Y/SUB/98-MVM64V/4

Y-12

OAK RIDGE
Y-12
PLANT

LOCKHEED MARTIN

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

UCN-13672 (26 6-95)

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM GROUNDWATER AND SURFACE WATER SAMPLING AND ANALYSIS PLAN FOR CALENDAR YEAR 1999

Prepared by

AJA TECHNICAL SERVICES, INC
Under Subcontract 70Y-MVM64V

September 1998

for the

Environmental Compliance Department
Environment, Safety, and Health Organization
Oak Ridge Y-12 Plant
Oak Ridge, Tennessee 37831

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LOCKHEED MARTIN ENERGY SYSTEMS, INC.
for the U.S. DEPARTMENT OF ENERGY
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List of Acronyms and Abbreviations

ASO	Analytical Services Organization
BC	Bear Creek Hydrogeologic Regime
CR	Chestnut Ridge Hydrogeologic Regime
CY	Calendar Year
DOE	U.S. Department of Energy
EF	Upper East Fork Poplar Creek Hydrogeologic Regime
GWPP	Groundwater Protection Program
IWQP	Integrated Water Quality Program
SESD	Sampling and Environmental Support Department
SWDF	Solid Waste Disposal Facility

1.0 INTRODUCTION

This plan provides a description of the groundwater and surface water quality monitoring activities planned for calendar year (CY) 1999 at the U.S. Department of Energy (DOE) Y-12 Plant that will be managed by the Y-12 Plant Environment, Safety, and Health Organization through the Y-12 Plant Groundwater Protection Program (GWPP). Groundwater and surface water monitoring during CY 1999 will be performed in three hydrogeologic regimes at the Y-12 Plant: the Bear Creek Hydrogeologic Regime (Bear Creek Regime), the Upper East Fork Poplar Creek Hydrogeologic Regime (East Fork Regime), and the Chestnut Ridge Hydrogeologic Regime (Chestnut Ridge Regime). The Bear Creek and East Fork regimes are located in Bear Creek Valley, and the Chestnut Ridge Regime is located south of the Y-12 Plant (Figure 1).

Groundwater and surface water monitoring performed under the auspices of the Y-12 Plant GWPP during CY 1999 will comply with:

- Tennessee Department of Environment and Conservation regulations governing detection monitoring at nonhazardous Solid Waste Disposal Facilities (SWDF); and
- DOE Order 5400.1 surveillance monitoring and exit pathway/perimeter monitoring.

Some of the data collected for these monitoring drivers will also be used to meet monitoring requirements of the Integrated Water Quality Program (IWQP), which is managed by Bechtel Jacobs Company LLC. Data from five sampling locations collected for SWDF monitoring in the Chestnut Ridge Regime will be used to comply with requirements specified in Resource Conservation and Recovery Act post-closure permit regarding corrective action monitoring. Also, data from sampling locations in each regime will be provided to the IWQP as requested.

Modifications to the CY 1999 monitoring program may be necessary during implementation. Changes in regulatory or programmatic requirements may alter the analytes specified for selected monitoring wells, or wells could be added or removed from the planned monitoring network. All modifications to the monitoring program will be approved by the Y-12 Plant GWPP manager and documented as addenda to this sampling and analysis plan.

2.0 MONITORING LOCATIONS

Groundwater samples will be collected from a total of 80 monitoring wells, including 32 wells located in the Bear Creek Regime (Figure 2), 17 wells located in the Chestnut Ridge Regime (Figure 3), and 31 wells located in the East Fork Regime (Figure 4). Samples of groundwater discharging from 10 natural springs also will be collected, including four springs (SS-1, SS-4, SS-5, and SS-6) in the Bear Creek Regime (Figure 2) and six springs (SCR2.1SP, SCR2.2SP, SCR3.4SP, SCR4.3SP, SCR5.1SP, and SCR5.4SP) in the Chestnut Ridge Regime (Figure 3).

Surface water samples will be collected from a total of 12 sampling locations during CY 1999, including 11 locations in the Bear Creek Regime and one location in the East Fork Regime. In the Bear Creek Regime, samples will be collected from Bear Creek at six sampling stations located from about 0.6 to 12 kilometers upstream of the confluence of Bear Creek and East Fork Poplar Creek (BCK-00.63 to BCK-11.97), and from five sampling stations along northern tributaries to Bear Creek (NT-01, NT-02, NT-06, NT-07, and NT-08) (Figure 2). In the East Fork Regime, samples will be collected from the Lake Reality Emergency Spillway (LRSPW) (Figure 4).

3.0 SAMPLE COLLECTION

Groundwater and surface water samples will be collected by personnel from the Sampling and Environmental Support Department (SESD) of the Analytical Services Organization (ASO). Groundwater sampling will be performed in accordance with the most recent version of the technical procedure approved by the Y-12 Plant GWPP Manager: *Groundwater Sampling* (Lockheed Martin Energy Systems, Inc. 1997). Procedures for obtaining field measurements and for surface water sampling are contained in *Environmental Surveillance Procedures Quality Control Manual* (Lockheed Martin Energy Systems, Inc. 1988). Sample collection, handling, analysis, and surveillance will be performed in accordance with the GWPP Quality Program Plan (Science Applications International Corporation 1994), and the ASO Laboratory Quality Assurance Project Plan for groundwater monitoring at the Y-12 Plant (Martin Marietta Energy Systems 1991).

Monitoring wells, springs, and surface water stations are subdivided into sample groups based on hydrogeologic regimes. These sample groups, located in the Bear Creek (BC), Chestnut Ridge (CR), and East Fork (EF) hydrogeologic regimes, will be sampled in the sequence shown on Table 1. The sampling sequence is generally from least contaminated wells to most contaminated wells at each location within each sampling group. Groundwater samples will be collected using dedicated sampling equipment (Well Wizard ™ bladder pumps) unless a well is scheduled for one-time sampling. For monitoring wells that are nested closely together or that are equipped with a Westbay™ multiport sampling system, the collection sequence is from shallowest to deepest monitored interval. For surface water and springs along Bear Creek, sampling is from the furthest downstream locations to the upstream location closest to the S-3 Site (Table 1).

Samples will be collected semiannually from all of the monitoring wells, springs, and surface water stations in each regime, with the exception of sampling groups BC-4(eight wells and four surface water stations), BC-WB (eight sampling ports of Westbay™ well GW-726), and EF-4 (two wells) that are scheduled for one-time sampling during CY 1999. As summarized below, the number of samples to be collected during each quarter will range from 36 to 80, for an annual total of 214 samples.

HYDROGEOLOGIC REGIME	NUMBER OF SAMPLES PER QUARTER OF CY 1999			
	1st	2nd	3rd	4th
BC Regime	54	0	34	0
CR Regime	16	7	16	7
EF Regime	10	29	10	31
TOTAL:	80	36	60	38

Groundwater samples from all monitoring wells, except those equipped with a Westbay™ multiport sampling system, will be collected using the low-flow minimal drawdown purging and sampling method. Sample collection using this method began in October 1997 and initial results show a significant reduction in sample turbidity and increased similarity between total (unfiltered) and dissolved (filtered) metal concentrations. Beginning in CY 1999, filtered samples will be collected only from specified wells (Table 1), including all of the sample groups in the Chestnut Ridge Regime and sample groups BC-4, BC-WB, EF-3, and EF-WB.

In addition to the groundwater and surface water samples, field blanks and equipment rinsate samples will be collected at the frequencies and analyzed for the parameters specified on Table 1. Field blank samples will be collected from at least 10% of the sample groups. Equipment rinsate samples will be collected from wells in sample groups with nondedicated sampling equipment (BC-4) or with Westbay™ multiport sampling systems (BC-WB and EF-WB). The rinsate sample will be collected at the last sampling port (Westbay™) or the last well sampled with each pump immediately following the field cleaning procedure.

Trip blank samples, field duplicate samples, and laboratory quality assurance samples will be prepared and analyzed as specified in the ASO Laboratory Quality Assurance Project Plan (Martin Marietta Energy Systems, Inc. 1991) using applicable analytical procedures. The location (building and room number) where the trip blank samples are prepared will be recorded on the field data sheets. Trip blank samples will be prepared for each cooler used to transport samples for volatile organic analyses. Duplicate samples will be collected from at least 10% of the sampling locations. A total of 26 field duplicate samples will be collected during CY 1999, including eight in the Bear Creek Regime, ten in the Chestnut Ridge Regime, and eight in the East Fork Regime (Table 1).

4.0 ANALYTICAL PARAMETERS

The monitoring drivers for CY 1999 require an extensive list of analytes (Table 2). For this Sampling and Analysis Plan, specific analytes are grouped by analytical method or by type (e.g., metals) and referenced as analytical parameters. All groundwater and surface water samples will be analyzed for the following suite of parameters (identified as the Standard Administrative Parameter Group):

- field measurements - water level (monitoring wells), temperature, pH, conductivity, dissolved oxygen, and oxidation-reduction potential;
- miscellaneous laboratory analytes - pH, conductivity, turbidity, total suspended solids, and total dissolved solids;
- major anions;
- trace metals (includes major cations);
- a comprehensive suite of organic compounds; and
- gross alpha and gross beta activity.

The Y-12 Plant National Pollution Elimination System Program requested results for several radionuclides in addition to the analytes included in the Standard Administrative Parameter Group for surface water samples from BCK-11.97 in BC-3 (Table 1). Additional radionuclides also will be reported for groundwater samples from the wells scheduled for one-time sampling in EF-4 (Table 1).

5.0 REFERENCES

Martin Marietta Energy Systems, Inc. 1991. *Laboratory Quality Assurance Project Plan for the Sampling and Analysis of Groundwater Wells at the Y-12 Plant Site on the Oak Ridge Reservation.* Prepared by Analytical Chemistry Department Technical Division, QAP: 04-90-0014.

Lockheed Martin Energy Systems, Inc. 1988. *Environmental Surveillance Procedures Quality Control Manual.* (ES/ESH/INT-14).

Lockheed Martin Energy Systems, Inc. 1997. *Groundwater Sampling.* Prepared by the Analytical Services Organization (SESD-TP-8204, Rev. 3).

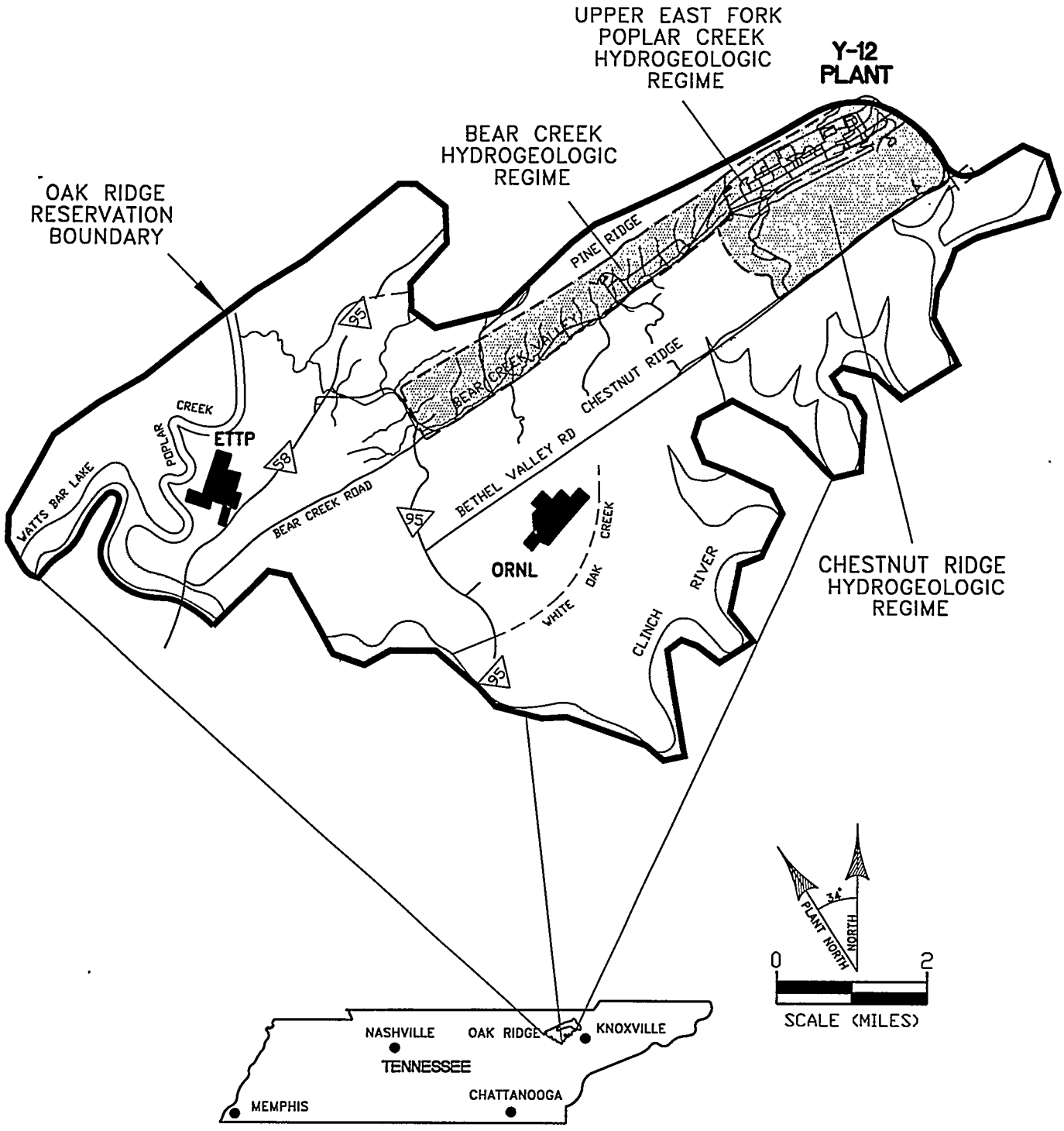
Science Applications International Corporation. 1994. *Groundwater Protection Program Quality Program Plan.* Prepared for Martin Marietta Energy Systems, Inc. (Y/SUB/94-99069C/Y13/1).

U.S. Environmental Protection Agency. 1983. *Methods for Chemical Analysis of Water and Wastes.*

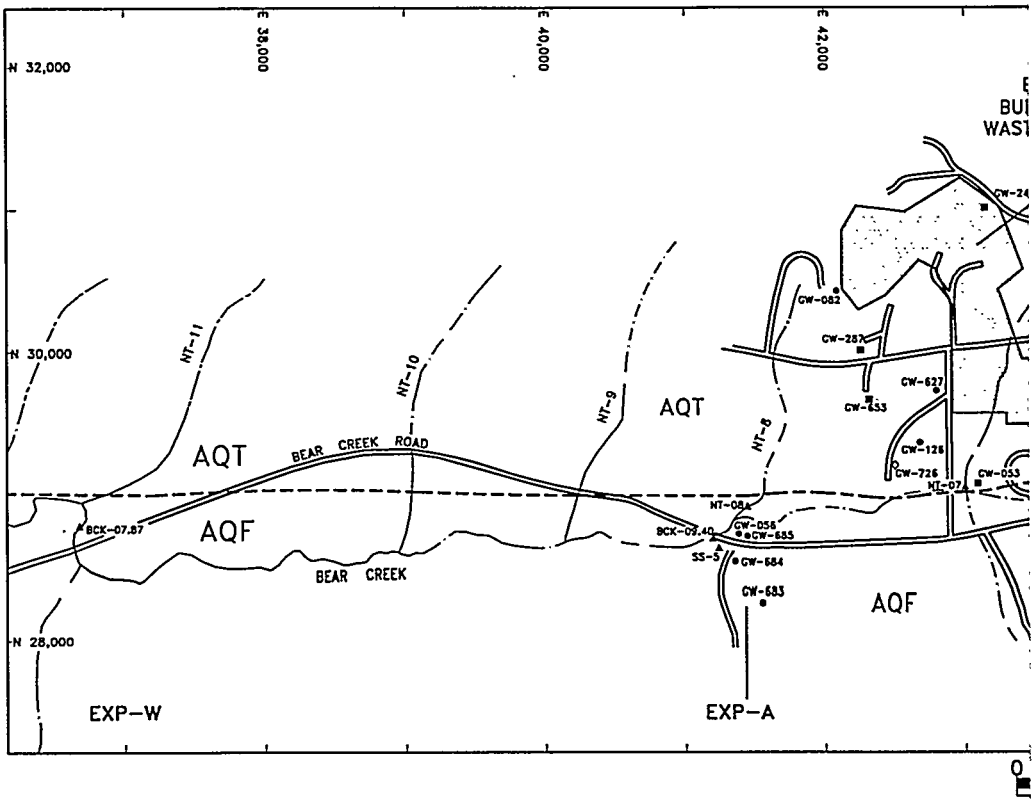
U.S. Environmental Protection Agency. 1986. *Test Methods for Evaluating Solid Waste Physical/Chemical Methods.*

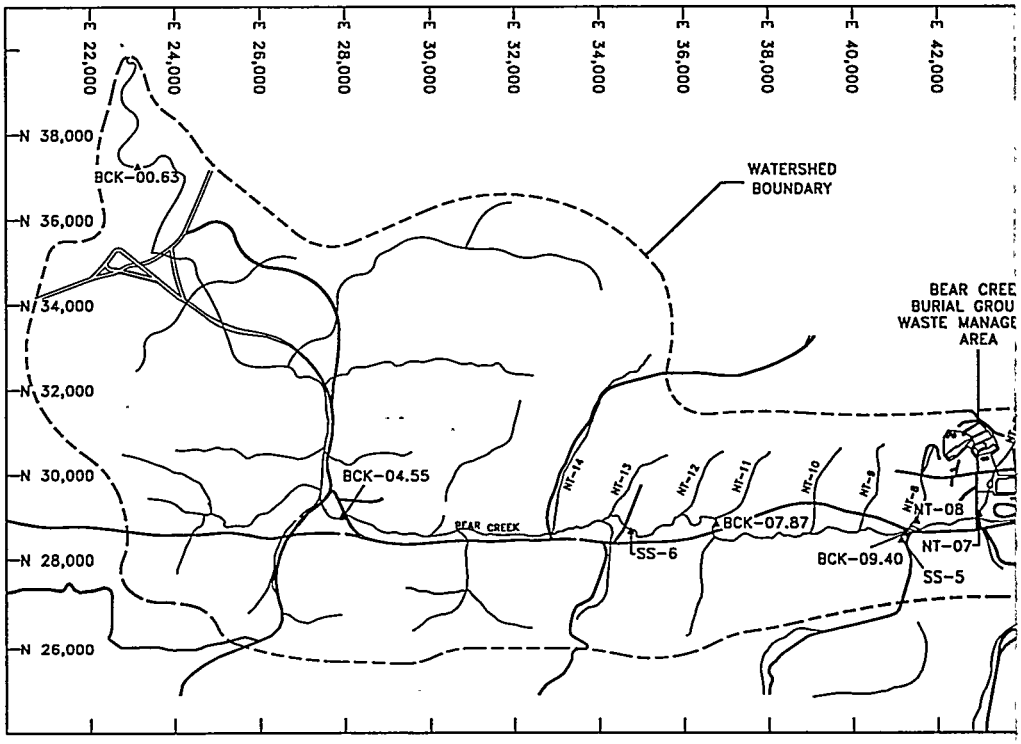
APPENDIX A

Figures



PREPARED FOR: *LOCKHEED MARTIN ENERGY SYSTEMS, INC.*	LOCATION:	Y-12 PLANT OAK RIDGE, TN.	FIGURE 1
PREPARED BY: *AJA TECHNICAL SERVICES, INC.*	DOC NUMBER:	MVM64V/4	HYDROGEOLOGIC REGIMES AT THE Y-12 PLANT
	DWG ID.:	HJC97-007	
	DATE:	9-15-98	

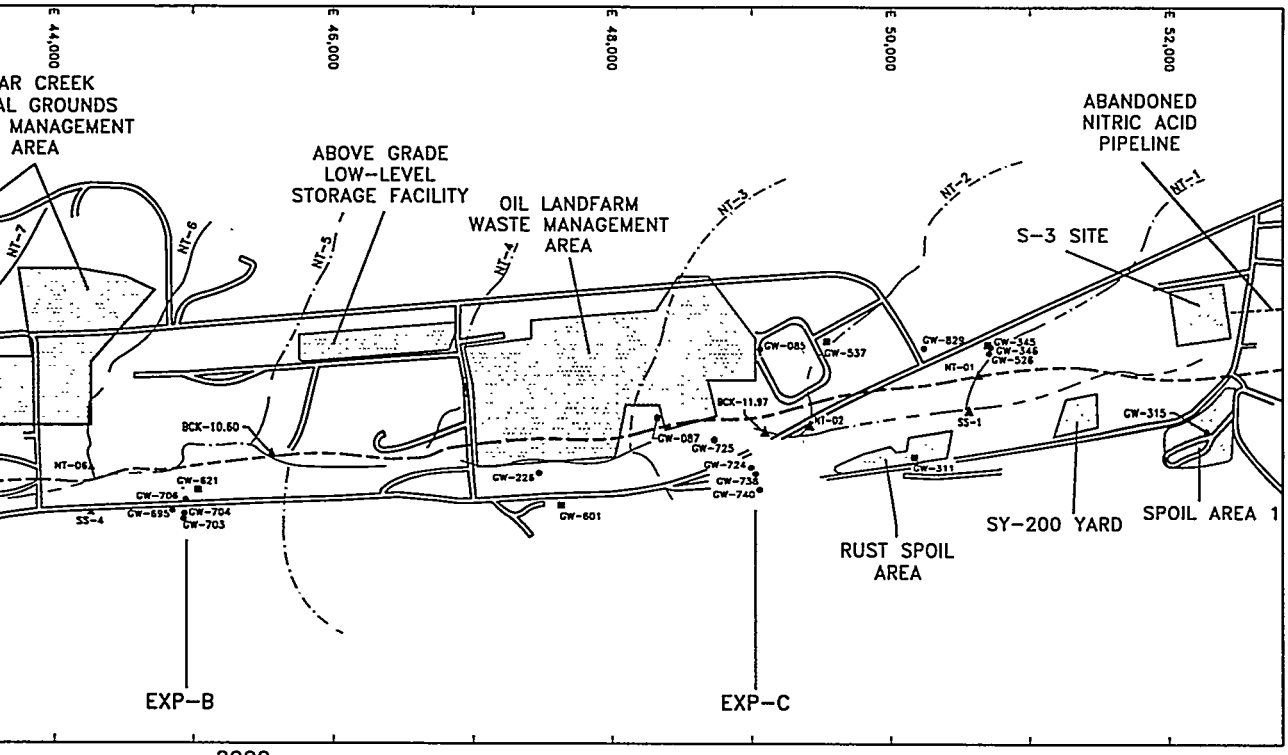


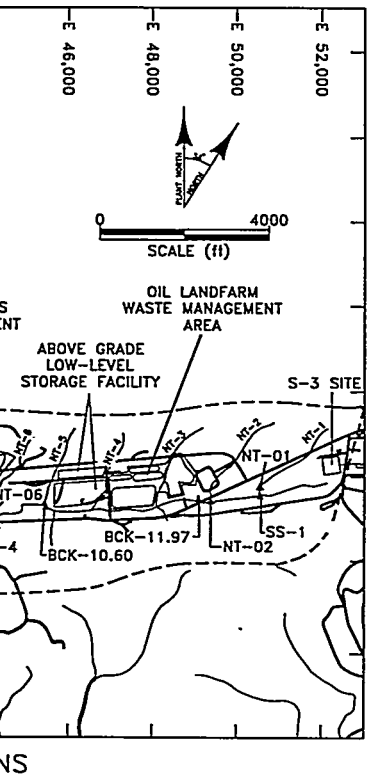


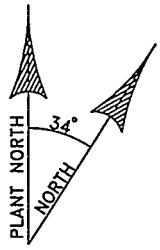
SPRINGS AND SURFACE WATER SAMPLING LOCATI

0 2000

SCALE (ft)







EXPLANATION

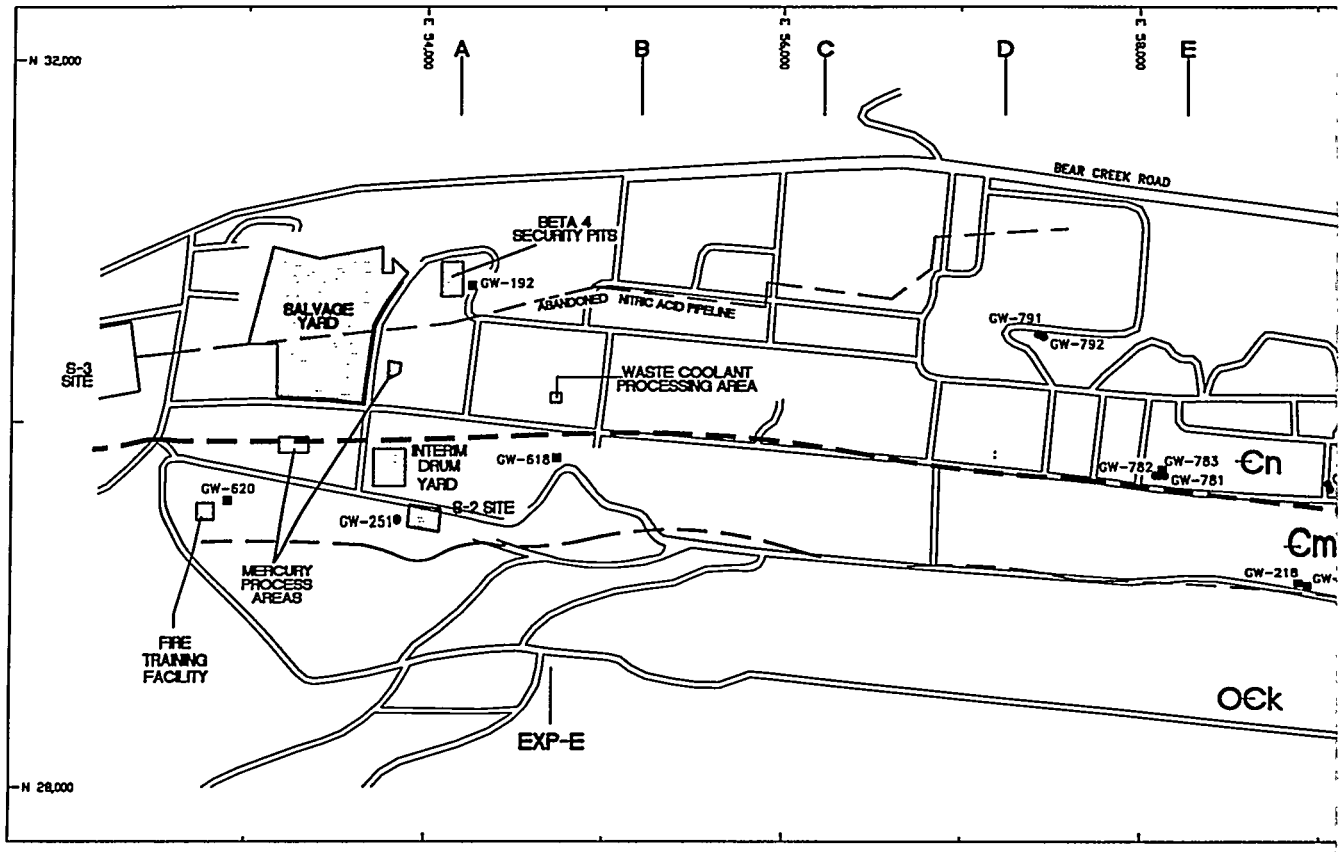
- ■ — Water Table Monitoring Well
- • — Bedrock Monitoring Well
- ◊ — Well With Westbay Multiport Monitoring System (8 Sampling Ports)
- ▲ — Spring or Surface Water Sampling Station
- EXP-C — Exit Pathway, Maynardville Limestone Picket
- ------ — Surface Drainage Feature
- NT-5 — North Tributary
- AQT — Aquitard
- ---------- — Approximate Nolichucky Shale\Maynardville Limestone Contact
- AQF — Aquifer

PREPARED FOR: *LOCKHEED MARTIN ENERGY SYSTEMS, INC.*	LOCATION:	Y-12 PLANT OAK RIDGE, TN.	FIGURE 2
PREPARED BY: *AJA TECHNICAL SERVICES, INC.*	DOC NUMBER:	MVM64V/4	SAMPLING LOCATIONS IN THE BEAR CREEK HYDROGEOLOGIC REGIME, CY 1999
	DWG ID.:	96-028	
	DATE:	9-15-98	

PREPARED FOR: *LOCKHEED MARTIN ENERGY SYSTEMS, INC.*	LOCATION:	Y-12 PLANT OAK RIDGE, TN.
PREPARED BY: *AJA TECHNICAL SERVICES, INC.*	DOC NUMBER:	MVM64V/4
	DWG ID.:	HJC96-033
	DATE:	9-15-98

FIGURE 3

SAMPLING LOCATIONS IN THE CHESTNUT RIDGE HYDROGEOLOGIC REGIME, CY 1999



■ — Water Table

• — Bedrock Mor

◇ — Well With W

▲ — Surface Wat

LRSPW — Lake Reality

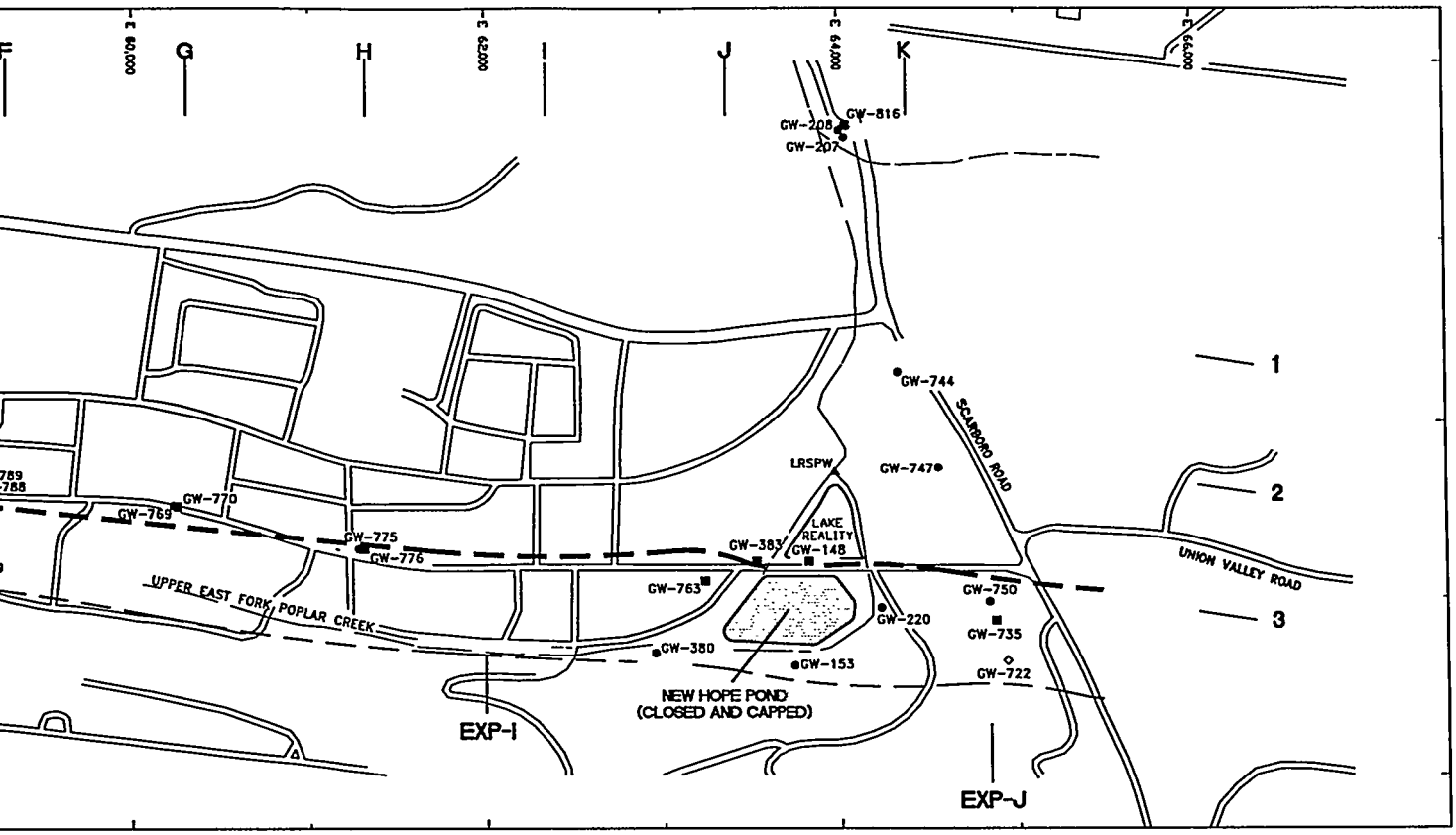
EXP-E — Exit Pathway

K — 1 — Comprehens

Cn — NOLICHUCKY

Cmn — MAYNARDVILLE

OCk — KNOX GROUP



EXPLANATION

lonitoring Well

oring Well

ltbay Multiport Monitoring System (10 Sampling Locations)

Sampling Location

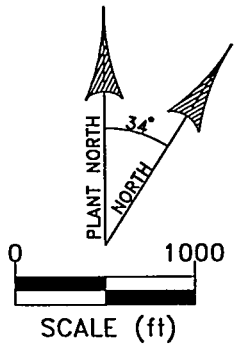
Emergency Spillway

Maynardville Limestone Picket

e Groundwater Monitoring Grid

ALE—— AQUITARD

IMESTONE — AQUIFER



PREPARED FOR: *LOCKHEED MARTIN ENERGY SYSTEMS, INC.*	LOCATION:	Y-12 PLANT OAK RIDGE, TN.	FIGURE 4
PREPARED BY: *AJA TECHNICAL SERVICES, INC.*	DOC NUMBER:	MVM64V/4	SAMPLING LOCATIONS IN THE UPPER EAST FORK POPLAR CREEK HYDROGEOLOGIC REGIME, CY 1999
	DWG ID.:	96-075	
	DATE:	9-15-98	

APPENDIX B

Tables

Table 1.

Sampling Sequence, Frequency, and Analytical Parameters for Groundwater and Surface Water Monitoring During CY 1999

Sample Group[1]	Location[2]	Sampling Point[3]	Duplicate[4]	Contain[5]	Monitoring Driver[6]	Parameters[7]
Bear Creek Hydrogeologic Regime						
BC-1	EXP-A	GW-056			EXP	STD
(Q1, Q3)	EXP-A	GW-685			EXP	STD
	EXP-A	GW-684		Y	EXP	STD
	EXP-A	GW-683		Y	EXP	STD
	EXP-B	GW-621			EXP	STD
	EXP-B	GW-695			EXP	STD
	EXP-B	GW-703		Y	EXP	STD
	EXP-B	GW-704		Y	EXP	STD
	EXP-B	GW-706	Q1	Y	EXP	STD
	EXP-C	GW-740		Y	EXP	STD
	EXP-C	GW-738		Y	EXP	STD
	EXP-C	GW-724		Y	EXP	STD
	EXP-C	GW-725	Q3	Y	EXP	STD
BC-2	BG	GW-287			SMP	STD
(Q1, Q3)	BG	GW-653		Y	SMP	STD
	BG	GW-053		Y	SMP	STD
	BG	GW-627	Q1	Y	SMP	STD
	SPI	GW-315		Y	SMP	STD
	RS	GW-311		Y	SMP	STD
	OLF	GW-829		Y	SMP	STD
	OLF	GW-085		Y	SMP	STD
	OLF	GW-537		Y	SMP	STD
	OLF	GW-226	Q3	Y	SMP	STD

Table 1 (cont'd)

Sample Group[1]	Location[2]	Sampling Point[3]	Duplicate[4]	Contain[5]	Monitoring Driver[6]	Parameters[7]
BC-3	EXP-SW	BCK-00.63			EXP	STD
(Q1, Q3)	EXP-SW	BCK-04.55			EXP	STD
	EXP-SW	SS-6			EXP	STD
	EXP-SW	BCK-07.87	Q1		EXP	STD
	EXP-SW	SS-5			EXP	STD
	EXP-SW	BCK-09.40			EXP	STD
	EXP-SW	SS-4	Q3		EXP	STD
	EXP-SW	BCK-10.60			EXP	STD
	EXP-SW	BCK-11.97			EXP	STD, RAD(2,3,4,5,8,13)
	EXP-SW	SS-1			EXP	STD
	EXP-SW	NT-01			EXP	STD
BC-4	EXP-SW	NT-08			SMP	STD
(Q1)	EXP-SW	NT-07			SMP	STD
	EXP-SW	NT-06			SMP	STD
	EXP-SW	NT-02			SMP	STD
	BG	GW-126		Y	SMP	STD/F
	BG	GW-082		Y	SMP	STD/F
	BG	GW-242		Y	SMP	STD/F
	OLF	GW-601		Y	SMP	STD/F
	S3	GW-345		Y	SMP	STD/F
	S3	GW-346		Y	SMP	STD/F
	S3	GW-526	Q1	Y	SMP	STD/F
	OLF	GW-087		Y	SMP	STD/F
		RINSATE SAMPLE				STD
BC-WB	BG	GW-726-23			SMP	STD/F
(Q1)	BG	GW-726-20			SMP	STD/F
	BG	GW-726-16			SMP	STD/F
	BG	GW-726-12			SMP	STD/F

Table 1 (cont'd)

Sample Group[1]	Location[2]	Sampling Point[3]	Duplicate[4]	Contain[5]	Monitoring Driver[6]	Parameters[7]
BC-WB (cont'd)	BG	GW-726-09	Q1		SMP	STD/F
	BG	GW-726-06			SMP	STD/F
	BG	GW-726-04			SMP	STD/F
	BG	GW-726-02			SMP	STD/F
		FIELD BLANK				VOC(1)
		RINSATE SAMPLE				STD
Chestnut Ridge Hydrogeologic Regime						
CR-1	LIV	GW-217	Q1		SDM	STD/F
(Q1,Q3)	LIV	GW-141			SDM	STD/F
	LIV	GW-521			SDM/CMP	STD/F
	LIV	GW-522			SDM	STD/F
	LIV	GW-305	Q3		SDM	STD/F
CR-2	LV	GW-557			SDM/CMP	STD/F
(Q1,Q3)	LV	GW-799			SDM/CMP	STD/F
	LV	GW-797	Q1		SDM	STD/F
	LV	GW-796			SDM/CMP	STD/F
	LV	GW-801	Q3		SDM/CMP	STD/F
	LV	SCR4.3SP			SDM	STD/F
		FIELD BLANK				VOC(1)
CR-3	EXP-SW	SCR2.1SP	Q1		EXP	STD/F
(Q1,Q3)	EXP-SW	SCR2.2SP	Q3		EXP	STD/F
	EXP-SW	SCR3.4SP			EXP	STD/F
	EXP-SW	SCR5.1SP			EXP	STD/F
	EXP-SW	SCR5.4SP			EXP	STD/F
CR-4	LII	GW-540	Q2		SDM	STD/F
(Q2,Q4)	LII	GW-709	Q4		SDM	STD/F
	LII	GW-757			SDM	STD/F

Table 1 (cont'd)

Sample Group[1]	Location[2]	Sampling Point[3]	Duplicate[4]	Contain[5]	Monitoring Driver[6]	Parameters[7]
CR-5	CDLVI	GW-827	Q2		SDM	STD/F
(Q2, Q4)	CDLVI	GW-542	Q4		SDM	STD/F
	CDLVI	GW-543			SDM	STD/F
	CDLVI	GW-544			SDM	STD/F
Upper East Fork Poplar Creek Hydrogeologic Regime						
EF-1	GRID F3	GW-789			SMP	STD
(Q2,Q4)	GRID F3	GW-788			SMP	STD
	GRID G3	GW-770			SMP	STD
	GRID G3	GW-769		Y	SMP	STD
	GRID H3	GW-776			SMP	STD
	GRID H3	GW-775		Y	SMP	STD
	GRID E3	GW-783		Y	SMP	STD
	GRID E3	GW-782	Q2	Y	SMP	STD
	GRID E3	GW-781		Y	SMP	STD
	GRID D2	GW-792		Y	SMP	STD
	GRID D2	GW-791	Q4	Y	SMP	STD
EF-2	B4	GW-192		Y	SMP	STD
(Q2,Q4)	EXP-E	GW-618		Y	EXP	STD
	S2	GW-251	Q2	Y	EXP	STD
	FTF	GW-620		Y	EXP	STD
	GRID JP	GW-763		Y	SMP	STD
	NHP	GW-148		Y	SMP	STD
	NHP	GW-153	Q4	Y	EXP	STD
	NHP	GW-380		Y	EXP	STD
	NHP	GW-220		Y	EXP	STD
	NHP	GW-383		Y	SMP	STD
EF-3	EXP-SW	LRSPW			EXP	STD/F
(Q2,Q4)	EXP-SR	GW-207			EXP	STD/F
	EXP-SR	GW-208			EXP	STD/F
	EXP-SR	GW-816	Q2		EXP	STD/F

Table 1 (cont'd)

Sample Group[1]	Location[2]	Sampling Point[3]	Duplicate[4]	Contain[5]	Monitoring Driver[6]	Parameters[7]
EF-3 (cont'd)	GRID K1	GW-744			SMP	STD/F
	GRID K2	GW-747			SMP	STD/F
	EXP-J	GW-735			EXP	STD/F
	EXP-J	GW-750	Q4		EXP	STD/F
EF-4	UOV	GW-218		Y	SMP	STD/F, RAD(2,3,4,5,8)
(Q4)	UOV	GW-219	Q4	Y	SMP	STD/F, RAD(2,3,4,5,8)
EF-WB	EXP-J	GW-722-33			EXP	STD/F
(Q1,Q3)	EXP-J	GW-722-32			EXP	STD/F
	EXP-J	GW-722-30			EXP	STD/F
	EXP-J	GW-722-26			EXP	STD/F
	EXP-J	GW-722-22	Q1		EXP	STD/F
	EXP-J	GW-722-20	Q3		EXP	STD/F
	EXP-J	GW-722-17			EXP	STD/F
	EXP-J	GW-722-14			EXP	STD/F
	EXP-J	GW-722-10			EXP	STD/F
	EXP-J	GW-722-06			EXP	STD/F
		FIELD BLANK				VOC(1)
		RINSATE SAMPLE				STD

Notes:

1 Samples will be collected during the calendar year quarter as specified (e.g., Q1). Surface water and spring samples in BC-3 will be collected on or about the same day as groundwater samples will be collected from wells GW-683 and GW-684 in BC-1.

2 **Bear Creek Regime**

BG - Bear Creek Burial Grounds Waste Management Area
EXP - Exit Pathway Monitoring Location:
Maynardville Limestone Picket (-A, -B, -C)
Spring or Surface Water Location (-SW)
OLF - Oil Landfarm Waste Management Area
RS - Rust Spoil Area
S3 - S-3 Site
SPI - Spoil Area I

Table 1 (cont'd)

Notes (cont'd):

Chestnut Ridge Regime

CDLVI - Construction/Demolition Landfill VI
EXP-SW - Exit Pathway Monitoring Location (spring)
LII - Industrial Landfill II
LIV - Industrial Landfill IV
LV - Industrial Landfill V

East Fork Regime

B4 - Beta-4 Security Pits
EXP - Exit Pathway Monitoring Location:
Maynardville Limestone Picket (-E, -J)
Along Scarboro Road in the gap through Pine Ridge (-SR)
FTF - Fire Training Facility
GRID - Comprehensive Groundwater Monitoring Plan Grid Location
NHP - New Hope Pond
UOV - Uranium Oxide Vault
S2 - S-2 Site

3 BCK - Bear Creek Kilometer (Surface Water Sampling Station)
GW - Groundwater Monitoring Well
LRSPW - Lake Reality Spillway (Surface Water Sampling Station)
NT - North Tributary to Bear Creek
SCR - South Chestnut Ridge (Spring Sampling Station)
SS - Spring Sampling Location: South Side of Bear Creek

4 Q_ - Field duplicate samples will be collected at these locations during the quarter specified.

5 Y - All purged groundwater will be contained at these locations.

6 CMP - RCRA Post-Closure Corrective Action Monitoring
EXP - DOE Order 5400.1 Exit Pathway Monitoring
SDM - SWDF Detection Monitoring
SMP - DOE Order 5400.1 Surveillance Monitoring

7 Table 2 provides a comprehensive list of analytes and analytical methods grouped by parameter.

/F - Filtered sample for dissolved metal concentrations.
STD - Standard administrative parameter group.
See the following list of parameters that apply to CY 1999 samples.

Table 1 (cont'd)

Notes (cont'd):

Standard Administrative Parameter Group:

FLD - Field measurements
CHEM - Miscellaneous laboratory analytes (e.g., pH) and anions
MET(1) - Metals; analyzed by inductively coupled plasma spectrometry, except those analyzed by:
- plasma mass spectrometry
  antimony, arsenic, cadmium, lead, thallium, and uranium
- cold vapor atomic absorption
  mercury

VOC(1) - Volatile organic compounds
RAD(1) - Gross alpha and gross beta

Additional Radionuclides:

RAD(2) - Strontium-89/90, technetium-99, and tritium
RAD(3) - Uranium-234, -235, and -238
RAD(4) - Americium-241, iodine-129, neptunium-237, plutonium-238 and -239/240
RAD(5) - Radium-223/224/226
RAD(8) - Thorium-228, -230, -232, and -234
RAD(13) - Total uranium and weight percent U-235

Table 2.
Field Measurements and Laboratory Analytes for CY 1999 Groundwater and Surface Water Samples

FLD - Field Measurements	Analytical Method[1]	Detection Limit[2]	Units[3]
Depth to Water	ESP 302-1	NA	ft
Water Temperature	ESP 307-1	NA	centigrade
pH	ESP 307-1	NA	pH units
Conductivity	ESP 307-1	NA	µmho/cm
Dissolved Oxygen	ESP 307-3	NA	ppm
Oxidation-Reduction Potential	ESP 307-5	NA	mV
CHEM - Miscellaneous Laboratory Analytes			
pH	EPA-9040	NA	pH units
Conductivity	EPA-9050	NA	µmho/cm
Total Dissolved Solids	EPA-160.1	1	mg/L
Total Suspended Solids	EPA-160.2	1	mg/L
Turbidity	EPA-180.1	0.1	NTU
CHEM - Anions			
Alkalinity - HCO3	EPA-310.1	1.0	mg/L
Alkalinity - CO3	EPA-310.1	1.0	mg/L
Chloride	EPA-300.0	0.2	mg/L
Fluoride	EPA-340.2	0.1	mg/L
Nitrate (as Nitrogen)	EPA-300.0	0.028	mg/L
Sulfate	EPA-300.0	0.25	mg/L
MET(1) - Metals: Unfiltered & Filtered[4]			
Aluminum	EPA-6010A	0.02	mg/L
Antimony	EPA-200.8	0.005	mg/L
Arsenic	EPA-200.8	0.005	mg/L
Barium	EPA-6010A	0.001	mg/L
Beryllium	EPA-6010A	0.0003	mg/L
Boron	EPA-6010A	0.004	mg/L
Cadmium	EPA-200.8	0.0005	mg/L
Calcium	EPA-6010A	0.008	mg/L
Chromium	EPA-6010A	0.01	mg/L
Cobalt	EPA-6010A	0.005	mg/L
Copper	EPA-6010A	0.004	mg/L
Iron	EPA-6010A	0.005	mg/L
Lead	EPA-200.8	0.0005	mg/L
Lithium	EPA-6010A	0.004	mg/L
Magnesium	EPA-6010A	0.003	mg/L
Manganese	EPA-6010A	0.001	mg/L
Mercury	EPA-7470	0.0002	mg/L
Molybdenum	EPA-6010A	0.01	mg/L

Table 2 (cont'd)

MET(1) - Metals (cont'd)	Analytical Method[1]	Detection Limit[2]	Units[3]
Nickel	EPA-6010A	0.01	mg/L
Potassium	EPA-6010A	0.6	mg/L
Selenium	EPA-200.8	0.01	mg/L
Silver	EPA-6010A	0.006	mg/L
Sodium	EPA-6010A	0.02	mg/L
Strontium	EPA-6010A	0.0004	mg/L
Thallium	EPA-200.8	0.0005	mg/L
Thorium	EPA-6010A	0.2	mg/L
Uranium	EPA-200.8	0.0005	mg/L
Vanadium	EPA-6010A	0.005	mg/L
Zinc	EPA-6010A	0.002	mg/L
VOC(1) - Volatile Organic Compounds		**CRQL[5]**	
Acetone	EPA-8260	10	µg/L
Acrolein	EPA-8260	10	µg/L
Acrylonitrile	EPA-8260	10	µg/L
Benzene	EPA-8260	5	µg/L
Bromochloromethane	EPA-8260	10	µg/L
Bromodichloromethane	EPA-8260	5	µg/L
Bromoform	EPA-8260	5	µg/L
Bromomethane	EPA-8260	10	µg/L
2-Butanone	EPA-8260	10	µg/L
Carbon disulfide	EPA-8260	5	µg/L
Carbon tetrachloride	EPA-8260	5	µg/L
Chlorobenzene	EPA-8260	5	µg/L
Chloroethane	EPA-8260	10	µg/L
2-Chloroethyl vinyl ether	EPA-8260	10	µg/L
Chloroform	EPA-8260	5	µg/L
Chloromethane	EPA-8260	10	µg/L
Dibromochloromethane	EPA-8260	5	µg/L
1,2-Dibromo-3-chloropropane	EPA-8260	10	µg/L
1,2-Dibromoethane	EPA-8260	5	µg/L
Dibromomethane	EPA-8260	10	µg/L
1,2-Dichlorobenzene	EPA-8260	5	µg/L
1,4-Dichlorobenzene	EPA-8260	5	µg/L
1,4-Dichloro-2-butene	EPA-8260	5	µg/L
trans-1,4-Dichloro-2-butene	EPA-8260	5	µg/L
Dichlorodifluoromethane	EPA-8260	5	µg/L
1,1-Dichloroethane	EPA-8260	5	µg/L
1,2-Dichloroethane	EPA-8260	5	µg/L
1,1-Dichloroethene	EPA-8260	5	µg/L
1,2-Dichloroethene	EPA-8260	5	µg/L

Table 2 (cont'd)

VOC(1) - Volatile Organic Compounds (cont'd)	Analytical Method[1]	CRQL[5]	Units[3]
cis-1,2-Dichloroethene	EPA-8260	5	µg/L
trans-1,2-Dichloroethene	EPA-8260	5	µg/L
1,2-Dichloropropane	EPA-8260	5	µg/L
cis-1,3-Dichloropropene	EPA-8260	5	µg/L
trans-1,3-Dichloropropene	EPA-8260	5	µg/L
Dimethylbenzene	EPA-8260	5	µg/L
Ethanol	EPA-8260	500	µg/L
Ethylbenzene	EPA-8260	5	µg/L
Ethyl methacrylate	EPA-8260	5	µg/L
2-Hexanone	EPA-8260	10	µg/L
Iodomethane	EPA-8260	5	µg/L
4-Methyl-2-pentanone	EPA-8260	10	µg/L
Methylene chloride	EPA-8260	5	µg/L
Styrene	EPA-8260	5	µg/L
1,1,1,2-Tetrachloroethane	EPA-8260	10	µg/L
1,1,2,2-Tetrachloroethane	EPA-8260	5	µg/L
Tetrachloroethene	EPA-8260	5	µg/L
Toluene	EPA-8260	5	µg/L
1,1,1-Trichloroethane	EPA-8260	5	µg/L
1,1,2-Trichloroethane	EPA-8260	5	µg/L
Trichloroethene	EPA-8260	5	µg/L
Trichlorofluoromethane	EPA-8260	5	µg/L
1,2,3-Trichloropropane	EPA-8260	5	µg/L
Vinyl acetate	EPA-8260	10	µg/L
Vinyl chloride	EPA-8260	10	µg/L
Radiological Analytes (pCi/L)		**Target MDA[6]**	
RAD(1) Gross Alpha Activity	EPA-900.0	3.5	pCi/L
RAD(1) Gross Beta Activity	EPA-900.0	7.0	pCi/L
RAD(2) Strontium-89/90	EPA-905.0	4.0	pCi/L
RAD(2) Technetium-99	Y/P65-7154	10	pCi/L
RAD(2) Tritium	EPA-906.0	300	pCi/L
RAD(3) Uranium-234, 235, & 238	AC-MM-2-22012	0.4	pCi/L
RAD(4) Americium-241	AC-MM-2-22012	0.4	pCi/L
RAD(4) Iodine-129	EPA-901.1	3.0	pCi/L
RAD(4) Neptunium-237	Y/P65-7206	0.4	pCi/L
RAD(4) Plutonium-238 & 239/240	AC-MM-2-22012	0.4	pCi/L
RAD(5) Radium-223/224/226	EPA-903.0 - 904.0	0.5	pCi/L
RAD(8) Thorium-228,230,232, & 234	Y/P65-7206	0.4	pCi/L
RAD(13) Total Uranium and weight % U-235	Y/P65-8044	NA	mg/L

Table 2 (cont'd)

Notes:

1 Analytical/field methods/procedures from:

- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods* (U.S. Environmental Protection Agency 1986)
- *Methods for Chemical Analysis of Water and Wastes* (U.S. Environmental Protection Agency 1983)
- *Environmental Surveillance Procedures Quality Control Manual* (Lockheed Martin Energy Systems, Inc. 1988)
- Lockheed Martin Energy Systems ASO radiological methods

2 NA - not applicable

3
ft - feet
µg/L - micrograms per liter
µmho/cm - micromhos per centimeter
mg/L - milligrams per liter
mV - millivolts
NTU - nephelometric turbidity units
ppm - parts per million
pCi/L - picoCuries per liter

4 Filtered samples will be collected only at specified locations (see Table 1). Groundwater samples for dissolved metals analysis collected with dedicated sampling equipment or portable pumps will be filtered in the field; samples collected with bailers and surface water samples will be filtered in the laboratory.

5 CRQL - contract-required quantitation limit

6 MDA - minimum detectable activity. The target MDA may be obtained under optimal analytical conditions; actual MDAs are sample-specific and may vary significantly from the target value.