

**RCRA FACILITY INVESTIGATION PROGRAM REPORT
SURFICIAL MEDIA OPERABLE UNIT
SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA
VOLUME I**

Prepared For:

**THE BOEING COMPANY
Rocketdyne Propulsion and Power**

The National Aeronautics and Space Administration

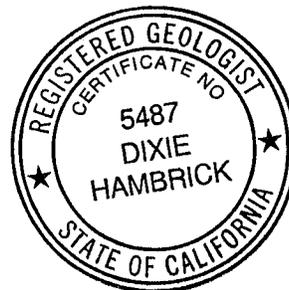
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LIST OF ACRONYMS

ABFF	Alfa/Bravo Fuel Farm
ABSP	Alfa/Bravo Skim Pond
AMEC	AMEC Earth & Environmental, Inc.
AOC	Area of Concern
APTF	Advanced Propulsion Test Facility
AR	air rotary
AST	aboveground storage tank
BAF	bioaccumulation factor
bgs	below ground surface
Boeing	The Boeing Company
BS	blank spikes
BTEX	benzene, toluene, ethylbenzene, and xylenes
CAL	Centrum Analytical Laboratories
Cal-EPA	California Environmental Protection Agency
Cal-OSHA	California Occupational Safety and Health Administration
CAS	Columbia Analytical Services
CCR	Current Conditions Report
CDFE	Coca/Delta Fuel Farm
Ceimic	Ceimic Corporation
CFOU	Chatsworth Formation OU
CIWMB	California Integrated Waste Management Board
CMS	corrective measures study
CMI	corrective measures implementation
COC	chain-of-custody
COPC	chemical of potential concern
CPEC	Chemical of potential ecological concern
CTL	Component Test Laboratory
DCE	dichloroethylene
DHS	Department of Health Services
DHS-RHB	Department of Health Services-Radiologic Health Branch
DOE	Department of Energy
DQO	data quality objective
DTSC	Department of Toxic Substances Control
ECL	Engineering Chemistry Lab
EDL	estimated detection limit
EEL	Environmental Effects Laboratory
EI	Environmental Indicators
ELV	Expendable Launch Vehicle
EMI	electromagnetic induction
ERA	ecological risk assessment
ESADA	Empire State Atomic Development Authority
ETEC	Energy Technology Engineering Center
FAL	Field Action Level

LIST OF ACRONYMS (Continued)

FSDF	Former Sodium Disposal Facility
ft	foot or feet
ft/ft	feet per foot
GIS	geographic information system
Gore	W.L. Gore and Associates, Inc.
GPR	ground penetrating radar
GPS	Global Positioning System
GRC	Groundwater Resource Consultants
GWTS	groundwater treatment systems
H&A	Haley and Aldrich
HGS	HydroGeoSpectrum
HML	Hazardous Materials Laboratory
HMSA	Hazardous Materials Storage Area
HI	Hazard Index
HQ	Hazard Quotient
HSA	hollow stem auger
HSP	Health and Safety Plan
HWSA	Hazardous Waste Storage Area
ICF	ICF Kaiser Engineers
ICP	inductively coupled plasma
ID	Identification
IDW	investigation-derived waste
IEL	Instrument and Equipment Laboratories
IM	Interim Measures
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LETF	Laser Engineering Test Facility
LOX	liquid oxygen
MCL	maximum contaminant level
MDL	method detection limit
mg	milligram
ml	milliliter
mL/min	milliliter per minute
mm	millimeter
MMH	monomethyl hydrazine
MS	matrix spike
MSD	matrix spike duplicate
msl	mean sea level
MWH	Montgomery Watson Harza
NASA	National Aeronautics and Space Administration
NCY	New Conservation Yard
NPDES	National Pollutant Discharge Elimination System
NFA	No Further Action

LIST OF ACRONYMS (Continued)

OCDD	octachlorodibenzo-p-dioxin
OCY	Old Conservation Yard
OD	outside diameter
Ogden	Ogden Environmental and Energy Services Co., Inc.
OU	Operable Unit
OVA	organic vapor analyzer
PAH	polynuclear aromatic hydrocarbon
PC	Post-Closure
PCB	polychlorinated biphenyl
PDU	Process Development Unit
PID	photoionization detector
PLF	Propellant Load Facility
PPE	personal protective equipment
ppb	parts per billion
ppm	parts per million
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RG	Registered Geologist
RIHL	Rockwell International Hot Laboratory
RMHF	Radioactive Materials Handling Facility
RWQCB	Regional Water Quality Control Board
SAIC	Science Applications International Corporation
SBA	Soil borrow area
SDG	sample delivery group
SE	Southeast
SIM	Selective Ion Monitoring
SMMC	Santa Monica Mountains Conservancy
SNAP	Systems for Nuclear Auxiliary Power
SOP	standard operation procedure
SPA	Storable Propellant Area
SPLP	synthetic precipitation leaching procedure
SQL	sample quantitation limits
SRAM	Standardized Risk Assessment Methodology
SRE	Sodium Reactor Experiment
SSFL	Santa Susana Field Laboratory
STL	Systems Test Laboratory
STP	Sewage Treatment Plant
SVOC	semivolatile organic compound

LIST OF ACRONYMS (Continued)

SWMU	Solid Waste Management Unit
TCA	trichloroethane
TCE	trichloroethene
TDS	total dissolved solids
TEG	Transglobal Environmental Geochemistry, Inc.
TPH	total petroleum hydrocarbons
TTF	Thermal Treatment Facility
UDMH	unsymmetrical dimethyl hydrazine
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VCAPCD	Ventura County Air Pollution Control District
VCEHD	Ventura County Environmental Health Division
VOC	volatile organic compound
WCT	Waste Coolant Tank
WDR	Waste Discharge Requirements
WPA	Work Plan Addendum
WPAA	Work Plan Addendum Amendment
µg	microgram
µg/kg	micrograms per kilogram
µg/l	micrograms per liter
µg/Lv	micrograms per liter vapor

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EXECUTIVE SUMMARY

This Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Program Report presents the activities performed for chemical characterization of surficial media at the Santa Susana Field Laboratory (SSFL). The RCRA Corrective Action Program is one of many ongoing, comprehensive environmental programs at the SSFL, and is under California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC) regulatory oversight. The RFI objectives are to characterize the nature and extent of chemical contamination in environmental media at the SSFL, evaluate risks to human and ecological receptors, and gather data to support the Corrective Measures Study (CMS). The CMS is the next phase of the RCRA Corrective Action Program, during which remedial alternatives for cleanup are evaluated.

Since the early 1980s, SSFL site characterization has proceeded along two parallel paths, one for groundwater and the other for soil and related surficial media. In 1999, DTSC formalized this approach by identifying two Operable Units (OUs). The OUs at the SSFL are: 1) the Surficial Media OU, comprised of soil, soil vapor, sediment, surface water, near-surface groundwater, air, biota, and weathered bedrock; and, 2) the Chatsworth formation OU (CFOU), comprised of the Chatsworth formation aquifer, and both unsaturated and saturated unweathered (competent) bedrock. One of the goals of the RFI program is to characterize the nature and extent of contamination in all environmental media at the SSFL – this goal will be achieved by combining and integrating site data from the chemical characterization programs for both OUs.

This Surficial OU RFI Program Report presents a comprehensive description of tasks performed for the surficial media investigation, and provides laboratory information for samples collected through December 31, 2003. This document has been prepared to partially fulfill RFI reporting requirements specified for the SSFL RCRA Correction Action Program, and serves to supplement information provided in the individual RFI site reports. In addition, this Program Report addresses recent DTSC requirements for: (1) a single, comprehensive document that clearly describes all elements of the RFI, including project objectives and scope of work; and, (2) information to allow the RFI site reports to be ‘stand-alone’ documents. To address the first of these requirements, this report provides a programmatic overview of the SSFL RFI process and, specifically for the Surficial OU RFI, summarizes

objectives and methods used for investigation, the RFI program history, and the guiding data quality objectives (DQOs) for the overall program. Also, it describes the expansion and changes in the Surficial OU RFI scope, work plans prepared, and programmatic decisions made during the course of an 8-year investigation. To address the second DTSC requirement, this report publishes laboratory information and quality assurance program findings for surficial media samples collected from RFI sites through December 31, 2003. This provides DTSC the requested laboratory and data quality information, so that together the Program Report and a RFI site report comprise a 'stand-alone' document. Since the RFI sampling program, data evaluation, and reporting are ongoing, an addendum to this document will be prepared when the RFI is nearing completion and all site reports are prepared and submitted to DTSC for approval.

To identify potential contamination source areas at the SSFL, three comprehensive evaluations of current and historical site operations and existing environmental data have been conducted by regulatory agencies during 1989, 1996, and 1999/2000. As a result of these reviews, a total of 135 Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) have been identified at the SSFL. Of these, 29 are either closed or being closed as part of other environmental programs at the facility, or do not require further action during the RFI. The remaining 106 SWMUs and AOCs are being evaluated in the Surficial OU RFI, and have been grouped into 51 RFI sites based on similarity of location, chemicals used, and historical operations (Figure ES-1). Eleven work plans have been prepared and approved by DTSC for investigation and assessment of surficial media at these 51 RFI sites. In their capacity as principal oversight agency, DTSC has also been frequently onsite to observe field conditions and review data to identify any additional source areas to include in the RFI.

Five questions were developed to guide the data collection and evaluation process for the Surficial OU RFI:

1. Has historical information on chemical use areas and chemical releases been used to identify potential source areas?
2. Have source area sampling and analysis plans been developed to characterize the nature and extent of contamination?

3. Is the nature and extent of contamination at potential source areas within RFI sites characterized sufficiently for risk assessment?
4. Have potential human health and ecological impacts been assessed?
5. Have characterization and risk assessment results been used to make site action recommendations for the CMS?

Based on multiple and comprehensive site and data reviews by DTSC, and numerous work plans prepared to investigate potential chemical contamination at the facility, answers to Questions 1 and 2 are “Yes, based on current information.” Answers to Questions 3, 4, and 5 are ongoing and RFI site-specific, and will be addressed in the RFI site reports. The process used to collect the data necessary to answer these questions, and the methods by which answers are developed, are described in this document.

RFI sampling has been conducted since 1996 following DTSC-approved work plans or as directed by DTSC during the field program. DTSC was present during much of the fieldwork to observe sample collection, well drilling and construction, review data, inspect site conditions, and collect confirmation samples for independent analysis. Sampling was supervised and directed by a California Registered Geologist.

The following summarizes the approach and methods used for surficial media characterization during the RFI. In general, a targeted investigation approach was used to collect samples from the location of potential chemical source areas to characterize the nature of impacts, with additional samples collected as necessary in the surrounding area to delineate the extent of contamination (Question 3).

Soil Vapor: Active soil vapor sampling was the predominant method used to identify volatile organic compound (VOC) impacts in soil. Because of the high volatility of VOCs, soil vapor sampling is the primary method to identify solvent source areas in soil and characterize the nature and extent of VOC impacts for the risk assessment.

Soil Matrix: Soil matrix sampling includes soil, sediment from drainages and ponds, surficial weathered bedrock, and materials from liquid containment features, such as sumps, clarifiers, etc. Sampling targeted potential chemical source areas; extent of migration from RFI sites was evaluated by sampling in downslope soil or drainage

sediments. Samples were collected using hand auger borings, direct-push drilling, or trenching methods.

Surface Water: The surface water sampling program has focused primarily on characterizing water present in seven surface water ponds onsite. In addition, limited sampling of surface water in drainages was performed to support of interim measures cleanup actions.

Near-Surface Groundwater: The RFI near-surface groundwater investigation included drilling and monitoring a total of 133 piezometers at 126 locations onsite. Detailed water level measurements were made to characterize the occurrence of near-surface groundwater at the facility. Each saturated piezometer was sampled for chemicals of concern based on nearby surficial media impacts or detections in Chatsworth formation groundwater.

Biota, Indoor Air: Sampling of these media has been performed to support risk assessment and evaluation of existing site conditions.

A summary of the samples collected and analyses performed for the RFI through December 31, 2003 is:

Surficial Sample Media*	Total Samples	Total Number Of Analyses
Soil Vapor (active and passive)	> 1,800	> 1,800
Soil and Sediment	> 5,800	> 11,300
Surface Water	> 190	> 300
Near-Surface Groundwater	> 2,200	> 3,400
Other (biota, indoor air)	> 50	> 100
Total Surficial Media Samples	> 10,000	> 17,000

**Rounded sample counts for RFI work conducted through December 31, 2003.*

Based on the quality assurance (QA) review conducted on the above sampling results, the data are usable and meet RFI program requirements as defined by DTSC-approved Quality Assurance Project Plans. The DTSC Hazardous Materials Laboratory (HML) is also performing an independent, complete data validation of 5 to 10% of the analyses performed for the RFI, including review of original electronic instrument raw data, as an additional QA

measure for this project. At the time of this report, the ongoing HML validation has also found that the RFI data collected to date meet project quality requirements.

Other sampling programs have been conducted to support characterization and risk assessment of the Surficial OU RFI at the SSFL, including soil background sampling. An overall evaluation of the background dataset by DTSC's Geological Services Unit was performed, and included a visit to all sample locations from the various studies and a review of data collected prior to dataset approval by DTSC in 2000.

Data collection and review has been an iterative process throughout the RFI field program that ensures completeness of the data for use in risk assessment and as a basis for site action recommendations (including interim cleanup actions). Although the RFI data collection is largely complete, data evaluation and reporting are ongoing, and the RFI data collection process will not be finished until the RFI is approved by DTSC.

The overall purpose of the RFI risk assessment program is to determine if environmental media at the SSFL pose an unacceptable risk to human and ecological receptors (Question 4). Evaluation of risks from all environmental media at the SSFL is achieved by combining information from the risk assessment programs for both OUs to ensure all appropriate exposure pathways are addressed. Human health and ecological risk assessment is being performed for the surficial media at RFI sites following the approach and methods specified in a DTSC-approved work plan. Risks from CFOU media will be estimated separately following approval of a risk assessment methodology by DTSC. Migration pathways both within an OU (i.e., between surficial media and between RFI sites) and between OUs (i.e., soil contamination migrating to CFOU groundwater) are considered in the risk assessments.

The final step of the RFI is formulation of a site action recommendation based on characterization and risk assessment findings (Question 5). Possible outcomes include either a recommendation for further evaluation during the CMS or no further action (NFA). These outcomes may be applicable to one or more source areas within an individual RFI site or for an entire RFI site. Site evaluation during the CMS may include limited sampling, risk assessment review, remedial option selection, or pilot testing.

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WHERE TO FIND MORE INFORMATION:

You may review the documents at these locations:

California State University, Northridge
Attn: Robert Marshall (818) 677-2832
Urban Archives Center
Oviatt Library, Room 265 (West Wing)
18111 Nordhoff Sreet
Northridge, CA 91330-8329

Simi Valley Library
Attn: Dale Redfield (805) 526-1735
2969 Tapo Canyon Road
Simi Valley, CA 93063

Los Angeles Public Library – Platt Branch
Attn: Janet Metzler (818) 340-9386
23600 Victory Hills Blvd
Woodland Hills, CA 91367

DTSC Regional Records Office
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1011 N. Grandview Avenue
Glendale, CA 91201