5.00	10.00	13017	12/20/90
		SB	25.00	30.00	13018	12/20/90
		SB	30.00	35.00	13019	12/20/90
		WS	0.00	0.00	16006	01/14/91
MW169	ON-SITE	GW	0.00	0.00	10128	03/25/91
		GW	0.00	0.00	10129	03/25/91
		GW	0.00	0.00	10208	04/29/91
		SB	0.00	5.00	13012	01/02/91
		SB	30.00	35.00	13013	01/02/91
		WS	0.00	0.00	16008	01/08/91
MW170	ON-SITE	GW	0.00	0.00	10130	03/25/91
		GW	0.00	0.00	10209	04/30/91
MW171	ON-SITE	GW	0.00	0.00	10131	03/19/91
		GW	0.00	0.00	10210	05/07/91
		SB	0.00	5.00	13002	01/04/91
		SB	5.00	10.00	13003	01/04/91
		SB	15.00	20.00	13004	01/04/91
		WS	0.00	0.00	16005	01/04/91
MW172	ON-SITE	GW	0.00	0.00	10132	03/26/91
		GW	0.00	0.00	10211	05/07/91
		SB	0.00	5.00	13005	01/08/91
		SB	0.00	5.00	13021	01/08/91
		SB	5.00	10.00	13022	01/08/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
MW172	ON-SITE	SB	15.00	20.00	13023	01/08/91
		WS	0.00	0.00	16007	01/08/91
		AQ	0.00	0.00	17022	01/08/91
MW173	ON-SITE	GW	0.00	0.00	10133	03/26/91
		GW	0.00	0.00	10212	05/10/91
		SB	0.00	5.00	13024	01/09/91
		SB	5.00	10.00	13025	01/09/91
		SB	15.00	20.00	13026	01/09/91
		WS	0.00	0.00	16009	01/15/91
MW174	ON-SITE	GW	0.00	0.00	10134	03/27/91
		GW	0.00	0.00	10213	05/10/91
MW175	ON-SITE	GW	0.00	0.00	10135	03/19/91
		GW	0.00	0.00	10214	05/07/91
		SB	0.00	5.00	13014	01/09/91
		SB	5.00	10.00	13015	01/09/91
		SB	10.00	15.00	13027	01/09/91
		SB	15.00	20.00	13028	01/09/91
		SB	20.00	25.00	13029	01/09/91
		SB	25.00	30.00	13030	01/09/91
		SB	30.00	35.00	13031	01/09/91
		SB	35.00	40.00	13032	01/09/91
		SB	35.00	40.00	13033	01/09/91
		WS	0.00	0.00	16010	01/15/91
		AQ	0.00	0.00	17023	01/09/91
MW177	ON-SITE	GW	0.00	0.00	10137	03/19/91
		GW	0.00	0.00	10216	05/09/91
		AQ	0.00	0.00	17084	05/09/91
MW178	ON-SITE	GW	0.00	0.00	10138	03/18/91
		GW	0.00	0.00	10217	05/01/91
		SB	0.00	14.00	13020	01/17/91
		SB	14.00	19.00	13034	01/17/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
MW178	ON-SITE	SB	19.00	24.00	13035	01/17/91
		SB	24.00	29.00	13036	01/17/91
		SB	29.00	34.00	13037	01/17/91
		SB	34.00	39.00	13038	01/17/91
		WS	0.00	0.00	16011	01/22/91
		AQ	0.00	0.00	17024	01/17/91
MW179	OFFST-DG	GW	0.00	0.00	10139	03/27/91
		GW	0.00	0.00	10153	03/27/91
		GW	0.00	0.00	10218	05/01/91
		WS	0.00	0.00	16022	02/04/91
MW180	OFFST-DG	GW	0.00	0.00	10140	03/27/91
		GW	0.00	0.00	10219	05/08/91
		AQ	0.00	0.00	17068	03/28/91
MW181	ON-SITE	GW	0.00	0.00	10142	03/29/91
		GW	0.00	0.00	10220	05/03/91
		GW	0.00	0.00	10221	05/03/91
		SB	5.00	10.00	13122	02/06/91
		SB	5.00	10.00	13123	02/06/91
		SB	25.00	30.00	13124	02/06/91
		SB	45.00	50.00	13134	02/11/91
		WS	0.00	0.00	16026	02/11/91
		AQ	0.00	0.00	17078	05/03/91
MW182	OFFST-DG	GW	0.00	0.00	10169	04/02/91
		GW	0.00	0.00	10222	05/03/91
MW183	ON-SITE	SB	10.00	15.00	13061	01/24/91
		SB	15.00	20.00	13062	01/24/91
		SB	15.00	20.00	13063	01/24/91
		WS	0.00	0.00	16017	01/29/91
		AQ	0.00	0.00	17028	01/28/91
MW184	OFF-SITE	GW	0.00	0.00	10144	04/03/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
MW184	OFF-SITE	GW	0.00	0.00	10223	05/03/91
		GW	0.00	0.00	10224	05/03/91
MW185	ONST-DG	GW	0.00	0.00	10126	03/26/91
		GW	0.00	0.00	10145	03/26/91
		GW	0.00	0.00	10225	05/13/91
		SB	5.00	10.00	13040	01/17/91
		SB	15.00	20.00	13041	01/17/91
		SB	35.00	40.00	13042	01/17/91
		WS	0.00	0.00	16012	01/22/91
MW186	ONST-DG	GW	0.00	0.00	10146	03/26/91
		GW	0.00	0.00	10226	05/13/91
		AQ	0.00	0.00	17086	05/14/91
MW187	ON-SITE	GW	0.00	0.00	10147	03/26/91
		GW	0.00	0.00	10227	05/13/91
		SB	5.00	10.00	13043	01/17/91
		SB	15.00	20.00	13044	01/17/91
		SB	25.00	30.00	13045	01/17/91
		WS	0.00	0.00	16013	01/17/91
MW188	ON-SITE	GW	0.00	0.00	10148	03/27/91
		GW	0.00	0.00	10228	05/11/91
		SB	5.00	10.00	13047	01/22/91
		SB	5.00	10.00	13048	01/22/91
		SB	15.00	20.00	13049	01/22/91
		WS	0.00	0.00	16016	01/23/91
		AQ	0.00	0.00	17025	01/22/91
		AQ	0.00	0.00	17066	03/27/91
MW189	ON-SITE	GW	0.00	0.00	10149	03/27/91
		GW	0.00	0.00	10229	05/11/91
		AQ	0.00	0.00	17065	03/27/91
MW190	ON-SITE	GW	0.00	0.00	10150	03/28/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
MW190	ON-SITE	GW	0.00	0.00	10230	05/13/91
		SB	5.00	10.00	13039	01/18/91
		SB	15.00	20.00	13046	01/18/91
		WS	0.00	0.00	16014	01/18/91
MW191	ON-SITE	GW	0.00	0.00	10170	04/01/91
		GW	0.00	0.00	10231	05/06/91
		WS	0.00	0.00	16056	03/14/91
MW192	ONST-DG	GW	0.00	0.00	10171	04/23/91
		GW	0.00	0.00	10232	05/06/91
MW193	ON-SITE	GW	0.00	0.00	10160	05/06/91
		GW	0.00	0.00	10233	05/08/91
		WS	0.00	0.00	16059	03/18/91
		WS	0.00	0.00	16073	04/26/91
		AQ	0.00	0.00	17079	05/06/91
MW194	ON-SITE	GW	0.00	0.00	10154	03/19/91
		GW	0.00	0.00	10234	05/01/91
		GW	0.00	0.00	10235	05/01/91
		WS	0.00	0.00	16052	03/08/91
MW195	ON-SITE	GW	0.00	0.00	10155	03/19/91
		GW	0.00	0.00	10236	05/07/91
		WS	0.00	0.00	16054	03/12/91
MW196	BACKGRND	GW	0.00	0.00	10173	04/22/91
		GW	0.00	0.00	10237	05/09/91
		SB	15.00	20.00	13362	03/18/91
MW197	ON-SITE	GW	0.00	0.00	10174	04/03/91
		GW	0.00	0.00	10238	05/03/91
		WS	0.00	0.00	16064	03/25/91
MW198	OFF-SITE	GW	0.00	0.00	10175	05/01/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
MW198	OFF-SITE	GW	0.00	0.00	10239	05/07/91
MW199	ONST-DG	GW	0.00	0.00	10240	05/14/91
		GW	0.00	0.00	10250	05/21/91
		WS	0.00	0.00	16076	05/08/91
MW200	OFFST-DG	GW	0.00	0.00	10172	04/02/91
		GW	0.00	0.00	10241	04/30/91
		WS	0.00	0.00	16063	03/20/91
MW201	ON-SITE	GW	0.00	0.00	10177	04/25/91
		GW	0.00	0.00	10242	05/07/91
		GW	0.00	0.00	10898	04/25/91
		WS	0.00	0.00	16065	03/27/91
MW202	OFF-SITE	GW	0.00	0.00	10168	04/02/91
		GW	0.00	0.00	10243	05/02/91
MW203	ON-SITE	GW	0.00	0.00	10178	04/25/91
		GW	0.00	0.00	10244	05/09/91
		WS	0.00	0.00	16072	04/03/91
		AQ	0.00	0.00	17075	04/25/91
MW204	ON-SITE	GW	0.00	0.00	10179	04/25/91
		GW	0.00	0.00	10245	05/09/91
MW205	ONST-DG	GW	0.00	0.00	10246	05/13/91
		GW	0.00	0.00	10248	05/21/91
		WS	0.00	0.00	16075	05/06/91
MW206	ON-SITE	GW	0.00	0.00	10247	05/15/91
		GW	0.00	0.00	10249	05/22/91
		WS	0.00	0.00	16078	05/10/91
		AQ	0.00	0.00	17087	05/16/91
		AQ	0.00	0.00	17088	05/16/91
MWD003	OFF-SITE	GW	0.00	0.00	10052	03/05/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
MWD004	OFF-SITE	GW	0.00	0.00	10053	03/04/91
MWD005	OFF-SITE	GW	0.00	0.00	10054	03/05/91
MWD009	OFF-SITE	GW	0.00	0.00	10056	03/07/91
MWD014	OFF-SITE	GW	0.00	0.00	10058	03/06/91
		GW	0.00	0.00	10059	03/06/91
MWD017	OFF-SITE	GW	0.00	0.00	10060	03/04/91
MWD019	OFF-SITE	GW	0.00	0.00	10061	03/05/91
MWD024	OFFST-DG	GW	0.00	0.00	10062	03/06/91
MWD025	OFF-SITE	GW	0.00	0.00	10063	03/06/91
MWD027	OFF-SITE	GW	0.00	0.00	10064	03/06/91
NM	ON-SITE	WL	0.00	0.00	15055	04/16/91
NS001	ONS-NSD	SW	0.00	0.00	11033	04/18/91
		SD	0.00	0.00	12033	04/18/91
NS002	OFFS-NSD	SW	0.00	0.00	11034	04/17/91
		SW	0.00	0.00	11035	04/17/91
		SD	0.00	0.00	12034	04/17/91
		SD	0.00	0.00	12035	04/17/91
		AQ	0.00	0.00	17107	04/17/91
NS003	OFFS-NSD	SW	0.00	0.00	11036	04/17/91
		SD	0.00	0.00	12036	04/17/91
NS004	OFFS-NSD	SW	0.00	0.00	11037	04/16/91
		SD	0.00	0.00	12037	04/16/91
		AQ	0.00	0.00	17103	04/17/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
NS005	OFFS-NSD	SD	0.00	0.00	12038	04/16/91
OF001	OUTFALL	SW	0.00	0.00	11039	03/26/91
OF002	OUTFALL	SW	0.00	0.00	11040	03/26/91
OF003	OUTFOFNS	SW	0.00	0.00	11041	03/27/91
OF004	OUTFALL	SW	0.00	0.00	11042	03/27/91
OF006	OUTFALL	SW	0.00	0.00	11044	03/26/91
		SW	0.00	0.00	11045	03/26/91
OF008	OUTFALL	SW	0.00	0.00	11046	03/26/91
OF009	OUTFALL	SW	0.00	0.00	11047	03/26/91
OF010	OUTFALL	SW	0.00	0.00	11048	03/26/91
		SD	0.00	0.00	12048	04/18/91
OF011	OUTFALL	SW	0.00	0.00	11049	03/26/91
OF012	OUTFALL	SW	0.00	0.00	11050	03/26/91
OF013	OUTFALL	SW	0.00	0.00	11052	03/26/91
OF014	OUTFALL	SW	0.00	0.00	11058	03/27/91
OF015	OUTFALL	SW	0.00	0.00	11053	03/27/91
OF016	OUTFALL	SW	0.00	0.00	11054	03/27/91
		SW	0.00	0.00	11055	03/27/91
OF017	OUTFALL	SW	0.00	0.00	11056	03/27/91
OF018	OUTFALL	SW	0.00	0.00	11057	03/27/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
OF1	OFF-SITE	SD	0.00	0.00	12039	04/17/91
OF11A	OFF-SITE	SD	0.00	0.00	12049	04/18/91
OF11B	OFF-SITE	SD	0.00	0.00	12051	04/18/91
OF15A	OFF-SITE	SD	0.00	0.00	12052	04/18/91
OF15B	OFF-SITE	SD	0.00	0.00	12053	04/18/91
OF2	OFF-SITE	SD	0.00	0.00	12040	04/17/91
OF8	OFF-SITE	SD	0.00	0.00	12046	04/17/91
		AQ	0.00	0.00	17102	04/17/91
PW001	ON-SITE	WS	0.00	0.00	16077	05/09/91
RA009	ON-SITE	WL	0.00	0.00	15013	01/08/91
RA010	ON-SITE	WL	0.00	0.00	15057	04/16/91
RA020	ON-SITE	WL	0.00	0.00	15004	12/20/90
RA021	ON-SITE	WL	0.00	0.00	15007	12/20/90
RA022	ON-SITE	WL	0.00	0.00	15005	12/20/90
RA023	ON-SITE	WL	0.00	0.00	15003	12/06/90
RA024	ON-SITE	WL	0.00	0.00	15054	03/21/91
RA026	ON-SITE	WL	0.00	0.00	15006	12/20/90
RA029	ON-SITE	WL	0.00	0.00	15009	12/20/90
RA030	ON-SITE	WL	0.00	0.00	15012	01/08/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
RA040	ON-SITE	WL	0.00	0.00	15016	01/23/91
RA042	ON-SITE	WL	0.00	0.00	15011	01/08/91
RA045	ON-SITE	WL	0.00	0.00	15010	12/20/90
RA049	ON-SITE	WL	0.00	0.00	15000	12/06/90
RA050	ON-SITE	WL	0.00	0.00	15024	02/05/91
RA052	ON-SITE	WL	0.00	0.00	15059	05/02/91
RA056	ON-SITE	WL	0.00	0.00	15008	12/20/90
RA060	ON-SITE	WL	0.00	0.00	15001	12/06/90
RA061	ON-SITE	WL	0.00	0.00	15002	12/06/90
RA066	ON-SITE	WL	0.00	0.00	15050	03/22/91
RA067	ON-SITE	WL	0.00	0.00	15017	01/23/91
RA068	ON-SITE	WL	0.00	0.00	15018	01/23/91
RA069	ON-SITE	WL	0.00	0.00	15019	01/23/91
RA070	ON-SITE	WL	0.00	0.00	15020	01/23/91
RA071	ON-SITE	WL	0.00	0.00	15022	01/23/91
RA072	ON-SITE	WL	0.00	0.00	15021	01/23/91
RA073	ON-SITE	WL	0.00	0.00	15034	02/19/91
RA074	ON-SITE	WL	0.00	0.00	15025	02/05/91
RA075	ON-SITE	WL	0.00	0.00	15026	02/05/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
RA076	ON-SITE	WL	0.00	0.00	15030	02/19/91
RA077	ON-SITE	WL	0.00	0.00	15027	02/05/91
RA078	ON-SITE	WL	0.00	0.00	15029	02/19/91
RA079	ON-SITE	WL	0.00	0.00	15048	03/21/91
RA080	ON-SITE	WL	0.00	0.00	15049	03/22/91
RA081	ON-SITE	WL	0.00	0.00	15052	03/22/91
RA082	ON-SITE	WL	0.00	0.00	15053	04/16/91
RA083	ON-SITE	WL	0.00	0.00	15058	05/02/91
RA086	ON-SITE	WL	0.00	0.00	15071	06/03/91
RA087	ON-SITE	WL	0.00	0.00	15064	06/03/91
RA088	ON-SITE	WL	0.00	0.00	15062	06/03/91
RA091	ON-SITE	WL	0.00	0.00	15060	05/02/91
RA098	ON-SITE	WL	0.00	0.00	15063	06/03/91
RA099	ON-SITE	WL	0.00	0.00	15061	06/03/91
RA101	ON-SITE	WL	0.00	0.00	15066	06/03/91
RA102	ON-SITE	WL	0.00	0.00	15067	06/17/91
RA103	ON-SITE	WL	0.00	0.00	15072	06/17/91
RA200	ON-SITE	WL	0.00	0.00	15069	06/04/91
RA300	ON-SITE	WL	0.00	0.00	15070	06/04/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
RW004	OFF-SITE	GW	0.00	0.00	10037	03/04/91
RW005	OFFST-DG	GW	0.00	0.00	10038	03/07/91
RW009	OFF-SITE	GW	0.00	0.00	10039	03/04/91
RW014	OFF-SITE	GW	0.00	0.00	10040	03/04/91
RW017	OFF-SITE	GW	0.00	0.00	10041	03/08/91
		AQ	0.00	0.00	17057	03/08/91
RW018	OFF-SITE	GW	0.00	0.00	10042	03/04/91
RW021	OFF-SITE	GW	0.00	0.00	10043	03/05/91
RW030	OFF-SITE	GW	0.00	0.00	10044	03/08/91
RW040	OFF-SITE	GW	0.00	0.00	10045	03/08/91
RW043	OFF-SITE	GW	0.00	0.00	10065	03/07/91
RW053	OFF-SITE	GW	0.00	0.00	10046	03/05/91
		GW	0.00	0.00	10047	03/05/91
RW247	OFF-SITE	GW	0.00	0.00	10066	03/07/91
RW251	OFF-SITE	GW	0.00	0.00	10048	03/15/91
RW252	ON-SITE	GW	0.00	0.00	10049	03/05/91
RW294	OFF-SITE	GW	0.00	0.00	10051	03/04/91
RW297	OFFST-DG	GW	0.00	0.00	10036	03/15/91
RW324	OFF-SITE	GW	0.00	0.00	10050	03/05/91
SI3015	ON-SITE	WS	0.00	0.00	16079	05/16/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
SI3512	ON-SITE	WS	0.00	0.00	16082	06/12/91
SUMP 1	ON-SITE	WL	0.00	0.00	15037	02/13/91
		WS	0.00	0.00	16037	02/13/91
SUMP 2	ON-SITE	WL	0.00	0.00	15038	02/13/91
		WS	0.00	0.00	16038	02/13/91
SUMP 3	ON-SITE	WL	0.00	0.00	15039	02/13/91
		WS	0.00	0.00	16039	02/13/91
SUMP 4	ON-SITE	WS	0.00	0.00	16032	02/20/91
SUMP 5	ON-SITE	WS	0.00	0.00	16042	02/27/91
SUMP 6	ON-SITE	WS	0.00	0.00	16066	03/27/91
SUMP 7	ON-SITE	WS	0.00	0.00	16074	05/02/91
SUMP 8	ON-SITE	WS	0.00	0.00	16080	05/29/91
SUMP 9	ON-SITE	WS	0.00	0.00	16081	06/04/91
TP001	ON-SITE	SS	2.00	4.00	14185	05/21/91
		SS	4.00	5.00	14186	05/21/91
		SS	5.00	9.00	14187	05/21/91
TP002	ON-SITE	SW	0.00	0.00	11060	05/22/91
		SS	5.00	6.00	14188	05/22/91
		SS	4.00	5.00	14189	05/22/91
		SS	6.00	7.00	14190	05/22/91
TP003	ON-SITE	SW	0.00	0.00	11062	05/22/91
		SS	5.00	6.00	14191	05/22/91
		SS	6.00	8.00	14192	05/22/91
		SS	8.00	10.00	14193	05/22/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
TP003	ON-SITE	SS	0.00	10.00	14194	05/22/91
		AQ	0.00	0.00	17089	05/23/91
TP005	ON-SITE	SW	0.00	0.00	11063	05/23/91
		SS	4.00	5.00	14195	05/23/91
		SS	0.00	5.00	14196	05/23/91
		SS	4.00	5.00	14197	05/23/91
UP001	BACKGRND	SS	0.00	0.50	14132	04/26/91
		SS	0.00	0.50	14133	04/26/91
UP002	BACKGRND	SS	0.00	0.50	14131	04/26/91
UP003	BACKGRND	SS	0.00	0.50	14176	05/07/91
UP004	BACKGRND	SS	0.00	0.50	14130	04/26/91
		AQ	0.00	0.00	17076	04/26/91
UP005	BACKGRND	SS	0.00	0.50	14175	05/07/91
WM001	ON-SITE	WL	0.00	0.00	15014	01/08/91
WM006	ON-SITE	WL	0.00	0.00	15015	01/08/91
WM012	ON-SITE	WL	0.00	0.00	15031	02/19/91
WM013	ON-SITE	WL	0.00	0.00	15035	02/28/91
WM014	ON-SITE	WL	0.00	0.00	15036	02/28/91
WM015	ON-SITE	WL	0.00	0.00	15032	02/19/91
WM016	ON-SITE	WL	0.00	0.00	15033	02/19/91
WM017	ON-SITE	WL	0.00	0.00	15056	04/16/91
WM018	ON-SITE	WL	0.00	0.00	15045	03/01/91

Station Number	Station Code	Sample Matrix	Sample Depth (ft.) Upper	Sample Depth (ft.) Lower	Sample/ Sub-Sample	Sampling Date
WM019	ON-SITE	WL	0.00	0.00	15047	03/21/91
WM023	ON-SITE	WL	0.00	0.00	15040	02/28/91
WM024	ON-SITE	WL	0.00	0.00	15041	02/28/91
WM025	ON-SITE	WL	0.00	0.00	15051	03/22/91
WM026	ON-SITE	WL	0.00	0.00	15042	03/01/91
WM027	ON-SITE	WL	0.00	0.00	15043	03/01/91
WM028	ON-SITE	WL	0.00	0.00	15046	03/21/91
WM030	ON-SITE	WL	0.00	0.00	15044	02/28/91
WMU003	ON-SITE	SW	0.00	0.00	11005	03/01/91
		SW	0.00	0.00	11006	03/01/91
		SW	0.00	0.00	11007	03/01/91
		SW	0.00	0.00	11061	04/25/91
WMU017	OFF-SITE	SW	0.00	0.00	11000	02/27/91
		SD	0.00	0.00	12000	02/27/91
		SD	0.00	0.00	12002	02/27/91
WMU018	OFF-SITE	SW	0.00	0.00	11001	02/27/91
		SD	0.00	0.00	12001	02/28/91
WMU019	ON-SITE	SW	0.00	0.00	11002	02/28/91
		SW	0.00	0.00	11003	02/28/91
		SD	0.00	0.00	12005	02/28/91
WMU038	ON-SITE	SD	0.00	0.00	12003	03/01/91

APPENDIX 4C

Summary of Energy Systems Groundwater Sampling Program

Appendix 4C
Summary of Energy Systems Groundwater Sampling Program
PGDP Phase II Site Investigation

Energy Systems' Station No. (Well Number)*	ID	Aug-88	Sep-88	Oct-88	Nov-88	Dec-88	Jan-89	Feb-89	Mar-89	Apr-89	May-89	Jun-89	Jul-89	Aug-89	Sep-89	Oct-89	Nov-89	Dec-89	Jan-90	Feb-90	Mar-90	Apr-90	May-90	Jun-90	Jul-90	Aug-90	Sep-90	Oct-90	Nov-90	Dec-90	Jan-91	Feb-91	Mar-91	Apr-91	May-91	Jun-91
1	TCE	4200		NA	5300	4700	5600		4500	6200	2000	6000	4400	3800	4050	5900	5400	2500	5000	2900	4900	5900	4100	4200	3500	2235	1600	3900	2000	2200	5400	6100	4700	4400	1600	
(MW-66)	Tc-99	3195		2149	3000	2746	2795		3658	3670	1306	3235	2427	1626	2329	2161	2194	1673	2558	2378	2318	2212	2091	2128	1658	4700	1184	1962	1289	1691	2244	2347	3321	2263	581	
2	TCE	623				749		940	990	1220	NST	1530			1370	1900	1900	1500	NST	1300	560	1600	1600	1300	1700	1700	2000	1400	1800	1500	NST	NST	1800	1800	1800	X
(RW-2)	Tc-99	407				574		651	687	835	NST	1058			1292	1169	1194	1266	NST	1088	1192	941	491	897	658	1232	1352	1216	1290	1039	NST	NST	1196	1280	1185	X
3	TCE					360		870	610	1040	1060	990	1160	600	1450	960	1000	NST	NST	NST	NST	NST	NST	NST	NST	NST	NST	NST	NST	NST	NST	NST	NST	NST	NST	
(RW-3)	Tc-99					373		633	857	859	823	868	892	792	882	788	880	NST	NST	NST	NST	NST	NST	NST	NST	NST	NST	NST	NST	NST	NST	NST	NST	NST	NST	
4	TCE	43	17			27		18	20	24	18	64	69	63	93	84	86	65	77	69	112	110	89	110	210	NST	NST	210	220	160	230	260	300	270	260	200
(RW-4)	Tc-99	51	26			30		5	10	23	22	54	62	52	53	74	68	63	57	30	86	54	79	94	124	NST	NST	129	112	37	91	107	167	130	109	14
5	TCE					1		ND	ND	ND	ND	7	2	2	1	1	2	NST	NST	NST	2	1	ND	4	2	1	4	1	4	2	ND	1	NST	NST	NST	X
(RW-5)	Tc-99					ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NST	NST	NST	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NST	NST	NST	X
16	TCE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	ND	ND	ND	ND	1	7	ND	ND	ND	ND	ND	6	ND	3	5	ND	4	1	ND	NST	NST	NST	NST	
(RW-16)	Tc-99	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NST	NST	NST	
17	TCE	51							250	350	440	3	320		20	190	145	120	100	65	100	220	200	240	220	180	180	140	120	76	150	270	390	320	370	X
(RW-17)	Tc-99	83							309	342	395	410	365		203	124	143	123	81	89	111	163	167	175	161	190	155	95	95	112	126	266	326	356	293	X
33	TCE	3	6	3	3	3	4	3	2		3	3	2	2	3	2	2	3	3	3	2	2	2	2	3	3	3	3	3	4	3	4	4	4	4	4
(MW-36)	Tc-99	ND	ND	ND	9	12	8	0	20		39	54	38	29	17	18	9	1	20	16	16	14	5	9	15	3	26	28	39	29	13	4	17	29	20	9
34	TCE	ND	1	ND	ND	ND	ND	ND	ND	NST	ND	ND	ND	ND	ND		1	NST	NST	ND	ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	ND	1	ND	ND	ND
(MW-43)	Tc-99	ND	ND	0	0	0	0	0	4	NST	12	26	26	24	13		15	NST	NST	12	11	0	0	13	11	17		2	0	8	2	0	12	0	9	10
46	TCE	1	ND		ND		ND				ND			20		6	3		10					46		54		59					62		59	
(MW-22)	Tc-99	ND	ND		0		0				12			17		37	37		6					11		26		30					23		29	
49	TCE	ND				ND			ND	ND						ND							1			1		ND				ND		2		
(MW-54)	Tc-99	ND				0			2	20						8							0			1		3				5		4		
57	TCE					26			28		54		71				29				47		41			39		42					33	NA		
	Tc-99					0			3		340		NA				52				46		149			19		80					61	13		
100	TCE	30			45		42			23			15			NA	12				28	29			12		NA	30	NA		28		NA	39	NA	
(MW-68)	Tc-99	104			121		75			137			116			129	117				125	95			102		NA	107	NA		88		NA	113	NA	
102	TCE	12			4		8			25			18	13		10	7				6	7			3		NA	3	NA		4		NA	4	NA	
(MW-71)	Tc-99	ND			0		0			37			NA	14		NA	33				20	18			2		NA	1	NA		0		NA	2	NA	
113	TCE	20				ND			ND	1	ND	30	960	950	1040	2	860	1000	14	340	520	720	520	850	860	1200	1400	1600	1000	1000	540	430	110	320	1300	X
(RW-113)	Tc-99	ND				ND			ND	ND	28	40	328	267	35	ND	443	580	58	222	402	319	266	440	376	493	655	286	404	486	308	259	64	384	507	X
156	TCE		1			1			ND			1			1	ND		2				ND		ND			1			1			ND			1
(TVA-3)	Tc-99		ND			ND			ND			ND			ND	ND		ND				ND		ND			ND			ND			ND			X

Appendix 4C
Summary of Energy Systems Groundwater Sampling Program
PGDP Phase II Site Investigation

Energy Systems' Station No. (Well Number)*	ID	Aug-88	Sep-88	Oct-88	Nov-88	Dec-88	Jan-89	Feb-89	Mar-89	Apr-89	May-89	Jun-89	Jul-89	Aug-89	Sep-89	Oct-89	Nov-89	Dec-89	Jan-90	Feb-90	Mar-90	Apr-90	May-90	Jun-90	Jul-90	Aug-90	Sep-90	Oct-90	Nov-90	Dec-90	Jan-91	Feb-91	Mar-91	Apr-91	May-91	Jun-91
157	TCE		5			3			1			3			3	3		3				3		2			2			2			2	NST	NST	NST
(TVA-4)	Tc-99		ND			ND			ND			ND			ND	ND		ND				ND		ND			ND			ND			ND	NST	NST	NST
160	TCE		32	17	18	19	19	20	19		21	13	15	16	19	10	21	21	18	15	21	18	14	14	18	18	21	22	22	21	26	26	25	21	26	25
(MW-44)	Tc-99		ND	ND	0	3	7	0	0		18	30	31	13	12	0	7	99	19	0	9	0	0	8	1	5	0	7	0	2	1	10	10	6	2	22
172	TCE		1			1			ND						ND			ND				ND		ND			1			1			1			NST
(TVA-14)	Tc-99		ND			ND			ND						ND			ND				ND		ND			ND			ND			ND			NST
173	TCE		ND			ND			ND						ND			ND				ND		ND			ND			ND			ND			ND
(TVA-27)	Tc-99		205			183			226						174			114				69		44			32			126			105			X
195	TCE		6			10		10			10				NST		6				8		8			4		4			5				4	
	Tc-99		48			133		94			177				NST		136				355		66			316		154			5				233	
200	TCE			ND					ND		ND			ND	ND			ND			ND		ND				ND			ND		ND				ND
(MW-85)	Tc-99			208					193		245			223	260			243			349		175				278			125		242				X
201	TCE			43								57		52	53	65		59			47			48			52			52		57				X
(MW-94)	Tc-99			527								682		667	748	NA		760			798			539			769			695		645				X
202	TCE			125					52			77		87	96	140		121			130		NA	140			190			140		300				260
(MW-88)	Tc-99			716					1465			1101		990	1196	1038		1137			1240		NA	767			1242			1023		986				X
204	TCE			ND					ND		ND			ND	ND			ND			ND		ND				ND			ND		ND				ND
(MW-84)	Tc-99			694					1000		633			688	552			452			732		269				247			125		508				X
206	TCE			6					22			32		36	19	NA		32		15			NA	13			19			19		16				27
(MW-91)	Tc-99			ND					0			36		34	16	15		37		14			NA	1			5			12		27				X
208	TCE			ND					ND			ND		ND	3			ND		ND			NA	4			1			1		4				ND
(MW-90)	Tc-99			ND					0			12		1	15			13		0			NA	9			7			0		6				X
216	TCE				ND			ND			ND				ND				ND	ND		4				ND			1				1		1	
	Tc-99				0			2			29				8		6		0	5		6				7			2				0		0	
224	TCE				3		2			ND					NST						NST			NST			NST			NST			NST			
(MW-50)	Tc-99				0		0			19					NST	4					NST			NST			NST			NST			NST			
225	TCE					18		15	14		14	16	15	15		11	13	14	13	12	14	17	15	14	17	12	17	16	15	ND	16	17	14	17	17	16
(MW-41)	Tc-99					0		12	0		22	30	39	30	13	1	8	8	13	2	23	0	4	9	12	0	6	11	27	8	7	5	0	5	0	X
227	TCE					ND		ND			ND				ND		ND		ND				ND			ND			ND			ND			ND	
	Tc-99					0		ND			25				25		1		7				3			9			10			0			0	
245	TCE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1	5	ND	ND	ND	ND	ND	4	ND	2	4	ND	3	ND	ND	NST	NST	NST	NST	
(RW-245)	Tc-99	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NST	NST	NST	NST	

Appendix 4C
Summary of Energy Systems Groundwater Sampling Program
PGDP Phase II Site Investigation

Energy Systems' Station No. (Well Number)*	ID	Aug-88	Sep-88	Oct-88	Nov-88	Dec-88	Jan-89	Feb-89	Mar-89	Apr-89	May-89	Jun-89	Jul-89	Aug-89	Sep-89	Oct-89	Nov-89	Dec-89	Jan-90	Feb-90	Mar-90	Apr-90	May-90	Jun-90	Jul-90	Aug-90	Sep-90	Oct-90	Nov-90	Dec-90	Jan-91	Feb-91	Mar-91	Apr-91	May-91	Jun-91
285	TCE																			44	170	123		NA												
	Tc-99																			1	NA	0		2												
6	TCE	ND					ND				NA							ND			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Tc-99	ND					ND				ND							ND			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
7	TCE	ND		ND													ND												ND							
	Tc-99	ND		ND													ND												ND							
8	TCE	ND					ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
	Tc-99	ND					ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
9	TCE	ND				ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND
(RW-09)	Tc-99	ND				ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		X
10	TCE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	X
(RW-10)	Tc-99	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	X
11	TCE	ND		ND													ND											ND								
	Tc-99	ND		ND													ND											ND								
12	TCE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	X
(RW-12)	Tc-99	ND	ND	ND	ND	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	X
13	TCE	ND	ND	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	X
(RW-13)	Tc-99	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	X
14	TCE	ND	ND	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	X
(RW-14)	Tc-99	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	X
15	TCE	ND																																		
	Tc-99	ND																																		
18	TCE	1.5					ND	ND	ND	ND	ND	ND	ND	1	ND	ND	1	ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5	ND	ND	X
(RW-18)	Tc-99	ND					ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	X
19	TCE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
(RW-19)	Tc-99	ND	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	X
20	TCE	ND											ND	ND		ND		NST		NST		NST		NST		NST	ND	ND		NST		NST		ND		ND
	Tc-99	ND											ND	ND		ND		NST		NST		NST		NST		NST	ND	ND		NST		NST		ND		X
21	TCE	ND				ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
(RW-21)	Tc-99	ND				ND		ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
22	TCE	ND				ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND
	Tc-99	ND				ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND

Appendix 4C
Summary of Energy Systems Groundwater Sampling Program
PGDP Phase II Site Investigation

Energy Systems' Station No. (Well Number)*	ID	Aug-88	Sep-88	Oct-88	Nov-88	Dec-88	Jan-89	Feb-89	Mar-89	Apr-89	May-89	Jun-89	Jul-89	Aug-89	Sep-89	Oct-89	Nov-89	Dec-89	Jan-90	Feb-90	Mar-90	Apr-90	May-90	Jun-90	Jul-90	Aug-90	Sep-90	Oct-90	Nov-90	Dec-90	Jan-91	Feb-91	Mar-91	Apr-91	May-91	Jun-91
23	TCE	ND					ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
(RW-23)	Tc-99	ND					ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
24	TCE	ND				ND			ND	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND
	Tc-99	ND				ND			ND	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND
25	TCE	ND					ND		ND		ND		ND				ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
	Tc-99	ND					ND		ND		ND		ND				ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
26	TCE	ND				ND			ND	ND		ND		ND		ND		ND		ND		ND		ND		ND	ND	ND		ND		ND		ND		ND
	Tc-99	ND				ND			ND	ND		ND		ND		ND		ND		ND		ND		ND		ND	ND	ND		ND		ND		ND		X
27	TCE	ND	ND	ND	ND																															
	Tc-99	ND	ND	ND	ND																															
28	TCE	ND					ND		ND		ND		ND				ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
	Tc-99	ND					ND		ND		ND		ND				ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
29	TCE	ND																																		ND
	Tc-99	ND																																		ND
30	TCE	ND		ND	ND												ND											ND						ND		
(RW-30)	Tc-99	ND		ND	ND												ND											ND						ND		
31	TCE	ND				ND	ND		ND		ND		ND		ND		ND		ND		ND			ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	2	ND
(RW-31)	Tc-99	ND				NA	ND		ND		ND		ND		ND		ND		ND		ND			ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
32	TCE	ND				ND		ND			ND				ND		ND		ND				ND			ND			ND				ND		ND	
	Tc-99	ND				0		0			24				34		9		8				1			3			18				3		0	
35	TCE	ND																						ND												
	Tc-99	ND																						ND												
36	TCE	ND				ND																		ND												
	Tc-99	ND				NA																		ND												
37	TCE	ND																																		
	Tc-99	ND																																		
38	TCE	ND																																		
	Tc-99	ND																																		
39	TCE	ND	ND	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	X
(RW-39)	Tc-99	ND	ND	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	X
40	TCE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	X
(RW-40)	Tc-99	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	X

Appendix 4C
Summary of Energy Systems Groundwater Sampling Program
PGDP Phase II Site Investigation

Energy Systems' Station No. (Well Number)*	ID	Aug-88	Sep-88	Oct-88	Nov-88	Dec-88	Jan-89	Feb-89	Mar-89	Apr-89	May-89	Jun-89	Jul-89	Aug-89	Sep-89	Oct-89	Nov-89	Dec-89	Jan-90	Feb-90	Mar-90	Apr-90	May-90	Jun-90	Jul-90	Aug-90	Sep-90	Oct-90	Nov-90	Dec-90	Jan-91	Feb-91	Mar-91	Apr-91	May-91	Jun-91
41	TCE	ND				ND	ND		ND		ND		ND		NST		NST		NST		NST		NST		ND		ND		ND		NST		NST		NST	
	Tc-99	ND				NA	ND		ND		ND		ND		NST		NST		NST		NST		NST		ND		ND		ND		NST		NST		NST	
42	TCE	ND					ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
	Tc-99	ND					ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
43	TCE					ND		ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
(RW-43)	Tc-99					ND		ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
44	TCE	ND																																		
	Tc-99	ND																																		
45	TCE	ND	ND		ND				ND		ND			ND		ND	ND		ND					ND		ND		ND					ND			ND
(MW-21)	Tc-99	71	ND		0				0		19			10		17	13		22					20		9		5					0			5
47	TCE	ND			ND			ND		ND			NST			NST			NST								NST									
(MW-52)	Tc-99	ND			0			0		27			NST			NST			NST								NST									
48	TCE	ND		NA		ND	ND			ND			NST			NST			NST			NST			NST			NST					ND	ND		
(MW-53)	Tc-99	ND		ND		0	0			12			NST			NST			NST			NST			NST			NST					0	3		
50	TCE	ND				ND																														
	Tc-99	ND				NA																														
51	TCE	ND																ND																		
	Tc-99	ND																ND																		
52	TCE	ND																																		
	Tc-99	ND																																		
53	TCE	ND																						ND		ND		ND				ND		ND		ND
(RW-53)	Tc-99	ND																						ND		ND		ND				ND		ND		X
54	TCE	ND	ND	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	X
(RW-54)	Tc-99	ND	ND	ND	ND	ND	ND	NA	ND	NA	4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	X
55	TCE	ND																																		
	Tc-99	ND																																		
56	TCE	ND																																		
	Tc-99	ND																																		
58	TCE	ND																																		
	Tc-99	ND																																		
59	TCE	ND																																		
	Tc-99	ND																																		

Appendix 4C
Summary of Energy Systems Groundwater Sampling Program
PGDP Phase II Site Investigation

Energy Systems' Station No. (Well Number)*	ID	Aug-89	Sep-89	Oct-89	Nov-89	Dec-89	Jan-90	Feb-90	Mar-90	Apr-90	May-90	Jun-90	Jul-90	Aug-90	Sep-90	Oct-90	Nov-90	Dec-90	Jan-91	Feb-91	Mar-91	Apr-91	May-91	Jun-91	Jul-91	Aug-91	Sep-91	Oct-91	Nov-91	Dec-91	Jan-92	Feb-92	Mar-92	Apr-92	May-92	Jun-92
60	TCE	ND																						ND												
	Tc-99	ND																						ND												
61	TCE	ND																																		
	Tc-99	ND																																		
62	TCE	ND																																		
	Tc-99	ND																																		
63	TCE	ND																																		
	Tc-99	ND																																		
64	TCE	ND																																		
	Tc-99	ND																																		
65	TCE	ND																									ND									
	Tc-99	ND																									ND									
66	TCE	ND																																		
	Tc-99	ND																																		
67	TCE	ND																																		
	Tc-99	ND																																		
68	TCE	ND																																		
	Tc-99	ND																																		
69	TCE	ND					ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
	Tc-99	ND					ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
70	TCE	ND																																		
	Tc-99	ND																																		
71	TCE	ND																																		
	Tc-99	ND																																		
72	TCE	ND					ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
(RW-72)	Tc-99	ND					ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
73	TCE	ND																																		
	Tc-99	ND																																		
74	TCE	ND																																		
	Tc-99	ND																																		
75	TCE	ND																																		
	Tc-99	ND																																		

Appendix 4C
Summary of Energy Systems Groundwater Sampling Program
PGDP Phase II Site Investigation

Energy Systems' Station No. (Well Number)*	ID	Aug-88	Sep-88	Oct-88	Nov-88	Dec-88	Jan-89	Feb-89	Mar-89	Apr-89	May-89	Jun-89	Jul-89	Aug-89	Sep-89	Oct-89	Nov-89	Dec-89	Jan-90	Feb-90	Mar-90	Apr-90	May-90	Jun-90	Jul-90	Aug-90	Sep-90	Oct-90	Nov-90	Dec-90	Jan-91	Feb-91	Mar-91	Apr-91	May-91	Jun-91
76	TCE	ND																																		
	Tc-99	ND																																		
77	TCE	ND																																		
	Tc-99	ND																																		
78	TCE	ND																																		
	Tc-99	ND																																		
79	TCE	ND				ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND
	Tc-99	ND				ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		X
80	TCE	ND																			ND															
	Tc-99	ND																			ND															
81	TCE	ND																																		
	Tc-99	ND																																		
82	TCE	ND				ND		ND	ND	ND	ND	ND	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Tc-99	ND				ND		ND	ND	NA	ND	ND	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
83	TCE					ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
(RW-83)	Tc-99					ND		ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
84	TCE	ND				ND				ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
(RW-84)	Tc-99	ND				ND				ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
85	TCE	ND																																		
	Tc-99	ND																																		
86	TCE	ND																																		
	Tc-99	ND																																		
87	TCE	ND																																		
	Tc-99	ND																																		
88	TCE	ND						ND		ND		ND		ND		ND		ND		ND		ND		ND		NST		ND		ND		ND		ND		ND
	Tc-99	ND						ND		ND		ND		ND		ND		ND		ND		ND		ND		NST		ND		ND		ND		ND		X
89	TCE	ND					ND	ND		ND		ND		ND		NST		NST		NST		NST		ND		ND		ND		NST		NST		NST		ND
	Tc-99	ND					ND	ND		ND		ND		ND		NST		NST		NST		NST		ND		ND		ND		NST		NST		NST		X
90	TCE	ND																										ND								ND
	Tc-99	ND																										ND								X
91	TCE	ND																																		
	Tc-99	ND																																		

Appendix 4C
Summary of Energy Systems Groundwater Sampling Program
PGDP Phase II Site Investigation

Energy Systems' Station No. (Well Number)*	ID	Aug-88	Sep-88	Oct-88	Nov-88	Dec-88	Jan-89	Feb-89	Mar-89	Apr-89	May-89	Jun-89	Jul-89	Aug-89	Sep-89	Oct-89	Nov-89	Dec-89	Jan-90	Feb-90	Mar-90	Apr-90	May-90	Jun-90	Jul-90	Aug-90	Sep-90	Oct-90	Nov-90	Dec-90	Jan-91	Feb-91	Mar-91	Apr-91	May-91	Jun-91
92	TCE	ND																																		
	Tc-99	ND																																		
93	TCE	ND							ND																											
	Tc-99	ND							ND																											
94	TCE	ND																																		
	Tc-99	ND																																		
95	TCE	ND																																		
	Tc-99	ND																																		
96	TCE	ND																																		
	Tc-99	ND																																		
97	TCE	ND																																		
	Tc-99	ND																																		
98	TCE	ND																																		
	Tc-99	ND																																		
99	TCE	ND																																		
	Tc-99	ND																																		
101	TCE																NA		NA		NA						NA		NA		NA		NA		NA	
	Tc-99																NA		NA		NA						NA		NA		NA		NA		NA	
103	TCE	ND		ND			ND			ND			ND			ND			ND			ND			ND			ND						ND	
(MW-63)	Tc-99	ND		6			0			13			3			5			1			0			0			0						1	
104	TCE	ND																																		
	Tc-99	ND																																		
105	TCE	ND																																		
	Tc-99	ND																																		
106	TCE	ND				ND																														
	Tc-99	ND				NA																														
107	TCE	ND																																		
	Tc-99	ND																																		
108	TCE	ND																									ND									
	Tc-99	2																									7									
109	TCE	ND			ND		ND			ND			NST			ND			ND			ND			ND			ND			ND			ND		
(MW-67)	Tc-99	ND			0		0			8			NST			27			14			2			11			0			0			0		

Appendix 4C
Summary of Energy Systems Groundwater Sampling Program
PGDP Phase II Site Investigation

Energy Systems' Station No. (Well Number)*	ID	Aug-88	Sep-88	Oct-88	Nov-88	Dec-88	Jan-89	Feb-89	Mar-89	Apr-89	May-89	Jun-89	Jul-89	Aug-89	Sep-89	Oct-89	Nov-89	Dec-89	Jan-90	Feb-90	Mar-90	Apr-90	May-90	Jun-90	Jul-90	Aug-90	Sep-90	Oct-90	Nov-90	Dec-90	Jan-91	Feb-91	Mar-91	Apr-91	May-91	Jun-91
110	TCE	ND																																		
	Tc-99	ND																																		
111	TCE	ND																																		
	Tc-99	ND																																		
112	TCE	ND					ND	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND
	Tc-99	ND					ND	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		X
114	TCE	ND																									ND									
	Tc-99	ND																									ND									
115	TCE	ND																																		
	Tc-99	ND																																		
116	TCE	ND																																		
	Tc-99	ND																																		
121	TCE	ND																																		
	Tc-99	ND																																		
122	TCE	ND																																		
	Tc-99	ND																																		
123	TCE	ND																																		
	Tc-99	ND																																		
124(home)	TCE	ND																																		
	Tc-99	ND																																		
124(grain)	TCE	ND																																		
	Tc-99	ND																																		
125	TCE	ND																																		
	Tc-99	ND																																		
126	TCE	ND																																		
	Tc-99	ND																																		
127	TCE	ND																																		
	Tc-99	ND																																		
128	TCE	ND																																		
	Tc-99	ND																																		
129	TCE	ND																																		
	Tc-99	ND																																		

Appendix 4C
Summary of Energy Systems Groundwater Sampling Program
PGDP Phase II Site Investigation

Energy Systems' Station No. (Well Number)*	ID	Aug-88	Sep-88	Oct-88	Nov-88	Dec-88	Jan-89	Feb-89	Mar-89	Apr-89	May-89	Jun-89	Jul-89	Aug-89	Sep-89	Oct-89	Nov-89	Dec-89	Jan-90	Feb-90	Mar-90	Apr-90	May-90	Jun-90	Jul-90	Aug-90	Sep-90	Oct-90	Nov-90	Dec-90	Jan-91	Feb-91	Mar-91	Apr-91	May-91	Jun-91
130	TCE	ND				ND																														
	Tc-99	ND																																		
131	TCE	ND																																		
	Tc-99	ND																																		
132	TCE	ND				ND																														
	Tc-99	ND																																		
133	TCE	ND																																		
	Tc-99	ND																																		
134	TCE	ND																																		
	Tc-99	ND																																		
135	TCE	ND																																		
	Tc-99	ND																																		
136	TCE	ND																																		
	Tc-99	ND																																		
137	TCE	ND																																		
	Tc-99	ND																																		
138	TCE	ND																																		
	Tc-99	ND																																		
139	TCE	ND																																		
	Tc-99	ND																																		
140	TCE	ND																																		
	Tc-99	ND																																		
141	TCE	ND																																		
	Tc-99	ND																																		
142	TCE	ND																																		
	Tc-99	ND																																		
143	TCE	ND																																		
	Tc-99	ND																																		
144	TCE		ND											ND																						
	Tc-99		ND											3														ND								
145	TCE		ND																									8								
	Tc-99																																			

Appendix 4C
Summary of Energy Systems Groundwater Sampling Program
PGDP Phase II Site Investigation

Energy Systems' Station No. (Well Number)*	ID	Aug-88	Sep-88	Oct-88	Nov-88	Dec-88	Jan-89	Feb-89	Mar-89	Apr-89	May-89	Jun-89	Jul-89	Aug-89	Sep-89	Oct-89	Nov-89	Dec-89	Jan-90	Feb-90	Mar-90	Apr-90	May-90	Jun-90	Jul-90	Aug-90	Sep-90	Oct-90	Nov-90	Dec-90	Jan-91	Feb-91	Mar-91	Apr-91	May-91	Jun-91
146 (n. grvl.	TCE		ND																																	
pit pond)	Tc-99		ND																																	
146 (s. grvl.	TCE		ND																																	
pit pond)	Tc-99		ND																																	
147	TCE		ND																					ND												
	Tc-99		ND																					ND												
148	TCE		ND																																	
	Tc-99		ND																																	
149	TCE		ND			NA																														
	Tc-99		ND			NA																														
150	TCE		ND																																	
	Tc-99		NA																																	
151	TCE		ND									NA																								
(water)	Tc-99		ND									NA																								
151	TCE		ND																																	
(sediment)	Tc-99		31295*																																	
152	TCE		ND																																	
(water)	Tc-99		30																																	
152	TCE		ND							NA		ND				ND																				
(sediment)	Tc-99		28339*							7		NA				NA																				
153	TCE		ND																																	
(water)	Tc-99		43																																	
153	TCE		ND																		NA															
(sediment)	Tc-99		27491*																		27															
154	TCE		ND			ND			ND			ND			ND			ND				ND		ND			ND			ND			ND			NST
	Tc-99		ND			ND			ND			ND			ND			ND				ND		ND			ND			ND			ND			NST
155	TCE		ND			ND			ND			ND			ND			ND				ND		ND			ND			ND			ND			ND
(TVA-5)	Tc-99		ND			ND			ND			ND			ND			ND				ND		ND			ND			ND			ND			X
158	TCE		ND			ND			NST									ND			NST			NST			ND			ND			NST			NST
(TVA-6)	Tc-99		ND			ND			NST									ND			NST			NST			ND			ND			NST			NST
159	TCE		ND			NA			ND			ND			ND			ND				ND		ND			ND			ND			ND			NST
(TVA-19)	Tc-99		ND			NA			ND			ND			ND			ND				ND		ND			ND			ND			ND			NST

Appendix 4C
Summary of Energy Systems Groundwater Sampling Program
PGDP Phase II Site Investigation

Energy Systems Station No. (Well Number)*	ID	Aug-88	Sep-88	Oct-88	Nov-88	Dec-88	Jan-89	Feb-89	Mar-89	Apr-89	May-89	Jun-89	Jul-89	Aug-89	Sep-89	Oct-89	Nov-89	Dec-89	Jan-90	Feb-90	Mar-90	Apr-90	May-90	Jun-90	Jul-90	Aug-90	Sep-90	Oct-90	Nov-90	Dec-90	Jan-91	Feb-91	Mar-91	Apr-91	May-91	Jun-91
160	TCE		ND			ND			ND						ND			ND				ND		ND			ND			ND			ND			NST
(MW-44)	Tc-99		ND			ND			ND						ND			ND				ND		ND			ND			ND			ND			NST
161	TCE		ND			ND			NST						ND			ND				ND		ND			ND			ND			ND			ND
	Tc-99		ND			ND			NST						ND			ND				ND		ND			ND			ND			ND			X
162	TCE		ND			ND			ND						ND			ND				ND		ND			ND			ND			ND			ND
	Tc-99		ND			ND			ND						ND			ND				ND		ND			ND			ND			ND			X
164	TCE		ND			ND			ND						ND			ND				ND		ND			ND			ND			ND			NST
	Tc-99		ND			ND			ND						ND			ND				ND		ND			ND			ND			ND			NST
165	TCE		ND			ND			ND						ND			ND				ND		ND			ND			ND			ND			NST
(TVA-24)	Tc-99		ND			ND			ND						ND			ND				ND		ND			ND			ND			ND			NST
166	TCE		ND			ND			ND						ND			ND				ND		ND			ND			ND			ND			ND
	Tc-99		ND			ND			ND						ND			ND				ND		ND			ND			ND			ND			X
167	TCE		ND			ND			ND						ND			ND				ND		ND			ND			ND			ND			ND
	Tc-99		ND			ND			ND						ND			ND				ND		ND			ND			ND			ND			X
168	TCE		ND			ND			ND						ND			ND				ND		ND			ND			ND			ND			NST
	Tc-99		ND			ND			ND						ND			ND				ND		ND			ND			ND			ND			NST
169	TCE		ND			ND			ND						ND			ND				ND		ND			ND			ND			ND			NST
	Tc-99		ND			ND			ND						ND			ND				ND		ND			ND			ND			ND			NST
170	TCE		ND			ND			ND						ND			ND				ND		ND			ND			ND			ND			ND
(TVA-25)	Tc-99		ND			ND			ND						ND			ND				ND		ND			ND			ND			ND			X
171	TCE		ND			ND			ND						ND			ND				ND		ND			ND			ND			ND			ND
	Tc-99		ND			ND			ND						ND			ND				ND		ND			ND			ND			ND			X
174	TCE		ND			ND			ND						ND							ND		ND			ND			ND			ND			ND
	Tc-99		ND			ND			ND						ND							ND		ND			ND			ND			ND			X
175	TCE		ND																																	
	Tc-99		ND																																	
176	TCE		ND																																	
	Tc-99		ND																																	
177	TCE		ND																																	
(cattle pond)	Tc-99		NA																																	
177	TCE		ND				ND																													
(pig pond)	Tc-99		NA				NA																													

Appendix 4C
Summary of Energy Systems Groundwater Sampling Program
PGDP Phase II Site Investigation

Energy Systems' Station No. (Well Number)*	ID	Aug-88	Sep-88	Oct-88	Nov-88	Dec-88	Jan-89	Feb-89	Mar-89	Apr-89	May-89	Jun-89	Jul-89	Aug-89	Sep-89	Oct-89	Nov-89	Dec-89	Jan-90	Feb-90	Mar-90	Apr-90	May-90	Jun-90	Jul-90	Aug-90	Sep-90	Oct-90	Nov-90	Dec-90	Jan-91	Feb-91	Mar-91	Apr-91	May-91	Jun-91
178	TCE		ND											ND													NA									
	Tc-99		ND											10													7									
180	TCE		ND											ND													NA									
	Tc-99		ND											ND													0									
181	TCE		ND																																	
	Tc-99		ND																																	
182	TCE		ND																		NST						ND			ND			ND			NST
(TVA-17)	Tc-99		ND																		NST						ND			ND			ND			NST
183	TCE		ND			ND			ND						ND			ND				ND		ND			ND			ND			ND			ND
	Tc-99		ND			ND			ND						ND			ND				ND		ND			ND			ND			ND			X
184	TCE		ND			ND			NST																		ND			ND			NST			NST
(TVA-11)	Tc-99		ND			ND			NST																		ND			ND			NST			NST
185	TCE		ND																																	
	Tc-99		ND																																	
186	TCE		ND																																	
	Tc-99		ND																																	
187	TCE		ND																																	
	Tc-99		ND																																	
188	TCE		ND																																	
	Tc-99		ND																																	
189	TCE		ND																																	
	Tc-99		ND																																	
190	TCE		ND																																	
	Tc-99		ND																																	
191	TCE		ND																																	
	Tc-99		ND																																	
192	TCE		ND																																	
	Tc-99		ND																																	
193	TCE		ND																																	
	Tc-99		ND																																	
194	TCE		ND																																	
	Tc-99		ND																																	

Appendix 4C
Summary of Energy Systems Groundwater Sampling Program
PGDP Phase II Site Investigation

Energy Systems' Station No. (Well Number)*	ID	Aug-88	Sep-88	Oct-88	Nov-88	Dec-88	Jan-89	Feb-89	Mar-89	Apr-89	May-89	Jun-89	Jul-89	Aug-89	Sep-89	Oct-89	Nov-89	Dec-89	Jan-90	Feb-90	Mar-90	Apr-90	May-90	Jun-90	Jul-90	Aug-90	Sep-90	Oct-90	Nov-90	Dec-90	Jan-91	Feb-91	Mar-91	Apr-91	May-91	Jun-91
196	TCE		ND		ND		ND			ND			ND			ND			ND			ND			ND			ND			ND			ND		
(MW-64)	Tc-99		ND		0		0			7			5			29			11			0			15			3			0			0		
197	TCE		ND	ND			ND			ND			4				ND			ND		ND			ND			ND						ND		
(MW-65)	Tc-99		ND	0			0			7			0				18			28		1			0			0						0		
198	TCE			ND					ND			ND		ND	ND			ND		ND			NA	ND			ND			ND		ND				ND
(MW-89)	Tc-99			ND					0			10		2	39			15		16			NA	0			13			0		1				X
199	TCE			ND					ND			ND		ND	ND			ND			ND		NA	ND			ND			ND		ND				ND
(MW-87)	Tc-99			ND					3			10		4	3			9			11		NA	7			7			0		3				X
203	TCE			ND					ND		ND			ND	ND			ND			ND		NA	ND			ND			ND		ND				ND
(MW-86)	Tc-99			ND					17		26			12	0			19			13		NA	0			5			6		12				X
205	TCE			ND					ND			ND		ND	ND			ND			ND			ND			ND			ND		ND				ND
(MW-93)	Tc-99			ND					0			3		1	0			13			14			14			5			0		0				X
207	TCE			ND					ND			ND		ND	ND			ND		ND			NA	ND			ND			ND		ND				ND
(MW-92)	Tc-99			ND					0			0		1	2			12		0			NA	0			0			0		8				X
209	TCE			ND					ND			ND		ND	ND			ND			ND			ND			ND			ND		ND				X
(MW-95)	Tc-99			ND					0			6		19	0			9			13			6			5			0		1				X
210	TCE			ND																																
	Tc-99			ND																																
211	TCE			ND													ND												ND							
	Tc-99			ND													ND												ND							
212	TCE				ND																															
	Tc-99				ND																															
213	TCE				ND																															
	Tc-99				ND																															
214	TCE				ND																															
	Tc-99				ND																															
215	TCE				ND			ND			ND				ND		ND		ND			ND				ND			ND				ND		ND	
	Tc-99				0			15			38				0		5		18			4				0			10				0		8	
217	TCE				ND				ND		ND				NST			NST		ND		ND				ND			ND				ND		ND	
(MW-42)	Tc-99				0				0		21				NST			NST		27		12				17			12				14		0	
218	TCE				ND				ND		ND				NST		ND				ND		ND			ND		ND					ND			X
	Tc-99				0				3		14				NST		18				6		2			0		2					14			X

Appendix 4C
Summary of Energy Systems Groundwater Sampling Program
PGDP Phase II Site Investigation

Energy Systems' Station No. (Well Number)*	ID	Aug-88	Sep-88	Oct-88	Nov-88	Dec-88	Jan-89	Feb-89	Mar-89	Apr-89	May-89	Jun-89	Jul-89	Aug-89	Sep-89	Oct-89	Nov-89	Dec-89	Jan-90	Feb-90	Mar-90	Apr-90	May-90	Jun-90	Jul-90	Aug-90	Sep-90	Oct-90	Nov-90	Dec-90	Jan-91	Feb-91	Mar-91	Apr-91	May-91	Jun-91
219	TCE				ND				ND		ND				NST	ND					NST		ND				NST						ND	NA		X
(MW-48)	Tc-99				0				0		8				NST	0					NST		0				NST						0	NA		X
220	TCE				ND			ND		ND					NST			NST			NST			NST			NST			NST			ND		ND	
	Tc-99				0			0		17					NST			NST			NST			NST			NST			NST			10		14	
221	TCE				ND																															
	Tc-99				ND																															
222	TCE				ND																															
	Tc-99				ND																															
223	TCE				ND																															
	Tc-99				ND																															
226	TCE					ND																														
(S-4/12A)	Tc-99					ND																														
226	TCE					ND																														
(S-4/12B)	Tc-99					NA																														
226	TCE					ND																														
(S-4/12C)	Tc-99					NA																														
226	TCE					ND																														
(S-4/12D)	Tc-99					NA																														
226	TCE					ND																														
(S-4/18A)	Tc-99					ND																														
226	TCE					ND																														
(S-4/18B)	Tc-99					NA																														
226	TCE					ND																														
(S-4/18C)	Tc-99					NA																														
226	TCE					ND																														
(S-4/18D)	Tc-99					NA																														
228	TCE					ND		ND			ND				ND		ND		ND				ND			ND			ND			ND			ND	
	Tc-99					1		0			22				11		9		8				5			18			20			8			0	
229	TCE					ND			NST			NST			NST			NST															NST			NST
	Tc-99					ND			NST			NST			NST			NST															NST			NST
230	TCE					ND			ND						ND			ND				ND		ND			ND			ND			NST			NST
	Tc-99					ND			ND						ND			ND				ND		ND			ND			ND			NST			NST

Appendix 4C
Summary of Energy Systems Groundwater Sampling Program
PGDP Phase II Site Investigation

Energy Systems' Station No. (Well Number)*	ID	Aug-88	Sep-88	Oct-88	Nov-88	Dec-88	Jan-89	Feb-89	Mar-89	Apr-89	May-89	Jun-89	Jul-89	Aug-89	Sep-89	Oct-89	Nov-89	Dec-89	Jan-90	Feb-90	Mar-90	Apr-90	May-90	Jun-90	Jul-90	Aug-90	Sep-90	Oct-90	Nov-90	Dec-90	Jan-91	Feb-91	Mar-91	Apr-91	May-91	Jun-91
231	TCE					ND			NST			NST															ND			ND			NST			NST
	Tc-99					ND			NST			NST															ND			ND			NST			NST
232	TCE					ND			ND						ND			ND						ND			2			ND			NST			NST
	Tc-99					ND			ND						ND			ND						ND			ND			ND			NST			NST
233	TCE					ND																														
	Tc-99					ND																														
234	TCE					ND																														
	Tc-99					ND																														
235	TCE							ND																ND												
	Tc-99							ND																ND												
236	TCE							ND																												
	Tc-99							ND																												
237	TCE							ND																								ND				
	Tc-99							ND																								ND				
238	TCE							ND																												
	Tc-99							ND																												
239	TCE								ND																											
	Tc-99								ND																											
240	TCE								ND																											
	Tc-99								ND																											
241	TCE									ND	NA																									
	Tc-99									NA	ND																									
242	TCE										ND				ND		ND		ND				ND			ND		ND					15		ND	
	Tc-99										28				9		19		NA				4			0		0					11		0	
243	TCE										ND													ND												
	Tc-99										ND													ND												
244	TCE											ND																								
	Tc-99											ND																								
246	TCE	ND																																		
	Tc-99	ND																																		
247	TCE											ND				ND																				
(RW-247)	Tc-99											NA				ND																				

Appendix 4C
Summary of Energy Systems Groundwater Sampling Program
PGDP Phase II Site Investigation

Energy Systems' Station No. (Well Number)*	ID	Aug-88	Sep-88	Oct-88	Nov-88	Dec-88	Jan-89	Feb-89	Mar-89	Apr-89	May-89	Jun-89	Jul-89	Aug-89	Sep-89	Oct-89	Nov-89	Dec-89	Jan-90	Feb-90	Mar-90	Apr-90	May-90	Jun-90	Jul-90	Aug-90	Sep-90	Oct-90	Nov-90	Dec-90	Jan-91	Feb-91	Mar-91	Apr-91	May-91	Jun-91
248	TCE									NA			ND			ND																				
	Tc-99									3			NA			NA																				
249	TCE											NA			NA														NA							
	Tc-99											12			12														15							
250	TCE											NA			NA						NA															
	Tc-99											NA			6						4															
251	TCE											NA				NA																				
(RW-251)	Tc-99											NA				NA																				
252	TCE											ND				ND																				
(RW-252)	Tc-99											ND				ND																				
253	TCE											NA					ND										ND		NA							
	Tc-99											NA					ND										ND		ND							
254	TCE											NA			NA														NA							
	Tc-99											NA			NA														ND							
255	TCE											ND																								
	Tc-99											ND																								
256	TCE																																			
	Tc-99																																			
257	TCE												ND																							
	Tc-99												ND																							
258	TCE												ND																							
	Tc-99												ND																							
259	TCE												ND																							
	Tc-99												ND																							
260	TCE													ND																						
	Tc-99													ND																						
261	TCE													ND																						
(water)	Tc-99													ND																						
261	TCE													NA																						
(sediment)	Tc-99													NA																						
262	TCE													ND																						
(water)	Tc-99													ND																						

Appendix 4C
Summary of Energy Systems Groundwater Sampling Program
PGDP Phase II Site Investigation

Energy Systems' Station No. (Well Number)*	ID	Aug-88	Sep-88	Oct-88	Nov-88	Dec-88	Jan-89	Feb-89	Mar-89	Apr-89	May-89	Jun-89	Jul-89	Aug-89	Sep-89	Oct-89	Nov-89	Dec-89	Jan-90	Feb-90	Mar-90	Apr-90	May-90	Jun-90	Jul-90	Aug-90	Sep-90	Oct-90	Nov-90	Dec-90	Jan-91	Feb-91	Mar-91	Apr-91	May-91	Jun-91
262	TCE													NA																						
(sediment)	Tc-99													NA																						
263	TCE													ND																						
(water)	Tc-99													ND																						
263	TCE													NA																						
(sediment)	Tc-99													NA																						
264	TCE													ND																						
(water)	Tc-99													ND																						
264	TCE													NA																						
(sediment)	Tc-99													NA																						
265	TCE																																			
	Tc-99																																			
266	TCE														ND																					
	Tc-99														ND																					
267	TCE														NA	NA	NA		NA		NA						NA		NA				NA		NA	
	Tc-99														NA	NA	NA		NA		NA						NA		NA				NA		NA	
268	TCE														NA		NA																			
	Tc-99														8		12																			
269	TCE															ND																				
	Tc-99															ND																				
270	TCE															ND																				
	Tc-99															ND																				
271	TCE															NA																				
	Tc-99															1140*																				
272	TCE															NA																				
	Tc-99															1160*																				
273	TCE															ND																				
(MW-7)	Tc-99															13																				
278	TCE																			ND							ND									ND
	Tc-99																			ND							ND									X
293	TCE																				ND		ND		ND		ND		ND		ND		ND		ND	
(RW-293)	Tc-99																				ND		ND		ND		ND		ND		ND		ND		ND	

Appendix 4C
Summary of Energy Systems Groundwater Sampling Program
PGDP Phase II Site Investigation

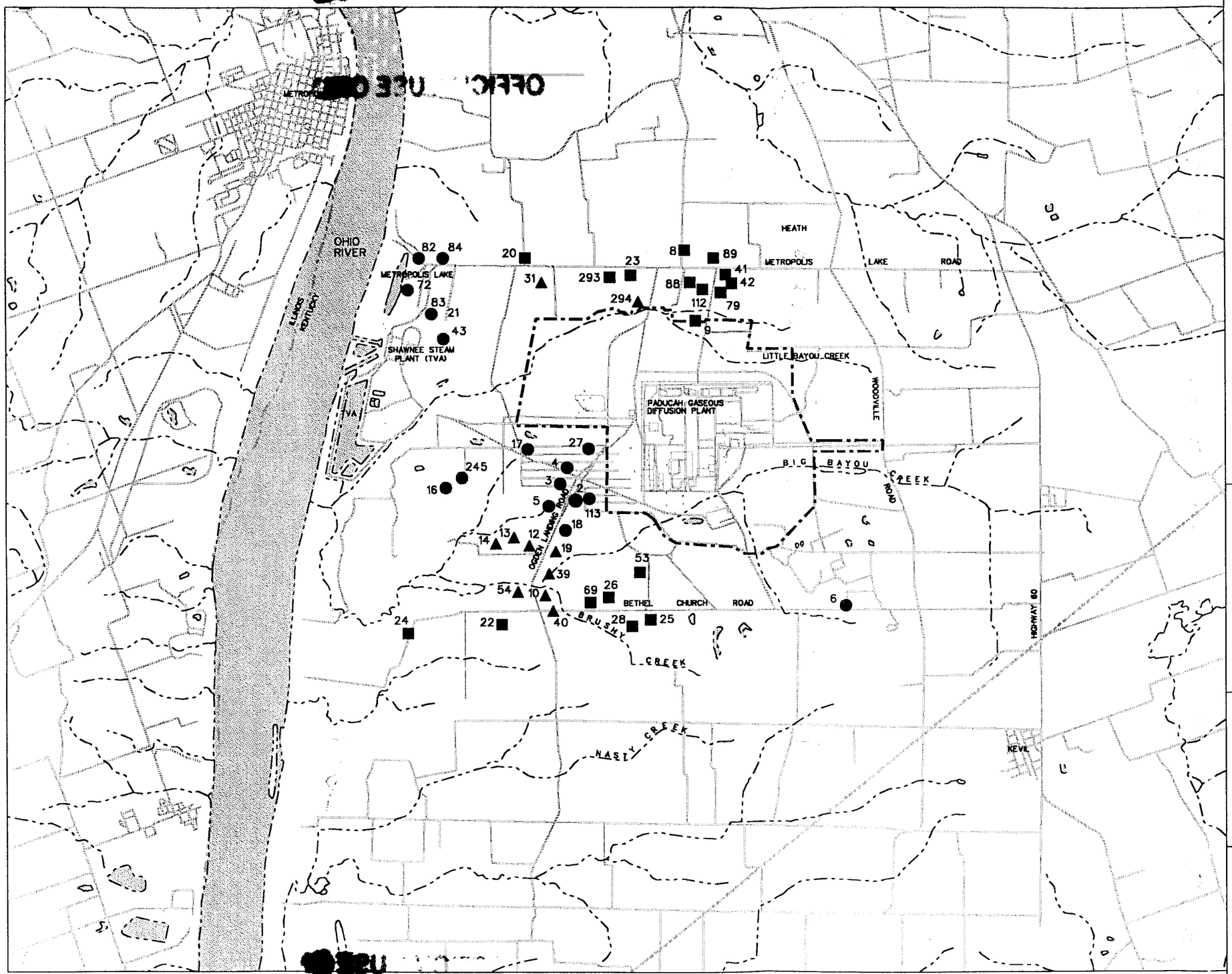
Energy Systems' Station No. (Well Number)*	ID	Aug-88	Sep-88	Oct-88	Nov-88	Dec-88	Jan-89	Feb-89	Mar-89	Apr-89	May-89	Jun-89	Jul-89	Aug-89	Sep-89	Oct-89	Nov-89	Dec-89	Jan-90	Feb-90	Mar-90	Apr-90	May-90	Jun-90	Jul-90	Aug-90	Sep-90	Oct-90	Nov-90	Dec-90	Jan-91	Feb-91	Mar-91	Apr-91	May-91	Jun-91
294	TCE																				ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	X
(RW-294)	Tc-99																				ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	X
302	TCE																				ND						ND			ND						ND
	Tc-99																				ND						ND			ND						ND

*This well was also sampled as part of the Phase I or Phase II Site Investigation.
NOTES:
TCE is measured in $\mu g/l$; Tc-99, in pCi/l.
A blank box indicates that sampling was not scheduled for that month.
Figure 4C-1 shows station locations only for wells sampled routinely by Energy Systems.
NA = Not analyzed
ND = Not detected
NST = No sample taken at time of scheduled sampling because well was inaccessible.
X = Sample collected; analysis in progress at time of Appendix preparation.

Source: Martin Marietta Energy Systems, Inc.

0888f063.dgn 10-Oct-1991

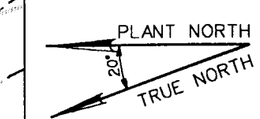
[redacted]



LEGEND

SAMPLING FREQUENCY:

- ● MONTHLY
- ■ BIMONTHLY
- ▲ WEEKLY



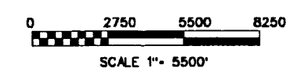


Figure 4C-1

RESIDENTIAL WELLS SAMPLED ON A ROUTINE BASIS FOR TCE AND Tc-99

PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION