Y-12

OAK RIDGE Y-12 PLANT

MARTIN MARIETTA

FISCAL YEAR 1994 WELL INSTALLATION
PROGRAM SUMMARY REPORT
Y-12 PLANT, OAK RIDGE, TENNESSEE

September 1994

ENVIRONMENTAL MANAGEMENT DEPARTMENT
HEALTH, SAFETY, ENVIRONMENT, AND
ACCOUNTABILITY ORGANIZATION

Prepared by

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for the

Oak Ridge Y-12 Plant
Oak Ridge, Tennessee

Managed by

Martin Marietta Energy Systems, Inc.
for the
U.S. Department of Energy

Under Contract Number DE-AC05-84OR21400

MANAGED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

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contributed to the preparation of this document and should not be considered an eligible contractor for its review.

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ACRONYMS

BGS	below ground surface
Energy Systems	Martin Marietta Energy Systems, Inc.
ESP	Environmental Surveillance Procedure
FY	fiscal year
GSA	Geological Society of America
GWPP	Groundwater Protection Program
HSEA	Health, Safety, Environment, and Accountability Organization
ID	inside diameter
LNAPL	light non-aqueous phase liquids
OD	outside diameter
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
SAIC	Science Applications International Corporation
TD	total depth
TOWR	top of weathered rock
UEFPC	Upper East Fork Poplar Creek
UST	Underground Storage Tank

EXECUTIVE SUMMARY

This report summarizes the well installation activities conducted during the federal fiscal year (FY) 1994 drilling program at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee. Synopses of monitoring well construction/well development data, well location rationale, geological/ hydrological observations, quality assurance/quality control methods, and health and safety monitoring are included.

Two monitoring wells were installed and one piezometer installation was attempted, but not completed, during the FY 1994 drilling program. In addition, SAIC provided health and safety and geotechnical oversight for two soil borings in support of the Y-12 Underground Storage Tank (UST) Program. All new monitoring wells were developed by either a 2.0-in. diameter swab rig or by hand bailing until nonspecific indicator parameters (pH and specific conductance) attained steady-state levels. Turbidity levels were lowered, if required, to the extent practicable by continued development beyond a steady-state level of pH and conductance.

All well installation was conducted following industry-standard methods and approved procedures in the *Environmental Surveillance Procedures Quality Control Program (Energy Systems 1988)*, the *Resource Conservation and Recovery Act (RCRA) Groundwater Monitoring Technical Enforcement Guidance Document (EPA 1986)*, and *Guidelines for Installation of Monitor Wells at the Y-12 Plant (Geraghty & Miller 1985)*.

Health and safety monitoring and field screening of drilling returns and development waters were conducted in accordance with approved Martin Marietta Energy Systems, Inc. (Energy Systems) guidelines.

All of the monitoring wells installed during FY 1994 at the Y-12 Plant were of screened construction.

1. INTRODUCTION

In late September 1993, Science Applications International Corporation (SAIC) was authorized by Martin Marietta Energy Systems, Inc. (Energy Systems) to provide hydrogeologic oversight to the Oak Ridge Y-12 Plant Groundwater Protection Program (GWPP) during the installation of monitoring wells and piezometers. As part of this effort, SAIC supervised drilling activities, directed monitoring well construction, and provided well site health and safety monitoring. The fiscal year (FY) 1994 drilling program (from October 1, 1993 through July 22, 1994) included the installation and development of two monitoring wells, the attempted installation of a temporary piezometer, and a health and safety oversight for the drilling and collection of two soil samples (Plate 1.1).

This report presents a summary of the activities and observations that took place during the FY 1994 drilling program. The report is organized in the following manner:

- general introduction and FY 1994 drilling program summary (Chap. 1);
- general geologic and hydrologic settings of the Y-12 Plant and vicinity, including field observations (Chap. 2);
- discussion of well construction methods and waste management practices (Chap. 3) (a Waste Management Plan for Drilling Activities is included in Appendix E);
- specific information regarding wells installed during the FY 1994 drilling program (Chap. 4); and
- quality assurance/quality control (QA/QC) and health and safety protocols used during the FY 1994 drilling program (Chaps. 5 and 6).

Copies of the well installation Activity/Progress Reports, Lithologic Logs, Well Construction Diagrams, Well Development Data, Waste Management Screening Data, and Equipment Decontamination Records are included in Appendices A, B, C, D, F, and G, respectively.

1.1 FISCAL YEAR 1994 WELL INSTALLATION PROGRAM SUMMARY

The FY 1994 drilling program consisted, in part, of the installation and development of two monitoring wells and the attempted installation of one temporary piezometer. The total depths (TDs) of the wells range from 16.1 ft to 23.0 ft below ground surface (BGS). The two monitoring wells (GW-816 and GW-817) were installed in a manner to ensure the collection of light non-aqueous phase liquids (LNPLs) during sampling episodes.

The piezometer was intended to measure water table levels near Building 9201-2 in an effort to understand the water table hydrology around the building whose basement is prone to flooding during high rainfall events. The piezometer borehole was drilled to a TD of 11.7 ft. No water was observed at that depth; therefore, the piezometer was not installed and the borehole plugged. Table 1.1 presents a list of the wells installed during the FY 1994 drilling program and includes location coordinates. Plate 1.1 presents the locations of the monitoring wells and piezometer.

Two soil borings, located within the Y-12 Plant, were drilled to collect soil samples at the Garage Underground Storage Tank (UST) site (the tank had been removed in 1989).

Table 1.1. FY 1994 monitoring wells and functional areas

Well	Functional area	Y-12 Grid easting coordinate	Y-12 Grid northing coordinate
GW-816	Scarboro Road	64031.36	31581.50
GW-817	Scarboro Road	64642.99	29269.15
GW-824 ^a	Y-12 Plant (Bldg. 9201-2)	E 60022	N 29454

^aPiezometer (grid coordinates were hand scaled)

2. GENERAL GEOLOGY AND HYDROLOGY

The Y-12 Plant is located in Bear Creek Valley, in the southwestern corner of Anderson County. The Y-12 Plant, occupying an area of approximately 86 square miles, lies in a portion of the Tennessee section of the Valley and Ridge Physiographic Province (McMaster 1963). This province is characterized by narrow, elongated ridges and valleys trending northeast-southwest. Resistant sandstone, siltstone, and siliceous limestone and dolostone typically form the ridges; valleys are commonly underlain by less resistant shale and soluble carbonates (Rodgers 1953). Bear Creek Valley is bounded by Pine Ridge to the north and Chestnut Ridge to the south (Fig. 2.1). Elevations within the Oak Ridge Reservation range from approximately 900 ft to just over 1200 ft above mean sea level.

2.1 STRATIGRAPHY

Three major stratigraphic units, classified according to lithology, fossils, and age, underlie the Bear Creek Valley area. From oldest to youngest, these units are the Rome Formation, Conasauga Group, and Knox Group. Figures 2.1 and 2.2 are a generalized geologic cross section and map, respectively, that illustrate the locations and stratigraphic positions of the major stratigraphic groups and formations that occur in the Bear Creek Valley area.

The Rome Formation, which forms Pine Ridge, is Lower Cambrian in age and consists of interbedded sandstone, shale, and siltstone with local beds of dolostone (McMaster 1963).

The Conasauga Group, of the Middle to Upper Cambrian period, has been subdivided into six formations of alternating, predominantly shale and limestone lithologies. The six divisions, from oldest to youngest, are Pumpkin Valley Shale, Rutledge Limestone, Rogersville Shale, Maryville Limestone, Nolichucky Shale, and Maynardville Limestone. Detailed lithologic descriptions of these formations are given in King and Haase (1987). The Conasauga Group formations are overlain by unconsolidated deposits of fill, alluvium, colluvium, and in situ weathered bedrock (residuum) from <1 ft to >30 ft.

Chestnut Ridge, to the south of Bear Creek Valley, is formed from siliceous dolostones of the Knox Group. This upper Cambrian to lower Ordovician-aged unit is divided into five formations that are, from oldest to youngest, the Copper Ridge Dolomite, Chepultepec Dolomite, Longview Dolomite, Kingsport Formation, and Mascot Dolomite. Detailed lithologic descriptions of the Knox Group formations are published in Milici (1973). Unconsolidated deposits overlying the Knox Group on Chestnut Ridge, in the vicinity of the Y-12 Plant, are considerably thicker than the unconsolidated deposits in the adjacent valleys.

Figure 2.3 is a generalized stratigraphic column of the major stratigraphic units and accepted subdivisions of the Y-12 Plant area bedrock formations.

The formations located in and around Bear Creek Valley generally strike N47°E to N67°E. Regional dips are from 30° to 50° to the southeast (King and Haase 1987). Joints are reported to be common features in the strata of Bear Creek Valley. Several studies have indicated that joint orientation and spacing in Bear Creek Valley are quite variable. However, each of these studies has identified at least one major joint set that roughly parallels the regional strike (Kamp 1985). Small-scale folds, produced from thrust faulting, are common in the Bear Creek Valley formations and contribute to the varied bedding orientations in the area (Rothschild et al. 1984).

Fig. 2.1. Generalized geologic cross section through the Y-12 Plant area.

Sources: McMaster 1963, King and Haase 1987

Fig. 2.2. Generalized geologic map of the Y-12 Plant area.

Age	Group	Formation	Approximate Thickness (ft)		
			King and Haase 1987	Milici 1973	McMaster 1963
Lower Ordovician	Knox	Mascot Formation	Not Determined	400-800	3000 (undivided)
		Kingsport Formation		200-320	
		Longview Dolomite		250-450	
		Chepuhtepac Dolomite		725-880	
		Copper Ridge Dolomite		900-1000	
Middle & Upper Cambrian	Conasauga	Maynardville Limestone	418-450		1500 (undivided)
		Nolichucky Shale	422-550		
		Maryville Limestone	346-445		
		Hogersville Shale	80-120		
		Bulledge Limestone	80-120		
		Pumpkin Valley Shale	260-320		
Lower Cambrian		Rome	Not Determined		800+

Fig. 2.3. Stratigraphic units in the vicinity of the Y-12 Plant.

2.2 HYDROLOGY

Three distinct hydrologic regimes exist in the Y-12 Plant vicinity. Within Bear Creek Valley, the Upper East Fork Poplar Creek (UEFPC) drainage channel controls groundwater flow in most of the Y-12 Plant vicinity and to the east. The Bear Creek drainage channel controls groundwater flow west of the Y-12 Plant. The flow path systems within the Maynardville Limestone that underlie the streams provide the principal conduits for groundwater movement. Although the surface and subsurface hydrologies have been altered by construction and recontouring of the topography, the original drainage still plays an important role in the subsurface movement of water. Major components of groundwater flow include movement through unconsolidated weathered rock and fill under unconfined conditions, and flow along bedding planes, fractures, and solution channels in the consolidated rock, generally under confined conditions (Kamp 1985). In Bear Creek Valley, recharge occurs predominantly by infiltrating precipitation through unconsolidated material downward to the underlying bedrock. In general, groundwater flow in bedrock appears to be predominantly within solution cavities and fractures in the bedrock.

A third hydrologic regime that influences the Y-12 Plant hydrology is the Chestnut Ridge area. This area impacts recharge to Bear Creek Valley and contributes strike-normal flow to the UEFPC and Bear Creek regimes (Geraghty & Miller 1990). Groundwater flow within this regime is also principally in fractures and cavities within consolidated bedrock or in the weathered bedrock zone under unconfined conditions. Flow in this regime is under substantial topographic influence with the principal pathways normal to strike and discharge primarily to springs in Bear Creek Valley to the north and Bethel Valley to the south.

2.3 FIELD OBSERVATIONS

During FY 1994, two monitoring wells were installed, one piezometer installation was attempted but abandoned due to lack of water, and two soil borings were drilled for soil sample collection.

The two monitoring wells installed, GW-816 and GW-817, were located at the far east end of the Y-12 Plant, in terrain affected by the UEFPC drainage channel. Well GW-816, drilled to a TD of 16.1 ft, was installed in alluvium overlying the Rome Formation. No bedrock (fresh or weathered) was encountered in the bore. The first indication of groundwater was a diffuse occurrence beginning at 7.0 ft BGS. Well GW-817 was installed in the Nolichucky Shale member of the Conasauga Group. Well GW-817 encountered 11.6 ft of unconsolidated material (soil/residuum) prior to reaching weathered bedrock. The weathered bedrock interval here was 6.8 ft thick. Groundwater, also of a diffuse nature, was observed from 5.5 ft to TD (23.0 ft BGS).

The piezometer was located in the Y-12 Plant near the headwaters of UEFPC. The piezometer (GW-824) penetrated 0.5 ft of asphalt and 10.5 ft of gravel fill before encountering bedrock. No groundwater was observed from the borehole, which was subsequently plugged and abandoned.

Both soil borings at the East End Fuel station penetrated approximately 8 ft of clayey soil capping the excavated tank pit, and gravel that was used as back-fill material for the pit. Boring BH-1 encountered an old concrete pad below the gravel at 13.9 ft BGS and no sample was obtained. Boring BH-2 reached residuum below the gravel at 15.0 ft BGS. No groundwater was observed in either boring.

3. WELL INSTALLATION AND DEVELOPMENT METHODS

Groundwater monitoring wells installed at the Y-12 Plant during FY 1994 were stainless-steel and of screened construction. There were no open-hole monitoring wells installed at the Y-12 Plant during FY 1994, and none of the screened wells required the use of surface casing. Highland Drilling, Inc., along with Ogden Environmental and Energy Services Co., was contracted to drill monitoring wells on this project. Both FY 1994 monitoring wells were drilled using a combination of a Central Mining Equipment 75 and an Ingersoll-Rand XL-750 air rotary drilling rigs.

3.1 SCREENED WELLS

Screened Wells installed during FY 1994 targeted the water table or groundwater occurrences of shallow depths; one exclusively in unconsolidated material, and another one monitoring unconsolidated material, weathered bedrock, and competent bedrock. No surface casing was used during FY 1994. The following presents the standard well installation procedure used at the Y-12 Plant.

3.1.1 Screened Wells in the Unconsolidated Zone

In general, the borehole was advanced to the target depth using 10.0-in. diameter augers on a 10 5/8-in. diameter tricone roller bit.

Stainless-steel screen and riser casing were then installed in the borehole. Screen segments were usually 10-ft long No. 10 (0.01-in.) openings, continuous-wire wound, 4.5-in. outer diameter (OD), 4.25-in. inner diameter (ID), 2- or 4-pitch, flush-threaded stainless steel. Riser segments were generally 10-ft-long Schedule 5, Number 304, 4.5-in. OD, 4.25-in. ID, flush-threaded stainless-steel casing. Stainless-steel centralizers were installed on the riser casing at approximately 40- to 60-ft intervals. If mud or cuttings remained in the well bore after final cleaning, approximately 1 ft of J-20 high-purity sand, on which to set the screen, was placed in the borehole.

The sand pack, consisting of J-20 high-purity sand, was placed around the screen using 1.5-in. OD PVC tremie pipe and potable water. The sand pack level during installation was monitored by continuous sounding with a weighted tape. The level of the sand was brought up to approximately 1.0 ft above the top of the screen. An unhydrated bentonite pellet seal approximately 2.0 ft thick was placed on the sand pack by slow pouring with constant sounding by weighted tape to avoid bridging. The seal was allowed to hydrate a minimum of 4 hrs according to manufacturers' recommendations, and hydrated thickness was checked to ensure a minimum of a 2.0-ft hydrated bentonite seal thickness.

The remaining annulus was grouted in several stages using 2% bentonite-cement grout. The initial stage almost always consisted of the placement of a 5- to 10-ft- (1 to 2 cubic ft) thick grout plug tremied on top of the bentonite seal and allowed to cure for 24 hrs. This initial stage prevents failure of the bentonite seal during subsequent grouting with larger volumes of cement.

Figure 3.1 represents a schematic of a typical screened well installed in unconsolidated material.

3.2 DEVIATIONS

Special circumstances sometimes necessitated deviations from the standard drilling and/or well installation programs discussed in Sect. 3.1. All deviations from approved well installation procedures received prior authorization from Energy Systems personnel.

Fig. 3.1. Typical screened well, unconsolidated zone schematic.

Well GW-817 borehole, originally drilled with 10.0-in. diameter augers to refusal, was deepened using a 10.75-in. diameter tricone roller bit. A 20.6-ft section of screen was used to ensure that an adequate water supply (for sampling) with sufficient recharge was available.

3.3 WELL DEVELOPMENT

Upon completion of well construction, all wells installed at the Y-12 Plant in FY 1994 were developed. Development is required to remove all sediment and foreign materials from the well and to restore natural hydraulic conditions in the formation by cleaning and grading the filter packs. Well GW-817 (22.3 ft deep) was developed by swabbing. This procedure involved installation of 2.0-in. ID, 2.38-in. OD steel tubing with a bottom check valve to the full depth of the well. A swab tool attached to a stainless-steel wire-line was then moved repeatedly up and down the length of the tubing evacuating water to the surface through an outlet. Very shallow, unconsolidated zone wells were developed by hand bailing. Development water obtained by both methods was placed in a drum where volumes were noted and field observations made. If required, development waters were placed and stored in U.S. Department of Transportation-approved, bung-top drums or polyethylene tanks pending sampling and analysis or disposal. If no containment requirements existed and indicator parameters were below action levels, then the development water was discharged to the ground surface.

Prior to development, a water level was measured in each well and a well volume was thereby calculated. Typically, an excess of one well volume, depending on recharge rates, was removed from each well for several consecutive days. If recharge rates permitted, the well was completely developed in as short a time as 1 day. Specific conductance, pH, temperature, and turbidity were monitored continuously during development. A minimum total of three well volumes was removed from each well; however, the principal acceptance criteria were stable values for pH and conductance for three consecutive samples. If the nonspecific indicator parameters stabilized but turbidity levels remained high, then the well continued to be developed until no further turbidity improvements were noted. Most wells, therefore, had substantially more than three well volumes removed. Appendix D contains well development data for each of the FY 1994 monitoring wells. Table 3.1 summarizes the development data from the wells installed in FY 1994.

Table 3.1. FY 1994 well development data summary

Well	Water level (ft BGS)	TD ^a (ft BGS)	Well volume (gal)	Development water		Development method	Aquifer
				(gal)	(well volumes)		
GW-816	8.75	14.2	3.5	55	15.6	Bailer	U ^b
GW-817	4.5	22.3	11.7	144	12.3	Swab/bailer	U/wB ^c /B ^d
GW-824	-NA-	11.7	-NA-	-NA-	-NA-	-NA-	U ^b

^aDepth to bottom of open interval or screen

^bU = Unconsolidated Aquifer

^cwB = Weathered Bedrock Aquifer

^dB = Bedrock Aquifer

-NA- Not Available

3.4 WASTE MANAGEMENT PRACTICES

A waste management plan for the well installation program was supplied by the Energy Systems Y-12 GWPP (Appendix E). Drilling cuttings and water were discharged to the ground surface or to an excavated cuttings pit, provided that field screening criteria for radiation, volatile organics, and pH were not exceeded. In the event that drill cuttings exceeded acceptable disposal limits, Health, Safety, Environment, and Accountability Organization (HSEA) personnel directed subcontractor personnel in the proper disposal techniques.

At no time during FY 1994 did drill cuttings or development water exceed acceptable disposal limits or require any unusual waste management techniques.

4. FISCAL YEAR 1994 WELL INSTALLATIONS

This section presents a brief summary of each of the FY 1994 monitoring wells, including pertinent drilling data, geologic and lithologic observations, and rationale for the well location. The descriptions are presented in numerical order, grouped by functional areas. Details of well installation activities, lithology, and well construction elements may be found in Appendices A through C. Table 4.1 presents a data summary for the FY 1994 drilling program.

4.1 SCARBORO ROAD AREA

The only two wells (GW-816, GW-817) installed at the Y-12 Plant during FY 1994 were located at the east end of the plant in the area at Scarboro Road. These wells were installed to monitor the groundwater table interval. The monitoring interval was positioned in such a way that it straddles the water table during all times of the year. This well design is advantageous in monitoring for any potential LNAPL contaminants.

GW-816

Well GW-816 is located on the west shoulder of Scarboro Road, near the Guard Shack in the Pine Ridge Water Gap. A 10.0-in. OD, 6.25-in. ID hollow-stem auger was used to drill the well bore to 16.1 ft BGS. Weathered bedrock was not encountered as the borehole remained in residuum to TD. The first occurrence of groundwater was of moist cuttings at 7.0 ft BGS. A 10.0-ft section of 4.5-in. OD, 4.25-in. ID, continuous wire-wound stainless-steel screen along with a 10.0-ft section of 4.5-in. OD, 4.25-in. ID, flush-threaded stainless-steel riser casing were run into the borehole (through the augers) to 14.2 ft BGS (the top of the screen is located at 4.2 ft BGS). A total of 10 sacks (500 lbs) of J-20 sand was poured into the well annulus as the augers were removed from the borehole. The top of the sand pack is at 2.9 ft BGS. One 50-lb bucket of 3/8 -in. diameter bentonite pellets was poured into the annulus and hydrated, creating the annular seal from 2.9 ft to 0.9 ft BGS. The remaining annulus was capped with Type I cement to complete the installation. The pre-development water level was measured at 8.75 ft BGS. Well GW-816 was installed entirely in the unconsolidated deposits overlying the Rome Formation.

GW-817

Well GW-817 is located northwest of the intersection of Second Street with Scarboro Road. A 10.0-in. OD, 6.25-in. ID hollow-stem auger was used to pilot the well bore to 11.6 ft BGS where auger refusal occurred at the top of weathered rock (TOWR). After waiting 3 days for the water table to reach its static position (last measured at 6.1 ft BGS), HSEA elected to deepen the well bore to try and improve the recharge.

A 10.75-in. diameter tricone roller bit (and air-rotary drilling rig) was used to extend the well bore from 11.6 ft to 23.0 ft BGS. Fresh bedrock of the Nolichucky Shale was encountered at 18.4 ft BGS. A 21.6-ft length of 4.5-in. OD, 4.25-in. ID, continuous wire-wound fabricated screen, plus a 6.8-ft section of 4.5-in. OD, 4.25-in. ID stainless-steel riser casing, were run into the borehole with the screen located between 1.0 ft and 22.3 ft BGS. A total of 21.5 sacks (1075 lbs) of J-20 sand was poured into the annulus to 0.6 ft BGS. One 50-lb bucket of 3/8-in. diameter bentonite pellets, poured into the annulus, form a seal from 0.6 ft to 0.2 ft BGS. The remaining annulus was filled with concrete as the pad was poured.

4.2 PIEZOMETER INSTALLATION

GW-824

A piezometer (GW-824) installation was attempted to help understand the groundwater hydrology around Building 9201-2 within the Y-12 Plant. The basement of the building is prone to flooding during high rainfall events.

Table 4.1. FY 1994 well construction data summary

Well number	Ground elevation (ft)	Top of casing elevation (ft)	Unconsolidated/weathered bedrock thickness (ft)	Depth of surface casing (ft BGS)	Construction type	Interval monitored	Total depth (ft BGS)	Collar/target formation
GW-816	894.56	898.21	-NA-	-NA-	Screened	4.2-14.2	16.1	Crm/Crm ^a
GW-817	914.61	918.12	11.6/6.8	-NA-	Screened	1.0-22.3	23.0	Cnl/Cnl ^b
GW-824 ^c	Unknown	-NA-	>11.7	-NA-	-NA-	-NA-	11.7	Cnl/Cnl ^b

^aCrm - Rome Foundation

^bCnl - Nolichucky Shale

^cPiezometer

-NA- Not Applicable

During the initial attempt to drill the piezometer borehole, a slab of concrete (greater than 1 ft) was encountered. Attempts to break the concrete proved futile and the borehole location was moved. The borehole was moved 3.0 ft north and was drilled to refusal at 11.0 ft BGS with 6.0-in. diameter solid-stem augers. Once through the asphalt paving, the augers penetrated 10.5 ft of gravel backfill. Upon removing the augers, it was discovered that the borehole had collapsed to 5.8 ft BGS. No water was encountered at this time.

An attempt to deepen the borehole and install the piezometer was made using 8.0-in. OD, 3 1/4-in. ID hollow-stem augers. Refusal for this attempt was at 11.7 ft BGS. Water was again absent from the borehole. The borehole was backfilled with gravel cuttings to 0.7 ft BGS. The remaining borehole was capped with Type I cement to the ground surface. No further attempts at piezometer installation were made.

4.3 SOIL BORINGS

The soil borings (BH-1/BH-2) were performed to obtain soil samples of the Garage UST (Building 9754) site.

BH-1

Boring BH-1 was drilled to 13.2 ft BGS with a 7.0-in. OD, 3 1/4-in. ID hollow-stem auger. The borehole penetrated approximately 8 ft of clayey soil and 5.2 ft of gravel. At 13.2 ft BGS a split-spoon sampler was driven to 13.9 ft BGS where refusal occurred on a concrete pad. The borehole was back-filled with cuttings along with Hole Plug™ granular bentonite, and subsequently capped with clay soil.

BH-2

Since no usable sample was obtained from BH-1, an alternate site was used (BH-2). Boring BH-2 was drilled using 7.0-in. OD, 3 1/4-in. ID hollow-stem augers to a depth of 15.0 ft BGS. BH-2 penetrated approximately 8 ft of clayey soil and an additional 7 ft of gravel fill. Two samples of soil/residuum were taken using split-spoon samplers from 15.0 ft to 18.5 ft BGS. The borehole was back-filled with cuttings and Hole Plug™, and subsequently capped with clay soil.

5. QUALITY ASSURANCE

All FY 1994 monitoring wells were installed and developed following procedures and technical guidelines in Environmental Surveillance Procedure (ESP)-600, *Well Installation, Development, and Abandonment* (Energy Systems 1988), the *Resource Conservation and Recovery Act (RCRA) Technical Enforcement Guidance Document* (EPA 1986), and *Guidelines for Installation of Monitor Wells at the Y-12 Plant* (Geraghty & Miller 1985). Details of well construction were recorded by SAIC oversight geologists in bound field books and the information was compiled into a final well-installation activity/progress report (Appendix A). Any deviations from standard well installation guidelines, such as the use of bentonite Hole Plug™ for the annular sealant, were preapproved by the Energy Systems GWPP Manager or designee and were recorded in the activity report. Independent verification of well depths and wellhead completion was conducted by Energy Systems.

All well construction materials and drilling equipment were decontaminated or certified as precleaned before use at each well and as needed during well installation. Inspection of all materials and equipment before use at each well site was conducted by the oversight geologist. Equipment was periodically checked during drilling activities to ensure sound mechanical operation and to avoid detrimental impact to well quality from equipment failure. A nonpetroleum (beeswax)-based lubricant (Well-Guard™) was used for all drilling and steel casing installation activities.

Lithologic control during well installation was maintained by continuously collecting and logging drill cutting samples over 2- to 5-ft intervals. The presence of cavities, fractures, and soft drilling zones was denoted by continuous observation of drilling characteristics, such as penetration rate. This information was also recorded in bound field books and compiled into a final well log for each well (Appendix B). All carbonate lithologic descriptions were accomplished following the system of classification established by Folk (Folk 1980), where applicable, and color notations were standardized through use of the Geological Society of America (GSA) Rock Color Chart (GSA 1980).

All well installation reports underwent internal technical and editorial reviews prior to being issued to Energy Systems.

6. HEALTH AND SAFETY

Health and safety monitoring during each well installation was conducted in accordance with the *Health and Safety Plan for Well Installation and Plugging and Abandonment Activities, Y-12 Plant, Oak Ridge, Tennessee* (SAIC 1992) [Y/SUB/92-99928C/(Y11)/1]. All personnel working on site were required to have completed the 40-hr hazardous waste site operations training in accordance with 29 CFR 1910.120, and have satisfied annual refresher requirements. Oversight personnel were required to have been Red Cross-certified in first aid and CPR techniques and to maintain that certification throughout the task. All personnel had undergone an occupational physical examination and respirator fit test within one year before drilling operations. On-site personnel attended a site-specific health and safety briefing before commencement of drilling activities to discuss potentially hazardous materials, potentially dangerous activities and situations, protective equipment, and decontamination procedures. Site-specific waste management plans and excavation/penetration permits were obtained prior to drilling at each well site.

Based on reviews of the hazard potential that were conducted at each specific site before drilling operations, Level D personnel protective equipment was selected for each site. At this level, individual protection consists of either Tyvek™ suits or individual work clothes, steel-toed safety boots, gloves, hard hats, ear plugs, and safety glasses.

Air quality in the breathing zone was monitored throughout the drilling program using an HNu™ photoionization detector, or a Century Foxboro OVA™ flame ionization detector. Radioactivity was measured using a Ludlum Model 3 survey meter and G-M pancake probe for beta and gamma activity, and a Ludlum Model 12 Count Ratemeter with a scintillation tube probe for alpha activity. Thermoluminescent detector badges were worn by all personnel at all times.

In addition to the health and safety screening outlined above, composite samples of drilling cuttings and well development waters were screened on a daily basis for organic vapors in headspace samples, pH, and specific conductance (in development water only) according to a general waste management plan (Appendix E). Screening data for well cuttings and development water (Appendix F) provided further information on the presence or absence of hazardous compounds and characteristics of drilling cuttings or fluids to which site personnel might be exposed.

7. REFERENCES

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APPENDIX A
ACTIVITY/PROGRESS REPORTS

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM			BORING NO. <u>BH-1/BH-2</u>
BOREHOLE ACTIVITY/PROGRESS REPORT			PAGE 1 of 4
LOCATION: <u>East End Fuel Station UST</u>		DATE: START: <u>11-30-93</u>	
DRILLER: <u>J.C. Draper - Law Engineering</u>		FINISH: <u>12-1-93</u>	
HELPER: <u>Woody Duncan - Law Engineering</u>		LOGGED BY: <u>Timothy Coffey - SAIC</u>	
DRILL: <u>CME 55</u>			

DATE	TIME		ACTIVITY/COMMENTS
	START	FINISH	
11-30-93	1235	1240	Arrive at East End Fuel Station. Law Engineering crew is onsite, waiting. W. Thedford (HSEA) is onsite, reports that he has inspected the Law drill rig for safety compliance, and approved it. Bill is checking on the split spoons.
	1240	1255	D. Bohrman and E. Ingram (both of Y-12 ER) arrive. Don briefs drill crew and oversight on site history and plan for today. Plan to drill a soil boring to a target depth of approximately 12 ft, then take 2 soil samples using split-spoon sampling devices. If, at the first location, the augers encounter the concrete pad on which the former UST sat, then samples will be taken from the alternate location.
	1255	1310	Move drill to BH-1 location and begin setting up site. Background radiation scan of site: alpha = 0 cpm, beta/gamma = 60 cpm. Sample technicians: A. Garland and J. Williams (both of HSEA) arrive.
	1310	1325	D. Bohrman conducts site-specific health and safety briefing. Action level for organic vapors in the breathing zone will be 1 ppm above background.
	1325	1333	Rig up a 3.25-in. inside diameter (ID), 7.0-in. outside diameter (OD), hollow-stem lead auger flight with bit; overall length = 5.4 ft. Background organic vapors = 0.2 ppm.

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM			BORING NO. <u>BH-1/BH-2</u>
BOREHOLE ACTIVITY/PROGRESS REPORT - continued			PAGE 2 of 4
DATE	TIME		ACTIVITY/COMMENTS
	START	FINISH	
10-30-93	1333	1346	Commence augering. Auger from 0.0 ft to 13.2 ft below ground surface (BGS). Continuous breathing zone analysis (BZA) over entire interval = 0.2 ppm. Encounter gravel at 6.0 ft BGS. Cuttings appear to be all gravel by 8.0 ft BGS. Organic vapor reading at collar of auger at 10.0 ft BGS = 0.4 ppm.
(cont.)			
	1346	1351	At target depth of 13.2 ft BGS. Driller suspects that rig is no longer drilling in gravel. Remove internal clean-out plug from augers. Run a 2.0-in. OD, 18-in. long carbon steel split-spoon sampler into borehole.
	1351	1353	Drive first split-spoon with standard 140 lb weight. Blow count (per 6-in. interval): 3/10 refusal after 0.2 ft of interval at 13.9 ft BGS (suspect concrete pad). Unable to sample at this location.
	1353	1400	Trip out augers. No water encountered, augers are dry and fairly clean.
	1400	1405	Slowly pour 2 sacks (1.4 cubic ft) of Hole Plug™ along with augered cuttings. Hole Plug™/cuttings level at 4.0 ft BGS.
	1405	1409	Move drill rig to BH-2 location (12.0 ft north of BH-1) and set up drill rig.
	1409	1412	Rig up with another (clean) 3.25-in. ID, 7.0-in. OD, hollow-stem lead auger flight with bit. Total length = 5.4 ft. Background organic vapors = 0.2 ppm.
	1412	1420	Commence augering. Auger from 0.0 ft to 15.0 ft BGS. Continuous BZA over entire interval never exceeded 0.2 ppm. Encounter gravel at 4.5 ft BGS. Cuttings, again, exclusively gravel by 8.0 ft BGS. Odor of diesel fuel near the borehole collar at 10.0 ft BGS.

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM			BORING NO. <u>BH-1/BH-2</u>
BOREHOLE ACTIVITY/PROGRESS REPORT - continued			
			PAGE 3 of 4
DATE	TIME		ACTIVITY/COMMENTS
	START	FINISH	
11-30-93			Organic vapors at collar:
(cont.)			
			10.0 ft BGS = 0.2
			14.0 ft BGS = 3.2 ppm (max), 2.0 ppm (steady)
			15.0 ft BGS = 1.5-2.0 ppm (steady)
	1420	1423	At target depth of 15.0 ft BGS, apparently below gravel interval.
			Remove internal clean-out plug from augers. Run a 2.0-in. OD,
			18-in. long carbon steel split-spoon sampler into the borehole.
	1423	1425	Drive first split-spoon from 15.0 ft to 16.5 ft BGS. Blow count (per
			6-in. interval): 3/7/12.
	1425	1430	Retrieve split-spoon. Split-spoon opened (time: 1426 hrs) and
			screened with HNu HW-101: 0.0 ppm. Slightly less than 100%
			recovery. Sample technicians composite sample and place in
			jars for analysis. Replace internal clean out plug.
	1430	1433	Advance augers to 16.5 ft BGS. Remove internal clean out plug.
			Run 2.0-in. OD, 24-in. long carbon steel split-spoon sampler into
			the borehole.
	1433	1436	Drive second split-spoon from 16.5 ft to 18.5 ft BGS. Blow count
			(per 6-in. interval): 9/20/30/32.
	1436	1445	Retrieve split-spoon with some difficulty (stuck). Split-spoon
			opened (time: 1440 hrs) and screened with HNu HW-101: 0.0 ppm.
			Recover 100%. Sample technicians composite sample and
			place in jars for analysis.
	1445	1452	Trip out augers.

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM			WELL NO. <u>GW-816</u>
WELL INSTALLATION ACTIVITY/PROGRESS REPORT			PAGE 1 of 3
LOCATION: <u>Scarboro Road</u> DRILLER: <u>G. Akins - Ogden Environmental and Energy Services Co.</u> HELPERS: <u>R. Phillips - Highland Drilling Co.</u> <u>C. Selvidge - Ogden</u> DRILL: <u>CME-75</u>		DATE: START: <u>5-31-94</u> FINISH: <u>6-2-94</u> LOGGED BY: <u>S.L. Abston - SAIC</u>	
DATE	TIME		ACTIVITY/COMMENTS
	START	FINISH	
5-31-94	0935	1005	Arrive at corner of Scarboro Road and Bear Creek Road for tailgate health and safety briefing. Conducted by S. Jones (HSEA). C. Taylor and G. Akins (Ogden), S. Abston and T. Coffey (SAIC), and R. Phillips (Highland) in attendance.
	1005	1018	G. Akins returns to Ogden to pick up a 12-ft grounding rod and to pick up J. Hutchins as a replacement helper. C. Taylor is not badged. Depart to GW-816 site.
	1018	1030	Arrive at GW-816 and position rig over well location.
	1030	1040	Flag work area and prepare to begin drilling.
	1040	1048	Conduct health and safety briefing for J. Hutchins. He departs site due to lack of current OSHA certificate. R. Phillips will help G. Akins.
	1048	1057	Raise mast and rig up with 5-ft auger flight with 0.2-ft bit with 2-ft teeth. Total length = 5.4 ft. Dimensions of auger bit: 10.0 in outside diameter (OD), 6.25 in. inside diameter (ID). Auger adapted with an internal clean out bit. Background radiation scan of location alpha = 10 cpm, beta/gamma = 70 cpm.
	1057	1103	Commence driving 12.5-ft grounding rod 10 ft into the ground using the automatic hammer of the drill rig. Breathing zone analysis (BZA) at 1.0 ft below ground surface (BGS) = 0.0 ppm lower explosive limit (LEL) reading of 1 ft BGS = <1%.

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM			WELL NO. <u>GW-816</u>
WELL INSTALLATION ACTIVITY/PROGRESS REPORT continued			PAGE 2 of 3
DATE	TIME		ACTIVITY/COMMENTS
	START	FINISH	
5-31-94	1103	1112	Commence augering. BZA @ 2.5 ft BGS = 0.0 ppm, LEL reading
(cont.)			= <1%. Beta/gamma scan of cuttings range from 20-60 cpm at
			borehole for first auger flight interval.
	1112	1116	Add second 5-ft auger flight, continue augering. BZA at 6.5 ft
			BGS = 0.0 ppm. LEL reading <1%. Beta/gamma scan of
			cuttings at borehole = 60 cpm. Becoming moist at 7.0 ft BGS.
	1116	1126	Add third 5-ft auger flight, continue augering. BZA at 13 ft BGS
			= 0.0 ppm. LEL reading <1%. Beta/gamma scan of cuttings at
			borehole = 30 cpm.
	1126	1140	Add fourth 5-ft auger flight, continue augering to 16 ft BGS. BZA
			at 15 ft BGS = 0.0 ppm. Beta/gamma scan of cuttings at
			borehole = 40 cpm. Stopped drilling at 16.1 ft BGS.
	1140	1215	Measure water level at 15.3 ft below top of augers (BTA) = 14.8
			ft BGS. Secure site and depart for lunch to let water accumulate
			in borehole.
	1215	1235	Conduct health and safety briefing for C. Selvidge (Ogden).
	1235	1248	Return to GW-816 site. Measure water level at 10.4 ft BGS. S.
			Jones on site. Decide to set well through augers before
			removing rig from site.
	1248	1258	Place composite soil cutting sample underfoil for headspace.
			Composite beta/gamma = 60 cpm, alpha = 20 ppm. Waiting on
			crew to bring sand, bentonite, and screen and casing.
	1258	1325	R. Phillips on site with materials: Well screen: 1, 10.0-ft section
			of 4.5-in. OD, 4.25-in. ID, flush-threaded, continuous wire-

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM			WELL NO. <u>GW-816</u>
WELL INSTALLATION ACTIVITY/PROGRESS REPORT continued			
			PAGE 3 of 3
DATE	TIME		ACTIVITY/COMMENTS
	START	FINISH	
5-31-94			wound #304 stainless steel screen with a 0.6-ft end cap welded
(cont.)			to the bottom (included in the length). Riser: 1, 10.0 -ft section
			of 4.5-in. OD, 4.25-in. ID, flush-threaded, #304 stainless steel
			casing. Total length of screen, cap, and riser = 20.0 ft.
	1325	1335	Measure water level at 9.1 ft BGS. Tag bottom of borehole at
			15.8 ft BGS.
	1335	1410	Pour 1 sack (50 lb) of J-20 sand into borehole. Run screen and
			riser into borehole. Casing stick-up = 5.8 ft. Top of screen is at
			4.2 ft BGS, bottom of the end cap is at 14.2 ft BGS. Pour an
			additional 9 sacks (450 lb) of sand through the augers while
			pulling out of borehole. Sand level to 2.9 ft BGS.
	1410	1415	Pour 1, 50-lb bucket of 3/8-in. bentonite pellets into borehole to
			0.9 ft BGS.
	1415	1450	Rig down. Screen augers, clean out bit and rods from borehole
			with beta/gamma ranging to 100 cpm and alpha ranging to 30
			cpm. Secure and depart site.
6-2-94	1000	1007	Mix and pour one 5-gal. bucket of cement into annulus from 0.9
			ft BGS to ground surface. Well construction complete.

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM			WELL NO. <u>GW-817</u>
WELL INSTALLATION ACTIVITY/PROGRESS REPORT			PAGE 1 of 5
LOCATION: <u>Scarboro Road</u> <u>G. Akins - Ogden Environmental & Energy Services Co.</u> DRILLER: <u>R. Collins - Highland Drilling Co.</u> <u>C. Selvidge- Ogden</u> HELPERS: <u>H. Hal/J. Monger/D. Williford - Highland Drilling Co.</u> DRILL: <u>CME-75/Ingersoll Rand - XL 750</u>		DATE: START: <u>5-31-94</u> FINISH: <u>6-3-94</u> LOGGED BY: <u>S.L. Abston - SAIC</u>	
DATE	TIME		ACTIVITY/COMMENTS
	START	FINISH	
5-31-94	1450	1502	Arrive at GW-817 site. Crew setting rig up over well location on plastic. Conduct Health and Safety briefing for Dewayne Williford (Highland).
	1502	1511	Raise mast and rig up with 5 ft auger flight with 0.4 ft bit. Dimensions of auger cutting bit: 10.0-in. outside diameter (OD), 6.25-in. inside diameter (ID). Add center clean out bit. Driving ground rod 10 ft into ground using the drill rig automatic hammer. Background radiation scan of location: alpha = 20 cpm, beta/gamma = 70 cpm. Breathing zone analysis (BZA) at 1 ft below ground surface (BGS) = 0 ppm. Lower explosive limit (LEL) reading <1%.
	1511	1516	Commence augering. BZA at 2.5 ft BGS 0 ppm. LEL reading at <1%. Borehole cuttings scan: beta/gamma = 90 cpm, alpha = 20 cpm.
	1516	1519	Add second 5 ft auger flight and internal clean out rod, continue augering.
	1519	1530	Beta/gamma meter malfunctioning. Interrupt drilling while S. Jones (HSEA) returns to Biology Building to replace meter.
	1530	1536	S. Jones returns to site with beta/gamma meter. Continue augering BZA at 7 ft BGS = 0 ppm, LEL <1%, borehole cuttings, beta/gamma = 40 cpm, alpha = 0 cpm.

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM			WELL NO. <u>GW-817</u>
WELL INSTALLATION ACTIVITY/PROGRESS REPORT continued			
			PAGE 2 of 5
DATE	TIME		ACTIVITY/COMMENTS
	START	FINISH	
5-31-94	1536	1542	Add 3rd 5 ft auger flight and 5 ft internal clean out rod, continue
(cont.)			augering. BZA at 11 ft BGS = 0 ppm, scan of borehole cuttings:
			beta/gamma = 30 cpm, alpha = 0 cpm.
	1542	1551	Auger refusal at 11.6 ft BGS on shale. Pulling internal clean out
			bit out and leaving augers in the ground to check for water level.
	1551	1628	Cuttings composite: beta/gamma = 40 cpm, alpha = 0 cpm.
			Clean up, secure site, and depart.
6-1-94	0741	0742	Arrive at GW-817. Measure water level at 8.5 ft BGS. Tag bottom
			of borehole at 11.0 ft BGS. Depart site.
	1312	1341	Return to GW-817. Measure water level at 7.8 ft BGS. Depart
			site.
6-2-94	1010	1030	Arrive at GW-817. Measure water level at 6.4 ft BGS. Depart
			site.
	1505	1515	Arrive at GW-817. Moving CME-75 off site to bring Highland's
			Ingersoll-Rand XL-750 onto the site, leaving augers in the
			ground.
	1515	1531	Auger rig off site. Measure water at 6.1 ft BGS, secure site and
			depart.
6-3-94	1047	1100	Arrive at GW-817. Crew and rig on site. Set rig up over borehole.
			Ground rig and raise mast. Conduct Health and Safety Briefing
			for J. Monger and H. Hall (Highland).

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM			WELL NO. <u>GW-817</u>
WELL INSTALLATION ACTIVITY/PROGRESS REPORT continued			
			PAGE 3 of 5
DATE	TIME		ACTIVITY/COMMENTS
	START	FINISH	
6-3-94	1100	1105	Pull augers out of borehole with rig cables.
(cont.)			
	1105	1135	Tag bottom of borehole at 10.3 ft BGS. Some cave in has occurred. Rig up Ingersoll Rand with a 10 3/4 in. diameter tri-cone bit on a 3.5 ft subadapter. Table height = 2.4 ft.
	1135	1138	Commence drilling with compressed air only. BZA at 3.0 ft BGS
			0 ppm. LEL reading = <1%.
	1138	1140	Add a 25-ft drill rod and continue drilling. BZA @ 8.0 ft BGS = 9
			ppm, LEL reading = <1%. Borehole cuttings scan: beta/gamma
			= 40 cpm, alpha = 0 cpm.
	1140	1143	Clean out borehole at 10 ft BGS and continue drilling. BZA at
			14.0ft BGS=0 ppm, LEL reading=<1%, borehole cuttings scan:
			beta/gamma = 30 cpm.
	1143	1153	Rig chattering at 13.5 ft BGS, cuttings are dry. Drill to 23.0 ft BGS,
			to set 20 ft of screen. Top of weathered bedrock at 11.6 ft BGS.
			Top of fresh bedrock at 18.4 ft BGS.
	1153	1201	Clean out borehole. Trip out.
	1201	1220	Rig down and move rig off borehole.
	1220	1238	Radiological scan of Ogden's augers: beta/gamma = 40 cpm,
			alpha = 20 cpm. Radiological scan of Highland's downhole
			equipment; beta/gamma 60 cpm, alpha = 30 cpm. Not able to
			thread screen together.

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM			WELL NO. <u>GW-817</u>
WELL INSTALLATION ACTIVITY/PROGRESS REPORT continued			
			PAGE 4 of 5
DATE	TIME		ACTIVITY/COMMENTS
	START	FINISH	
6-3-94	1238	1255	Technical oversight assumed by T.J. Coffey (SAIC). Crew breaks
(cont.)			for lunch.
	1255	1439	Oversight and crew depart for Highland Drilling Co. Pipeyard for
			additional screen/casing that is compatible with existing screen.
			Find compatible screen sections, but forced to weld on end cap
			to the bottom. Screen and casing tally:
			Well screen: total of 21.6 ft of 4.5-in. OD, 4.25-in. ID, flush-
			threaded, continuous wire-wound, #304 stainless steel
			screen (includes a 0.7-ft end cap welded to the bottom,
			plus a 0.2-ft collar at the top of the screen).
			Riser: 1, 6.8-ft long section of 4.5-in. OD, 4.25-in. ID, Schedule 5,
			#304 stainless steel casing.
			Total of end cap, screen, and riser = 28.4 ft. Crew steam cleans
			casing at pipeyard.
	1439	1446	Return to GW-817 site and run screen and casing into the
			borehole.
	1446	1449	Pour 2 sacks (100 lbs) of J-20 sand into borehole. Pull up screen
			and casings so that the top of the screen (not the collar at the top
			of the screen) is at 1.0 ft BGS. The bottom of the screen (cap) is
			at 22.3 ft BGS.
	1449	1501	Pour an additional 19.5 sacks (975 lbs) of J-20 sand into the
			annulus, continuously tamping with a weighted tap to prevent
			bridging. Sand pack level to 0.6 ft BGS.

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM			WELL NO. <u>GW-824</u>
PIEZOMETER INSTALLATION ACTIVITY/PROGRESS REPORT			PAGE 1 of 3
LOCATION: <u>Y-12 Plant, Building 9201-2</u>		DATE: START: <u>7-20-94</u>	
DRILLER: <u>Dewayne Williford - Highland Drilling Co.</u>		FINISH: <u>7-22-94</u>	
HELPERS: <u>R. Phillips/H. Hall - Highland Drilling Co.</u>		T. Coffey (SAIC)/	
DRILL: <u>Ford 455 Backhoe with McMillan Diggerhead</u>		B. McMaster (UT-HSEA)	
LOGGED BY:			

DATE	TIME		ACTIVITY/COMMENTS
	START	FINISH	
7-20-94	1222	1227	Technical oversight by T. Coffey (SAIC). Arrive at piezometer location, on the north side of Building 9201-2, between the building and Second Street. Move backhoe onto location. Background radiation survey of location: alpha = 0 cpm, beta/gamma = 40-60 cpm.
	1227	1232	W. Thedford (HSEA) conducts site-specific health and safety briefing, stressing: working in high-traffic area and the potential presence of mercury in the subsurface.
	1232	1245	Set up site, prepare to drill. Add a 6.0-in. diameter, 5.6-ft long solid stem lead auger flight to the backhoe auger motor.
	1245	1308	Commence augering. Auger from 0.0 ft to approximately 0.6 ft below ground surface (BGS). Auger through the asphalt at 0.5 ft BGS: organic vapors = 2.7 ppm (background = 0.4 ppm), lower explosive limit (LEL) reading <1% (15.0 ppm), mercury vapor = 0.0 mg/m ³ . Encounter hard concrete below asphalt. Nearly impossible to advance auger through the concrete.
	1308	1342	Interrupt augering, crew departs.
	1342	1408	Crew returns with jackhammer. Begin breaking up concrete inside borehole, and use auger to clean out. Auger from 0.6 ft to about 1.0 ft through concrete.

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM			WELL NO. <u>GW-824</u>
PIEZOMETER INSTALLATION ACTIVITY/PROGRESS REPORT continued			PAGE 2 of 3
DATE	TIME		ACTIVITY/COMMENTS
	START	FINISH	
7-20-94	1408	1416	Stop augering. Not making much progress as concrete seems to
(cont.)			be greater than 1 ft thick. Plan to move borehole location to get
			away from concrete. Move location approximately 3 ft to the
			north.
	1416	1431	Commence augering. Auger from 0.0 ft to 11.0 ft BGS. Auger
			through the asphalt at 0.5 ft BGS: organic vapors = 2.2 ppm
			(background = 0.0 ppm), LEL reading <1% (11.0 ppm), mercury
			vapor = 0.0 mg/m ³ . Encounter gravel fill below asphalt. Breathing
			zone analysis (BZA) at 4.0 ft and 8.5 ft BGS both read 0.0 ppm.
			Radiation survey of cuttings throughout interval: alpha = 0 cpm,
			beta/gamma = 50 cpm.
	1431	1444	At 11.0 ft BGS. Spin augers to clean out borehole and trip out.
			Tag bottom of borehole at 5.8 ft BGS (5.2 ft of fill). Measure
			following parameters at borehole collar: organic vapors: 0.8 ppm
			(background = 0.8 ppm), LEL reading <1% (13.0 ppm), mercury
			vapor = 0.0 mg/m ³ . No water observed in borehole.
	1444	1454	Place cuttings in labelled open-top drum and seal. Clean up.
			Secure site and depart. May need to complete piezometer
			through hollow-stem augers.
7-22-94	0933	0950	Technical oversight by B. McMaster (UT-HSEA). Arrive at
			GW-824 location. Plan to auger borehole deeper in an effort to
			find groundwater. Tag bottom of borehole at 5.5 ft BGS (an
			additional 0.3 ft of fill has accumulated in the hole). Rig up with
			an 8.0-in. outside diameter (OD), 3 1/4-in. inside diameter (ID),
			5.4-ft long lead hollow-stem auger flight.

[illegible]

APPENDIX B LITHOLOGIC LOGS

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM		BORING NO. <u>BH-1</u>	
BOREHOLE LOG		PAGE 1 of 1	
LOCATION: <u>East End Fuel Station</u>		DATE: START: <u>11/30/93</u>	
DRILLER: <u>J.C. Draper - Law Engineering</u>		FINISH: <u>12/1/93</u>	
HELPER: <u>Woody Duncan - Law Engineering</u>		DRILLING METHOD: <u>Hollow-Stem Auger</u>	
DRILL: <u>CME 55</u>		LOGGED BY: <u>Timothy Coffey - SAIC</u>	
NOTES: <u>Soil boring in support of Fuel Station UST investigation.</u>			
DEPTH (ft)		SAMPLE (NO. & INTERVAL)	SOIL/BEDROCK DESCRIPTION
FROM	TO		
0.0	6.0	Alpha = 0 cpm, beta/ gamma = 60 cpm; breathing zone analysis (BZA) = 0.2 ppm	Light brown (5YR 5/6), moist, clayey soil/fill material. Encounter gravel at 6.0 ft below ground surface (BGS).
6.0	13.2	Alpha = 0 cpm, beta/ gamma = 60 cpm; BZA = 0.2 ppm. Organic vapors at collar (10.0 ft BGS) = 0.4 ppm	Moderate brown (5YR 3/4), moist, clayey subsoil with undiffer- entiated medium dark gray (N4) gravel approximately 0.1-0.2 ft in diameter. Becoming exclusively gravel at about 8.0 ft BGS.
13.2	13.9	Cuttings composite from 0.0 to 13.2 ft: alpha = 0 cpm, beta/ gamma = 60 cpm; headspace = 0.2 ppm	No sample collected. Refusal on concrete pad at 13.9 ft BGS. Total Depth = 13.9 ft.

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM			BORING NO. <u>BH-2</u>
BOREHOLE LOG			PAGE 1 of 1
LOCATION: <u>East End Fuel Station</u>		DATE: START: <u>11/30/93</u>	
DRILLER: <u>J.C. Draper - Law Engineering</u>		FINISH: <u>12/1/93</u>	
HELPER: <u>Woody Duncan - Law Engineering</u>		DRILLING METHOD: <u>Hollow-Stem Auger</u>	
DRILL: <u>CME 55</u>		LOGGED BY: <u>Timothy Coffey - SAIC</u>	
NOTES: <u>Soil boring in support of Fuel Station UST investigation.</u>			
DEPTH (ft)		SAMPLE (NO. & INTERVAL)	SOIL/BEDROCK DESCRIPTION
FROM	TO		
0.0	4.5	Beta/gamma = 60 cpm; breathing zone analysis (BZA) = 0.2 ppm.	Light brown (5YR 5/6), moist, clayey soil/fill material. Encounter gravel at 4.5 ft below ground surface (BGS).
4.5	15.0	Beta/gamma = 60 cpm; BZA = 0.2 ppm. Organic vapors: 10.0 ft = 0.2 ppm, 14.0 ft = 2.0 ppm, 3.2 ppm (max); 15.0 ft = 1.5-2.0 ppm.	Moderate brown (5YR 3/4), moist, clayey subsoil with undifferentiated medium dark gray (N4) gravel approximately 0.1-0.2 ft in diameter. Becoming exclusively gravel at about 8.0 ft BGS.
15.0	16.5	Sample #1 (15.0 - 16.5): organic vapors = 0.2 ppm.	Pale yellowish-brown (10YR 6/2) to dark yellowish-orange (10YR 6/6), dry, stiff, clayey shale (extremely weathered) with occasional siltstone fragments.
16.5	18.5	Sample #2 (16.5 - 18.5): organic vapors = 0.2 ppm. Cuttings composite from 0.0 to 15.0: Alpha = 0 cpm, beta/ gamma = 60 cpm; headspace = 0.2 ppm.	Continuation of the 15.0 to 16.5 ft interval: degree of weathering decreasing, relict bedding is apparent. Total Depth = 18.5 ft.

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM			WELL NO. <u>GW-816</u>																																																																																								
WELL LOG			PAGE 1 OF 2																																																																																								
LOCATION: <u>Scarboro Rd</u> <u>G. Akins - Ogden Environmental and</u> DRILLER: <u>Energy Services Co.</u> <u>R. Phillips - Highland Drilling Co./</u> HELPER: <u>C. Selvidge - Ogden</u> DRILL: <u>CME 75</u>		DATE: START: <u>5/31/94</u> FINISH: <u>6/2/94</u> DRILLING METHOD: <u>Hollow Stem Auger</u> LOGGED BY: <u>S.L. Abston - SAIC</u>																																																																																									
NOTES: <u>Stainless steel, screened monitoring well, monitoring unconsolidated, from 14.2 to 4.2 ft BGS.</u> <u>Soil cuttings described using a GSA color chart</u>																																																																																											
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="text-align: center;">DEPTH (ft)</th> <th style="text-align: center;">SAMPLE (NO. & INTERVAL)</th> <th style="text-align: center;">SOIL/BEDROCK DESCRIPTION</th> </tr> <tr> <th style="text-align: center;">FROM</th> <th style="text-align: center;">TO</th> <th></th> <th></th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0.0</td> <td style="text-align: center;">0.5</td> <td>Breathing zone</td> <td>Gray (N7) limestone gravel fragments.</td> </tr> <tr> <td></td> <td></td> <td>analysis (BZA) =</td> <td></td> </tr> <tr> <td></td> <td></td> <td>0.0 ppm; beta/</td> <td></td> </tr> <tr> <td></td> <td></td> <td>gamma = 60 cpm,</td> <td></td> </tr> <tr> <td></td> <td></td> <td>alpha = 0 cpm</td> <td></td> </tr> <tr> <td style="text-align: center;">0.5</td> <td style="text-align: center;">12.6</td> <td>BZA = 0.0 ppm,</td> <td>Moderate brown (5YR 3/4) with a reddish tint dry clay, contains gray (N7)</td> </tr> <tr> <td></td> <td></td> <td>LEL = <1%, beta/</td> <td>limestone gravel fragments and some plant fragments. Cuttings become</td> </tr> <tr> <td></td> <td></td> <td>gamma = 60 cpm</td> <td>moist at 7 ft BGS.</td> </tr> <tr> <td></td> <td></td> <td>alpha = 0 cpm</td> <td></td> </tr> <tr> <td style="text-align: center;">12.6</td> <td style="text-align: center;">16.1</td> <td>BZA = 0.0 ppm,</td> <td>Grayish brown (5YR 3/1) moist clay with very small pale orange (10YR</td> </tr> <tr> <td></td> <td></td> <td>LEL = <1%, beta/</td> <td>8/2) weathered, stained chert fragments < 1 mm.</td> </tr> <tr> <td></td> <td></td> <td>gamma = 30 cpm</td> <td></td> </tr> <tr> <td></td> <td></td> <td>alpha = 10 cpm</td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td>Total depth 16.1 ft.</td> </tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td></tr> </tbody> </table>				DEPTH (ft)		SAMPLE (NO. & INTERVAL)	SOIL/BEDROCK DESCRIPTION	FROM	TO			0.0	0.5	Breathing zone	Gray (N7) limestone gravel fragments.			analysis (BZA) =				0.0 ppm; beta/				gamma = 60 cpm,				alpha = 0 cpm		0.5	12.6	BZA = 0.0 ppm,	Moderate brown (5YR 3/4) with a reddish tint dry clay, contains gray (N7)			LEL = <1%, beta/	limestone gravel fragments and some plant fragments. Cuttings become			gamma = 60 cpm	moist at 7 ft BGS.			alpha = 0 cpm		12.6	16.1	BZA = 0.0 ppm,	Grayish brown (5YR 3/1) moist clay with very small pale orange (10YR			LEL = <1%, beta/	8/2) weathered, stained chert fragments < 1 mm.			gamma = 30 cpm				alpha = 10 cpm									Total depth 16.1 ft.																				
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Y-12 PLANT GROUNDWATER PROTECTION PROGRAM		WELL NO. <u>GW-817</u>
WELL LOG		PAGE 1 OF 2

LOCATION: <u>Scarboro Rd</u> DRILLER: <u>G. AKINS - Ogden Environmental & Energy Services Co.</u> <u>R. Phillips - Highland Drilling Co.</u> HELPER: <u>C. Selvidge - Ogden</u> <u>H. Hall/J. Monger - Highland</u> DRILL: <u>CME 75/Ingersoll Rand XL-750</u>	DATE: START: <u>5/31/94</u> FINISH: <u>6/3/94</u> DRILLING METHOD: <u>Hollow Stem Auger/Air Rotary</u> LOGGED BY: <u>S.L. Abston - SAIC</u>
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NOTES: Stainless steel, screened monitoring well, monitoring competent bedrock, weathered bedrock, and unconsolidated material from 20.6 to 1.0 ft BGS in the Nolichucky Shale. Soil and rock cuttings described using a GSA color chart.

DEPTH (ft)		SAMPLE (NO. & INTERVAL)	SOIL/BEDROCK DESCRIPTION
FROM	TO		
0.0	0.5		Topsoil.
0.5	11.6	Breathing zone analysis (BZA) 0.0 ppm; beta/gamma = 90 cpm, alpha = 20 cpm	Moderate yellowish brown (10 YR 5/4) clay grading into a dark yellowish brown (10 YR 4/2) clay at 7 ft below ground surface (BGS). Cuttings contain some (5 YR 5/2) pale brown shale fragments increasing with depth and pale yellowish orange (10 YR 8/6) weathered chert fragments in the top 4 ft of the interval.
11.6	18.4	BZA = 0.0 ppm, LEL = <1%, beta/ gamma = 40 cpm alpha = 200 cpm	60% grayish brown (5 YR 3/2), dry shale fragments with 30% gray (N7) crystalline limestone fragments and 10% grayish brown (5 YR 3/2) clay. Top of weathered bedrock at 11.6 ft BGS.
18.4	23.0	BZA = 0.0 ppm, LEL = <1%, beta/ gamma = 50 cpm alpha = 25 cpm	Same as above with 90% shale fragments and 10% limestone fragments (bedrock). Top of fresh bedrock at 18.4 ft BGS. Total depth 23.0 ft BGS.

APPENDIX C
WELL CONSTRUCTION DIAGRAMS

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM		BORING NO. <u>BH-1</u>
WELL PLUGGING AND ABANDONMENT DIAGRAM		
LOCATION: <u>East End Fuel Station</u>	DATE: START: <u>11-30-93</u>	
COORDINATES: <u>None</u>	FINISH: <u>12-1-93</u>	
REFERENCE POINT FOR MEASUREMENTS: <u>Ground Surface</u>	PREPARED BY: <u>Timothy Coffey - SAIC</u>	
DRILLING COMPANY: <u>Law Engineering</u> DRILL: <u>CME 55</u>		
DRILLER: <u>J.C. Draper</u> HELPER: <u>Woody Duncan</u>		
REASON FOR P&A: <u>Unable to sample. Refusal on concrete pad.</u>		
P&A: METHOD: <u>-NA-</u> DEVIATIONS FROM METHOD: <u>-NA-</u>		
BOREHOLE CONSTRUCTION SUMMARY	P&A SUMMARY	
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p style="margin-top: 20px;">GROUND SURFACE</p> <p style="margin-top: 100px;">BOREHOLE DIA: <u>7.0 in.</u></p> <p style="margin-top: 10px;">TOP <u>0.0 ft</u> BOTTOM <u>13.2 ft</u></p> <p style="margin-top: 10px;">SAMPLE INTERVAL DIA: <u>2.0 in.</u></p> <p style="margin-top: 10px;">TOP <u>13.2 ft</u> BOTTOM <u>13.9 ft</u></p> <p style="margin-top: 10px;">TOTAL DEPTH: <u>13.9 ft</u></p> </div> <div style="width: 50%;"> <p>REAMED DIA: <u>-NA-</u></p> <p>DRILLED/REAMED DEPTH: <u>-NA-</u></p> <p>Cuttings/Hole PLUG MATERIAL: <u>Plug™</u></p> <p>CAP MATERIAL: <u>Clay soil</u></p> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 20px;"> <div style="width: 45%;"> <p style="margin-top: 10px;">CAP</p> <p style="margin-top: 10px;">DEPTH: <u>0.3 ft</u></p> <p style="margin-top: 10px;">PLUG</p> <p style="margin-top: 10px;">DIA: <u>7.0 in.</u></p> <p style="margin-top: 10px;">DEPTH: <u>13.2 ft</u></p> <p style="margin-top: 10px;">DIA: <u>2.0 in.</u></p> <p style="margin-top: 10px;">DEPTH: <u>13.9 ft</u></p> </div> <div style="width: 50%;"></div> </div>		

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM

BORING NO. BH-2

WELL PLUGGING AND ABANDONMENT DIAGRAM

LOCATION: East End Fuel StationDATE: START: 11-30-93COORDINATES: NoneFINISH: 12-1-93REFERENCE POINT FOR MEASUREMENTS: Ground SurfacePREPARED BY: Timothy Coffey - SAICDRILLING COMPANY: Law EngineeringDRILL: CME 55DRILLER: J.C. DraperHELPER: Woody DuncanREASON FOR P&A: Sampling completed.P&A: METHOD: -NA-DEVIATIONS FROM METHOD: -NA-

BOREHOLE CONSTRUCTION SUMMARY

P&A SUMMARY

REAMED DIA: -NA-

DRILLED/REAMED

DEPTH: -NA-PLUG MATERIAL: Plug™ Cuttings/HoleCAP MATERIAL: Clay soil

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM

WELL NO. GW-816

WELL INSTALLATION DIAGRAM

LOGGED BY: Susan Abston - SAIC

DRILLING DATES

DRILLING COMPANY: Ogden Environmental and Energy Services Co. STARTED: 5-31-94DRILLER: G. Akins - Ogden R. Phillips- Highland
HELPER: C. Selvidge - Ogden FINISHED: 6-2-94

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM

WELL NO. GW-817

WELL INSTALLATION DIAGRAM

LOGGED BY: Susan Abston/Timothy Coffey - SAIC

Ogden Environmental and Energy Services Co.

DRILLING DATES

DRILLING COMPANY: Highland Drilling Co.STARTED: 5-31-94DRILLER: G. Akins - Ogden

C. Selvidge - Ogden

FINISHED: 6-3-94DRILLER: R. Phillips - HighlandHELPER: H. Hall/J. Monger - Highland

APPENDIX D
WELL DEVELOPMENT DATA

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM						WELL NO. <u>GW-816</u>	
MONITORING WELL DEVELOPMENT PROGRESS							
LOCATION: <u>Scarboro Road</u> ONE WELL VOLUME: <u>3.5</u> GALLONS WELL INSTALLATION COMPLETION DATE: <u>6-2-94</u>							
DATE	GALLONS PUMPED	DESCRIPTION OF TURBIDITY	pH	DISSOLVED SOLIDS (μS)	TOTAL GALLONS PUMPED	WELL VOLUMES PUMPED	COMMENTS
6-1-94	0	Very turbid	7.5	340	0	0	1, 2
6-1-94	5	Very turbid	7.0	350	5	1.4	
6-1-94	5	Very turbid	7.2	350	10	2.9	3
6-1-94	5	Very turbid	7.2	300	15	4.3	2, 3
6-2-94	5	Clear	7.6	310	20	5.7	
6-2-94	5	Very turbid	7.7	310	25	7.1	2, 3
6-2-94	5	Very turbid	7.5	300	30	8.6	2
6-2-94	5	Very turbid	7.1	300	35	10.0	2, 3
6-2-94	5	Very turbid	7.0	300	40	11.4	2
6-2-94	5	Very turbid	7.0	300	45	12.9	2, 3
6-6-94	2	Clear	7.7	310	47	13.4	
6-6-94	5	Very turbid	7.2	310	52	14.9	
6-6-94	3	Very turbid	7.0	300	55	15.7	3
RESULTS AT END OF DEVELOPMENT		Very turbid	7.0	300	55	15.7	
COMMENTS							
1: Initial readings.							
2: Water has a glossy surface.							
3: Well bailed to dryness.							
Development water frequently has glossy surface. Unable to clear the water.							

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM	WELL NO. <u>GW-816</u>
MONITORING WELL REDEVELOPMENT SUMMARY	
METHOD OF DEVELOPMENT: <u>Bailing</u>	
DEVELOPMENT OBSERVED BY: <u>S.L. Abston - SAIC</u>	
ONE WELL VOLUME: <u>3.5</u> GALLONS	
TOTAL GALLONS PUMPED: <u>55</u> TOTAL WELL VOLUMES PUMPED: <u>15.6</u>	
INITIAL pH: <u>7.5</u> FINAL pH: <u>7.0</u>	
INITIAL SPECIFIC CONDUCTANCE: <u>340 µmhos/cm</u> FINAL: <u>300 µmhos/cm</u>	
DESCRIPTION OF INITIAL TURBIDITY: <u>Very turbid</u>	
DESCRIPTION OF FINAL TURBIDITY: <u>Very turbid</u>	
FINAL MEASURED TURBIDITY: <u>Not measured</u>	
WELL APPROVED BY: <u>S.B. Jones - HSEA</u>	
ODOR OF WATER: <u>None Discernable</u>	
WATER DISCHARGED TO: ☒ GROUND SURFACE ☐ TANK TRUCK ☐ STORM SEWERS ☐ STORAGE TANKS ☐ DRUMS ☐ OTHER _____	
INITIAL PRE-DEVELOPMENT WATER DEPTH: <u>8.75 ft BGS on 6-1-94</u>	
DEVELOPMENT OBSERVATIONS: <u>Unable to clear up well at all. Well is a moderately good producing well, however, easily bailed to dryness. Well development terminated by HSEA after purging 55 gals.</u>	
OBSERVER SIGNATURE: <u><i>Susan L. Abston</i></u>	
DATE: <u>6-6-94</u>	

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM

WELL NO. GW-817

MONITORING WELL DEVELOPMENT PROGRESS

LOCATION: Scarboro RoadCOMPLETION DATE: 6-3-94ONE WELL VOLUME: 11.7 GALLONS

DATE	GALLONS PUMPED	DESCRIPTION OF TURBIDITY	pH	DISSOLVED SOLIDS (μ S)	TOTAL GALLONS PUMPED	WELL VOLUMES PUMPED	COMMENTS
6-6-94	0	Very turbid	8.2	370	0	0	Initial, 1
6-6-94	15	Very turbid		360	15	1.3	1
6-6-94	10				25	2.1	2
6-15-94	18	Moderately turbid	7.6	390	43	3.7	3
6-15-94	10	Moderately turbid	7.8	390	53	4.5	3, 4
6-16-94	18	Moderately turbid	7.9	350	71	6.1	3
6-16-94	10	Moderately turbid	7.8	360	81	6.9	3, 4
6-16-94	18	Moderately turbid	7.8	360	99	8.5	3, 4
6-17-94	18	Slightly turbid	7.8	370	117	10.0	3
6-17-94	10	Moderately turbid	7.8	365	127	10.9	3, 4
6-17-94	17	Slightly turbid	7.8	370	144	12.3	3, 4
RESULTS AT END OF DEVELOPMENT		Slightly turbid	7.8	370	144	12.3	

COMMENTS

1: Bailer used for development.

2: Parameters not measured.

3: Swab rig used for development, swab tubing to 19.2 ft BGS.

4: Swabbed to dryness.

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM

WELL NO. GW-817

MONITORING WELL DEVELOPMENT SUMMARY

METHOD OF DEVELOPMENT: Bail/Swab

DEVELOPMENT DATE:

DEVELOPMENT OBSERVED BY: S.L. Abston/T. Coffey - SAICSTART: 6-6-94FINISH: 6-17-94ONE WELL VOLUME: 11.7 GALLONSTOTAL GALLONS PUMPED: 144 TOTAL WELL VOLUMES PUMPED: 12.3INITIAL pH: 8.2 FINAL pH: 7.8INITIAL SPECIFIC CONDUCTANCE: 370 μ mhos/cm FINAL: 370 μ mhos/cmDESCRIPTION OF INITIAL TURBIDITY: Very TurbidDESCRIPTION OF FINAL TURBIDITY: Slightly TurbidFINAL MEASURED TURBIDITY: N/AWELL APPROVED BY: Steven B. Jones - HSEAODOR OF WATER: None Discernible

WATER DISCHARGED TO: ☒ GROUND SURFACE ☐ TANK TRUCK
☐ STORM SEWERS ☐ STORAGE TANKS
☐ DRUMS ☐ OTHER _____

INITIAL PRE-DEVELOPMENT

WATER DEPTH: 4.5 ft BGS on 6-6-94

DEVELOPMENT OBSERVATIONS: Development started using a bailer, however, bailing did not significantly lower water level. Development completed by swabbing. Development water eventually cleared significantly, though not completely. Well is an adequate producer.

OBSERVER SIGNATURE: *S.L. Abston*DATE: 6-17-94

APPENDIX E
WASTE MANAGEMENT PLAN FOR DRILLING ACTIVITIES

WASTE MANAGEMENT PLAN FOR WELL INSTALLATION

1.0 INTRODUCTION

The ultimate objective of monitoring groundwater is gathering data to assess potential impacts to human health and the environment. It is also the objective of Y-12 Groundwater Protection Program (GWPP) to handle drill cuttings from the installation of groundwater monitoring wells or borings in a manner that protects the environment. The Y-12 philosophy has been and continues to be consistent with the EPA and Energy Systems E&SA guidance for managing well cuttings. Site-specific professional judgment is used to determine the potential for contamination prior to installation of each well. Factors considered in evaluating potential for site contamination include:

- Previously collected sampling and analysis data
- Groundwater flow patterns
- Geologic and hydrogeologic setting
- Purpose of well (containment plume assessment, background monitoring defining lines of compliance, etc.)

Based on the evaluation, one of two options is selected:

- Stabilize material on site
- Collect for treatment or storage

2.0 DRILL CUTTINGS DISPOSAL

There are two levels of drill cuttings management at the Y-12 Plant: (1) drill-site disposal and (2) containerization for waste disposal. Disposal of drill cuttings at the drill-site following best management practices (BMP) is permitted if the cuttings do not exceed the field-screening criteria discussed below. If the field-screening criteria are exceeded, the cuttings must be containerized at the drill-site, labeled, and handled according to Y-12 Plant waste disposal procedures. Sampling and field screening of the drill cuttings will be conducted in accordance with the procedures specified in the Energy Systems Environmental Surveillance Procedures Quality Control Program document (ESH/Sub/87/21706/1).

2.1 Field Screening

Field screening of drill cuttings will consist of measuring three parameters: radioactivity, volatile organics, and pH. The Energy Systems procedures specified in Table 1 will be followed with some modification as described below.

Table 1. Y-12. Field-screening criteria for drill cuttings and development water

Field Analysis	Energy Systems Procedure No.	Limit
pH	ESP-307-2	4.0 - 10.5
Specific Conductivity ¹	ESP-307-8	< 1000 μ mhos/cm
Organic	ESP-307-6	< 5 ppm
Radioactivity	ESP-307-7	beta/gamma < 600 dpm/100 cm ² (< 100 cpm)
		alpha < 1000 dpm/100 cm (< 500 cpm)

¹ Not applicable to drill cuttings.

Radioactivity will be measured using two separate meters: a survey meter with a pancake Geiger tube for determining beta and gamma activity and a scintillation counter with a zinc sulfide window for determining alpha activity. The meters will be passed over the surface area of the cuttings and the highest readings will be recorded.

Screening for organic vapors will be conducted on a composite sample from the cuttings generated at a single well. The sample will be collected with a hand trowel or similar tool to select cuttings from several depths. Enough cuttings will be placed in a clean 1-gal glass or metal container to half fill it. Aluminum foil will be placed over the mouth of the container to make an airtight seal. The sample will then be incubated for 1 h at 70°F or the ambient temperature, whichever is higher. Organic vapors in the headspace of the sample container will be measured by puncturing the aluminum foil and inserting the probe of an organic vapor analyzer. This instrument will have a photoionization detector with a 10.2 eV lamp and will be calibrated to isobutylene. The highest reading of the headspace vapors will be recorded.

The pH of the cuttings will be estimated by adding one quart of deionized water to the composite sample used to determine the presence of organic vapors. The sample will be agitated until well mixed. The pH of the mixture will be determined by moistening a piece of pH paper (range 4-9 or similar) and checking the color of the paper against the color key. This pH will be recorded.

2.2 Containerization for Waste Disposal

If the cuttings from a borehole exceed any one of the field screening limits, they will be containerized at the drill-site and labeled with the contents (drill cuttings), borehole number, and date. The cuttings will then be handled according to Y-12 Plant waste management procedures.

An exception to the above may be made if the cuttings only exceed the organic vapor limits. Weather permitting, those cuttings may be passively treated by aeration at the drill-site in order to reduce the organic vapor content. Such treatment shall not exceed five working days. If reanalysis following aeration indicates the cuttings continue to exceed the organic vapor limits, they must be containerized and handled as above.

2.3 BMP for Drill-Site Disposal

Drill cuttings which do not exceed the field-screening criteria will be disposed of at the drill site, if practicable. BMP dictates that the cuttings be disposed in such a way as to not be

unsightly or cause erosion/sedimentation impacts on nearby surface water. The cuttings shall therefore be used as part of the restoration of the drill site, to fill in low areas and tire tracks, or spread to conform to the natural topography. They will subsequently be seeded and mulched. If bedrock cuttings contain a liquid fraction, care shall be taken to ensure this liquid infiltrates or evaporates at the drill site and in no case runs off into surface waters, ephemeral drainages, or storm sewers. Drill cuttings that do not exceed the field-screening criteria but cannot be disposed at the drill site due to its location (parking lot, yard, etc.) will be transported to a designated location and disposed of as clean fill, following BMP.

2.4 Documentation

The results of all field-screening analyses and a description of the disposition of the drill cuttings from each borehole will be documented on a Drill Cuttings Field Screening/Disposal Sheet, an example of which is attached. These forms will be completed for each borehole by the onsite geologist who conducts the screening. A copy of each form will be provided to the Project Manager of the GWPP within two days of its completion.

3.0 DEVELOPMENT WATER DISPOSAL

There are two levels of development water management at the Y-12 Plant: (1) drill-site disposal and (2) containerization for waste disposal. Disposal of development water at the drill-site following BMP is permitted if the water does not exceed the field-screening discussed below. If the field-screening criteria are exceeded, the water must be containerized at the drill-site, labeled, and handled according to Y-12 Plant waste disposal procedures. Sampling and field screening of development water will be conducted in accordance with the procedures specified in the Energy Systems Environmental Surveillance Procedures Quality Control Program document (ESH/Sub/87/21706/1).

3.1 Field Screening

Initial development water will be containerized until it has been screened. This is accomplished by pumping the water into drums or other suitable container(s). Screening will be conducted on grab samples taken approximately every hour after the first one-half hour of development. (An alternative to the hourly grab samples is to totally contain all the development water produced at a well, then analyze a composite sample.) If initial grab samples do not exceed the limits specified in Table 1, development water may be pumped directly on the ground (following BMP) unless or until a subsequent grab sample exceeds the limits.

Field screening of development water will consist of measuring four parameters: radioactivity, volatile organics, specific conductivity, and pH. The Energy Systems procedures specified in Table 1 will be followed with some modification, as described below.

Radioactivity will be measured using two separate meters: a survey meter with a pancake Geiger tube for determining beta and gamma activity and a scintillation counter with a zinc sulfide window for determining alpha activity. The meters will be passed over the surface area of the sample and the highest readings will be recorded.

Screening for organic vapors will be conducted by placing enough development water in a clean 1-gal glass or metal container to half fill it. Aluminum foil will be placed over the mouth of the container to make an airtight seal. The sample will then be incubated for 1 h at 70°F or the ambient temperature, whichever is higher. Organic vapors in the headspace of the sample container will be measured by puncturing the aluminum foil and inserting the probe of an organic vapor analyzer. This instrument will have a photoionization detector with a 10.2 eV lamp and will be calibrated to isobutylene. The highest reading of the headspace vapors will be recorded.

3.2 Containerization for Waste Disposal

If the development water from a well exceeds any one of the field screening limits, it will be containerized at the drill-site and labeled with the contents (development water), well number, and date. The water will then be handled according to Y-12 Plant waste management procedures.

An exception to the above may be made if the development water only exceeds the organic vapor limits. Weather permitting, the water may be passively treated at the drill-site by leaving the containers open for aeration in order to reduce the organic vapor content. Such treatment shall not exceed five working days and shall not be conducted over weekends without supervision. If reanalysis following aeration indicates the development water continues to exceed the organic vapor limits, it must be containerized and handled as above.

3.3 BMP for Drill-Site Disposal

Development water that does not exceed the field-screening criteria will be disposed of at the drill site if practicable. BMP dictates that the water be disposed in such a way as to not cause erosion or enter nearby surface water or storm sewers. Precautions shall therefore be taken to ensure that development water pumped onto the ground or released from containers at the drill site either infiltrates or evaporates at the site and in no case runs off into surface waters,

ephemeral drainages, or storm sewers. Development water that does not exceed the field screening (i.e., within a drainage, near a storm sewer, etc.) will be transported to a designated location and disposed as clean water following BMP.

3.4 Documentation

The results of all field-screening analyses and a description of the disposition of the development water from each well will be documented on a Development Water Field Screening/Disposal Sheet, an example of which is attached. These forms will be completed for each well by the onsite geologist who conducts the screening. A copy of each form will be provided to the Project Manager of the GWPP within two days of its completion.

APPENDIX F
WASTE MANAGEMENT SCREENING DATA

Y-12 PLANT GWPP WELL CUTTINGS FIELD SCREENING/DISPOSAL SHEET

WELL/BOREHOLE NO. BH-1 SITE: East End Fuel Station

APPROX. VOLUME OF CUTTINGS: -NA-

CALIBRATION OF INSTRUMENTS (Check those instruments calibrated to manufacturer's specifications):

pH meter	<u>-NA-</u>	(model)	<u>-NA-</u>
Organic vapor meter	<u>X</u>	(model)	<u>HNu Model HW-101</u>
Beta/gamma meter	<u>X</u>	(model)	<u>Ludlum Model 3 Survey Meter with G-M Pancake Probe</u>
Alpha meter	<u>X</u>	(model)	<u>Ludlum Model 12 Count Ratemeter with Scintillation Tube Probe</u>

FIELD SCREENING RESULTS (Background/Maximum Observed Readings):

pH	<u>Not Measured</u>	Date/Time	<u>-NA-</u> (4.0 - 10.5)
Organic vapors	<u>0.2 ppm/0.2 ppm</u>	Date/Time	<u>11-30-93/1447</u> (<5.0 ppm above background)
Beta/Gamma	<u>60 cpm/60 cpm</u>	Date/Time	<u>11-30-93/1350</u> (<100 cpm above background)
Alpha	<u>0 cpm/0 cpm</u>	Date/Time	<u>11-30-93/1347</u> (<500 cpm above background)

Weather: Mostly clear and cool Temp.: Low-50s F

DISPOSITION: Drill-site Disposal X Containerization
(Labeled?) y/n

Describe: Cuttings temporarily stock-piled on plastic sheeting while augering. At conclusion of sampling activities, cuttings were returned to borehole to aid in plugging and abandonment.

Onsite Geologist (print): Timothy Coffey - SAIC

Signature:

Date: 11-30-93

Y-12 PLANT GWPP WELL CUTTINGS FIELD SCREENING/DISPOSAL SHEET

WELL/BOREHOLE NO. BH-2 SITE: East End Fuel Station

APPROX. VOLUME OF CUTTINGS: -NA-

CALIBRATION OF INSTRUMENTS (Check those instruments calibrated to manufacturer's specifications):

pH meter	<u>-NA-</u>	(model)	<u>-NA-</u>
Organic vapor meter	<u>X</u>	(model)	<u>HNu Model HW-101</u>
Beta/gamma meter	<u>X</u>	(model)	<u>Ludlum Model 3 Survey Meter with G-M Pancake Probe</u>
Alpha meter	<u>X</u>	(model)	<u>Ludlum Model 12 Count Ratemeter with Scintillation Tube Probe</u>

FIELD SCREENING RESULTS (Background/Maximum Observed Readings):

pH	<u>Not Measured</u>	Date/Time	<u>-NA-</u>	(4.0 - 10.5)
Organic vapors	<u>0.2 ppm/0.2 ppm</u>	Date/Time	<u>11-30-93/1509</u>	(<5.0 ppm above background)
Beta/Gamma	<u>60 cpm/60 cpm</u>	Date/Time	<u>11-30-93/1440</u>	(<100 cpm above background)
Alpha	<u>0 cpm/0 cpm</u>	Date/Time	<u>11-30-93/1438</u>	(<500 cpm above background)

Weather: Mostly clear and cool Temp.: Low-50s F

DISPOSITION: Drill-site Disposal X Containerization
(Labeled?) y/n

Describe: Cuttings temporarily stock-piled on plastic sheeting while augering. At conclusion of sampling activities, cuttings were returned to borehole to aid in plugging and abandonment.

Onsite Geologist (print): Timothy Coffey - SAIC

Signature:

Date: 11-30-93

Y-12 PLANT GWPP WELL CUTTINGS FIELD SCREENING/DISPOSAL SHEET

WELL/BOREHOLE NO. GW-816 SITE: Scarboro Road

APPROX. VOLUME OF CUTTINGS: 8.8 cubic ft

CALIBRATION OF INSTRUMENTS (Check those instruments calibrated to manufacturer's specifications):

pH meter	<u>X</u>	(model)	<u>Horiba Model U-7</u>
Organic vapor meter	<u>X</u>	(model)	<u>HNu Model HW-101</u>
Beta/gamma meter	<u>X</u>	(model)	<u>Ludlum Model 3 Survey Meter with G-M Pancake Probe.</u>
Alpha meter	<u>X</u>	(model)	<u>Ludlum Model 12 Count Ratemeter with Scintillation Tube Probe</u>

FIELD SCREENING RESULTS (Background/Maximum Observed Values):

pH	<u>8.7</u>	Date/Time	<u>5-31-94/452</u> (4.0 - 10.5)
Organic vapors	<u>0.0 ppm/0.0 ppm</u>	Date/Time	<u>5-31-94/1450</u> (<5.0 ppm Above Background)
Beta/Gamma	<u>60 cpm/70 cpm</u>	Date/Time	<u>5-31-94/1116</u> (<100 cpm Above Background)
Alpha	<u>10 cpm/10 cpm</u>	Date/Time	<u>5-31-94/1116</u> (<500 cpm Above Background)

Weather: Partly cloudy, warm Temp.: Mid 60s to mid 80s°F.

DISPOSITION: Drill-site Disposal X Containerization
(Labeled?) y / n

Describe: Cuttings discharged and spread on ground surface at well location.

Onsite Geologist (print): Susan L. Abston - SAIC

Signature: *Susan L. Abston*

Date: 5-31-94

Y-12 PLANT GWPP DEVELOPMENT WATER FIELD SCREENING/DISPOSAL SHEET

WELL NO. GW-816 Pg. 1 of 2 SITE: Scarboro Road

APPROX. VOLUME OF DEVELOPMENT WATER: 55 gal.

CALIBRATION OF INSTRUMENTS (Check those instruments calibrated to manufacturer's specifications):

pH meter	<u>X</u>	(model)	<u>Horiba Model U-7</u>
Sp. Cond. meter	<u>X</u>	(model)	<u>YSI S-C-T Meter Model #33</u>
Organic vapor meter	<u>X</u>	(model)	<u>Century-Foxboro OVA Model 128/ HNu Model HW-101</u>
Beta/gamma meter	<u>X</u>	(model)	<u>Ludlum Model 3 Survey Meter; with G-M Pancake Probe</u>
Alpha meter	<u>X</u>	(model)	<u>Ludlum Model 12 Count Ratemeter with Scintillation Tube Probe</u>

FIELD SCREENING RESULTS:

Date	Time	pH	Sp. Cond.	Organic Vapors	Beta/Gamma	Alpha
<u>6-1-94</u>	<u>1046</u>	<u>7.5</u>	<u>340 mhos/cm</u>	<u>0.0 ppm</u>	<u>30 cpm</u>	<u>0 cpm</u>
<u>6-1-94</u>	<u>1101</u>	<u>7.0</u>	<u>350 mhos/cm</u>	<u>0.0 ppm</u>	<u>0 cpm</u>	<u>0 cpm</u>
<u>6-1-94</u>	<u>1106</u>	<u>7.2</u>	<u>350 mhos/cm</u>	<u>0.0 ppm</u>	<u>20 cpm</u>	<u>0 cpm</u>
<u>6-1-94</u>	<u>1300</u>	<u>7.2</u>	<u>300 mhos/cm</u>	<u>0.0 ppm</u>	<u>20 cpm</u>	<u>0 cpm</u>
<u>6-2-94</u>	<u>0951</u>	<u>7.6</u>	<u>310 mhos/cm</u>	<u>0.0 ppm</u>	<u>30 cpm</u>	<u>0 cpm</u>
<u>6-2-94</u>	<u>0956</u>	<u>7.2</u>	<u>310 mhos/cm</u>	<u>0.0 ppm</u>	<u>50 cpm</u>	<u>0 cpm</u>
<u>6-2-94</u>	<u>1320</u>	<u>7.5</u>	<u>300 mhos/cm</u>	<u>0.0 ppm</u>	<u>20 cpm</u>	<u>0 cpm</u>
		<u>(4.0-10.5)</u>	<u>(<1000 mhos/cm)</u>	<u>(<5 ppm)</u>	<u>(<100 cpm)</u>	<u>(<500 cpm)</u>

Weather: Refer to field logbook

Temp.: Refer to field logbook

DISPOSITION: Drill-site Disposal X

Containerization
(Labeled?) y/n

Describe: Development water discharged to ground surface.

Onsite Geologist (print): Susan L. Abston - SAIC

Signature: Susan L Abston

Date: 6-6-94

Y-12 PLANT GWPP DEVELOPMENT WATER FIELD SCREENING/DISPOSAL SHEET

WELL NO. GW-816 Pg. 2 of 2 SITE: Scarboro Road

APPROX. VOLUME OF DEVELOPMENT WATER: 55 gal.

CALIBRATION OF INSTRUMENTS (Check those instruments calibrated to manufacturer's specifications):

pH meter	<u>X</u>	(model)	<u>Horiba Model U-7</u>
Sp. Cond. meter	<u>X</u>	(model)	<u>YSI S-C-T Meter Model #33</u>
Organic vapor meter	<u>X</u>	(model)	<u>Century-Foxboro OVA Model 128/ HNu Model HW-101</u>
Beta/gamma meter	<u>X</u>	(model)	<u>Ludlum Model 3 Survey Meter; with G-M Pancake Probe</u>
Alpha meter	<u>X</u>	(model)	<u>Ludlum Model 12 Count Ratemeter with Scintillation Tube Probe</u>

FIELD SCREENING RESULTS:

Date	Time	pH	Sp. Cond.	Organic Vapors	Beta/Gamma	Alpha
6-2-94	1325	7.1	300 mhos/cm	0.0 ppm	30 cpm	0 cpm
6-2-94	1441	7.0	300 mhos/cm	0.0 ppm	20 cpm	0 cpm
6-2-94	1445	7.0	300 mhos/cm	0.0 ppm	20 cpm	0 cpm
6-6-94	1038	7.7	310 mhos/cm	0.0 ppm	40 cpm	0 cpm
6-6-94	1042	7.2	310 mhos/cm	450 ppm	20 cpm	0 cpm
6-6-94	1045	7.0	300 mhos/cm	>1000 ppm*	30 cpm	0 cpm
		(4.0-10.5)	(<1000 mhos/cm)	(<5 ppm)	(<100 cpm)	(<500 cpm)

* High reading attributed to high humidity affecting OVA and HNu.

Weather: Refer to field logbook

Temp.: Refer to field logbook

DISPOSITION: Drill-site Disposal X

Containerization (Labeled?) y/n

Describe: Development water discharged to ground surface.

Onsite Geologist (print): Susan L. Abston - SAIC

Signature: *Susan L. Abston*

Date: 6-6-94

Y-12 PLANT GWPP WELL CUTTINGS FIELD SCREENING/DISPOSAL SHEET

WELL/BOREHOLE NO. GW-817 SITE: Scarboro Road

APPROX. VOLUME OF CUTTINGS: 14.5 cubic ft

CALIBRATION OF INSTRUMENTS (Check those instruments calibrated to manufacturer's specifications):

pH meter	<u>X</u>	(model)	<u>Horiba Model U-7</u>
			<u>HNu Model HW-101</u>
Organic vapor meter	<u>X</u>	(model)	<u>OVA Model #128</u>
Beta/gamma meter	<u>X</u>	(model)	<u>Ludlum Model 3 Survey Meter</u>
Alpha meter	<u>X</u>	(model)	<u>Ludlum Model 12 Count Ratemeter with Scintillation Tube Probe</u>

FIELD SCREENING RESULTS (Background/Maximum Observed Values):

pH	<u>9.3</u>	Date/Time	<u>6-3-94 / 1252</u> (4.0 - 10.5)
Organic vapors	<u>0.0 ppm/0.0 ppm</u>	Date/Time	<u>6-3-94 / 1252</u> (<5.0 ppm Above Background)
Beta/Gamma	<u>70 cpm/90 cpm</u>	Date/Time	<u>5-31-94 / 1513</u> (<100 cpm Above Background)
Alpha	<u>0 cpm/20 cpm</u>	Date/Time	<u>6-3-94 / 1153</u> (<500 cpm Above Background)

Weather: Partly cloudy, warm

Temp.: Mid 70s to upper 80s°F.

DISPOSITION: Drill-site Disposal X

Containerization
(Labeled?) y / n

Describe: Cuttings discharged to ground surface.

Onsite Geologist (print): S.L. Abston - SAIC

Signature: *Susan L Abston*

Date: 6-3-94

Y-12 PLANT GWPP DEVELOPMENT WATER FIELD SCREENING/DISPOSAL SHEET

WELL NO. GW-817 Page 1 of 2 SITE: Scarboro Road

APPROX. VOLUME OF DEVELOPMENT WATER: 144 gallons

CALIBRATION OF INSTRUMENTS: Check those calibrated to manufacturer's specifications.

pH meter	<u>X</u>	(model)	<u>Horiba Model U-7</u>
Sp. Cond. meter	<u>X</u>	(model)	<u>YSI S-C-T Meter Model 33</u>
Organic vapor meter	<u>X</u>	(model)	<u>Century-Foxboro OVA Model 128</u>
Beta/gamma meter	<u>X</u>	(model)	<u>Ludlum Model 3 Survey Meter; with G-M Pancake Probe</u>
Alpha meter	<u>X</u>	(model)	<u>Ludlum Model 12 Count Ratemeter; with Scintillation Tube Probe</u>

FIELD SCREENING RESULTS:

Date	Time	pH	Sp. Cond.	Organic Vapors	Beta/Gamma	Alpha
<u>6-6-94</u>	<u>0950</u>	<u>8.2</u>	<u>370 mhos/cm</u>	<u>0.0 ppm</u>	<u>40 cpm</u>	<u>0 cpm</u>
<u>6-6-94</u>	<u>0954</u>	<u>NR*</u>	<u>360 mhos/cm</u>	<u>0.0 ppm</u>	<u>30 cpm</u>	<u>0 cpm</u>
<u>6-15-94</u>	<u>1307</u>	<u>7.6</u>	<u>390 mhos/cm</u>	<u>0.0 ppm</u>	<u>40 cpm</u>	<u>0 cpm</u>
<u>6-15-94</u>	<u>1319</u>	<u>7.8</u>	<u>390 mhos/cm</u>	<u>0.0 ppm</u>	<u>40 cpm</u>	<u>0 cpm</u>
<u>6-16-94</u>	<u>0838</u>	<u>7.9</u>	<u>350 mhos/cm</u>	<u>0.0 ppm</u>	<u>40 cpm</u>	<u>0 cpm</u>
<u>6-16-94</u>	<u>0850</u>	<u>7.8</u>	<u>360 mhos/cm</u>	<u>0.0 ppm</u>	<u>40 cpm</u>	<u>0 cpm</u>
<u>6-16-95</u>	<u>1013</u>	<u>7.8</u>	<u>360 mhos/cm</u>	<u>0.0 ppm</u>	<u>40 cpm</u>	<u>0 cpm</u>
		(4.0-10.5)	(<1000 mhos/cm)	(<5 ppm)	(<100 cpm)	(<500 cpm)

*NR: Not Recorded

Weather: Refer to field logbooks

Temp.: Refer to field logbooks

DISPOSITION: Drill-site Disposal X

Containerization
(Labeled?) y/n

Describe: Development water discharged to ground surface.

Onsite Geologist (print): Timothy Coffey - SAIC

Signature:

Date: 6-17-94

Y-12 PLANT GWPP DEVELOPMENT WATER FIELD SCREENING/DISPOSAL SHEET

WELL NO. GW-817 Page 2 of 2 SITE: Scarboro Road

APPROX. VOLUME OF DEVELOPMENT WATER: 144 gallons

CALIBRATION OF INSTRUMENTS: Check those calibrated to manufacturer's specifications.

pH meter	<u>X</u>	(model)	<u>Horiba Model U-7</u>
Sp. Cond. meter	<u>X</u>	(model)	<u>YSI S-C-T Meter Model 33</u>
Organic vapor meter	<u>X</u>	(model)	<u>Century-Foxboro OVA Model 128</u>
Beta/gamma meter	<u>X</u>	(model)	<u>Ludlum Model 3 Survey Meter; with G-M Pancake Probe</u>
Alpha meter	<u>X</u>	(model)	<u>Ludlum Model 12 Count Ratemeter; with Scintillation Tube Probe</u>

FIELD SCREENING RESULTS:

Date	Time	pH	Sp. Cond.	Organic Vapors	Beta/Gamma	Alpha
<u>6-17-94</u>	<u>0837</u>	<u>7.8</u>	<u>370 mhos/cm</u>	<u>0.0 ppm</u>	<u>40 cpm</u>	<u>0 cpm</u>
<u>6-17-94</u>	<u>0850</u>	<u>7.8</u>	<u>365 mhos/cm</u>	<u>0.0 ppm</u>	<u>40 cpm</u>	<u>0 cpm</u>
<u>6-17-94</u>	<u>1036</u>	<u>7.8</u>	<u>370 mhos/cm</u>	<u>0.0 ppm</u>	<u>40 cpm</u>	<u>0 cpm</u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
		(4.0-10.5)	(<1000 mhos/cm)	(<5 ppm)	(<100 cpm)	(<500 cpm)

Weather: Refer to field logbooks

Temp.: Refer to field logbooks

DISPOSITION: Drill-site Disposal X

Containerization (Labeled?) y/n

Describe: Development water discharged to ground surface.

Onsite Geologist (print): Timothy Coffey - SAIC

Signature:

Date: 6-17-94

WELL/BOREHOLE NO. GW-824 SITE: Y-12 Plant, Building 9201-2

CALIBRATION OF INSTRUMENTS (Check those instruments calibrated to manufacturer's specifications):

FIELD SCREENING RESULTS (Background/Maximum Observed Values):

Weather: Partly to mostly cloudy Temp.: Low- to mid-80s °F.

Describe: Cuttings placed in labelled, U.S. DOT-approved 55-gal open-top drum. Some cuttings used to backfill borehole up to asphalt pavement as per HSEA.

Onsite Geologist (print): Timothy Coffey - SAIC

Date: 7-22-94

APPENDIX G
EQUIPMENT DECONTAMINATION SUMMARIES

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM		BORING NO. <u>BH-1/BH-2</u>		
EQUIPMENT DECONTAMINATION INSPECTION SUMMARY		SOIL BORING ☒ INSTALLATION ☐ P&A ☐		
LOCATION: <u>East End Fuel Station</u>		DATE: START: <u>11-30-93</u>		
DECONTAMINATION CREW <u>J.C. Draper/Woody Duncan - Law Eng.</u>		FINISH: <u>12-1-93</u>		
<u>A. Garland/J. Williams - HSEA</u>				
EQUIPMENT	DECON DATE	INSPECTION DATE	INSPECTION (PASS/FAIL)	INSPECTOR'S INITIALS
DRILL RIG <u>CME 55</u> (Mast, Chassis, Cables, Carousel, Hoses, Etc.)	11-29-93 11-30-93	11-30-93	Pass	TJC
DRILLING TOOLS (Pipe Wrenches, Hand Tools, Lifting Bells, Clevis, Chains, Etc.)	11-29-93 11-30-93	11-30-93	Pass	TJC
DOWN HOLE TOOLS (Drilling Rods, Stabilizers, Washover Pipe, Bits, Etc.)	11-29-93 11-30-93	11-30-93	Pass	TJC
WELL CONSTRUCTION MATERIALS (Casing, Screen, Centralizers, Etc.)	-NA-			
WORKOVER RIG _____ (Mast, Chassis, Cables, Hoses, Etc.)	-NA-			
DEVELOPMENT TOOLS (Tubing, Bailers, Pumps, Etc.)	-NA-			
OTHER EQUIPMENT OR RE-INSPECTIONS (SPECIFY)				
Split-spoon samplers	11-30-93	11-30-93	Pass	TJC
COMMENTS: Law Eng. driller stated: drill rig and equipment steam-cleaned twice, evening of 11-29-93 and morning of 11-30-93.				
Split-spoon samplers (provided by Highland Drilling Co.) decontaminated by A. Garland/ J. Williams (HSEA).				

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM			WELL NO. <u>GW-816</u>	
EQUIPMENT DECONTAMINATION INSPECTION SUMMARY			INSTALLATION ☒ P&A ☐	
LOCATION: <u>Scarboro Road</u>		DATE: START: <u>5-31-94</u>		
DECONTAMINATION CREW <u>G. Akins/C. Taylor/H. Hall</u>		FINISH: <u>6-6-94</u>		

EQUIPMENT	DECON DATE	INSPECTION DATE	INSPECTION (PASS/FAIL)	INSPECTOR'S INITIALS
DRILL RIG <u>CME 75</u> (Mast, Chassis, Cables, Carousel, Hoses, Etc.)	5-31-94	5-31-94	Pass	SLA
DRILLING TOOLS (Pipe Wrenches, Hand Tools, Lifting Bells, Clevis, Chains, Etc.)	5-31-94	5-31-94	Pass	SLA
DOWN HOLE TOOLS (Drilling Rods, Stabilizers, Washover Pipe, Bits, Etc.)	5-31-94	5-31-94	Pass	SLA
WELL CONSTRUCTION MATERIALS (Casing, Screen, Centralizers, Etc.)	.	5-31-91	Pass	SLA
WORKOVER RIG (Mast, Chassis, Cables, Hoses, Etc.)	NA	—	—	—
DEVELOPMENT TOOLS (Tubing, Bailers, Pumps, Etc.)	6-1-94	6-1-94	Pass	SLA
OTHER EQUIPMENT OR RE-INSPECTIONS (SPECIFY)				

COMMENTS: *Well construction materials come pre-packaged from manufacturer; no decontamination necessary.
Packaging inspected and appeared to be clean, and free of rips, holes, and tears. Casing and screen inspected as it
was installed and also appeared to be clean.

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM		WELL NO. <u>GW-817</u> Page 1 of 2	
EQUIPMENT DECONTAMINATION INSPECTION SUMMARY		INSTALLATION ☒ P&A ☐	
LOCATION: <u>Scarboro Road</u>		DATE: START: <u>5-31-94</u>	
DECONTAMINATION CREW <u>G. Akins/C. Taylor</u>		FINISH: <u>6-3-94</u>	

EQUIPMENT	DECON DATE	INSPECTION DATE	INSPECTION (PASS/FAIL)	INSPECTOR'S INITIALS
DRILL RIG <u>CME 75</u> (Mast, Chassis, Cables, Carousel, Hoses, Etc.)	5-31-94	5-31-94	Pass	SLA
DRILLING TOOLS (Pipe Wrenches, Hand Tools, Lifting Bells, Clevis, Chains, Etc.)	5-31-94	5-31-94	Pass	SLA
DOWN HOLE TOOLS (Drilling Rods, Stabilizers, Washover Pipe, Bits, Etc.)	5-31-94	5-31-94	Pass	SLA
WELL CONSTRUCTION MATERIALS (Casing, Screen, Centralizers, Etc.)	- NA -	—	—	—
WORKOVER RIG (Mast, Chassis, Cables, Hoses, Etc.)	- NA -	—	—	—
DEVELOPMENT TOOLS (Tubing, Ballers, Pumps, Etc.)	- NA -	—	—	—
OTHER EQUIPMENT OR RE-INSPECTIONS (SPECIFY)				

COMMENTS: <u>Two drill rigs used on this well, see page 2.</u>

Y-12 PLANT GROUNDWATER PROTECTION PROGRAMWELL NO. GW-817

Page 2 of 2

EQUIPMENT DECONTAMINATION INSPECTION SUMMARYINSTALLATION ☒P&A ☐LOCATION: Scarboro RoadDATE: START: 5-31-94DECONTAMINATION CREW R. Phillips/H. HallFINISH: 6-3-94J. Monger

EQUIPMENT	DECON DATE	INSPECTION DATE	INSPECTION (PASS/FAIL)	INSPECTOR'S INITIALS
DRILL RIG <u>Ingersoll-Rand XL-750</u> (Mast, Chassis, Cables, Carousel, Hoses, Etc.)	6-3-94	6-3-94	Pass	SLA
DRILLING TOOLS (Pipe Wrenches, Hand Tools, Lifting Bells, Clevis, Chains, Etc.)	6-3-94	6-3-94	Pass	SLA
DOWN HOLE TOOLS (Drilling Rods, Stabilizers, Washover Pipe, Bits, Etc.)	6-3-94	6-3-94	Pass	SLA
WELL CONSTRUCTION MATERIALS (Casing, Screen, Centralizers, Etc.)	6-3-94	6-3-94	Pass	TJC
WORKOVER RIG <u>Smeal Rig</u> (Mast, Chassis, Cables, Hoses, Etc.)	6-15-94	6-15-94	Pass	TJC
DEVELOPMENT TOOLS (Tubing, Bailers, Pumps, Etc.)	6-6-94*	6-6-94	Pass	SLA
OTHER EQUIPMENT OR RE-INSPECTIONS (SPECIFY)				
Swab tubing, sinker bar, etc.	6-15-94	6-15-94	Pass	TJC

COMMENTS: *Bailer and rope.

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM		WELL NO. <u>GW-824</u>		
EQUIPMENT DECONTAMINATION INSPECTION SUMMARY		INSTALLATION ☒ P&A ☐		
LOCATION: <u>Y-12 Plant, Building 9201-2</u>		DATE: START: <u>7-20-94</u>		
DECONTAMINATION CREW <u>D. Williford</u>		FINISH: <u>7-22-94</u>		
EQUIPMENT	DECON DATE	INSPECTION DATE	INSPECTION (PASS/FAIL)	INSPECTOR'S INITIALS
DRILL RIG <u>Ford 455 Backhoe with McMillan Diggerhead</u> (Mast, Chassis, Cables, Carousel, Hoses, Etc.)	7-19-94	7-20-94	Pass	TJC
DRILLING TOOLS (Pipe Wrenches, Hand Tools, Lifting Bells, Clevis, Chains, Etc.)	7-19-94	7-20-94	Pass	TJC
DOWN HOLE TOOLS (Drilling Rods, Stabilizers, Washover Pipe, Bits, Etc.)	7-19-94	7-20-94	Pass	TJC
WELL CONSTRUCTION MATERIALS (Casing, Screen, Centralizers, Etc.)	- NA -	—	—	—
WORKOVER RIG _____ (Mast, Chassis, Cables, Hoses, Etc.)	- NA -	—	—	—
DEVELOPMENT TOOLS (Tubing, Ballers, Pumps, Etc.)	- NA -	—	—	—
OTHER EQUIPMENT OR RE-INSPECTIONS (SPECIFY)				
Hollow-stem augers	7-21-94	7-22-94	Pass	BWM
COMMENTS: *Piezometer not installed, well construction materials not used.				

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