

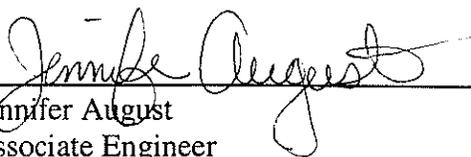
**CLOSURE PLAN
FOR THE
HAZARDOUS WASTE MANAGEMENT FACILITY
BUILDINGS T029 AND T133
SANTA SUSANA FIELD LABORATORY, AREA IV
VENTURA COUNTY, CALIFORNIA
EPA ID No. CAD000629972**

Prepared for:

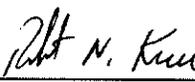
Rocketdyne Propulsion and Power
The Boeing Company
6633 Canoga Avenue
Canoga Park, CA 91309

December 2003

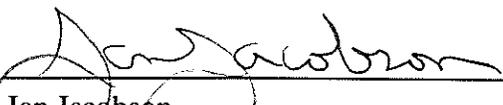
Prepared By:



Jennifer August
Associate Engineer
MWH



Robert N. Kull, PE
Supervising Engineer
MWH



Jan Jacobson
Project Manager
Jacobson Environmental



TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
EXECUTIVE SUMMARY	vii
1.0 FACILITY IDENTIFICATION	1-1
1.1 FACILITY NAME	1-1
1.2 EPA ID NUMBER	1-1
1.3 ADDRESS	1-1
1.4 MAILING ADDRESS	1-1
1.5 CONTACT PERSON	1-1
1.6 FACILITY CO-OPERATORS	1-2
1.7 FACILITY OWNER	1-2
1.8 LANDOWNER	1-2
1.9 PREPARER OF CLOSURE PLAN	1-2
1.10 NATURE OF BUSINESS	1-3
1.10.1 <i>Regulatory Framework</i>	1-5
1.11 ENVIRONMENTAL PERMITS	1-6
1.12 CERTIFICATION	1-7
2.0 FACILITY LOCATION	2-1
2.1 FACILITY SIZE AND LOCATION	2-1
2.2 LAND USE	2-1
2.3 HYDROGEOLOGIC CONDITIONS	2-2
2.3.1 <i>Geology Units and Structure</i>	2-2
2.3.2 <i>Groundwater Occurrence</i>	2-4
2.3.3 <i>Groundwater Quality</i>	2-6
2.4 BACKGROUND CONDITIONS	2-7
2.5 WEATHER AND CLIMATIC CONDITIONS	2-8
2.5.1 <i>Climate</i>	2-8
2.5.2 <i>Wind</i>	2-8
3.0 FACILITY DESIGN AND OPERATION	3-1
3.1 BUILDING T029 AREA	3-1
3.1.1 <i>Description of Building T029</i>	3-1
3.1.2 <i>Design Capacity of T029</i>	3-3
3.1.3 <i>Ancillary Equipment at T029</i>	3-3
3.1.4 <i>Containment Systems</i>	3-3
3.2 BUILDING T133 AREA	3-5
3.2.1 <i>Description of Building T133 Area</i>	3-5
3.2.2 <i>Treatment Chamber/Pan and Ancillary Equipment Descriptions</i>	3-8
3.2.3 <i>Design Capacity</i>	3-11
3.2.4 <i>Containment Systems</i>	3-12
3.2.5 <i>Environmental Leak Detection and Monitoring Systems</i>	3-13
3.3 HISTORY OF SPILLS AT THE HWMF	3-13
4.0 HAZARDOUS WASTE CONSTITUENTS	4-1
4.1 WASTE GENERATION PROCESS	4-1
4.1.1 <i>Sodium and Sodium-Potassium Wastes</i>	4-1
4.1.2 <i>Lithium Metal Wastes</i>	4-2
4.1.3 <i>Lithium Hydride and Zirconium Hydride Powder Wastes</i>	4-2

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
4.2 WASTE GENERATED DURING HANDLING AND TREATMENT OF METAL WASTES	4-3
4.2.1 Fire Suppression Wastes	4-3
4.2.2 Sodium Hydroxide Generated During Storage/Management	4-3
4.2.3 Sodium, Potassium, Lithium and Zirconium Hydroxide Solutions	4-4
4.2.4 Mineral Oil and Kerosene	4-4
4.3 HAZARDOUS WASTE CONSTITUENTS	4-5
5.0 ESTIMATE AND MANAGEMENT OF MAXIMUM INVENTORY	5-1
5.1 T029 AREA	5-1
5.2 T133 AREA	5-1
6.0 CLOSURE APPROACH AND PERFORMANCE OBJECTIVES	6-1
6.1 CLOSURE APPROACH	6-1
6.2 CLOSURE PERFORMANCE OBJECTIVES	6-2
6.2.1 Performance Standard for HWMF Improvements (Equipment and Structures)	6-2
6.2.2 Performance Standard for Soil	6-3
6.2.3 Performance Standard for Groundwater	6-6
6.3 DETERMINATION OF BACKGROUND VALUES FOR FLUORIDE, PH, LITHIUM AND ZIRCONIUM	6-6
6.3.1 Background Soil Sample Collection and Analyses	6-8
7.0 DECONTAMINATION PROCEDURES	7-1
7.1 POTENTIALLY CONTAMINATED STRUCTURES AND EQUIPMENT	7-1
7.2 DECONTAMINATION PROCEDURES	7-3
7.2.1 T029 Area	7-3
7.2.2 T133 Area	7-3
7.2.3 Decontamination Water Sampling Objectives	7-7
7.2.4 Sampling and Analysis of Decontamination Water	7-7
8.0 VERIFICATION SAMPLING AND DEMOLITION	8-1
8.1 VERIFICATION SAMPLING	8-1
8.1.1 Verification Sampling Objectives	8-1
8.1.2 Verification Sampling Methodology	8-2
8.1.3 Quality Assurance/Quality Control	8-5
8.1.4 Decontamination Procedure for Sampling and Demolition Equipment	8-6
8.1.5 Sample Labeling, Packaging, Preservation and Transportation	8-6
8.1.6 Chain-of-Custody Procedure	8-7
8.1.7 Documentation	8-8
8.1.8 Analytical Test Methods	8-8
8.2 DEMOLITION	8-9
8.2.1 Land Surveying and Utility Search	8-9
8.2.2 Equipment, Structures and Piping	8-9
8.2.3 Flooring and Road Materials	8-10
9.0 SOIL SAMPLING	9-1
9.1 SOIL SAMPLING OBJECTIVES	9-1
9.2 NUMBERS AND LOCATIONS OF SAMPLES	9-2
9.2.1 T029 Investigation Subareas and Boring Locations	9-2
9.2.2 T133 Investigation Subareas and Boring Locations	9-5
9.2.3 Soil Investigation at Former T133 Spill Areas	9-7
9.3 FIELD SAMPLING METHODS AND PROCEDURES	9-9

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
9.3.1 <i>Hand Auger Method</i>	9-9
9.3.2 <i>Geoprobe Method</i>	9-9
9.3.3 <i>Quality Control Samples</i>	9-11
9.3.4 <i>Decontamination Procedure</i>	9-12
9.3.5 <i>Labeling, Packaging, and Documentation</i>	9-12
9.4 SOIL ANALYTICAL PROGRAM.....	9-13
10.0 GROUNDWATER SAMPLING	10-1
10.1 PURPOSE AND LOCATION OF GROUNDWATER SAMPLING.....	10-1
10.2 GROUNDWATER SAMPLING PROCEDURES.....	10-2
10.2.1 <i>Groundwater Sampling from Geoprobe Borings</i>	10-2
10.2.2 <i>Water Level Measurement</i>	10-3
10.2.3 <i>Well Groundwater Sampling</i>	10-3
10.2.4 <i>Equipment Decontamination</i>	10-4
10.2.5 <i>Sample Labeling, Packaging and Documentation</i>	10-4
10.3 GROUNDWATER ANALYTICAL PROGRAM.....	10-5
11.0 SOIL REMEDIATION PROCEDURES	11-1
11.1 PURPOSE OF REMEDIATION.....	11-1
11.2 METHODS AND PROCEDURES.....	11-2
11.2.1 <i>Excavation</i>	11-2
11.2.2 <i>Verification Sampling</i>	11-3
11.2.3 <i>Backfill</i>	11-4
11.2.4 <i>Soil Management and Disposal</i>	11-5
11.2.5 <i>Equipment Decontamination</i>	11-5
11.2.6 <i>Sample Labeling, Packaging and Documentation</i>	11-6
11.3 ANALYTICAL METHODS.....	11-7
12.0 CLOSURE COST ESTIMATE AND FINANCIAL RESPONSIBILITY	12-1
13.0 CLOSURE IMPLEMENTATION SCHEDULE	13-1
14.0 CLOSURE CERTIFICATION REPORT REQUIREMENT	14-1
15.0 SITE SECURITY	15-1
16.0 CONTINGENT POST CLOSURE PLAN FOR TANK T-1	16-1
16.1 POST CLOSURE NOTIFICATION.....	16-1
16.2 CLOSURE AND POST CLOSURE CARE AS A LANDFILL.....	16-2
16.3 CONTINGENT POST CLOSURE CARE COST ESTIMATE AND FINANCIAL RESPONSIBILITY.....	16-3
16.4 FACILITY CONTACTS DURING POST CLOSURE PERIOD.....	16-3
16.5 REVISED POST CLOSURE PLAN SUBMITTAL.....	16-3
17.0 REFERENCES	17-1

LIST OF FIGURES

Figure 1	Site Location Map
Figure 2	Building T029 and Building T133 Location
Figure 3	Building T029 and Building T133 2000' Radius Map
Figure 4	Current Geologic Map of SSFL (Dec. 2002)
Figure 5	Conceptual Cross Section – Groundwater Systems at SSFL
Figure 6	Waste Management Overview
Figure 7	T029 Topographic Detail
Figure 8	Building T029 Area Layout
Figure 9	Photos for HWMF – T029 Area (Photo 1 and Photo 2)
Figure 10	Photos for HWMF – T029 Area (Photo 3 and Photo 4)
Figure 11	Photos for HWMF – T029 Area (Photo 5 and Photo 6)
Figure 12	Photos for HWMF – T029 Area (Photo 7 and Photo 8)
Figure 13	T133 Topographic Detail
Figure 14	Building T133 Area Layout
Figure 15	Treatment Chamber Detail at Building T133
Figure 16	Photos for HWMF – T133 Area (Photo 1)
Figure 17	Photos for HWMF – T133 Area (Photo 2 and Photo 3)
Figure 18	Photos for HWMF – T133 Area (Photo 4 and Photo 5)
Figure 19	Photos for HWMF – T133 Area (Photo 6 and Photo 7)
Figure 20	Photos for HWMF – T133 Area (Photo 8 and Photo 9)
Figure 21	Photos for HWMF – T133 Area (Photo 10 and Photo 11)
Figure 22	Photos for HWMF – T133 Area (Photo 12 and Photo 13)
Figure 23	Sodium and Potassium Treatment Process Overview
Figure 24	Background Sampling Locations for Fluoride, Lithium, Zirconium and pH
Figure 25	Building T133 Decontamination Area
Figure 26	Building T029 Soil and Groundwater Sampling Locations
Figure 27	T029 Sampling Locations on Roadway
Figure 28	Building T133 Soil and Groundwater Sampling Locations
Figure 29	1988 Building T133 Investigation Data for Soil
Figure 30	Soil Sampling Locations North of T133 Area
Figure 31	T133 Sampling for PVC Drainage Pipe and Asphalt Culvert

LIST OF TABLES

Table 1	Well Locations in Vicinity of Building T029 and T133
Table 2	Water Level Data (2000-2002) for PZ-112, RD-16, RD-19, RS-24 and RS-25
Table 3	Well RS-25 April 2003 Sampling Results Summary
Table 4	Preliminary Background Data For Metals In Groundwater
Table 5	Background Metal Concentrations in Soil
Table 6	HWMF Spill History
Table 7	List of Chemicals of Concern (COC) – Hazardous Waste Management Facility
Table 8	Analytical Results Summary for Tank T-1 and Tank T-3 Contents
Table 9	Closure and Sampling Objectives, T029 – Hazardous Waste Storage Building

Table 10	Closure and Sampling Objectives, T133 – Hazardous Waste Treatment Building
Table 11	Analytical Program
Table 12	Detection Limits for Proposed Analytical Methods – Soil and Groundwater Sampling Program
Table 13	Soil Sampling – T029 Area
Table 14	Soil Sampling – T133 Area
Table 15	Soil Sampling – Offsite of T133 Area
Table 16	Analytical Program for Backfill Material
Table 17	Closure Implementation Schedule

LIST OF APPENDICES

Appendix A	Ventura County Air Pollution Control District Permit to Operate, No. 0271, Emergency Hazardous Waste Facility Permit and Part A Application
Appendix B	RS-25 April 2003 Sampling: Field Forms, Data Validation and Laboratory Analytical Report
Appendix C	Climate Data: Precipitation Tables and Wind Rose
Appendix D	Building T029 and T133 Construction Drawings, Tank T-1 Specifications and Photograph of Tank T-1 Installation in Former Sump Pit Excavation
Appendix E	Building T133 Caustic Storage Tank Sludge and Liquid Analysis Laboratory Reports
Appendix F	Hazardous Waste Manifests from HWMF, 1997
Appendix G	Chain-of-Custody Form
Appendix H	List of Potential Equipment To Be Used During Closure of the HWMF
Appendix I	DTSC 1998 Backfill Approval Letter

LIST OF ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
AEA	Atomic Energy Act
ASTM	American Society for Testing and Materials
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, xylenes
CCR	California Code of Regulations
COC	chemicals of concern
DHS	Department of Health Services
DOE	Department of Energy
DTSC	Department of Toxic Substances Control
EPA	U.S. Environmental Protection Agency
ETEC	Energy Technology Engineering Center
HDPE	high-density polyethylene
HWMF	Hazardous Waste Management Facility
HWSA	Hazardous Waste Storage Area
KLCS	lower Chatsworth Formation
KUCS	upper Chatsworth Formation
LMEC	Liquid Metal Engineering Center
MCL	maximum contaminant level
mg/L	milligrams per liter
MS/MSD	matrix spike/matrix spikes duplicate
NaOH	sodium hydroxide
NPDES	National Pollutant Discharge Elimination System
PAH	polyaromatic hydrocarbon
ppm	parts per million
PRG	preliminary remediation goal
psig	pounds per square inch gauge
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
SRAM	Standard Risk Assessment Methodology
SSFL	Santa Susana Field Laboratory
STLC	Soluble Threshold Limits Concentrations
SVOC	semivolatile organic compound
TCLP	Toxicity Characteristics Leachate Procedure
TDS	total dissolved solids
TPH	total petroleum hydrocarbons
USCS	Unified Soil Classification System
USGS	United States Geological Survey
VCAPCD	Ventura County Air Pollution Control District
VOC	volatile organic compound

EXECUTIVE SUMMARY

Rocketdyne Propulsion and Power, a Division of The Boeing Company, (Rocketdyne) submits this updated Resource Conservation and Recovery Act (RCRA) Closure Plan for the Hazardous Waste Management Facility (HWMF) Buildings T029 and T133 located in the Energy Technology Engineering Center (ETEC) of Area IV of the Santa Susana Field Laboratory (SSFL) in Ventura County, California. This RCRA Closure Plan describes the closure tasks for decontamination, demolition, verification sampling and remediation of non-radiological chemicals associated with the HWMF. The Closure Plan objective is to achieve clean closure. Separate clean closure evaluations will be made for T029 and T133 as they are physically distinct locations separated by approximately 1,300 feet.

The ETEC structures and improvements (including the HWMF Buildings T029 and T133) are owned by the U.S. Department of Energy (DOE), although the land on which they are located is owned by Rocketdyne. The ETEC was co-operated by the DOE and Rocketdyne. DOE and its predecessor agencies conducted nuclear research and energy development at ETEC from the mid-1950's until the mid-1990's. All nuclear research was terminated in 1988. The DOE performed decommissioning and a survey of Building T029 because it housed radioactive calibration equipment from 1959 until 1974. This work was published in DOE Certification Docket dated April 1997, confirming that all radiological standards have been achieved for T029. DOE did not use Building T133 and was therefore not responsible for the final radiological screening. Rocketdyne has completed the T133 screening which was submitted the Department of Health Services (DHS) in September 2003. The survey indicates that all radiological standards have also been achieved for T133. This Closure Plan will not be implemented until DHS review of the T133 survey report is complete.

The ETEC operations included facilities for testing alkaline liquid metal coolants (primarily sodium and sodium-potassium alloy). The ETEC HWMF (Buildings T029 and T133) was permitted by the DTSC as a RCRA hazardous waste storage and treatment facility for non-radiological alkaline metal wastes. Building T029 was used for containerized storage of alkaline metal wastes. The containerized wastes were then transferred to Building T133 for treatment. At Building T133, the wastes were heated in a metal lined treatment chamber where they would react with the air to form metal oxides. The metal oxides were removed from the air with an air scrubber, which was operated under a Ventura County Air Pollution Control Permit. After the heat treatment, the residual metal oxides were rinsed from the treatment chamber walls and floor. This rinsate and the air scrubber liquid wastes were stored in onsite tanks pending removal by vacuum trucks for management at permitted offsite facilities. Operation of the HWMF ceased in 1997.

All hazardous wastes have been previously removed from the HWMF. HWMF closure will therefore start with decontamination of buildings, equipment, structures and improvements. Verification samples will then be collected of the various media (i.e., metal, concrete, wood, asphalt, etc) to confirm that decontamination is complete and to provide waste classification data. After verification of decontamination, the T029 and T133 equipment and structures will be demolished and removed for management at permitted offsite facilities as there will be no reuse of any equipment. Soil and groundwater verification sampling will be performed to assess if there have been releases to environmental media. If environmental media have been impacted, then remedial measures such as soil removal will be evaluated to achieve clean closure. Post-closure requirements will be implemented if clean closure can not be achieved.

1.0 FACILITY IDENTIFICATION

1.1 FACILITY NAME

Hazardous Waste Management Facility: Buildings T029 and T133
Santa Susana Field Laboratory, Area IV - Energy Technology Engineering Center
U.S. Department of Energy

1.2 EPA ID NUMBER

U.S. Environmental Protection Agency ID No. CAD000629972

1.3 ADDRESS

Santa Susana Field Laboratory
End of Woolsey Canyon Road
5 miles west of the town of Chatsworth in the Simi Hills, Ventura County, California

1.4 MAILING ADDRESS

Rocketdyne Propulsion and Power
The Boeing Company
6633 Canoga Avenue
P.O. Box 7922
Canoga Park, California, 91309-7922

1.5 CONTACT PERSON

Ms. Majelle E. Lee
Program Manager, DOE Site Closure
Rocketdyne Propulsion and Power
The Boeing Company
Tel: (818) 586-5283

Mr. Brian Sujata
Project Manager, DOE Site Closure
Rocketdyne Propulsion and Power
The Boeing Company
Tel: (818) 586-6043

1.6 FACILITY CO-OPERATORS

Rocketdyne Propulsion and Power
The Boeing Company
6633 Canoga Avenue
Canoga Park, CA 91309

U. S. Department of Energy
Oakland Operations Office
1301 Clay Street
Oakland, CA 94612-5208

1.7 FACILITY OWNER

U. S. Department of Energy
Oakland Operations Office
1301 Clay Street
Oakland, CA 94612-5208
(510) 637-1640

1.8 LANDOWNER

The Boeing Company
6633 Canoga Avenue
Canoga Park, CA 91309

1.9 PREPARER OF CLOSURE PLAN

Mr. Robert Kull, PE (No. C55037)
MWH
777 Campus Commons Rd, Suite 175
Sacramento, CA 95825
(916) 924-8844

Ms. Jan Jacobson, Project Manager
Jacobson Environmental
10171 Quail Hill Drive
Newcastle, CA 95658
(916) 663-9971

FOR

Rocketdyne Propulsion and Power
The Boeing Company
6633 Canoga Avenue
Canoga Park, CA 91309

AND

U. S. Department of Energy
Oakland Operations Office
1301 Clay Street
Oakland, CA 94612-5208

1.10 NATURE OF BUSINESS

The U.S. Department of Energy (DOE) is responsible for operation of the Energy Technology Engineering Center (ETEC), which is a government-owned complex of buildings located within Area IV of the Santa Susana Field Laboratory (SSFL) in Ventura County, California. Although owned by DOE, ETEC has been co-operated by The Boeing Company, Rocketdyne Propulsion and Power (Rocketdyne). ETEC does not have specific site boundaries, but is instead a group of experimental research, development and testing facilities owned by DOE or where DOE sponsored operations occurred. The remaining portions of Area IV are not owned or controlled by DOE.

DOE and its predecessor agencies conducted nuclear research and energy development at the ETEC from the mid-1950s until the mid-1990s. Activities sponsored by DOE included nuclear operations (development, fabrication, disassembly, and examination of nuclear reactors, reactor fuel and other radioactive materials) and the development of liquid metal heat transfer systems in support of the Liquid Metal Fast Breeder Reactor Program. All nuclear research at ETEC terminated in 1988. Since that time, DOE has been performing decontamination and decommissioning of ETEC facilities which became radioactively activated or contaminated.

ETEC was originally known as the Liquid Metal Engineering Center (LMEC). The LMEC was established to provide research, engineering development and testing of liquid metal (primarily

sodium) heat transfer components and systems. The title of the center was changed to ETEC in 1978, to support a broadening mission inclusive of work on more diverse energy technologies (e.g. solar, geothermal and fossil). ETEC was operated as a center of excellence for the non-nuclear testing of liquid metal reactor components for the DOE. ETEC facilities were involved with the design, construction and operation of the world's largest and most sophisticated facilities for testing liquid metal steam generators, pumps, tanks, valves, and instrumentation. ETEC also served as a skill center for heat transfer engineering expertise on nation-wide energy conversion projects.

The ETEC complex maintained facilities for testing liquid metal components (e.g., sodium and sodium-potassium), a seismic test facility, and several multi-purpose test facilities. The major test facility operated by ETEC was the Sodium Components Test Installation, a sodium-heated steam generator test facility. Testing support programs included the Small Components Test Loop and the Sodium Pump Test Facility.

The ETEC complex also includes two buildings permitted by the Department of Toxic Substances Control (DTSC) for the storage (Building T029) and treatment (Building T133) of alkali metal wastes such as sodium, sodium-potassium alloy, lithium and materials containing or having residuals of these alkali metals (e.g., piping, valves, etc). The T029 and T133 buildings are referred to collectively as the Hazardous Waste Management Facility (HWMF). The HWMF began operation in 1978 and was fully permitted in 1983 as a Resource Conservation and Recovery Act (RCRA) hazardous waste treatment and storage facility for non-radiological chemical wastes generated on-site. The RCRA operating permit was renewed in 1988 and 1993 (See Appendix A for the most recent Part A Application). In 1990 the HWMF was allowed to treat alkali metals from an off-site Northern California location via an emergency permit issued July 2, 1990 (Appendix A). The emergency permit was issued by the Department of Health Services (DHS) because seventy-five, thirty-ounce containers of metallic sodium waste were illegally abandoned by an unknown party on a privately owned five acre parcel in Butte County, California. Each thirty-ounce container held six 1"x1"x6" bars of metallic sodium waste. The DHS determined that the Rocketdyne Treatment Facility at Building T133 offered the most

desirable means for treating this waste under emergency conditions. The HWMF ceased operations in 1997.

The operations performed under the RCRA permit included the storage of sodium, sodium-potassium or lithium waste or equipment contaminated with these metals at Building T029; transfer of the wastes and contaminated equipment to Building T133; and treatment of the metals wastes and contaminated equipment at Building T133. At the Building T133 location, the metal wastes treated were placed on an iron bowl in a metal lined treatment chamber. The bowl was heated using natural gas and the waste metals reacted with the air to form metal oxides. The metal oxides were removed from the air with an air pollution control device (an air scrubber) under a Ventura County Air Pollution Control Permit. After the heat treatment, the residual metal oxides were rinsed from the inside area of the treatment chamber with water. The air scrubber produced a liquid waste water which, along with the treatment chamber rinse water, was drained to a below grade tank and then pumped to an above ground tank for temporary storage. Both tanks were located within the Building T133 boundary. The alkali wastewater was transferred to waste water trucks for off-site disposal.

Closure of the HWMF buildings T029 and T133 within the ETEC is the focus of this RCRA Closure Plan. Detailed information regarding the HWMF location, construction, operation and history is provided in subsequent sections of this RCRA Closure Plan.

1.10.1 Regulatory Framework

Hazardous Waste Closure and Corrective Action. Closure of the HWMF buildings T029 and T133 and corrective action for the investigation and cleanup of chemical contamination at ETEC locations is being regulated under RCRA. The RCRA closure and corrective action activities are under the jurisdiction of the California DTSC, pursuant to delegated authority from the United States Environmental Protection Agency (EPA). This RCRA closure plan describes the closure tasks for decontamination, demolition, verification sampling and remediation of non-radiological chemicals associated with the T029 and T133 buildings.

Radiological Decommissioning and Decontamination. Decontamination of radiological contamination at ETEC is being performed by DOE under authority of the Atomic Energy Act (AEA). Before a former DOE radiological facility at ETEC can be released for unrestricted use per state regulatory standards, the California DHS must concur with the DOE determination regarding the decontamination and decommissioning of the facility. This release process is to ensure that the facility will not expose future users to hazards or risks from radiation. As an Agreement State under the provisions of the AEA, the State of California also has jurisdiction over non-DOE radiological activities at ETEC.

The DOE performed decommissioning and a survey of Building T029 because it housed radioactive calibration equipment from 1959 until 1974. This work was published in the DOE Certification Docket for the Release of Building 029 at the Energy Technology Engineering Center, dated April 1997, documenting that all radiological standards had been achieved for T029. DOE did not use Building T133 and was therefore not responsible for the final radiological screening. Rocketdyne has completed the T133 screening, which is planned for submittal to the DHS in January 2004. . The survey indicates that all radiological standards have also been achieved for T133. This Closure Plan will not be implemented until DHS review of the T133 survey report is complete.

1.11 ENVIRONMENTAL PERMITS

The only environmental permit at the HWMF is a Ventura County Air Pollution Control District (VCAPCD) Permit to Operate, Number 0271, which regulated the operation of the scrubber at Building T133. This permit is currently not active because the HWMF is not active. Rocketdyne will cancel the Permit to Operate and will notify the VCAPCD that the HWMF will be undergoing closure. (See Appendix A for a copy of the VCAPCD Permit to Operate, Number 0271).

1.12 CERTIFICATION

“I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.”

Ms. Majelle E. Lee
Program Manager, DOE Site Closure
Rocketdyne Propulsion and Power
The Boeing Company

Many Gross
Assistant Manager for
Department of Energy
Oakland Operations Office
Facility Owner/Co-Operator

2.0 FACILITY LOCATION

2.1 FACILITY SIZE AND LOCATION

The HWMF (comprised of the T029 and T133 buildings) is part of the ETEC complex located within Area IV of the Santa Susana Field Laboratory (SSFL). SSFL is located in the Simi Hills of eastern Ventura County, on the border with the western Los Angeles County in Sections 19, 20, 29, and 30, Township 2 North, Range 17 West (see Figure 1). SSFL occupies approximately 2,700 acres of mostly undeveloped land in the Simi Hills between the communities of Chatsworth and Simi Valley. There is approximately 700 feet of topographic relief at SSFL as shown on Figure 2.

ETEC is comprised of a number of buildings used to support DOE sponsored research in Area IV. Buildings T029 and T133 were part of the ETEC complex. The locations of the HWMF buildings T029 and T133 within Area IV are shown on Figure 2 which is a portion of the United States Geological Survey (USGS) Calabasas Quadrangle 7.5 minute topographic map (1952; photo revised in 1967).

2.2 LAND USE

Land use within a 2,000-foot radius of the T029 and T133 buildings is depicted on Figure 3. As shown, the only development within this radius is the SSFL infrastructure. The nearest schools identified are located more than one mile from SSFL in Chatsworth and Simi Valley.

The closest developments are located south and northeast of the SSFL site. The development to the south of the site is approximately 4,800 ft from the edge of the T029 2000 ft. radius. The development to the northeast is approximately 11,000 ft from the edge of the T029 2000 ft radius.

Springs and Drinking Water Wells

Previous field investigations conducted by Ogden, MWH and Haley & Aldrich (formerly GRC) have identified 28 locations where seeps or springs occur within or adjacent to the SSFL property boundary. As shown on Figure 3, three of the springs (S2, S3, and S5) have been identified within the 2,000-foot radius of building T029 and four of the springs (S2, S3, S5 and S20) have been identified within the 2,000-foot radius of building T133.

There are no drinking water wells at SSFL; however, wells have been installed for industrial use. None of these wells are within 1/4 mile of the HWMF buildings T029 and T133 as shown on Figure 3.

2.3 HYDROGEOLOGIC CONDITIONS

The following sections describe the geology, structure and occurrence of groundwater at the SSFL in general and, specifically in the vicinity of the HWMF buildings T029 and T133.

2.3.1 Geology Units and Structure

SSFL Overview. SSFL is located in the Simi Hills of Eastern Ventura County. The Simi Hills are in the northern part of the Transverse Range geomorphic province and separate the Simi Valley from the western part of the San Fernando Valley.

The primary geologic units present at the SSFL are the Quaternary Alluvium and the Cretaceous Chatsworth Formation. The alluvium is a mixture comprised principally of sand and silty sand, with minor amounts of silt and clay. The thickness of the alluvium is typically 5 to 15-feet, but in a few locations it is over 30 feet thick. The Chatsworth Formation is a marine turbidite sequence primarily comprised of medium-grained sandstone with interbedded siltstone and shale units that generally strike N70⁰E and dip to the northwest at approximately 25 to 35 degrees (MWH, 2003a). A geologic map of the SSFL is presented as Figure 4.

The Chatsworth Formation at the SSFL has been divided into stratigraphic units as shown on Figure 4. The lower Chatsworth Formation (KLCS) is located in the eastern and southern parts of the SSFL and is differentiated from the upper Chatsworth Formation (KUCS) by a much higher proportion of fine-grained material. The definition of the Upper Chatsworth Formation has been refined significantly since 1999. In work performed by Dr. Ross Wagner, the Upper Chatsworth Formation was separated into two sandstone units (Sandstones 1 and 2) and three finer-grained units (Shale 1A, 1B, 2 and 3) (MWH, 2003a). Sandstone 1 was defined as a predominately sandstone section between the top of the lower Chatsworth Formation and consists primarily of shale and siltstones interbedded with fine-grained sandstones. Sandstone 2 was defined as the predominant sandstone unit, which lies between the top of Shale 2 and the bottom of Shale 3. Shale 3 is the stratigraphically upper most unit in the Chatsworth Formation and has a composition similar to Shale 2. The Simi Conglomerate Member of the Santa Susana Formation lies in depositional contact on Shale 3 (upper Chatsworth Formation).

Additional work performed in the northeast part of the SSFL east of the Shear Zone resulted in redefining Sandstone 1 (MWH, 2003a). Sandstone 1 was divided into three coarser-grained members (sandstones named the Bowl Member, Canyon Member and Sage Member) and two finer-grained members (siltstones/shales named the Happy Valley Member and the Woolsey Member). Furthermore, additional work performed in late 2001 to mid-2002 by Dr. Wagner resulted in redefining Sandstone 2 (MWH, 2003a). Sandstone 2 was divided into three coarser-grained members (the Silvernale Member, Lower Burro Flats Member and the Upper Burro Flats Member) and two finer-grained siltstone/shale members (the SPA Member and the ELV Member).

A number of faults are present at the site, and have two general orientations. The North, Coca, Burro Flats, Woolsey Canyon, IEL and the Happy Valley Faults generally strike east-west, while the Shear Zone and Skyline Fault generally strike northeast-southwest. All faults appear to dip nearly vertically. It should be noted that the characterization of the geologic framework at the SSFL is still in progress.

HWMF Buildings T029 and T133 Vicinity. The HWMF buildings T029 and T133 lie within different geologic units. As shown on Figure 4, Building T133 is located on alluvium overlying the Upper Burro Flats Member of the Chatsworth formation north of the Lot Bed (a shale member). Building T029 is located on alluvium overlying the Lower Burro Flats Member of the Chatsworth Formation south of the ELV member.

2.3.2 Groundwater Occurrence

2.3.2.1 SSFL Overview

Groundwater occurs at the SSFL in the alluvium (transiently), weathered bedrock, and unweathered bedrock (MWH, 2003a). Prior work performed under the RCRA corrective action program identifies groundwater at SSFL as either near-surface groundwater or Chatsworth Formation groundwater.

At certain locations within the SSFL, groundwater is vertically continuous (e.g. not separated by a vadose zone) from the unit in which it first occurs to the underlying units. At other locations at SSFL, a vadose zone within the weathered Chatsworth Formation may be present and locally separates the near surface groundwater from the saturated unweathered Chatsworth Formation bedrock. Figure 5 provides a conceptual model of the scenario where near surface groundwater is present in alluvium and weathered bedrock with a vadose zone separating this perched water from the deeper Chatsworth Formation groundwater.

Near-Surface Groundwater. The near-surface groundwater primarily occurs within the weathered bedrock beneath much of the Burro Flats area and along ephemeral drainages. The lateral occurrence of near-surface groundwater is discontinuous. Some portions of the alluvium and weathered Chatsworth Formation are saturated only during and immediately following the wet season. Water elevations are generally highest in the late winter and spring rainy season and lowest during the summer and early fall. Discharge of surface water to SSFL storage reservoirs and channels as part of site operations also affects near-surface groundwater levels (Haley & Aldrich, 2003).

Chatsworth Formation. The principal water bearing system at SSFL is the fractured Chatsworth Formation. Several structural features are apparent at the site including the Shear Zone, trending to the northeast through Area I, several faults and shale beds (as mentioned in Section 2.3.1) that affects groundwater occurrence and flow.

2.3.2.2 HWMF Buildings T029 and T133 Vicinity Groundwater Occurrence

Groundwater occurrence in the vicinity of buildings T029 and T133 is controlled by geologic units and structure and is therefore potentially different since the underlying geology at each location varies as referenced in section 2.3.1. The T029 and T133 locations are separated by the surface water divide shown on Figure 2. A groundwater divide is also likely present between T029 and T133.

Figure 3 shows the wells and piezometers in the vicinity of buildings T029 and T133. Table 1 provides a summary of the well and piezometer information.

Building T029. As shown on Figure 3, there are no wells or piezometers directly adjacent to building T029. Building T029 is located on alluvium, however it is not known if near surface groundwater is present in the area of T029.

Groundwater occurrence around the vicinity of T029 has been evaluated by reviewing water level information from the existing wells closest to T029 (RS-24, RD-16 and PZ-112) which are shown on Figure 3. RS-24 and PZ-112 monitor near-surface groundwater. RS-24 is typically dry; however, PZ-112 has consistently contained water since it's installation in 2001. RD-16 is a Chatsworth Formation well.

Water level data collected for the three wells (RS-24, RD-16 and PZ-112) since 2000 is summarized in Table 2. As shown, the water levels in the shallow zone PZ-112 have ranged from 20 to 25 feet below ground surface (bgs). Water levels in the Chatsworth Formation well RD-16 since 2000 have ranged from 40 to 45 feet bgs.

Building T133. Well RS-25 monitors near-surface groundwater and is located at the Building T133 site as shown in Figure 3. There is no Chatsworth Formation monitoring well at the T133 site. As shown on Figure 3, the closest Chatsworth Formation monitoring well is RD-19, which is approximately 125 ft west of Building T133. Groundwater occurrence in the area of T133 has been evaluated by reviewing water level information from these wells.

As shown in Table 2, near-surface groundwater appears to be seasonally present in RS-25, at a depth of approximately 10 to 15 feet bgs. The depth of groundwater in the Chatsworth Formation directly beneath the site has not been defined. Groundwater at well RD-19, the closest deep groundwater well, has ranged from 65 to 75 feet bgs.

2.3.3 Groundwater Quality

The quality of groundwater from RS-25 is relevant to the HWMF closure because it is located at the HWMF. As previously stated, well RS-25 is a near-surface water monitoring well. RS-25 was installed approximately 3 feet north of the T133 fence line as part of a previous release investigation and has frequently been dry during routine scheduled sampling events at SSFL.

Groundwater was present during the early 2003 monitoring events and Rocketdyne collected samples in February, March and May for perchlorate analyses in accordance with the ongoing groundwater monitoring program for SSFL. Rocketdyne also collected samples from RS-25 in April 2003 for analysis of chemicals potentially associated with past HWMF operations in support of the HWMF closure tasks.

The 2003 perchlorate results were inconsistent, with reports of perchlorate detections below or near reporting limits of 1 and 4 ug/l and reports of non-detections with method detection limits of 0.8 and 2 ug/l. This inconsistency indicates that the reported detections may be false positives. Since these sampling events, a laboratory protocol has been developed for perchlorate analyses to reduce false positive occurrences. This protocol was provided in the December 5, 2003 document "Perchlorate Characterization Work Plan, Revision 1, SSFL, Ventura County, California" prepared by MWH (MWH, 2003b). Future analyses of groundwater from RS-25 for

perchlorate will be performed in accordance with this protocol to confirm its presence or absence.

As previously indicated, the samples collected in April 2003 were analyzed for chemicals potentially associated with past HWMF operations. These samples were collected and analyzed in accordance with DTSC approved protocols for the corrective action program. The samples were analyzed as follows:

<u>Chemicals</u>	<u>Method</u>
VOCs	EPA 8260B
SVOCs	EPA 8270C
Metals/Inorganic Ions	EPA 6000/7000 Series
Hexavalent Chromium	EPA Method 7196A
pH	EPA Method 9040B/9045C
TPH	EPA Method 8015BM
Fluoride	EPA Method 340.2

The analytical results for the April 2003 sampling of RS-25 are summarized in Table 3. As shown in Table 3, the laboratory reported no detections for any of the chemicals with the exception of the metals and inorganic ions. The concentrations of the metal detections are consistent with the background data set developed using the RFI protocol, with the exception of vanadium, which revealed a concentration of 8.4 ug/l compared to the background value of 4.7 ug/l. The background concentrations for groundwater are summarized in Table 4 and discussed in the Section 2.4.

Appendix B provides the field forms, chain-of-custody forms, laboratory reports and data validation results for the April 2003 sampling of well RS-25.

2.4 BACKGROUND CONDITIONS

Background data has been developed for soil and groundwater at SSFL in support of the ongoing RCRA corrective action program. The background conditions for soil was presented in the document Standardized Risk Assessment Methodology (SRAM) Work Plan, Surficial Operable

Unit, Santa Susana Field Laboratory, Ventura County, California; Final (Ogden, 2000), which was approved by DTSC in correspondence dated June 5, 2000. Table 5 provides the background concentrations for soil.

The background groundwater data is presented in Table 4. The background values shown in Table 4 were submitted to DTSC electronically in November 2002 and in the Draft SRAM, Revision 1 (MWH, 2003c) in September 2003. The background values are still in review with DTSC. Rocketdyne anticipates submitting the final background groundwater data set in the SRAM, Revision 1, in August 2003. Upon DTSC approval, the SRAM Revision 1 background groundwater data will become the basis for any background groundwater comparisons required in support of the HWMF buildings T029 and T133 closure activities.

2.5 WEATHER AND CLIMATIC CONDITIONS

2.5.1 Climate

The climate in the Simi Hills area is classified as Mediterranean type climate. Monthly mean temperatures range from 50 degrees Fahrenheit (°F) in the winter months to 70°F in the summer months. Rainfall is measured at two weather stations (one in Area I and the other one in Area IV). At the Area I weather station, annual rainfall measured from 7.69 to 35.48 inches between 1985 and 1998. At the Area IV weather station, annual rainfall measured from 7.76 to 35.05 inches. Ninety-five percent of the rain falls between November and April, and the majority of the precipitation occurs during January through March. A bar graph showing precipitation totals, as measured at the SSFL Area I and Area IV Meteorological Station is provided in Appendix C.

2.5.2 Wind

From April to October, a consistent westerly wind pattern develops from the unequal heating of the landmass and the Pacific Ocean. The thermal westerly winds typically range from 5 to 10 knots and occur between noon and sunset.

From November to March, the westerly wind pattern is interrupted by the passage of weather fronts and the occurrence of Santa Ana wind conditions. Gusty winds to 20 knots are typically directed from the southeast to south as a cyclonic low pressure system approaches southern California from the north Pacific. Winds shift to westerly or northerly following frontal passage and sustained winds exceeding 25 knots may occur. At various times during the fall, winter, and spring months, strong high-pressure systems may move in the basin. During these periods a strong offshore-directed pressure gradient/wind condition may form that is referred to as a Santa Ana wind. The gusty Santa Ana winds are generally directed from the north or northeast and may exceed 30 knots below passes and canyons.

A wind rose diagram is provided in Appendix C. The wind rose data was collected from the Area 4 Weather Station at SSFL (Figure 3).

3.0 FACILITY DESIGN AND OPERATION

The HWMF T029 and T133 buildings were designed to provide hazardous waste storage and treatment for ETEC operations that generated alkali metal wastes through the use of alkali metals as heat transfer media. Overtime, the alkali metals used as heat transfer media would become saturated with impurities (such as oxygen, hydrogen or carbonaceous compounds) and they would be declared a waste material. The waste material and the equipment/components that contained them were then transferred to Building T029 for storage. The waste stored in Building T029 was then transferred to the Building T133 treatment facility when capacity in the T133 treatment chamber was available. A flow chart providing an overview of the waste management process for sodium and sodium-potassium wastes (the predominant alkali metals used) at buildings T029 and T133 is shown on Figure 6.

The storage and treatment of lithium metal, used as heat transfer media, was also performed at the T029 and T133 buildings, as authorized under the 1988 RCRA Part B permit. Additionally, the HWMF operations plan indicated that excess lithium hydride and zirconium hydride powder, which was purchased but never used was stored at T029 and then treated at T133.

The following sections provide the facility design and operating details for buildings T029 and T133, respectively.

3.1 BUILDING T029 AREA

3.1.1 Description of Building T029

Building T029 was designed and constructed in 1959, but has been designated and used only for the storage of alkali metals since 1978. Building T029 was used as the instrument calibration facility between 1959 and 1974. The building was vacant between 1974 and 1978.

Building T029 is located adjacent to a sandstone outcrop and has an elevation change of approximately 12 feet across the site as shown on Figure 7, T029 Topographic Detail.

Construction drawings for T029 are presented in Appendix D. However, Figure 8 depicts the current layout and figures 9 through 12 provide photographs of Building T029. A description of Building T029 with reference to applicable photographs is provided as follows:

- Building T029 is a 20-foot by 40-foot building; steel frame, roof, and siding; constructed on a concrete slab (Figure 9, Photos 1 and 2).
- An 8-foot wide door is located on the northwestern side of the building. This area was used for the movement of metal boxes or drums containing waste material. A 10-foot by 4-foot, 8-inch concrete pad is located to the west of this door (Figure 9, Photo 1).
- Another concrete pad, approximately 13.5-foot by 5-foot, is located to the northeast of the building. No door is located at that area as shown in Figure 8.
- A 3-foot wide pedestrian entrance door is located on the south side of the building (Figure 11, Photo 5).
- The two concrete patches shown on Figure 8 were placed when the calibration instruments were removed from this building in the 1970s. Figure 10, Photo 3 shows the patch located in the northeast corner of the building.

A description of the Building T029 setting and external characteristics is provided as follows with references to applicable photographs:

- Building T029 is located immediately to the south of a large rock formation (Figure 12, Photo 7).
- A fence surrounds the building and the road leading to the building (Figure 8).
- This road approaches from the west and is covered with asphalt (Figure 8).
- The areas immediately to the north, south and east of the building are bare soil/rock, except where previously indicated (Figure 8, Figure 12-Photo 8).
- A low drainage spot is located to the southeast of the building. A 4-inch polyvinyl chloride (PVC) drainage pipe has been installed at this low point and the pipe extends by approximately 1.5 feet beyond the fence. The purpose of this pipe is for drainage of rainfall from the south side of the building, including rain from the roof of the building. The total length of the pipe is about 6 feet (Figure 11, Photo 6).

3.1.2 Design Capacity of T029

Metal boxes (referred to as B-boxes), and drums containing waste components were stored on pallets along the perimeter of the building, allowing approximately 12 feet of aisle space in the middle of the building. Total storage capacity at T029 was approximately 5,500 gallons in any combination of containers.

3.1.3 Ancillary Equipment at T029

Ancillary equipment used at T029 consisted of a standard forklift for moving the B-boxes and drums.

3.1.4 Containment Systems

The concrete floor of Building T029 was sealed with a chemically resistant coating, applied on a yearly basis during active use of the building, as required by the RCRA Part B permit conditions. See Figure 9, Photo 2.

The waste stored at T029 had varying types of containers, depending on the nature of the waste stored. The wastes stored consisted of: (1) alkali metal wastes (sodium, sodium-potassium, lithium) used as heat transfer media, (2) test components containing or contaminated with alkali metal wastes, and (3) excess lithium hydride and zirconium hydride powder which were purchased as raw materials but never used. The storage method for these different wastes is described as follows. Descriptions of the process that generated these wastes are provided in Section 4.0.

Sodium and Lithium Metal Waste and Components with Sodium or Lithium: The sodium and lithium metal wastes are solid at ambient temperature and were packaged in Department of Transportation (DOT) drums or in smaller, sealed containers (B-boxes).

Sodium-Potassium Alloy Waste and Components with Sodium-Potassium: The sodium-potassium alloy is a liquid at ambient temperature. Sodium-potassium was contained in sealed components (such as bubblers) which were stored in 55-gallon containers, under argon cover gas. The 55-gallon containers were over packed in 85-gallon drums. Therefore, each sodium-potassium storage container was placed in individual secondary containment.

Lithium Hydride Waste: Lithium hydride is a solid at room temperature. As described in the Operation Plan, lithium hydride waste was not produced at the site. Lithium hydride was a material, which was purchased new and was held in storage in the “as-received” containers or cast into various sizes. The material was subsequently declared excess and managed as waste. The containers of lithium hydride were moved on pallets by forklifts from T029 to T133 for treatment.

Zirconium Hydride Waste: Similar to the lithium hydride, zirconium waste was not produced at the site. As described in the Operation Plan, zirconium hydride powder was purchased new and was held in storage in the “as-received” containers in building T029. The material was subsequently declared excess and managed as waste. The containers of zirconium hydride powder were moved on pallets by forklifts and transported to T133.

3.2 BUILDING T133 AREA

3.2.1 Description of Building T133 Area

The T133 area was designed and constructed in 1977 for the treatment of alkali metal wastes (see Section 4.0 for description of waste materials). Part of Building T133 was previously used at the former Building T724, the Hot Oil Sodium Cleaning facility. When Building T724 was closed, the upper portion of the building (walls and ceiling) were decontaminated and certified clean. The walls and ceiling were then cut free from the bottom metal floor and transferred for use in construction of Building T133.

Building T133 is located on a flat pad with less than 10 feet of elevation change across the site as shown on Figure 13. A schematic of the T133 layout is provided as Figure 14. Figure 15 provides a layout detail for the treatment chamber and photographs of T133 are provided as figures 16 through 22. A description of the Building T029 layout and area with reference to applicable figures and photographs is provided as follows:

- The T133 area is fenced and is approximately 87 feet by 71 feet. This area includes the treatment room, the office building, a size reduction area, a sodium-potassium feed tank (referred to as tank T-2), an air scrubber and two tanks for storage of caustic wastewaters generated by the scrubber and treatment room. See Figure 14, Building T133 Layout.
- The treatment chamber and building are constructed on a concrete slab; see Figures 14, 15 and 16. The treatment building is of metal construction
- The T133 area is covered with asphalt or concrete, and the overall area is surrounded by an 8-inch high berm as shown on Figures 14 and 16.
- Areas to the north, west and south of the bermed area are not paved (e.g. soil). See Figure 14, Figure 19 – Photo 7, Figure 22- Photo 12 and Photo 13.
- Part of the area to the east of T133 is road and covered with asphalt. See Figure 16.

3.2.1.1 Process Description for Treatment of Sodium and Sodium-Potassium Metals

There were two primary treatment processes performed at T133: (1) the treatment of solid alkali metals (sodium) and components containing sodium and/or sodium-potassium, and (2) the treatment of liquid alkali metals (sodium-potassium). In both cases, the reactive metals were

converted to caustic aqueous solutions by heat in the treatment chamber. For the solid sodium metal, a batch process was used whereby metal pieces would be manually placed in the treatment chamber. For the sodium-potassium, a specially designed feed system was utilized because this material is a liquid at room temperature. An overview of the chemical reactions and basic steps involved in the treatment of the alkali metals is presented in Figure 23. The following sections describe the pre-treatment and treatment steps for the solid and liquid alkali metal wastes, respectively. Specification drawings for the T133 area are provided in Appendix D and descriptions of the process equipment is provided in section 3.2.2.

Solid Alkali Waste Treatment. The basic steps associated with treatment of the solid alkali wastes are as follows:

1. Size Reduction

In preparation for treatment, the solid components containing sodium (e.g., solid metals) were cut into smaller sections, as necessary, prior to placement in the treatment room. The components were cut in order to expose the sodium or sodium-potassium; and to ensure materials would fit on the treatment pan. The size-reduction operation was performed on the cement-floored handling area of the facility, located to the south of the treatment chamber under the canopy as shown in Figure 17, Photo 2. This area was constructed within a carbon steel secondary containment system.

Cutting was performed using electric saws. Due to the nature of the material to be cut (steel and stainless steel), blades were frequently broken. These were disposed in accordance with applicable regulations. Occasionally mineral oil or kerosene was used as a lubricant during cutting operations. Between one and 5 gallons of kerosene or mineral oil was placed in a container within the metal pan, and the oil recirculated within the cutting area.

2. Transfer to Treatment Chamber

After size reduction, the components were transferred to the treatment chamber within T133 and placed on the treatment pan (see Figure 15 and Figure 21 – Photo 10). If the articles were small, they were placed back into their original storage container (steel drum or metal box) which was then transferred to the treatment chamber using the hoist located at T133. The pieces were then removed from the container manually and placed onto the treatment pan. When emptied, the container was then removed from the chamber with the hoist – prior to initiating treatment.

Larger pieces were hooked to the hoist directly and transferred onto the treatment pan within the treatment chamber.

3. Treatment

Heating/Scrubbing - The components within the treatment pan were heated with a natural gas burner until the sodium or sodium/potassium metals melted. The metal(s) in the pan reacted with the air in the treatment chamber (e.g. were oxidized) to form oxides that either remained in the pan or were exhausted from the room through a wet (water) scrubber to remove the oxide aerosols prior to release to the atmosphere. Wastewater from the scrubber was directed via underground piping with secondary containment to Tank T-1 as shown in Figure 18- Photo 4.

Wash Down - After the oxidation was completed, the treatment pan was washed with water to remove remaining oxides. In the wash-down process the oxides were converted to a solution of sodium hydroxide (NaOH) or potassium hydroxide (KOH). The wash-down liquid was directed via the sump shown in Figure 21-Photo 11 through underground piping with secondary containment to Tank T-1 as shown in Figure 20-Photo 8.

4. Liquid Waste Storage/Management

The caustic solution in tank T-1 was either: (1) emptied directly via vacuum truck for offsite disposal or recycling, or (2) transferred to tank T-3 through an above-grade rubber hose (tank T-3 has been installed to provide additional caustic solution storage capacity). When tank T-3 was used, its contents would also be emptied via vacuum truck for offsite disposal or recycling. The transfer of stored caustic solution from tanks T-1 and T-3 was performed by lowering the vacuum truck's hose into the tanks and activating the truck's pump. See Figure 18-Photo 5 and Figure 19-Photo 6 for tank T-1; and Figure 20-Photo 9 for tank T-3.

Sodium-Potassium Wastes. Devices containing sodium-potassium were first chilled to solidification with liquid nitrogen and placed on the treatment pan. Waste sodium-potassium (a liquid at room temperatures) would be transferred under pressurized argon gas to tank T-2 first; and then fed from tank T-2 into the treatment chamber for treatment (See Figure 17-Photo 3 for the T-2 tank and section 3.2.2.4 for detailed description of tank T-2 operation). The reaction process for sodium-potassium is similar to the sodium treatment as shown on Figure 23. Because of the presence of potassium, the treatment by-products included potassium hydroxide in addition to the sodium hydroxide in the chamber wash down and air scrubber discharges. The

treatment chamber wash down and air scrubber liquid wastes were sent to tank T-1 and then to tank T-3 when T-1 reached capacity.

3.2.1.2 Process Description for Treatment of Lithium Metal, Lithium Hydride and Zirconium Hydride

Per the HWMF operation plan dated December 1988, lithium metal, lithium hydride and zirconium hydride were also treated at T133 in the same manner as the sodium waste. Treatment of lithium metal and lithium hydride would have contributed lithium to the caustic waste streams stored in tanks T-1 and T-3. Treatment of zirconium hydride would have contributed zirconium to the caustic waste streams stored in tanks T-1 and T-3.

3.2.2 Treatment Chamber/Pan and Ancillary Equipment Descriptions

3.2.2.1 Treatment Chamber/Pan

As shown on Figure 14, the treatment chamber is located at the southern end of the T133 building. A schematic of the treatment chamber is provided as Figure 15. The treatment chamber is approximately 21 feet by 10 feet with 10-foot high walls. The walls are steel lined and the floor is concrete. An elevated steel drain pan, approximately 9 feet by 14 feet, is located within the treatment chamber and the 5 foot diameter treatment pan with the 3 foot diameter steel ring is located towards its center. The elevated steel drain pan serves to collect and funnel the sodium hydroxide solution generated through the wash down phase.

The treatment pan is constructed from a 5-foot diameter carbon steel dished-head and is approximately 3/4-inch thick. The bottom of the pan is directly heated using a natural gas ring burner. A smaller carbon steel ring, with an area of about 6 square feet, is welded inside the larger pan in order to limit the exposed surface area of the liquid metals, which controls the oxidation rate. See Figure 21-Photo 10 for burner and pan photo.

A welded 3-inch carbon steel drain line is connected between the drain pan and the steel lined sump in the treatment room. The sump's dimensions are 16 inches by 21 inches and 27 inches

deep (See Figure 21-Photo 11). The caustic solution finally drains through a 4-inch diameter cast iron line, located within an 18-inch wide by 23-inch high concrete containment trench, to storage Tank T-1 (See Figure 20-Photo 8).

3.2.2.2 Air Scrubber

A Venturi air scrubber is located to the west of the treatment chamber as shown on Figure 17-Photo 3. The purpose of this scrubber is to remove the oxides in the air stream by transformation to sodium hydroxide or potassium hydroxide solution. This is a wet scrubbing system consisting of a Venturi scrubbing section, separator section, recirculation tank, and recirculation pump. The wastewater solutions are discharged to Tank T-1 as shown in Figure 18-Photo 4.

The scrubber was permitted through a Ventura County Air Pollution Control District Permit to Operate (No. 0271), which established air emissions limits and monitoring and reporting requirements. (See Appendix A for a copy of the Permit to Operate).

3.2.2.3 Tank T-1

Tank T-1 (Figure 18-Photo 5; Figure 19-Photo 6) is a below-grade storage tank used to receive and hold liquid wastes (hydroxide solutions) produced by the scrubber and the treatment chamber wash down following the treatment of alkali metal wastes. This tank was designed to contain caustic solution and is of steel construction. It is a rectangular tank, approximately 61 inches wide by 128 inches long by 73.5 inches deep (from flange to base). It has a capacity of 1,318 gallons.

Tank T-1 was installed in 1988 and is located within a secondary concrete containment. This secondary containment tank for T-1 is an 8-inch thick concrete pit. The inner surface of this concrete had been sealed with an epoxy coating. Specifications drawing for Tank T-1 are provided in Appendix D.

Tank T-1 replaced the prior caustic solution storage vessel referred to as the “sump pit” in the first RCRA Part B permit for this facility. The sump pit was a 6-foot by 12-foot and 6-foot deep

pit, lined with 4-inch concrete. It was replaced because it did not have secondary containment. Location and specifications for this sump pit is provided in Appendix D (Drawing No. 303-133-S1, dated August 18, 1977). As the Appendix D drawing indicates, the former sump pit was located at the same location as current Tank T-1. A photograph also included in Appendix D shows the installation of the new tank T-1 in the excavation location of the former sump pit.

3.2.2.4 Tank T-2

The intended purpose of Tank T-2 was to temporarily hold waste sodium-potassium, and to transfer it through a feed line into the treatment chamber. Tank T-2 was brought to the T133 area from another location that also included the use of sodium-potassium; however, the prior location could not be determined.

This tank was manufactured by the Butane Tank Corp. and is rated for 1,000°F service at 50 psig. However, the application at the HWMF only required it to contain sodium-potassium at room temperature for a maximum pressure of 14 psig.

Tank T-2 is a stainless steel, horizontal tank, 36-inch diameter by 60-inch long, with an operating capacity of 270 gallons. Tank T-2 is an elevated tank, approximately 20-inch above grade. It is located within a 7-foot by 4-foot and 2-foot high carbon steel containment area (See Figure 17-Photo 3).

Operation of Tank T-2 (e.g. filling with sodium-potassium and transfer of sodium-potassium to the treatment chamber) was described in the HWMF Operation Plan as follows.

“T-2 is filled through valve V-3 from a supply tank of sodium-potassium that is brought to the site. The sodium-potassium is transferred into tank T-2 by raising the argon cover gas pressure in the supply tank to greater than 3 psig. An argon cover gas of 3 psig is maintained by a pressure regulator attached to argon compressed gas cylinder. This pressure is used to control the feed of eutectic sodium-potassium from the tank to the treatment pan. A pressure relief set at 14 psig prevents over-pressurization.”

A normally closed pneumatically operated valve, PV-1, starts and stops the eutectic sodium-potassium flow to the treatment pan. The following lines are used in this operation:

3/4" ID feed line with manual isolation valve (V-1), 1/2" remotely operated shutoff valve (PV-1) with Swagelok connections, 1/2" manual isolation valve (V-2) with Swagelok connections, and 1/2" tubing with Swagelok connections installed into the treatment room for Sodium-potassium injection. A 3/4" manual valve (V-3) with Swagelok end cap is connected to the feed line in parallel with isolation valve (V-1) for Sodium-potassium filling. The 1/2" tubing leading to the treatment room is connected to a 1/4" check valve (CV-1) and solenoid valve (SV-1) with Swagelok connections for argon purge supply. The feed line is connected to an internal dip tube 1 in. from tank bottom. All lines are stainless steel."

3.2.2.5 Tank T-3

Tank T-3 was used for storage of the caustic solution prior to off-site transfer. Tank T-3 is made from high-density polyethylene (HDPE) resin. Tank T-3 is a vertical cylindrical double wall tank. The inner tank is 120 inches in diameter and 106 inches high with a capacity of 5,190 gallons. The outer tank is 144 inches in diameter and 97 inches high with a capacity of 6,840 gallons. See Figure 20 – Photo 9.

Tank T-3 was batch loaded from the tank T-1, whenever tank T-1 approached its capacity. A sump pump transferred the caustic solution through an aboveground rubber hose from tank T-1 to an opening in the top of tank T-3. The contents of tank T-3 would be removed by a vacuum truck, similar to the removal process for tank T-1, for offsite management at a permitted facility.

3.2.3 Design Capacity

The design capacities for the Building T133 treatment chamber and ancillary equipment are described as follows:

- Treatment Chamber: Design of the treatment pan limits the surface area of the molten metal to 6.25 square feet, which will provide a maximum oxidation rate of 62.5 pounds per hour of sodium, based on experimental evidence. This rate would generate a caustic solution from the Venturi scrubber and treatment chamber of approximately 1,900 pounds of 10 percent NaOH.
- Tank T-1: Maximum capacity of 1,318 gallons, working capacity of 1,000 gallons.

- Tank T-2: Working capacity of 270 gallons.
- Tank T-3: Maximum capacity of 5,190 gallons, working capacity of 5,000 gallons.

3.2.4 Containment Systems

Containment systems were installed at all levels at the Building T133 area as follows.

- T133 Area: The ground surface at the T133 area is covered with concrete or asphalt. The concrete was epoxy coated on an annual basis during the active use of the area. The overall area is surrounded by an 8-inch berm. Two sumps are located, respectively, on the northeastern and northwestern corners of the T133 area for rainwater collection.
- Treatment Chamber: The floor of the treatment room is constructed of 4-inch thick reinforced concrete and surrounded with 3-inch carbon steel angle (net height is 2-3/4 inches) to provide secondary containment beneath the steel lining/drain pan. The floor and steel angle are sealed with caustic-resistant material. Concrete secondary containment is also provided for the steel sump located in the treatment chamber.
- Venturi Scrubber: The scrubber is located to the west of the treatment building, on an epoxy coated concrete pad. The area is bermed with a 2-inch metal plate.
- Tank T-1: Tank T-1 is located within a secondary concrete containment. This secondary containment tank for T-1 is an 8-inch thick concrete pit. The inner surface of this concrete had been sealed with an epoxy coating.
- Tank T-2: Tank T-2 is located within a 7-foot by 4-foot and 2-foot high carbon steel containment area.
- Tank T-3: Tank T-3 is a double-wall aboveground tank. The secondary containment has a capacity of 6,840 gallons.
- Pipes: All pipes at the HWMF designed to transfer caustic solution are located within secondary containment structures. The steel pipe from the sump in the treatment chamber to Tank T-1 is located in an 18-inch wide by 23-inch high concrete trench epoxy-coated. The pipe from the scrubber to Tank T-1 is above grade, within the secondary containment located at the Venturi Scrubber area, and extending to Tank T-1. The above-grade rubber hose from Tank T-1 to Tank T-3 was located within a 4-inch HDPE flexible hose.

3.2.5 Environmental Leak Detection and Monitoring Systems

- Tank T-1: A high level alarm was installed at Tank T-1. This tank also had a leak detection system. Tank T-1 has a 2-inch to 9-inch dead air space between the carbon steel liner tank and the concrete pit that it sits within. A leak detector, consisting of an electrical conductivity probe, was installed near the bottom of the steel tank. Any liquid that would have accumulated in the concrete containment area would have activated the detection system. The integrity of Tank T-1 was confirmed every two years since 1993, using an ultrasound examination (as required by the Part B permit). No leakage from the 1988-installed Tank T-1 has been noted.
- Tanks T-2, T-3: Tanks T-2 and T-3 are aboveground tanks and were visually inspected for leaks.
- Piping: All of the pipes at the HWMF were above-grade with the exception of the pipe connecting the sump in the treatment room to tank T-1. Inspections were required by the Part B Operating Permit. The integrity of the pipe from the treatment room to tank T-1 was tested on an annual basis. No leakage had been detected, except the pipe failure that occurred in September 1988 (refer to Section 3.3 – History of Spills at the HWMF). The concrete trenches that provide conveyance for the pipes to Tank T-1 are coated with caustic resistant epoxy. The trenches were inspected every six months, and all exposed piping examined on an annual basis. No leakage had been found.

3.3 HISTORY OF SPILLS AT THE HWMF

No spills have occurred at the T029 storage area. Several spills of sodium hydroxide solution have been documented at the T133 area since activation of the HWMF in 1978. The T133 spill history is summarized in Table 6, and described below.

- On April 13, 1984, approximately 1,500 gallons of caustic solution was spilled due to a faulty drain line. The exact location of this spill could not be determined from the reviewed records. Due to the amount of reported spilled material, this event would have occurred near a caustic solution storage tank area, such as either T-1 or T-3. Note that at that time, T-3 was placed to the north of bermed area, and T-1 consisted of the concrete-lined pit referred to as “sump pit”. The “sump pit” was located at the same area as the current Tank T-1. Sampling in support of the HWMF closure will occur at both the T-1 location and north of the bermed area as described in Sections 9.2.2 and 9.2.3.

treatment building T133. Samples were collected from the area just north of the building, as this area had been used in the past as the vacuum truck staging area during pumping of Tank T-3. Samples were collected at depths ranging from 1.2 to 9 feet. The pH was reported as ranging from 7.5 to 11.8 (GRC, 1990). A shallow groundwater monitoring well (RS-25) was installed to a depth of 13.5 feet below the surface in the area immediately north of the T133 Area. This well was installed to assess the potential presence and quality of shallow groundwater occurring at or near the alluvium/bedrock interface. The well is frequently dry during routine sampling events but was sampled in April 2003 when water was present in anticipation of the HWMF closure data needs. The sampling results were presented in Section 2.3.3.

- In September 1988, a PVC drain line between the treatment room and the hydroxide tank failed. Approximately 60 gallons of aqueous sodium hydroxide drained into a temporary drainage ditch on the north side of T133. A cast iron pipe has replaced this PVC pipe. This area will be further characterized by the placement of a hand auger boring (refer to Section 9.2.3).
- On February 16, 1989, approximately 10 to 230 gallons of caustic solution was accidentally spilled due to a 'pinhole leak' in Tank T-3; and in October 1990, due to a faulty flange at Tank T-3, approximately 5-10 gallons of sodium hydroxide solution was spilled onto the ground when the caustic solution was pumped from T-1 into T-3. It should be noted that at that time, this T-3 tank was placed outside the bermed area, just to the north of T133. The contaminated soil was removed and transported off-site for disposal. Since that time, T-3 has been placed inside the bermed area and has not been moved from its location.

The locations of these historic spills are pertinent to the selection of soil sampling locations to determine if geologic media has been impacted by HWMF operations or not. The spill locations have thus been considered in the selection of soil sampling locations as discussed in Section 9.0 – Soil Sampling.

4.0 HAZARDOUS WASTE CONSTITUENTS

Knowledge of the processes associated with the waste generation and treatment is important to understand the hazardous waste constituents that may have been present at the HWMF buildings T029 and T133. Therefore, this section provides a description of the waste generation and waste treatment processes followed by identification of the hazardous waste constituents potentially present.

4.1 WASTE GENERATION PROCESS

4.1.1 Sodium and Sodium-Potassium Wastes

The primary alkali metals used for the heat exchange test loop at the ETEC were sodium metal and a sodium-potassium alloy. The wastes generated in association with the heat exchange test loops were: (1) components (piping, pumps, valves, etc.) contaminated with and/or containing spent sodium or sodium-potassium, (2) spent sodium metal, or (3) spent sodium-potassium alloy. The components and spent sodium metal and sodium-potassium alloy are referred to as alkali metal wastes.

Components to be tested were filled with sodium metal or sodium-potassium alloy, which acted as heat transfer media in large loop heat exchanger tests and other small experimental test loops. These tests were performed in inert atmospheres (e.g., argon or nitrogen) as the physical nature of the alkali metals required that they be kept clean of atmospheric impurities (oxygen, carbon dioxide, water vapor etc.). The sodium or sodium-potassium was heated to a temperature of 200 to 1,500°F and pumped through a recirculating loop as part of a normal test facility operation. A test sodium loop typically incorporates a smaller loop designed to remove any impurities that may enter the system and deteriorate the heat transfer properties of the sodium. Within this smaller loop, the sodium is cooled in a device referred to as a “cold trap” for the removal of impurities such as oxygen, carbon dioxide or hydrogen. Bubblers containing sodium-potassium were used to purify the inert gas.

Generally, stainless steel material was used for sodium test components, while carbon steel was used for sodium-potassium test components. It should be noted that chemicals (such as fluorinated or chlorinated solvents) having the potential to etch the stainless steel or carbon steel metals were deliberately excluded from the system in order to minimize stress and corrosion failure in the components.

Over time the sodium and sodium-potassium used in the test loops would become saturated with impurities such as oxygen, hydrogen or carbonaceous compounds (such as sodium carbonate). When they became saturated, these metals could no longer function as heat transfer media.

The types of waste generated were the various stainless steel or carbon steel components (pipes, valves, pumps, heat exchangers, etc.) that had been filled with sodium or sodium-potassium; the spent sodium metal and spent sodium-potassium alloy; the sodium cold traps; and the sodium-potassium bubblers. These wastes were transported to building T029 for storage and then moved to T133 for treatment as described in Sections 3.1 and 3.2, respectively.

4.1.2 Lithium Metal Wastes

According to the HWMF Operation Plan, lithium metal was also used as heat transfer media in a manner consistent to that described above for sodium metal. Use of lithium metal as heat transfer media would have resulted in the generation of lithium metal waste and components containing lithium metal.

4.1.3 Lithium Hydride and Zirconium Hydride Powder Wastes

The Operation Plan also indicated that lithium hydride and zirconium hydride powder had been purchased new but never used. These materials were subsequently declared excess and managed as a waste.

4.2 WASTE GENERATED DURING HANDLING AND TREATMENT OF METAL WASTES

Different wastes were generated in the handling, storage and treatment of the alkali metal wastes. The wastes generated as a result of handling, storing and treating the alkali metal wastes included:

- Fire suppression residues resulting from fire suppression activities when sodium or sodium-potassium media was exposed to air.
- Sodium hydroxide generated during waste storage due to contact with air.
- Spent petroleum liquid wastes from operating the saws to cut alkali metal impacted components into smaller sizes for treatment in the treatment chamber.
- Sodium, potassium, lithium and zirconium hydroxide (caustic) solutions from the air scrubber and treatment chamber wash down water; these solutions contained varying concentrations of metals.

4.2.1 Fire Suppression Wastes

Though infrequent, wastes could also be generated as the result of a spill or a fire. The physical characteristics of sodium and sodium-potassium include reactivity with exposure to air resulting in fire. In these events, fire-fighting chemicals such as sodium carbonate (Na_2CO_3), referred to by brand name "NaX", would be used to extinguish the sodium based fires. The suppressed fire waste was scooped up and placed into approved containers. The suppressed fire waste material was layered with additional NaX to preclude further reaction with air.

4.2.2 Sodium Hydroxide Generated During Storage/Management

Sodium wastes were moved in Department of Transportation approved drums. The wastes were placed in containers in layers such that the sodium waste was separated by alternating layers of the fire extinguishing NaX material. The NaX smothers the waste and prevents direct contact with air. Any in-leakage of air (small quantity) will result in a relatively small reaction of sodium forming sodium hydroxide.

4.2.3 Sodium, Potassium, Lithium and Zirconium Hydroxide Solutions

The waste treatment process was previously described in sections 3.2.1.1 and 3.2.1.2. The following is a summary of the treatment process as it pertains to the generation of waste by-products that were managed onsite.

By heating the alkali metal waste (sodium, sodium-potassium, lithium or zirconium), the metal reacted with the oxygen in the treatment room and formed oxides. These were removed from the air with the air scrubber and from the chamber floor, walls, pan, etc. during the wash down. The resultant liquid from both the air scrubber and the chamber wash down was a caustic solution of sodium, potassium, lithium or zirconium hydroxide. The generated hydroxide solutions are categorized as having a RCRA hazardous waste characteristic of corrosivity (D002 - pH>12.5).

During treatment of the alkali metal wastes in the treatment chamber, the exposed parts of the steel and stainless steel components may also have been oxidized. The metal parts (steel and stainless steel) contain various metals, at concentration ranges set by the American Society for Testing and Material (ASTM) or by the American Iron and Steel Institute. Thus concentrations of metals associated with component materials could be detected in the final hydroxide solution generated by the treatment process.

4.2.4 Mineral Oil and Kerosene

In addition to the production of caustic solutions with potential metals, the T133 area produced spent mineral oil and kerosene products. The mineral oil and kerosene wastes were associated with operation of the saw system used to reduce the size of equipment/components impacted with alkali metals.

4.3 HAZARDOUS WASTE CONSTITUENTS

Hazardous waste constituents potentially present at the HWMF based on storage activities at T029 and treatment at T133 include the following:

Constituent	Building T029	Building T133
Sodium metal (D003, D001)	✓	✓
Sodium-potassium alloy (D003, D001)	✓	✓
Sodium oxide (D003)	✓	✓
Potassium oxide (D003)	✓	✓
Sodium hydroxide solution (D002)		✓
Potassium hydroxide solution (D002)		✓
Various Metals (various D-codes)		✓
Lithium metal (D003)	✓	✓
Zirconium (no waste codes)	✓	✓
Mineral oil or kerosene (potential D-codes associated with volatile organic components of the mineral oil or kerosene if present)		✓

Other compounds such as VOCs and SVOCs are considered hazardous waste constituents that could potentially be present due to the kerosene/mineral oil products produced at T133 (Section 4.2.4). Fluoride is also included in the list of hazardous waste constituents present at the site because it was included in the prior Closure Plan, although there is no discussion or documentation of fluoride use at T133 nor T029 in the HWMF records.

No other constituents (e.g., PCBs, pesticides, herbicides, etc.) would be present at the HWMF buildings as all other waste products not associated with the liquid metals test projects were managed at the hazardous waste storage area (HWSA) which is located at a different facility.

Table 7 provides a summary of the chemicals of concern (COCs) for the HWMF closure tasks, based on the hazardous waste constituents managed at T029 and T133. A description of these chemicals is provided in the following paragraphs.

Reactive, Corrosive and Ignitable Constituents

The sodium metal, sodium-potassium alloys and lithium metal can be ignitable and reactive if exposed to air or water. The oxides are produced as an intermittent step in the treatment process and can exhibit reactive characteristics. They are ultimately transformed into corrosive hydroxide liquids (e.g. caustic solution with a pH>12.5).

Metals

The generated caustic solution has been previously analyzed for metals to determine whether any metal, from the various components heated, was present at significant concentrations and could be associated with the treated sodium or sodium-potassium waste. The caustic solution in tanks T-1 and T-3 and the sludge in tank T-1 were analyzed for California Code of Regulations (CCR) Title 22 (section 66261.24) metals. The caustic solutions in tanks T-1 and T-3 were analyzed by Columbia Analytical Services, Inc. on September 3, 1997. The sodium hydroxide sludge was analyzed by SSFL Analytical Chemistry laboratory on March 23, 1997. Laboratory reports for the total metals analyses are included in Appendix E. The analytical results are summarized in Table 8. As shown, metals were present in both the sludge and liquid samples. Comparison of the metal concentrations indicated that chromium and nickel were present in the liquid wastes at concentrations exceeding hazardous waste thresholds as follows:

- Chromium exceeded the RCRA Toxicity Characteristic Leachate Procedure (TCLP) regulatory level of 5.0 milligrams per liter (mg/L).
- Nickel exceeded the California state Soluble Threshold Limits Concentrations (STLC) of 20 mg/L.

The treatment of lithium hydride was performed at T133 (authorized under the 1984 RCRA Part B Permit) and zirconium was stored at T029. Thus, lithium and zirconium are also considered hazardous waste constituents – as shown in Table 7.

Mineral Oil and Kerosene: TPH, BTEX and PAHs

Petroleum hydrocarbons include varying concentrations of volatile organic compounds (VOCs - e.g. benzene, toluene, ethylbenzene and xylenes (BTEX)), and polyaromatic hydrocarbons (PAHs) depending on the type of petroleum product. The PAHs and aromatic VOCs were not used as individual chemicals, but are included in the chemicals of concern (COC) list due to being part of TPH composition.

The TPH used at the HWMF was kerosene or mineral oil (also referred to as white oil). This product was used at the T133 area only, as a lubricant during the size reduction cutting process. Concentrations of BTEX and PAHs is very low in mineral oil and kerosene products, and a TPH trigger concentration will therefore be used to select samples for BTEX and PAH analyses as further discussed in Section 9.4.

Other Compounds

In the Closure Plan included in the approved Operation Plan for the HWMF, the following analyses were proposed:

- Analysis for semi-volatile organic compounds (SVOCs)
- Analysis for non-BTEX VOCs
- Analysis for fluoride

The non-petroleum VOC compounds and fluoride were not part of the generating waste stream or the waste treatment process. Due to inclusion in the approved Operation Plan however, despite absence of onsite use, the closure approach will include analysis of these chemicals only as a verification measure. These chemical analyses will be performed less frequently than the analyses for hazardous constituents associated with the generating waste stream and/or the treatment process, as further discussed in Section 9.4.

5.0 ESTIMATE AND MANAGEMENT OF MAXIMUM INVENTORY

Operation at the HWMF was discontinued in 1997. Since the HWMF is a storage and treatment facility, the maximum inventory would not necessarily equate to the amount of waste present at the time of cessation of operations.

5.1 T029 AREA

The maximum potential inventory at T029 storage area is 5,500 gallons. However, at the time of cessation of operations in 1997, only 1,365 pounds of sodium and Sodium-potassium waste was stored in this building. In 1997, this waste was shipped to Laidlaw Environmental Services in New York for treatment/disposal. Copies of the hazardous waste manifests are included in Appendix F.

5.2 T133 AREA

No sodium or sodium-potassium waste was present at the T133 area at the time of cessation of operations, because all of the sodium or sodium-potassium material had been treated.

The maximum volume of caustic solution potentially present at the T133 area is the following:

- Tank T-1: 1,000 gallons (equivalent to 8,340 lbs.)
- Tank T-3: 5,000 gallons (equivalent to 41,700 lbs.)

However, due to disposal of the waste caustic solution during the operation at T133 Area, the amount of generated/stored caustic solution was less than the maximum amount at the time of cessation of operation. In 1997, two shipments of caustic solution were sent to 21st Century Environmental Management (NVD980895338) in Fenley, Nevada for treatment/disposal. The analytical results for metals performed in January 1997 are included in Table 8. In addition, the hydroxide solution was analyzed for pH, which was measured at pH of 13.5, for the hydroxide solution contained in T-1 and 13.7 for the hydroxide solution contained in T-3. The final shipment was 15,920 pounds. Copies of the hazardous waste manifests and Land Disposal

Restriction notification are included in Appendix F. No waste has been treated at the T133 area since that time, and thus no further generation and storage of caustic solution has occurred. Tanks T-1 and T-3 have been empty since that time.

6.0 CLOSURE APPROACH AND PERFORMANCE OBJECTIVES

The hazardous waste units (containers, building and tanks) located at T029 and T133 will be closed according to the applicable sections of California Code of Regulations, Title 22 including section 66264.178 (containers), 66264.197 (tanks) and 66264.1102 (buildings). All work will be performed in accordance with the associated Health and Safety Plan (MWH, 2003d) and Transportation Plan (MWH, 2003e). The following sections identify the closure approach and specific closure performance objectives.

6.1 CLOSURE APPROACH

As previously stated, all hazardous wastes and materials have been previously removed from containers, tanks and associated equipment at the HWMF buildings T029 and T133. The closure approach for the HWMF buildings T029 and T133 will therefore start with decontamination of buildings, equipment and structures. The HWMF buildings T029 and T133 and all associated features will be demolished and removed through this closure action and there will be no reuse of any equipment. The closure approach will include the following steps, which are described in detail in the referenced sections. The approach as identified is based on the fact that the hazardous wastes have already been removed from both T029 and T133.

1. Decontamination of T029 and T133 Structures/Equipment/Area (Section 7.0).
2. Verification Sampling and Demolition of T029 and T133 Equipment and Buildings (Section 8.0).
3. Removal of T029 and T133 Equipment and Buildings (Section 8.0).
4. Soil Verification Sampling (Section 9.0).
5. Groundwater Verification Sampling (Section 10.0).
6. Soil Removal Action and Confirmation Sampling (Section 11.0).

6.2 CLOSURE PERFORMANCE OBJECTIVES

The objective of this Closure Plan is to outline procedures for achieving clean closure of the HWMF. As defined in the Permit Writer Instructions – Closure (DTSC, 2002), “Clean closure is the process where all hazardous waste and hazardous constituent residues are removed or are left in place at levels that are protective of public health and the environment.” In addition to providing the most protection of the environment and human health, clean closure will eliminate any need for further maintenance and post-closure care. Clean closure will be achieved after all materials and debris are removed from the building T029 and T133 locations, and if final samples from the alluvium, weathered bedrock (e.g., alluvium/bedrock interface) and groundwater meet the closure performance objectives.

Separate clean closure evaluations will be made for the T029 and T133 areas, as they are physically distinct locations separated by approximately 1,300 feet. Additionally, the T029 and T133 locations are on opposite sides of the SSFL surface water divide. If clean closure conditions are not achieved for T029 or T133 then post-closure care requirements will be implemented pursuant to 22 CCR 66264.1102(b) (Containment Buildings) and 22 CCR 66264.197(b) (Tank Systems), respectively. Additionally, corrective action will be triggered for T029 and T133 if releases have impacted soil and/or groundwater and if such impacts can not be corrected during the closure period.

6.2.1 Performance Standard for HWMF Improvements (Equipment and Structures)

The decontamination performance standard will be the removal of hazardous waste constituent residues from the various equipment and structures as described in section 7.0. Prior to demolition, the equipment and structures will be analyzed for the appropriate hazardous waste characteristics in accordance with CCR Title 22, Section 66261 and for verification of decontamination levels as summarized in Tables 8 and 9, Closure Sampling Objectives for T029 and T133, respectively. This characterization will provide the basis for management of the demolished and removed material and equipment, as discussed in Section 8.0.

6.2.2 Performance Standard for Soil

A risk-based performance standard will be used for soil, consistent with the March 16, 1998 EPA Guidance document which states that “ *The purpose of this memorandum is to provide guidance on risk-based clean closure and to confirm that, under current regulations, RCRA regulated units may be clean closed to protective, risk-based media cleanup levels (USEPA, 1998).*” The 1998 guidance further clarifies that:

“Since the 1987 notice, EPA and the states have gained considerable experience in making protective, risk-based cleanup decisions under the RCRA corrective action and CERCLA cleanup programs. EPA’s position is that the procedures and guidance generally used to develop protective, risk-based media cleanup standards for the RCRA corrective action and CERCLA cleanup programs are also appropriate to define the amount of hazardous constituents that may remain in environmental media after clean closure. In other words, site-specific, risk-based media cleanup levels developed under the RCRA corrective action and CERCLA cleanup programs are appropriate levels at which to define clean closure”.

The methodology for achieving the performance standard for soil will initially include a comparison of sample verification results to background conditions. If there is no exceedance of background concentrations, then no further data evaluation or assessment of risks will be required to support clean closure. If there are exceedances of background concentrations, then the soil data will be evaluated through a risk assessment to determine if soil removal actions are necessary to achieve clean closure.

The methodologies for making background comparisons and risk based evaluations for the HWMF will be as described in the SRAM for SSFL (Ogden, 2000) as updated by the SRAM Revision 1 (MWH, 2003c). The SRAM and SRAM Revision 1 have been prepared to support the SSFL RCRA corrective action program. As such, the SRAM and SRAM Revision 1 will provide “appropriate levels at which to define clean closure” as described in the 1998 EPA

guidance excerpt above regarding the suitability of RCRA corrective action and CERCLA risk assessment approaches to RCRA closures.

The methodology to support the HWMF closure will follow the SRAM and SRAM Revision 1, as reviewed and approved by the DTSC to ensure state protocols for risk assessment are complied with as specified in the Permit Writer Instructions (DTSC, 2002).

Background Comparison. The SRAM provides for the use of only validated sampling data from the facility. The concentrations of naturally occurring compounds in the validated samples will be compared to background soil concentrations (See Table 5 for Background Metal Concentrations in Soil). This procedure follows the DTSC policy (DTSC, 1997) which specifies the Wilcoxon Rank Sum Test. The pH data will also be compared to the background pH data, using the Wilcoxon Rank Sum Test.

Background concentrations for organics is non-detect. Background concentrations for pH, fluoride, lithium and zirconium will be established by collecting soil samples from the selected background locations for the SSFL (refer to the following Section 6.3).

Risk Assessment. All compounds detected at the site above background levels will be evaluated in a risk assessment according to the SRAM (Ogden, 2000) and SRAM Revision 1 (MWH, 2003c), which are consistent with DTSC risk assessment protocols. The results will include lifetime incremental cancer risks and Hazard Indices for human and Margins of Safety for ecological receptors, as appropriate for this site. If DTSC determines that the magnitude of all these risk endpoints are within an acceptable range, then no further action will be necessary and clean closure will have been achieved. If DTSC determines that the magnitude of all or some of these risk endpoints are not within an acceptable range, then further action may be required to achieve clean closure. Further action to achieve clean closure based upon the risk assessment may include the removal or treatment of impacted media to lower concentrations until these risk endpoints are within an acceptable range. This will require the performing of iterative risk assessments on the site until the remaining concentrations result in acceptable risk endpoints.

The process of calculating the initial and iterative risks, if performed, will be documented in the closure report for buildings T029 and T133. (See Section 11.0 for a discussion of remediation options which may be implemented as part of the closure activity).

Approach for pH. If the average pH is found to exceed the background level at the area under investigation, then a range of 6 to 9 is proposed for remediation decision making – unless the background level is less than 6 or greater than 9 in which case background will be used as the decision making range. The range of 6 – 9 is proposed based on the discharge limit for surface water under the NPDES program, because risk assessment for pH cannot be performed and because no specific guidelines exist for pH in soil. If the average soil pH is measured outside of this range (or the background range if the background pH is less than 6 or greater than 9), the soil will be considered as impacted and remediation options will be evaluated as described in Section 11.

6.2.3 Performance Standard for Groundwater

If any groundwater is encountered during the closure of buildings T029 and T133, then the groundwater quality will be assessed to confirm the presence or absence of impacts from releases at T029 and T133. The performance standard for groundwater, to support the clean closure objective, is groundwater concentrations below or equal to the maximum contaminant level (MCL) for the respective chemicals. If the chemical is naturally occurring then the performance standard will have been met if concentrations are below, or equal to, the background concentration – even if the background concentration exceeds the respective MCL.

If background concentrations are exceeded for one or more chemicals for which no MCLs exist, then other potentially applicable water quality goals will be evaluated and the methodology presented in the SRAM and SRAM Revision 1 will be implemented. If the calculated risks, following the SRAM are below acceptable levels, then the performance standard will have been met for groundwater and no further work will be needed.

If the performance standard for groundwater is not met through the closure action, then clean closure will not have been achieved for the specific HWMF area (e.g., building T029 and/or T133).

6.3 DETERMINATION OF BACKGROUND VALUES FOR FLUORIDE, pH, LITHIUM AND ZIRCONIUM

Establishing background concentrations of chemicals in soil provides comparison concentrations for site samples to determine if a release has occurred. The sampling and the subsequent laboratory analysis of soil from locations which are distant from industrial activities results in a set of data which indicates ambient or background soil conditions for the constituents analyzed. Under the current corrective action program at SSFL, 19 sample locations have been used to establish the background concentrations of inorganic constituents and dioxin (polychlorinated dibenzo-dioxin and furan compounds). The background locations have been reviewed by the DTSC and approved for use in the SRAM for SSFL.

The HWMF has been associated with materials containing fluoride, lithium and zirconium, among others. The existing SSFL background data set for inorganic constituents described in Section 2.4 does not include the elements fluoride, lithium, or zirconium. Additionally, the existing SSFL background data set does not define pH.

To properly assess if the HWMF operations have impacted the environment, the background concentrations of fluoride, lithium and zirconium, and the background range of pH, must be established. Six soil samples will be retrieved from six different sampling locations previously approved by the DTSC for the SSFL RCRA corrective action program. Six samples were chosen to ensure an adequate number analytical results are provided as input to the background comparison. The six sampling locations (denoted in bold lettering) were chosen from the locations indicated below using a random number generator. The sampling locations are shown on Figure 24. The samples will be retrieved at the time of soil sampling at the T133 and T029 facilities and analyzed for pH, total fluoride, lithium and zirconium.

The background data will be compared to the analytical results from the HWMF using the Wilcoxon Rank Sum Test in accordance with the SRAM and SRAM Revision 1 procedure.

**Background Soil Sample Locations Used in the RCRA Facility Investigation
 at the Santa Susana Field Laboratory.**

Number/Designation/Location	Number/Designation/Location
1. BKND-1 Area IV	2. BKND-2 Area IV
3. BKND-3 Undeveloped Land	4. BKND-4 Undeveloped Land
5. BKND-5 Undeveloped Land	6. BKND-6 Undeveloped Land
7. BKND-7 Undeveloped Land	8. BZSS01 Undeveloped Land
9. BZSS02 Undeveloped Land	10. BZSS03 Undeveloped Land
11. BZSS04 Undeveloped Land	12. BZSS05 Undeveloped Land
13. BZSS06 Undeveloped Land	14. BGSS01 Area I
BGSS02 Area I	16. BGSS04 Area IV
17. BGSS06 Area I	18. BGSS07 Area I
19. BGSS08 North of Area I	

6.3.1 Background Soil Sample Collection and Analyses

Soil samples to be collected from the background locations specified on page 6-7 for determining background levels of pH, fluoride, lithium and zirconium, will be collected from a depth of approximately 6 inches bgs. The samples will be collected using the hand auger/slide hammer technique, as described in Section 9.3.1. The QA/QC procedures, decontamination procedures, sample labeling and packaging, and field documentation will follow the procedures described in Section 9.3.3, 9.3.4 and 9.3.5.

The collected soil samples will be analyzed for pH by 9045C, fluoride by EPA Method 340.2, lithium by EPA Method 6010 and zirconium by EPA Method 6010.

7.0 DECONTAMINATION PROCEDURES

7.1 POTENTIALLY CONTAMINATED STRUCTURES AND EQUIPMENT

The HWMF was used for the storage and treatment of alkali metals. Some structures and equipment have come into direct contact with the waste material, while other areas only had a potential for contact with the waste. These two different categories are described below.

7.1.1 Direct Contact with Waste

Structures and equipment that have come into direct contact with the waste material include the ones where waste was treated or directly stored in. This type of direct contact occurred at the T133 area, where the waste was treated and the generated caustic solution stored. These items include:

- The treatment chamber: As the alkali metal was oxidized, the sodium oxides or potassium oxides filled the chamber, and were then transformed into sodium hydroxide solution through the water spray and rinse. Thus the overall chamber has come into contact with the waste material, including the metal walls and door, the elevated steel lining, the treatment pan, the metal liner in the sump, and the pipe connecting the elevated steel lining to the sump.
- Venturi scrubber: The Venturi scrubber was used for treatment of the sodium and potassium oxides in the air stream prior to discharge to the atmosphere, and the scrubber and ancillary equipment such as pumps, etc., would have come into direct contact with the waste material.
- Tank T-1: Tank T-1 was used as a storage tank for the generated caustic solution, and thus has come into direct contact with the waste. T-1 is defined as the metal lining.
- Tank T-2: The purpose of Tank T-2 was the storage of the waste sodium-potassium for feeding into the treatment chamber, and thus would have come into direct contact with the waste.
- Tank T-3: Tank T-3 was used for the storage of the generated caustic solution, and thus has come into direct contact with the waste.

- Miscellaneous piping: Pipes transferring the caustic solution from the treatment chamber and the scrubber to Tank T-1, and the hose from T-1 to T-3 would have come into direct contact with the waste material.
- Sumps: The sump located inside the treatment building has had direct contact with waste. The two sumps that are located on the north side of the T133 bermed area were used for containment of rainwater or any spills. According to reviewed records, the northeastern sump had contact with spilled hydroxide solution from Tank T-3. No records were found that the northwestern sump had any contact with waste material.

7.1.2 No Direct Contact with Waste

All other areas, not specifically enumerated in Section 7.1.1, have not come into direct contact with the waste material. At T133, the remaining areas were used as staging, support function or secondary containment. The leak detection equipment that is located in the interstitial space between the metal liner and concrete of Tank T-1 has not been in contact with the treated waste, as no leakage has occurred from this liner, according to available records.

At T029, the waste was stored in the B-boxes or drums. No waste handling occurred at the T029 area other than the movement of the closed containers; thus the T029 structure or concrete pads used for unloading have not come into direct contact with the waste. Only as a precautionary measure, these areas will also be decontaminated. The pipe located on the southern side of building T029 that extends out 1.5 feet was used to provide better drainage of the rainwater collected from the rooftop. Due to the nature of the stored material water was specifically kept out of the building. The rainwater did not have any contact with the waste material therefore the pipeline also did not have any contact with the waste.

7.2 DECONTAMINATION PROCEDURES

This section describes the decontamination procedures to be used at T029 and T133. All decontamination work will be performed in accordance with the Health and Safety Plan (MWH, 2003d) procedures and requirements.

7.2.1 T029 Area

The containerized wastes stored in Building T029 have been previously removed and the T029 building is empty. Decontamination of the building and associated areas will be performed as follows:

Pressure Washing the Walls and Ceiling

A plastic liner (10 mil Visqueen) will be placed on the floor of the building, and extend slightly onto the walls. The liner will be taped to the wall to capture the water from the pressure washing process to ensure the water does not escape through cracks or joints in the concrete floor. The captured water will be vacuumed into drums or an aboveground storage tank for analytical testing (see section 7.2.4) and subsequent disposal. The liner and adhesive tape will be removed and disposed in accordance with applicable regulations using the same waste designation as is used for the fluids.

Pressure Washing the Concrete Floor

The concrete floor will then be pressure washed. Due to the lack of any sump in this building, the water will be simultaneously vacuumed, to control any wastewater flow. The decontamination water will be pumped into appropriate drums. The standing rinsate contained in drums will be tested for waste characterization (refer to Section 7.2.4) and properly transported and disposed to an off-site treatment/disposal facility.

7.2.2 T133 Area

Decontamination of the T133 area, equipment and structures will be performed using a high-pressure wash down - with the exception of: (1) Tank T-2 and its associated hoses; and (2) the

containment for piping connecting Tank T-1 to Tank T-3. All waste materials, such as the caustic solution, have already been removed from the T133 area (see Appendix F for waste manifests).

The following paragraphs describe the decontamination procedures for the Building T133 Area.

Removable Piping/Equipment, Treatment Chamber Building and Tanks T-1 and T-3

A decontamination area or wash area will be set up within the southwestern part of the T133 bermed area as shown on Figure 25. The decontaminated area will be approximately 20 feet by 30 feet, lined with a minimum 10 mil Visqueen and bermed with sandbags. The Visqueen will be tucked and rolled under the sand bags to insure a seamless containment. The decontamination pad will be used for pressure washing miscellaneous items such as process piping, metal catch pans, etc. The decontamination pad rinsate will either be pumped into appropriate drums or into tank T-3.

The treatment chamber will be thoroughly pressure washed, including the floor, ceiling, walls and inside doors. The existing wastewater flow system will be used to capture the decontamination rinsate. The rinsate will flow from the treatment chamber to Tank T-1. From here the rinsate from the treatment chamber and the rinsate generated from pressure washing T-1, will be pumped into the aboveground tank, T-3. A check valve will be installed on the transfer line to prevent backflow.

The rinsate contained in T-3 and in drums, if any, will be tested for waste disposal characterization (refer to Section 7.2.4) and appropriately transported and disposed off at an off-site treatment/disposal facility. The T-3 tank will also get a final rinse prior to transporting the rinsate off-site.

Venturi Air Scrubber

An internal surficial decontamination of the Venturi scrubber will be performed. This scrubber is currently empty. This type of scrubber did not use any packing; while in operation water was sprayed at different levels within the scrubber chamber. This water was recirculated for a period of time and then discharged into Tank T-1. Prior to discharge, the air passed through a de-mister. The main purpose of the de-mister was to capture the large water droplets so that they collected and dropped back down into the scrubber and were not released out of the stack. The scrubber reservoir is at the bottom of the system. The reservoir will most likely contain lime (hard water deposits), caustic build-up from the sodium hydroxide solution, rust, corrosion and scale.

The scrubber will be accessed through the main opening, on the east side of the scrubber. The overall scrubber decontamination will be performed from the outside, without entering the chamber. The bolts from the manway will be removed and any residual water, if present, will be pumped-out. The material will be pumped directly into 55-gallon drums to await analysis for profiling and appropriate disposal.

Once any residual liquid/sludge has been removed from the reservoir, the decontamination of the main ducting and main chamber of the scrubber will be performed. The floor, walls, de-mister and ducting of the main chamber will be pressure washed using a high pressure wash with four to six foot extension wands. The rinsate will be collected in the scrubber reservoir and pumped directly into drums or in Tank T-3. Once this is complete, decontamination of the top of the stack will be performed by pressure washing the stack chamber from the top. The order for cleaning the scrubber will be from top to bottom, in order to minimize the possibility for recontamination. First, the manway will be sealed to prevent any rinsate water from splashing outside the main chamber of the scrubber. Again, the rinsate will be collected in the scrubber reservoir. To access the top of the stack, a two man "basket" scissers lift will be used with the necessary OSHA required safety lanyards, body harnesses and webbing. A final rinse will then be performed of the main chamber, walls, ducting and reservoir. Again, the rinsate will be pumped from the reservoir, directly into drums and or Tank T-3.

Concrete/Asphalt Areas

The overall concrete/asphalt area at the T133, including secondary containment for the piping will also be washed, as a precautionary measure. The water would accumulate in the two sumps located on the northeastern and northwestern corners of the pad. The water will be pumped into T-3 or drums for sampling and ultimate treatment/disposal offsite.

Tank T-2 and Associated Lines

Tank T-2 is maintained with an inert cover gas (argon), as a preventative measure to protect against the reaction of possible sodium-potassium residues with oxygen from the air. Tank T-2 is reportedly empty. Efforts have been taken to determine the extent, if any, of sodium-potassium residuals in Tank T-2. An ultrasonic examination of the tank was made, and no residual sodium-potassium was detected within Tank T-2. However, as a precautionary safety step, residual sodium-potassium will be presumed to be present, and the tank will be managed accordingly. Tank T-2 and appurtenant lines will be cleaned on-site (e.g. at T133) by personnel utilizing a water vapor nitrogen (WVN) process. The process passes low concentration water vapor carried by nitrogen over the contaminated surfaces to react with the alkaline metals. The reaction generates a solution of sodium hydroxide and potassium hydroxide. The hydroxide solutions are then considered stable and can be flushed out with a water rinse.

Only technicians specially trained in this procedure will be allowed to work on the decontamination of Tank T-2. The generated solution will be stored in compatible containers and characterized for waste disposal purposes, in accordance with California Code of Regulations, Title 22, Division 4.5 (See section 7.2.4).

Tank T-1 to Tank T-3 Transfer Hose

The flexible hose used for transferring the caustic waste from Tank T-1 to Tank T-3, including the secondary flexible containment pipe will be disposed as a hazardous waste at an off-site

facility. Due to the nature of this material (e.g. relatively lightweight and compact material), this option is more cost effective than decontamination.

7.2.3 Decontamination Water Sampling Objectives

The sampling objective for the decontamination water is for waste characterization purposes only. Table 9 presents the sampling objectives for the decontamination water generated from Building T029 and Table 10 presents the sampling objectives for the decontamination water for Building T133.

7.2.4 Sampling and Analysis of Decontamination Water

The wastewater generated as part of the decontamination process will be sampled and analyzed for waste disposal characterization. The water from T029 will be contained in drums or tanks and the water from T133 area will be placed in Tank T-3, rental tanks or drums. One sample from each drum and/or tank will be collected. A glass bottle will be lowered into the drum or aboveground tank to obtain representative samples of the wash fluid. The bottle will be equipped with a closing mechanism. The closed bottle will be brought to the surface, and the collected water used to fill the appropriate sampling containers for the various chemical analyses. If sludge/solids accumulate in Tank T-3 as part of the decontamination activities, the sludge/solids will also be sampled. The collected samples will be analyzed for waste characterization purposes, in accordance with the requirements of the treatment/disposal facility.

The wastewater will be analyzed for hazardous waste characteristics, following California Code of Regulations Title 22, Division 4.5. The collected decontamination wastewater will be evaluated for corrosivity by pH analysis using by EPA Method 150.1 or 9040, and for toxicity by metal analysis (Title 22 metals), using EPA Method 6000 and 7000 series.

Tank T-3 is a plastic tank with an integrated secondary containment unit. After the decontamination wastewater is removed from T-3, the tank and secondary containment will be

demolished by saw cutting and will not be reused. The debris will be characterized in accordance with Division 4.5, Title 22, California Code of Regulations.

8.0 VERIFICATION SAMPLING AND DEMOLITION

After decontamination is complete, all improvements (including buildings, slabs, etc.) at the HWMF buildings T029 and T133 will be demolished. None of the improvements or equipment will be reused or left onsite. All verification sampling and demolition tasks will be performed in accordance with the Health and Safety Plan (MWH, 2003d). All movement of wastes generated through demolition will be managed in accordance with the Transportation Plan (MWH, 2003e).

The following section describes the tasks associated with the verification sampling (Section 8.1), demolition and demolition debris management (Section 8.2) steps of the HWMF closure for buildings T029 and T133.

8.1 VERIFICATION SAMPLING

8.1.1 Verification Sampling Objectives

After the decontamination described in section 7.0 is complete, verification sampling will be performed prior to demolition. The primary verification sampling objective is to determine if additional decontamination is warranted. If additional decontamination is performed, it will be followed by another round of verification sampling.

An additional verification sampling objective is to provide the data necessary for waste classification in accordance with the California Code of Regulations, Title 22, Division 4.5. This is a necessary objective as the closure approach includes demolition and removal of all structures and equipment. Classification of the materials before demolition will allow for proper segregation of the demolition debris (e.g., nonhazardous versus hazardous waste).

Based on the hazardous constituents potentially associated with the T029 and T133 operations described in section 4.3, the following constituents and hazardous waste criteria will be evaluated in the verification sampling step:

- reactivity and ignitability due to the presence of alkali metals (sodium, sodium-potassium, lithium);
- corrosivity due to the high pH of the sodium and potassium hydroxide solutions;
- toxicity due to the presence of metals;

Table 9 summarizes the sampling objectives for building T029 and Table 10 summarizes the sampling objectives for building T133 and its associated hazardous waste units.

8.1.2 Verification Sampling Methodology

The types of verification samples to be collected include core, chip or wipe samples from the various types of building material, which may consist of concrete, metal, plastic or wood. Samples will be collected from each piece of equipment, and for each 50 linear feet of pipe. Water samples (i.e., rinsate) may also be collected if equipment is inaccessible for wipe or matrix sampling.

Concrete and asphalt floor samples will be collected based on both biased (locations of high probability of release – such as under tanks) and random (larger areas with low probability of release – such as open floors/roadways) criteria. The concrete and roadway samples will be collected at the same locations and at the same time as the soil samples (soil sampling details are presented in Section 9.0 and are shown on figures 26 and 27 for T029, and figure 28 for T133). The concrete and asphalt samples will represent the “surface material”; where as the underlying soil samples will represent native geologic materials.

Sampling locations, numbers and procedures for the verification task are described in the following sections.

8.1.2.1 Concrete

Core or chip samples will be collected of concrete as appropriate. Chip samples will be collected from concrete surfaces where it is impractical to core concrete samples. The chip samples will be collected from the surface of the concrete pad, or other concrete surfaces, using cold chisel and hammer, or similar tools. The concrete core or chips will be placed in glass jars and labeled with the appropriate information as described in Section 8.1.5.

A total of 8 concrete samples will be collected at T029 from the tops of the borings located on concrete as shown on Figure 26. A total of 8 concrete samples will be collected at T133 at the borings located on concrete as shown on Figure 28.

8.1.2.2 Metal

Wipe samples will be collected to verify decontamination of metal surfaces. Wipe samples will be collected by placing a 10 cm x 10 cm template on the surface and wiping the area inside the template with a wet piece of gauze. The gauze should be folded in half with the exposed side in and then folded again to form a 90 degree angle in the center. The gauze will be placed, angle first, into a clean glass jar and labeled with the appropriate information as described in Section 8.1.5. Clean gloves will be used to perform the wipe sampling; and gloves will be changed between each sampling.

Wipe samples will be collected from the various metal areas and equipment as follows.

Building T029

- T029 Building: the total wall area of T029 is approximately 960 square feet. One wipe sample will be collected from each wall of the T029 building for a total of 4 wipe samples. This is consistent with the recommended frequency of one sample per 300 square feet in the Permit Writer Instructions for Closure of Treatment and Storage Facilities (DTSC, 2002). The location of the wipe samples on each will be selected to be representative of wall condition and building use.

Building T133

- T133 Treatment Chamber Walls and Ceiling: a total of 5 wipe samples will be collected from the chamber – one from each wall, and one from the ceiling. This number of samples is consistent with the Permit Writer Instructions for Closure of Treatment and Storage Facilities (DTSC, 2002).
- Treatment pan: one sample due to relatively small size.
- Steel lining/drain pan: one sample due to relatively small size.
- Sump lining: one sample due to relatively small size.
- Tank T-1: One sample will be collected from the inside of this tank, due to the equal potential for contamination distribution on the interior surface of the tank.
- Tank T-2: One sample will be collected from the inside of this tank, due to the equal potential for contamination distribution on the interior surface of the tank.
- Tank T-3: One sample will be collected from the inside of this tank, due to the equal potential for contamination distribution on the interior surface of the tank.

8.1.2.3 Other Types of Verification Samples

Other building materials may consist of plastic or wood. Chip or core samples of these types of material will be collected by sawing, cutting or drilling the area to be analyzed. Core samples will be the primary collection method where practical. A consistent approach of one sample per 300 square feet will be used to determine the number of samples. Samples will be placed in glass jars and labeled with the appropriate information as described in Section 8.1.5.

Verification sampling may also include analysis of rinsate water run through decontaminated equipment. This option may be used for inaccessible portions of piping or equipment.

8.1.2.4 Asphalt Roadways

The T029 asphalt roadway will be sampled to determine if any releases occurred due to storage of containers outside of building T029. A total of 3 random and 3 biased locations will provide a total of 6 asphalt samples at T029 as shown on Figure 27.

A total of two asphalt samples will be collected at T133 from random locations as depicted by the borings located on asphalt on Figure 28.

Core samples of the asphalt will be collected for analysis of COCs with the exception of VOCs/SVOCs. Asphalt is a petroleum product; therefore, VOCs and SVOCs will be present irrespective of a release. The analytical results will be evaluated to determine if there is evidence of a release at T029 and also for waste characterization purposes to ensure that the asphalt is properly disposed of. The pH values from the asphalt samples will be an indicator parameter for release evaluation.

8.1.3 Quality Assurance/Quality Control

A Quality Assurance/Quality Control (QA/QC) program will be conducted to ensure the precision, accuracy, reproducibility and completeness of field and laboratory data. The QA/QC program will include laboratory matrix spike and matrix spike duplicates, field duplicates and equipment blanks as described in the following sections.

Laboratory QA/QC Samples. Laboratory QA/QC will be performed in accordance with the laboratory's own program. To check for possible matrix interference, the laboratory will analyze matrix spike and matrix spike duplicates (MS/MSD). These samples are prepared by the analytical laboratory.

Field Duplicates. The field duplicate is a sample that is intended to provide an evaluation of the laboratory's performance by comparing analytical results from two identical, or nearly identical samples. Field duplicates will be collected at a rate of one per every 10 primary samples. If the number of samples per day is less than 10, at least one duplicate sample will be

taken. For wipe samples, an area adjacent to the sample will constitute the duplicate one. For metal and concrete chip samples, the duplicate will be collected at the same area. For the water samples, the water that was collected from the pipe area or other equipment will be poured in two sets of bottles. Any duplicate sample will be analyzed for the same parameter as the original field sample.

Equipment Blanks. Equipment or rinsate blanks will be prepared and submitted at the rate of one per sampling method per event, except when disposable sampling equipment is used.

8.1.4 Decontamination Procedure for Sampling and Demolition Equipment

Any equipment that will come in contact with the waste media to be sampled will be cleaned prior to its usage. The sample containers, such as glass jars and bottles, are specially cleaned for analytical use and therefore do not need decontamination.

The equipment to be decontaminated will be washed in a non-phosphate cleaning solution, rinsed with tap water and rinsed a second time with deionized water. The equipment will then be air-dried, but protected from dust or potential air borne contaminants.

Any decontamination fluids will be containerized and presumptively stored onsite as a hazardous waste pending characterization results. The fluids will be sampled at the end of the field work activities and analyzed for the hazardous waste criteria pursuant to California Code of Regulations Title 22, Division 4.5, and disposed of or recycled in accordance with applicable regulations. Documentation of disposal or recycling will be provided in the Closure Report.

8.1.5 Sample Labeling, Packaging, Preservation and Transportation

All samples will have a label attached to the sample container. Each sample will be assigned unique identification information as follows:

- Location – Unit ID.– Number

- Location: (T029 or T133)
- Unit ID (e.g., T1 for tank T-1, TCF for treatment chamber floor, etc)
- Number: Sequentially assigned, beginning with 1

The sample label will contain the following information:

- Project: HWMF Closure
- Site: Area IV SSFL
- Sample No.: As described above
- Sampler's Name
- Date and time the sample was collected
- Preservative- (as appropriate)
- Parameters for analysis

After collection and labeling of the sample, it will be immediately placed in a cooler with ice or frozen ice pack (e.g., cooler at 4 degrees Celsius). The samples will then be delivered or couriered to a state certified analytical laboratory under chain-of-custody procedure as detailed below. The certified analytical laboratory will perform the requested analyses within the EPA Method holding times.

8.1.6 Chain-of Custody Procedure

A chain-of-custody form will be completed in the field (sample provided in Appendix G). This form will accompany every shipment of samples to the analytical laboratory. The sampler will note each sample container on the form and fill the appropriate sample information and analytical procedure for each sample, and sign-off the custody to courier or laboratory as appropriate, when the transfer occurs.

8.1.7 Documentation

A field notebook will be maintained to document field activities. Daily activities and observations made during the sampling, or documentation that could affect the quality of a sample will be recorded in the field logbook. Examples of information to be recorded are:

- Date and time of day
- Weather conditions
- Name of personnel present and name of samplers
- Sampling information: sample number, location such as a map if applicable, decontamination, type of sample, etc...
- Unusual conditions such as staining, evidence of release, problems encountered during sampling, deviation from sampling plan, etc...
- Daily tail-gate safety orientation meeting attendees and notes
- Miscellaneous comments, as appropriate

8.1.8 Analytical Test Methods

All samples will be analyzed for the following:

- Ignitability by EPA Method 1010
- Reactivity by requirements of California Code of Regulations, Title 22, section 66261.23
- Corrosivity (pH) by EPA Method 9045 for solids; and EPA Method 9040 or field method 150.1 for liquids
- Title 22 Metals by EPA Methods 6000 and 7000 series, (for metal parts, only soluble metal fraction will be determined)
- Hexavalent chromium by EPA Method 7196, (only at building T133)
- TCLP extraction and analysis for RCRA metals (for sludges)
- Fluoride by EPA Method 340.2
- Zirconium and Lithium by EPA Method 6010/6020

Analysis will be performed by a State Certified and the laboratory.

8.2 DEMOLITION

8.2.1 Land Surveying and Utility Search

Prior to demolition, the T029 and T133 facilities will be surveyed to a survey mark established by a registered land survey. The surveying will ensure that the prior locations of buildings and improvements (such as tanks, sumps, piping, etc) will be documented. This information will be used to ensure that the soil sampling program objectives described in Section 9.0 can be met, which includes sampling at locations with high potential for releases.

Also prior to any demolition activities, a utility locator service will be retained to search and locate underground utilities. Any utility lines on the site or running through the site will be identified so that they will not be disturbed during demolition activities.

The T029 and T133 equipment and structures will be removed after decontamination, surveying and utility location are completed as described in this Section and Section 8.2.3.

8.2.2 Asbestos Survey

An asbestos survey will also be performed prior to demolition tasks. If asbestos is confirmed present, then a certified asbestos removal contractor will be used to remove the asbestos containing materials. These materials will be segregated from other non-asbestos materials for offsite disposal.

8.2.3 Equipment, Structures and Piping

After decontamination and verification sampling, the equipment at buildings T029 and T133 will be dismantled and removed. After the equipment has been removed, the structures will be

demolished. Based on the verification sampling results, the dismantled equipment and demolition debris will be segregated (as it is generated) into nonhazardous or hazardous waste storage roll-off bins. In addition, materials that can be recycled will be segregated from materials, which will be shipped for offsite disposal. For example, the metal from the metal tanks may be recyclable and the specifications of California Code of Regulations, Title 22 for “Management of Tanks”, specifically section 67383.3(e) will be followed for materials to be recycled. A qualified individual (described in section 67383.3(f)) will develop a certificate that includes information under section 67383.3(g). The certificate will accompany the tanks and hazardous material debris to the recycling/disposal facility. All materials and bins will be transported to the appropriate waste management or recycling facilities in accordance with the Transportation Plan (MWH, 2003e).

It is anticipated that all debris from the building T029 demolition will be decontaminated sufficiently to meet nonhazardous waste classification criteria. All building T029 materials and debris will be shipped to the Nevada Test Site (NTS). The shipment of all T029 demolition debris and materials to NTS is in accordance with DOE policy, which requires all wastes from locations with former radiological usage to be sent to the NTS – even wastes and debris from locations which have been closed and documented to meet radiological cleanup goals. The NTS location and route are included in the Transportation Plan (MWH, 2003e).

8.2.4 Flooring and Road Materials

The concrete and asphalt materials associated with T029 and T133 will be removed after the soil sampling described in Section 9.0 is complete. These materials will be segregated based on the verification sampling results and placed in roll-off bins for offsite management. The concrete and asphalt materials will be characterized in accordance with California Code of Regulations, Title 22, Division 4.5.

9.0 SOIL SAMPLING

This section describes the objectives and procedures associated with soil sampling tasks. All soil sampling tasks will be performed in accordance with the Health and Safety Plan (MWH, 2003d). If it is determined that soils must be managed offsite, then all management will be in accordance with the Transportation Plan (MWH, 2003e).

9.1 SOIL SAMPLING OBJECTIVES

The objective of the soil sampling program is to determine whether underlying soils have been impacted from the HWMF operations at the building T029 and T133 areas. Soil quality is one of the criteria that will be evaluated to determine if the clean closure performance standard discussed in Section 6.2 has been achieved. If the soil quality data indicates that concentrations exceed background, then a risk based evaluation will be made to determine if soil remediation is necessary to achieve clean closure. If it is, then soil removal will be implemented as discussed in Section 11.0.

Sampling locations will include biased (selected to represent areas with high potential for impact – such as underneath storage tanks) as well as random sampling (for larger areas without heavy use and low potential for impact). The subsurface investigation will be performed after all above-grade site improvements and pipes (both above and below grade) have been removed, but floor covering remains. This will ensure the samples are collected at the targeted areas. The closure sampling objectives for building T029 are summarized in Table 9 and for T133 in Table 10.

Results of the investigation will be analyzed in accordance with the closure performance standards specified in Section 6.2.2. Consistent with the clean closure goal, an attempt will be made to define the extent of impact and to remove soil as necessary to meet the closure performance standard. However, should the extent of impact require efforts beyond the scope and allowed time for closure, then characterization and cleanup may have to be completed through post closure and corrective action.

9.2 NUMBERS AND LOCATIONS OF SAMPLES

Buildings T029 and T133 have been divided into investigation subareas, based upon physical structure and activity as described in the following sections. All sampling will be performed after removal and demolition of the above-grade equipment and structures and all piping. Sections 9.2.1 and 9.2.2 describe the boring locations for each of the investigation subareas. Borings will generally be performed using a Geoprobe rig, except for a few locations where hand augering will be used as indicated in Tables 13, 14 and 15 (soil sampling summaries for T029, T133 and Area North of T133). These tables also identify the sampling depths and number of samples to be collected per boring. Sections 9.3 and 9.4 describe the sampling and analytical methods.

9.2.1 T029 Investigation Subareas and Boring Locations

For soil sampling purposes, the storage area known as Building T029 has been divided into the following investigation subareas:

- The T029 building
- Concrete pads on the northeast and northwest sides of the building
- Drainage area
- Asphalt roadway

A total of 15 borings will be performed beneath the T029 subareas as shown on figures 26 and 27. As described in section 9.3, the borings will be advanced to the alluvium/bedrock interface which is assumed to be approximately 9 feet below grade at T029. Based on the assumed depth to bedrock, it is anticipated that up to 3 samples will be collected per boring for evaluation of T029.

Further discussion of the boring location rationale for each subarea is provided in the following sections.

The T029 Building

Concrete patches are present at the two locations where the calibration equipment was removed along two cracks at the T029 building (See Figure 26). Borings will be placed in the middle of each patch or crack, extending to the bedrock/alluvium interface. Sampling locations are shown on Figure 26.

The loading area is defined as the entrance area of the 8-foot door, on the northwest side of the building. Although no cracks were seen in this area, one boring will be placed towards the center of the door area, as shown on Figure 26, because this area has a higher potential for accidental spillage.

Concrete Pads Outside T029 Building

Two concrete pads are located at the T029 Area. One pad is located to the west of the loading door, and another on the northeast side of the building. Both pads are flat. No crack was observed on these pads, but because these areas may have been loading or staging areas, they could have been more susceptible to accidental spillage. One boring will be placed at each area as shown on Figure 26.

Drainage Area

Surface water drainage around building T029 is directed towards a low spot on the southeastern corner of the structure. A 4-inch PVC pipe is located in this area and extends to the south. The purpose of this pipe was for drainage of rainfall from the south side of the building, including rain from the roof of the building. The total length of the pipe is approximately 6 feet and the discharge area is located on the south side of the fence (see Figure 26). A boring extending to bedrock level will be placed at each end of the drainage pipe, one at the low spot and the second one at the drainage spot for a total of two borings (see Figure 26).

Asphalt Roadway

The gated area of the roadway leading to Building T029 will be sampled. Due to the lack of features indicating area of higher potential for subsurface contamination, samples will be collected from three random locations. In addition, a records search performed for the HWMF

indicated that cold traps were stored outside T029, on the northern side of the asphalt pavement. Three additional sampling locations will therefore be placed on the northern side of the asphalt roadway, equidistant from one another as shown of Figure 27. Borings will be drilled at each location to bedrock.

The random sampling is based upon a numbered x-y coordinate grid and a random generator (calculator). For example, sample location from the asphalt roadway to the west of T029 was performed as follows: the (0,0) coordinate is located at the southeast corner of the roadway (e.g., southern area closest to the building). The width is 29 feet (take the maximum width) and the length of the roadway the roadway is 119 feet. A pair of numbers between 0 and 1 were randomly selected using a calculator. As an example, if the randomly selected pair of number is 0.6549 and 0.8389, the sample location will correspond to (0.6549 x 29 feet, 0.8389 x 119 feet) or (19 feet, 100 feet). If a randomly selected location corresponded to an area outside of the roadway, a new pair of random numbers were generated. The following locations of the random samples were determined using this method.

	X	Y
Random Sample 1	19 feet	100 feet
Random Sample 2	16 feet	89 feet
Random Sample 3	6 feet	113 feet

(0,0) at southeast corner of asphalt roadway

The three biased and three random sampling locations are shown on Figure 27.

At time of site demolition, and removal of the asphalt cover, the underlying soils will be examined for staining and photographed. Additional oil sampling will be performed at areas with staining.

9.2.2 T133 Investigation Subareas and Boring Locations

For sampling purposes, the Building T133 area has also been divided into subareas. A total of 38 borings will be performed beneath the T133 building area and adjacent locations as shown on figures 28, 30 and 31. All borings will be advanced to the alluvium/bedrock interface, which is assumed to be approximately 15 feet below grade at T133, with the exception of 8 hand auger locations north of T133 (see Figure 30) and 6 hand auger locations along the culvert shown in Figure 31. With the exception of the hand auger locations, it is anticipated that up to 5 samples will be collected per boring for evaluation of T029 based on an assumed depth to bedrock of approximately 15 feet.

Further discussion of the boring location rationale for each subarea is provided in the following sections.

Treatment Chamber

Two different areas will be sampled at the Treatment Chamber. One boring will be located towards the middle of the steel lining, and a second boring in the area of the sump as shown on Figure 28. Two borings will be drilled using the Geoprobe technique (see Section 9.3.2) and samples will be collected as described in Section 19.3.2.

Venturi Scrubber

One boring will be drilled in the area of the Venturi air scrubber as shown on Figure 28.

Tanks at T133

Due to the direct management of waste in these units, subsurface conditions will be assessed through drilling one boring at the footprint of each former tank (T-1, T-2 and T-3) as shown in Figure 28. The sample at the T-1 footprint will also provide data relative to potential impacts from the previous sump-pit, as T-1 was constructed in the sump-pit excavation.

Pipes

One boring will be drilled at the location of the pipes connecting the scrubber to T-1 and at the location of the pipe connecting the treatment chamber to T-1 as shown on Figure 28.

Size Reduction/Canopy Area

One boring will be drilled within the center of the concrete-paved area, under the canopy, where components were cut within a metal pan. This area is approximately 15 feet by 10 feet. See Figure 28 for the boring location.

Concrete Areas

No waste was directly handled at the concrete pads located to the south and to the west of the treatment building. Due to the lack of features indicating area of higher potential for subsurface contamination, randomly located borings will be drilled at each pad. One area is the scrubber containment area (about 15 feet by 8 feet), excluding the foot-print area of the scrubber. One randomly selected boring will be placed within the scrubber containment area due to the small surface area of this unit.

The remaining concrete consists of the concrete pad located to the southwest and south of the treatment building (excluding the area under the canopy). Three randomly selected borings will be placed in this area. The location of the random samples was determined following the procedure described in Section 9.2.1 for the Asphalt Roadway Subarea, with the (0,0) coordinate located at the southwestern corner of each pad.

	X	Y
Concrete Area SW and S of Treatment Building		
Random Sample 1	4 feet	39 feet
Random Sample 2	3 feet	49 feet
Random Sample 3	8 feet	4 feet
Scrubber Containment Area		
Random Sample 1	2	2

(0,0) at southwest corner of each area

Sampling locations are shown on Figure 28.

Sump Areas

Two sumps were located on the northern side of the T133 Area. These sumps were used for collection of any storm water accumulated at the T133 Area. One boring will be placed at the location of each sump as shown on Figure 28.

Asphalt Area

The remaining area of T133 is asphalt. No waste was directly handled on the asphalt area. Due to the lack of features indicating area of higher potential for subsurface contamination, samples will be collected from three random locations. The location of the random samples was determined following the procedure described in Section 9.2.1 for the Asphalt Roadway Subarea, with the (0,0) coordinate located at the southwestern corner of the asphalt area. The boring locations are provided below. If a boring location fell under an area being investigated separately (e.g, sump area, tanks, pipe, etc.), another location was selected following the random sampling procedure.

	X	Y
Random Sample 1	1 foot	47 feet
Random Sample 2	21 feet	9 feet
Random Sample 3	50 feet	22 feet

(0,0) at southwest corner of bermed area

Sampling locations are shown on Figure 28.

9.2.3 Soil Investigation at Former T133 Spill Areas

Area to the North of T133

As described in Section 3.3, spills have occurred in the area north of T133 where tank T-3 was previously located. Soil sampling was performed in 1988 in this area which indicated the presence of organic compounds as summarized on Figure 29.

A systematic sampling grid will be used in this spill area because the exact location of a historic spill could not be determined from available records. Hand auger samples will be collected from the centers of 10 foot by 15 foot cells as shown on Figure 30. This grid will be located along the northern boundary of the berm, and extend 20 feet to the north, and will include a total of 10 sampling locations. Eight locations will be hand augered and two will be deeper Geoprobe borings for additional subsurface characterization (See Figure 30 for deeper Geoprobe locations). One deep boring will be drilled at the presumed location of the former tank T-3, and another deep boring at the northwestern grid. This will provide a range of subsurface conditions from the presumed most likely contamination area to the least likely one.

Former Sump-Pit Location

As discussed in Section 9.2.2, for the tanks at T133 investigation subarea, a boring will be placed in the footprint of tank T-1 after it is removed. This boring will provide data for potential impacts from the prior sump-pit as tank T-1 was constructed in the sump-pit excavation. Figure 28 provides the boring location at T-1.

PVC Pipe From T133 to Culvert and Asphalt Culvert

A PVC pipe is located from northeastern part of the bermed T133 area to the culvert located to the east of T133 as shown on Figure 31. This pipe is approximately 40 feet long. Geoprobe borings will be drilled at 20 foot distances along this PVC pipe (total of two locations) as shown on Figure 31. Note that this pipe will be removed prior to drilling.

The asphalt culvert is approximately 300 feet long and 4 feet wide. Its depth varies between 1 and 2 feet. Systematic sampling will be performed to determine if the past release has impacted the culvert area. One Geoprobe boring will be drilled at the PVC drainage pipe discharge point because it is the area presumed most likely to have been affected. Hand auger samples will then be collected at 50-foot intervals along the culvert starting from the Geoprobe location for a total of seven hand auger sampling locations. The Geoprobe and hand auger sampling locations are shown on Figure 31.

9.3 FIELD SAMPLING METHODS AND PROCEDURES

9.3.1 Hand Auger Method

Shallow soil borings will be drilled using the hand auger drilling method. This method utilizes a 2- to 4-inch diameter earth auger attached to a 4-foot long T-bar that is turned by hand. As the depth of the boring increases, additional drill bars will be attached. Sometimes, a continuous flight auger, powered by an electric drill may be substituted. For collection of the soil samples, the auger will be removed and replaced with a sliding hammer type sampler. A brass or acetate sleeve will be inserted into the sampling shoe area. To collect a soil sample, the shoe and liner will be driven with the sliding hammer into the undisturbed soil. The liner will then be removed, and sealed on both ends with Teflon sheets and plastic end caps.

A boring log will be recorded from the soil cuttings. Soil samples will be logged under the supervision of a registered geologist using the Unified Soil Classification System (USCS). The soil cuttings will be placed in a 55-gallon steel drum for disposition. The boring will be backfilled with hydrated bentonite.

Soil samples will be collected from approximately 1-foot and 5-foot depth. All sampling equipment, brass sleeves and caps will be decontaminated as described in Section 9.3.4. Samples will be labeled and placed in a cooler prior to transportation to the analytical laboratory.

9.3.2 Geoprobe Method

The deep borings will be drilled using a Geoprobe. The Geoprobe is a hydraulically powered, truck mounted, percussion/probing machine, designed specifically for use in the environmental industry. The system utilizes a powerful percussion hammer attached to a hydraulic ram to advance small diameter sampling equipment into the ground. No soil cuttings are produced by this method of soil boring completion and sample collection.

Samples are collected through two 1-inch diameter by 6-inch long brass or acetate rings (1-foot long acetate sleeves) inserted within the sampling equipment of the Geoprobe. The on-site geologist will use the soil from the upper sample ring to describe and log the lithology in accordance with the USCS. The lower ring (discolored area or lower part of the acetate ring will be cut) will be immediately capped with Teflon sheet and plastic end caps, labeled and placed in a cooler for shipment to the analytical laboratory.

The first boring drilled at the T133 area and at the T029 area will be continuously sampled using the acetate sleeves. The sleeves will be retrieved and inspected for changes in lithology. Discrete soil sampling depths will be determined based on changes in lithology or depth, if no significant lithological changes are observed. Soil samples will be collected from the 1-foot depth (for near surface evaluation), and the bottom of the boring at the weathered bedrock level, as permitted by the Geoprobe technology. Additional samples will be collected averaging about 5-foot distance. For example, if the distance between the top of the alluvium and the top of the bedrock is six feet, one sample will be collected at the 1-foot depth, another at the weathered bedrock level, and one additional sample within the alluvium. If the distance between the top of the alluvium and the top of the bedrock is fifteen feet, one sample will be collected at the 1-foot depth, another at the weathered bedrock level, and three additional samples within the alluvium. If no changes are seen in the lithology within the alluvium thickness, then soil samples will be collected from depths of approximately 1 foot, 5 feet, 10 feet and 15 feet, and bottom of boring (above alluvium/bedrock interface).

Sampling for VOC Analysis

Samples that are designated for VOC analysis, will be collected in a manner to minimize volatilization from the sample container, during transportation, storage and handling. The En Core™ sampler will be used to retrieve a soil sample from the sampling sleeve. This sampler includes an airtight sealing cap, which prevents the transfer of volatile compounds. Each En Core™ sampler is designed for one-time use only. After retrieving the sampling sleeve, the En Core™ sampler will be used to collect a subsample of the soil following the manufacturer's guidelines. The use of this sampler eliminates the need for using preservatives in the field.

All sampling equipment will be decontaminated as described in Section 9.3.4. All borings will be backfilled with hydrated bentonite.

9.3.3 Quality Control Samples

A Quality Assurance/Quality Control (QA/QC) program will be conducted to ensure the precision, accuracy, reproducibility and completeness of field and laboratory data, in accordance with procedures described in SW-846. The QA/QC program will include the following types of samples.

9.3.3.1 Field Duplicates

The field duplicate is a sample that is intended to provide an evaluation of the laboratory's performance by comparing analytical results from two identical, or nearly identical sample. Field duplicates will be collected at a rate of one per every 10 samples, or one per day if less than 10 samples are collected. The duplicate soil sample will be collected immediately below the original sample. Any duplicate sample will be analyzed for the same parameter(s) as the original field sample. Such samples will be sent "blind" to the laboratory.

9.3.3.2 Laboratory QA/QC

Laboratory QA/QC will be performed in accordance with the laboratory's own QA program. To check for possible matrix interference, the laboratory will analyze MS/MSD samples. These samples are prepared by the analytical laboratory in a manner consistent with the analytical method employed.

9.3.3.3 Travel Blank

The purpose of the travel blank sample is to check whether cross-contamination of samples occurred during transit to the analytical laboratory. This check is generally performed for volatile compounds. One travel blank will be placed in each cooler that contains samples designated for VOC analysis. The travel blank samples will be analyzed for VOC only by EPA Method 8260B.

9.3.4 Decontamination Procedure

Any equipment that will come in contact with the media to be sampled, and has not been certified as clean, will be cleaned prior to its usage. Such equipment includes the hand auger, sample collection devices, brass liners, etc.

The equipment to be decontaminated will be washed in a non-phosphate cleaning solution, rinsed with tap water and rinsed a second time with deionized water. The equipment will then be air-dried, but protected from dust or potential airborne contaminants.

In order to check on equipment decontamination procedure, equipment blank sample(s) will be collected and analyzed at the certified laboratory. Deionized water or laboratory grade water will be poured over the decontaminated sampling equipment and collected in the sampling container(s). The sampling jar will then be labeled and sent to the analytical laboratory for analysis (refer to Section 9.3.5 and 9.4). One equipment blank sample will be collected for each day of sampling (for each building (e.g., T029 and T133) location).

Any decontamination water will be containerized. The water will be sampled at the end of the field work, analyzed for the chemicals of concern as provided in Section 9.5, and disposed in accordance with applicable regulations, based on the analytical result.

9.3.5 Labeling, Packaging, and Documentation

All samples will have a label attached to the sample container. Each sample will be assigned a unique number as follows:

- Location – Type of Boring – Number – Depth
 - Location: T029 or T133
 - Type of Boring: GB for Geoprobe boring, HB for Hand auger boring
 - Number: Sequentially assigned
 - Depth: Depth of the sample
 - Duplicate samples are designated by a DP at the beginning of the sequence

The sample label will contain the following information

- Project: HWMF Closure
- Site: Area IV SSFL
- Sample No.: As described above
- Sampler's Name
- Date and time the sample was collected
- Parameters for analysis
- Preservative

After collection and labeling of the sample, it will be immediately placed in a cooler with ice or frozen ice pack in an effort to cool the sample to $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$. The samples will then be delivered or couriered to a state certified analytical laboratory under chain-of-custody procedure, as described in Section 8.1.6. Field documentation will be recorded as described in Section 8.1.7.

9.4 SOIL ANALYTICAL PROGRAM

The collected soil samples will be analyzed for pH, sodium, potassium, Title 22 metals, lithium, zirconium, and TPH. Ten percent of the collected soil samples will be analyzed for fluoride, VOCs and SVOCs.

A TPH analytical trigger concentration will be used for selection of samples for PAH and BTEX analyses. This is an appropriate approach consistent with site investigation standards and information regarding composition of kerosene and mineral oil obtained from "T. L. Potter and K. E. Simmons, May 1998: Composition of Petroleum Mixtures." Based on the kerosene and mineral oil compositions, an expected PAH concentration (e.g., acenaphthylene and naphthalene) in the raw product would be less than their corresponding EPA Region IX published Preliminary Remediation Goal. Even a TPH concentration (determined as TPH-Modified extended range) of 10,000 ppm would have corresponding naphthalene and acenaphthylene concentrations below their respective PRG-residential concentrations. Using an additional safety factor of 10, due to the nature of PRGs as 'planning concentrations', a TPH trigger concentration of 1,000 ppm has been developed. As such, samples with TPH of 1,000 ppm or higher will also be analyzed for PAHs and BTEX. The TPH analysis will be performed on a 5 day turn around time to ensure

that the holding times for the PAH and BTEX analyses are not exceeded. Additionally, to ensure that the BTEX analytical requirements are met – extractions will be performed within 48 hours of sample collection. The extract will then be analyzed if the TPH result is 1,000 ppm or greater.

A summary of the soil sampling program is provided in Tables 13, 14 and 15 including the number and type of samples to be collected, and the analytical parameters. The analytical methods to be used are as follows:

- pH by EPA Method 9045C
- Title 22 metals by EPA Method 6010B/7000 series
- hexavalent chromium (T133 only) by EPA Method 7199
- lithium and zirconium by EPA Method 6010B
- sodium and potassium by EPA Method 6010B
- TPH by EPA Method 8015M.
- PAHs by EPA Method 8310
- BTEX by EPA Method 8021
- fluoride by EPA Method 340.2
- VOCs by EPA Method 8260B
- SVOCs by EPA Method 8270C

Table 11 provides a summary of the analytical program requirements (methods, containers, preservatives, etc.) and Table 12 identifies detection limits for the various methods and chemicals.

10.0 GROUNDWATER SAMPLING

This section describes the objectives and procedures associated with groundwater sampling tasks. All groundwater sampling tasks will be performed in accordance with the Health and Safety Plan (MWH, 2003d). If it is determined that groundwater waste must be managed offsite, then all management will be in accordance with the Transportation Plan (MWH, 2003e).

10.1 PURPOSE AND LOCATION OF GROUNDWATER SAMPLING

The sampling objectives for the shallow zone (near surface groundwater) are to determine if operation of the HWMF has impacted near surface groundwater and to determine if the units meet the closure performance standards discussed in Section 6.0. The groundwater sampling objectives to obtain closure are summarized in Table 9 for building T029 and Table 10 for building T133.

If near surface groundwater is not present at or above the bedrock surface, and soil sampling data indicates that releases have occurred impacting soil to the depths explored – then groundwater sampling from the deeper Chatsworth Formation may be necessary to provide data on the presence or absence of groundwater impacts from HWMF releases. As indicated in Section 2.4.2, Chatsworth Formation groundwater is expected to be in the range of 40-45 and 65-75 feet bgs for the T029 and T133 areas respectively.

The need to collect groundwater data from the Chatsworth Formation will be based on: (1) the magnitude (concentration) and extent (depth) of contamination defined by the soil sampling program, and (2) consultation with the DTSC. If Chatsworth Formation groundwater sampling is determined to be necessary, then only the constituents of concern detected in the impacted soil will be analyzed for.

Building T029 Area

No wells are present at the T029 area. At T029, shallow groundwater samples will be collected, if groundwater is present, from the Geoprobe locations located furthest east, west and south as shown on Figure 26. Groundwater samples will be collected as grab samples from temporary screens placed at the bottom of Geoprobe borings.

Building T133 Area

At the T133 area, shallow zone well RS-25 was installed in 1989, immediately to the north of the bermed area as shown on Figure 28. Groundwater samples were collected from well RS-25 in April 2003 as described in Section 2.3.3. Samples were collected in April 2003 because this well is frequently dry and groundwater quality data was needed to support the HWMF closure.

Additional groundwater samples will be collected from the northern, eastern, western and southern parts of the T133 area within the fence line from Geoprobe locations as shown on Figure 28, if groundwater is present.

10.2 GROUNDWATER SAMPLING PROCEDURES

10.2.1 Groundwater Sampling from Geoprobe Borings

Selected Geoprobe locations will function as both soil sampling and groundwater sampling locations. These locations are shown on Figure 26 for T029 area and Figure 28 for T133 area. If groundwater is encountered at these locations in the Geoprobe boring, a stainless steel screen with an exposed screen length of about 3.5 feet will be lowered to the desired depth into the formation. The screen is exposed and left in place for a certain period (between 5 and 15 minutes) to allow for groundwater recharge. The groundwater level will be measured as described in the following section. Groundwater will be collected using new ¼-inch tubing and a check valve. New and clean tubing will be used in each boring. All non-dedicated sampling equipment will be decontaminated prior to use.

The collected groundwater will be immediately poured into the appropriate containers for laboratory analyses as summarized in Table 11. The samples collected for soluble metal analysis will be filtered. Measurement for pH will be performed in the field. Note that groundwater sampled by this technique may contain sediments, as grab groundwater samples are collected from a temporary screen lowered into the formation and no “filter pack and well development” takes place.

10.2.2 Water Level Measurement

The depth to the water table will be measured to the nearest 1/100 of a foot using an electronic water level meter. The water level meter works on the principle of conductivity, and it is typically built with both a light and audible alarm being activated when the probe (or tip) contacts the water. The tip of the meter will be decontaminated (refer to Section 10.2.4), and slowly lowered into the well casing for RS-25 or into the opening of the Geoprobe. The depth will be measured relative to the surveyed elevation point on the well for RS-25 and at the ground level for the Geoprobe borings. If no water is encountered or the well is dry, no sampling can be performed. For RS-25, total well depth will also be measured. The measured depth will be compared to the construction log for RS-25.

10.2.3 Well Groundwater Sampling

As previously described, well RS-25 was sampled in April 2003 for the constituents of concern. Well RS-25 will be monitored to determine water elevation data but will not be sampled.

In the event that RS-25 is sampled in the future to support the HWMF closure, then the procedure described within this paragraph will be followed. The RS-25 well will be purged of three wetted well casing volumes. Purged water will be periodically monitored for temperature, pH and specific conductivity using the appropriate meters, and for turbidity. The pH and specific conductivity meters will be calibrated prior to use, in accordance with manufacturer’s directions. All purged water will be placed in a drum.

If the well was purged dry, than the pH, conductivity and temperature will be measured on the removed water. The well will be allowed to recover to at least 80% or 1 hour prior to sampling.

After field parameters have stabilized and the required volume of water removed, then a sample will be collected using a decontaminated bailer. The water will be poured into the appropriate bottles for laboratory analysis as identified in Table 11.

10.2.4 Equipment Decontamination

All equipment used for well purging and sampling will be decontaminated according to the procedures described in Section 8.1.5. The generated water will be containerized for subsequent sampling and disposal. One equipment blank will be collected per day per groundwater sampling for each area (e.g. one per day at T133 area and one per day at T029 area).

10.2.5 Sample Labeling, Packaging and Documentation

All sample bottles will have a label attached. Each sample will be assigned a unique number as follows:

- Well No. – Month – Year
 - Well No.: RS25, or DP25 for the duplicate sample
 - Or Geoprobe No.
 - Number: Sequentially assigned

The sample label will contain the following information:

- Project: HWMF Closure
- Site: Area IV SSFL
- Sample No.: As described above
- Sampler's Name
- Date and time the sample was collected
- Parameters for analysis
- Preservative used

After collection and labeling of the sample containers, they will be immediately placed in a cooler with ice or frozen ice pack in an effort to cool the sample to $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$). The samples will then be delivered or couriered to a state certified analytical laboratory under chain-of-custody procedure, as described in Section 8.1.7. Field documentation will be recorded as described in Section 8.1.8.

10.3 GROUNDWATER ANALYTICAL PROGRAM

A summary of the groundwater sampling program is provided in Table 11 and detection limits for the various analytes are provided in Table 12. The collected groundwater samples will be analyzed at the state certified laboratory for the following compounds of concern:

- Title 22 metals by EPA Method 6010B/7000 series
- hexavalent chromium (T133 only) by EPA Method 7199
- lithium and zirconium by EPA Method 6010B
- sodium and potassium by EPA Method 6010B
- TPH by EPA Method 8015M.
- If TPH is detected, then the sample will also be analyzed for PAHs (EPA Method 8310) and for BTEX (EPA Method 8021).
- One groundwater sample from T133 area and one sample from T029 area will be analyzed for fluoride (EPA Method 340.2), VOCs (EPA Method 8260B) and SVOCs (EPA Method 8270C)
- Total Dissolved Solids (TDS) using EPA Method 160.1
- pH using EPA Method 9040 or field method 150.1

11.0 SOIL REMEDIATION PROCEDURES

11.1 PURPOSE OF REMEDIATION

The objective of the Closure Plan is to document guidelines and procedures to obtain clean closure of the HWMF. Therefore, any soil exceeding the closure performance standard as specified in Section 6.2.2 will be remediated. The goal of the remediation will be to achieve risk-based clean closure for both the T029 and T133 areas.

Soil remediation will be performed by excavation and removal. Confirmation sampling will be performed at the excavated area. Upon confirming that the soil removal goals have been achieved, clean material will be brought in and the excavation will be backfilled. Rocketdyne will coordinate with the DTSC regarding the type and source of backfill material prior to implementation of the backfill step.

Soil removal is presented as the remedial approach for the following reasons:

- Closure time frame: activities performed as part of RCRA closures are preferred to be implemented and completed within the period specified in 22 CCR 66264.113, though extensions can be requested.
- The type of expected contaminants: (e.g., metals and elevated pH): pH is typically buffered quickly within the subsurface environment and metals do not readily migrate; the maximum depth of migration is therefore not expected to be beyond the capabilities of soil removal equipment.
- The maximum depth of potential contaminant migration within the alluvium is the depth of the alluvium/bedrock interface, which is expected to be at a maximum depth of 15 feet in the area of the HWMF. Soils from this depth can be easily excavated using standard equipment.

The pH levels will be used in the field as an indicator parameter to guide the extent of the excavation. Sampling and analysis for pH will be performed in the field. Analysis for metals or other chemicals of concern (if determined to be present through the soil sampling program described in Section 9.0) will be performed in a California state certified laboratory.

If contaminant concentrations exceed the closure performance standard for soil (see Section 6.0) at the alluvium/bedrock interface, then the objective of clean closure cannot be met as bedrock remediation will be beyond the scope of actions under RCRA closure. Further actions under post closure and corrective action may be considered at such time.

11.2 METHODS AND PROCEDURES

This section describes the methods and procedures associated with soil remediation tasks. All soil remediation tasks will be performed in accordance with the Health and Safety Plan (MWH, 2003d). If it is determined that soils must be managed offsite, then all management will be in accordance with the Transportation Plan (MWH, 2003e).

11.2.1 Excavation

Based on the soil analytical results, areas exceeding the closure performance standard will be excavated using a backhoe or similar type equipment. The extent of the excavation will be guided through field testing of soil samples for the indicator parameter pH (refer to Section 11.2.2.1). During the excavation process, application of a light mist of water will be used as a dust suppressant. The excavated material will be stockpiled or placed in Visqueen-lined roll-offs as described in Section 11.2.4. A list of potential equipment to be used is provided in Appendix H.

If groundwater is encountered during the excavation (e.g., at the alluvium/bedrock interface), the excavation area will be dewatered by excavating a “sump area” and placement of a sump pump. The water will be pumped to an above ground tank. Any soil excavated after dewatering will be placed in roll-off boxes. The collected water in the above ground tank will be sampled following procedure described in Section 7.2.4. The collected sample will be analyzed for potential hazardous waste constituents and waste characterization purposes.

For purposes of providing an approximation of the amount of soil that might be excavated, a volume of 2,000 cubic yards is proposed. This volume is just an estimate, based on the type and

areas where wastes were handled. This volume estimate is not based on any analytical data, as no such data exist at this time. If smaller or larger quantities are to be excavated, this fact will not constitute a major change to this Closure Plan, and no further approval would be needed.

11.2.2 Verification Sampling

Two types of verification sampling will be performed during the remediation phase:

1. Soil sampling and field-testing to guide the progress of the excavation.
2. Soil sampling and analysis at a state-certified laboratory to confirm removal of soils exceeding the closure performance standard.

11.2.2.1 Soil Sampling for Field Testing

pH will be used as a field indicator for contamination. Soil samples will be collected at regular intervals during the active excavation phase for pH screening, to guide the extent of the excavation. Samples will be collected from the undisturbed areas of the sidewalls and bottom of the excavation in progress. Sampling may be performed through the equipment bucket. The samples will be placed in a glass container or a plastic bag (Ziploc type) and labeled as described in Section 11.2.6.

Field testing for pH will be performed as follows:

1. Calibrate pH instrument at the beginning, mid-point, and end of the day, as specified by the manufacturer. Use standard solutions of pH 3, 7, and 10. Record the expiration date, lot number, and supplier of the standard pH solutions in the field logbook.
2. Measure the pH of the deionized water to be used for sample preparation, at the beginning of the day.
3. Using a balance, measure 20 grams of soil and place in a glass or plastic container.
4. Add 20 ml of deionized water to the sample and stir well.
5. Let the suspension stand for about 15 minutes and then measure the pH of the supernatant water solution.
6. Record the pH in the field logbook.

11.2.2.2 Soil Sampling for Excavation Verification

Soil samples will be collected and analyzed at a state-certified laboratory to confirm removal of soil material exceeding the closure performance standard. Soil samples will be collected from the bottom and sidewalls of the excavation, The samples will be labeled in accordance with the procedure described in Section 11.2.6.

Samples will be collected at a rate of approximately one sample per 100 square foot of excavation. The exact location of the sample will be measured (for example south wall, 10-foot depth, 10 feet from eastern wall). All collected samples will be analyzed for the parameters that exceeded the closure performance standard.

11.2.3 Backfill

After laboratory confirmation and regulatory concurrence that soils exceeding the closure performance standard have been removed, the excavation will be backfilled. Depending on the backfill volume required, Rocketdyne will either import clean fill or use materials from on-site sources. If onsite sources are preferred, then for consistency purposes regarding environmental restoration activities at the SSFL, Rocketdyne proposes to use backfill material in accordance with the DTSC's September 1998 correspondence provided in Appendix I.

The accepted backfill material will be placed in the excavation, by lifts, and compacted to at least 85 percent of the modified Proctor density. Backfill material will be placed in lifts up to 18 inches. The soil will be wetted to approximately -2 to +3 percentage points from optimum moisture content and compacted using standard compaction techniques that may include vibratory plates, wheel rolling or compaction attachments (such as a compaction wheel or plate) mounted on the excavator's or backhoe's arm. One relative compaction test will be performed for each lift, using the Sand Cone Method (ASTM D1556) or the Drive Tube Method (ASTM D2937). The excavation will be backfilled to existing grade level. The results will be included in the final report.

11.2.4 Soil Management and Disposal

Impacted soil will be excavated based on the soil sampling work described in Section 9.0 and the pH screening results as described in Section 11.2.2.1. Depending on the excavated volume, soils will be either stockpiled or placed in roll-off bins pending sampling and analysis results for disposal characterization. Stockpiled materials will be managed on site in accordance with applicable Federal and State laws and regulations. Similarly, storage in roll-off bins will be performed in compliance with Federal and State laws and regulations. All stored soil will be covered at the end of the day. Offsite transport will be performed as described in the Transportation Plan (MWH, 2003e).

Samples will be collected from the excavated soil at the rate of approximately 4 samples per 500 cubic yards of excavated material. The samples will be placed in glass containers, labeled and shipped to certified laboratory following the procedures described in the following Section 11.2.6. The samples will be identified as described in section 11.2.6. Sample identification will correlate to the specific stockpile sampled.

If these samples exhibit characteristics of a hazardous waste, as defined in 22 CCR 66261, then the material will be handled as a hazardous waste and sent for treatment/disposal at an offsite facility. If these samples do not exhibit characteristics of a hazardous waste, then the material will be handled as non-hazardous waste.

11.2.5 Equipment Decontamination

Equipment used in the active excavation phase and used for sampling will be decontaminated according to the procedures described in Section 8.1.5. The wheels and buckets of the backhoe will be decontaminated on a Visqueen-lined, bermed area. The generated water will be containerized for sampling and disposed of accordingly as stated in Section 7.2.4.

11.2.6 Sample Labeling, Packaging and Documentation

All sample containers will have a label attached. Each sample will be assigned a unique number as follows:

- Area – Excavation Number – Field or Lab Test – Sample Number – Sample Location
 - Area: T029 or T133
 - Excavation Number: Self-explanatory
 - Field or Lab Test: F for Field test, L for certified laboratory test
 - Sample Number: Sequentially assigned, beginning with number 1
 - Sample Location: B for bottom, N for north wall, S for south wall, E for east wall, W for west wall; and depth in feet.

The samples to be collected from the stockpile or roll-off bins will be numbered as follows:

- Area – Pile or Roll-off Number – Sample Number
 - Area: T029 or T133
 - Pile or Roll-off Bin Number: Sequentially assigned, starting with A
 - Sample Number: Sequentially assigned, starting with 1

The labels for the samples to be analyzed at a certified laboratory will contain the following information:

- Project: HWMF Closure
- Site: Area IV SSFL
- Sample No.: As described above
- Sampler's Name
- Date and time the sample was collected
- Parameters for analysis

After collection and labeling of the sample containers, they will be immediately placed in a cooler with ice or frozen ice pack. The samples slated for laboratory analysis will then be delivered or couriered to a state certified analytical laboratory under chain-of-custody documentation, as described in Section 8.1.7. Field documentation will be recorded as described in Section 8.1.8.

11.3 ANALYTICAL METHODS

The soil excavation samples collected for field analysis will be analyzed for pH, as described in Section 11.2.2.1. The soil excavation confirmation samples collected for laboratory analyses will be analyzed for the compounds or parameters that had exceeded the closure performance standard. Excavated soil pile samples will be analyzed for the parameters and compounds that exceeded the closure performance standard and for waste characterization purposes. The soil analytical methods will be those described in Section 9.4 with detection limits provided in Table 12. If off site material is used for backfill, then the soil will be analyzed for the compounds listed in Table 16 to confirm soil quantity.

12.0 CLOSURE COST ESTIMATE AND FINANCIAL RESPONSIBILITY

The owner of the HWMF is the US Department of Energy (DOE). In accordance with CCR Title 22, Section 66264.140(c), the owner is exempt from the requirements of CCR Title 22 Article 8 – Financial Requirements. Therefore, a closure cost estimate and financial assurance are not included in this Closure Plan.

13.0 CLOSURE IMPLEMENTATION SCHEDULE

The schedule presented in Table 17 is proposed for implementation of this Closure Plan at the HWMF, after formal plan approval from the DTSC. Start of this schedule will occur within four weeks after receipt of DTSC's formal approval, to allow time for mobilization including contract negotiations with subcontractors and procurement of required equipment and materials.

It is anticipated that closure of the HWMF will be completed within 26 weeks. This schedule estimate has been prepared assuming that a relatively minimal amount of soil will require excavation, and that excavation, verification sampling and backfill would be performed in the allocated time. This time is in conformance with the closure period provided in CCR Title 22 Section 66264.113. If due to unforeseen conditions, such as requirement for removal of a larger volume of soil, additional time is needed, then an extension to the closure period will be requested, in accordance with CCR Title 22 Section 66264.113(c).

A professional engineer certified in the State of California will oversee closure activities and monitor closure performance.

14.0 CLOSURE CERTIFICATION REPORT REQUIREMENT

A Closure Report will be prepared and submitted to the DTSC. The report will summarize all activities performed for Closure of the HWMF, as described in this Closure Plan and as implemented in the field. The report will also include certification by an independent registered California Professional Engineer as required by CCR Title 22 Section 66264.115.

A general outline of the Closure Report is provided below.

Introduction

Description of HWMF closure activities

Modifications to the approved Closure Plan

Decontamination Procedure, Sampling, Analytical Data and Disposition of Waste Material

Subsurface Investigation

Results of Subsurface Investigation, including laboratory reports and QA/QC demonstration

Analysis of Subsurface Data, including statistical analysis and performance of risk assessment, as applicable

Remediation Activities and Sampling Data, as applicable, including laboratory reports and QA/QC demonstration

Conclusion

Recommendation/Closure Certification

Laboratory reports, waste manifests, field engineer observations, and photographs will be included as appendices to the Closure Report.

Documentation supporting closure activities will be maintained at the SSFL and made available to the DTSC for review upon request. These documents may include the following:

- Laboratory reports and QA/QC reports
- Manifests showing disposition of the waste
- Field observation of the Professional Engineer overseeing closure activities
- Photographs
- Copy of the Closure Report

15.0 SITE SECURITY

Entry to the SSFL is restricted, and only authorized personnel can enter the complex. In addition, access to the HWMF Building T029 and Building T133 areas is currently restricted. A fence with locked access gate is present at each area. During implementation of the closure activities, these fences will be removed. However, the road leading to each building area will be cordoned off. Placards indicating that the area is restricted to authorized personnel only will be maintained at the site until the completion of closure activities.

16.0 CONTINGENT POST CLOSURE PLAN FOR TANK T-1

This contingent post closure plan is provided for tank T-1 at the building T133 area per 22 CCR 66264.197(c) because the tank used prior to installation of the T-1 tank system (e.g., the sump-pit) did not have secondary containment. As required by 22 CCR 66264.197(c) (5), the contingent post closure plan must consider such a tank system (e.g., without secondary containment) a landfill and comply with landfill closure and post closure requirements.

This contingent post closure plan is provided for the scenario where clean closure can not be achieved at T133 due to releases from the T-1 tank area. If clean closure is achieved, then no further post closure action will be required. If clean closure can not be achieved, then a revised version of this contingent post closure plan will be submitted to the DTSC to reflect actual conditions.

16.1 POST CLOSURE NOTIFICATION

Pursuant to 22 CCR 66264.119, notifications and deed restrictions shall be submitted within 60 days after certification of closure of Building T133. A notification shall be submitted to the local zoning authority (or other authority with jurisdiction over local land use) and the DTSC describing the type, location and quantity of hazardous wastes disposed within the building T133 area. Additionally, a notation on the deed to the facility property (or other instrument normally examined during a title search) that will “in perpetuity notify any potential purchaser of the property” that: (1) the land has been used to manage hazardous wastes, and (2) its use is restricted under CCR Title 22, Division 4.5, Chapter 14, Article 7. The deed notation will also state that the survey plot and record (of the type, location and quantity of hazardous wastes disposed of in the area) has been filed with the local zoning authority (or other authority with jurisdiction over local land use) and with the DTSC.

A certification, signed by the owner, will be submitted to the DTSC when the deed notation has been recorded. A copy of the document in which the deed notation has been placed will be included with the signed certification submittal to the DTSC.

16.2 CLOSURE AND POST CLOSURE CARE AS A LANDFILL

If clean closure cannot be achieved at the building T133 area due to releases from the tanks, then post-closure care pursuant to 22 CCR 66264.197(b) will be implemented. As such, post closure care will meet the closure and post closure requirements that apply to landfills (22 CCR 66264.310). The closure and post closure tasks that will be implemented will include the following:

1. COVER. The former tank location areas will be covered with a final cover designed and constructed to:
 - Prevent downward entry of water into the closed unit throughout a period of at least 100 years.
 - Function with minimum maintenance.
 - Promote drainage and minimize erosion or abrasion of the cover.
 - Accommodate settling and subsidence so that the cover's integrity is maintained.
 - Accommodate earthquake forces so that the cover integrity is maintained.
 - Have a permeability less than or equal to the permeability of any bottom liner or natural subsoils present.
 - Conform to the provisions of 22 CCR 66264.228(e) through (r), closure and post closure care requirements for surface impoundments, unless it is demonstrated to the DTSC that these requirements are not necessary to protected public health, water quality or other environmental quality and the DTSC approves through issuance of a variance.
2. COVER MAINTENANCE. The integrity and effectiveness of the final cover will be maintained including repairs. Routine inspections of the cover will be performed using a checklist of required observations and measurements. Notes will be made regarding needed maintenance and repairs and corrective actions implemented.

3. RUN-ON AND RUN-OFF PREVENTION. Surface water control measures will be designed and implemented to ensure that there is no erosion or other damage to the final cover.
4. SURVEY BENCHMARKS. Benchmarks will be installed and surveyed. These benchmarks will be protected and maintained; and monitored to ensure cover subsidence does not occur.
5. GROUNDWATER MONITORING. A groundwater quality monitoring program will be designed and implemented as required by Article 6 of Chapter 14 (CCR, Title 22, Division 4.5).

16.3 CONTINGENT POST CLOSURE CARE COST ESTIMATE AND FINANCIAL RESPONSIBILITY

The owner of the HWMF is the US Department of Energy (DOE). In accordance with 22 CCR 66264.140(c), the owner is exempt from the requirements of CCR Title 22 Article 8 – Financial Requirements. Therefore, a post closure cost estimate and financial assurance are not included in this contingent post closure plan.

16.4 FACILITY CONTACTS DURING POST CLOSURE PERIOD

The facility contact during closure activities is as follows:

Mr. Brian Sujata
Project Manager, DOE Site Closure
Rocketdyne Propulsion and Power
The Boeing Company
Tel: (818) 586-6043

16.5 REVISED POST CLOSURE PLAN SUBMITTAL

More details regarding the post closure care activities will be provided if clean closure is not achieved in a revised post closure plan for DTSC submittal. This revised post closure plan will reflect the site-specific information generated through implementation of the closure work. This revised post closure plan will address other tank systems, beyond tank T-1, if they are confirmed

to have contributed to releases which can not be remediated within the scope of the closure effort. The revised post closure plan will be submitted in accordance with 22 CCR 66264.118.

17.0 REFERENCES

- Abrahms, G. : Letter from Mr. G Abrahms of the DTSC to Mr. M. Sullivan of Boeing, SRAM...
- Chandler, P., 1998: Letter from Mr. P Chandler of the DTSC to Mr. S. Lafflam of Boeing, Concentration of Inorganic Constituents in Imported Soil for Use as Fill Material at the Former Sodium Disposal Facility, Department of Energy, The Boeing Company, Santa Susana Field Laboratory, Simi Hill, California, EPA ID Number CAD000629972, September 9.
- I. P. Colburn, L. R. Saul and A. A. Almgren, "The Chatsworth Formation: A New Formation for the Upper Cretaceous Strata of the Simi Hills, California," in M. H. Link, R. L. Squires and I. P. Colburn eds., *Simi Hills Cretaceous Turbidites, Southern California*, Pacific Section, Society of Economic Paleontologists and Mineralogists, 1981.
- Department of Toxic Substances Control (DTSC), 1997. Selecting Inorganic Constituents as Chemicals of Potential Concern at Risk Assessments at Hazardous Waste Sites and Permitted Facilities. February 2003.
- DTSC, 2002. Permit Writer Instructions for Closure of Treatment and Storage Facility, October 2002.
- Groundwater Resources Consultants, Inc. (GRC), 1990. Assessment of Potential Soil Contamination in the Vicinity of Building T-133 Hazardous Waste Treatment Facility at the Rockwell International Corporation, Rocketdyne Division, Santa Susana Field Laboratory, Ventura County, California, July 27.
- GRC, 1992: Results of Collection and Analysis of Rock Cores, Santa Susana Field Laboratory, Rockwell International Corporation, Rocketdyne Division, Canoga Park, California, May 4.
- GRC, 1998: Annual Groundwater Monitoring Report, Santa Susana Field Laboratory, 1997, Boeing North American, Inc., Rocketdyne Propulsion & Power, Ventura County, California, February 25.
- Haley & Aldrich, 2003. Annual Report of Groundwater Monitoring. February 2003.
- Montgomery Watson Harza (MWH), 2003a. Spring and Seep Sampling and Analysis Report, Santa Susana Field Laboratory, Ventura County, California, March 2003.
- MWH, 2003b. Perchlorate Characterization Work Plan, Revision 1, Santa Susana Field Laboratory, Ventura County, California, December 5.

MWH, 2003c. Draft SRAM, Revision 1, Santa Susana Field Laboratory, Ventura County, California, September 2003.

MWH, 2003d. Health and Safety Plan for Hazardous Waste Management Facility Closure
Santa Susana Field Laboratory, Area IV, Ventura County, California, August 2003

MWH, 2003e. Transportation Plan for Hazardous Waste Management Facility Closure
Santa Susana Field Laboratory, Area IV, Ventura County, California, August 2003.

Ogden, 2000: Standardized Risk Assessment Methodology (SRAM) Work Plan, Superficial
Operable Unit, Santa Susana Field Laboratory, Ventura County, California, June.

United States Environmental Protection Agency (USEPA), 1986: Test Methods for Evaluating
Solid Waste, SW-846, Third Edition, November.

USEPA, 1998. Memorandum From Elizabeth Cotsworth (Acting Director, USEPA Office of
Solid Waste) to Senior Policy Advisors (Regions I – X), March 16.

LIST OF TABLES

Table 1	Well Locations in Vicinity of Building T029 and T133
Table 2	Water Level Data (2000-2002) for PZ-112, RD-16, RD-19, RS-24 and RS-25
Table 3	Well RS-25 April 2003 Sampling Results Summary
Table 4	Preliminary Background Data For Metals In Groundwater
Table 5	Background Metal Concentrations in Soil
Table 6	HWMF Spill History
Table 7	List of Chemicals of Concern (COC) – Hazardous Waste Management Facility
Table 8	Analytical Results Summary for Tank T-1 and Tank T-3 Contents
Table 9	Closure and Sampling Objectives, T029 – Hazardous Waste Storage Building
Table 10	Closure and Sampling Objectives, T133 – Hazardous Waste Treatment Building
Table 11	Analytical Program
Table 12	Detection Limits for Proposed Analytical Methods – Soil and Groundwater Sampling Program
Table 13	Soil Sampling – T029 Area
Table 14	Soil Sampling – T133 Area
Table 15	Soil Sampling – Offsite of T133 Area
Table 16	Analytical Program for Backfill Material
Table 17	Closure Implementation Schedule

TABLE 1
WELL LOCATIONS IN VICINITY OF
BUILDING T029 AND T133
HWMF Closure
Santa Susana Field Laboratory
Ventura County, California

Area	Well No.	Well Depth (ft bgs)	Screen Interval (ft bgs)	Measuring Point Elevation (ft msl)	Location/Distance	Comment
T029	RS-24	8.5	4 – 8.5	1809.24	300 ft to the Southwest	Shallow Zone Well
	RS-11	17.5	10-17.5	1789.30	1300 ft to the Southwest	Shallow Zone Well
	RD-16	220	Open Hole	1808.99	300 ft to the Southwest	Chatsworth Formation Well
	PZ-107	11	5-10	1793.62	1300 ft to the Southwest	Shallow Zone Well
	PZ-110	17.5	7-17	1818.90	1250 ft to the Southwest	Shallow Zone Well
	PZ-111	20	7.5-17.5	1794.90	750 ft to the Southwest	Shallow Zone Well
	PZ-112	35	24-34	1829.14	250 ft to the west	Shallow Zone Well
	PZ-113	15	7-15	1823.68	400 ft to the Northeast	Shallow Zone Well
	PZ-052	30	18.9-28.9	1790.72	1500 ft to the Southwest	Shallow Zone Well
	PZ-055	29.5	19-29	1818.40	475 ft to the Southeast	Shallow Zone Well
T133	RS-25	13.5	8.5 – 13.5	1862.71	3 ft to the North	Shallow Zone Well
	RD-19	135	Open Hole	1853.13	150 ft to the Northwest	Chatsworth Formation Well
	RD-27	150	Open Hole	1841.67	400 ft to the Southwest	Chatsworth Formation Well
	RD-17	125	Open Hole	1836.00	550 ft to the South	Chatsworth Formation Well
	RS28	19	14 – 19	1768.59	650 ft to the Southwest	Shallow Zone Well
	RD30	75	Open Hole	1768.69	650 ft to the Southwest	Chatsworth Formation Well
	RD63	230	Open Hole	1764.85	750 ft to the Southwest	Chatsworth Formation Well
	RD18	240	Open Hole	1839.49	950 ft to the Northeast	Chatsworth Formation Well
	PZ-108	30	16-26	1763.01	1100 ft to the Southwest	Shallow Zone Well
	PZ-116	34	22-32	1827.78	800 ft to the Southwest	Shallow Zone Well

Wells selected for water level data information relevant to T029 and T133.
ft bgs ft below ground surface
ft msl ft above mean sea level

Source: Haley & Aldrich, 2003
For Additional Well Construction Information, refer to Table I – Well Construction Data, Annual Groundwater Monitoring Report Santa Susana Field Laboratory, 2002, prepared by Haley & Aldrich, Dated February 2003.

TABLE 2
WATER LEVEL DATA (2000 - 2002) FOR PZ-112, RD-16, RD-19, RS-24 and RS-25
HWMF Closure
Santa Susana Field Laboratory
Ventura County, California

Well ID	Date Of Measurement	Reference Point Elevation (feet above MSL)	Depth to Water (ft)	Water Level Elevation (feet above MSL)
PZ-112	01/22/01	1829.14	NE	
PZ-112	01/23/01	1829.14	NE	
PZ-112	01/24/01	1829.14	NE	
PZ-112	01/25/01	1829.14	NE	
PZ-112	01/26/01	1829.14	NE	
PZ-112	01/27/01	1829.14	NE	
PZ-112	01/29/01	1829.14	NE	
PZ-112	01/30/01	1829.14	NE	
PZ-112	01/31/01	1829.14	NE	
PZ-112	02/01/01	1829.14	NE	
PZ-112	02/02/01	1829.14	NE	
PZ-112	02/11/01	1829.14	NE	
PZ-112	02/12/01	1829.14	NE	
PZ-112	02/13/01	1829.14	NE	
PZ-112	02/14/01	1829.14	NE	
PZ-112	02/15/01	1829.14	NE	
PZ-112	02/16/01	1829.14	NE	
PZ-112	02/17/01	1829.14	NE	
PZ-112	02/18/01	1829.14	NE	
PZ-112	02/19/01	1829.14	NE	
PZ-112	02/20/01	1829.14	NE	
PZ-112	02/21/01	1829.14	NE	
PZ-112	02/22/01	1829.14	NE	
PZ-112	02/23/01	1829.14	NE	
PZ-112	02/26/01	1829.14	NE	
PZ-112	02/27/01	1829.14	NE	
PZ-112	02/28/01	1829.14	NE	
PZ-112	03/01/01	1829.14	NE	
PZ-112	03/02/01	1829.14	NE	
PZ-112	03/03/01	1829.14	NE	
PZ-112	03/05/01	1829.14	NE	
PZ-112	03/06/01	1829.14	NE	
PZ-112	03/07/01	1829.14	NE	
PZ-112	03/08/01	1829.14	NE	
PZ-112	03/09/01	1829.14	NE	
PZ-112	03/10/01	1829.14	NE	
PZ-112	03/12/01	1829.14	NE	
PZ-112	03/13/01	1829.14	NE	
PZ-112	03/14/01	1829.14	NE	
PZ-112	03/15/01	1829.14	NE	
PZ-112	03/16/01	1829.14	NE	
PZ-112	03/22/01	1829.14	NE	
PZ-112	03/29/01	1829.14	NE	
PZ-112	04/05/01	1829.14	NE	

TABLE 2
WATER LEVEL DATA (2000 - 2002) FOR PZ-112, RD-16, RD-19, RS-24 and RS-25
HWMF Closure
Santa Susana Field Laboratory
Ventura County, California

Well ID	Date Of Measurement	Reference Point Elevation (feet above MSL)	Depth to Water (ft)	Water Level Elevation (feet above MSL)
PZ-112	04/09/01	1829.14	NE	
PZ-112	04/11/01	1829.14	NE	
PZ-112	04/13/01	1829.14	NE	
PZ-112	04/16/01	1829.14	NE	
PZ-112	04/19/01	1829.14	NE	
PZ-112	04/24/01	1829.14	NE	
PZ-112	04/27/01	1829.14	NE	
PZ-112	04/30/01	1829.14	NE	
PZ-112	05/03/01	1829.14	NE	
PZ-112	05/11/01	1829.14	NE	
PZ-112	05/18/01	1829.14	NE	
PZ-112	06/22/01	1829.14	NE	
PZ-112	06/26/01	1829.14	NE	
PZ-112	11/14/01	1829.14	23.52	1805.62
PZ-112	11/15/01	1829.14	NM	
PZ-112	11/16/01	1829.14	23.46	1805.68
PZ-112	11/17/01	1829.14	23.65	1805.49
PZ-112	11/21/01	1829.14	23.58	1805.56
PZ-112	11/26/01	1829.14	23.78	1805.36
PZ-112	11/28/01	1829.14	23.83	1805.31
PZ-112	11/30/01	1829.14	23.77	1805.37
PZ-112	12/03/01	1829.14	23.86	1805.28
PZ-112	12/05/01	1829.14	24.17	1804.97
PZ-112	12/07/01	1829.14	24.16	1804.98
PZ-112	12/10/01	1829.14	23.81	1805.33
PZ-112	12/12/01	1829.14	24.15	1804.99
PZ-112	12/21/01	1829.14	24.26	1804.88
PZ-112	01/04/02	1829.14	24.7	1804.44
PZ-112	01/11/02	1829.14	24.9	1804.24
PZ-112	01/18/02	1829.14	24.87	1804.27
PZ-112	01/31/02	1829.14	25.27	1803.87
PZ-112	02/07/02	1829.14	25.31	1803.83
PZ-112	02/14/02	1829.14	25.23	1803.91
PZ-112	02/21/02	1829.14	25.57	1803.57
PZ-112	02/28/02	1829.14	25.32	1803.82
PZ-112	03/15/02	1829.14	25.7	1803.44
PZ-112	03/22/02	1829.14	25.83	1803.31
PZ-112	04/12/02	1829.14	26.43	1802.71
PZ-112	04/17/02	1829.14	26.49	1802.65
PZ-112	05/15/02	1829.14	26.75	1802.39
PZ-112	06/19/02	1829.14	DRY	
PZ-112	07/18/02	1829.14	28.01	1801.13
PZ-112	08/26/02	1829.14	28.63	1800.51

TABLE 2
WATER LEVEL DATA (2000 - 2002) FOR PZ-112, RD-16, RD-19, RS-24 and RS-25
HWMF Closure
Santa Susana Field Laboratory
Ventura County, California

Well ID	Date Of Measurement	Reference Point Elevation (feet above MSL)	Depth to Water (ft)	Water Level Elevation (feet above MSL)
RD-16	02/01/00	1808.99	46.88	1762.11
RD-16	05/02/00	1808.99	42.55	1766.44
RD-16	08/02/00	1808.99	45.25	1763.74
RD-16	11/02/00	1808.99	46.70	1762.29
RD-16	01/31/01	1808.99	46.47	1762.52
RD-16	05/01/01	1808.99	39.33	1769.66
RD-16	08/07/01	1808.99	43.57	1765.42
RD-16	10/23/01	1808.99	45.99	1763
RD-16	10/23/01	1808.99	45.99	1763
RD-19	02/01/00	1853.13	76.68	1776.45
RD-19	05/02/00	1853.13	73.59	1779.54
RD-19	08/02/00	1853.13	73.86	1779.27
RD-19	11/01/00	1853.13	76.26	1776.87
RD-19	01/31/01	1853.13	78.00	1775.13
RD-19	05/01/01	1853.13	65.34	1787.79
RD-19	08/07/01	1853.13	69.03	1784.1
RD-19	10/23/01	1853.13	72.98	1780.15
RD-19	10/23/01	1853.13	72.98	1780.15
RS-24	02/01/00	1809.24	DRY	
RS-24	05/02/00	1809.24	DRY	
RS-24	08/02/00	1809.24	DRY	
RS-24	11/02/00	1809.24	DRY	
RS-24	01/31/01	1809.24	DRY	
RS-24	05/01/01	1809.24	DRY	
RS-24	08/07/01	1809.24	DRY	
RS-24	10/23/01	1809.24	DRY	
RS-24	10/23/01	1809.24	DRY	
RS-25	02/01/00	1862.71	DRY	
RS-25	05/02/00	1862.71	DRY	
RS-25	08/02/00	1862.71	DRY	
RS-25	11/01/00	1862.71	DRY	
RS-25	01/31/01	1862.71	13.31	1849.4
RS-25	05/01/01	1862.71	13.31	1849.4
RS-25	08/07/01	1862.71	DRY	
RS-25	10/23/01	1862.71	DRY	
RS-25	10/23/01	1862.71	DRY	
Footnote	Footnote Explanation			
(---)	No data available/not applicable		NM	Not Measured
ft	Feet		NE	Not Existant at specified date
DRY	DRY			
MSL	Mean Sea Level			

TABLE 3
WELL RS-25 APRIL 2003 SAMPLING RESULTS SUMMARY
HWMF Closure
Santa Susana Field Laboratory
Ventura County, California

Analyte	Concentration	Units	Detection Limit
Calcium	81000	UG/L	39.12
Sodium	63000	UG/L	117
Magnesium	39000	UG/L	11.8
Potassium	3200	UG/L	114.52
Barium	140	UG/L	12.03
Aluminum	100	UG/L	98.83
Iron	100	UG/L	34.29
Boron	34.5	UG/L	29.2
Vanadium	8.4	UG/L	1.94
Manganese	7.7	UG/L	3.1
pH	6.47	pH Units	0.1
Chromium	0.97	UG/L	0.63
Fluoride	0.334	MG/L	
1,1,1,2-Tetrachloroethane	<5	UG/L	5
1,1,1-Trichloroethane	<5	UG/L	5
1,1,2,2-Tetrachloroethane	<5	UG/L	5
1,1,2-Trichloroethane	<5	UG/L	5
1,1,2-Trichlorotrifluoroethane	<5	UG/L	5
1,1-Dichloroethane	<5	UG/L	5
1,1-Dichloroethene	<5	UG/L	5
1,2,3-Trichloropropane	<5	UG/L	5
1,2,4-Trichlorobenzene	<5	UG/L	5
1,2,4-Trimethylbenzene	<5	UG/L	5
1,2-Dibromo-3-Chloropropane	<5	UG/L	5
1,2-Dichlorobenzene	<5	UG/L	5
1,2-Dichlorobenzene	<5	UG/L	5
1,2-Dichloroethane	<5	UG/L	5
1,2-Dichloroethene (total)	<5	UG/L	5
1,2-Dichloropropane	<5	UG/L	5
1,3,5-Trimethylbenzene	<5	UG/L	5
1,3-Dichlorobenzene	<5	UG/L	5
1,3-Dichlorobenzene	<5	UG/L	5

TABLE 3
WELL RS-25 APRIL 2003 SAMPLING RESULTS SUMMARY

HWMF Closure
Santa Susana Field Laboratory
Ventura County, California

Analyte	Concentration	Units	Detection Limit
1,4-Dichlorobenzene	<5	UG/L	5
1,4-Dichlorobenzene	<5	UG/L	5
2,2'-oxybis(1-Chloropropane)	<5	UG/L	5
2,4,5-Trichlorophenol	<10	UG/L	10
2,4,6-Trichlorophenol	<5	UG/L	5
2,4-Dichlorophenol	<5	UG/L	5
2,4-Dimethylphenol	<5	UG/L	5
2,4-Dinitrophenol	<10	UG/L	10
2,4-Dinitrotoluene	<5	UG/L	5
2,6-Dinitrotoluene	<5	UG/L	5
2-Butanone	<5	UG/L	5
2-Chloroethylvinyl ether	<50	UG/L	50
2-Chloronaphthalene	<5	UG/L	5
2-Chlorophenol	<5	UG/L	5
2-Hexanone	<5	UG/L	5
2-Methylnaphthalene	<5	UG/L	5
2-Methylphenol	<5	UG/L	5
2-Nitroaniline	<10	UG/L	10
2-Nitrophenol	<5	UG/L	5
3,3'-Dichlorobenzidine	<5	UG/L	5
3-Nitroaniline	<10	UG/L	10
4,6-Dinitro-2-methylphenol	<10	UG/L	10
4-Bromophenyl-phenylether	<5	UG/L	5
4-Chloro-3-Methylphenol	<5	UG/L	5
4-Chloroaniline	<5	UG/L	5
4-Chlorophenyl-phenylether	<5	UG/L	5
4-Methyl-2-Pentanone	<5	UG/L	5
4-Methylphenol	<5	UG/L	5
4-Nitroaniline	<10	UG/L	10
4-Nitrophenol	<10	UG/L	10
Acenaphthene	<5	UG/L	5
Acenaphthylene	<5	UG/L	5

MG/L milligrams per liter
UG/L micrograms per liter

TABLE 3
WELL RS-25 APRIL 2003 SAMPLING RESULTS SUMMARY
HWMF Closure
Santa Susana Field Laboratory
Ventura County, California

Analyte	Concentration	Units	Detection Limit
Acetone	<5	UG/L	5
Anthracene	<5	UG/L	5
Antimony	<5.6	UG/L	5.6
Arsenic	<6.34	UG/L	6.94
Azobenzene	<5	UG/L	5
Benzene	<5	UG/L	5
Benzo(a)anthracene	<5	UG/L	5
Benzo(a)pyrene	<5	UG/L	5
Benzo(b)fluoranthene	<5	UG/L	5
Benzo(g,h,i)perylene	<5	UG/L	5
Benzo(k)fluoranthene	<5	UG/L	5
Benzoic Acid	<10	UG/L	10
Benzyl Alcohol	<5	UG/L	5
Beryllium	<0.28	UG/L	0.28
bis(-2-Chloroethoxy)methane	<5	UG/L	5
bis(-2-Chloroethyl)Ether	<5	UG/L	5
bis(2-Ethylhexyl)phthalate	<5	UG/L	5
Bromodichloromethane	<5	UG/L	5
Bromoform	<5	UG/L	5
Bromomethane	<5	UG/L	5
Butylbenzylphthalate	<5	UG/L	5
C08-C11 (Gasoline Range)	<0.1	MG/L	0.1
C11-C14 (Kerosene Range)	<0.1	MG/L	0.1
C14-C20 (Diesel Range)	<0.1	MG/L	0.1
C20-C30 (Lubricant Oil Range)	<0.1	MG/L	0.1
Cadmium	<0.31	UG/L	0.31
Carbazole	<5	UG/L	5
Carbon Disulfide	<5	UG/L	5
Carbon Tetrachloride	<5	UG/L	5

MG/L milligrams per liter
 UG/L micrograms per liter

TABLE 3
WELL RS-25 APRIL 2003 SAMPLING RESULTS SUMMARY
HWMF Closure
Santa Susana Field Laboratory
Ventura County, California

Analyte	Concentration	Units	Detection Limit
Chlorobenzene	<5	UG/L	5
Chloroethane	<5	UG/L	5
Chloroform	<5	UG/L	5
Chloromethane	<5	UG/L	5
Chlorotrifluoroethene	<5	UG/L	5
Chrysene	<5	UG/L	5
cis-1,2-Dichloroethene	<5	UG/L	5
cis-1,3-Dichloropropene	<5	UG/L	5
Cobalt	<1.03	UG/L	1.03
Copper	<2.96	UG/L	2.96
Dibenzo(a,h)anthracene	<5	UG/L	5
Dibenzofuran	<5	UG/L	5
Dibromochloromethane	<5	UG/L	5
Dichlorodifluoromethane	<5	UG/L	5
Diethylphthalate	<5	UG/L	5
Dimethylphthalate	<5	UG/L	5
Di-n-butylphthalate	<5	UG/L	5
Di-n-octylphthalate	<5	UG/L	5
Ethylbenzene	<5	UG/L	5
Fluoranthene	<5	UG/L	5
Fluorene	<5	UG/L	5
Hexachlorobenzene	<5	UG/L	5
Hexachlorobutadiene	<5	UG/L	5
Hexachlorocyclopentadiene	<10	UG/L	10
Hexachloroethane	<5	UG/L	5
Hexavalent Chromium	<50	UG/L	50
Indeno(1,2,3-cd)pyrene	<5	UG/L	5
Isophorone	<5	UG/L	5
Lead	<3.45	UG/L	3.45
Lithium	<20	UG/L	20
m,p-Xylenes	<5	UG/L	5

MG/L milligrams per liter
 UG/L micrograms per liter

TABLE 3
WELL RS-25 APRIL 2003 SAMPLING RESULTS SUMMARY
HWMF Closure
Santa Susana Field Laboratory
Ventura County, California

Analyte	Concentration	Units	Detection Limit
Methylene Chloride	<5	UG/L	5
Molybdenum	<1.56	UG/L	1.56
Naphthalene	<5	UG/L	5
Nickel	<2.61	UG/L	2.61
Nitrobenzene	<5	UG/L	5
N-Nitrosodimethylamine	<5	UG/L	5
N-Nitroso-di-n-propylamine	<5	UG/L	5
N-nitrosodiphenylamine (1)	<5	UG/L	5
o-Xylene	<5	UG/L	5
Pentachlorophenol	<10	UG/L	10
Phenanthrene	<5	UG/L	5
Phenol	<5	UG/L	5
Pyrene	<5	UG/L	5
Pyridine	<5	UG/L	5
Selenium	<6.73	UG/L	6.73
Silver	<0.58	UG/L	0.58
Styrene	<5	UG/L	5
Tetrachloroethene	<5	UG/L	5
Thallium	<7.44	UG/L	7.44
Toluene	<5	UG/L	5
trans-1,2-Dichloroethene	<5	UG/L	5
trans-1,3-Dichloropropene	<5	UG/L	5
Trichloroethene	<5	UG/L	5
Trichlorofluoromethane	<5	UG/L	5
Vinyl Chloride	<5	UG/L	5
Xylenes (total)	<5	UG/L	5
Zinc	<26.68	UG/L	26.68
Zirconium	<5	UG/L	20

MG/L milligrams per liter
 UG/L micrograms per liter

TABLE 4
PRELIMINARY BACKGROUND DATA FOR METALS IN GROUNDWATER
HWMF Closure
Santa Susana Field Laboratory
Ventura County, California

Analyte		Units
Aluminum	none	ug/L
Antimony	2.6	ug/L
Arsenic	11	ug/L
Barium	320	ug/L
Beryllium	0.6	ug/L
Boron	340	ug/L
Cadmium	3.0	ug/L
Chromium	14	ug/L
Cobalt	3.7	ug/L
Copper	10	ug/L
Lead	18	ug/L
Manganese	550	ug/L
Mercury	0.32	ug/L
Molybdenum	2.5	ug/L
Nickle	25	ug/L
Selenium	6.0	ug/L
Silver	3.5	ug/L
Stronium	1,000	ug/L
Thallium	0.51	ug/L
Tin	0.4	ug/L
Vanadium	4.7	ug/L
Zinc	5,300	ug/L

Note:

Based on dissolved metals as submitted electronically to DTSC in 2002 and in the SRAM Revision 1 document (MWH, 2003c) this data is currently under DTSC review.

TABLE 5
BACKGROUND METAL CONCENTRATIONS IN SOIL
HWMF Closure
Santa Susana Field Laboratory
Ventura County, California

CONSTITUENT	CONCENTRATION ⁽¹⁾ (ppm)
Aluminum	1.8E+04
Antimony	8.7E+00
Arsenic	1.6E+01
Barium	3.6E+02
Beryllium	1.1E+00
Boron	1.3E+01
Cadmium	7.3E+00
Chromium	9.6E+01
Cobalt	1.2E+01
Copper	7.2E+01
Lead	3.4E+01
Manganese	6.1E+02
Mercury	9.0E-02
Molybdenum	5.4E+00
Nickel	8.2E+01
Selenium	1.1E+00
Silver	1.3E+00
Thallium	2.5E-01
Vanadium	5.7E+01
Zinc	1.2E+02

⁽¹⁾ Determined as the maximum concentration from the DTSC-approved background data set, with the exception of boron and manganese. Background concentrations for boron and manganese were derived following DTSC guidance using all site data and cumulative probability distributions to identify two discrete populations (background and non-background), with the maximum boron or manganese concentrations within the background population representing maximum background.

TABLE 6
HWMF SPILL HISTORY
HWMF Closure
Santa Susana Field Laboratory
Ventura County, California

History of Spills at T133 Area				
Date	Release-Description	Material Released	Estimated Volume (gallons)	Cleanup Response/Investigations
Oct-90	Faulty Flange at Tank T-3. A release onto the ground surface occurred when solution was pumped from T-1 to T-3. At the time T-3 was located outside the bermed area, just to the north of T133.	caustic solution	5 to 10	Contaminated soil was removed and transported off-site. T-3 has since been placed inside the bermed area at the location noted on figure ? This area will be further characterized as part of the closure plan (See section 8.2.4).
16-Feb-89	Pin-hole leak from Tank T-3 (I assume from the Oct 90 description that the tank was located outside the bermed area).	caustic solution	10 to 230	This area is proposed to be further characterized as part of the closure plan (See section 8.2.2 and 8.2.4?)
1-Sep-88	A PVC drain line between the treatment room and hydroxide tank (T-1) failed, releasing sodium hydroxide into a temporary drainage ditch on the north side of T-133.	caustic solution	60	A cast iron pipe replaced the PVC drainage line. This area is proposed to be further characterized as part of the closure plan. (See section 8.2.2)
Feb - May 1988				Soil and groundwater Investigation was conducted to address the previous releases. Well RS-25 was installed to evaluate shallow groundwater impact.
27-Nov-87	A spill occurred in the area immediately north of the HWMF bermed area as a result of a temporary tank placed at that location was used while tank T-1 was being refurbished.	caustic solution	6 to 30	This area is proposed to be further characterized as part of the closure plan (See section 8.2.4)
Apr-87	During the replacement of Tank T-3 soil samples were collected and pH measured between 10 to 11. (I assume from the Oct 90 description that the tank was located outside the bermed area).	caustic solution	unknown	This area is proposed to be further characterized as part of the closure plan (See section 8.2.2)
Feb-86	An expandable plug worked loose from it's housing releasing 2.4% hydroxide solution from an underground drain pipe into an asphalt paved 300-foot long flood control culvert. The culvert is located on the west side of Building 041 and south side of Building 043?	caustic solution	1,000	The culvert was flushed with additional water and vacuumed. This resulted in a recovered 2,500-gallons of 0.02% solution. The drainage pipe was plugged at T133 after this incident. The culvert area will be further characterized as part of the closure plan (See section 8.2.4)
27-Sep-85	A spill occurred due to a faulty drain line. The exact location of this spill was not determined from the records reviewed. However, the likely areas for such a release to have occurred would be T-1, T-3 or the area between the treatment chamber and the tank T-1.	caustic solution	100- gallons	These areas will be further characterized as part of the closure plan (See sections 8.2.2 and 8.2.4)
13-Apr-84	A spill occurred due to a faulty drain line. The exact location of this spill was not determined from the records reviewed. The volume of material released suggests that the spill must have occurred near a caustic solution tank (T-1 or T-3. At this time T-1 consisted of the concrete lined sump pit and T-3 was located north of the bermed area.	caustic solution	1,500 - gallons	These areas will be further characterized as part of the closure plan (See sections 8.2.2 and 8.2.4)

Note: No spills were documented to have occurred at the T029 area as a result of operation as containerized storage for the HWMF.

TABLE 7
List of Chemicals of Concern (COC) –Hazardous Waste Management Facility
HWMF Closure
Santa Susana Field Laboratory
Ventura County, California

Compound of Concern	Building T029 Waste Storage	Building T133 Waste Treatment	Comment
Sodium, potassium, pH	X	X	Caustic waste metals (Na and K) storage and treatment
Metals: Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Mercury, Molybdenum, Nickel, Selenium, Silver, Thallium, Vanadium, Zinc	X	X	California Code of Regulations, Title 22 Metals List, to address storage and treatment of waste metals and potential corrosion of metal components of the treatment system.
Hexavalent Chromium		X	Detected in caustic solution at levels exceeding hazardous waste levels of 5.0 mg/L
Lithium	X		Documentation indicates lithium hydride was treated at T133, therefore storage at T029 must also be considered.
Zirconium	X	X	Documentation indicated zirconium was stored at T029 therefore treatment at T133 must also be considered.
Total Petroleum Hydrocarbons (TPH)		X	Due to use of kerosene and mineral oil as cutting fluid at Building T133 only.
Polyaromatic Hydrocarbons (PAHs)		X	As part of kerosene and mineral oil, to be analyzed on TPH trigger basis T133.
Aromatic Volatile Organics: Benzene, Toluene, Ethylbenzene and Xylenes (BTEX)		X	BTEX are part of TPH compounds. To be analyzed on TPH trigger basis.
Fluoride	X	X	Due to inclusion in Operation Plan, not withstanding use, analyze on less frequent basis (10% of samples)
Volatile Organic Compounds (VOCs)	X	X	Due to inclusion in Operation Plan, not withstanding use, analyze on less frequent basis (10% of samples)
Semi- Volatile Organic Compounds (SVOCs)	X	X	Due to inclusion in Operation Plan, not withstanding use, analyze on less frequent basis (10% of samples)

TABLE 8
ANALYTICAL RESULTS SUMMARY FOR TANK T-1 AND TANK T-3 CONTENTS
HWMF - Building T133 Tanks
Santa Susana Field Laboratory
Ventura County, California

Analyte	1995 Tank Sludge Sampling		1997 Tank Water Sampling		
	Result	Units	Tank T-1	Tank T-3	Units
pH	12.8	pH unit	--	--	--
Sodium Hydroxide	0.36	% by weight	--	--	--
Chloride	39	mg/L	--	--	--
Nitrate	4.5	mg/L	--	--	--
Antimony	6.3	mg/kg	<0.25	<0.25	mg/L
Arsenic	ND	mg/kg	<0.025	0.046	mg/L
Barium	57	mg/kg	5.4	<0.1	mg/L
Beryllium	ND	mg/kg	<0.025	<0.025	mg/L
Cadmium	14	mg/kg	0.88	<0.025	mg/L
Chromium (total)	1500	mg/kg	110	81	mg/L
Cobalt	9.6	mg/kg	12	0.07	mg/L
Copper	180	mg/kg	13	0.81	mg/L
Lead	100	mg/kg	4.9	<0.25	mg/L
Mercury	16	mg/kg	0.034	<0.005	mg/L
Molybdenum	7.1	mg/kg	2.2	2.9	mg/L
Nickel	1400	mg/kg	390	0.98	mg/L
Selenium	ND	mg/kg	<0.025	<0.025	mg/L
Silver	29	mg/kg	0.37	<0.05	mg/L
Thallium	ND	mg/kg	<2	<0.5	mg/L
Vanadium	4.3	mg/kg	0.4	0.25	mg/L
Zinc	310	mg/kg	31	5.9	mg/L

mg/L = milligrams per liter

mg/kg = milligrams per kilogram

ND = not detected above reporting limit; reporting limit not indicated on laboratory reports.

**TABLE 9
CLOSURE AND SAMPLING OBJECTIVES
T029 – HAZARDOUS WASTE STORAGE BUILDING
HWMF CLOSURE**

**Santa Susana Field Laboratory
Ventura County, California**

Wastes Potentially Managed: Sodium Metal (D003, D001), Sodium-Potassium-Alloy (D003, D001), Lithium Metal/Lithium Hydride (D002), Zirconium Hydride (D002), Sodium Hydroxide Solution (D002), Potassium Hydroxide Solution (D002), Mineral oil or Kerosene, Sodium Oxide (D003), Potassium Oxide (D003).

Materials/Media of Concern	Decontamination/ Waste Characterization	Release Verification	Closure Objective	Sampling Plan	
				Sampling	COCs
DECON WATER / RESIDUALS					
Decontamination Water	X		Characterize decontamination water for waste disposal.	Water samples will be collected and analyzed for waste characterization criteria per the methods presented in Table 11 and discussed in detail in Section 6.2.4.	See Section 7.2.4
EQUIPMENT STRUCTURES					
Concrete Floor of Building and Concrete Pads Outside of Building	X	X	Analyze concrete samples for confirmation of decontamination, release verification and characterization for waste disposal	8 concrete samples will be collected from the surface sample at the soil borings located on concrete as shown on Figure 26.	See Section 8.1.8
Building Walls	X		Characterize wall samples for confirmation of decontamination and for waste characterization.	Collect 1 wipe samples from each wall of the T029 building.	See Section 8.1.8
Asphalted Roadway		X	Characterization of this area on a random grid to determine if any releases of COCs have occurred due to storage of contained wastes outside of the building.	6 borings will be cored along the roadway to provide 6 asphalt samples at 3 random and 3 biased locations.	See Section 8.1.8

Materials/Media of Concern	Waste Characterization	Release Verification	Closure Objective	Sampling Plan	
				Sampling	COCs
ENVIRONMENTAL MEDIA Soil beneath T029 building, concrete pads, and low spot on southeast corner of building		X	Characterization of soil beneath two patches and two concrete cracks to determine if the storage operations impacted soil; evaluation of potential impacts for operations.	A total of 8 borings will be performed beneath and around the T029 building to the bedrock interface as described in Section 9.0 at locations shown on Figure 26.	See Section 9.4
Asphalt Road Area		X	Evaluation of potential impacts from storage of containers outside of the T029 building.	A total of 6 (3 random and 3 biased) borings will be advanced to the bedrock interface at the locations shown on Figure 27.	See Section 9.4
Groundwater		X	Near surface groundwater will be characterized (if present) to determine if groundwater has been impacted from the storage operations at Building T029.	Three groundwater samples will be collected at the locations shown on Figure 26.	See Section 10.3
Excavated Soil and Verification Sampling	X	X	Characterization of any excavated soil for waste disposal and verification of removal of COC impacted soil.	Four soil samples per 500 yds ³ will be collected from excavated soil. One verification sample will be collected per 100 ft ² of excavation. The excavation samples will be analyzed for waste characterization criteria and the verification samples will be analyzed for the COCs, which exceeded closure goals per the methods presented in Table 11 and discussed in Section 11.3.	See Section 11.3

Note: * VOCs and floride were identified in the Operations Plan, however, they have not been identified as COCs through use.

**TABLE 10
CLOSURE AND SAMPLING OBJECTIVES
T133 – HAZARDOUS WASTE TREATMENT BUILDING
HWMF CLOSURE**

Santa Susana Field Laboratory
Ventura County, California

Wastes Potentially Managed: Sodium Metal (D003, D001), Sodium-Potassium-Alloy (D003, D001), Lithium Metal/Lithium Hydride (D002), Zirconium Hydride (D002), Sodium Hydroxide Solution (D002), Potassium Hydroxide Solution (D002), Mineral oil or Kerosene, Sodium Oxide (D003), Potassium Oxide (D003).

Materials/Media of Concern	Decontamination/Waste Characterization	Release Verification	Closure Objective	Sampling Plan	
				Sampling	COCs
DECON WATER / RESIDUALS					
Decontamination Water	X		Characterize decontamination water for waste disposal.	Water samples will be collected from tanks and/or drums used to store water generated through decontamination task.	See Section 7.2.4
EQUIPMENT STRUCTURES					
Treatment Chamber	X		Decontamination verification	One wipe sample will be collected from each wall and the ceiling of the treatment chamber; one wipe sample will be collected for each of the other units – i.e. treatment pan, steel lining and sump lining.	See Section 8.1.8
Treatment Pan					
Steel Lining/Drain Pan					
Sump Lining					
Venturi Scrubber	X		Decontamination verification	Collect one water sample from the venturi scrubber after it has been decontaminated.	See Section 8.1.8
Tank T-1	X		Characterize samples collected from T-1 for confirmation of decontamination and classification for waste disposal.	Collect one wipe sample from T-1.	See Section 8.1.8
Tank T-2	X		Characterize samples collected from T-2 for confirmation of decontamination and classification for waste disposal.	Collect one wipe sample from T-2.	See Section 8.1.8
Tank T-3	X		Characterize samples collected from T-3 for confirmation of decontamination and classification for waste disposal	Collect one wipe sample from T-3.	See Section 8.1.8

Materials/Media of Concern	Decontamination/Waste Characterization	Release Verification	Closure Objective	Sampling Plan	
				Sampling	COCs
Miscellaneous Piping	X		Characterize samples collected from piping for confirmation of decontamination and classification for waste disposal.	Collect one wipe sample for each 50 ft of linear pipe.	See Section 8.1.8
Concrete	X		Characterize samples collected from concrete for confirmation of decontamination and classification for waste disposal.	8 concrete samples will be collected from the borings located on concrete as shown on Figure 28.	See Section 8.1.8
ENVIRONMENTAL MEDIA					
Soil beneath tanks, treatment chamber, scrubber, piping and in areas of releases		X	Characterization of soil beneath tanks and structures for release verification.	19 soil borings will be drilled to the bedrock interface at the locations shown on Figure 28 per the rationale discussed in Section 9.2.2.	See Section 9.4
Soil north of T133		X	Characterization of soil from former release area	8 shallow hand auger borings and 2 Geoprobe borings to bedrock interface at the locations shown on Figure 30 per rationale in Section 9.2.3	See Section 9.4
Soil beneath PVC drainage pipe and asphalt culvert		X	Characterization from potential former release	2 Geoprobe borings to bedrock interface along the PVC drainage pipe; 1 Geoprobe boring to bedrock interface at PVC discharge point to asphalt culvert; 6 hand augers for shallow soil sampling along asphalt culvert	See Section 9.4
Groundwater		X	Near surface groundwater will be characterized (if present) to determine if groundwater has been impacted from the operations at Building T133.	Three groundwater samples will be collected at the T133 building locations shown on Figure 28.	See Section 10.3

Materials/Media of Concern	Decontamination/ Waste Characterization	Release Verification	Closure Objective	Sampling Plan Sampling	COCs
Excavated Soil	X	X	Characterization of any excavated soil for waste disposal and verification of removal of COC impacted soil.	Four soil samples per 500 yds ³ will be collected from excavated soil. One verification sample will be collected per 100 ft ² of excavation. The excavation samples will be analyzed for waste characterization criteria and the verification samples for the exceeding COC per the methods presented in Table 11 and discussed in Section 11.3.	See Section 11.3

Note: * VOCs and fluoride* were identified in the Operations Plan, however, they have not been identified as COCs through use.

TABLE 11
 ANALYTICAL PROGRAM
 HWMF Closure Plan
 Santa Susana Field Laboratory
 Ventura County, California

SOIL ANALYSES				
Analyte	Method	Container	Preservative	Holding Time
Volatile Organic Compounds (Table 13)	EPA 8260B	Encore	4 °C	48 hours to extraction, 14 days to analysis
Semivolatile Organic Compounds (Table 13)	EPA 8270C	4 oz glass or sleeve	4 °C	14 days to extraction, 40 days to analysis
Polynuclear Aromatic Hydrocarbons (Table 13)	EPA 8310	4 oz glass or sleeve	4 °C	14 days to extraction, 40 days to analysis
Volatile Aromatic Compounds (Table 13)	EPA 8021	Encore	4 °C	48 hours to extraction, 14 days to analysis
Total Petroleum Hydrocarbons – kerosene, mineral oil	EPA 8015M	4 oz glass or sleeve	4 °C	14 days
Metals (Table 13)	EPA 6010B/6020	4 oz glass or sleeve	4 °C	180 days
Mercury	EPA 7471A	4 oz glass or sleeve	4 °C	28 days
Hexavalent Chromium	EPA 7199	4 oz glass or sleeve	4 °C	30 days to extraction, 24 hours to analysis
Fluoride	EPA 300.0/340.2	4 oz glass or sleeve	4 °C	28 days
Corrosivity (pH)	EPA 9045C	4 oz glass or sleeve	4 °C	7 days

GROUNDWATER/WASTEWATER ANALYSES				
Analyte	Method	Container	Preservative	Holding Time
Volatile Organic Compounds (Table 13)	EPA 8260B	3 – 40mL VOA Vials	4 °C, HCl pH <2	14 days to analysis
Semivolatile Organic Compounds (Table 13)	EPA 8270C	2 - 1 L amber glass	4 °C	7 days to extraction, 40 days to analysis
Polynuclear Aromatic Hydrocarbons (Table 13)	EPA 8310	2 - 1 L amber glass	4 °C	7 days to extraction, 40 days to analysis
Aromatic Volatile Compounds (see Table 13)	EPA 8021	3 – 40mL VOA Vials	4 °C, HCl pH <2	14 days to analysis
Total Petroleum Hydrocarbons – kerosene, mineral oil	EPA 8015M	2 - 1 L amber glass	4 °C	7 days to extraction, 40 days to analysis
Metals (Table 13)	EPA 6020	1 - 500 mL poly	4 °C, HNO ₃ pH <2	180 days
Mercury	EPA 7470A	1- 500 mL poly	4 °C, HNO ₃ pH <2	28 days
Hexavalent Chromium	EPA 7199	1 - 500 mL poly	4 °C	24 hours
Fluoride	EPA 300.0/340.2	1 – 250 mL poly	4 °C	28 days
pH	Field (EPA 150.1)	NA	NA	Within 15 minutes after sample collection
pH	EPA 9040	1 – 250 mL poly	4 °C	As soon as possible. No more than 24 hours.

TABLE 12
DETECTION LIMITS FOR PROPOSED ANALYTICAL METHODS – SOIL AND GROUNDWATER
SAMPLING PROGRAM
HWMF Closure Plan
Santa Susana Field Laboratory
Ventura County, California

VOLATILE ORGANIC COMPOUNDS			
Method	Compound	Water Detection Limit (µg/L)	Soil Detection Limit (µg/kg)
EPA 8260B	Benzene	1	1
	Methylene chloride	10	10
	Bromodichloromethane	10	1
	Bromoform	10	5
	Bromomethane	10	20
	1,1,2,2-Tetrachloroethane	1	2
	Tetrachloroethene	1	1
	Toluene	1	1
	Carbon tetrachloride	1	1
	Chlorobenzene	5	1
	Chloroethane	10	2
	Chloroform	1	1
	Chloromethane	10	20
	1,1,1-Trichloroethane	1	1
	1,1,2-Trichloroethane	1	1
	Trichloroethene	1	2
	Trichlorofluoromethane	5	10
	Dibromochloromethane	10	2
	Methyl tert-butyl ether (MTBE)	1	2
	1,2-Dibromoethane	5	1
	1,2-Dichlorobenzene	5	1
	1,3-Dichlorobenzene	5	1
	1,4-Dichlorobenzene	5	1
	Dichlorodifluoromethane	10	1
	1,1-Dichloroethane	1	2
	1,2-Dichloroethane	1	1
	1,1-Dichloroethene	1	1
	Cis-1,2-Dichloroethene	1	1
	Trans-1,2-Dichloroethene	1	1
	1,2-Dichloropropane	1	1
	1,1,2-Trichloro-1,2,2-trifluoroethane	10	5
	Vinyl chloride	5	1
	Xylenes	2	2

VOLATILE ORGANIC COMPOUNDS CONTINUED			
Method	Compound	Water Detection Limit (µg/L)	Soil Detection Limit (µg/kg)
	Cis-1,3-Dichloropropene	2	1
	Trans-1,3-Dichloropropene	2	2
	Ethylbenzene	1	1
AROMATIC VOLATILE COMPOUNDS			
Method	Compound	Water Detection Limit (µg/L)	Soil Detection Limit (µg/kg)
EPA 8021	Benzene	0.5	0.5
	Ethylbenzene	0.5	0.5
	Toluene	0.5	0.5
	Xylenes	0.5	0.5
METALS			
Method	Compound	Water Detection Limit (mg/L)	Soil Detection Limit (mg/kg)
EPA 6010B/6020	Antimony	0.040	0.5
	Arsenic	0.006	1
	Barium	0.10	1
	Beryllium	0.001	0.25
	Cadmium	0.005	0.5
	Chromium	0.01	1
	Cobalt	0.005	0.25
	Copper	0.005	0.5
	Lead	0.01	1
	Molybdenum	0.005	0.5
	Nickel	0.01	1
	Potassium	0.50	5
	Selenium	0.04	1
	Silver	0.01	0.25
	Sodium	0.50	5
	Thallium	0.04	0.25
	Vanadium	0.005	1
Zinc	0.02	2	
EPA 6020	Lithium	TBD	TBD
	Zirconium	TBD	TBD
EPA 7741A/7740	Mercury	0.0002	0.2

TPH			
Method	Compound	Water Detection Limit (mg/L)	Soil Detection Limit (mg/kg)
EPA 8015M	TPH as kerosene	0.5	50
	TPH as mineral oil	1.0	100
PAHS			
Method	Compound	Water Detection Limit (µg/L)	Soil Detection Limit (µg/kg)
EPA 8310	naphthalene	NA	0.5
	acenaphthylene	NA	0.5
	acenaphthene	NA	0.5
	fluorene	NA	0.5
	phenanthrene	NA	0.5
	anthracene	NA	0.5
	fluoranthene	NA	0.5
	pyrene	NA	0.2
	benzo(a)anthracene	NA	0.2
	chrysene	NA	0.5
	benzo(b)fluoranthene	NA	0.2
	benzo(k)fluoranthene	NA	0.2
	benzo(a)pyrene	NA	0.2
	dibenz(a,h)anthracene	NA	0.2
	benzo(g,h,i)perylene	NA	0.2
indeno(1,2,3-cd)pyrene	NA	0.2	
SEMIVOLATILE ORGANIC COMPOUNDS			
Method	Compound	Water Detection Limit (µg/L)	Soil Detection Limit (µg/kg)
EPA 8270C	2,4,5-Trichlorophenol	10	330
	2,4,6-Trichlorophenol	10	330
	2,4-Dichlorophenol	50	500
	2,4-Dimethylphenol	50	500
	2,4-Dinitrophenol	50	500
	2,4-Dinitrotoluene	10	330
	2,6-Dinitrotoluene	10	330
	2-Chloronaphthalene	50	500
	2-Chlorophenol	50	500
	2-Methylnaphthalene	50	500
	2-Nitroaniline	50	500
	2-Nitrophenol	50	500

SEMIVOLATILE ORGANIC COMPOUNDS CONTINUED

Method	Compound	Water Detection Limit (µg/L)	Soil Detection Limit (µg/kg)
	3,3'-Dichlorobenzidine	50	500
	3-Nitroaniline	50	500
	4,6-Dinitro-o-cresol	50	500
	4-Bromophenyl phenyl ether	10	330
	4-Chloro-3-methyl phenol	10	330
	1,2-Dichlorobenzene	10	330
	4-Chlorophenyl phenyl ether	50	500
	4-Nitrophenol	50	500
	Acenaphthene	50	500
	Acenaphthalene	50	500
	Acetylaldehyde	50	500
	Aniline	50	500
	Anthracene	10	330
	Benzo(a)anthracene	10	330
	Benzo(a)pyrene	10	330
	Benzo(b)fluoranthene	10	330
	Benzo(g,h,i)perylene	10	330
	Benzo(k)fluoranthene	10	330
	Benzoic Acid	50	500
	Benzyl Alcohol	50	500
	Benzylbutylphthalate	50	500
	bis(2-chloroethoxy)methane	50	500
	bis(2-chloroethyl) ether	50	500
	Bis(2-chloroisopropyl) ether	50	500
	Bis(2-ethylhexyl) phthalate	50	500
	Carbazole	50	500
	Chrysene	10	330
	Dibenzo(a,h)anthracene	10	330
	Dibenzofuran	50	500
	Dibutyl phthalate	50	500
	Di-n-octyl phthalate	50	500
	Diethyl phthalate	50	500
	Dimethyl phthalate	50	500
	Fluoranthene	10	330
	Fluorene	10	330
	Hexachloro-1,3-Butadiene	10	330

SEMIVOLATILE ORGANIC COMPOUNDS CONTINUED

Method	Compound	Water Detection Limit (µg/L)	Soil Detection Limit (µg/kg)
	Hexachlorocyclopentadiene	10	330
	Hexachlorethane	10	330
	Indeno(1,2,3-cd)pyrene	10	330
	Isophorone	50	500
	1,3-Dichlorobenzene	10	330
	1,4-Dichlorobenzene	10	330
	Naphthalene	50	500
	Nitrobenzene	50	500
	N-Nitrosodi-n-propylamine	50	500
	N-Nitrosodiphenylamine	50	500
	o-Cresol	10	330
	p-Cresol	10	330
	Pentachlorophenol	10	330
	Phenanthrene	10	330
	Phenol	50	500
	Pyrene	10	330
	Pyridine	50	500

TABLE 13
SOIL SAMPLING – T029 AREA
HWMF CLOSURE
Santa Susana Field Laboratory
Ventura County, California

Location	Number of Borings	Number of Samples	Analytical Method ^(c)
Building T029	4 GB	15 ^(a)	pH: 9045C TITLE 22 Metals: 6010B & 7000 series Na and K: 6010B Zirconium and Lithium One sample for VOCs (8260B) and Fluoride (340.2)
Loading Area, Inside Building	1 GB	3 ^(a)	pH: 9045C TITLE 22 Metals: 6010 & 7000 series Na and K: (6010B) Zirconium, Lithium one sample for VOCs (8260B) and Fluoride (340.2)
Concrete Pads, Outside Building	2 GB	6 ^(a)	pH: 9045C TITLE 22 Metals: 6010 & 7000 series Na and K: (6010B) Zirconium, Lithium one sample for VOCs (8260B) and Fluoride (340.2)
Drainage Area	2 GB	6 ^(a)	pH: 9045C TITLE 22 Metals: 6010 & 7000 series Na and K: (6010B) Zirconium, Lithium one sample for VOCs (8260B) and Fluoride (340.2)
Asphalt Roadway, Inside Fence	6 GB	18 ^(a)	pH: 9045C TITLE 22 Metals: 6010 & 7000 series Na and K: (6010B) Zirconium, Lithium one sample for VOCs (8260B) and Fluoride (340.2)
Duplicate Samples	---	5 ^(b)	pH: 9045C TITLE 22 Metals: 6010 & 7000 series Na and K: (6010B) Zirconium, Lithium one sample for VOCs (8260B) and Fluoride (340.2)

Note:

GB: Geoprobe Boring

~~27~~ 53

- (a) number of samples calculated based
- (b) Duplicate number of sample may va
- (c) 10% of collected samples will be an Method 340.2)

of collected samples.
 6010B) and for Fluoride (EPA

TABLE 14
SOIL SAMPLING – T133 AREA
HWMF Closure
Santa Susana Field Laboratory
Ventura County, California

Location	Number of Borings	Number of Samples	Analytical Method ^(c)
Treatment Building	2 GB	10 ^(a)	pH: 9045C TITLE 22 Metals: 6010B & 7000 series Na and K: 6010B Cr VI: 7199, Lithium and zirconium TPH: 8015M ^(d) , VOCs, SVOCs, Fluoride
Venturi Scrubber	1 GB	5 ^(a)	pH: 9045C TITLE 22 Metals: 6010B & 7000 series Cr VI: 7199
Venturi Scrubber Containment	2GB		TPH: 8015M ^(d)
Tanks (T-1, T-2 and T-3)	3 GB	15 ^(a)	pH: 9045C TITLE 22 Metals: 6010B & 7000 series Cr VI: 7199 TPH: 8015M ^(d)
Pipes (Treatment Chamber to T-1, & Scrubber to T-1)	2 GB	10 ^(a)	pH: 9045C TITLE 22 Metals: 6010B & 7000 series Cr VI: 7199 TPH: 8015M ^(d)
Size Reduction Area	1GB	5 ^(a)	pH: 9045C TITLE 22 Metals: 6010B & 7000 series Cr VI: 7199 TPH: 8015M ^(d)
Southern Concrete Pad (Excluding under canopy)	3 GB	15 ^(a)	pH: 9045C TITLE 22 Metals: 6010B & 7000 series Cr VI: 7199 TPH: 8015M ^(d)
Drainage Sumps	2 GB	10 ^(a)	pH: 9045C TITLE 22 Metals: 6010B & 7000 series Cr VI: 7199 TPH: 8015M ^(d)
Asphalt Area	3 GB	15 ^(a)	pH: 9045C TITLE 22 Metals: 6010B & 7000 series Cr VI: 7199 TPH: 8015M ^(d)
Duplicates samples	---	9 ^(b)	pH: 9045C TITLE 22 Metals: 6010B & 7000 series Cr VI: 7199 TPH: 8015M ^(d)

Note:

GB: Geoprobe Boring

Cr VI: Hexavalent Chromium

TPH: Total Petroleum Hydrocarbon

- (a) number of samples calculated based on alluvium depth of 15 feet
- (b) Duplicate number of sample may vary. It is set at 10% of total number of collected samples.
- (c) 10% of collected samples will be analyzed for VOCs (EPA Method 8260B) and for Fluoride (EPA Method 340.2)
- (d) Sample will be analyzed for BTEX (8021) and PAH (8270C) if TPH concentration is greater than or equal to the trigger concentration.

TABLE 15
SOIL SAMPLING – OFFSITE OF T133 AREA
HWMF CLOSURE
Santa Susana Field Laboratory
Ventura County, California

Location	Number of Borings	Number of Samples	Analytical Method ^(c)
North of T133	8 HB	16	pH: 9045C TITLE 22 Metals: 6010 & 7000 series Cr VI: 7199 TPH: 8015M ^(d)
	2 GB	10 ^(a)	pH: 9045C TITLE 22 Metals: 6010 & 7000 series Cr VI: 7199 TPH: 8015M ^(d)
PVC Pipe from Tank T-3 to Culvert	2 GB	10 ^(a)	pH: 9045C TITLE 22 Metals: 6010 & 7000 series Cr VI: 7199 TPH: 8015M ^(d)
Culvert Area	6 HB	6	pH: 9045C COC Metals: 6010 & 7000 series TPH: 8015M
	1GB	5 ^(a)	pH: 9045C COC Metals: 6010 & 7000 series TPH: 8015M
Duplicate Samples	---	6 ^(b)	pH: 9045C COC Metals: 6010 & 7000 series TPH: 8015M

Note:

HB: Hand Auger Boring

GB: Geoprobe Boring

Cr VI: Hexavalent Chromium

TPH: Total Petroleum Hydrocarbon

^(a) number of samples calculated based on alluvium depth of 15 feet

^(b) Duplicate number of sample may vary. It is set at 10% of total number of collected samples.

^(c) 10% of collected samples will be analyzed for VOCs (EPA Method 8260B) and for Fluoride (EPA Method 340.2)

^(d) Sample will be analyzed for BTEX (8021) and PAH (8270C) if TPH concentration is greater than or equal to the trigger concentration.

TABLE 16
ANALYTICAL PROGRAM FOR BACKFILL MATERIAL
HWMF Closure
Santa Susana Field Laboratory
Ventura County, California

Parameter	EPA Method
Antimony	6010B
Arsenic	6010
Barium	6010
Beryllium	6010
Cadmium	6010
Chromium	6010
Cobalt	6010
Copper	6010
Lead	6010
Mercury	7470
Molybdenum	6010
Nickel	6010
Selenium	7740
Silver	6010
Thallium	6010
Vanadium	6010
Zinc	6010
Volatile Organic Compounds	8260B

TABLE 17
CLOSURE IMPLEMENTATION SCHEDULE¹
HWMF Closure
Santa Susana Field Laboratory
Ventura County, California

Description	Weeks Required for Completion
Decontamination	2
Site Demolition	4
Subsurface Investigation	4
Data Analysis	4
Remediation of Impacted Soil, if required	7
Completion of Closure Report and Closure Certification	5
TOTAL WEEKS	26

Note:

26 weeks are equivalent to approximately 180 days, the time required for completion of closure (CCR Title 22 Section 66264.113)

¹The start of this schedule will occur within 4 weeks after receipt of DTSC's formal approval of the Closure Plan for the HWMF