National Aeronautics and
Space Administration
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P.O. Box 20
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July 30, 2014

Reply to Attn of: RE-14-087

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NMED
Hazardous Waste Bureau

Mr. John E. Kieling, Chief
New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

Subject: NASA WSTF SWMUs 1, 3, and 15 (100 Area Burn Pit, 100 Container Storage Area, and 600 Area Burn Pit) Investigation Work Plan and Historical Information Summary

This transmittal provides the Investigation Work Plan (IWP) and Historical Information Summary (HIS) for the WSTF 100 Area Burn Pit, 100 Container Storage Area, and 600 Area Burn Pit (SWMUs 1, 3, and 15). The IWP and HIS were prepared in accordance with the WSTF Hazardous Waste Permit.

Enclosure 1 provides executive summaries for the 100 Area Burn Pit, 100 Container Storage Area, and 600 Area Burn Pit (SWMUs 1, 3 and 15) IWP and HIS. Enclosure 2 provides bound copies of the IWP and HIS. Enclosure 3 provides electronic versions of the IWP and HIS on a CD-ROM.

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 known violations.

If you have any questions or comments concerning this submittal, please contact Tim Davis of my staff at 575–524–5024.

Radel Bunker-Farrah
Chief, Environmental Office

3 Enclosures

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National Aeronautics and
Space Administration

SWMUs 1, 3, and 15 Investigation Work Plan

(100 Area Burn Pit, 100 Area Container Storage Area, and 600 Area Burn Pit)

July 2014

NM8800019434
NASA Johnson Space Center White Sands Test Facility
12600 NASA Road Las Cruces, New Mexico 88012

NASA Johnson Space Center White Sands Test Facility

SWMUs 1, 3, and 15 Investigation Work Plan

(100 Area Burn Pit, 100 Area Container Storage Area, and 600 Area Burn Pit)

July 2014

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.

Radel Bunker-Farrah
Chief, NASA Environmental Office

7-30-14
Date

Executive Summary

National Aeronautics and Space Administration (NASA) is required by the Hazardous Waste Permit (NMED, 2009) issued by the New Mexico Environment Department (NMED) to develop Investigation Work Plans (IWPs) for solid waste management units (SWMUs) and Areas of Concern (AOCs) at the Johnson Space Center (JSC) White Sands Test Facility (WSTF) to determine the nature, extent, and potential migration pathways of contaminant releases. This IWP addresses NASA's applicable regulatory requirements, summarizes SWMU background information, presents a potential exposure model, an investigation strategy, and data management procedures, and proposes a schedule for completion of investigation activities at WSTF SWMUs 1, 3, and 15.

The investigation will be conducted at the 100 Area burn pit (SWMU 1), 100 container storage area (SWMU 3), and 600 Area burn pit (SWMU 15). Additional related areas of interest (AOIs) were discovered during research conducted for the SWMU 1, 3, and 15 Historical Information Summary (HIS; NASA, 2014c) associated with this investigation. These AOIs are identified as the 100 Area burn pit overflow area, additional 100 Area burn pit, north 100 container storage area, and Fire Department training area, and have been added to this investigation. Collectively, these sites supported WSTF Fire Department training activities. SWMUs 1, 3, 15, and the AOIs were active from approximately 1964 through 1988, but are no longer in use for their original purposes. Previous investigations and cleanup activities were conducted at SWMUs 1 and 3 from approximately 1983 through 1986. Additional investigative work was performed at SWMUs 1, 3, and 15 during the WSTF RCRA Facility Investigation (RFI) between October 1994 and June 1995 (NASA, 1996).

A total of twenty soil borings will be installed at the investigation sites with the following distribution:

- Two borings at the 100 Area burn pit (SWMU 1).
- Two soil borings at the 100 burn pit overflow area.
- Four soil borings at the 100 container storage area (SWMU 3).
- One soil boring at the north 100 container storage area.
- Nine soil borings at the Fire Department training area and additional 100 Area burn pit
- Two soil borings at the 600 Area burn pit (SWMU 15).

The collection of soil chemical samples will be attempted every 5 feet (ft) in each boring and samples will be analyzed for contaminants of potential concern (COPC). The comprehensive list of COPC was derived from the HIS. Soil samples will be analyzed for volatile organic compounds, semi-volatile organic compounds, total petroleum hydrocarbons, hydrazines, polychlorinated biphenyls, and total metals, depending on the specific site. In addition, pre-investigation screening for asbestos will be performed at the AOI identified as the Fire Department training area. If it is determined that asbestos is present at this location, NASA will comply with all applicable Occupational Safety and Health Administration (OSHA) standards and National Emission Standards for Hazardous Air Pollutants (NESHAP) under the Clean Air Act (CAA), 40 CFR Part 1 for asbestos during the subsequent investigation of that AOI.

The results from soil sample analyses (excluding asbestos) will be compared to New Mexico soil screening levels (SSLs) in accordance with Attachment 15 of the Permit (NMED, 2009).

The schedule for planning and preparation, conducting the field investigation, and performing data assessment and reporting is provided. Following NMED approval of this IWP, NASA anticipates planning and preparation to be completed in late 2014, field work to commence in early 2015, and data assessment and reporting to be completed in late 2015.

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List of Figures and Tables

List of Acronyms

"R"	rejected
ACM	Asbestos-containing material
AFFF	aqueous film-forming foams
AGI	American Geological Institute
AOC	Area of Concern
AOI	Area of Interest
ASTM	American Society for Testing and Materials
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylene
CAA	Clean Air Act
CAP	RCRA Corrective Action Program
CAS	Chemical Abstracts Service
CFR	Code of Federal Regulations
cm/sec	centimeters per second
CME	Corrective Measures Evaluation
CO_2	Carbon Dioxide
CoC	Chain-of-custody
COC	Contaminants of Concern
COPC	Contaminant of Potential Concern
DCDF	Dichlorodifluoromethane
DMN	N-nitrodimethylamine
DQOs	Data Quality Objectives
DRO	Diesel Range Organics
ECD	Electron Capture Detector
EDD	electronic data deliverable
EPA	Environmental Protection Agency
EPP	Emergency Preparedness Plan
F-11	Freon 11
F-113	Freon 113
F-123A	Freon 123A
F-21	Freon 21
ft	feet/foot
GMP	Groundwater Monitoring Plan
gpm	gallons per minute
GPS	Global Positioning System
HAZWOPER	Hazardous Waste Operations and Emergency Response
HHF	Hardscrabble Hill Fault
HIS	Historical Information Summary
HSA	Hollow-stem auger
HSM	Health and Safety Manager
HSO	Health and Safety Officer
HWB	Hazardous Waste Bureau
HWMU	Hazardous Waste Management Unit
IDW	Investigation-derived waste
IPA	isopropyl alcohol
IWP	Investigation Work Plan
JDMB	Jornada del Muerto Basin
JHA	Job Hazard Analysis

JSC	Johnson Space Center
LC	liquid chromatography
m	meter
MCL	Maximum Contaminant Level
MeCl	Methylene chloride
MEK	methyl ethyl ketone
mg/Kg	milligrams per kilogram
mg/L	milligrams per liter
MS	Matrix spike
MSD	Matrix spike duplicate
NASA	National Aeronautics and Space Administration
ND	Not Detected
NDMA	N-nitrosodimethylamine
NELAP	National Environmental Laboratory Accreditation Program
NESHAP	National Emission Standards for Hazardous Air Pollutants
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NTU	Nephelometric Turbidity Units
NVLAP	National Voluntary Laboratory Accreditation Program
OSHA	Occupational Safety and Health Administration
PAH	Polynuclear Aromatic Hydrocarbons
PCB	polychlorinated biphenyl
PCE	Tetrachloroethene
PFC	perfluorinated compounds
PFHRA	Plume Front Health Risk Assessment
PFC	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
PID	Photoionization Detector
PLM	polarized light microscopy
PM	project manager
POC	Point of Compliance
PPE	Personal Protective Equipment
QA/QC	Quality Assurance and Quality Control
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RSL	Regional Screening Level
SAM	San Andres Mountains
SCEM	Site conceptual exposure model
SHP	Safety and Health Plan
SOP	Standard Operating Procedure
SOW	Statement of Work
SSL	Soil Screening Level
SVOC	Semivolatile Organic Carbons
SWMU	Solid Waste Management Unit
TCA	1,1,1-Trichloroethane

TCE	Trichloroethene
TIVC	Total Ionizable Volatile Compounds
TPH	Total petroleum hydrocarbon
UDMH	unsymmetrical dimethylhydrazine
ug/L	micrograms per liter
USCS	Unified System Classification System
USDA	United States Department of Agriculture
UV	ultraviolet
VOC	Volatile Organic Compounds
WSTF	White Sands Test Facility

1.0 Introduction

The National Aeronautics and Space Administration (NASA) White Sands Test Facility (WSTF) is located in Doña Ana County, 18 miles northeast of Las Cruces, New Mexico and 65 miles north of El Paso, Texas. Figure 1.1 provides a WSTF location map. Access to the site is provided via a paved road (NASA Road) that intersects U.S. Highway 70 one mile west of Organ, New Mexico. The installation occupies approximately 60,500 acres.

WSTF has supported safety-related testing of space flight equipment and hazardous materials from 1964 to the present time. During approximately the first 20 years of facility operations, undocumented episodes of hazardous chemical releases to the environment occurred. As a result, NASA has been conducting an extensive Resource Conservation and Recovery Act (RCRA) investigation and implementing interim corrective measures at the site since the mid-1980s. WSTF currently operates under Hazardous Waste Permit No. NM8800019434 (Permit) issued by the New Mexico Environment Department (NMED) in November 2009 (NMED, 2009).

NASA is required to submit to NMED an Investigation Work Plan (IWP) for each Solid Waste Management Unit (SWMU) and areas of concern (AOC) listed, or combination of two or more, for approval. This IWP addresses three SWMUs and four areas of interest (AOIs) discovered during research conducted for the Historical Information Summary (HIS). Figure 1.2 presents the locations of SWMUs and related AOIs that will be investigated under this work plan.

The following sections present the investigation objectives and scope, applicable regulatory requirements, and a special consideration for the potential presence of asbestos.

1.1 Objectives and Scope

The objective of this IWP is to determine the nature, extent, and potential migration pathways of contaminant releases to the vadose zone, if present, from:

- 100 Area burn pit (SWMU 1)
- 100 container storage area (SWMU 3)
- 600 Area burn pit (SWMU 15)
- Associated AOIs:
  - 100 Area burn pit overflow
  - Additional 100 Area burn pit
  - North 100 container storage area
  - Fire Department training area

1.2 Regulatory Requirements

The Permit requires that NASA investigate and address historical releases of hazardous waste and hazardous constituents that may have occurred at sites throughout WSTF as part of the Resource Conservation and Recovery Act (RCRA) corrective action process (CAP). The CAP consists of investigation, characterization, and, if necessary, cleanup. The principal components of the CAP are:

1. RCRA Facility Assessment.

2. RCRA Facility Investigation.

3. Interim Corrective Measures (if necessary).

4. Corrective Measures Study (if necessary).

5. Corrective Measures Implementation (if necessary).

NASA is currently implementing interim corrective measures to address groundwater contamination within a groundwater plume that extends from the WSTF source areas west toward the Mid-plume and Plume Front areas. RCRA Facility Investigations (RFIs) are being conducted for specific closures, SWMUs, AOCs, and AOIs in the source areas.

NASA is required to submit to NMED for approval an IWP for each of the SWMUs and AOCs, or a combination of two or more with NMED approval, identified in Permit Attachment 22 (VII.H.1.a). The Permit also requires that the IWP include schedules for implementation and completion of specific actions necessary to determine the nature and extent of contamination and potential migration pathways of contaminant releases at each of the identified SWMU locations (Section VII.H.1.b). NMED will require corrective measures if it is determined, based upon the investigation and other relevant information, that there has been a release of hazardous waste or hazardous constituents into the environment that requires corrective action to protect human health or the environment (Section VII.J). Proposed remedies for contaminant removal will be evaluated and submitted to NMED in a Corrective Measures Evaluation (CME) (Section V.D.2) format (Section VII.J.2).

This document satisfies the requirements set forth in Permit Section VII.H.1 for the SWMUs and AOIs presented. The proposed methodology includes all investigations necessary to ensure compliance with Code of Federal Regulations (CFR) 40 CFR 264.101 and 264.111, as required by the Permit.

1.3 Other Considerations

The AOI identified as the Fire Department training area may have released asbestos to the environment by nature of the materials burned there, according to the HIS (NASA, 2014). NASA proposes to perform a field screening sampling at this site to determine the presence of asbestos. NASA will comply with Occupational Safety and Health Administration (OSHA) standards and the National Emission Standards for Hazardous Air Pollutants (NESHAP) under the Clean Air Act (CAA), 40 CFR Part 1 for asbestos. For the purposes of this work plan, properly trained personnel (16-hour minimum training) are required for sampling potential asbestos containing materials (ACMs). ACMs are defined as those materials containing 1 % or greater asbestos as determined by analysis. Additionally, proper precautions must be taken to prevent visible emissions at the sampling location during the sampling event.

2.0 Background

Waste is generated during the course of testing and evaluation processes at WSTF and many wastes generated within each industrial area are flammable in nature. Historically, many of these flammable wastes were provided to the WSTF Fire Department as a training tool. The Fire Department required frequent training practices to maintain readiness for emergency response at WSTF, including performing live practice fires at WSTF. Through WSTF history, multiple live fire burning locations were established. The first burning areas established were burn pits, comprising excavated, unlined soil areas where liquids, including laboratory chemicals at some pits, were burned and then extinguished. This current investigation and IWP focuses on the Fire Department burning locations and the flammable waste storage area located within and near the 100 and 600 Areas at WSTF; the 100 Area burn pit (SWMU 1), 100 container storage area (SWMU 3), 600 Area burn pit (SWMU 15), and associated AOIs.

2.1 Operational History

Extensive information regarding the operational histories for SWMUs 1, 3, and 5 and associated AOIs are provided in the HIS. Summaries of operational histories are provided below.

The first Fire Department training area established at WSTF was the 600 Area burn pit (SWMU 15, Figure 1.2) in 1964. For convenience, this burn pit was located close to the WSTF Fire Department Building 112 and was adjacent to the 100 Area wastewater lagoon to the west and Apollo Boulevard to the east. This burn pit was used to train Fire Department personnel to extinguish small liquid fires using fire extinguishers. Liquids burned reportedly included alcohols, gasoline, and diesel. In 1964, fire training activities were relocated to another area and the 600 Area burn pit was mostly abandoned. Infrequent fire extinguisher training continued for new Fire Department personnel until final abandonment of the 600 Area burn pit in 1969, with the establishment of the 100 Area burn pit (SWMU 1, Figure 1.2).

In 1969, a designated training area was established for the WSTF Fire Department, located to the east of the main 100 Area. The 100 Area burn pit was established in this area in order to conduct large fires for firefighting practice. Long-term WSTF personnel stated that the 100 Area burn pit commonly overflowed while conducting/extinguishing practice fires (AOI - 100 burn pit overflow area, Figure 1.2).

Waste chemicals/liquids burned in the 100 Area burn pit included any liquids at WSTF that would burn. The Fire Department received waste chemicals/liquids from the 200, 300, and 400 Areas, flammable liquids from the 100 and 500 Areas, and residual isopropyl alcohol (IPA) from other areas on site for burning use. Chemicals known to have been burned within or identified in analyses of the 100 Area burn pit included 1,1-dichloroethane, 1,2-dichloro-1,1,2-trifluoroethane (Freon®[1] 123A; F-123A), 1,1,2-trichloro-1,2,2-trifluoroethane (F-113), dichlorofluoromethane (F-21) trichlorofluoromethane (F-11), 2-propanol, carbon tetrachloride, chloroform, dichlorobenzene, dichloroethylene, dichloromethane, tetrachloroethene (PCE), methylene chloride, methyl ethyl ketone (MEK), methyl isobutyl ketone, isopropyl acetate, IPA, acetone, ethanol, methanol, n-butyl alcohol, sec-butyl alcohol, other alcohols, toluene, xylene, ethylene glycol, ethyl benzene, benzene, diesel, gasoline, surfactant, motor oils, lubricating oils, hydraulic oils, spent vacuum pump oil (which included trace fuels [unsymmetrical dimethylhydrazine (UDMH), monomethylhydrazine (MMH), Aerozine-50 (A-50; an equal mixture of UDMH and hydrazine), and hydrazine] and combustion and partial combustion products of these fuels), and small amounts of nitrogen tetroxide (N_2O_4). Other chemicals that may have been burned may have included trichloroethene (TCE), 5-butanol, 2-butanone, acetic acid, chromic acid, acetonitrile, tetrahydrofuran, pyridine, 1-propene, butyl cellosolve, and potentially paints. Metals may have also been present in oils or wastes.

Fires conducted at the 100 Area burn pit were large and were extinguished using mostly water only; however, aqueous film-forming foams (AFFFs) were used occasionally and an alcohol-resistant AFFF was reportedly used once, added to water to extinguish the 100 Area burn pit. These foams may have contained perfluorooctanoic acid (PFC) or perfluorooctane sulfonate (PFOS) as ingredients.

Use of the 100 Area burn pit ended, reportedly in June 1983, and another burn pit (AOI – additional 100 Area burn pit, Figure 1.2) was excavated to the south and east of the original 100 Area burn pit. From photographic evidence, this pit was established in 1981 and was used until it was reportedly cleaned up in September 1985. The same chemicals and liquids burned in the original 100 Area burn pit were burned in this additional burn pit. Reportedly later in the active history of the pit, only alcohols, gasoline, and diesel were burned (NASA, 2014c).

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[1] Freon® is a registered trademark of E.I. du Point de Nemours & Company Corporation (DuPont).

A container storage area (SWMU 3, Figure 1.2) was established adjacent to the 100 Area burn pit in addition to a second, smaller area north of the burn pit (AOI – north 100 container storage area, Figure 1.2) where drums of waste chemicals/liquids could be stored for use in burning within the 100 Area burn pit. Wastes were typically stored within these areas in 55-gal drums on wooden pallets or directly on the soil and exposed to the environment. Some wastes and empty drums were stored for years, and leaks and spills occurred over time. Releases to the environment from spilled or leaking drums included contaminated vacuum pump oil and could have included all the chemicals known to have been burned in the 100 Area burn pit.

In addition to conducting burns at the 100 Area burn pits, the WSTF Fire department conducted other training in a cleared soil area located across a dirt berm to the east of the 100 Area burn pit (AOI – Fire Department training area, Figure 1.2). This training included spill release drills, hazardous materials training (including simulated leaking tankers), ladder training, lanyard use, fire hose and fire hydrant hookup training, smoke training, rescues from cars/buildings, and many live fire extinguishing trainings. Conducting the live fires within the Fire Department training area resulted in releases to the environment. According to long-term WSTF personnel, scrap wood, wooden pallets, 1950s and 1960s model trailers, and many cars were burned in this area. Fires were ignited with gasoline or diesel.

Potential contaminants released to the environment through burning include asbestos (from tiles/construction of the trailer), polychlorinated biphenyl (PCBs) and mercury (from florescent lights/ballasts), lead (from paints), cadmium, chromium, copper, and lead (from other metal parts/plumbing), and volatiles and phthalates (from plastics). Following burning, remains of the wood, cars, and trailers were buried within the Fire Department training area to the north, in line with Building 151, to the east of a soil berm. Remains included ashes, metal pipes, electrical wires, etc., items that did not readily burn.

According to long-term WSTF employees, fires conducted in this area were extinguished with water and a type of foam titled “light water” or “wet water.” These foams could also have historically contained PFC and PFOS.

2.2 Contaminants of Potential Concern

Contaminants of potential concern (COPCs) are those substances likely to be present in environmental media affected by a release. Information gathered for the HIS enabled the compilation of a comprehensive list of COPCs based on operational histories of the units under investigation. The purpose of this list is to assist in selecting appropriate analytical methods and sampling, health, and safety strategies for this investigation. Table 2.1 provides the list of COPCs.

2.3 Preliminary Site Conceptual Exposure Model

A preliminary site conceptual exposure model (SCEM) was developed (Figure 2.1) to provide an understanding of the potential for exposure to hazardous contaminants at the sites based on the source of contamination, the release mechanism, the exposure pathway, and the potential receptor(s).

2.3.1 Contamination Sources

There are multiple SWMUs identified in the Permit as potential sources for contamination in the 100/600 Areas, however this IWP and SCEM addresses only the 100 Area burn pit (SWMU 1), 100 container storage area (SWMU 3), 600 Area burn pit (SWMU 15), and previously mentioned AOIs.

2.3.2 Release Mechanisms

All SWMUs and AOIs under investigation were used in support of fire training exercises at WSTF. The practice of spraying high pressure water or extinguishing agents on an open fire (ignited material or liquids in a pit) produced splashing or pit overflow, as with AOI - 100 Area burn pit overflow, which could release contamination to surrounding surface soils. It is known that burn pits were left open and unlined during historical operations and any residual, unburned hazardous waste would have been able to infiltrate into the soil beneath the units, with potential migration to groundwater. The 100 container storage areas held hazardous waste in drums until it was applied to the surface of the 100 Area burn pits and ignited. HIS research has confirmed that drums were stored on unprotected ground and there was evidence of leakage. Hazardous waste from leaking drums would have been able to infiltrate into the soil beneath the unit, with potential migration to groundwater.

2.3.3 Exposure Pathways

Four potential exposure pathways are identified: 1) ingestion of groundwater; 2) incidental ingestion of soil; 3) inhalation of volatile contaminants or particulate emissions (dust); and 4) dermal contact with soil.

The groundwater underlying much of WSTF is known to be contaminated and its future use and potential risk to receptors are part of an ongoing site-wide evaluation and corrective actions. The only water supply wells for the site are located several miles to the west of the investigation areas and are monitored regularly for the presence of any site-source contaminants. A risk assessment of the groundwater itself will not be conducted as part of this investigation.

It is known from the HIS that significant amounts of soil were removed from the 100 Area burn pit and container storage area sites during cleanup efforts in 1985. Reportedly, the 100 Area additional burn pit and Fire Department training area were cleaned up at the same time, but cleanup details were not found in any historical records. The 600 Area burn pit was cleaned up by shoveling sludge and residue to the side of the pit, but there is no record of contaminated soil removal. The site, however, for decades has been regularly disturbed by road grading and maintenance for the 100 Area wastewater lagoons. The potential for exposure from contaminated soil is planned to be addressed under this IWP, but it is believed the removal/disturbance of soil in the past has significantly reduced the exposure risk related to soil ingestion, inhalation of particulate emissions, and dermal contact.

There are no current or future residential land use scenarios anticipated in the vicinity of the 100/600 Areas. The area is within a controlled test site located on the U.S. Army White Sands Missile Range. There are no encroaching residential areas. Therefore, there are no complete exposure pathways identified for residential land use scenarios.

Industrial facilities and buildings are located in the immediate vicinity of each SWMU and AOI. There are no additional industrial/occupational land use scenarios anticipated for the 100/600 Areas beyond the current use scenario. There are no complete exposure pathways for an industrial/occupational receptor population because it has been over 20 years since the SWMUs have been decommissioned and cleaned up (100 Area burn pit and container storage area) or covered up (600 Area burn pit).

If it is assumed that not all contaminated soil was removed from the 100 Area SWMUs during cleanup activities, and residual soil contamination exists after decades of routine dirt work at the sites of the 600 Area burn pit, then a worker may encounter contaminated material when working on roads or utility conduits in the area. Therefore, inadvertent ingestion of, inhalation of, or dermal contact with contaminated soil may be considered a complete exposure pathway for this evaluation.

2.3.4 Potential Receptors

Construction work provides the most likely exposure scenario at SWMUs 1, 3, 15, and AOIs and potential receptors are workers conducting excavation activities in the area of the units (Figure 2.1).

2.4 Summary of Previous Investigations

This section describes previous soil investigations performed at SWMUs 1, 3, and 15. AOIs are not included since they were discovered in 2014 during HIS research.

2.4.1 Initial Cleanup Activities – 1983 through 1986

Cleanup of the 100 Area burn pit and container storage area was initiated in 1983 and occurred in stages until completion in 1986. Historical documentation states analytical sampling was conducted prior to and/or after large volumes of soil were removed from these locations, however, very few of the analytical reports could be located. Personnel interviews indicated the additional 100 Area burn pit and Fire Department Training area were cleaned up at the same time. The 600 Area burn pit was not investigated as part of these cleanup efforts, but historical information indicates that sludge and residue were removed by shovel from the pit as part of maintenance. A detailed description of cleanup activities and evidence for hazardous substances is provided in the HIS.

2.4.2 Shallow Soil Gas Investigation – 1986 through 1988

Between October 1986 and April 1988, an aerially comprehensive soil gas investigation was conducted to support WSTF's RCRA Facility Assessment. As part of that assessment, aromatic (BTEX) and total hydrocarbon soil gas sampling was conducted for WSTF SWMUs that included the 100 Area burn pit (the investigation area encompassed the container storage areas and additional burn pit sites) and 600 Area burn pit. A mobile field laboratory performed real-time analysis of soil gas samples extracted from depths up to 2.5 feet (ft) below ground surface (bgs). Twenty-nine samples were collected from each location for analysis. BTEX concentrations were detected in approximately half the samples ranging from 0.09 ug/l to 16 ug/l. Total hydrocarbon concentrations were detected in almost all samples ranging from 0.5 ug/l to 96 ug/l. More details are available in the investigation report (GCL, 1989).

2.4.3 RCRA Facility Investigation (RFI) Phase II Soil Boring Investigation - 1994

SWMUs 1, 3, and 15 were investigated again in 1994 as part of WSTF's RFI Phase II SWMU soil boring activities. The historical boring locations are presented in Figure 2.2 along with proposed soil borings that are discussed in Section 5.1. Soil samples were analyzed for RCRA metals and organics using Methods 8240 and 8270. The RFI reported that for all SWMUs there were sporadic occurrences of RCRA metals. Metals detected above reporting limits were barium, chromium, lead, cadmium, arsenic, and silver. The RFI also stated that all concentrations were comparable to measured RFI Phase II background levels as well as values published for soils in the region.

All organic compounds analyzed in samples from the SWMUs during RFI Phase II were below detection limits except for low frequency occurrences of methylene chloride, acetone, and phthalates (all three compounds detected at each SWMU). The RFI explains and interprets the presence of the compounds as sampling or lab contaminants. A detailed description of the results of the soil boring investigations performed at SWMUs 1, 3, and 15 is provided in the draft RFI report (NASA, 1996)

3.0 Site Conditions

The WSTF is an industrial site that supports safety-related testing of space flight equipment and hazardous materials. The HIS describes in detail and provides maps of buildings and structures within the administration area and testing areas (NASA, 2014c). The SWMUs and AOIs under this investigation are contained within the 100 and 600 Areas. Access to these areas is via Apollo Boulevard, the main access road through WSTF.

The local topography at WSTF is typical of the basin and range physiographic province of the southwestern United States; formed as a result of late Tertiary extensional tectonism. The adjacent San Andres Mountains (SAM) represent an uplifted northwest-trending mountain block immediately to the east of WSTF, separated from adjacent mountain ranges by broad intermontane basins. The Jornada del Muerto Basin (JDMB) is located on the west side of the SAM and the adjacent alluvial-covered bedrock pediment slope on which WSTF is located.

3.1 Investigation Area Descriptions

The operational history of each SWMU and AOI for this IWP was presented in Section 2.1. The following sections describe the physical characteristics of each SWMU or AOI. Figure 1.2 presents SWMU and AOI locations with circumscribed investigation areas based on historical information. For additional details regarding the SWMUs and AOIs refer to the HIS (NASA, 2014c).

3.1.1 SWMU 1 - 100 Area Burn Pit

Dimensions of the 100 Area burn pit were initially 30 ft long by 15 ft wide by 2 ft deep. Over time, the pit size increased to 60 ft long by 20 ft wide by 2 ft deep due to dredging. Cleanup of the 100 Area burn pit was initiated in 1983 and completed by 1986. Based on sampling results, the 100 Area burn pit wastes were classified as industrial wastes and not hazardous waste. Approximately 50 yd^3 of liquid, sludge, and soils were shipped off-site for disposal in September 1985. Contaminated soils removed consisted of soils immediately surrounding the burn pit and soils underlying the pit to a depth of 1 ft. There was reportedly an oil odor and some soil staining remaining after the site cleanup.

3.1.2 SWMU 3 – 100 Container Storage Area

The 100 container storage area encompasses approximately 9,000 ft^2, located mostly to the south of the 100 Area burn pit. Many containers, mostly 55-gal drums, were situated on pallets or the ground and held site wastes that could be burned in the 100 Area burn pit. Some of the containers were unlabeled, corroded and leaked or spilled through time. Like the 100 Area burn pit, the 100 container storage area was also cleaned up in the mid-1980s. Cleanup included steam-cleaning the outsides of containers, moving containers to a new drum storage facility, shipping containers off-site for disposal, removing underlying contaminated soils, and shipping soils off-site for disposal. A total of 15 yd^3 of soil were removed and shipped off-site for disposal.

3.1.3 SWMU 15 – 600 Area Burn Pit

Dimensions of the 600 Area burn pit were reportedly approximately 8 ft by 8 ft. Residue and/or sludge was removed from the 600 Area pit using shovels and placed to the south end of the pit. After abandonment, this pit was back-filled, but no soils were removed, and no soil samples were collected.

3.1.4 AOI – 100 Burn Pit Overflow Area

As discussed in Section 2.1, the 100 Area burn pit reportedly overflowed. The frequency of overflow and quantity of fluids that overflowed are unknown; however, photographic evidence presented in the HIS of a large overflow shows soil staining extending from the northwest corner of the 100 Area burn pit approximately 200 ft to the northwest across the 150 yard. Photographic evidence also indicates the first extensive overflow of the 100 Area burn pit occurred between June 1974 and April 1976 and overflow stains remained visible until August 1982. No soil sampling or clean-up of the area has been conducted.

3.1.5 AOI – Additional 100 Area Burn Pit

The additional 100 Area burn pit was roughly square with approximate dimensions of 10 to 15 ft by 10 to12 ft by 1.5 ft deep and was located to the south and east of the 100 Area burn pit. The site was reportedly cleaned up in September 1985 with the 100 Area burn pit. Based on information presented in the HIS, this area may have contained PCBs.

3.1.6 AOI – North 100 Container Storage Area

The HIS identified a northern portion of the 100 container storage area, previously undescribed. Reportedly, empty drums were stored north of the 100 Area burn pit after the chemicals/liquids were poured into the pit. Long-term WSTF personnel also stated that additional drums were located in this area, but were not associated with the 100 Area burn pit, and were being overseen by the WSTF warehouse. Leaking drums of some sort of oil were documented in this portion of the 100 container area, however, no PCBs were detected in the oil. Quantities and substances spilled in this northern 100 container storage area are unknown.

3.1.7 AOI – Fire Department Training Area

The Fire Department training area consisted of an area approximately 87,100 ft^2 cleared of vegetation. As discussed in Section 2.1, wood, trailers, and cars were burned in this area, which resulted in potential releases to the environment of metals, semi-volatiles, volatiles, asbestos, PFC, and PFOS. Remains from fires were buried to the north of the area, adjacent to the 100 Area burn pit and the GSA Building 151. Early fire remains may have been removed in September 1985 when the 100 Area burn pit was cleaned up. Later fire remains are likely still present in the soil in the northern part of the Fire Department training area.

3.2 Surface Conditions

Ground surface where the SWMUs/AOIs reside slopes gently from an elevation of approximately 4,810 ft (1,466 m) above mean sea level at SWMUs 1 and 15 in the 100 Area to 4,767 ft (1,453 m) at SWMU 3 in the 600 Area over a distance of 1,729 ft (527 m). The soil is characterized by the U.S. Department of Agriculture (USDA) Soil Classification (USDA SCS, 1976) as the Nickel-Tencee Association consisting of approximately 60% Nickel gravelly fine sandy loam and 25% Tencee very gravelly loam. The natural surface conditions have been disturbed by a variety of site activities. SWMUs/AOIs are located within the WSTF industrial area and as such ground surface adjacent to or in their vicinity has been impacted by the construction of paved or dirt roads, building structures, berms, or cleared for storage area. Additionally, soil has been removed from the sites of the 100 Area burn pit and container storage area during cleanup operations conducted in the mid-1980s.

Major vegetation within WSTF includes a combination of woody shrubs and grasses characteristic of the Chihuahuan Desert Shrub Biotic Community. These shrubs include Louisiana White Sage, Creosotebush, Honey Mesquite, Tarbush, Broom Snakeweed, and Lotebush. Common grasses include Alkali Sacaton, Side-Oats Grama, Fluff Grass, Tobosa Grass, and Purple Three Awn. Plant species biodiversity is low relative to that in better drained upland slopes. Shrubs provide a microhabitat for warm season grasses and forbs as well as herptiles and small mammals. WSTF is considered to be a low affectability area. The facility receives little use by wildlife species because it has been physically altered by human disturbance or overgrazing. The area provides reduced topographic relief and vegetation diversity associated with food and cover.

Numerous well-developed arroyos are present but hidden from sight within the low profile topography and vegetation. Water flows in a westward direction toward the JDMB. The drainage pattern forming off the mountain front east of the 100/600 Areas consists of a network of arroyos cut through the alluvial fan emerging from Loman Canyon that trend southeast -northwest. Significant storm water that might flow in these arroyos is diverted around the 100 Area via a man-made berm. The only natural surface water feature in the area is Gardner Spring located in the 200 Area, approximately 1 ¼ miles (2 km) northeast of the investigation area. It is an intermittent spring and ceases flow for long periods of up to several years between rare periods of heavy mountain-front rainfall. The nearest natural water body of significant scale is the ephemeral Isaacs Lake, located approximately 10 mi (16.1 km) to the southwest of WSTF. It is located at the lowest point of the SJMB at an elevation of 4,285 ft (1,306 m) amsl.

3.3 Subsurface Conditions

The subsurface below the investigation areas is comprised of alluvium deposits overlying a bedrock pediment slope. The alluvium is classified as the piedmont slope facies of the Camp Rice Formation, which forms part of the Quaternary Santa Fe Group (Seager, 1981). The alluvium consists of intercalated fan, interfan valley, and erosion surface veneer deposits derived from the SAM between Bear Canyon, located to the northeast, and Loman Canyon, located to the southeast of the WSTF industrial areas. The heterogeneous alluvial soil lithologies in the vadose zone have porosities up to 20 percent and consist primarily of unconsolidated to moderately cemented, poorly sorted, pebble to boulder conglomerates with interbedded lenticular sandy gravels, and sandy silts. Calcic horizons to well-formed caliche is present in the shallow subsurface. The alluvium thickens moving from the SAM front westward, towards the JDMB. Lithologic logs from groundwater wells located closest to the investigation areas have recorded alluvium thickness ranging from 87 ft (26 m) and 105 ft (32 m) (100-A-182 and WB-1) to 125 ft (38 m) (NASA 4) in the 100 Area and increasing to 176 ft (54 m) (100-D-176) in the 600 Area. Refer to the GMP (NASA, 2014b) for a well location map.

Below Quaternary Santa Fe Group Alluvium, 100 Area lithologic logs have identified bedrock as Permian Hueco Limestone (100-A-182, WB-1, and NASA 4) then a lithologic change to Tertiary Orejon Andesite in the 600 Area (100-D-176). The bedrock lithology change is attributed to the Hardscrabble Hill Fault (HHF), a Late Tertiary, northwest trending normal fault related to Basin and Range activity with significant inferred displacement (estimated at between 1,000 ft [305 m; Seager, 1981] to 7,900 ft [2,408 m; Maciejewski, 1996]) located in the vicinity of well NASA 4.

Groundwater resides within fractured bedrock in the vicinity of the investigation areas. In the Permian Hueco Limestone, under confined to semi-confined aquifer conditions, groundwater level has been measured between 134 ft (41 m) and 177 ft (54 m) below ground surface (100-A-182 and NASA 4). In the Tertiary Orejon Andesite, under unconfined aquifer conditions, groundwater level has been measured at 173 ft (53 m) (100-D-176) below ground surface. Groundwater flows from east to west in this area. There is little to no data on well productivity and hydraulic conductivity from the above mentioned wells; 100-A-182 produced 10 gallons per minute (gpm) during well development and WB-1 has yielded a hydraulic conductivity of 3.54E+00 ft (1.08E+00 m) per day.

4.0 Scope of Activities

The following is a list of anticipated activities to be performed during the SWMUs investigation:

- Selection of appropriate sampling locations (based on the HIS and previous investigations), representative number of samples for each area, and sampling method.
- Field operations for the collection, management, and shipment of soil samples (including quality control field samples).
- Daily health and safety briefings.
- Field and Global Positioning System (GPS) survey data collection (decimeter accuracy).
- Laboratory analysis (including laboratory quality control samples), analytical reporting, and data processing through the WSTF data management system.
- Development of soil analytical data for SWMUs/AOIs for interpretation and presentation in the SWMU Investigation Report.

The scope of activities for this SWMU IWP is developed based on project data quality objectives (DQOs) and other requirements of Permit Attachment 17. Section 4.1 of this IWP discusses the DQO process, Section 4.2 describes the sampling plan, and Section 4.3 describes the investigation-derived waste (IDW) plan.

4.1 Data Quality Objective Process

The investigation methodology was developed based on "Guidance on Systematic Planning Using the Data Quality Objectives Process" (EPA, 2006) and the Corrective Action Site Investigations requirements of the Permit (NMED, 2009; Section VII.H). The data acquisition plan (i.e., sampling design) is based on the DQO process.

4.1.1 Problem Statement

The problem statement is summarized in the Permit (NMED, 2009; Section VII.H.1.b), which states that the IWP "…shall include schedules for implementation and completion of specific actions necessary to determine the nature and extent of contamination and the potential migration pathways of contaminant releases to the air, soil, surface water, and ground water."

4.1.2 Decision Statement and Alternative Actions

The primary decision is whether additional corrective actions are warranted at these sites due to the presence of a residual contamination source(s). Alternative actions for the decisions include:

- Consider a "Corrective Action Complete" status determination.
- If needed, perform a CME for the site(s) to identify remedial options for mitigation of source(s) of continuing contamination or human health risk.

4.1.3 Decision Inputs

Contaminants of Concern (COC) concentrations measured in vadose zone soil, soil vapor, and groundwater are primary inputs to the decision. COCs for this investigation have been identified using two primary information sources:

- Detailed information pertinent to the operational history and use of chemicals documented in the SWMUs 1, 3, and 15 HIS (NASA, 2014c) through a variety of historical documents and reports, personnel interviews, and personnel questionnaires.
- Comprehensive analytical data sets for samples collected from previous investigations at these sites that include soil, soil vapor, and groundwater. Analytical methods selected for this investigation will be used to quantify COC concentrations at or below NMED soil screening levels (SSLs) whenever possible (NMED, 2012[a]).

4.1.4 Study Boundaries

This investigation addresses and is limited to the upper portion of the vadose zone (the unsaturated area between ground surface and the water table) beneath SWMUs 1, 3, and 15 and associated areas. This includes the 100 Area burn pit, the 100 container storage area, and the 600 Area burn pit, as well as the additional AOIs (Figure 1.2). The horizontal boundaries of the study represent the known extent of the three SWMUs and the recently determined extent of the nearby AOIs (Figure 1.2). Contaminated soil was removed from the 100 Area burn pit and Container storage area in 1985 (NASA, 2014c), substantially reducing the potential that residual contamination migrated downward in significant amounts. This was confirmed during the RFI when soil borings and sample collection indicated the near absence of volatile COCs beneath these sites. Because of these factors, and the existence of calcic horizons in the subsurface that potentially interfere with downward contaminant movement, the vertical boundary of the study is limited to the uppermost 30 ft (9 m) of the vadose zone.

4.1.5 Study Constraints

A potential constraint is related to subsurface geology. Cobbles and boulders are common within the coarse-grained coalescent alluvial fan deposits at WSTF and have challenged ample sample recovery during past soil investigations. Hollow stem augering and the split spoon sampling are good methods for this investigation, however, and acceptable sample recovery is expected.

4.1.6 Decision Rule

The purpose of this investigation is to determine if residual contamination in the vadose zone, if present at the three SWMUs and related AOIs, exceeds applicable regulatory criteria or represents a continuing source of contamination to the groundwater. The strategy is to address the upper portion of the vadose zone to determine if COCs are present. In accordance with NMED soil screening guidance (NMED, 2012) and the Permit (NMED, 2009), validated analytical results from soil samples collected during the investigation will be compared to the appropriate risk-based screening level as described in Permit Attachment 15 (e.g., New Mexico or EPA Regional SSLs) for direct exposure of construction workers. Where multiple contaminants are detected, the cumulative effects of those contaminants will be considered as described in the guidance.

Project DQOs are summarized as follows: If COC concentrations in vadose zone soils exceed the cleanup levels as described in Permit Attachment 15 for direct exposure routes under the construction worker scenario, then move to the corrective measures evaluation phase. Otherwise, consider a “Corrective Action Complete” status determination. If this investigation fails to fully determine the nature and extent of contamination, additional site characterization may be required even if the DQOs are achieved.

4.2 Sampling Tasks

The following sections describe the SWMU investigation sampling strategy.

4.2.1 Sampling Design

Prior to chemical sample management, each soil sample will be visually evaluated for physical characteristics such as mineralogy, American Society for Testing and Materials (ASTM) soil classification, American Geological Institute (AGI) rock classification, moisture content, texture, color, presence of stains or odors, and field screening results. The depth where each sample was obtained, method of sample collection, and other observations will be recorded in the field log. Additional discussions of the proposed investigation methods are provided in Section 5.0.

The sampling design for SWMUs 1, 3, and 15 must fulfill the project DQOs. In order to meet the DQOs, contaminant concentration data from the SWMU subsurface soils will be recorded through the collection of soil chemical samples. Chemical soil samples collected from the soil borings within the footprint of the former SWMUs will be analyzed for the COPCs listed in Table 2.1 and the sampling and analyses that will be performed for each specific soil boring is summarized in Table 4.1. Chemical analysis for the PFCs will be performed for the shallow soil samples (at approximately 5 ft depth) for soil borings specifically located within the Fire Department training area. Soil geotechnical samples are not planned for the soil borings due to the soil geotechnical data previously collected during the RFI at SWMUs 1, 3, and 15 (NASA, 1996).

For each location, the soil boring will be drilled to the target depth. A maximum of two consecutive refusals above the target depth at a single location will also constitute completion of a soil boring. Refusal is defined as the inability of the auger to penetrate 0.5 ft in one minute with supporting evidence from the driller and geologist of a lithological obstruction in the soil boring that inhibits further advancement of the augers. Soil chemical samples will be collected using direct push core barrels. Refusal of the sampling device will be determined in accordance with ASTM D 1586 (1997). The core barrels will be decontaminated between uses as described in ASTM D 6282-98 (2005).

Historical lithological logging, soil sampling, and soil analytical data were collected at the SWMUs 1, 3, and 15 in October, 1994 as part of the RFI (NASA, 1996), with a summary provided in Section 2.4. These data were used to support the sampling plan for each SWMU of this IWP. Sections 4.2.2.1 through 4.2.2.3 provide discussions of the sampling plan for each individual SWMU.

4.2.2 Soil Sampling Plan

The following sections describe the sampling plan for SWMUs 1, 3, 15, and associated AOIs.

4.2.2.1 SWMU 1 (100 Area Burn Pit and Associated AOIs) Soil Sampling Plan

Four soil borings have been previously installed at the 100 Area Burn Pit (BP-100-1 through BP-100-4; NASA, 1996). Soil boring BP-100-4 was installed using continuous recovery by pushing split spoons through 2-ft intervals in order to identify continuous lithologic characteristics of the soils, and define the type and distribution of any shallow soil contamination encountered.

A total of 14 soil borings are proposed for installation and sampling for SWMU 1 and the adjacent AOIs (Figure 2.2; Table 4.1). Two soil borings will be installed through the former 100 Area Burn Pit location (100-SB-11 and 100-SB-12), two soil borings will be installed within the 100 Area Burn Pit Overflow (100-SB-13 and 100-SB-14), one soil boring will be installed within the north 100 Container Storage Area (100-SB-24), and nine soil borings within the Area Fire Department training area (100-SB-15 through 100-SB-23).

Based on a review of the Permit requirements (NMED, 2009), 100 Area burn pit lithological logs, and the results of geotechnical and geochemical soil samples for existing soil borings, the depth of drilling proposed for the two 100 Area Burn Pit soil borings (100-SB-11 and 100-SB-12) and the two overflow soil borings (100-SB-13 and 100-SB-14) is 30 ft bgs. Historical activities involved the transfer of combustible liquids from the container storage area to the 100 Area Burn Pit prior to incineration. The basis for this depth determination is as follows:

- The 30-ft depth exceeds the minimum depth requirement of 20 ft below the base of disposal units as specified in the Permit (Attachment 17, Section 17.2.2.b.i- Drilling) for areas where contamination is not detected (ND) based on previous investigations.
- Previous lithological analysis indicates eight alluvial soil horizons in the upper 30 ft. These are primarily alluvial sandy gravels as defined in field lithologic logs and from laboratory particle size analyses. Soil porosity was evaluated within two of the horizons and was reported as 29.6% and 32.0%, both from gravel samples. Soil moisture ranged from 2.09 to 12.96%, with the highest value in a horizon with silt and clay. The average moisture content from these samples was 5.85%. The low moisture content indicates low potential to transport dissolved contaminants. Horizons with abundant clay and silt were reported in the 12 to 16 ft interval, but this interval was not laterally continuous between borings. A gravelly clay horizon in the 25 to 28 ft interval in soil borings BP-100-3, BP-100-4 is considered to be less conducive to the infiltration of contaminants to depth.

The depth of drilling proposed for the 10 soil borings within the North 100 Container Storage Area (100-SB-24) and the 100 Area Fire Department training area and additional burn pit (100-SB-15 through 100-SB-23) is 20 ft bgs. These soil borings also meet Permit specific specifications for areas where contamination is not detected based on previous investigations. This depth is based on the fact that historical activities were confined to burning combustible construction materials at surface as part of training drills.

In the event that the auger cannot advance to the target depth of the soil borings, a twin boring will be installed approximately 5 ft from the initial boring and will be noted in the deviations section of the associated Investigation Report. Soil chemical samples will be attempted using direct push core barrels at 5-ft depth intervals to the total depth from each boring. The precise location of soil samples may be adjusted depending on specific site lithological conditions or other observations such as soil discoloration or odor.

Prior to the installation of the eight soil borings in the Fire Department training area , eight preliminary shallow soil borings for asbestos screening purposes will be installed to a depth of 4 ft using either direct push or hand auger techniques to minimize the potential for fiber release. These soil borings will be twinned adjacent to the locations for the deeper soil borings. These borings will be used to determine whether precautionary measures for asbestos management and additional asbestos sampling are required as part of the installation for the deeper soil borings.

4.2.2.2 SWMU 15 (600 Area Burn Pit) Soil Sampling Plan

Four soil borings were installed at the 600 Area Burn Pit (BP-600-1 through BP-600-4; NASA, 1996). All four soil borings were installed using continuous recovery by pushing split spoons through 2-ft intervals in order to identify continuous lithologic characteristics of the soils, and define the type and distribution of any shallow soil contamination encountered.

Two soil borings are proposed for installation and sampling at SWMU 15 that will be installed through the former 600 Area Burn Pit location (600-SB-11 and 600-SB-12; Figure 2.2; Table 4.1). Based on a review of the Permit (NMED, 2009), existing 600 Area Burn Pit lithological logs, and the results of geotechnical and geochemical soil samples for existing soil borings, the depth of drilling proposed for the 600 Area Burn Pit soil borings is 20 ft bgs. The basis for this depth determination is as follows:

- The 20 ft depth meets the minimum depth requirement for drilling below the base of disposal units where contamination is not detected as specified in the Permit (Attachment 17, Section 17.2.2.b.i- Drilling) for areas where contamination is not detected based on previous investigations.
- Previous lithological analysis indicates six alluvial soil horizons in the upper 30 ft. These comprise alluvial silts and gravels as defined in field lithologic logs and from laboratory particle size analyses. Soil porosity was evaluated within two of the horizons and was reported as 38.8 and 40.5%, both from gravel samples. Soil moisture ranged from 0.96 to 4.04%, with the average moisture content at 2.21%. The low moisture contents indicate low potential to transport dissolved contaminants. Horizons with abundant clay and silt soils in the 0 to 10 ft depth interval, and a clayey silt horizon in the 21 to 24 ft interval in soil borings BP-600-1, BP-600-2, and BP-600-3 are considered to be less conducive to the infiltration of contaminants to depth. Soils of this nature have lower porosities and permeabilities which can act as a buffer to prevent further migration. NASA recommends preventing further migration of potential contaminants through this identified buffer zone by not placing a borehole past the lower clayey silt horizon.

In the event that the auger cannot advance to the 20 ft target depth, a twin boring will be installed approximately 5 ft from the initial boring and will be noted in the deviations section of the associated Investigation Report. Soil chemical samples will be attempted at 5-ft depth intervals to the total depth from each boring. The precise location of soil samples may be adjusted depending on specific site lithological conditions or other observations such as soil discoloration or odor.

4.2.2.3 SWMU 3 (100 Area container storage area) Soil Sampling Plan

Three soil borings were installed at the 100 Area container storage area (CS-100-1 through CS-100-3; NASA 1996). All three soil borings were installed using continuous recovery by pushing split spoons through 2-ft intervals in order to identify continuous lithologic characteristics of the soils, and define the type and distribution of any shallow soil contamination encountered.

A total of four soil borings are proposed for installation and sampling at SWMU 3 within the area formerly used for container storage (100-SB-25 through 100-SB-28; Figure 2.2; Table 4.1). Based on a review of the Permit (NMED, 2009), existing 600 Area Burn Pit lithological logs, and the results of geotechnical and geochemical soil samples for existing soil borings, the depth of drilling proposed for the 100 Area container storage area soil borings is 20 ft bgs. The basis for this depth determination is as follows:

- The 20 ft depth meets the minimum depth requirement of 20 ft below the base of disposal units as specified in the Permit (Attachment 17, Section 17.2.2.b.i- Drilling) for areas where contamination is not detected based on previous investigations.
- Previous lithological analysis indicates six alluvial soil horizons in the upper 30 ft. These comprise alluvial silts and gravels as defined in field lithologic logs and from laboratory particle size analyses. Soil porosity was evaluated within two of the horizons and was reported as 25.7% and 30.0%, both from gravel samples. Soil moisture ranged from 1.16% (gravel) to 9.81% (silt), with the average moisture content at 2.21%. The low moisture contents indicate low potential to transport dissolved contaminants. Horizons described as clay and silt within the 0 to 6 ft and 20- to 30-ft intervals are considered to be less conducive to the infiltration of contaminants to depth.

Soils of this nature have lower porosities and permeabilities which can act as a buffer to prevent further migration. NASA recommends preventing further migration of potential contaminants through this identified buffer zone by not placing a borehole though the clay horizons between 20 to 30 ft.

In the event that the auger cannot advance to the 20 ft target depth, a twin boring will be installed approximately 5 ft from the initial boring and will be noted in the deviations section of the associated investigation report. Soil chemical samples will be attempted at 5-ft depth intervals to the total depth from each boring. The precise location of soil samples may be adjusted depending on specific site lithological conditions and observations made such as soil discoloration or odor.

4.2.2.4 Asbestos Sampling

A preliminary sampling event will be conducted at the Fire Department training area (AOI) to screen for the presence of asbestos. Approximately eight shallow borings, from ground surface to approximately 4 ft bgs, will be completed using either direct push techniques or hand auger techniques, to minimize the potential for fiber release and possible exposure to personnel or the environment. NASA will attempt to obtain samples from the following approximate depths: 0 to 0.5 ft, 1 to 2 ft, and 3 to 4 ft bgs. The samples will be properly obtained, containerized and transported under chain-of-custody protocol. The samples obtained will be analyzed for asbestos via polarized light microscopy (PLM) methods by a National Voluntary Laboratory Accreditation Program (NVLAP), as well as, National Environmental Laboratory Accreditation Program (NELAP)-registered and accredited laboratory. Upon receipt of the analytical results, areas containing ACMs will be sampled using additional precautions to prevent or minimize the potential for fiber release. This will include minimization of dust/visible emissions and the use of additional personal protective equipment (PPE).

4.3 Investigation-Derived Waste Plan

Attachment 20 of the NASA WSTF Hazardous Waste Permit (Permit Section 20.2.13) requires that a discussion of IDW be provided as an appendix to this Investigation Work Plan. The IDW Plan is presented in Appendix A.

5.0 Investigation Methods

This section describes the sampling strategy for placing boreholes, drilling rig access to boring locations, drilling method, and soil sampling procedures including equipment, decontamination, sample management, sampling for lab quality control, and data management.

5.1 Soil Boring Locations

5.1.1 SWMU 1 (100 Area Burn Pit and AOIs) Soil Boring Locations

Due to the nature in which the COPCs were dispersed throughout the 100 Area Burn Pit, additional 100 Area burn pit, 100 Area burn pit overflow, and Fire Department training area, as discussed in Section 2.0, NASA will utilize a judgmental sampling and random sampling strategy for placement of the boreholes. Areas in which definitive historical information is available will be targeted for specific borehole placement. To fulfill the DQOs, random placement of 13 boreholes within these areas will be utilized. Figure 2.2 provides a visual of the proposed soil borings within the 100 Area Burn Pit and associated areas of interest.

5.1.2 SWMU 15 (600 Area Burn Pit) Soil Boring Locations

Based on a review of historical information, NASA will utilize a judgmental sampling strategy for placement of the boreholes. NASA proposes two boreholes be placed within the 600 Area burn pit. Figure 2.2 provides a visual of the proposed locations of the boreholes.

5.1.3 SWMU 3 (100 Area Container Storage Area) and North 100 Container Storage Area Soil Boring Locations

Due to the nature in which the COPCs were dispersed throughout the 100 Area and north 100 Area container storage areas, as discussed in Section 2.0, NASA will utilize a judgmental sampling strategy for placement of the boreholes. Areas in which definitive historical information is available will be targeted for specific borehole placement. NASA proposes a total of five boreholes to be placed within these areas. Figure 2.2 provides a description of the proposed locations of the boreholes at the sites.

5.2 Drilling Rig Access Procedures

Drilling rig and associated equipment access to WSTF is provided by a 6-mile paved road to the facility from the US Highway 70 NASA exit ramp. The project site is located within the WSTF 100 Area that contains office facilities for administrative, management, and engineering activities and facilities for vehicle and facility maintenance, emergency medical, firefighting, and warehousing functions. The 100 Area consists of several buildings and adjacent parking areas with access from paved roads. The required soil borings are located within relatively well graded and developed unpaved gravel lot areas adjacent to access roads and a short distance from facility buildings. NASA's Maintenance and Operations (M & O) Department are available to assist with additional access support to all of the soil boring locations.

The drilling subcontractor is required to submit all drilling and related equipment to a detailed safety inspection within a 100 Area holding yard prior to admission to the specific soil boring locations. Any concerns regarding the condition or performance of drilling equipment are resolved prior to proceeding to the first soil boring location. The only structure that may impede access to the drilling rig is an 8-ft chain link fence that surrounds the yard located in the vicinity of SWMUs 1 and 3. This fence will be temporarily removed to accommodate rig access to the designated soil boring locations if required.

Equipment unloading and rigging up will take place at or near the exact soil boring location that it will occupy during operations. Overhead and underground utilities, traffic, and rig access were researched following selection of the proposed boring locations. Utility maps of the area were reviewed to ensure the proposed borings were not in the immediate vicinity of known underground utilities. A site inspection will also be conducted at each proposed soil boring location with the drilling subcontractor to ensure that an appropriate setback distance between the drilling rig and overhead utilities exists.

5.3 Drilling Method

Shallow soil borings up to a depth of approximately 4 ft will be installed in the area of potential asbestos contamination at the Fire Department training area AOI to screen for the presence of asbestos prior to the installation of deeper soil borings. The shallow soil borings will be completed using either direct push techniques (a Geoprobe or equivalent device), or hand auger techniques to minimize the potential for fiber release. Where feasible, soil samples will be collected using a dual tube sampling system (or similar device). These allow efficient collection of continuous soil cores with the benefit of a cased borehole.

Deeper soil borings (>10 ft depth) that will be installed at each of the project SWMUs and associated AOIs will be advanced using a truck mounted Central Mine Equipment (CME)-55, CME-75, or equivalent hollow-stem auger (HSA) drilling rig. The drilling rig, auger flights, and associated down-hole sampling equipment will be steam cleaned using pressurized steam at >180ºF prior to the start of the investigation. The auger flights and down-hole sampling equipment will be steam cleaned prior to the advancement of each soil boring.

Soil borings will be advanced using a carbide-tipped bit and 5-ft length x 8.75-inch diameter augers until the target total depth is achieved or auger refusal is encountered. The criterion for a refusal condition was derived from the ASTM D-1586-11 (2011) and corresponds to the time when the direct push sampler, driven by a 140-pound weight dropped 2.5 ft, will not penetrate six inches in 50 impacts.

The coarse-grained alluvial soils proximal to the San Andres Mountains are predominantly composed of coarse-grained sandy gravels. The HSA drilling rig will be equipped with a continuous core sampling device and several alternate drill bits. Soil sampling will be attempted using a 2-ft split-spoon sampler driver by a drop hammer. The split-spoon sampling device employed during the installation of soil borings will produce 2-ft x 1.5-inch diameter cores samples. Soil recoveries for split-spoon samples in the alluvial lithologies of the 100 Area have been moderate and average about 1 ft per split spoon (50%). If the sampling recovery with the split spoon is insufficient and does not meet project requirements, an alternative continuous core barrel sampler will be attempted. These core sampling devices are wider with a 2.75-inch diameter and length between 3 to 5 ft.

Following advancement of the sampling device through the required interval, the sampler will be removed from the soil boring and immediately transferred to project support personnel for lithologic evaluation and sample collection. Soil samples will be immediately removed from the sampling device, evaluated, tightly sealed in laboratory-supplied sample containers, and stored in an ice chest packed with ice. Samples for chemical analysis will be collected immediately following exposure of the sample. Direct push sampling devices (split-spoons, continuous core barrels, and associated tools) will be decontaminated using an Alconox wash and rinse following individual sample removal.

Soil cuttings generated during soil boring installation will be managed as IDW (Section 4.3). Following completion of the soil borings, each boring will be infilled using a cement-bentonite grout containing 5 % bentonite by weight from total depth to 2 ft below ground surface. The grout will be allowed to set, covered by 2 ft of concrete, staked with a brass cap, and stamped with the boring number and coordinates.

5.4 Sampling Procedures and Requirements

This section describes procedures for soil sampling.

5.4.1 Sample Collection Procedures

NASA maintains internal sampling procedures for field personnel to follow that ensure samples collected for investigations are handled in a manner that maintains their integrity. The following procedures are applied before, during, and after sample collection:

- Equipment decontamination procedures are completed before initial use and between individual sample collection locations to prevent contamination and cross-contamination of samples.
- Sampling equipment is either single-use pre-cleaned (per EPA protocol as with sample containers) or multiple-use decontaminated as indicated in the applicable site-specific internal procedural documentation and plans following ASTM D 5088-02 (2008) “Standard Practice for Decontamination of Field Equipment Used at Waste Sites” guidance.

- The inside of the soil sample container is not to be touched, and dedicated chemical resistant gloves are donned prior to sample collection to prevent contamination.
- All gasoline or diesel engines are turned off near and upwind of the sample locations to prevent the introduction of VOCs into the sample and to protect sample integrity.
- All samples are collected in a manner that minimizes the introduction of foreign material (e.g., dust, rain, and snow).
- Specified holding times, containers, and preservatives are strictly followed.
- For samples that require temperature preservation, samples are placed in a cooler with ice immediately following collection.
- If limited soil sample material is available due to low core recovery, chemical samples are collected in order of importance to the project as presented in Table 4.1. The anticipated order, preparation, and analytical methods for soil chemical samples is as follows:
    - VOCs – SW-846 Method 8260C;
    - SVOCs –SW-846 Method 8270C – including low level PAH;
    - TPH – most appropriate method using NMED guidelines;
    - PCBs – SW-846 Method 8082;
    - Dioxins/Furans – SW-846 Method 8290;
    - Inorganics including total metals – most appropriate method;
    - PFCs – most appropriate method ;
    - Hydrazines – most appropriate method;
    - Asbestos (where applicable) – most appropriate method.
- Soil samples specifically collected for perfluorinated compounds (PFCs) are analyzed using liquid chromatography and mass spectrometry.
- If limited geotechnical soil sample material is available, prioritization of the following characteristics are used for testing: grain size, porosity, moisture content, bulk density, organic carbon content, and saturated/unsaturated hydraulic conductivity.
- In the event groundwater is encountered, and a limited volume of groundwater is available due to low production, samples are collected in order of decreasing volatility as for the soil samples.

5.4.2 Field Screening Procedures

The field screening of soil samples for headspace analysis has proven difficult during previous WSTF source area investigations. Problems arise primarily from the types of alluvial sample (generally coarse grained range-front alluvium), poor sample recoveries and the need to collect a comprehensive suite of soil samples, and the lack of any residual contaminants given the elevated soil porosity and permeability. If sufficient soil sample is available during borehole installation activities, the analysis of soil vapors derived from soil samples will be attempted via the headspace method for total ionizable volatile compounds (TIVC) with a portable photoionization detector (PID); MiniRae or similar. The PID will be equipped with a 10.6 electron volt (eV) lamp and will be calibrated daily with isobutylene gas according to manufacturer’s instructions.

For headspace analysis, a representative soil sample is placed in an airtight plastic zip-closure bag immediately following collection. The soil is agitated and left in the bag for approximately five minutes in a shaded area, after which the head space soil vapors in the bag are measured for TIVC. The meter readings for TIVC are recorded in the field lithologic logs. The probability of obtaining meaningful headspace results is low. Any headspace detections will be used to assist with the selection of soil chemical sample locations either within a core sample, or between soil samples as applicable.

5.4.3 Soil Sampling Procedures

Soil samples will be collected during boring installation to characterize the lithological and chemical characteristics of the vadose zone. Soil sampling will be carried out as described in section 4.2. The coarse alluvial material anticipated in the vadose zone may limit sample recovery as the coarse gravel and cobbles often prevent advancement of the sampling tool. Previous vadose zone investigations have yielded sample recoveries as low as 20%. Core samples will be extruded and recovered into a new or decontaminated sample container. Following the collection of each sample, the sampling tool will be decontaminated as described in subsequent sections.

5.4.4 Sample Containers, Volume, and Preservation

Appropriately prepared and preserved (if required) sample containers will be provided by the contracted analytical laboratory. Containers will be third party clean certified. Preservatives will be provided by the analytical laboratory in accordance with the analytical method requirements. Chemical samples will be containerized according to laboratory instructions. All sample containers will have identifying labels and custody seals. Geotechnical soil samples will be collected in clean plastic sealable bags or buckets as specified by the analytical laboratory.

5.5 Sampling Supply Inspection and Acceptance Procedures

Sampling supplies will be inspected for cleanliness and integrity prior to use. Glassware will be checked for nicks, cracks, and breakage prior to use and will be replaced as necessary.

5.6 Equipment Decontamination Procedures

Neutralizing or removing contaminants from equipment minimizes the likelihood of sample cross-contamination, reduces or eliminates transfer of contaminants to clean areas, and prevents the mixing of incompatible substances. For our purposes, decontamination may consist of physical removal, chemical removal/neutralization or a combination of the two. All non-dedicated or reusable sampling equipment will be decontaminated between sampling events/sampling points.

One or more decontamination areas will be established in the work area. Decontamination areas will be positioned so as to not interfere with drilling operations while still being easily accessible from the drilling site. Typically, a small decontamination area is set up for sampling equipment outside the exclusion (drilling) zone and a larger and heavier duty decontamination pad is set up in a central project location for larger drilling equipment. Decontamination areas will be established within the contaminant reduction zone to prevent transfer of contamination outside of the controlled work area. All non-dedicated or reusable soil sampling equipment will be decontaminated between sampling events/sampling points.

Subcontractor drilling equipment and associated appurtenances are required to be decontaminated before mobilization to WSTF and at the project site before work commences. In addition, all downhole drilling equipment will be decontaminated between individual soil borings. All drilling and sampling equipment including, but not limited to, drill casing, stainless steel sampling tools and core barrels will be thoroughly decontaminated according to site-specific internal procedural documentation. In general, drilling/sampling equipment will be cleaned first by physically removing (brushing, scraping, etc.) heavy contamination such as loose soil then by using a high-pressure, hot-water wash (“steam cleaning”). The use of surfactants may make decontamination quicker or more efficient and will be considered if steam cleaning does not adequately remove contamination. The waste generated during decontamination will be managed as IDW. The IDW Plan is presented as Appendix A.

5.7 Field Documentation Procedures

Field personnel ensure that details of all activities related to this investigation are documented using a field logbook, field data records, and/or any required site-specific procedural documentation. Logbook entries will be thorough and sufficiently detailed to allow a skilled and experienced individual who is unfamiliar with the investigation to recreate the documented events. Logbooks will have durable pages and be bound and serially numbered. Entries will be made in ink with no erasures. If an incorrect entry is made, the information will be crossed out with a single strike mark, initialed, and dated. Each completed logbook page will be signed on the date created by the responsible field individual. Subsequently, each page will be reviewed and approved by another environmental professional. Multiple logbooks may be used (e.g. geologist’s logbook and sampler’s logbook); however, redundancy should be avoided. Logbook entries will include, as applicable, information such as (<u>underlined text below denotes Permit requirement</u>):

- Standard Daily Header:
    - Project name, logbook number, <u>current date</u>.
    - <u>Weather conditions</u>.
    - <u>Team members present (including subcontractors) and their affiliations</u>.
    - <u>Boring/Sampling location identification</u>.
    - Day’s planned task(s).
    - Description of daily safety meeting conducted.
    - <u>Brief description of required PPE</u>.
    - <u>Equipment in use (include calibration information, if applicable)</u>.
- Daily activities, times conducted, and observations:
    - Site arrival and departure.
    - Drilling (e. g., method, equipment, borehole diameter, footages, drill casing lengths, drilling conditions, all observations of formation water production, rig downtime with reason for delay, etc.).
    - Lithology (e.g., stratigraphy, moisture conditions, formation changes, bedrock depth and type).
    - Decontamination (e.g., method, equipment cleaned, IDW management).
    - Analytical Sampling (e.g., location, type, collection method, ID number(s), time, depth, sampler’s name).
    - Well completion (e.g., casing inventory and tally, construction measurements (screen, top of sand, etc.), materials used).
    - Well development (e.g., method, volumes, recovery rates, pump rates).

  - Field monitoring data (e.g., static water levels, PID readings, groundwater parameters).
  - Reference data sheets or maps, if applicable.
- Daily summary:
  - Action items, materials used, footages, changes or deviations made from planned protocol, visitors and the purpose of their visit, plan for the next day.
  - IDW generated and the method of storage, transport, and disposal.
- Signatures (field personnel and logbook reviewer).

At a minimum, field data records will include lithologic logs, location surveys, and sample documentation. Lithologic logs will be completed by the on-site geologist for each boring installed during the investigation. Soil classification will be determined using the Unified Soil Classification System (USCS) pursuant to ASTM D 2487-10 (2010), "Standard Classification of Soils for Engineering Purposes". Lithologic logs will include general information (e.g., boring or well name, location, dates, depths, and drilling details), USCS description, core depth intervals and recoveries, headspace PID readings, sample locations and ID number, and a detailed lithologic description using standard USCS criteria. For record and reporting purposes, finalized versions of lithologic logs will be generated using computer software.

For analytical samples, the date, location, depth, sample type and collection method, ID number, sampling technicians involved, and any circumstances, events, or decisions that could impact sample quality will be documented by the on-site geologist in the field logbook. Even though each case may be unique, the geologist's decision must be documented as to conditions that precipitated any "no-go" decisions for suitability of analyses. In addition to the field logbook notes for sampling events, Chain-of-custody (CoC) forms will be completed and maintained as investigation documentation.

Evidential records for the entire project will be maintained in paper copy or electronic form and will consist of:

- NMED-approved project IWP with any deviations redlined.
- Site-specific internal procedural documentation or plans.
- Project logbooks.
- Field data records (i.e., lithologic logs, well completion diagrams, location survey).
- Sample CoC forms.
- Correspondence between NASA and NMED.
- Final analytical data packages.
- Project associated reports.
- Miscellaneous – photos, maps, drawings, etc.

5.8 Analytical Tasks

NASA contracts services from off-site analytical laboratories as required to support program and project needs. Typically laboratories considered to support this project must be accredited by NELAP. However, for specialized analytical work, such as that required for hydrazines, non-accredited laboratories with demonstrated analytical capabilities may be considered. The analytical tasks required to achieve the project objectives will be awarded to the laboratory that is successful in the competitive bid process. Potential laboratories must respond to comprehensive statements of work (SOWs) developed to meet the project objectives defined in this IWP. Analytical standard operating procedures (SOPs), laboratory quality manuals, and other laboratory-specific documentation are provided by the analytical laboratory following award of the contract and are not available in advance. These documents are retained in the project record and will be available for NMED review as required.

5.9 Sample Management

NASA has developed a comprehensive internal procedure for sample management. This procedure provides specific information on sample management and related documentation, including instructions for sample custody (internal to NASA and external during shipment), storage, packaging, shipment, delivery tracking, and related recordkeeping.

5.10 Field Quality Control Samples

- Field Blank Samples

  Field rinsate (equipment) blanks will be collected at a minimum of once per borehole prior to spudding. Analytical results of field rinsate blanks are used to evaluate the adequacy of the equipment decontamination procedures and the possibility of cross-contamination caused by incomplete decontamination of sampling equipment.

  Trip blanks will be taken for each soil sample shipment to an off-site laboratory. The analytical results of trip blanks shall be reviewed to evaluate the possibility for the introduction of environmental contamination during shipping.

- Field Duplicate Samples

  Field duplicate samples will be collected from select sampling locations at a frequency of 10% of investigation samples. Duplicate samples will be analyzed for the same media and parameters as the primary samples. Duplicate sample locations will be recorded in the field, but will not be disclosed to the laboratory.

  MS samples are used to evaluate the effect that a sample matrix has on the accuracy of a measurement. MS samples will be collected at a minimum frequency of 5% of investigation samples.

5.11 Laboratory Quality Control Samples

The overall objective for laboratory analysis is to produce data of known and sufficient quality. Appropriate procedures and QC checks will be used so that known and acceptable levels of accuracy and precision are maintained for each data set. All samples will be analyzed by a fully qualified laboratory in accordance with the laboratory QA Plan, which ensures that the contract laboratory adheres to standardized analytical protocols and reporting requirements and is capable of producing accurate analytical data.

Method blanks and laboratory QC samples are prepared and analyzed in accordance with the laboratory’s method-specific SOPs. The analytical results of method blanks shall be reviewed to evaluate the possibility of contamination caused by analytical procedures. At a minimum, the laboratory will analyze method blanks and laboratory control samples at a frequency of one in 20 for all batch runs.

5.12 Data Management Tasks

- Project Documentation and Records – All facets of this investigation will be documented in detail by the responsible project personnel. Records are retained in the WSTF Environmental Records Management System as part of the facility Operating Record and can be accessed at any time by authorized WSTF personnel.
- Sample Collection and Field Measurements Data Package Deliverables – Sample information and field measurements are recorded in the field logbook by the responsible contractor field personnel. These data packages are reviewed on a regular basis during the investigation by knowledgeable project personnel and are retained in the project file. They are eventually archived in the WSTF Records Management System as part of the facility Operating Record. As required for reporting, these data are also transferred to and archived in operational and historical databases.
- Off-site Laboratory Data Package Deliverables – Data packages from off-site analytical laboratories will consist of two primary components: comprehensive "hard copy" reports, to be submitted as Adobe portable document files (.pdf) for review and archiving; and electronic data deliverable (EDD) files to facilitate transfer of chemical analytical data into WSTF's analytical database(s). The hard copy report will include a variety of information, including laboratory name, report date, sample-specific information, analyte names and Chemical Abstracts Service (CAS) numbers, analytical results, QC sample results, data qualifiers and narratives, pertinent analytical notes, laboratory reviewer signatures, and a variety of other information specific to the laboratory and analytical method. The EDD will include the associated electronic data and follow the same review and approval cycle as the paper report.
- Data Assessment, Review, and CAP – A QA/QC specialist will evaluate the sample data, field, and laboratory QC results for acceptability with respect to the project DQOs. Chemical analytical data will be compared with the project quality objectives and evaluated using the data validation guidelines contained in EPA guidance documents, the latest version of SW-846, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," and industry-accepted QA/QC methods and procedures (EPA, 2008).
- Assessment and Response Actions – The conformance of field activities to specifications in the IWP will be evaluated on an ongoing basis while field activities are in progress. Additional verification will be provided through oversight of the field activities by the Environmental Department project lead (PL). If a sample cannot be collected as planned, the PL will be notified and, if possible, an alternate location or sampling method may be selected. The assessment process will include immediate evaluation of any change to the sampling plan so that, if necessary, an alternate field procedure may be quickly established. Daily quality field assessments will be conducted during drilling and sampling activities. Field assessments will be performed by environmental professionals who are not immediate members of the field team. Following completion of field activities, a final review of field activities will be performed by a subject matter expert who was not directly involved with the field activities. Any deviations from the IWP or procedures will be documented.
- The contract laboratory will be required to notify NASA of significant data quality exceptions within one business day of discovery. Sample re-analysis will be performed, if possible. Any issues identified as part of the weekly field inspections will also be communicated to NASA within one business day.
- A NASA Project Manager (PM) or designee will contact NMED as soon as practical to discuss any data quality exceptions that may affect the ability to meet the investigation objectives. The

NASA PM or designee will also summarize the results of the discussion with NMED in a memorandum, copies of which will be provided to NMED via fax or electronic mail and included in the project file.

- Data Review Process - A comprehensive review of sample analytical data will be conducted as described in the sections below. Prior to conducting the review, the following information (where required and applicable) will be compiled and provided for the review:
  - The NMED-approved IWP.
  - Field sampling and geologist logs.
  - Laboratory reports.
  - Statements of work and the lab quality management plan.
  - EDDs.
  - SOPs.
  - Database tools.
- Data Review Elements:

  Step I: Verification – Verification (review for completeness) is the confirmation by examination and provision of objective evidence that the specified requirements (sampling and analytical) have been completed (EPA, 2005).

  Data verification is the process of determining whether data have been collected or generated as required by the project documents. The process consists of the following categories: 1) verifying that field sampling operations were performed as outlined in the IWP; 2) verifying that the data collection procedures and protocols were followed; 3) verifying completeness to establish that sufficient data necessary to meet project objectives have been collected; and 4) checking that QC sample results meet control limits defined in the analytical methods.

  Step II: Validation – Validation is the confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled. Validation is a sampling and analytical process that includes evaluating compliance with method, procedure, or contract requirements and extends to evaluating against criteria based on the quality objectives developed (EPA, 2005).

  The purpose of validation is to assess the performance of the sampling and analysis processes to determine the quality of specified data. Data validation consists of the following objectives: 1) verifying that measurements (field and laboratory) meet the user's needs; 2) providing information to the data user regarding data quality by assignment of individual data qualifiers based on the associated degree of variability; and 3) determining whether project quality objectives were met. Data management personnel will perform data validation in accordance with the requirements in this IWP and existing WSTF procedures.

  Step III: Usability Assessment – Usability assessment is the determination of the adequacy of data, based on the results of validation and verification, for the decisions being made. The usability process involves assessing whether the process execution and resulting data meet project quality objectives (EPA, 2005).

  The goal of data validation is to determine the quality of each data point and to identify data that are not acceptable to support project quality objectives. Data may be qualified as being unusable or rejected (R), as based on established quality review protocols. An explanation of the rejected data will be included in the report. Data qualified as estimated (J) are less precise, or less accurate, than unqualified data but are still acceptable for use. The data users, with support from the contractor Environmental Department data management staff, are responsible for assessing the effect of the inaccuracy or imprecision of the qualified data on statistical procedures and other data uses. The report will include available information regarding the direction or magnitude of bias or the degree of imprecision for qualified data to facilitate the assessment of data usability. The data reporting will include a discussion of data limitations and their effect on data interpretation activities.

5.13 Safety and Health Procedures

Field activities will be conducted in accordance with requirements of OSHA Standards for Hazardous Waste Operations and Emergency Response ([HAZWOPER]; 29 CFR 1910.120 [a] – [o]). The WSTF environmental contractor's Safety and Health Plan (SHP) will be augmented with a site-specific addendum for WSTF environmental restoration activities and site-specific Job Hazard Analyses (JHAs) to address potential hazards foreseeable for the project. The SHP, addendum, and JHAs will be followed in accordance with applicable requirements of the standards. The augmented SHP will address safety and health issues pertaining to work activities, including known and reasonably anticipated hazards associated with project scope of work as well as contingencies for unexpected conditions. The requirements of the SHP will apply to prime and sub-tier contractors as well as personnel requesting access to controlled areas of the investigation site. Project field personnel are required to be current in HAZWOPER training. In the event that new hazards are encountered that are not addressed by the SHP, the field team will stop work and contact a contractor health and safety representative to develop additional guidance on means to eliminate or mitigate any new threats. As required by 29 CFR 1910.120(b)(4), the SHP and project-specific addendum will address:

- A safety and health risk or hazard analysis for each site task and operation found in this work plan.
- Employee training assignments.
- PPE to be used by employees for each of the site tasks and operations being conducted.
- Medical surveillance and fitness for duty requirements (based on nature of the project scope and COPCs).
- Frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation to be used, including methods of maintenance and calibration of monitoring and sampling equipment to be used.
- Site control measures in accordance with the site control program.
- Decontamination procedures.
- An emergency response plan for safe and effective responses to emergencies, including the necessary PPE and other equipment.
- Confined space entry procedures.
- A spill containment program.
- Pre-entry briefing. The SHP shall provide for pre-entry briefings to be held prior to initiating any site activity, and at such other times as necessary to ensure that employees are apprised of the SHP and that this plan is being followed.

- Inspections shall be conducted by the Health and Safety Manager or, in the absence of that individual, another individual who is knowledgeable in occupational safety and health.

During the project, subcontractors must comply with OSHA and EPA standards applicable to this IWP, the SHP, and addendum. Project subcontractor field personnel are required to be current in HAZWOPER training required under 29 CFR 1910.120(e).

Safety professionals, or their designees, will inspect subcontractor equipment prior to the commencement of work. Any significant health and safety concerns will be identified, and the subcontractor will be allowed to address the concerns. If significant concerns cannot be rectified, this may be cause for termination of the subcontract.

6.0 Current Monitoring and Sampling Programs

There are currently two significant monitoring programs at WSTF that contribute to or potentially impact the investigation of SWMUs 1, 3 and 15.

Although there are no groundwater monitoring wells immediately adjacent to the study area, NASA relies on the data generated from groundwater monitoring to provide input for the development of IWPs. NASA routinely collects groundwater samples from a comprehensive network of monitoring wells at WSTF in accordance with the NMED-approved Groundwater Monitoring Plan (GMP; NASA, 2014b). Groundwater samples are collected for the analysis of the following primary constituents: VOCs; NDMA, bromacil, and metals. In addition to routine groundwater samples required by the GMP (NASA, 2014b), samples for other chemical analyses are frequently collected at many of the groundwater monitoring wells. Because these samples are not a direct requirement of the GMP, the results of these analyses are provided in the appropriate project-specific report.

NASA also monitors the vadose zone in the 200 and 600 Areas using multiport soil vapor monitoring wells. The most recent comprehensive sampling of soil vapor in these areas was performed in March 2013. The results of this sampling event were provided to NMED on June 14, 2013 (NASA, 2013a). NMED approved the report and directed NASA to perform an additional comprehensive 200/600 Area soil vapor sampling event following the installation of soil vapor monitoring wells proposed in the 200 Area Investigation – Phase II Investigation Work Plan (NASA, 2013b). NASA also performs quarterly groundwater and soil vapor monitoring at the 600 Area Closure in accordance with the NMED-approved 600 Area Perched Groundwater Extraction Pilot Test Work Plan (NASA, 2012). Samples are analyzed for VOCs to determine the impact of ongoing perched groundwater extraction from monitoring well 600-G-138.

7.0 Schedule

This investigation consists of three primary phases: 1) pre-investigation planning and preparation; 2) execution of the field investigation activities; and 3) data assessment and preparation of the investigation report detailing the findings of the investigation. The schedule for these activities is presented below.

7.1 Planning and Preparation

In addition to NMED review of this work plan, NASA must complete several important activities prior to the initiation of field activities. Resource requirements must be clearly identified and scheduled using the established NASA process for planning, funding, and executing work at WSTF. In addition, off-site resources must be coordinated. NASA expects these activities to require three to four months after NMED approval of this plan, which is anticipated in November 2014.

7.2 Field Investigation

NASA expects to begin the field activities described in this work plan in early 2015. It is expected that fieldwork can be performed in approximately six weeks. Unforeseen field conditions, off-site resource availability, delays in approval of this work plan, or other complications possibly impacting this schedule will be discussed with NMED as they arise to determine the best resolution.

7.3 Data Assessment and Reporting

NASA expects to complete field activities associated with this investigation in May 2015. Chemical analytical data from samples collected during the investigation should be fully available for verification and validation by NASA scientists within 30 days of the completion of field activities. These data will be evaluated as previously described, a process that typically requires up to two months. Additional resources, guidance, or supporting data will also be assessed and utilized to support the investigation. The results of these evaluations will be incorporated into a final report for submittal to NMED by November 30, 2015. Unforeseen delays in the completion of field investigation activities or data evaluation may adversely impact the completion of the report on this schedule and will be discussed with NMED as soon as possible upon NASA becoming aware of a problem.

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Figures

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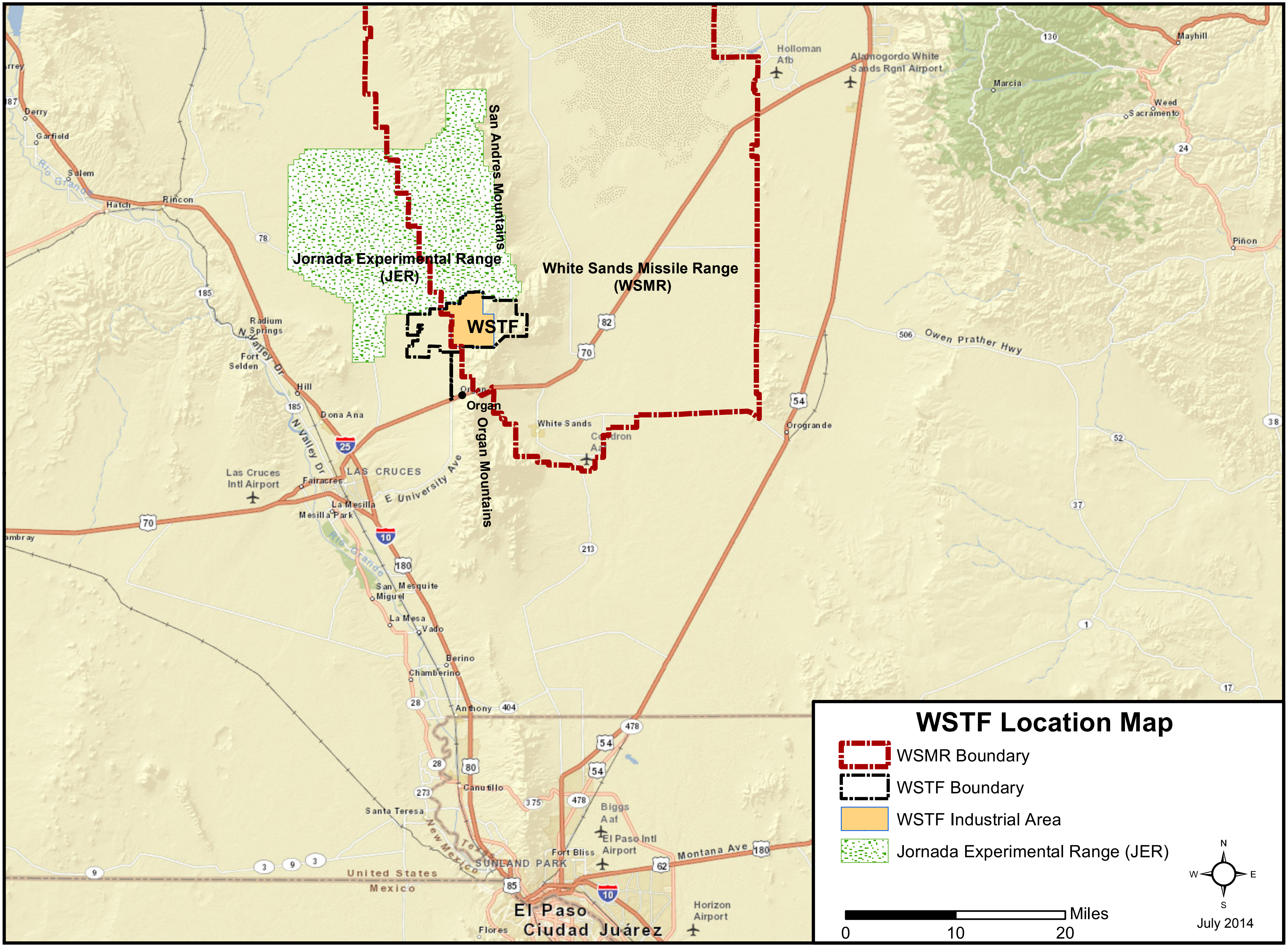
WSTF Location Map
WSMR Boundary
WSTF Boundary
WSTF Industrial Area
Jornada Experimental Range (JER)
Miles
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July 2014
Jornada Experimental Range
(JER)
White Sands Missile Range
(WSMR)
WSTF
San Andres Mountains
Organ Mountains
Organ
Holloman
Afb
Alamogordo White
Sands Rgnl Airport
Mayhill
Marcia
Weed
Sacramento
Piñon
Derry
Garfield
Salem
Hatch
Rincon
Radium
Springs
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Selden
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Dona Ana
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Intl Airport
Fairacres
La Mesilla
Mesilla Park
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N Valley Dr
Owen Prather Hwy
White Sands
Orogrande
San Miguel
Mesquite
La Mesa
Vado
Berino
Chamberino
Anthony
Canutillo
Santa Teresa
SUNLAND PARK
Fort Bliss
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Aaf
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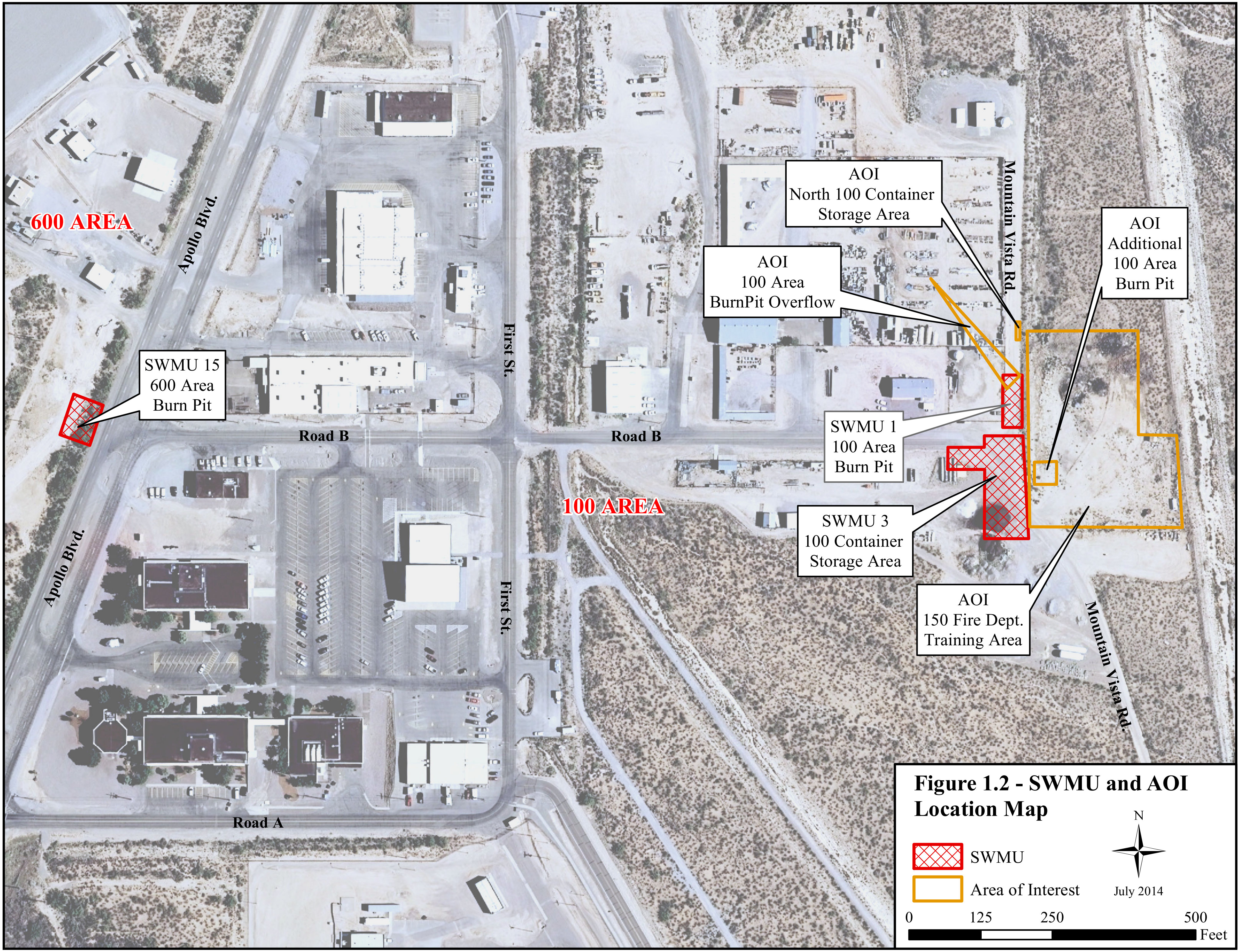
600 AREA
Apollo Blvd.
AOI
North 100 Container
Storage Area
Mountain Vista Rd.
AOI
Additional
100 Area
Burn Pit
AOI
100 Area
BurnPit Overflow
First St.
SWMU 15
600 Area
Burn Pit
SWMU 1
100 Area
Burn Pit
Road B
Road B
100 AREA
SWMU 3
100 Container
Storage Area
Apollo Blvd.
First St.
AOI
150 Fire Dept.
Training Area
Mountain Vista Rd.
Road A
Figure 1.2 - SWMU and AOI
Location Map
N
SWMU
Area of Interest
July 2014
0
125
250
500
Feet

Figure 2.1 Preliminary Site Conceptual Exposure Model

(SEE NEXT PAGE)

Site Conceptual Exposure Model

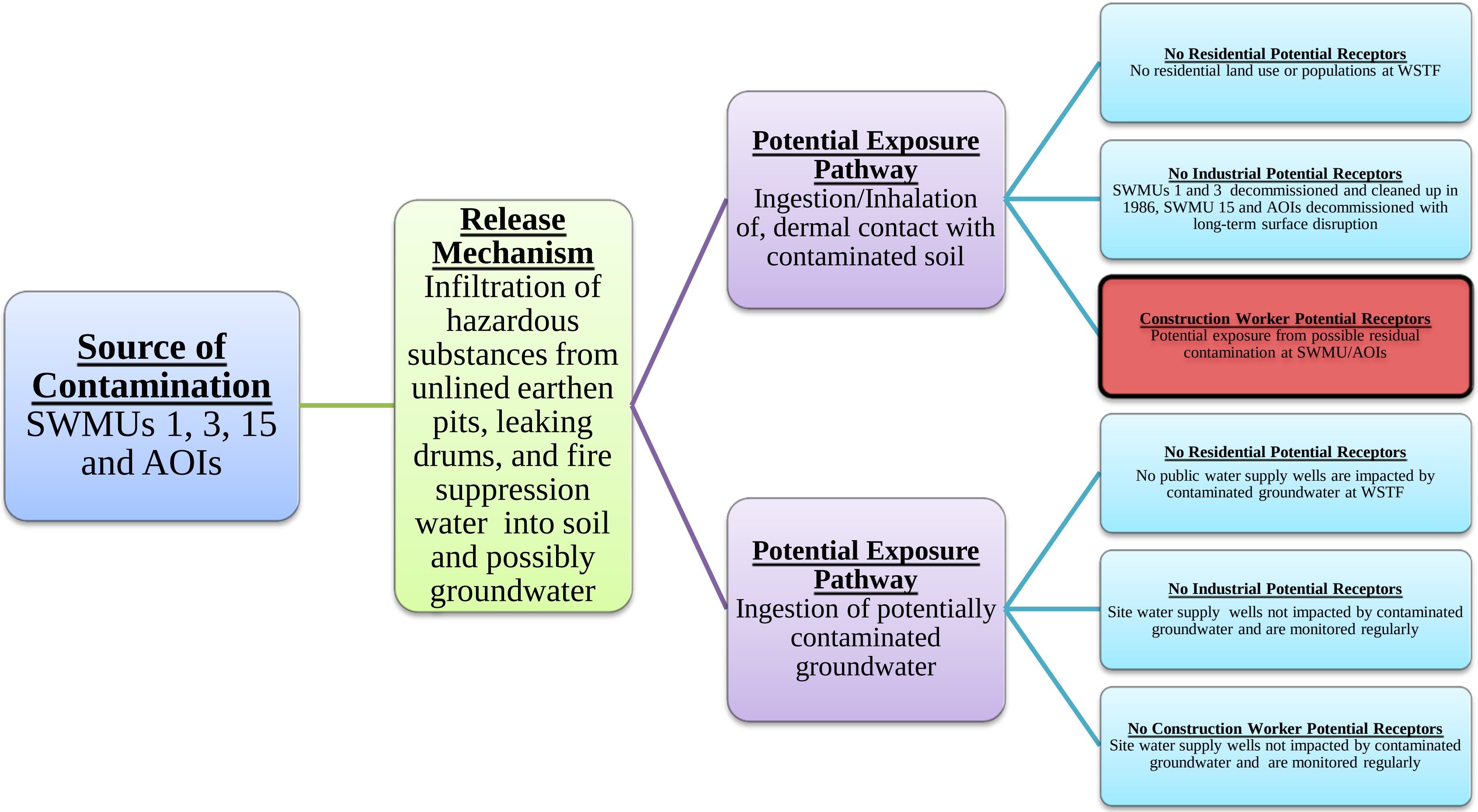

Figure 2.2 **Historical and Proposed Boring Locations**

(SEE NEXT PAGE)

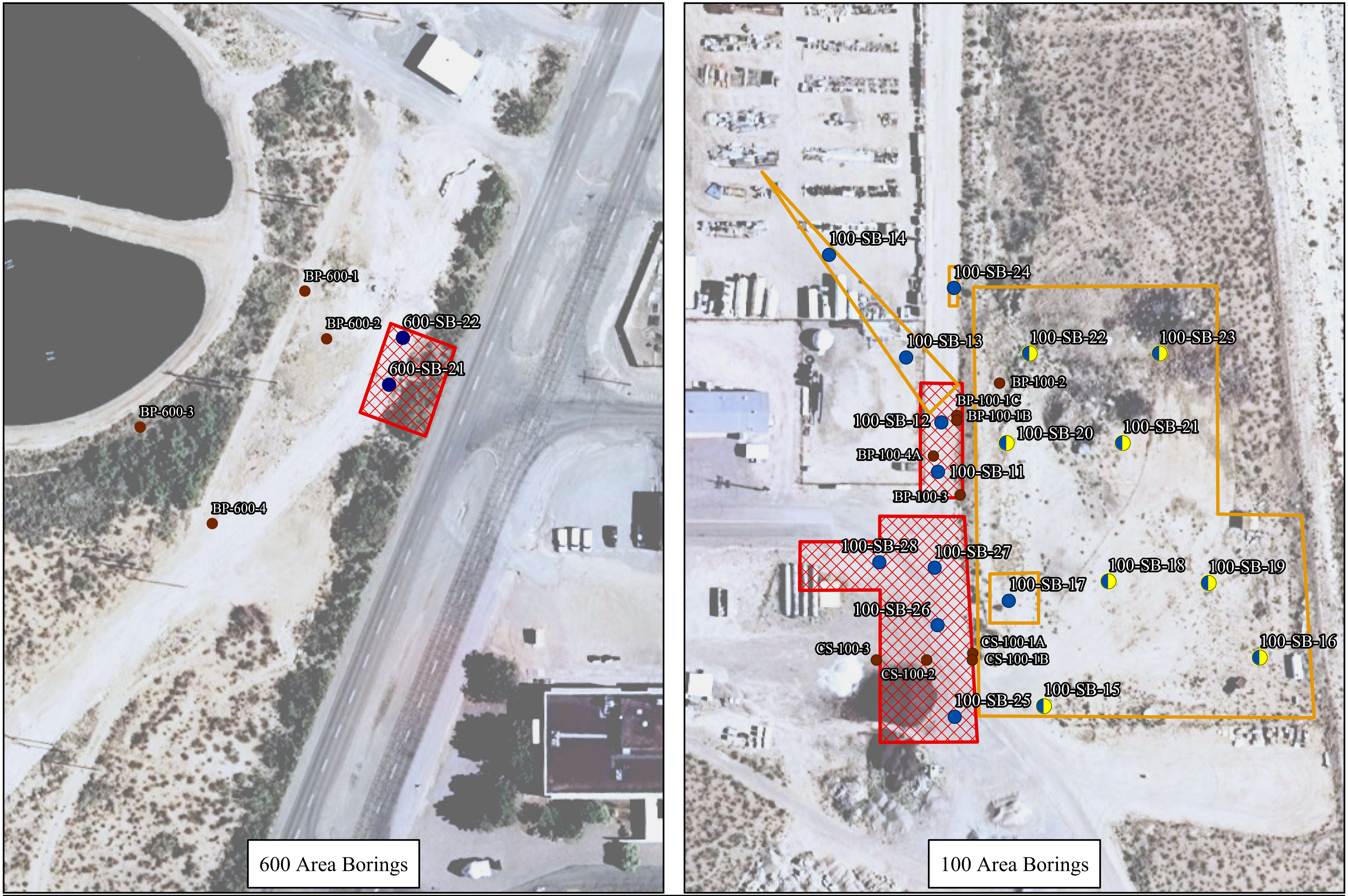

Figure 2.2 - 100 and 600 Area Soil Boring Location Map

Tables

Table 2.1 Contaminants of Potential Concern

Substance	Analytical Group
1,1-Dichloroethane	VOC
1,1,1-trichloroethane	VOC
1,2-Dichloro-1,1,2-trifluoroethane (F123A)	VOC
1,1,2-Trichloro-1,2,2-trifluoroethane (F113)	VOC
2-Butanone (methyl ethyl ketone) (MEK)	VOC
2-Propanol (isopropyl alcohol) (IPA)	VOC
Butanols (n-butanol, sec-butanol)	VOC
Acetone	VOC
Acetonitrile	VOC
Alcohols	VOC
Ammonium persulfate	INORGANICS
Asbestos	ACM
Benzene	VOC
Butyl cellosolve	VOC/SVOC+TICs
Carbon tetrachloride	VOC
Chloroform	VOC
Chromic acid	CHROMIUM(VI)/METALS
Dichlorobenzenes	VOC
Dichloroethylene (or 1,2-DCE)	VOC
Dichlorofluoromethane (F21)	VOC
Dichloromethane (methylene chloride)	VOC
Diesel	DRO/SVOC
Ethanol	VOC
Ethyl benzene	VOC
Ethylene glycol	VOC
Fuels (UDMH, A-50, MMH, hydrazine) – small amounts from fuel contaminated rags	HYDRAZINES
Gasoline	GRO
Hydraulic fluid	TPH
Hydrocarbons, C_7 Unsaturated	TPH
Isopropyl acetate	VOC+TICs
Lubricating oils	TPH

Table 2.1 Contaminants of Potential Concern (cont.)

Substance	Analytical Group
Metals (cadmium, chromium, copper, lead, mercury)	METALS
Methanol	VOC
Methyl isobutyl ketone (MIBK)	VOC
Motor oil	TPH
Dinitrogen tetroxide (N_2O_4) (small amounts used in burning)	INORGANICS
Oils	TPH
PCBs	PCBs
Perfluorooctanoic acid (PFC)	PFCs
Perfluorooctane sulfonate (PFOS)	PFCs
Phthalates	SVOC
Propene	VOC+TICs
Pyridine	SVOC
Surfactant	SVOC+TICs/INORGANICS
Tar	TPH
Tetrachloroethene (PCE)	VOC
Tetrahydrofuran	VOC
TOC (total organic carbon)	TOC
Toluene	VOC
Trichloroethene (TCE)	VOC
Trichlorofluoromethane (F11)	VOC
Vacuum pump oil contaminated with UDMH, A-50, MMH, hydrazine, and N_2O_4	TPH/HYDRAZINE
Xylenes	VOC

Table 4.1 Summary of Planned Sampling and Analytical Methods

SWMU or AOC Location	Soil Boring & Soil Vapor Well ID and Location[1]	Anticipated Boring Depth	Number of Samples	Sample Collection Summary				
				Field Screening[2]	Soil Chemical[3]	Duplicates[4]	Spikes[4]	Blanks[5]
100 Area Burn Pit (SWMU 1)	100-SB-11	30'	Soil chemical (6) Parameters: VOCs, SVOCs, TPH, PCBs, Dioxins/Furans, PFCs, Hydrazines, Inorganics including total metals		**X**	Field Duplicate		Rinsate Blank & Trip Blank
100 Area Burn Pit (SWMU 1)	100-SB-12	30'	Soil chemical (6) Parameters: VOCs, SVOCs, TPH, PCBs, Dioxins/Furans, PFCs, Hydrazines, Inorganics including total metals		**X**		Matrix Spike	Rinsate Blank & Trip Blank
100 Area Burn Pit Overflow	100-SB-13	30'	Soil chemical (6) Parameters: VOCs, SVOCs, TPH, PCBs, Dioxins/Furans, PFCs, Inorganics including total metals		**X**	Field Duplicate		Rinsate Blank & Trip Blank
100 Area Burn Pit Overflow	100-SB-14	30'	Soil chemical (6) Parameters: VOCs, SVOCs, TPH, PCBs, Dioxins/Furans, PFCs, Inorganics including total metals		**X**			Rinsate Blank & Trip Blank
Fire Training Area	100-SB-15	20'	Soil Screening (1) Parameters: Asbestos[2]	**X**		N/A	N/A	N/A
			Soil chemical (4) Parameters: VOCs, TPH, PCBs, Dioxins/Furans, SVOCs, PFCs, Inorganics including total metals, Asbestos[2]		**X**	Field Duplicate		Rinsate Blank & Trip Blank
Fire Training Area	100-SB-16	20'	Soil Screening (1) Parameters: Asbestos[2]	**X**		N/A	N/A	N/A
			Soil chemical (4) Parameters: VOCs, TPH, PCBs, Dioxins/Furans, SVOCs, PFCs, Inorganics including total metals, Asbestos[2]		**X**			Rinsate Blank & Trip Blank

Table 4.1 Summary of Planned Sampling and Analytical Methods (cont.)

SWMU or AOC Location	Soil Boring & Soil Vapor Well ID and Location[1]	Anticipated Boring Depth	Number of Samples	Sample Collection Summary				
				Field Screening[2]	Soil Chemical[3]	Duplicates[4]	Spikes[4]	Blanks[5]
Additional 100 Area Burn Pit	100-SB-17	20'	Soil chemical (4) Parameters: VOCs, Hydrazines, TPH, PCBs, Dioxins/Furans, SVOCs, PFCs, Inorganics including total metals, Asbestos[2]		**X**	Field Duplicate		Rinsate Blank & Trip Blank
Fire Training Area	100-SB-18	20'	Soil Screening (1) Parameters: Asbestos[2]	**X**		N/A	N/A	N/A
			Soil chemical (4) Parameters: VOCs, TPH, PCBs, Dioxins/Furans, SVOCs, PFCs, Inorganics including total metals, Asbestos[2]		**X**			Rinsate Blank & Trip Blank
Fire Training Area	100-SB-19	20'	Soil Screening (1) Parameters: Asbestos[2]	**X**		N/A	N/A	N/A
			Soil chemical (4) Parameters: VOCs, TPH, PCBs, Dioxins/Furans, SVOCs, PFCs, Inorganics including total metals, Asbestos[2]		**X**	Field Duplicate		Rinsate Blank & Trip Blank
Fire Training Area	100-SB-20	20'	Soil Screening (1) Parameters: Asbestos[2]	**X**		N/A	N/A	N/A
			Soil chemical (4) Parameters: VOCs, TPH, PCBs, Dioxins/Furans, SVOCs, PFCs, Inorganics including total metals, Asbestos[2]		**X**		Matrix Spike	Rinsate Blank & Trip Blank
Fire Training Area	100-SB-21	20'	Soil Screening (1) Parameters: Asbestos[2]	**X**		N/A	N/A	N/A
			Soil chemical (4) Parameters: VOCs, TPH, PCBs, Dioxins/Furans, SVOCs, PFCs, Inorganics including total metals, Asbestos[2]		**X**	Field Duplicate		Rinsate Blank & Trip Blank

Table 4.1 Summary of Planned Sampling and Analytical Methods (cont.)

SWMU or AOC Location	Soil Boring & Soil Vapor Well ID and Location[1]	Anticipated Boring Depth	Number of Samples	Sample Collection Summary				
				Field Screening[2]	Soil Chemical[3]	Duplicates[4]	Spikes[4]	Blanks[5]
Fire Training Area	100-SB-22	20'	Soil Screening (1) Parameters: Asbestos[2]	**X**		N/A	N/A	N/A
			Soil chemical (4) Parameters: VOCs, TPH, PCBs, Dioxins/Furans, SVOCs, PFCs, Inorganics including total metals, Asbestos[2]		**X**			Rinsate Blank & Trip Blank
Fire Training Area	100-SB-23	20'	Soil Screening (1) Parameters: Asbestos[2]	**X**		N/A	N/A	N/A
			Soil chemical (4) Parameters: VOCs, TPH, PCBs, Dioxins/Furans, SVOCs, PFCs, Inorganics including total metals, Asbestos[2]		**X**			Rinsate Blank & Trip Blank
North 100 CSA	100-SB-24	20'	Soil chemical (4) Parameters: VOCs, TPH, PCBs, SVOCs, PFCs, Inorganics including total metals		**X**		Matrix Spike	Rinsate Blank & Trip Blank
100 CSA (SWMU 3)	100-SB-25	20'	Soil chemical (4) Parameters: VOCs, Hydrazines, TPH, PCBs, SVOCs, PFCs, Inorganics including total metals		**X**	Field Duplicate		Rinsate Blank & Trip Blank
100 CSA (SWMU 3)	100-SB-26	20'	Soil chemical (4) Parameters: VOCs, Hydrazines, TPH, PCBs, SVOCs, PFCs, Inorganics including total metals		**X**		Matrix Spike	Rinsate Blank & Trip Blank
100 CSA (SWMU 3)	100-SB-27	20'	Soil chemical (4) Parameters: VOCs, Hydrazines, TPH, PCBs, SVOCs, PFCs, Inorganics including total metals		**X**	Field Duplicate		Rinsate Blank & Trip Blank
100 CSA (SWMU 3)	100-SB-28	20'	Soil chemical (4) Parameters: VOCs, Hydrazines, TPH, PCBs, SVOCs, PFCs, Inorganics including total metals		**X**			Rinsate Blank & Trip Blank

Table 4.1 Summary of Planned Sampling and Analytical Methods (cont.)

SWMU or AOC Location	Soil Boring & Soil Vapor Well ID and Location[1]	Anticipated Boring Depth	Number of Samples	Sample Collection Summary				
				Field Screening[2]	Soil Chemical[3]	Duplicates[4]	Spikes[4]	Blanks[5]
600 Burn Pit (SWMU 15)	600-SB-20	20'	Soil chemical (4) Parameters: VOCs, TPH, PCBs, SVOCs, Inorganics including total metals		**X**	Field Duplicate		Rinsate Blank & Trip Blank
600 Burn Pit (SWMU 15)	600-SB-21	20'	Soil chemical (4) Parameters: VOCs, TPH, PCBs, SVOCs, Inorganics including total metals		**X**		Matrix Spike	Rinsate Blank & Trip Blank

Maximum Sample Totals:

Soil Screening Parameters: Asbestos (8 samples)

Soil Chemical Parameters: VOCs (88 samples), SVOCs (88 samples), TPH (88 samples), PCBs (88 samples), Dioxin/Furans (88 samples), PFCs (18 samples), Hydrazines (32 samples), Inorganics including total metals (88 samples), Asbestos (36 samples)

Sample Blank/Duplicate Totals:

1 x trip blank (VOCs using distilled water in a 40 mL vial) for each soil sampling shipment (estimated 18 samples)

1 x rinsate blank per SWMU/AOI (estimated 5 samples)

Field Duplicates + Matrix Spikes Samples:

Soil Chemical Parameters: VOCs (9+5 samples), SVOCs (9+5 samples), TPH (9+5 samples), PCBs (9+5 samples), Dioxins/Furans (9+5 samples), PFCs[6] (2+1 samples), Hydrazines (4+2 samples), Inorganics including total metals (9+5 samples), Asbestos (4+2 samples)

Notes:

N/A Not applicable.

1 Refer to Figure 4.1 for soil boring locations.

2 Asbestos sampling pending field screening results. Asbestos will be sampled in boring locations if field screening yields positive results.

3 Samples to be collected on 5 ft intervals. Anticipated order, preparation, and analytical methods: VOCs – SW-846 Method 8260C; SVOCs – SW-846 Method 8270C – including low level PAH; TPH – most appropriate method using NMED guidelines; PCBs – SW-846 Method 8082; Dioxins/Furans – SW-846 Method 8290; Inorganics including total metals – most appropriate methods; PFCs – most appropriate method; hydrazines – most appropriate method; where applicable, Asbestos – most appropriate method.

4 Duplicates and Spikes: 1 x field duplicate per 10 soil/soil vapor samples, 1 x matrix spike per 20 soil samples, no matrix spikes collected for soil vapor.

5 Field blanks: 1 x trip blank per soil sampling shipment and 1 x rinsate blank for each SWMU and AOI.

Appendix A
SWMUs 1, 3, and 15 Investigation-Derived Waste Management Plan

National Aeronautics and
Space Administration

SWMUs 1, 3, and 15 Investigation-Derived Waste Management Plan (100 Area Burn Pit, 100 Area Container Storage Area, and 600 Area Burn Pit)

July 2014

NM8800019434
NASA Johnson Space Center White Sands Test Facility
12600 NASA Road Las Cruces, New Mexico 88012

Table of Contents

List of Acronyms

ACM	Asbestos-containing material
bgs	below ground surface
COPC	Contaminant of Potential Concern
CFR	Code of Federal Regulations
DOT	Department of Transportation
EPA	Environmental Protection Agency
HIS	Historical Information Summary
IDW	Investigation-derived waste
IWP	Investigation Work Plan
NASA	National Aeronautics and Space Administration
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
OSHA	Occupational Safety and Health Administration
PAH	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PPE	Personal protective equipment
RCRA	Resource Conservation and Recovery Act
RO	RCRA Online
RSSL	Residential Soil Screening Levels
SAP	Sampling and Analysis Plan
SWMU	Solid Waste Management Unit
TCLP	Toxicity Characteristic Leaching Procedure
TSCA	Toxic Substances Control Act
TD	total depth
TPH	Total Petroleum Hydrocarbons
WSTF	White Sands Test Facility

1.0 Waste / Activity Description

The National Aeronautics and Space Administration (NASA) will conduct a Solid Waste Management Unit (SWMU) investigation of SWMU 1 (100 Area burn pit), SWMU 3 (100 Area container storage Area), and SWMU 15 (600 Area burn pit). The purpose of this investigation is to determine any possible contamination to the environment from activities conducted at these SWMUs and to identify if any future corrective action measures for each of the SWMUs is required. NASA plans to install soil borings to depths of 30 feet below ground surface (bgs) at SWMU 1, and 20 ft bgs at SWMU 15 and SWMU 3. NASA anticipates collecting soil chemical samples from the soil borings at 5 ft depth intervals to total depth (TD), or as approved by the New Mexico Environment Department (NMED). This Investigation-Derived Waste (IDW) Plan will address the management of IDW that will be generated from the investigation activities.

Various types of IDW are expected to be generated from the SWMU 1, 3, and 15 Investigation. For the purpose of this IDW Plan, the types of IDW anticipated are identified as:

- Soil cuttings from the investigation drilling and sampling process.
- Decontamination water.
- Contact waste, including:
    - Non-dedicated sampling equipment.
    - PPE.
    - Plastic sheeting.
    - Rags.
    - Other debris contaminated by soil or fluids.
    - Equipment maintenance wastes (e.g., grease, contaminated rags, oil, WD-40®[1], diesel, soil contaminated with hydraulic fluids, etc.)

2.0 Waste Characterization (Acceptable Knowledge)

Contaminated environmental media is considered to meet the definition of a Resource Conservation and Recovery Act (RCRA) solid waste at the time that it becomes actively managed. The term “Active Management” is defined by the Environmental Protection Agency (EPA) as “physically disturbing the accumulated wastes within a management unit…” (54 FR 36597, September 1, 1989; 57 FR 37298, August 18, 1992; EPA, 2005). As a result, contaminated environmental media is considered to be a solid waste and is therefore subject to the RCRA hazardous waste identification and management requirements at the time that it is removed from a soil boring or borehole. Contaminated environmental media is subject to regulation under the EPA’s “contained-in policy” (EPA, 1986, 1989, 1991).

The wastes generated may contain any of the substances listed as potential substances used or stored in the SWMUs reported in Table 7.1 of the SWMUs 1, 3, and 15 Historical Information Summary (NASA, 2014a). Spent solvents (meeting the listing description of a listed hazardous waste per 40 CFR Part 261 Subpart D) carrying EPA Waste Codes F001 and F002 were discharged in SWMUs 1 and 3.

[1] WD-40® is a registered trademark of WD-40 Manufacturing Company.

In addition to contaminated environmental media, non-dedicated disposable sampling equipment, personal protective equipment, plastic sheeting, rags, and other debris contaminated by contact with soil or fluids, and water and soap solutions used to wash and decontaminate equipment will be generated. Debris containing contaminated environmental media is also subject to regulation. Therefore, pending completion of sampling and analysis, all IDW is a generator declared hazardous waste (40 CFR Part 262.11[c][2]) carrying EPA Waste Codes F001 and F002.

3.0 Waste Management

IDW will be accumulated and placed into containers and will be managed in accordance with WSTF Standard Instruction (WSI) 22-SW-0005 incorporating 40 CFR Part 262.34. This includes, but is not limited to, container content labels, accumulation start dates, less-than-90-day accumulation areas, hazardous waste labels, and Department of Transportation (DOT) container specifications. Per 40 CFR § 264.1080(b)(5) subpart CC standards do not apply to waste management units that are used solely for on-site storage of hazardous waste that is placed in the unit as a result of implementing remedial activities required under the corrective action authorities of RCRA.

The following IDW will be managed and accumulated in accordance with WSI 22-SW-0005.E incorporating 40 CFR Part 262.34:

- Used personal protective equipment, plastic sheeting, and other debris will be containerized in DOT compliant drums or bulk containers (roll-offs, Super Sacks[2], or similar).
- Soils, cuttings, and returns (unsaturated or saturated due to water from dust minimization) generated during drilling and sampling will be containerized in DOT compliant drums or bulk containers (Roll-offs, Super Sacks, or similar). Any liquids that separate may be decanted off and accumulated in DOT compliant drums.
- Decontamination fluids, muddy water, etc. will be either absorbed and managed with the unsaturated soils, or containerized in DOT compliant drums.
- Wastes typically associated with equipment maintenance (e.g., grease, contaminated rags, oil, WD-40®[3], diesel, soil contaminated with hydraulic fluids, etc.) may also be generated and will be managed as a hazardous waste.
- Any inadvertent spills onto the soil (e.g., discharged IDW decon. water to grade) are also considered IDW and will be containerized in DOT compliant drums or bulk containers (roll-offs, Super Sacks, or similar). All spills will be documented and evaluated for Reportable Quantity Notifications per WSTF procedures. All spills will be handled immediately in order to minimize the volume of waste generated.

In addition, potentially polychlorinated biphenyl (PCB)-containing material, which are regulated under the Toxic Substances Control Act (TSCA), will be managed in accordance with applicable TSCA regulations including, but not limited to, 40 CFR Part 761. As part of the preliminary field screening for potential asbestos-containing material (ACM), wastes such as soil cuttings, disposable PPE, and sampling equipment generated from this screening will managed and disposed of in accordance with the New Mexico Administrative Code (NMAC), Section 20, Part 9, subsection 8.12.

[2] Super Sack® is a registered trademark of Better Agricultural Goals Corporation DBA/ B.A.G. Corp.

[3] WD-40® is a registered trademark of WD-40 Manufacturing Company.

4.0 Waste Characterization (Sampling and Analysis)

Final waste characterization for the IDW will be completed in accordance with Attachment 12: *Waste Analysis Plan* of the NASA WSTF Hazardous Waste Permit (NMED, 2009) incorporating the SWMU 1, 3, and 15 Investigation Work Plan (IWP) and Sampling and Analysis Plan (SAP). The contaminants of potential concern and analytical parameters are summarized in Table 2.1 and Table 4.1 of the SWMUs 1, 3, and 15 IWP.

The listed determinations and characteristic determinations for the IDW will be based on the analytical data generated from the investigation samples (i.e. samples collected from the boreholes). To evaluate the toxicity characteristic, the total concentration of each reported constituent may be divided by 20 to determine the maximum theoretical leachate concentration that could result from performing the toxicity characteristic leaching procedure (TCLP – EPA Method 1311). These concentrations will be compared to the values listed in 40 CFR Part 261.24 Subpart C (Table 1) to determine if the waste exhibits the characteristic of toxicity. Alternatively, NASA may perform TCLP analysis on representative soil samples to evaluate the toxicity characteristic.

5.0 "No Longer Contained-In" Determination

For environmental media that are identified as containing listed wastes per 40 CFR Part 261 Subpart D, a request for a "no longer contained-in" determination may be submitted to the NMED Hazardous Waste Bureau (Land Disposal Restrictions, 1998).

To perform a "no longer contained-in" determination, the analytical data generated from borehole sampling may be compared to the applicable 40 CFR Part 268 Treatment Standards and the New Mexico Environment Department (NMED) Residential Soil Screening Levels (RSSLs) to determine whether the material poses an unacceptable risk. If contaminant concentrations are found to not pose an unacceptable risk, then NMED may determine that the wastes can be managed as no-longer containing listed wastes. Written approval by NMED of NASA's request for a "no longer contained-in" determination will be required to document such a determination.

6.0 Waste Disposal

For IDW characterized as hazardous waste (40 CFR Part 261), Land Disposal notifications (40 CFR Part 268), disposal facility profiles, and hazardous waste manifests (40 CFR Part 262) will be completed as required (US, 2013). Waste will be transported (49 CFR) for treatment and disposal at a permitted RCRA Treatment, Storage, and Disposal Facility (US, 2013). For IDW that is determined to be New Mexico Special Waste (20.9.2.7 NMAC), the IDW will be transported and disposed in accordance with 20.9.8 NMAC. In the event that IDW contains hazardous constituent(s) above industrial SSLs or the applicable 40 CFR Part 268 Treatment Standards (Land Disposal Restrictions, 2014), then NASA will discuss disposal options with NMED.

IDW (groundwater) is not expected to be generated during the investigation, however, if it is, it may be treated at the Mid-plume Interception and Treatment System in accordance with NASA's Hazardous Waste Operating Permit. In the event that the IDW (groundwater) cannot be treated at either of these units, land disposal notifications, disposal facility profiles, and hazardous waste manifests will be completed as required. Waste will be transported for treatment and disposal at a permitted RCRA Treatment, Storage, and Disposal Facility.

Upon receipt of an NMED "no longer contained-in" determination, soil (environmental media) will be spread on the ground in the vicinity of the borings, but in an area that will not be readily accessible to routine traffic or easily subject to runoff. Also, IDW debris that is determined to be non-hazardous waste will be disposed of as solid waste.

7.0 Reusable Materials

Any materials, equipment, and structures associated with the SWMUs 1, 3, and 15 investigation (e.g., plastic sheeting, non-contaminated piping, etc.) will be evaluated for potential recycling or reuse.

8.0 References

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National Aeronautics and
Space Administration

SWMUs 1, 3, and 15 Historical Information Summary (100 Area Burn Pit, 100 Container Storage Area, and 600 Area Burn Pit)

July 2014

NM8800019434
NASA Johnson Space Center White Sands Test Facility
12600 NASA Road Las Cruces, New Mexico 88012

Executive Summary

This report summarizes information regarding historical site operations, hazardous chemical use, and hazardous waste management practices for the National Aeronautics and Space Administration (NASA) White Sands Test Facility (WSTF) regarding use of the Solid Waste Management Units (SWMUs) 1, 3, and 15, also called the 100 Area burn pit, 100 container storage area, and the 600 Area burn pit. This summary will facilitate identification of any releases or potential releases of hazardous substances or hazardous waste to the environment and is designed to support the development of the SWMU 1, 3 and 15 Investigation Work Plan (IWP; NASA, 2014d). This IWP is required to be submitted to the New Mexico Environment Department (NMED) on or before June 30, 2014 by the WSTF Hazardous Waste Permit (Permit; NMED, 2009). NMED granted an extension to July 30, 2014.

Operations and waste management practices at WSTF were not well documented prior to 1985, when a full-time Environmental Department was established at WSTF. NASA has researched existing historical environmental records and conducted interviews of both retired and active long-term site employees to determine the nature and timing of any releases or potential releases to the environment.

The operational periods and any associated SWMU numbers as listed in the Permit for the 100 Area burn pit, 100 container storage area, and the 600 Area burn pit are:

- 100 Area burn pit: 1969-June 1983, designated as SWMU 1.
- 100 container storage area: 1969-1988, designated as SWMU 3.
- 600 Area burn pit: 1964-1969, designated as SWMU 15.

The exact amount of chemicals burned at SWMUs 1 and 15, the 100 and 600 Area burn pits, is not known; however, using the burn permit requests and information from WSTF employees as a guide, the approximate total amount of chemicals burned at each burn pit was estimated. The 600 Area burn pit may have burned approximately 500 gallons (gal) total of chemicals including alcohol, diesel, and gasoline. The 100 Area burn pit may have burned approximately 36,960 to 672,000 gal of chemicals/liquids. Chemicals burned within or identified through analyses of the 100 Area burn pit included 1,1-dichloroethane, 1,2-dichloro-1,1,2-trifluoroethane (Freon® 123A), 1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113), dichlorofluoromethane (Freon 21), trichlorofluoromethane (Freon 11), 2-butanone (or methyl ethyl ketone [MEK]), 2-propanol (or isopropyl alcohol [IPA]), butanols (n-butanol, sec-butanol), carbon tetrachloride, chloroform, dichlorobenzene, dichloroethylene, dichloromethane (methylene chloride), tetrachloroethene (PCE), methyl isobutyl ketone (MIBK), isopropyl acetate, acetone, ethanol, methanol, other alcohols, toluene, xylenes, ethylene glycol, ethyl benzene, benzene, diesel, gasoline, surfactant, motor oils, lubricating oils, hydraulic oils, spent vacuum pump oil (which included trace fuels [unsymmetrical dimethylhydrazine (UDMH), monomethylhydrazine (MMH), Aerozine-50 (A-50; an equal mixture of UDMH and hydrazine), and hydrazine] and combustion and partial combustion products of these fuels), and small amounts of dinitrogen tetroxide (N_2O_4). Other chemicals that may have been burned may have included trichloroethene (TCE), acetic acid, chromic acid, acetonitrile, tetrahydrofuran, pyridine, propene, butyl cellosolve, and potentially paints. Metals may have also been present in oils or wastes.

The 100 container storage area (SWMU 3) stored mostly 55-gal drums of chemicals that were burned in the 100 Area burn pit. Releases to the environment occurred from spilled or leaking drums. Exact volumes and chemicals released to the soil are unknown but included contaminated vacuum pump oil and could have included all the chemicals known to have been burned in the 100 Area burn pit.

The 600 Area burn pit (SWMU 15) was the first burn pit established at WSTF and was located directly adjacent to the 100 Area wastewater lagoon to the west and Apollo Boulevard to the east. Chemicals burned included alcohols, gasoline, and diesel.

Results of the current evaluation indicate that there are three areas of interest (AOI) where releases to the environment occurred. An additional burn pit, located in the 100 Area to the east and south of the main 100 Area burn pit, was roughly square and smaller than the original 100 Area burn pit. This pit was active from approximately 1981 to 1985, and burned similar chemicals/liquids to the 100 Area burn pit. An estimated total amount of chemicals burned, assuming burning 100 to 500 gal of chemicals/liquids per burn two times per quarter is 4,000 to 20,000 gal.

The second AOI identified was the Fire Department (FD) training area located within the entire cleared area east of the main 100 Area burn pit. Scrap wood, 1950s and 1960s model trailers, and many cars were burned from 1981 to 2007. There were also smaller wood fires ignited with gasoline and diesel on the soil adjacent to the 200 Area burn pit and the 100 Area burn pit. These fires were used for fire extinguisher practice. Fire extinguishers at WSTF contained carbon dioxide, water, and powder, not Aqueous Film-Forming Foam (AFFF); however, AFFFs were used in extinguishing the 100 Area burn pit historically and “light water,” containing perfluorocarbons, was used to extinguish wood and trailer fires in the FD training area. It is unknown, but likely, that perfluoroctanoic acid (PFOA) and/or perfluorooctane sulfonate (PFOS) were components in the AFFFs.

The third AOI is an overflow area from the 100 Area burn pit, extending downgradient to the northwest from the pit. Also located north of the 100 Area burn pit is a previously unidentified northern portion of the 100 container storage area where waste drums were stored and historical leaks occurred.

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List of Figures/Tables

List of Acronyms

1,1-DCE	1,1-Dichloroethane
A-50	Aerozine-50
AFFF	Aqueous film-forming foams
amsl	Above mean sea level
AOI	Area of interest
AR-AFFF	Alcohol resistant aqueous film-forming foam
Bgs	Below ground surface
BLM	Bureau of Land Management
BTEX	Benzene, toluene, ethylbenzene, xylene
DoD	Department of Defense
EPA	Environmental Protection Agency
ETU	Evaporation Tank Unit
FD	Fire department
FFFC	Fire Fighting Foam Coalition
Freon 11	Trichlorofluoromethane
Freon 113	1,1,2-trichloro-1,2,2-trifluoroethane
Ft	Foot or feet
gal	Gallon(s)
GCL	Geoscience Consultants Limited
GC-MS	Gas chromatography-mass spectroscopy
GSA	Government Services Administration
HIS	Historical Information Summary
HWMU	Hazardous Waste Management Unit
in.	Inches
IPA	Isopropyl alcohol
IWP	Investigation Work Plan
JER	Jornada Experimental Range
JP	Jet propulsion or propellant
JSC	Johnson Space Center
MEK	Methyl ethyl ketone
MMH	Monomethylhydrazine
MSDS	Material Safety Data Sheets
n.t.	No title
N_2O_4	Nitrogen tetroxide
NASA	National Aeronautics and Space Administration
NMED	New Mexico Environment Department
NMEID	New Mexico Environmental Improvement Division
NMSLO	New Mexico State Land Office
NOV	Notice of violation
PCB	Polychlorinated biphenyls
PCE	Tetrachloroethene
Permit	Hazardous Waste Operating Permit
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonate

RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SAM	San Andres Mountains
SWMU(s)	Solid Waste Management Unit(s)
TCE	Trichloroethene
TOC	Total Organic Carbon
TPS	Test Preparation Sheet
UDMH	Unsymmetrical dimethylhydrazine
UST	Underground Storage Tank
WIWPS	WSTF Individual Waste Profile Sheet
WSMR	White Sands Missile Range
WSTF	White Sands Test Facility

1.0 Introduction

1.1 Purpose

The National Aeronautics and Space Administration (NASA) Johnson Space Center (JSC) White Sands Test Facility (WSTF) Hazardous Waste Permit (Permit) issued by the New Mexico Environment Department (NMED) requires the preparation and submittal of a historical information summary (HIS) for each solid waste management unit (SWMU) or area of concern to be investigated (NMED, 2009, Section VII.H.1.c). The information gathered during preparation of each HIS will be used to aid the development of unit-specific investigation work plans (IWPs). The purpose of this HIS is to evaluate past site operations, hazardous chemical usage, and waste management practices to identify known or potential releases of hazardous waste or hazardous substances to the environment in or around WSTF SWMUs 1 (the 100 Area burn pit), 3 (the 100 container storage area), and 15 (the 600 Area burn pit). This SWMU 1, 3, and 15 IWP (NASA, 2014d) will be submitted concurrently with this HIS.

1.2 Scope

Information compiled in this summary was obtained from review of historical documentation, including reports, correspondence, files, and photographs. Additional information was obtained from questionnaires or interviews with current and former WSTF employees. NASA collected and reviewed the information in this HIS between April and July 2014.

The observations and interpretation presented in this document are strictly limited in time and scope to the information obtained during the review process. No subsurface exploratory drilling, sampling, or chemical analyses were performed during the course of this evaluation. However, a summary of previous clean-up operations, sampling, and analyses of the 100 Area burn pit is provided.

1.3 Limitations and Assumptions

WSTF historical operations and waste management practices were not well documented from the inception of the site in 1963 through the mid-1980s. For this HIS, NASA relied on a limited assortment of documents, correspondence, and the recollections of long-term WSTF employees to develop a conceptual understanding of activities performed at SWMUs 1, 3, and 15. The information is subject to the limitations of historical documentation, availability and accuracy of pertinent records, and the personal recollection of the individuals interviewed. In many cases, there is insufficient information available to provide independent verification that the information is accurate and correct.

2.0 Site Description

2.1 Location

WSTF is located in Doña Ana County, 18 miles northeast of Las Cruces, New Mexico and 65 miles north of El Paso, Texas. Figure 2.1 provides a WSTF location map. Access to the site is provided via a paved road (NASA Road) that intersects U.S. Highway 70, one mile west of Organ, New Mexico. The installation occupies approximately 60,500 acres.

2.2 Land Ownership

WSTF administrative and testing facilities are located on White Sands Missile Range (WSMR), owned by the U.S. Department of the Defense, Department of the Army (DoD; U.S. Army). NASA is the operator of the facility under an inter-agency agreement with the U.S. Army. NASA also maintains land-use agreements with the Bureau of Land Management (BLM; a right-of-way agreement), the New Mexico State Land Office (NMSLO; a water exploration/development easement), and the U.S. Department of Agriculture, Agricultural Research Service Jornada Experimental Range (JER; an easement deed) for the use of lands located to the west of the industrial facility. Figure 2.2 provides an ownership overview of lands used by NASA.

2.3 Land Use

All of the WSTF industrial areas are strictly for industrial use. Security and firefighting personnel staff the facility 24 hours per day, seven days per week; however, there are no full-time residents at WSTF. WSTF is a restricted access area closed to the public, and access by visitors is provided only in accordance with NASA JSC policies.

Cattle are grazed on BLM, NMSLO, and JER lands to the south and west of the industrial facilities area; however, fences prohibit the cattle from entering the industrial portions of the facility. The DoD U.S. Army, on behalf of NASA, maintains an inter-agency agreement with the BLM to provide a safety or buffer zone adjacent to WSTF that limits land use to ensure public safety due to the dangers involved with using hydrazine-based propellants and nitrogen tetroxide (N_2O_4), an oxidizer. WSMR occupies the area to the north and east of WSTF.

The land for WSTF occupied by NASA and NASA contractors remains vested with the DoD U.S. Army. All permanent buildings, structures, and other related facilities erected in this land area will become the property of the DoD U.S. Army upon termination of their use by NASA (DoD, 1982).

2.4 General Physical Setting

WSTF is located on soil composed of coalescent alluvial fans that are locally dissected. The facility is bordered on the east by the north-south trending San Andres Mountains (SAM) that ascend over 6,000 feet (ft) above mean sea level (amsl). The WSTF site is bordered on the west by a broad uniformly sloping alluvial pediment plain extending into the Jornada del Muerto Basin and to the Doña Ana Mountains. The major alluvial fan systems originate from Bear Canyon to the northeast and Loman Canyon to the southeast of WSTF. Foothills on the western pediment of the SAM at WSTF are typically 4,800 to 5,000 ft amsl, are moderately sloping (15 to 25%), and consist of thin layers of alluvium covering fractured limestone and volcanic bedrock. Numerous arroyos, which only flow during periods of heavy rainfall, dissect the alluvial fan deposits. Figure 2.3 provides a topographic map of WSTF and surrounding areas.

3.0 SWMUs 1, 3, and 15 Background

3.1 Location and Current Use of SWMUs 1, 3, and 15

For the purposes of this HIS, the 100 Area and the eastern 600 Area, located adjacent to the 100 Area, will be discussed together within various sections of this document. The 100 and eastern 600 Areas are located within Section 2, Township 21 South, and Range 3 East. Access to these areas is via Apollo Boulevard, the main access road through WSTF. The 100 and eastern 600 Areas are currently used for support of the entire WSTF site. Buildings, structures, and SWMUs located in the 100 and eastern 600 Areas are described in Section 3.3 and shown on Figure 3.1.

The 100 Area consists of buildings designated with numbers in the one hundreds. The 100 Area burn pit (SWMU 1) and the 100 container storage area (SWMU 3) are located in the eastern portion of the 100 Area. The 100 Area burn pit site is currently used as a part of Mountain Vista Road (Figure 3.1). The 100 container storage area is currently used to store rock for construction use and occasionally, empty compressed gas cylinders (Figure 3.1).

The 600 Area is located to the west of Apollo Boulevard and contains buildings designated with numbers in the six hundreds. The eastern 600 Area is located adjacent to the 100 Area, directly west of Apollo Boulevard. The 600 Area burn pit (SWMU 15) is located just east of the 100 Area Wastewater Lagoon (Figure 3.1) and is not currently being used for any industrial purpose.

3.2 Physical Setting at the Property

Sections 3.2, Surface Conditions and 3.3, Subsurface Conditions in the SWMUs 1, 3, and 15 IWP provide detailed descriptions of the physical setting at WSTF (NASA, 2014d).

3.3 Description of Structures

Buildings, structures, and SWMUs located in the 100 Area are illustrated in Figure 3.1. Structures and buildings within the 100 Area include office facilities for administrative, management, and engineering activities, an emergency center (Fire Department [FD] and Clinic), security facilities, heavy equipment maintenance and related facilities, vehicle maintenance facilities, construction facilities, warehouse facilities, trade/fabrication shops, storage buildings, waste accumulation areas, a fuel station, a cafeteria, a fitness center, and an auditorium (NASA, 1994c). The warehouse and support buildings house all materials, supplies, and substances entering WSTF. Distribution of goods/substances to the appropriate industrial area is accomplished following receiving procedures at the warehouse. There are two in-ground and two above-ground magazines for explosives and detonators located to the northwest of the 100 Area, and not shown on Figure 3.1 for security reasons.

The eastern 600 Area buildings and structures include buildings for transfer of WSTF site water and groundwater assessment support buildings containing generators, gas cylinders, tools, and equipment necessary for performing groundwater assessment activities (Figure 3.1).

Attachment 22 of the Permit (NMED, 2009) identifies SWMUs at WSTF. SWMUs located within the 100 Area and shown on Figure 3.1 include the 100 Area burn pit (SWMU 1), the 100 container storage area (SWMU 3), and a septic tank located adjacent to Building 114 (SWMU 22). There are three 100 Area SWMUs not shown in Figure 3.1, due to the scale of the figure. These are a septic tank located adjacent to the former WSTF security main gate (SWMU 21), an abandoned small arms firing range located near groundwater monitoring well WB-2 (SWMU 31), and the WSTF active firing range (SWMU 53).

As seen in Figure 3.1, the eastern 600 Area contains four SWMUs, the 100 Area wastewater lagoon (SWMU 2, managed in accordance with DP-392), the terminus of the historical 200 Area hazardous waste transmission line (SWMU 10), the 600 Area burn pit (SWMU 15) and the 600 Area overflow wastewater lagoon (SWMU 34, managed in accordance with DP-392), and one hazardous waste management unit (HWMU), the former 600 Area surface impoundments that historically contained dilute hazardous waste resulting from 200 Area laboratory operations. This HWMU was closed in 1989 as an interim landfill. An HWMU investigation was completed in March 2011 (NASA, 2011a) with NMED approval of the 600 Area Closure Investigation Report (NMED, 2011a).

There are two additional 600 Area SWMUs that are not located in the eastern 600 Area and are therefore not shown on Figure 3.1. These SWMUs are the JP test areas (SWMU 14) and the BLM or 600 Area off-site pile (SWMU 16). Both SWMUs are located to the west of the industrial area with access via the WSTF Well Road.

3.4 Current Uses of Adjoining Properties

Figure 3.2 is a map showing the WSTF industrial areas. The locations of adjoining properties are discussed below in relation to the 100 Area.

3.4.1 200 Area

The 200 Area is located to the northeast of the 100 Area (Figure 3.2). Personnel and facilities in the 200 Area provide support for the Propulsion Test Department at WSTF, including preparing test articles, performing analytical services, and fabrication and cleaning of aerospace program articles. Personnel in the 200 Area also conduct materials and component testing in hazardous environments, including materials properties determination, materials compatibility and toxicity analyses, detonation studies, flight article outgassing characterization, systems analysis, orbital debris impact simulation testing, and propellant characterization (NASA, 2013b).

The 200 Area laboratory and test preparation complex consists of offices, storage space, preparation rooms, clean rooms, shops, test facilities, various laboratories (including photography, fuel oxidizer, chemistry, metallurgy, molecular desorption analytical, gas, and spectroscopy, x-ray, vacuum, and calibration laboratories), and support areas for testing activities. The laboratory and test preparation complex also contains systems for the storage and handling of many types of propellants, corrosive chemicals, flammable solvents, and compressed gasses.

SWMUs located within the 200 Area include the clean room discharge pipe (SWMU 4), the scape room discharge pipe (SWMU 5), the Building 203 discharge pipe (SWMU 6), the South Highbay discharge pipe (SWMU 7), the 200 Area wastewater lagoon (SWMU 8), the 200 Area main burn pit (SWMU 9), the beginning of the historical hazardous waste transmission line (SWMU 10), two septic tanks located adjacent to Building 272 (SWMU 23), and the 200 Area small arms firing range (SWMU 30). On June 27, 2013, NASA submitted an IWP and Closure Plan to NMED regarding the 200 Area septic tanks (NASA, 2013a) and received approval of the IWP from NMED on November 8, 2013 (NMED, 2013).

The 200 Area also contains one HWMU in the process of closing (the Evaporation Tank Unit [ETU]) and two closed HWMUs (two separate sites that historically contained four hazardous waste underground storage tanks [USTs]). The ETU treated aqueous wastes by evaporation in accordance with the Permit (NMED, 2009) that consisted of two circular, flat-bottomed, open-top, carbon steel tanks lined with two 30-mil polyvinyl chloride liners in each tank. The ETU received its last waste on December 8, 2012, and the tanks were removed by February 15, 2013. NASA submitted the ETU Closure Certification Report to NMED on August 1, 2013 (NASA, 2013c). The two closed HWMUs were the west and east closures. The west closure consisted of two steel USTs for storing hazardous wastes derived from the clean room. The east closure consisted of two USTs, one steel and one concrete, for storing hazardous wastes derived from the 200 Area laboratories complex (other than the clean room). All of the USTs were excavated and removed, and the areas were closed as interim landfills in 1986, with NMED approval received in 1989. The west and east closure areas are currently under investigation as part of the Phase II 200 Area vadose zone investigation.

3.4.2 300 Area

Both the WSTF 300 and 400 Areas are part of the WSTF propulsion test office. Both areas were designed and constructed to test various propulsion systems, including those necessary to accommodate cold flow and hot firing static testing (NASA, 1994c). Combined current capabilities include testing with hypergolic, liquid oxygen, liquid methane, and other hydrocarbon propellants, propellant and test article conditioning, providing saturated propellants to test article inlets, support and handling of propellants at any location, and hypergolic propellant handling training (NASA, 2014a, 2014b).

The 300 Area is located to the northeast of the 100 Area (Figure 3.2). Test facilities and support buildings in the 300 Area include one ambient, dual-position (vertical and horizontal) firing test stand, one altitude simulation, dual-position (vertical and horizontal) firing test stand, one altitude simulation, horizontal-firing test stand, one ambient, horizontal-firing test stand, two below grade structures for instrumentation and control signal conditioning equipment, a test control center, a remote command building, and shelters for equipment storage. Test support systems include fuel and oxidizer storage, pressurizing, and handling.

SWMUs located within the 300 Area include the 300 Area oxidizer burner (SWMU 11), three septic tanks (the 300 Area main septic tank [SWMU 24] and the Building 320 septic tank [SWMU 25], and the Building 364 septic tank [SWMU 26], all three managed in accordance with DP-392), and the 302 condensing water discharge pond (SWMU 33, managed in accordance with DP-697). On June 27, 2013, NASA submitted an IWP and Closure Plan to NMED regarding the 300 Area septic tanks (NASA, 2013a) and received approval of the IWP from NMED on November 8, 2013 (NMED, 2013).

There is one HWMU located within the 300 Area. This HWMU consisted of two concrete-lined surface impoundments and three reinforced concrete treatment tanks that historically contained dilute hydrazine-type propellants (Monomethylhydrazine [MMH], hydrazine, unsymmetrical dimethylhydrazine [UDMH], Aerozine-50 [A-50]), and oxidizer. This HWMU was approved as an interim landfill in 1989 by NMED (NMED, 1989). An investigation of the HWMU was completed in October 2011. NASA submitted the Closure Investigation Report on August 30, 2011 (NASA, 2011c), and NMED approved the 300 Investigation Closure Report on October 13, 2011 (NMED, 2011b).

3.4.3 400 Area

The 400 Area is located north and slightly east of the 100 Area (Figure 3.2). Test facilities and support buildings in this area include two altitude dual-position (vertical and horizontal) firing test stands, one ambient dual-position (vertical and horizontal) firing test stand, and two altitude horizontal-firing test stands (one capable of firing solid propellant engines), a test control building, and several preparation buildings. The altitude simulation test stands use either boilers to operate vacuum pumps or three alcohol/liquid oxygen combustion rocket engines to operate a water steam generator to create a vacuum that simulates high altitude conditions. Test support systems include pressurization, storage, and handling of large amounts of alcohol, liquid oxygen, nitrogen, oxidizer, hypergolic propellants, diesel generators, and a pretreatment boiler water system. Testing within the 400 Area is currently supporting Commercial Crew Development testing and Air Force Minuteman activities.

SWMUs located within the 400 Area include the 400 Area oxidizer burner (SWMU 12), the 400 Area historical aspirator discharge pipe (SWMU 13), the 400 Area main septic tank (SWMU 27, managed in accordance with DP-392), and the 400 Area four-cell, boiler water discharge (salt) pond (SWMU 48, managed in accordance with DP-1170). On June 27, 2013, NASA submitted an IWP and Closure Plan to NMED regarding the 400 Area septic tanks (NASA, 2013a) and received approval of the IWP from NMED on November 8, 2013 (NMED, 2013).

The 400 Area also contains one HWMU, in the process of closing. This HWMU consisted of two concrete-lined surface impoundments and three reinforced concrete treatment tanks that historically contained dilute hydrazine-type propellants (MMH, hydrazine, UDMH, A-50), oxidizer, and referee propellants (1,1,2-Trichloro-1,2,2-trifluoroethane [Freon®[1] 113] and Trichlorofluoromethane [Freon 11]). This HWMU was approved as an interim landfill by NMED in 1989 (NMED, 1989), and the 400 Area Closure IWP (NASA, 2011b) was approved by NMED in November 2011 (NMED, 2011c). Investigation of the HWMU is pending.

3.4.4 500 Area

The 500 Area contains two separate locations, one area is located to the north of the 100 and 400 Areas and the other area is located to the east of the 400 Area (Figure 3.2). The 500 cryogenic storage area is used for storing large quantities of gases used at WSTF, including nitrogen and oxygen. There are no SWMUs associated within this area.

The 500 fuel and oxidizer storage area was designed to store fuel and oxidizer for use at WSTF. Buildings and structures include small control buildings, shelters, piping, breathing air generation equipment, and the permitted Fuel Treatment Unit, where fuel wastes are diluted and stored until shipment off site for disposal. There is one SWMU located in the area, the 500 fuel storage Area (SWMU 47), identified by NASA in March 2000 (NASA, 2000). A preliminary investigation consisting of three soil sampling events was completed in July and December 2000 and May 2001. The results of this investigation were summarized in the 500 Fuel Storage Area HIS (NASA, 2011b).

3.4.5 700 Area

The 700 Area is located north of the 400 Area (Figure 3.2). The 700 Area contains a remote testing area and the closed WSTF landfill. Buildings and structures in the 700 Area include a control center, three temporary buildings/shelters, and several steel pole remnants in the 700 remote testing area. SWMUs located in the 700 Area are the 700 Area high energy blast facility (SWMU 18) and the 700 Area landfill (SWMU 49). The landfill was closed and the Landfill Closure and Post-Closure Care Plan was approved by NMED in August 1997 (NMED, 1997).

3.4.6 800 Area

The 800 Area is located adjacent to the 200 Area to the northeast (Figure 3.2). This area performs tests for ignition and combustion characteristics on a variety of materials in various liquid and gaseous atmospheres for aerospace, aircraft, medical, and industrial applications. Compatibility assessments and post-fire failure analyses are performed to identify potential problems and fire causes to recommend design criteria and avoid future real-world fires. The 800 Area contains a control building, eight reinforced concrete test cells, various test support structures, and test support systems for the pressurization, storage, and handling of cryogenic materials and oxygen.

SWMUs located within the 800 Area include an oxidizer burner (SWMU 20) and a below grade storage tank (SWMU 19) for temporary storage of diluted and residual testing fuels. The 800 Area also contains a septic tank that services Buildings 802 and 803 that is managed in accordance with DP-392.

[1] Freon® is a registered trademark of E.I. du Pont de Nemours & Company Corporation (DuPont).

4.0 Historical Records Review

4.1 Record Sources

Reasonably ascertainable and practically reviewable records relevant to the history, operations, and environmental conditions of SWMUs 1, 3, and 15 were selected and reviewed dating back to 1964. The type and location of these records are as follows:

- NASA Environmental Records – Located on site in the WSTF Environmental Department and available in both paper copy and electronic form. They include:
  - Reports (RCRA Facility Investigation [RFI], WSMR quarterly reports, contractor to NASA, exposure information reports).
  - Correspondence (contractor to NASA, NASA, NMED, Environmental Protection Agency [EPA]).
  - Burn Permit Requests.
  - Internal WSTF documents (correspondence, analytical data, memoranda, reports, e-mail communications, Environmental Committee Meeting Minutes, polychlorinated biphenyl [PCB] records).
  - Laboratory reports.

- WSTF Internal Records – Located on site in the Quality Assurance Office available both in paper copy and electronic form, including:
  - WSTF test preparation sheets (TPSs).
  - Discrepancy records.

- NASA Photographs – Located on site in the WSTF Photography Laboratory.

4.2 Interviews and Questionnaires

In addition to the review of historical records, interviews with current long-term and retired WSTF personnel were also conducted. A summary of information obtained from interviews is provided in Appendix A.

5.0 Operational History

5.1 Pre-WSTF History

From the early 1800s to approximately 1935, the Organ Mountains and the SAM were mined for gold, silver, zinc, copper, and lead. There were several established mines located in the SAM and numerous prospect mines. The nearest established mine to WSTF was the Smith Mine located approximately 1 mile southeast of WSTF within the Loman Canyon area. The Smith Mine produced approximately $30,000 worth of silver ore during its operations. Deposits of galena (lead sulfide) and barite ($BaSO_4$) were also mined just north of the eastern mouth of Bear Canyon.

Lands now occupied by WSTF were historically open-range grazing lands. The ruins of a historic ranch house (Gardner Ranch, dates of operation unknown) are located just east of the current 200 Area laboratory facilities, and Love Ranch (believed to be in operation from the early 1900s until the 1950s) is located approximately 2.5 miles northeast of the 200 Area. These properties were acquired by the federal government and became part of WSMR.

5.2 Inception of WSTF

NASA Headquarters announced selection of a testing site in south-central New Mexico on July 6, 1962. The site was chosen for the isolated location and topography, which minimize the inherent hazards of aerospace propulsion testing to the general population. From the date of the official announcement until January 1965, the site was known as the Propulsion Systems Development facility. From January to June 1965, the official designation was White Sands Operations. Then on June 16, 1965, the official name of the installation was changed to White Sands Test Facility (NASA, 1986b).

Site planning activities began in August 1962. Exploratory drilling to locate a water supply source began in December 1962, and drilling of water supply wells was completed in May 1963. Development of the site location began in May 1963 with construction of the access road (NASA Road) from U.S. Highway 70. The access road was completed in October 1963 (NASA, 1980, 1986b). The first increment of the 300 Propulsion Test Area was completed in January 1964, and the first permanent personnel began working at WSTF in January 1964 (FD) and April 1964 (Propulsion Department). The second increment of the 300 Propulsion Test Area was completed by June 1964, followed by the 200 Area Preparation Buildings (200 and 201 in December 1964 and 203 in March 1965) and the 400 Propulsion Test Area in November 1965. The 100 Area was constructed to be the project control area. Building 100 was completed in March 1964, followed by Building 101 in January 1965. The initial emergency center (Building 112, with the WSTF FD and Clinic), the security guard station (Building 116), cafeteria (Building 111), the warehouse (Building 120), and maintenance shops (Buildings 113 and 121) were also constructed during 1964. Other support buildings were constructed as needed from 1965 through 1966. The 800 Area was completed between January 1974 and December 1979 (NASA, 1986b). The 200 Area Laboratory consolidation facility addition to Building 200 was constructed from 1989 to 1990, and the 250 and 270 testing areas were completed between 1987 and 1991. The current emergency center, Building 104 (FD and Clinic) was built in 1992 (NASA, 1994c).

Locations for the specific areas of WSTF were chosen to minimize the potential impact and hazards in one area from affecting any other areas. Hazardous test and storage areas were located downwind from administration areas, the 300 and 400 propulsion areas were positioned so that they were not in line with respect to the prevailing wind direction, and the 200 Area was located far enough from the 300 and 400 propulsion areas for sufficient acoustic attenuation, blast pressure decay, and adequate reduction of fragment impingement hazards, but close enough for easy transport of test articles to and from the test areas (NASA, 1980). The land use buffer zone surrounding WSTF was designed to ensure a safe distance for diffusion of vapors or other hazards to avoid impacts to off-site inhabitants, livestock, and agriculture.

5.3 Eastern 100 Area

The eastern 100 Area is located to the east of the main 100 Area. This area has historically been informally referred to as the 150 Area, but will only be referred to as the 100 Area or eastern 100 Area in this HIS. The eastern 100 Area was constructed with support buildings (with number designations of 150 and above) deemed necessary after initial 100 Area construction and has contained a support warehouse for extra storage (Building 150), the Government Services Administration (GSA) Vehicle Maintenance facility (Building 151), lumber storage (Building 152), and various other storage buildings and outdoor equipment storage (NASA, 1994c; Figure 3.1). The outdoor storage area adjacent to the Building 150 warehouse was historically, and currently still is, informally referred to as the 150 yard. Facilities in the eastern 100 Area have been added or modified to support warehouse and storage needs throughout WSTF history.

In addition to storage, the eastern 100 Area was historically used as a WSTF FD training area. This resulted in the formation of two SWMUs at WSTF, SWMU 1 (the 100 Area burn pit) and SWMU 3 (the

100 container storage area). As NASA began the permitting process for a hazardous waste permit (beginning in 1980) and initiated a full-time Environmental Department at WSTF (in 1985), operating and waste management practices were reviewed and altered to reduce, eliminate, or better manage wastes and reduce the potential for environmental contamination at WSTF. Appendix B contains historical photographs of the 100 Area and SWMUs 1 and 3.

5.4 600 Area

The 600 Area at WSTF has always been designated as west of Apollo Boulevard. This area consists of Buildings 633 (WSTF water supply support building), 634 (initial water softening shelter), 636 (water supply booster station), 637 and 638 (groundwater assessment support buildings), all shown on Figure 3.1 (NASA, 1994c). Not shown on Figure 3.1 are Buildings 632 and 645 (WSTF water supply booster stations), the WSTF water supply production wells J and K, various groundwater monitoring wells, piezometers, exploration wells, extraction wells, injection wells, Buildings 650 and 655 (two groundwater treatment facilities), Building 651 (injection well manifold building), and a treated groundwater infiltration basin.

SWMUs and an HWMU present in the eastern 600 Area include the terminus of the historical 200 Area hazardous waste transmission line (SWMU 10), the 600 Area burn pit (SWMU 15), the 600 Area overflow wastewater lagoon (SWMU 34), and the 600 Area HWMU, which historically contained 200 Area laboratory wastes within a two-celled, lined surface impoundment. This HWMU was closed as an interim landfill in 1989 and an HWMU investigation was completed in May 2011 (NASA, 2011a) with NMED approval of the 600 Area Closure Investigation Report in June 2011(NMED, 2011a). These SWMUs and HWMU are illustrated in Figure 3.1.

SWMUs located in the 600 Area but not shown on Figure 3.1 include the 600 Area jet propulsion or propellant (JP) fuel remote test areas (JP4 and JP5; SWMU 14) and the BLM or 600 Area off-site soil pile (SWMU 16). An investigation of SWMU 14 was performed in February 2014 and reported to NMED on May 1, 2014 (NASA, 2014c).

Notice in Figure 3.1 that the boundary between what is designated as 100 Area and 600 Area is not clear, geographically. All buildings located west of Apollo Boulevard are designated with 600 Area building numbers; however, the 100 Area wastewater lagoon (sewage lagoon) is also located west of Apollo Boulevard but is now and has always been designated as part of the 100 Area. Throughout WSTF history, the water bodies located in the 100/600 eastern areas have been informally and formally inconsistently referenced by Area. The closed 600 Area HWMU was historically referred to as the evaporation ponds, the salt ponds, the impoundments, and the HWMU. Its location was, at times, referred to as in the 100 Area and at times referred to as in the 600 Area. The 600 Area overflow wastewater lagoon was, at times, historically referred to without an area designation. This causes confusion when discussing these areas. The 600 Area burn pit was located adjacent to the 100 Area wastewater lagoon; however, for the purpose of this HIS, this burn pit will only be referred to as the 600 Area burn pit.

6.0 SWMUs 1, 3, and 15

Details of FD trainings that may have resulted in releases to the environment are described in this HIS. Burn pits at WSTF were historically constructed to conduct open fires that could be extinguished by WSTF firefighting personnel as part of their training. Burn pits comprised excavated, unlined soil areas where liquids, including laboratory chemicals at some pits, were burned and then extinguished. Site potable water was always added to the burn pit prior to each burn. At pits where chemicals were burned, the procedure was to first test a sample of the liquid/chemical in a steel 55-gallon (gal) drum, or within the burn pit, to ensure it would burn and that the fire could be controlled. Following a small-scale test, one or more partially full to full 55-gal drum(s) of chemicals/liquids were added and ignited. WSTF personnel would then practice extinguishing the fire. Any remaining chemicals/flammable liquids were reignited and allowed to burn to completion (Appendix A).

The formation of SWMU 3, the 100 container storage area, was a direct result of the use of the adjacent SWMU 1, the 100 Area burn pit. Documentation regarding use of burn pits and the 100 container storage area at WSTF are incomplete and infrequent. Recollections from long-term WSTF employees were an important source for this HIS. The following sections summarize available information regarding SWMUs 1 (100 Area burn pit), 3 (100 container storage area), and 15 (600 Area burn pit).

6.1 SWMU 1 – 100 Area Burn Pit

The 100 Area burn pit was previously described in the RFI (NASA, 1996). This pit was located at the southeastern corner of the 100 Area, adjacent to the GSA Building 151 (Figure 3.1). A photograph of the pit from 1972 is provided as Figure 6.1. Appendix B contains other historical photographs of the 100 Area burn pit. Historically, the 100 Area burn pit has also been referred to as the 150 Area burn pit (Appendix A), but for the purpose of this HIS it will only be referred to as the 100 Area burn pit.

6.1.1 Historical Use

The 100 Area burn pit (SWMU 1) was constructed in 1969 for use in firefighting training in the eastern 100 Area and reportedly used through June 1983 (NASA, 1985i), making it the longest operating burn pit at WSTF. The dimensions of this pit changed through time. Long-term WSTF employees stated that the pit was initially approximately 30 ft by 15 ft by 2 ft deep. Through time and use of the pit, it was necessary to occasionally have the pit dredged. This involved a WSTF heavy equipment operator pushing the sludge with a loader to the north end of the pit, which enlarged the pit over time (Appendix A). Final dimensions of the pit were approximately 60 ft long by 20 ft wide by 2 ft deep (NASA, 1985i, 1996). From a WSTF inspection by New Mexico Environmental Improvement Division (NMEID) personnel on April 3, 1984, a description of the 100 Area burn pit was provided, *"Open burning of waste oil takes place as part of fire training exercises. The pit is about 10" deep at each end and 18" deep in middle. There is liquid in the pit…Does not burn at this time"* (NMEID, 1984).

Chemicals/flammable liquids were generally poured into the pit from the south side (closest to the 100 container storage area); however, at times, chemicals/liquids were poured from the north side, especially if a large fire was planned. The types of chemicals burned and the frequency of burning were described in several pollution control reports that were submitted from the WSTF FD contractor, Dynalectron, to NASA from October 1972 through October 1974. These reports did not state the location for burning at WSTF. Between those years, there were three active burn pits at WSTF, the 100 Area burn pit and two smaller burn pits located in the 200 Area. (Refer to the 200 Area HIS, Section 9.5 for descriptions of the additional 200 Area burn pits [NASA, 2012]).

There was a discrepancy reported for the frequency of training fires conducted at WSTF. According to the four pollution control reports, live fires were conducted approximately five times between July 1972 and September 1974 (NASA, 1972, 1973a, 1973b, 1974). However, according to long-term WSTF FD and auxiliary personnel, live fires were conducted at least once per month and up to four times per month (Appendix A).

The quantity of chemicals burned in the 100 Area burn pit is not well constrained. Only one pollution control report submitted between 1972 and 1974 provided a volume, and it was listed as 250 gal of chemicals (NASA, 1974). This number is consistent with the lower estimate of the amount of chemicals burned per fire provided by a long-term FD employee. The volume of chemicals burned per fire was estimated at 220 to 2,000 gal. Over the life of the 100 Area burn pit, this would result in an estimated total volume of approximately 36,960 gal, assuming one 220-gal fire was conducted per month, and up to 672,000 gal, assuming an average of two 2,000-gal fires were conducted per month. Long-term WSTF personnel stated, *"these were big fires"* (Appendix A).

Fires were extinguished using fire trucks, hoses, and primarily water as the extinguishing agent. A long-term WSTF FD employee stated that aqueous film-forming foam (AFFF) was aspirated into the water occasionally to extinguish fires at the 100 Area burn pit. Section 7.4 provides additional details.

Burn pits were not used historically for fire extinguisher practice. However, one fire extinguisher was reportedly used in the 100 Area burn pit, a Purple-K fire extinguisher. The fire extinguisher had been used on a smoking truck located near the JP Area, and FD personnel stated that it needed to be used; therefore, the remainder of this Purple-K fire extinguisher was used to practice extinguishing a fire at the 100 Area burn pit (Appendix A). Purple-K fire extinguishers did not contain AFFF. An MSDS for this type of fire extinguisher is provided in Appendix D.

Use of the 100 Area burn pit ended due to excess foam production within the pit. A long-term FD employee stated that the 100 Area burn pit became fouled over time, and when ignited, eventually began producing its own foam that moved *"across the pit and put out the fire before we even got a chance to fight it."*

6.1.2 Previous Cleanup Activities

In December 1983, as part of initiating the cleanup of the 100 Area burn pit, samples of the liquid in the pit, an upper oil phase and a lower aqueous phase, were collected at five locations within the 100 Area burn pit. These five locations were the *"pour area,"* where the chemicals/liquids were poured into the pit, and one set in each quarter of the rectangular pit. Figure 6.2 shows a diagram of the location of the samples within the pit. Samples were analyzed at an off-site laboratory for PCBs and at the WSTF laboratory for flash point, EP Toxicity, halogenated volatile organics, and chlorine oxidizable materials (NASA, 1984a). Funding constraints precluded any further clean-up efforts until 1985 (NASA, 1985i). Even though the results could not be located for this sampling event, a list of detected compounds was located. Refer to Section 7.1.2 and Appendix C for details (Lockheed, 1985).

In July 1985, liquid (aqueous and oil phases), sludge, and soil samples were collected and analyzed from the 100 Area burn pit (NASA, 1985e, 1985f, 1985h). MMH analyses were conducted by the WSTF laboratory; however, results could not be located. Other results from this sampling event are discussed in Section 7.1.2 and provided in Appendix C.

From environmental committee meeting minutes in April 1985, a list of discussion items was generated *"after an initial review of WSTF's status of compliance with EPA/EID regulations…The burn pit closure…was considered as the highest priority on the list"* (NASA, 1985d). Burn pit waste was described in a letter to a disposal company in August 1985, *"To facilitate your ability to properly manage and dispose of this waste, please note that it will consist of liquid, sludge and solid material. The liquid waste consists of an aquesous*[sic]*/oil material which is predominantly water…The pit presently contains about 5,000 gallons of this liquid. The sludge appears to be a viscous oil/soil mixture. There is an estimated 40-60 cubic yards of sludge in the Burn Pit…An estimated 90-100 yards of soil both surrounding and below the Burn Pit will be disposed. This material is mostly soil with a small amount of oil staining"* (Lockheed, 1985).

A letter to NMEID in September 1985 describes the clean-up procedure, *"In an attempt to reduce the potential for ground-water contamination at the NASA White Sands Test Facility, the firemen's burn pit is* *scheduled for clean up during the latter part of September. Liquid, sludge, and some surrounding and underlying soil will be removed and shipped off site to USPCI's Grassy Mountain (Utah) Facility…The first step was to characterize the contents of the pit and to determine the extent of the contamination of the underlying and surrounding soil…Aqueous and sludge samples were taken and submitted to an off-site laboratory for analysis. A 5-foot-deep hole was excavated at the immediate perimeter of the pit and soil samples at the 2-foot and 5-foot depths were collected and analyzed…Based upon the analyses performed and the operational history of the pit, the waste material removed will be disposed of as an industrial as opposed to hazardous waste. The clean up will entail removal of the aqueous layer with a Vactor truck, excavation of the sludge layer, excavation of 1 foot of underlying soil and excavation of oil-stained soil adjacent to the burn pit. We do not propose backfilling or capping the site after removal, as the underlying soil will need to be aerated to remove the oil odor"* (NASA, 1985i). The analytical results from the clean-up of the 100 Area burn pit are provided in Appendix C. Refer to Section 7.1.2 for a summary of the analytical results.

From the WSTF TPS describing the cleanup procedure, cleanup of the 100 Area burn pit was conducted on September 23, 1985. Absorbent booms were used to absorb fluids/oils, a road grader was used to loosen and stockpile the top 4 to 6 inches (in.) of soil, a front-end loader was used to load the sludge and a 1 ft thick layer of underlying soils into the transport trucks, and a grader was used to grade the area without adding fill to the pit. A sketch of the boundaries of the burn pit and stained soil was produced and is included as Figure 6.3 (NASA, 1985j). Three more truckloads of debris/soil from the 100 Area burn pit were loaded and disposed off site on September 30, 1985 (NASA, 1985l). This resulted in a total of five truckloads of material that were transported off site for disposal from the 100 Area burn pit, which is estimated to be 50 yd^3.

To determine if the soil had any residual contamination, a composite soil sample was collected in May 1986 by mixing samples from ten locations. The composite sample was analyzed for semi-volatile and volatile organics, but results for this analysis could not be located (NASA, 1986e).

6.1.3 Previous Investigations

Between October 1986 and April 1988, a soil gas investigation was conducted to support the WSTF contamination assessment program. Aromatic and total hydrocarbon soil gas sampling was conducted for WSTF SWMUs, including the 100 Area burn pit. Soil gas samples were collected by hydraulically driving a 2.75 in. diameter hollow galvanized steel probe to an average depth of 2.5 ft and evacuating 5 to 10 liters of soil gas with a vacuum pump. 10 ml gas samples were obtained by inserting a hypodermic needle through a section of silicone rubber tubing connecting the soil probe to the vacuum pump and analyzed in a mobile field laboratory. A flame ionization detector was used to analyze for benzene, toluene, ethylbenzene, and xylenes (BTEX) and total hydrocarbons using nitrogen as a carrier gas. BTEX and total hydrocarbon concentrations were analyzed at 29 sample points 50-ft apart around the original site of the abandoned 100 Area burn pit. Appendix C provides maps of the 100 burn pit area with BTEX concentrations. Refer to Section 8.1 for a discussion of the results of this investigation. The 100 Area burn pit site was eventually back-filled with clean fill, and is presently a dirt road (NASA, 1996).

A soil boring and sampling investigation of SWMUs at WSTF was also conducted between October 1994 and June 1995 as part of the RFI, with the draft report submitted to NMED in March 1996. Four soil borings were installed within and adjacent to the 100 Area burn pit to 30 ft below ground surface (bgs) using a truck mounted hollow stem auger drill rig. Continuous sampling was attempted using a 5-ft core barrel advanced 6-in. ahead of the auger for the first two soil borings; however, soil recovery was low. For the final two borings, a 2-ft split spoon sampler was driven by a 140-pound hammer for continuous sampling. Soil recovery ranged from 0.1 to 2 ft in each sampling run. Each soil boring was plugged using a concrete-bentonite grout containing five percent bentonite by weight from the total depth to approximately 2 ft bgs. The upper 2 ft was completed with concrete, staked with a brass cap, and stamped with the boring number and location coordinates. Refer to the RFI for details of geotechnical analyses (NASA, 1996). Summaries of soil sampling results are provided in Appendix C.

6.2 SWMU 3 – 100 Container Storage Area

The 100 container storage area was also previously described in the RFI (NASA, 1996). The 100 container storage area was located at the end and south of Road B in the eastern 100 Area (Figure 3.1).

6.2.1 Historical Use

The 100 container storage area (SWMU 3) historically stored full and partially full drums (mostly 55-gal in capacity) of mostly flammable waste chemicals/liquids to provide easily available substances for burning within the 100 Area burn pit (SWMU 1). Drums were either stored on wooden pallets or directly on the ground/soil and were exposed to the weather. From 1969 until 1985, these waste drums were actively collected from all industrial areas at WSTF and stored here (NASA, 1996; Appendix A). The use of burn pits ended at WSTF in 1985; however, containers and drums that were already present continued being stored in this location until late 1987 or early 1988 (NASA, 1996, 1988b). WSTF personnel confirmed that there was no specified time for waste storage or empty drum removal at the 100 container storage area; therefore, many drums accumulated over time and were stored in the area for years. Personnel stated that there were 10 to 150 drums located in the 100 container storage area at all times (Appendix A).

According to a long-term WSTF FD employee, FD personnel would request flammable liquids from each industrial area at WSTF. Then, personnel from those areas would deliver drums of waste liquids to the 100 container storage area. The waste drum delivery procedure was for personnel to inform the WSTF FD of the drum contents, quantity of drums, and the volume of waste inside each drum. Drums were to be delivered to the appropriate location within the 100 container storage area. Each type of chemical/liquid was stored together and separated from other chemicals/liquids. There were separate areas for vacuum pump oil, other oils and antifreeze, alcohols, and other chemicals (such as Freons, TCE, PCE, etc.). WSTF personnel, however, commonly did not follow this procedure, and the contents of many drums were unknown. Unknown liquids were either tested in a drum or within the 100 Area burn pit in small quantities first to see if they would ignite and the fire could be controlled (Appendix A).

Long-term WSTF employees stated that empty 55-gal waste drums were likely cleaned and reused or disposed of in the WSTF landfill prior to 1985 (Appendix A). The only available documentation discussing empty drums at WSTF was from an inspection conducted on April 3, 1984 by NMEID. In the NMEID inspection checklist, handwritten notes of the NMEID employee stated that empty drums were *"used for bad diesel, etc., sent to Holloman* [Air Force Base near Alamogordo, NM]*, or used on site"* [at WSTF] (NMEID, 1984). Holloman Air Force Base historically recycled some items generated at WSTF, such as used batteries and drums (Lockheed, 1989).

Following removal of the drums and cleanup of contaminated soils, the former 100 container storage area was used to store construction materials, such as crusher fines and concrete, and large empty gas canisters (Appendix A), and is still used for this purpose currently.

6.2.2 Previous Cleanup Activities

The cleanup process for the 100 container storage area (SWMU 3) was initiated in response to a warning letter issued by the EPA to NASA in 1984 regarding an inspection conducted at WSTF in November and December 1982. It was decided that laboratory analyses were needed for all waste drums in the storage area and new wastes/drums would be controlled and placed in a separate facility. In a letter to the EPA in April 1984, it was stated, *"All containers showing evidence of corrosion have been replaced"* (NASA, 1984b).

Cleanup of the 100 container storage area continued with characterization of the liquids/substances within the drums and addressing leaking drums. From a document identifying hazardous disposal areas at WSTF in August 1985, it was stated, *"Action to identify the containerized waste materials has been implemented so that the appropriate disposal method can be selected"* (NASA, 1985g). Then in mid-October 1985, several TPSs were written to manage leaking drums (NASA, 1985m, 1985n). Section 8.2 provides additional details regarding these releases to the environment. Some of these drums were shipped off-site for disposal on October 23, 1985 (NASA, 1985n).

On October 30, 1985, NMEID inspected WSTF and issued a notice of violation (NOV) regarding spills and leaking containers in the 100 container storage area. NASA was required to clean the area up within 30 calendar days (NMEID, 1986).

In response to the NMED NOV, NASA initiated soil cleanup in December 1985. A TPS describes the process, *"…transport empty drums to the drum storage area. Using hand tools, excavate the stained surface soils…It is critical that the amount of soil is minimized, yet the stained soil must be removed. Place the soil in the empty drums. Put lids on the drums and tighten. Label the drums with a paint stick or similar marker to read – 'vacuum pump oil contaminated soil'"* (NASA, 1985p).

After this initial cleanup attempt, NASA responded to NMED on February 14, 1986. *"All wastes and contaminated soil in the drum storage area will be removed from the site by April 15, 1986. Soil samples will be taken after removal of the soil and will be analyzed for volatiles and semi-volatiles by GC/MS scan techniques. These analyses will be completed by June 15, 1986…All hazardous waste stored in the 150 Area will be put in proper containers prior to shipment to an off-site waste disposal facility"* (NASA, 1986a).

Soil cleanup continued in April 1986. This excerpt shows there were still drums and contaminated soil located in the area. *"The soils excavation shall be dependent upon the removal of existing waste drums, hence the excavation work may be requested on short notice…Using the road grader, stockpile the contaminated soils…Use the front end loader to load these soils into the contractors end dump truck"* (NASA, 1986c).

The cleanup activities for the 100 container storage area (SWMU 3) were summarized in two quarterly reports to WSMR. The first part of the cleanup was conducted during the second quarter of fiscal year 1986. *"A shipment of five drums of vacuum pump oil and related waste was shipped to ENSCO* [Environmental Sciences Company] *for incineration. Soils contaminated with vacuum pump oils were excavated and shipped to a hazardous waste disposal site in Utah. Drums of unidentified wastes in the 150 yard have been sampled by a hazardous waste contractor who is presently completing the analyses. Upon receipt of the analyses, the drums will be shipped off site for disposal"* (NASA, 1986d). Additional cleanup was conducted in the third quarter of fiscal year 1986. *"As part of the New Mexico Environmental Improvement Division (NMEID) Compliance Order issued on January 16, 1986, approximately eighty drums of suspected hazardous waste located in the 150 yard (near the old burn pit) were required to be disposed of properly. During April and May, a hazardous waste disposal firm was contracted and performed a turn-key operation which culminated in the wastes being shipped to an EPA permitted disposal site. The soil was also cleaned up and disposed"* (NASA, 1986g). WSTF long-term personnel stated that between 1985 and the late 1980s, drums that had been stored in the 100 container storage area were relocated to the drum storage facility to the north prior to shipment off-site for disposal (Figure 3.1; Appendix A).

Following excavation of the visibly contaminated soil, soil samples were collected in May 1986 within the areas where oil and vacuum pump oil had been stored in the 100 container storage area. Samples from ten locations within each area were collected from the upper 1 in. of soil and blended to form one composite sample from the oil area and two composite samples from the vacuum pump oil area. Samples were analyzed for volatile and semi volatile organics, but no results could be located (NASA, 1986f). Figure 6.4 shows the oil and vacuum pump oil storage areas in relation to the 100 Area burn pit.

The last mention of soil cleanup in the 100 container storage area was from the WSTF quarterly report to WSMR in April 1987, *"A total of 15 cubic yards of soil and gravel contaminated with oil, diesel, kerosene, and hydraulic fluids were excavated from beneath an area where drums containing the products were stored. A concrete pad was built to contain future spills"* (NASA, 1987a). The draft RFI reported that between 1985 and 1987, 162 drums were evaluated. Of these drums, 84 were empty, and the remaining drums were sampled, characterized, and then shipped off-site to a Resource Conservation and Recovery Act (RCRA) disposal facility (NASA, 1996).

The last mention of drums being stored in the 150 yard was from a WSTF individual waste stream profile (WIWPS) and associated laboratory reports in March 1988. There were several drums with unknown contents that were analyzed and then shipped off-site for disposal. Appendix C contains the laboratory reports for these drums.

6.2.3 Previous Investigations

Two previous investigations have been conducted at the 100 container storage area. The first investigation, conducted between October 1986 and April 1988, consisted of a shallow soil gas investigation at WSTF, sampling the SWMUs for total hydrocarbons and BTEX. Refer to Section 8.2 for results of this investigation. Refer to Section 6.1.3 (100 Area burn pit Previous Investigations) for details of the sampling and analysis procedures. Appendix C also provides maps of BTEX concentrations in the combined 100 Area burn pit and container storage area.

Finally, a soil boring and sampling investigation of SWMUs at WSTF was conducted between October 1994 and June 1995 as part of the RFI, with the draft report submitted to NMED in March 1996. Three soil borings were installed within and adjacent to the 100 container storage area to approximately 30 ft bgs using a truck mounted hollow-stem auger drill rig. Continuous sampling was performed using a 2-ft split spoon sampler driven by a 140-pound hammer. Soil recovery ranged from 0.1 to 2 ft in each sampling run. Each soil boring was plugged using a concrete-bentonite grout containing 5 % bentonite by weight from the total depth to approximately 2 ft bgs. The upper 2 ft was completed with concrete, staked with a brass cap, and stamped with the boring number and location coordinates. Refer to the RFI for geotechnical sample information (NASA, 1996). Summaries of soil sampling results are provided in Appendix C.

6.3 Historical Drum Storage at WSTF

The purpose and manner of storing drums at WSTF have changed through time. Initially, wastes were not shipped off site for disposal. Fuel wastes were generated and treated in the propulsion areas (300 and 400 Areas) and occasionally released to grade from the impoundments to the 300/400 Area arroyo. Refer to the Evaluation of Historical Records for the NASA White Sands Test Facility 300 Test Area and the 400 Area HIS for details (NASA, 2010, 2011b). 200 Area laboratory wastes were stored in underground tanks and/or the 600 Area surface impoundment. Refer to the 200 Area HIS and the 600 Area Closure Investigation Work Plan for details (NASA, 2012, 2008). Oils and flammable wastes were provided to the WSTF FD to use for firefighting training, stored in the area adjacent to the 100 Area burn pit, and termed the 100 container storage area. From 1969 to 1985, waste drums were actively brought to the area for storage prior to use for fire training. Refer to Section 6.2.1 above for details. With the Part B Permit application process, establishment of a full-time Environmental Department at WSTF to ensure environmental compliance, and cleanup of the 100 Area burn pit, waste drums began being shipped off site for disposal, and a more protected and permanent storage facility was developed. The drum storage facility and container storage unit were utilized as more permanent facilities to store hazardous wastes prior to shipment off site for disposal. The following sections provide a brief description and history of the drum storage facility and the container storage unit, and Table 6.1 summarizes operational histories and current uses of each of the historical drum storage areas at WSTF.

6.3.1 Drum Storage Facility

The drum storage facility, Building 159, was located north of the 100 Area burn pit (Figure 3.1). Modifications to a surplus radar dome obtained from WSMR were completed in the first calendar quarter of 1986 to become the drum storage facility, a permanent storage facility for hazardous waste containers/drums (NASA, 1986d).

6.3.1.1 Historical Use

The Part B application for a RCRA hazardous waste operating permit was modified to incorporate the drum storage facility; however, this facility was only used during the interim between applying for a permit and receiving the Permit in February 1993. The purpose of the drum storage facility was to accumulate and store up to 25, 55-gal drums of waste from generation points throughout WSTF pending off-site shipment for disposal (NASA, 1993c).

The modified radar dome was 13 ft 5 in. high with a 15 ft 9 in. diameter. The outer shell was constructed of 1.2-in thick honeycombed aluminum to provide thermal and precipitation protection. The floor of the dome consisted of a 16-ft, 9-in. diameter concrete pad over a 6-mil vapor barrier. Secondary containment was provided by a 6-in. high, $^{5}/_{16}$-in. wide carbon steel ring sealed to the pad with silicon caulking inside and outside the ring. Access to the dome was provided by a 9-ft, 4-in. high and 7-ft wide aluminum roll-up door (NASA, 1993c). Figure 6.5 is a photograph of the drum storage facility radar dome from 1987. The drum storage facility was used to store hazardous waste from May 1986 to March 1993 (NASA, 1994b). According to long-term WSTF personnel, the storage of hazardous waste in Building 159, the radar dome drum storage facility, ceased when use of the container storage unit commenced (Appendix A).

6.3.1.2 Closure

NASA submitted a closure plan for the drum storage facility to NMED on May 18, 1993 (NASA, 1993c) and subsequent response to NMED's notice of deficiency response on June 14, 1994 (NASA, 1994b). NMED approved the drum storage facility closure plan on September 29, 1994 (NMED, 1994). NASA completed closure work in February 1995 and submitted a certification of closure report on February 28, 1995 (NASA, 1995). NMED approved clean closure of the drum storage facility on May 12, 1995 (NMED, 1995). Table 6.1 summarizes closure activities and current use of the drum storage facility.

6.3.1.3 Current Use

The former drum storage facility radar dome, Building 159, is currently used to store empty drums.

6.3.2 Container Storage Unit

The container storage unit, Building 161, was also located north of the 100 Area burn pit, directly adjacent to, and west of, the drum storage facility. The container storage unit was built to replace the drum storage facility (Figure 3.1). Figure 6.6 is a photograph of the container storage unit in 2003.

6.3.2.1 Historical Use

This building was constructed in 1990 at WSTF (NASA, 1994c), and began use as a less than 90 day hazardous waste storage area (Appendix A). NASA received the Permit in February 1993, and in March 1993, the container storage unit began operations as a permitted hazardous waste storage facility and received and stored wastes from generation points in all WSTF areas pending shipment off site for disposal (NASA, 1996).

Dimensions of the container storage unit are 30 ft by 40 ft by 12 ft high and capacity is 48 55-gal drums. Secondary containment is provided by ramps or berms at all entrances and a 2.5-in. wide by 6-in. high, 14 gauge galvanized zee-bar ring bolted to the floor and sealed with Thiocaulk. Access to the container storage unit is provided by a 12 ft wide by 20 ft tall overhead door and two walk-in doors. No spills or releases of hazardous waste occurred during the operation of the container storage unit (NASA, 2001).

6.3.2.2 Closure

NASA submitted a closure plan to NMED on October 30, 2001 (NASA, 2001). While waiting for approval of the closure plan, NASA completed closure of the container storage unit between February and April 2002 (NASA, 2003a). NMED approved the container storage unit closure plan on January 21, 2003 (NMED, 2003a), and NASA submitted the certification of final closure to NMED on February 11, 2003 (NASA, 2003a). NMED approved the clean closure of the container storage unit on April 7, 2003 but requested that NASA provide photographs of the condition of the unit (NMED, 2003b). NASA submitted closure photographs on May 8, 2003 (NASA, 2003b), and NMED provided verification of the clean closure to NASA on May 20, 2003 (NMED, 2003b). Table 6.1 summarizes closure activities and current use of the container storage unit.

6.3.2.3 Current Use

The container storage unit is currently used as a staging area for wastes prior to shipment off site for disposal. This facility serves as a less than 90 day area, a satellite accumulation area, and a Toxic Substances Control Act storage area for PCB waste (Appendix A).The container storage unit is not listed as a SWMU and will not be included as a subsequent part of this HIS or the accompanying IWP.

6.4 SWMU 15 – 600 Area Burn Pit

The 600 Area burn pit (SWMU 15) was previously described in the RFI (NASA, 1996). The 600 Area burn pit was located adjacent to the 100 Area wastewater lagoon, directly west of Apollo Boulevard. Figure 6.7 provides a photograph of the burn pit in 1964. An employee stated that it was referred to as *"the burn pit next to the ponds"* (Appendix A). Dimensions of this pit were reported to be 8 ft by 8 ft.

6.4.1 Historical Use

A long-term WSTF employee stated that the 600 Area burn pit was the first burn pit used on site at WSTF. The pit was established at this location because it was conveniently close to the FD (Figure 6.7). This pit was used exclusively to practice extinguishing small liquid fires with on-site fire extinguishers at least once per month and up to four times per month (Appendix A). Refer to Section 7.3 for a list of flammable liquids burned within this pit.

When use of the 200 Area main burn pit commenced in 1964, use of this 600 Area burn pit almost ceased because fire extinguisher training was relocated adjacent to the 200 Area burn pit using wood on the ground. The 600 Area burn pit continued to be used infrequently from 1964 to 1969 to train new FD personnel in using fire extinguishers to put out small liquid fires. This pit was abandoned when the 100 Area burn pit was established in the eastern 100 Area at WSTF in 1969 (Appendix A).

6.4.2 Previous Cleanup Activities

In late 1964, the 600 Area burn pit required residue/sludge removal. FD personnel dug the pit out using shovels and placed the residue to the south end of the pit *"by the two big telephone poles"* (Appendix A).

According to long-term WSTF employees, the 600 Area burn pit was not officially cleaned up following abandonment. The pit was likely backfilled with clean soil in 1969, and the site was graded several times historically as part of maintenance surrounding the 100 Area wastewater lagoon. A long-term WSTF FD employee believed that any residue after grading the area was disposed of in the WSTF landfill (Appendix A).

6.4.3 Previous Investigations

There have been two previous investigations conducted at the 600 Area burn pit. The first was a shallow soil gas investigation performed between October 1986 and April 1988 to support the WSTF contamination assessment program. Aromatic and total hydrocarbon soil gas sampling was conducted for SWMUs at WSTF, including the 600 Area burn pit. Section 6.1.3 provides a description of the sampling and analysis procedures used during the shallow soil gas investigation. At the 600 Area burn pit, BTEX and total hydrocarbon concentrations were analyzed at 29 sample points established on a 50-ft grid system located around the estimated original site of the abandoned 600 Area burn pit. Refer to Section 8.3 for a discussion of the results of this investigation. Also, maps of the 600 Area burn pit BTEX concentrations are provided in Appendix C.

A soil boring and sampling investigation of SWMUs at WSTF was also conducted between October 1994 and June 1995 as part of the RFI, with the draft report submitted to NMED in March 1996. Four soil borings were installed within and adjacent to the perceived location of the 600 Area burn pit to 30 ft bgs (NASA, 1996). Refer to Section 6.2.3 (100 container storage area Previous Investigations) for a description of drilling procedures. Summaries of soil sampling results are provided in Appendix C.

7.0 Evidence of Hazardous Substances

Hazardous substances have been used at WSTF since the inception of the site in 1964 to the present. Hazardous substances used, processes, and waste management have varied through time to accommodate varying testing and operations at WSTF.

Chemical/flammable liquid substances were burned at SWMUs 1 and 15 and mostly 55-gal drums of chemicals/flammable liquid substances were stored at SWMU 3. A comprehensive review of available historical records and interviews with WSTF personnel has not produced a complete inventory of hazardous substances and wastes generated at WSTF and used or stored at SWMUs 1, 3, and 15. Table 7.1 provides a list of known and potential substances burned or stored at SWMUs 1, 3, and 15 and the surrounding area. Representative Material Safety Data Sheets (MSDSs) for several firefighting foams that may have been used at WSTF are provided in Appendix D. Refer to Section 7.4 for details regarding AFFF use at WSTF.

In addition to known substances stored or used at SWMUs 1, 3, and 15, aqueous and soil samples have been collected within the SWMUs in an attempt at further characterization. The following sections describe the known and potential substances burned or stored at SWMUs 1, 3, and 15 as well as any sampling conducted and analytical results available for these SWMUs.

7.1 SWMU 1 – 100 Area Burn Pit

7.1.1 Known or Potential Substances

No comprehensive documentation exists of all wastes burned at the 100 Area burn pit. Several documents provide a partial list of chemicals or substances known to have been burned at WSTF burn pits, and specifically the 100 Area burn pit. Chemicals burned were listed as benzene, methanol, alcohol, oil, and contaminated oil within pollution control reports from the FD contractor, Dynalectron, to NASA beginning in October 1972 through October 1974 (NASA, 1972, 1973a, 1973b, 1974). As discussed previously in Section 6.1.1, these pollution control reports did not specify where at WSTF burning occurred; however, since the 100 Area burn pit was the main active burn pit at the time, it is assumed that the chemicals listed in the pollution control reports were used at that location.

Further documentation provided for wastes burned in the WSTF burn pits was provided within a data sheet from a questionnaire of hazardous waste disposal areas at NASA facilities in August 1985 requested by DeLeuw, Cather & Company. The list provided waste names, disposal method by incineration, the years waste was disposed in this manner, the quantity of wastes, and comments. The data sheet did not specify where the wastes were incinerated, but comparing this information with other documents and statements from long-term WSTF personnel, it can be assumed that these wastes were burned at the 100 Area burn pit. Wastes included *"water contaminated diesel fuel," "MMH contaminated vacuum pump oils,"* and *"flammable solvents"* (NASA, 1985g). Timeframe and quantities of the wastes that were burned are discussed in Section 8.1. A description of SWMUs at WSTF was also included in the document to DeLeuw, Cather & Company as an appendix. Within SWMU 100-B, the *"burn pit area,"* substances or wastes listed as burned in the pit included *"a wide variety of solvents, fuels, and oils…It is certain that RCRA hazardous wastes have been burned in the pit. Materials burned include benzene, isopropyl alcohol, oil, diesel fuel, and gasoline. Contaminants in the oil would include hydrazine, monomethylhydrazine and unsymmetrical dimethylhydraxine, nitrogen tetroxide and the combustion products of these contaminants"* (NASA, 1985g). Combustion products potentially included ammonium nitrate, monomethylhydrazine nitrite (MMH-HNO_3), monomethylammonium nitrate (Takimoto & Denault, 1969), dimethylamine, nitrite, N-nitrosodimethylamine, H_2, ammonia, nitrogen, and water (Greene, Buchannan & Baker, 2003). To ascertain if the contaminated vacuum pump oil was considered a hazardous waste, NASA contacted NMEID personnel in August 1984. At that time, it was stated, *"since the MMH is not added to the oil as a waste product, the oil is not a hazardous waste unless it meets the hazardous waste and characteristics of ignitability, corrosivity, reactivity, or EP toxicity"* (NASA, 1984c).

Long-term WSTF employees confirmed that waste vacuum pump oil from the 300 and 400 Test Areas was burned at the 100 Area burn pit. This waste oil would have contained fuels (UDMH, A-50, MMH, and hydrazine) and combustion and partial combustion products of these fuels. The substances burned within the 100 Area burn pit were described as *"any flammable liquid."* Paints could also be considered flammable, and were stored in the 100 container storage area (Lockheed, 1985); it could not be confirmed that paints were burned in the 100 Area burn pit. Other known chemicals/liquids reportedly burned at the 100 Area burn pit included:

- alcohols
- ketones (including methyl ethyl ketone [MEK])
- TCE
- Freons
- organics
- acetone
- carbon tetrachloride
- antifreeze
- motor oils
- lubricating oils
- grease
- clean room cleaning solutions
- toluene
- benzene
- gasoline
- diesel

Each industrial area provided some chemicals or flammable liquids. The IPA left in the hoses from refilling site IPA storage tanks was provided to the FD as well. Also, according to one long-term WSTF FD employee, *"on a few occasions, N_2O_4 was used in small quantities (a few liters) to ignite the large fires at the burn pit,"* referring to the 100 Area burn pit (Appendix A).
From the WSTF shallow soil gas investigation (October 1986 and April 1988), it was stated, *"The 100 Area abandoned burn pit was used for fire training purposes from 1969 through 1983. Pit construction consisted of excavating a hole with a backhoe. The old site of this pit was analyzed for BTEX and total hydrocarbon concentrations because such constituents were known to have been poured on a water surface in the pit and ignited. The pit was not lined and infiltration of residual liquids into the subsurface was possible. All burn pits at WSTF were constructed and used in the same manner"* (Geoscience Consultant Limited [GCL], 1989).

7.1.2 Analytical Data

The first attempt to characterize the releases at the 100 Area burn pit (SWMU 1) took place in December 1983, when aqueous samples, both a liquid and oily phase, were collected. Samples were sent to an off-site laboratory for PCB analyses and to the WSTF laboratory for volatile analyses (NASA, 1984a). Section 6.1.2 provides details regarding analytes. Only the PCB analytical results could be located for this sampling event. These consisted of non-detect results for all 100 Area burn pit samples (NASA, 1984a). The laboratory report is provided in Appendix C. Although no results could be located for the volatile analyses, a letter from Lockheed to a waste disposal company provided a list of compounds detected by GC-MS (Lockheed, 1985). No concentrations were provided; however, the compounds consisted of the following:

- Dichlorofluoromethane (Freon 21)
- dichloromethane (methylene chloride)
- acetone
- 2-propanol (or IPA)
- butanols (n-butanol, sec-butanol)
- trichlorofluoromethane (Freon 11)
- dichloroethylene (1,2-DCE)
- 1,2-dichloro-1,1,2-trifluoroethane (Freon 123A)

- 1,1-dichloroethane
- chloroform
- 1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113)
- MEK (2-butanone)
- dichlorobenzenes
- isopropyl acetate
- benzene
- methyl isobutyl ketone (MIBK)
- PCE
- C_7unsat
- hydrocarbons
- toluene
- xylenes

The letter continues, *"Based upon these analyses, the Burn Pit waste is an industrial waste"* (Lockheed, 1985).

Confirmation of solvent detections within the 100 Area burn pit from the December 1983 sampling event was shown in notes from an NMEID inspection of WSTF conducted April 3, 1984. Referring to the 100 Area burn pit, it was stated, *"burned old motor oil…No idea on subsurface contamination."* The notes continued, stating that waste oil or vacuum pump oil may contain MMH. *"They have analyzed the liquid* [in the 100 Area burn pit] – *results negative for PCBs and MMH. Positive for solvents"* (NMEID, 1984).

In an attempt to determine the amount of contamination and the proper disposal of excavated material during the cleanup process for the 100 Area burn pit, samples were collected from the liquid and sludge phases within the pit and from soil beneath the pit in July 1985. The burn pit *"water*" and *"sludge"* were analyzed for the following:

- TCE
- carbon tetrachloride
- benzene, sulfur
- bromine
- chlorine
- fluorine, silver
- arsenic
- barium
- cadmium
- chromium
- mercury
- lead
- selenium
- copper
- potassium
- sodium
- manganese
- phosphorous
- antimony
- silicon

- tin
- zinc

Soils at 2 ft and 5 ft depths within and beneath the pit were sampled and analyzed for TCE, carbon tetrachloride, and benzene. These constituents were not detected in any sample (NASA, 1985e, 1985f, 1985i). Table 7.2 summarizes the results of the July 1985 sampling, and the laboratory reports are provided in Appendix C.

7.2 SWMU 3 – 100 Container Storage Area

7.2.1 Known or Potential Substances

Only one document was located that discussed the chemicals stored in the 100 container storage area (SWMU 3). An undated handwritten document was located within a letter to a disposal company in August 1986 that provides a *"burn area inventory."* The handwritten document provided an inventory of drums of chemicals/liquids that were located in the *"Burn Area,"* which was referring to the 100 container storage area. This inventory list included halocarbon cans (possibly referring to carbon tetrachloride, 1,1-dichloroethane, dichloroethylene, TCE, PCE, etc.), tar, several types of paints (including lead-based), alcohol, *"duoSeal cans"* (possibly a vacuum pump oil), methylene chloride, hydraulic oil, antifreeze, and unknown oils (Lockheed, 1986). Details of drum types and quantities are provided in Table 7.3. Long-term WSTF employees interviewed remembered paint being stored in the 100 container storage area (Appendix A).

7.2.2 Analytical Data

Unidentified waste drums located in the 100 container storage area have been sampled over time. A WIWPS was located for drums *"in the 150 yard."* Analyses were included from drums in February 1986 and February 1988, and all drums contained varying amounts of water as well as the waste. Of the six drums analyzed in 1986, four contained IPA, three contained ethylene glycol (antifreeze), and one contained a hydrocarbon. An unknown drum located in the 150 yard in February 1988 was determined to consist of methylene chloride, Freon, surfactant (soap), and some TOC (total organic carbon), likely TCE or MEK. Several other drums contained diesel fuel and water (100 gal total). Appendix C provides the WIWPS laboratory reports for these analyses.

7.3 SWMU 15 – 600 Area Burn Pit

No documents could be located that discussed the substances burned at the 600 Area burn pit (SWMU 15); however, a long-term WSTF FD employee stated that gasoline, diesel, and alcohols were burned in volumes of approximately 10 gal per burn (Appendix A). No soil analyses were conducted when the pit was abandoned. The only characterization of the area was provided in two investigations, a soil gas study conducted between 1986 and 1988, and a soil boring investigation conducted between 1994 and 1995. Refer to Section 8.3 for details of these investigations.

7.4 Aqueous Film-Forming Foams

Long-term WSTF personnel stated that AFFFs and alcohol resistant (AR)-AFFFs have never been used at WSTF to extinguish a non-training fire. The only usage of AFFFs and AR-AFFFs was for occasional training purposes in localized areas. Details of the type of foams and usage are provided below.

No documentation was located that discussed AFFF usage at WSTF. Long-term FD personnel provided the available information. In the early 1960s, only protein-based foams were available. These foams reportedly *"stunk,"* were unpleasant to handle, and were only used occasionally to extinguish fires at the 200 Area burn pit. When AFFF became available, (one employee believed in the late 1960s), this foam was purchased and used for occasional practice firefighting at the 100 Area burn pit in order for FD personnel to become familiar with the product. Because it was expensive and was not needed to extinguish the training fires, AFFF was only rarely used at WSTF. AR-AFFF, the employee believed, was purchased in the late 1970s, but was only used once at WSTF to practice extinguishing a fire. This fire was conducted at the 100 Area burn pit. AFFF was stored in 5 gal containers, and when used, aspirated into large amounts of water (Appendix A).

WSTF currently stocks an AR-AFFF titled Chemguard 3%/6% AR-AFFF C-361. A MSDS was located for this AR-AFFF and is provided in Appendix D. The fluorocarbon ingredients in the Chemguard 3%/6% AR-AFFF C-361 are listed as proprietary on the MSDS; however, according to the Chemguard website, this product does not contain any perfluorooctanoic acid (PFOA) or perfluorooctane sulfonate (PFOS) ingredients (Chemguard, 2014). The WSTF FD began stocking this AR-AFFF at WSTF in 2006, which corresponds to the initiation of use of E85 fuel at WSTF. E85 produces a high temperature fire, against which AFFF alone is not effective. This Chemguard 3%/6% AR-AFFF C-361 foam has reportedly never been used at WSTF. There have been few to no live training fires since the product was purchased, and foam has not been used for extinguishing practice fires at least since 1995 (Appendix A). The type and ingredients of previous AFFF or AR-AFFF products stocked at WSTF prior to this Chemguard product are unknown; however, one FD employee believed the manufacturer of the AFFF was 3M (Appendix A). 3M historically manufactured AFFF products containing PFOS (Fire Fighting Foam Coalition [FFFC], 2002).

A long-term WSTF FD employee did not know if PFOA or PFOS were present in the historical AFFF or AR-AFFF (Appendix A). Since these chemicals were historically common in AFFF, it is likely that PFOA and/or PFOS were released to the WSTF environment at the 100 Area burn pit and/or the overflow area of the pit prior to June 1983, when use of the pit ceased. Refer to Section 10.1 for details regarding this overflow area of interest (AOI).

According to long-term WSTF personnel, other foaming or wetting products were also used historically at WSTF to help extinguish the wood and trailer fires within the FD training area. These products were called *"wet water"* and *"light water"* and helped soak into the wood to provide faster *"knock down"* of the fires (Appendix A). A light water stocked at WSTF was ATC-603 Light Water ™ ATC™3[2] AR-AFFF 3%. The MSDS is provided in Appendix D. It is unknown how long this particular light water was used at WSTF and whether a previous light water would have contained PFOS or PFOA. No information files could be located at WSTF regarding the type of wet water used at WSTF. An internet search produced an explanation sheet describing wet water and a sample MSDS (Appendix D).

A biodegradable foam and a wetting/cleaning product called *"Micro-Blaze"* are currently available for use at WSTF. The employee believed that stocking *"Light Water"* was discontinued at WSTF when *"Micro-Blaze"* was purchased. The AFFF, *"Micro-Blaze Out,"* may have been used on site at WSTF for extinguishing the final live fire conducted in 2007, according to one FD employee (Appendix A). MSDS for *"Light Water"* and *"Micro-Blaze"* wetting/cleaning agent and AFFF are also provided in Appendix D.

[2] Light Water ATC is a trademark of the 3M Company.

7.5 Polychlorinated Biphenyls

PCBs were not reportedly stored in the 100 container storage area and were not present in samples obtained from the 100 Area burn pit or the north 100 container storage area (NASA, 1984a, 1985k). Analytical results for various PCB sampling events were all non-detect and are provided in Appendix C. The only analytical evidence for possible PCB contamination was from December 1983. There is a sample included with the 100 Area burn pit samples titled *"New Sit* [sic] *Oil Dump,"* which contained 80 ppm PCBs. There was a handwritten note on the document from June 1987 stating that the 80 ppm result was obtained from the blank (NASA, 1984a); however, this *"New Sit* [sic] *Oil Dump"* sample may have been referring to the additional 100 Area burn pit as suggested by its title. Long-term WSTF personnel stated that this additional 100 Area burn pit had been sampled and cleaned up at the same time as the original 100 Area burn pit (Appendix A); therefore a sample from this pit could have been included with the 100 Area burn pit samples. Section 10.3 describes the additional 100 Area burn pit.

The only other possibility for PCB contamination identified in this HIS is for the FD training area, due to the possibility of the release of small amounts of PCBs to the environment from burning the older trailers that may have included PCB-containing light ballasts. There is no evidence that PCB-containing light ballasts were present in the trailers, or that if present, they were not removed from the trailers prior to burning. However, there is also no evidence that the trailers did not include PCB-containing light ballasts, and long-term WSTF personnel stated that to their knowledge, the trailers were provided to the WSTF FD without removal of items (Appendix A), except for the removal of asbestos from the last trailers burned at WSTF in 1993/1994 (NASA, 1992d).

8.0 Indication of Releases to the Environment

As discussed in Section 7.0, WSTF historically used many hazardous substances, generating hazardous wastes. Prior to the submittal process for a Hazardous Waste Operating Permit, waste management documentation had not been developed at WSTF. This is indicated by the lack of documents discovered during historical research conducted at WSTF and notes from an NMEID inspection of WSTF conducted in April 1984 where the NMEID employee noted that WSTF did not have a written operating record in place at the time, but was in the process of preparing one (NMEID, 1984). Although some records of wastes produced at WSTF were maintained at the time in the individual waste generation areas, some of these records have been lost over time.

NASA also did not employ full-time environmental employees prior to 1985. All environmental issues were overseen by a NASA engineer on a part-time basis. For the original Permit submittal process, NASA contracted an outside environmental firm to compile the necessary data. In the early to mid-1980s, the EPA and NMEID began enforcing environmental laws at WSTF (including waste management documentation) and conducting inspections. By 1985, NASA determined that a full-time Environmental Department was needed to establish a groundwater monitoring program, standardize and create appropriate documentation and develop appropriate waste management procedures, and to ensure environmental compliance. An environmental committee was established in March 1985 to discuss, track, and implement compliance with environmental regulations, including changes in WSTF waste management, and the first full-time environmental employee was hired at WSTF in April 1985 (NASA, 1985a, 1985c). A review of the NASA status of compliance with environmental regulations was completed and personnel were appointed to oversee off-site disposal of hazardous and industrial wastes and waste management practices. The *"highest priority"* initially established was to clean up the 100 Area burn pit (NASA, 1985d), which was later designated as SWMU 1.

There have been releases to the environment from SWMUs 1, 3, and 15. Evidence originates from both WSTF documentation and from interviews with long-term WSTF employees. The following sections provide details regarding known and potential releases to the environment from SWMU 1 (the 100 Area burn pit), SWMU 3 (the 100 container storage area), and SWMU 15 (the 600 Area burn pit).

8.1 SWMU 1 – 100 Area Burn Pit Releases

The process of using a burn pit at WSTF constituted a release to the environment, since burn pits were unlined open soil pits. According to long-term WSTF FD and auxiliary employees, the 100 Area burn pit fires were extinguished with large amounts of water and *"commonly overflowed"* (Appendix A). Section 10.1 provides additional information regarding overflows from the 100 Area burn pit.

According to long-term WSTF employees, chemicals/liquids and fuel contaminated rags from the 200 Area chemistry and fuel laboratories were burned within the 100 Area burn pit. Chemicals/liquids were burned from the inception of the pit (1969) until use of the pit ended (in 1983); however, evidence for burning the fuel contaminated rags was provided from the early 1980s until use of the burn pit ended (Appendix A). Fuel contaminated rags may have been burned as early as 1969; however, long-term personnel that worked at WSTF prior to the early 1980s could not recall when the practice was initiated. (Appendix A).

While describing the 100 Area burn pit in 1984, NMEID personnel described the pit as necessary for cleanup and likely hazardous waste disposal. *"Look at cleaning it up – absorb vacuum pump – ship to h.w.* [hazardous waste] *disposal site"* (NMEID, 1984).

Additional evidence for releases to the environment from the 100 Area burn pit was provided in a letter to the NMEID from NASA in 1985, *"By design and use, it* [the 100 Area burn pit] *served as a containment vessel for flammable liquids which the NASA WSTF fire department would ignite and practice extinguishing. During its operating life, appreciable quantities of oils, solvents, and fuels were burned in the pit. The pit presently contains 2,000-5,000 gallons of aqueous material above a 6- to 12-inch thick layer of oily, black sludge."* When discussing cleanup of the 100 Area burn pit, it was stated in the 1985 letter, *"A 5-foot-deep hole was excavated at the immediate perimeter of the pit…An oil odor permeated the caliche-type soil for a depth of 2 to 3 feet. However, the soil did not smell of any aromatic or highly volatile solvents."* The fluid, sludge, and surrounding and underlying soil was disposed of as an industrial waste and not a hazardous waste, based on the analyses performed at the time. Regarding the remaining soil after removal of some of the surrounding soils and 1 ft beneath the pit, it was stated, *"We do not propose backfilling or capping the site after removal, as the underlying soil will need to be aerated to remove the oil odor"* (NASA, 1985i).

From an inventory of WSTF hazardous waste disposal areas submitted to DeLeuw, Cather & Company in August 1985, wastes *"incinerated"* included 20 gal per year of *"water contaminated diesel fuel"* that was burned from 1980 through 1983, 300 gal per year of MMH contaminated vacuum pump oils from 1963 through 1983, and *"flammable solvents"* from 1963 through 1985. The amount of solvents burned is not specified because this entry discusses disposal of all solvents at WSTF and disposal methods included incineration, evaporation, and impoundments. The only solvent specified was Freon, using 160,000 gal per year at WSTF (NASA, 1985g). The description of the 100 Area burn pit included this statement, *"The potential that this burn pit area may create a groundwater contamination problem is real and is presently being studied to identify the proper remedial action"* (NASA, 1985g).

Long-term WSTF personnel stated that there was still visible soil staining with an oil smell in the area for several years following the 100 Area burn pit site cleanup (Appendix A). Evidence supporting oil remaining in 100 Area burn pit soils after cleanup of the site is provided by results of the shallow soil gas investigation conducted at the 100 Area burn pit between October 1986 and April 1988. Total hydrocarbons were detected at all locations except two points, and BTEX concentrations were detected at two areas, near the GSA Building 151 (to the west of the 100 Area burn pit) and approximately 150 ft south of the 100 Area burn pit (in the 100 container storage area; GCL, 1989). Maps showing results of these analyses are provided in Appendix C.

8.2 SWMU 3 – 100 Container Storage Area Releases

Environmental committee personnel stated in April 1985, *"Control of drums containing waste material on the site was discussed and it was agreed that no firm control exists."* Personnel were chosen to be responsible *"for the off-site disposal of hazardous and industrial wastes"* and also designated to *"develop a plan to control these drums."* From the list of items for cleanup, it was stated regarding the 100 container storage area, *"Control influx of new wastes to enable easier identification"* (NASA, 1985d), providing evidence that drums in the 100 container storage area were often not labeled and were delivered to the area informally with no documentation or identification of what substance the drums contained.

A long-term WSTF FD employee confirmed that drums were commonly delivered without labels and without informing the FD of what waste or volume was in the drums. Unidentified drum contents were assumed to be flammable, since the purpose of the 100 container storage area was for storing flammable liquids that could be burned in the 100 Area burn pit. The employee also stated that as employees delivered drums, at times the drums *"would tip over and half of the contents spilled on the ground before we knew the drum was there."* Other drums leaked over time. *"Most of the time it was vacuum pump oil or alcohol"* that leaked (Appendix A).

Further evidence of a release to the environment was provided in a letter from the EPA regarding an inspection conducted at WSTF on November 30 and December 1, 1982. The EPA submitted a warning letter to NASA in March 1984 noting numerous RCRA violations associated with the 100 container storage area, including corroded containers, no waste logs, and no written operating record describing each hazardous waste, its location and quantity, and method(s) and date(s) of treatment, storage, or disposal at the facility (EPA, 1984). This included a lack of labels on some of the containers. NASA responded to the EPA in April 1984, and referring to the documentation violations, it was stated that NASA would be in full compliance no later than June 1, 1984 (NASA, 1984b). NASA's response to the EPA is discussed in Section 6.2.2. Figure 8.1 shows the 100 container storage area three months prior to the EPA inspection. Numerous 55-gal drums are visible in the 100 container storage area in two separate locations.

In October 1985, the 100 container storage area was still in poor condition. Evidence for this is provided by several TPSs and an NOV issued by the NMEID to NASA. A TPS was written to transfer four 55-gal drums of MMH-contaminated vacuum pump oil in the 100 container storage area to new drums on October 17, 1985. Additional drums stored in the 100 container storage area were open at the time. *"The supervisor in charge shall also ensure the transfer of other liquids presently in open containers (within the roped area set aside for MMH contaminated vacuum pump oil), to the new 55 gallon drums."* The original drums were then to be triple rinsed with 0.5 gal Freon for each rinse, capped loosely, and left on their sides (NASA, 1985m). Another TPS from October 21, 1985 describes steam-cleaning the outsides of 55-gal drums. *"…the exteriors of several drums need cleaned. The drums are roped-off near the burn pit and labeled as MMH contaminated vacuum pump oil…cleaning is to be done with a steam cleaner. All that is necessary is to remove the oily material from the top and sides"* (NASA, 1985n).

NASA received another NOV from NMEID regarding the 100 container storage area on January 16, 1986 following an inspection conducted on October 30, 1985. NASA was cited for *"improper use and management of containers…"* and was required to submit *"certification that the spills that have occurred at the 150 storage area have been cleaned up…and certification that all hazardous waste in the 150 area is stored in proper containers"* (NMEID, 1986).

The environmental committee meeting minutes from November 12, 1985 describe the condition of the 100 container storage area. *"Comments from the inspection of WSTF by the EID* [NMEID]*/EPA include the following:…Several comments were made concerning the drum storage area. In general, the drum storage and the drums stored there are in poor shape"* (NASA, 1985o). In a TPS describing soil cleanup conducted in December 1985, the purpose of the TPS was, *"To clean up the oil stained area where the vacuum pump oil has previously been stored (in the 150 yd)."* The volume of contaminated soil was estimated to be enough to fill six to ten 55-gal drums (NASA, 1985p).

In April 1986, there was still contaminated soil located in the area. *"…Using the road grader, stockpile the contaminated soils…It is critical that the amount of soil does not exceed 10 yds as only one disposal truck will be available"* (NASA, 1986c). *"As the drums were stored for several years at this location, several of them had leaked contaminating the underlying soils"* (NASA, 1986g).

Results of the shallow soil gas investigation conducted at the 100 container storage area between October 1986 and April 1988 also indicate releases to the environment. BTEX were also detected within the 100 container storage area boundary. Toluene and xylene were detected at 14 µg/l. Benzene and ethyl benzene were not detected (GCL, 1989). Refer to Appendix C for a map of the results.

8.3 SWMU 15 – 600 Area Burn Pit Releases

The process of using a burn pit at WSTF constituted a release to the environment, since burn pits were unlined open soil pits. Further evidence for releases to the environment from the 600 Area burn pit was documented during the shallow soil gas investigation that was conducted between October 1986 and April 1988 to determine if continued soil contamination was present at WSTF SWMUs. The 600 Area burn pit was sampled at 29 points on a 50 ft grid. All sample points were positive for total hydrocarbons, ranging in concentration from 0.09 to 16 µg/l. BTEX concentrations were observed as well. Benzene ranged between 0.03 to 2 µg/l, toluene ranged between 0.02 and 2 µg/l, and xylene ranged between 0.2 and 1 µg/l (GCL, 1989). Ethyl benzene was not detected. Maps showing results of these analyses are provided in Appendix C.

9.0 WSTF Fire Personnel Training

WSTF maintains a full-time, 24-hour per day FD to respond to any potential fire or medical emergencies at the facility. The WSTF FD was established in December 1963, when the first FD employee was hired (Appendix A). The FD and medical services have always been housed together at WSTF. Full-time FD personnel were, and are, trained to respond to both fire and medical emergencies at WSTF. Nurses and a part-time doctor or nurse practitioner have also been (and continue to be) available at WSTF to evaluate and treat potential employee injuries, illnesses, and to perform routine employee physicals. The first emergency services/FD facility was a temporary trailer located adjacent to Building 114 (Appendix A). Following construction of the initial 100 Area buildings, FD and emergency services personnel relocated to Building 112 in 1964. Appendix B includes a 1964 photograph showing the completed FD Building 112 and the administration Building 101 and the auditorium Building 110 under construction.

Emergency equipment included/s ambulances, automatic fire alarm systems, fire suppression systems, fire extinguishers, pumper units and pumpers, fire trucks/hoses, etc. (NASA, 1994c). Historically, fire response capability included the full-time FD personnel and, if needed for a larger emergency, 12 to 35 auxiliary firefighters. To maintain emergency and fire response readiness, it was necessary to continually train WSTF emergency personnel. Training consisted of spill release drills, hazardous materials training (including simulated leaking tankers), ladder training, lanyard use, fire hose and fire hydrant hookup training, smoke training, rescues from cars/buildings, and many live fire extinguishing trainings. In 1992, a new emergency services/FD facility (Building 104) was constructed, and FD (and emergency services) personnel relocated to this building. Building 112 became the construction services building (NASA, 1994c; Figure 3.1).

According to a long-term WSTF FD employee, within and prior to the 1990s, training at WSTF was not conducted equally among the FD shifts. When training was scheduled, personnel working that shift were trained. Personnel from the other shifts may or may not have received the same training; therefore, each FD employee may have a different memory of what training was conducted and when it occurred (Appendix A).

Large live fires were *"knocked down"* with water and then allowed to build back up in cycles to maximize the firefighting practice for each live fire training conducted at WSTF. Through time, conducting large live fire trainings became less frequent at WSTF. Currently, no live fire trainings are conducted at WSTF. All live fire training is conducted at the fire academy in Alamogordo, NM (Appendix A). The following sections provide a brief summary and history of firefighting training at WSTF.

9.1 WSTF Auxiliary Firefighters

Historically, WSTF trained and used both full-time firefighters and auxiliary firefighters. According to long-term WSTF personnel, auxiliary firefighters, also known as the *"fire brigade,"* were WSTF employees from all over the site that volunteered and participated in firefighting training. Auxiliary firefighters included 300 and 400 Area propulsion engineers and technicians, 200 Area laboratory engineers, chemists, and technicians, 100 Area plumbers, shop personnel, heavy equipment operators, engineers, technicians, and many others. WSTF FD personnel stated that there were approximately 12 to 35 auxiliary firefighting employees that were trained once a month, on a weekend (usually a Saturday) to avoid interfering with the employees' regular work schedules. Auxiliary firefighters received basically the same type of training as the full-time firefighters (Appendix A).

Training frequency for full-time WSTF firefighters and auxiliary WSTF firefighters were different and have altered through time. According to long-term WSTF personnel, full-time firefighters historically participated in live fire training up to four times per month, an addition to other training performed on a daily basis. Live fires for auxiliary firefighters were conducted approximately once per quarter to once per month historically, with the frequency decreasing through time. When conducting a large fire-training for auxiliary firefighters, full-time FD personnel were always present as a safety precaution; however, long-term WSTF employees stated that the auxiliary firefighters were always able to extinguish the live fires (Appendix A).

Auxiliary firefighters are no longer utilized at WSTF. According to long-term WSTF employees, auxiliary firefighting training ended approximately three to six years ago (Appendix A).

9.2 Fire Extinguisher Training

Historically, fire extinguisher training has been provided to FD personnel, auxiliary firefighters, and regular WSTF employees. Small liquid-fuel fires used for historical fire extinguishing practice were ignited within the 600 Area burn pit. Refer to Sections 6.4, 7.3, and 8.3 for details. Wood fire-training using pallets, crates, or scrap wood ignited with gasoline, diesel, or alcohols were conducted historically on the ground/soil adjacent to the 100 Area burn pits. These fires were short-lived since they were immediately put out with fire extinguishers. The same wood was used for five or six fires. This practice stopped in 1985 when use of burn pits ended.

After use of the 100 Area burn pits ceased, training fires were ignited in a steel 55-gal drum cut in half vertically (using both liquids and wood as fuel) and within a steel pan or tray with a non-working electric motor to simulate an electrical fire. Fuels used for fire extinguishing practice consisted mostly of diesel (one employee stated it was approximately ½ gal) with a much smaller amount of gasoline to ignite the diesel. Employees practiced extinguishing the flames with combination (ABC or ABCD), CO_2, or water fire extinguishers. Fire extinguisher practice on drum or pan fires was conducted in parking lots in front of various WSTF Buildings and north of the current Emergency Services Building 104 (in a paved area where the new Security Building 108 is now located). Fluids were contained within the half-drum or pan, and no spills were reported. Excess fuel was reignited, allowed to burn completely, and any ashes were transported to the WSTF landfill or shipped off site for disposal. According to a long-term FD employee, fire extinguisher practice was also conducted once a year with the CO_2 extinguishers *"when they were about to go out of date"* (Appendix A).

Fire extinguisher training at WSTF using wood or diesel fuel ended in approximately 2007, when the Bullex system was purchased. The Bullex system uses a controlled propane-based fire, and employees extinguish the fire with a water-based fire extinguisher (Appendix A). Information regarding this system is provided in Appendix D.

The Part B application submitted to NMEID provided a list of all fire extinguishers at WSTF in 1986. Types of fire extinguishers included CO_2, pressurized water, dry powder, and Purple-K. A sample MSDS obtained from the internet indicated that a dry powder ABC extinguisher potentially consisted of monoammonium phosphate, calcium carbonate, magnesium aluminum silicate (fullers earth), mica, methyl hydrogen polysiloxane, and amorphous silica. A Purple-K extinguisher potentially consisted of silicone fluid, purple pigment, mica, fullers earth, and potassium bicarbonate. Appendix D provides a sample MSDS for dry powder and Purple-K fire extinguishers. Because no foam fire extinguishers have ever been used at WSTF (Appendix A), there would not be any PFOA or PFOS associated with fire extinguisher use on site. Refer to Section 7.4 for a discussion of other foam firefighting products historically used or potentially used at WSTF.

9.3 Burn Pits

Refer to Sections 6.1, 6.4, 7.1, 7.3, 8.1, 8.3, and 10.3 for additional details regarding WSTF burn pits. The last burn pit was used at WSTF in 1985, prior to the cleanup of the 100 Area burn pit.

9.4 Post-Burn Pits

Following the cleanup of the 100 Area burn pit and the FD training area at WSTF, FD training with chemical/liquid live fires continued; however, training fires were no longer ignited in an open, unlined soil pit. Long-term WSTF personnel stated that for several years following the 100 Area burn pit cleanup (to the late 1980s), large chemical fires were conducted by the WSTF FD (but not the WSTF auxiliary firefighters) in the JP Area on the JP-4 and JP-5 concrete pads. Fires in the JP Areas were conducted sporadically with many months between fires. A WSTF FD employee estimated that approximately five to six fires total were conducted on the JP cement pads. FD personnel built a sand berm at the edges of the pad and poured gasoline, diesel, or alcohol onto the cement pad and then ignited the fuel. WSTF FD personnel then practiced extinguishing the fires with water only. Any remaining fuels were reignited and allowed to burn to completion. FD personnel stated that both the fuel and the extinguishing water were contained on the cement pads, with no spills or leaks having occurred (Appendix A). The February 2014 investigation of the JP remote test area supports the available evidence that no flammable constituents were released to the soil from the concrete pads (NASA, 2014c).

Also following the cleanup of the 100 Area burn pit, smaller chemical/liquid fires were conducted in an open top steel tank (approximately 250 gal) or within up to five or six modified open ½ drums (55-gal capacity) cut lengthwise. These tanks or half drums were located in the FD training area to the east, northeast, and southeast of the 100 Area burn pit. Chemicals or liquids burned included gasoline, diesel, and alcohols (mainly IPA) according to a long-term WSTF employee (Appendix A), but may have included kerosene (NASA, 1987b, 1987c, 1987d). Fuel (MMH and hydrazine) contaminated rags were also reportedly burned in drums until approximately 1986. The burning process was the same as within the previous burn pits and was described in an application for an open burning permit in June 1987, *"Steel tank will be filled with water and fuel and lighted with lit rag or stick thrown in tank."* Following extinguishing the fire for practice, the liquids were reignited to allow any excess chemicals or liquid to burn off (NASA, 1987b, 1987c, 1987d). The last liquids burn permit application requested burning in September 1987 (NASA, 1987d).

9.5 Smoke Structures

Smoke structures were buildings, trailers (a house trailer and later, a small portable enclosed trailer), or possibly a tank that were filled with smoke, either by burning straw or wood within the structure or using a smoke grenade or smoke machine (Appendix A). These smoke structures were used historically at WSTF to create a smoke environment for WSTF firefighters (both full-time and auxiliary) to practice entering an enclosed space full of smoke, become familiar with smoke hazards, and to practice rescuing personnel in a smoke-filled space. Breathing protection was worn by all full-time and auxiliary firefighters. Figure 9.1 shows a photograph of WSTF FD personnel conducting rescue training in a small enclosed portable smoke trailer in 2010. No other historical photographs were located showing a smoke structure in use.

No documents discussing smoke structures or training within smoke structures could be located at WSTF; however, historical photographs in conjunction with long-term WSTF personnel provided information regarding this practice. From initial use of the 100 Area burn pit in 1969, there was a smoke trailer located just east across the berm from the 100 Area burn pit. According to long-term WSTF personnel, smoke was generated by placing a smoke grenade (with gray, red, green, or yellow smoke) obtained from WSMR within a steel drum inside the trailer. If the grenade was not placed in the drum, sparks from the grenade could ignite the trailer. Long-term WSTF personnel stated that several trailers were accidentally burned in this manner. Once the trailer was burning, FD personnel practiced extinguishing the fire (Appendix A). Photographs provide timing for the accidental burning of the first smoke trailer. The first trailer is visible in photographs from 1969 to May 1979 but burned by March 1981 (Appendix B). No photographs of the eastern 100 Area were located in between those years. The March 1981 photograph also shows the second smoke trailer located in the100 FD training area to the south in the 100 container storage area (Appendix B). This second smoke trailer was accidentally burned by September 1983. Figure 9.2 shows a close up view of the 100 Area burn pit and the remains of both of the smoke trailers that were accidentally burned.

A surplus radar dome was relocated to the FD training area between 1983 and 1986. This dome was used as a smoke building for fire department training. Only smoke grenades were used, and no live fires were set within the building (Appendix A). In 1988, photographs show the radar dome, another trailer present in the FD training area, and several smaller buildings that FD personnel may have burned, used as smoke structures, or both (Figure 9.3). Long-term employees recalled the burning of a temporary building made of tin or metal with 2x4 wooden framing (Appendix A), which may be referring to the buildings in the 1988 photograph.

According to a long-term WSTF employee, WSTF auxiliary firefighters trained in a smoke house at the fire academy in Alamogordo twice between 1994 and 2010, when the auxiliary fire brigade training discontinued at WSTF. In addition to training in Alamogordo, a conex box, or shipping container was used as a smoke trailer within the FD training area, east of the GSA Building 151. Straw and wood were placed at the far end of the box inside, away from the door, and lit with gasoline. Auxiliary fire firefighting personnel practiced entering the simulated burning building to become familiar with the heat, smoke, and low visibility associated with actual fires. Use of the conex box as a smoke structure ended reportedly in the late 1990s or early 2000s (Appendix A).

9.6 Wood Fires

According to long-term WSTF personnel, scrap wood, wooden pallets, and wooden trailers were burned at WSTF in the FD training area. Trailers (1950s and 1960s models) were originally used at WSTF as office space prior to completion of all the buildings on site. After construction of the WSTF site was completed, some of these trailers were then transported around the WSTF site, continuing use as extra office space. Once the trailers were no longer needed, long-term WSTF personnel stated that the trailers were brought to the FD training area and used as smoke trailers or ignited with gasoline or diesel fuel. According to a long-term WSTF FD employee, *"Sometimes trailers were packed full of wood"* to assist in starting the fire and to provide a lasting fire for firefighting practice. All trailers were ignited three to four times to maximize firefighting practice with each trailer. Both FD and auxiliary firefighting personnel practiced extinguishing the fires using water, hoses, and fire trucks. A long-term FD employee estimated that between 20 and 25 trailers were burned at WSTF in the FD training area total, resulting from conducting trailer fires approximately every month for several years. Trailers were single, duplex, 4-plex, and one 8-plex trailer, a FD employee stated. The metal frames of the trailers were disposed of as scrap metal.

The first evidence of a wood fire conducted in the FD training area (other than the accidental burning of the smoke trailer in 1981 discussed in Section 9.5), is shown in a photograph from August 1982 (Figure 8.1). The original 100 Area burn pit is clearly visible, as are the additional 100 Area burn pit and the remains of the first smoke trailer; however, there is also a burned area to the south of the additional 100 Area burn pit that is likely the remains of either a trailer or a wood fire (Figure 8.1).

The last trailers burned at WSTF were those used as the original quarters for the WSTF FD in early 1964 (Appendix A). These 4-plex trailers were burned in late 1993 or early 1994, based on photographs of the FD training area with these trailers located there, but not yet burned in September 1993 (Figure 9.4). A TPS describing moving the former Firemen's living quarter trailers in 1992 indicated that asbestos was removed from the four trailers prior to moving them *"to the burn pit"* (NASA, 1992d). No evidence was located to indicate the presence of any active burn pits at WSTF after cleaning up the 100 Area burn pit in September 1985. This is corroborated both by statements from long-term WSTF employees (Appendix A) and by photographic evidence (Appendix B). It is believed that the location description of the *"burn pit"* was used within the TPS to provide a description of the delivery area that all WSTF personnel were familiar with at the time.

Besides trailers, scrap wood and wooden pallets were also stored in the FD training area, first east of the GSA Building 151, then south and east of the GSA Building 151. Long-term WSTF employees stated that the wood pile location was moved south over time, to avoid damaging vehicles delivering wood. Vehicle tires were being punctured with debris from past fires, such as metal parts and nails. Fires were never conducted in that southern wood pile area. If a live training fire was to be conducted using scrap wood/pallets, the wood was piled up in the northern portion of the FD training area (east of the GSA Building 151). Wood for fires could be piled up as high as a building prior to being burned. The last known wood live training fire was conducted at WSTF in the FD training area in 2007 (Appendix A). Details for this fire are provided in Section 10.4.1. The southern FD training area had, however, experienced one large trailer fire when the second smoke trailer was accidentally burned, in approximately 1983. Refer to Section 9.5 for details of this fire.

9.7 Cars

According to long-term WSTF employees, cars were obtained from a scrapyard for FD and auxiliary firefighter training. The condition of the cars ranged from new-looking to mostly stripped-down. These cars were used to practice rescuing personnel and *"dummies"* in accident scenarios, including using the *"jaws-of-life."* When the cars were *"beat up"* from accident rescue practice, WSTF FD personnel burned the cars and practiced firefighting. No materials were reportedly removed from cars prior to burning. Each car could provide two to three months of training. When the cars had been completely burned, the car shells were returned to the scrapyard that had provided the car (Appendix A).

10.0 Newly Identified Areas of Interest

While conducting research for this HIS, four additional areas of interest, an overflow area from the 100 Area burn pit, an extension of the 100 container storage area located to the north of the 100 Area burn pit, an additional 100 Area burn pit, and the FD training area, were identified where potentially hazardous substances may have been released. The following sections provide available information regarding these areas and any evidence of releases to the environment. Figure 10.1 shows the locations of the overflow area from the 100 Area burn pit, the northern 100 container storage area, the additional 100 area burn pit, and the FD training area.

10.1 100 Burn Pit Overflow Area

As reported in Section 8.1, long-term WSTF FD and auxiliary firefighters stated that the 100 Area burn pit overflowed historically. One employee commented that the overflows were common (Appendix A). Evidence of the overflow is provided in several historical photographs showing a stain adjacent to the 100 Area burn pit, the same color as the aqueous fluid within the pit (Appendix B). This stain trends to the northwest directly from the northwest corner of the 100 Area burn pit for approximately 200 ft. Photographs from the 100 Area burn pit detailed enough to discern soil staining are not common; however, there is a photograph from April 1976 showing the northwest-trending stain (Appendix B). A June 1974 photograph does not show extensive soil staining, suggesting that the first extensive overflow of the 100 Area burn pit occurred between June 1974 and April 1976. Figure 10.2 shows a photograph of the 100 Area burn pit in June 1977 with the greatest extent of soil staining observed in any photograph. This soil staining becomes less pronounced over time, but is visible in photographs until August 1982 (Appendix B). The dark-colored patches near the tip of the northwest-trending stain are believed to be piles of cinders, used for building construction at WSTF. Small amounts of these cinders remain in this location today. In photographs after 1982, a dirt road can be seen that extends through the 150 yard obscuring the soil stain.

Quantities of fluids that overflowed and the frequency of overflows is unknown. No soil sampling or cleanup of the overflow area has been conducted.

10.2 North 100 Container Storage Area

Historical photographs from July 1977 to September 1983 show several 55-gal drums being stored to the north of the 100 Area burn pit. Figure 9.2 shows a close-up of this area in September 1983. There were no photographs located of the FD training area between September 1983 and September 1986. This area north of the 100 Area burn pit had not been previously described at WSTF as storing any drums; however, for this HIS evaluation, one document was located that describes sampling 55-gal drums in a location fitting this area. In September 1985, two unlabeled drums of oil *"located north of the fireman's burn pit and east of the 150 yard fence"* were sampled for PCBs. PCBs were not detected (< 1 ppm) in either sample (NASA, 1985k). Analytical results are provided in Appendix C.

10.2.1 Historical Use

There is little available documentation and few recollections from WSTF employees regarding drum storage to the north of the 100 Area burn pit. The reasons for storing drums in this area may have been related to the 100 Area burn pit or the WSTF warehouse. A long-term WSTF FD employee stated that drums stored adjacent to the 100 Area burn pit were separated by type of contents, when the contents were known. For example, drums containing oils were placed together, and drums containing alcohols were placed together in a slightly different location (Appendix A). This northern container storage area may be a result of the practice at WSTF of storing different wastes in separate locations; however, a long-term WSTF FD employee stated that only empty drums were stored by the FD to the north of the 100 Area burn pit. The employee continued by stating that there were, however, other drums stored to the north of the 100 Area burn pit, approximately 100 to 150 ft northeast of Building 151, by warehouse personnel (Appendix A). These drums may have been off-specification chemicals that were being returned. The drums located north of the 100 Area burn pit may have been part of the drums stored by the warehouse, or may have been waste drums delivered by other WSTF employees unfamiliar with FD drum delivery procedures. Regardless of the origin, drums were historically stored to the north of the 100 Area burn pit as well as to the south. As part of the 100 container storage area cleanup, any drums located in this north 100 container storage area were moved to the drum storage facility and then shipped off site for disposal (Appendix A).

10.2.2 Potential Environmental Releases

There is evidence of a release to the environment in this area. In the document describing sampling of the two 55-gal drums in September 1985, one of the drums was coated with *"oil and dirt"* over the *"entire outside surface"* with no caps or plugs to seal the drum. The top of the drum also contained a clear liquid believed to be water. A sample was collected approximately 6 in. below the surface of the liquid, which was at the top of the bung hole (NASA, 1985k). The very full drum and the oil-coated surface suggest that leaking of the drum contents had occurred.

A WSTF TPS describes steam-cleaning the outsides of these drums in October 1985 prior to shipment off site for disposal, *"There are also 2 drums north west of the pit which need cleaned…Cleaning is to be done with a steam cleaner…to remove the oily material from the top and sides"* (NASA, 1985n).

10.3 Additional 100 Area Burn Pit

10.3.1 Historical Use

Section 6.1.1 discussed the 100 Area burn pit producing its own foam when it was ignited. As a result of this foam production, a new 100 Area burn pit was established to the east of the original 100 Area burn pit *"over the berm"* southeast of the original 100 Area burn pit (Appendix A). The berm was a linear soil pile oriented north-south that was located at the eastern edge of the developed eastern 100 Area. According to a long-term FD employee, the additional 100 Area burn pit was roughly square with dimensions of approximately 10 to 15 ft by 10 to 12 ft by 18 in. deep. This pit began use *"the year before we stopped using the other pit"* and was active until the original 100 Area burn pit was cleaned up (Appendix A). The term 'other pit' refers to the original 100 Area burn pit (SWMU 1). The approximate active life of this additional 100 Area burn pit can be determined based on historical documents. In a letter from NASA to NMEID describing cleanup activities for the original 100 Area burn pit, it was stated, *"The firemen's burn pit came into service about 1969 and was used through June 1983"* (NASA, 1985i). Historical photographs show a square burn feature located east and south of the 100 Area burn pit (Figure 8.1), which is in the location described by long-term WSTF FD personnel. Based on these documents and the employees statements, the additional 100 Area burn pit was in use from approximately 1981 to September 1985. Long-term WSTF FD personnel stated that the additional 100 Area burn pit was cleaned up at the same time as the original 100 Area burn pit, with soils removed as well (Appendix A). Photographs show the additional 100 Area burn pit possibly present as early as March and September 1981 (Appendix B).

Historical documents and employee interviews were used to attempt to determine the frequency of live training fires conducted at the additional 100 Area burn pit. A long-time FD employee stated that live fires for firefighting training became less frequent through time at WSTF (Appendix A), and burning was requested for *"a maximum of two burns each quarter of 1985"* from burn permit applications (NASA, 1985b). This information indicates somewhat regular burning at the additional 100 Area burn pit.

10.3.2 Potential Environmental Releases

Evidence of releases to the environment from the additional 100 Area burn pit include the existence of the burn pit, since by design, burn pits at WSTF were open unlined soil pits where chemicals/flammable liquids were placed before burning. Also, burn pit permit applications and statements from long-term WSTF employees provided additional evidence for environmental releases. According to a long-term FD employee, chemicals burned within the additional 100 Area burn pit consisted of the same chemicals and flammable liquids that had been burned in the original 100 Area burn pit when this additional pit was initially used, *"but with new regulations towards the end, only gasoline, diesel, and sometimes alcohols were burned"* (Appendix A). The continuation of burning chemicals or liquids other than just gasoline, diesel, and alcohols is corroborated in burn permit applications submitted to NMEID in December 1983 and April 1984 for permission to conduct training fires in 1984 and 1985, *"110 gallons of waste oil and 55 gal. of alcohol and/or misc. class A type fires"* were to be burned *"in the Administration Area (100) of White Sands Test Facility"* for a *"maximum of two burns each quarter of 1984"* (NASA, 1983) and for a *"maximum of two burns each quarter of 1985"* (NASA, 1985b). Since the original 100 Area burn pit was reportedly not in use from July 1983, these burn permit applications were likely referring to the additional 100 Area burn pit. The waste oil described indicates that burning practices used for the original 100 Area burn pit were still in effect for the additional 100 Area burn pit through April 1985, when the burn permit application was submitted. It is unclear if burning oils/chemicals/flammable liquids continued through the active life of the additional 100 Area burn pit based on the burn permit applications, or if only alcohols, gasoline, and diesel were burned later in the active life of the pit, based on statements from a WSTF employee. Since the burn permit applications were reportedly incorrect previously, and burn permit applications by nature are reporting planned and not actual activities, it is assumed that the employee statement is correct.

Fuel contaminated rags from the WSTF 200 Area chemistry and fuel laboratories were also reportedly burned within the additional 100 Area burn pit, based on statements by WSTF personnel. Rags were reportedly burned until approximately 1987, which is during the time this pit was in use at WSTF (Appendix A).

10.3.3 Previous Cleanup Activities

According to a long-term WSTF FD employee, the additional 100 Area burn pit was cleaned up when the original 100 Area burn pit was cleaned up (in September 1985; Appendix A).

10.4 Fire Department Training Area

The FD training area is located to the east of the 100 Area burn pit (SWMU 1) and the 100 container storage area (SWMU 3) within the eastern 100 Area of WSTF. The area encompasses approximately 78,000 ft^2.

10.4.1 Historical Use

The FD training area developed over time and began use due to the proximity of the 100 Area burn pit and the remote location of the area away from buildings and other activities at WSTF. In the early 1980s, fires began being conducted with wood in a cleared area across the berm from the 100 Area burn pit. This FD training area began as a place to locate the smoke structures. After the first smoke trailer was accidentally burned approximately in 1981, WSTF FD personnel began using the FD training area as an additional burning area. An additional 100 Area burn pit was constructed and used and additional wood fires were conducted. By 1986, a dome smoke structure was added to the area, and by 1988, two additional buildings for FD training were added. Also at this time, crusher fines (construction rocks) and scrap wood/pallets began being stored in the 100 container storage area (SWMU 3) location. Wood pallets and scrap wood began being stored in this FD training area to have the wood easily available for conducting live training fires. The last trailers were brought to the area for burning and firefighting training in 1993. Sections 9.3 through 9.7 provide details of burn pit history, post-burn pit fires, use of smoke structures, burning wood, and use and burning of cars in this area.

After 1994, only scrap wood fires were conducted in the FD training area, with diminishing frequency. WSTF FD personnel stated that from 1994 to the present, approximately three to four live firefighting training fires were conducted at WSTF. The last known live training fire conducted at WSTF was in 2007, using wood pallets ignited with a torch, with no fuels (Figure 10.3). After the last live fire conducted at WSTF, both WSTF FD personnel and WSTF auxiliary firefighting personnel stated that training for burning building rescues was conducted with smoke machines within other WSTF buildings, such as the test area block houses or more commonly, the FD high bay in Building 104.

10.4.2 Potential Environmental Releases

Conducting live training fires in the FD training area likely resulted in releases to the environment based on the nature of burning. Scrap wood, 1950s and 1960s model trailers, and many types of cars were all burned in this area over time. Long-term WSTF personnel stated that these wood fires were ignited with gasoline or diesel fuel, usually a few gal, but up to 110 gal. To the employees' knowledge, no materials were removed from the trailers and cars prior to burning the items in this area. Older trailers potentially contained asbestos, florescent light ballasts (with PCBs), paints (with lead), metal parts (with chromium, lead, cadmium, copper, etc.), and plastics. Following burning, remains of the wood, cars, and trailers were buried within the FD training area to the north, in line with Building 151 to the east of the berm. Remains included ashes, metal pipes, electrical wires, etc., items that did not readily burn. A FD employee stated that portions of the metal pipes and other metals melted (Appendix A). Cleanup of this area is discussed in Section 10.4.3 below.

Applications for open-burning permits from June 1987 through July 1994 provide evidence of planned wood-burning fires in the FD training area. These permit applications requested burning with wood, ignited with diesel fuel. Dates requested for fires at WSTF from the burn permit applications were November-April, 1986 (NASA, 1986h), June 13 and July 9-10, 1987 (NASA, 1987b, 1987c), February 20-21, April 16-17, and August 27-28, 1988 (NASA, 1988a, 1988c, 1988d), March 4-5, June 17-18, August 8-9, September 16-17, and October 14-15, 1989 (NASA, 1989a, 1989b, 1989c, 1989d, 1989e), January 27-28, April 28-29, and July 28-29, 1990 (NASA, 1990a, 1990b, 1990c), January 8-July 8, July

1-August 1, October 19-20, and October 26-27, 1991 (NASA, 1991a, 1991b, 1991c), January 24-26, April 11-12, July 17-19, and October 2-4, 1992 (NASA, 1992a, 1992b, 1992c, 1992e), January 29-31, April 16-24, July 17-31, and October 22-25, 1993 (NASA, 1993a, 1993b, 1993d, 1993e), and June 4-July 31 and October 28-November 31, 1994 (NASA, 1994a, 1994d). Most of these burn permit applications list approximately 1 gal of diesel fuel as the amount used for igniting the fires; however, in several permit applications, the amount of diesel fuel for igniting the proposed fires was not specified. Also, for the January 1993 burn, 50 gal of diesel fuel was requested for use to ignite the wood, and all the other 1993 and 1994 burn permit applications list using 5 gal of diesel fuel for ignition of the wood fires. The burn permit for March 4-5, 1989 was the only permit where method of ignition contained no diesel fuel, but was described as lit with a match (NASA, 1989a).

Further evidence of a release to the environment was provided in a letter from the EPA regarding an inspection conducted at WSTF on November 30 and December 1, 1982. The EPA noted numerous violations of RCRA, including *"evidence of a fire in the drum storage area"* (EPA, 1984), which was referring to the *"fire department training area,"* which at the time consisted of the 100 Area burn pit, the area east of the 100 Area burn pit, and the 100 container storage area (NASA, 1984b). Figure 8.1 shows the FD training area in August 1982, only three months prior to the EPA inspection. Evidence of three separate burned areas and the additional 100 Area burn pit is visible to the east of the 100 Area burn pit. Photographs from 1986 show no evidence of burning in the FD training area. (Refer to Section 10.4.3 below for details.) Then, in photographs from 1988 and 1991, a partially burned pile of wood or trailer can be seen to the north of the FD training area (Figure 9.3). This provides evidence that wood/trailer-burning was conducted once again approximately in 1988, but the frequency of conducting live training fires was much less than when chemicals/liquids were being burned in the burn pits. WSTF personnel have stated, *"later, towards the end* [of the employee's service in the Auxiliary fire brigade in 1989]*, we didn't burn at all. We hooked up hoses to a fake fire hydrant and practiced rescue training in the trailers and dome with fake smoke"* (Appendix A).

10.4.3 Previous Cleanup Activities

When the 100 Area burn pit (SWMU 1) was cleaned up in September 1985, it appears that the entire FD training area was cleaned up as well. A photograph from September 1986, a year after the 100 Area burn pit was cleaned up, shows no evidence of fires, neither the additional 100 Area burn pit, nor the wood burning/trailer residues. A long-term WSTF FD employee stated that both 100 Area burn pits were cleaned up simultaneously. Another long-term WSTF employee stated that a front end loader was used to collect the ashes/residues/pipings of the burned trailers and transported the material to the WSTF 700 Area landfill. The employee was uncertain what year this occurred, but it is likely it was around the time the 100 Area burn pit was cleaned up.

For training fires conducted after September 1985, ashes/residues from wood fires and burned trailers were buried to the north within the FD training area, and to the employees' knowledge, have not been cleaned up again (Appendix A).

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Figures

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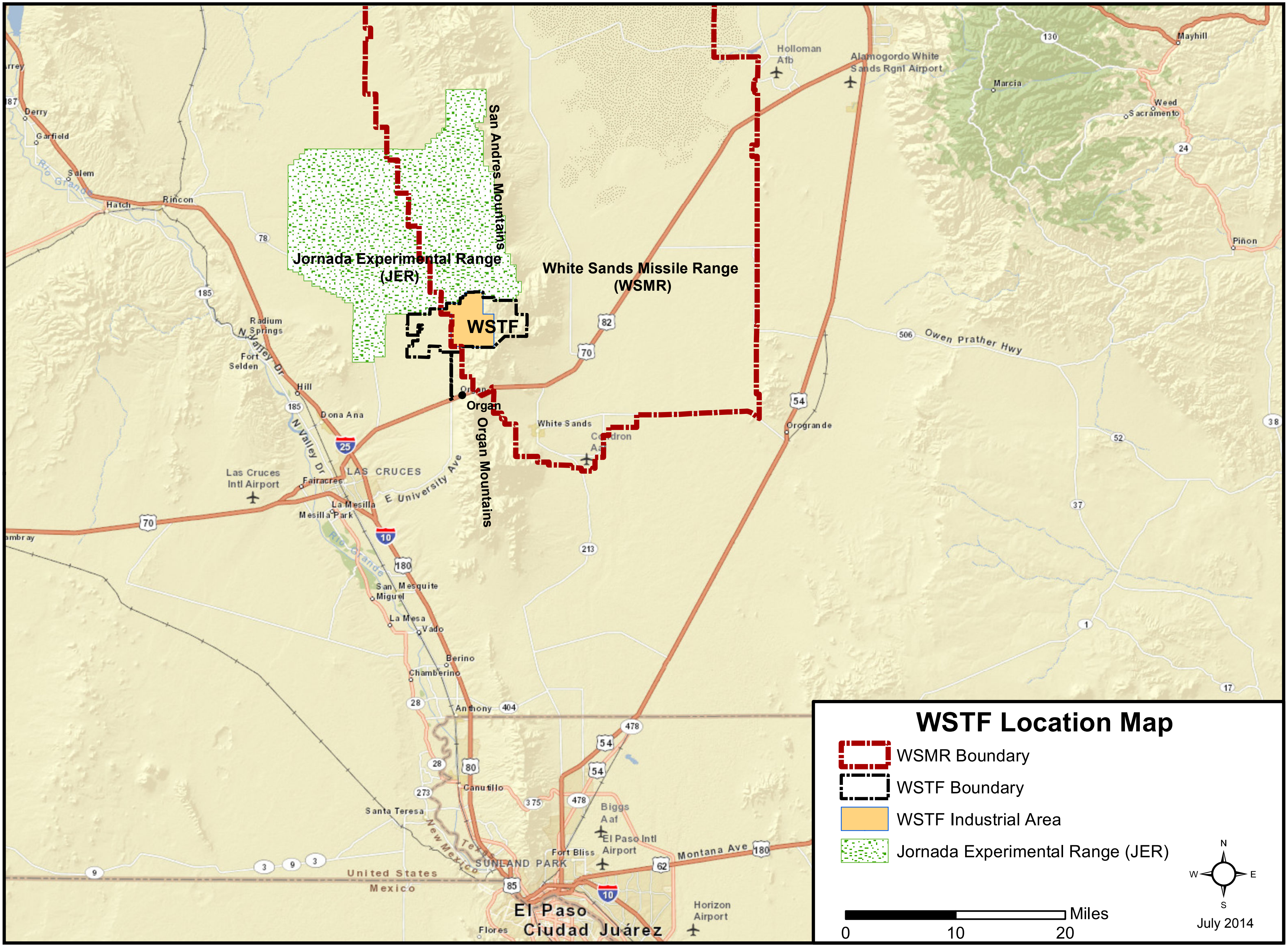

WSTF Location Map
WSMR Boundary
WSTF Boundary
WSTF Industrial Area
Jornada Experimental Range (JER)
Miles
0
10
20
N
S
E
W
July 2014
WSTF
White Sands Missile Range
(WSMR)
Jornada Experimental Range
(JER)
San Andres Mountains
Organ Mountains
Organ
LAS CRUCES
El Paso
Ciudad Juárez
United States
Mexico
Holloman Afb
Alamogordo White Sands Rgnl Airport
Las Cruces Intl Airport
El Paso Intl Airport
Horizon Airport
Owen Prather Hwy
Montana Ave
E University Ave
N Valley Dr

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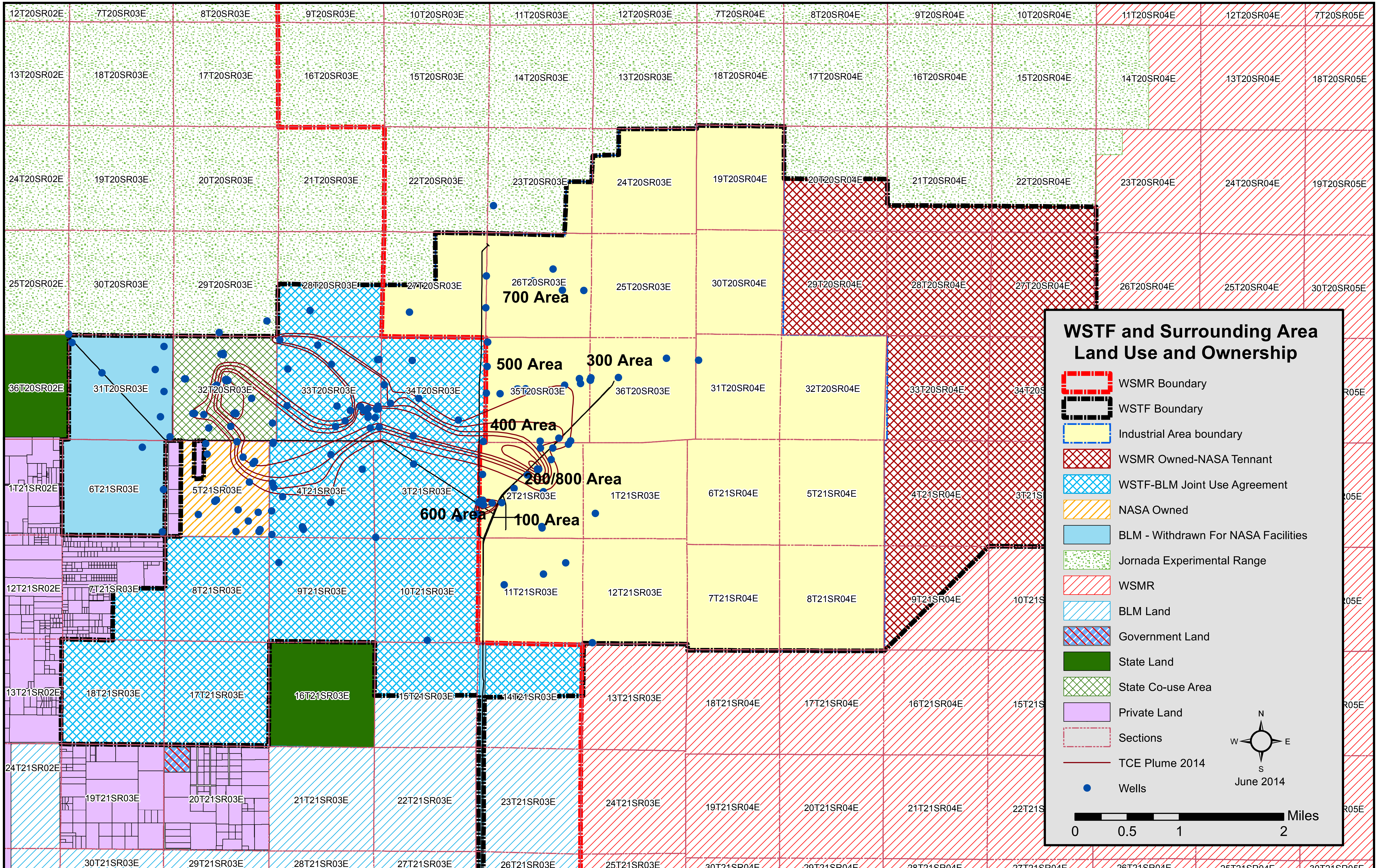
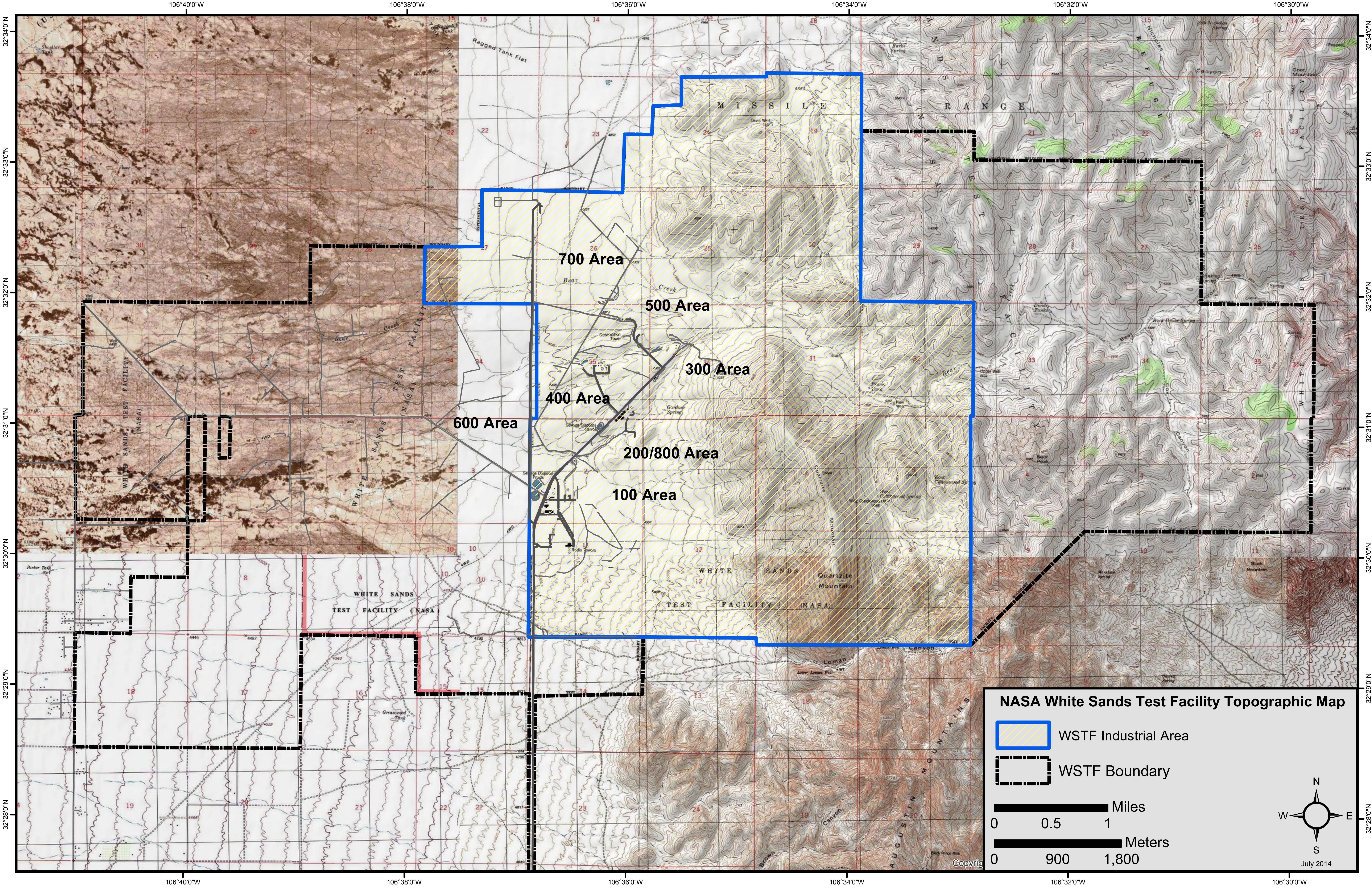


WSTF and Surrounding Area
Land Use and Ownership
WSMR Boundary
WSTF Boundary
Industrial Area boundary
WSMR Owned-NASA Tennant
WSTF-BLM Joint Use Agreement
NASA Owned
BLM - Withdrawn For NASA Facilities
Jornada Experimental Range
WSMR
BLM Land
Government Land
State Land
State Co-use Area
Private Land
Sections
TCE Plume 2014
Wells
N
W
E
S
June 2014
Miles
0
0.5
1
2
700 Area
500 Area
300 Area
400 Area
200/800 Area
600 Area
100 Area

Figure 2.3 **WSTF Topographic Map**

(SEE NEXT PAGE)


106°40'0"W
106°38'0"W
106°36'0"W
106°34'0"W
106°32'0"W
106°30'0"W
32°34'0"N
32°33'0"N
32°32'0"N
32°31'0"N
32°30'0"N
32°29'0"N
32°28'0"N
700 Area
500 Area
300 Area
400 Area
600 Area
200/800 Area
100 Area
Ragged Tank Flat
MISSILE
RANGE
WHITE SANDS TEST FACILITY (NASA)
Quartzite Mountain
AUGUSTIN MOUNTAINS
NASA White Sands Test Facility Topographic Map
WSTF Industrial Area
WSTF Boundary
Miles
0
0.5
1
Meters
0
900
1,800
N
S
E
W
July 2014

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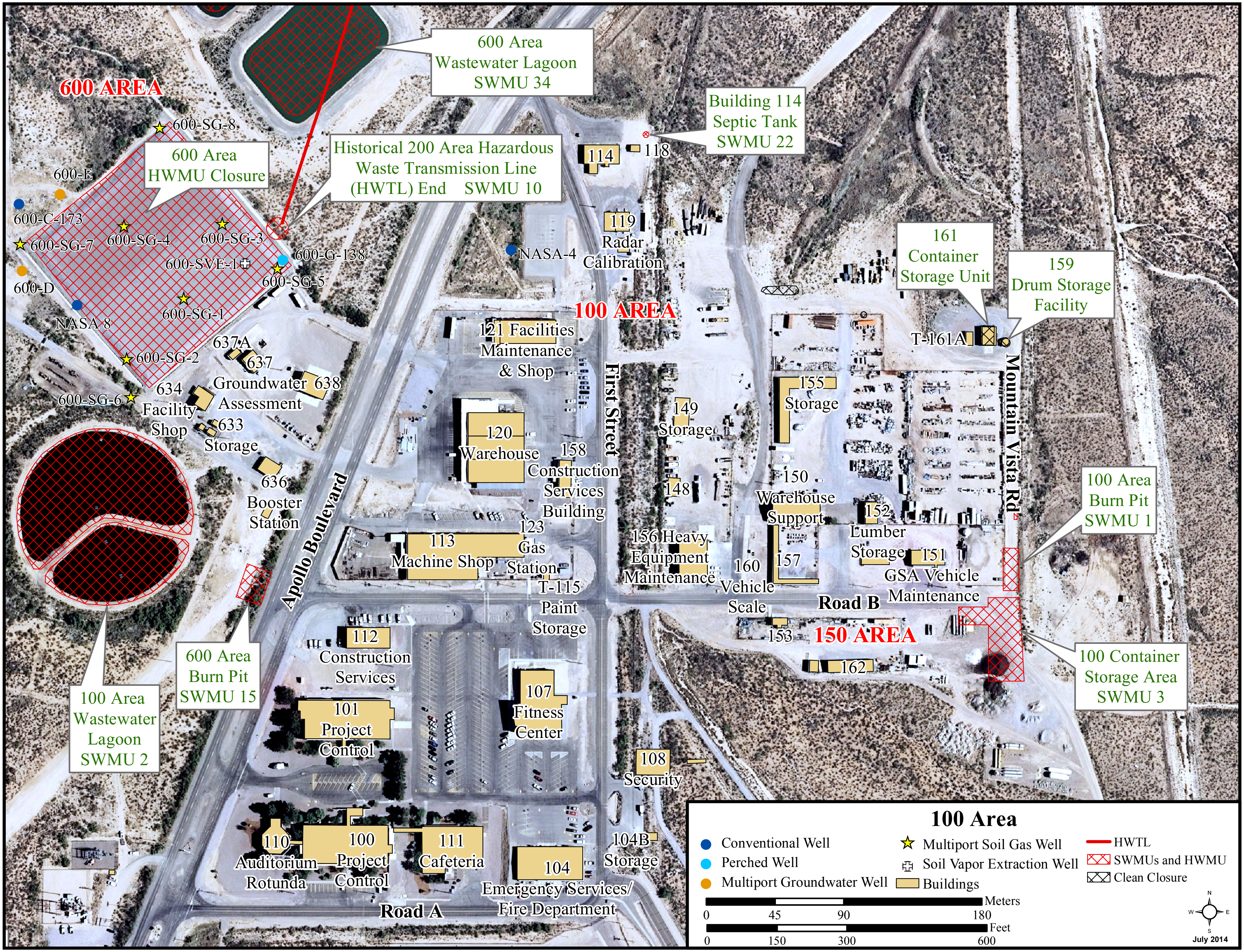
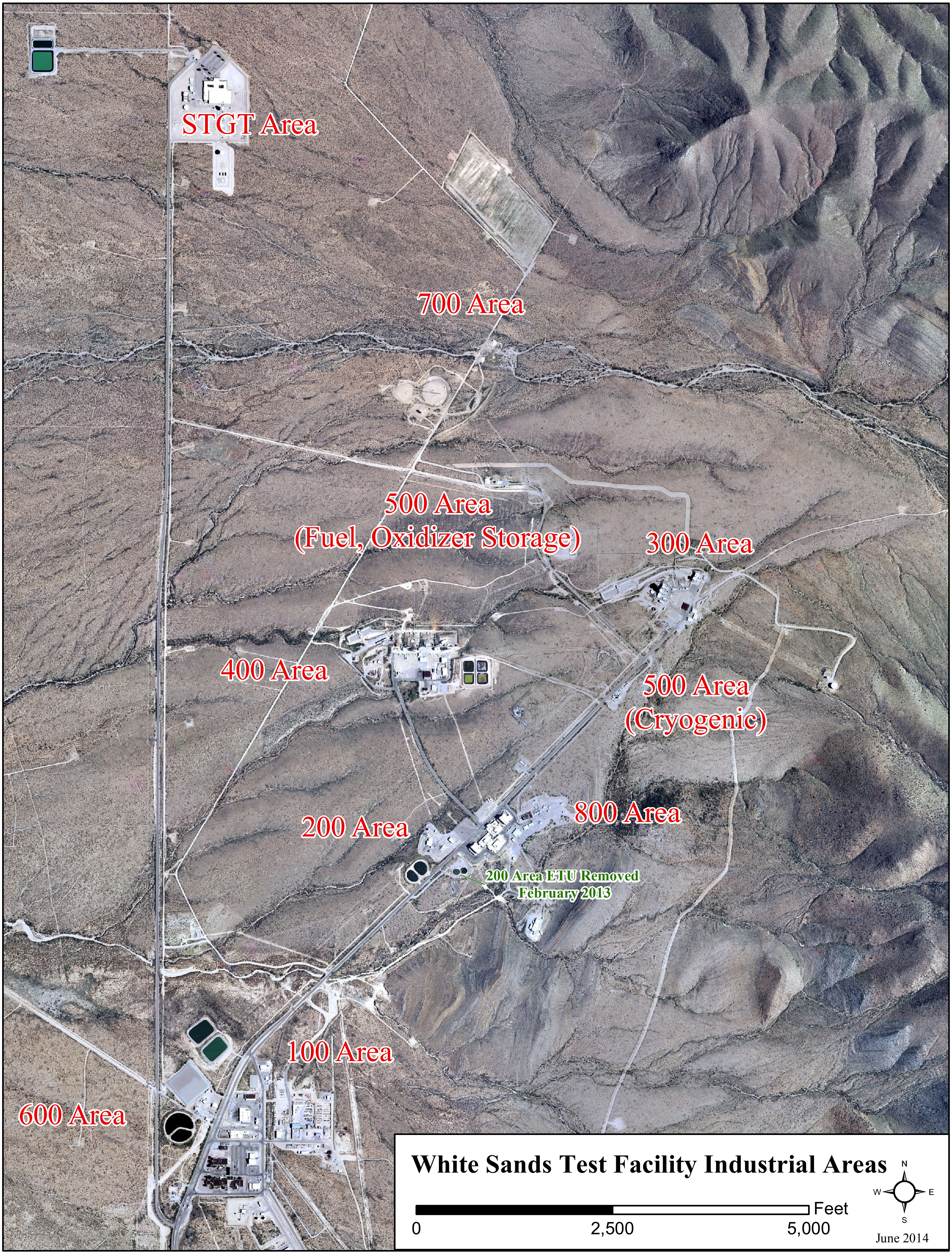


600 AREA
600 Area Wastewater Lagoon SWMU 34
Building 114 Septic Tank SWMU 22
600 Area HWMU Closure
Historical 200 Area Hazardous Waste Transmission Line (HWTL) End SWMU 10
600-SG-8
600-E
600-C-173
600-SG-7
600-SG-4
600-SG-3
600-G-138
600-SVE-1
600-SG-5
600-D
600-SG-1
NASA-8
NASA-4
600-SG-2
600-SG-6
114
118
119 Radar Calibration
161 Container Storage Unit
159 Drum Storage Facility
T-161A
100 AREA
121 Facilities Maintenance & Shop
637A
637
638
634 Facility Shop
Groundwater Assessment
633 Storage
636 Booster Station
120 Warehouse
158 Construction Services Building
149 Storage
155 Storage
148
150 Warehouse Support
152 Lumber Storage
151 GSA Vehicle Maintenance
Mountain Vista Rd
First Street
Apollo Boulevard
100 Area Burn Pit SWMU 1
113 Machine Shop
123 Gas Station
T-115 Paint Storage
156 Heavy Equipment Maintenance
160 Vehicle Scale
157
Road B
153
150 AREA
162
100 Container Storage Area SWMU 3
600 Area Burn Pit SWMU 15
100 Area Wastewater Lagoon SWMU 2
112 Construction Services
107 Fitness Center
101 Project Control
108 Security
110 Auditorium Rotunda
100 Project Control
111 Cafeteria
104 Emergency Services/ Fire Department
104B Storage
Road A
100 Area
Conventional Well
Perched Well
Multiport Groundwater Well
Multiport Soil Gas Well
Soil Vapor Extraction Well
Buildings
HWTL
SWMUs and HWMU
Clean Closure
Meters
0 45 90 180
Feet
0 150 300 600
N
W E
S
July 2014

Figure 3.2 **WSTF Industrial Areas**

(SEE NEXT PAGE)



STGT Area
700 Area
500 Area
(Fuel, Oxidizer Storage)
300 Area
400 Area
500 Area
(Cryogenic)
200 Area
800 Area
200 Area ETU Removed
February 2013
100 Area
600 Area
White Sands Test Facility Industrial Areas
N
W
E
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Feet
0
2,500
5,000
June 2014

Figure 6.1 **100 Area Burn Pit (SWMU 1; 1972)**

(July 1972 – view to the northeast)

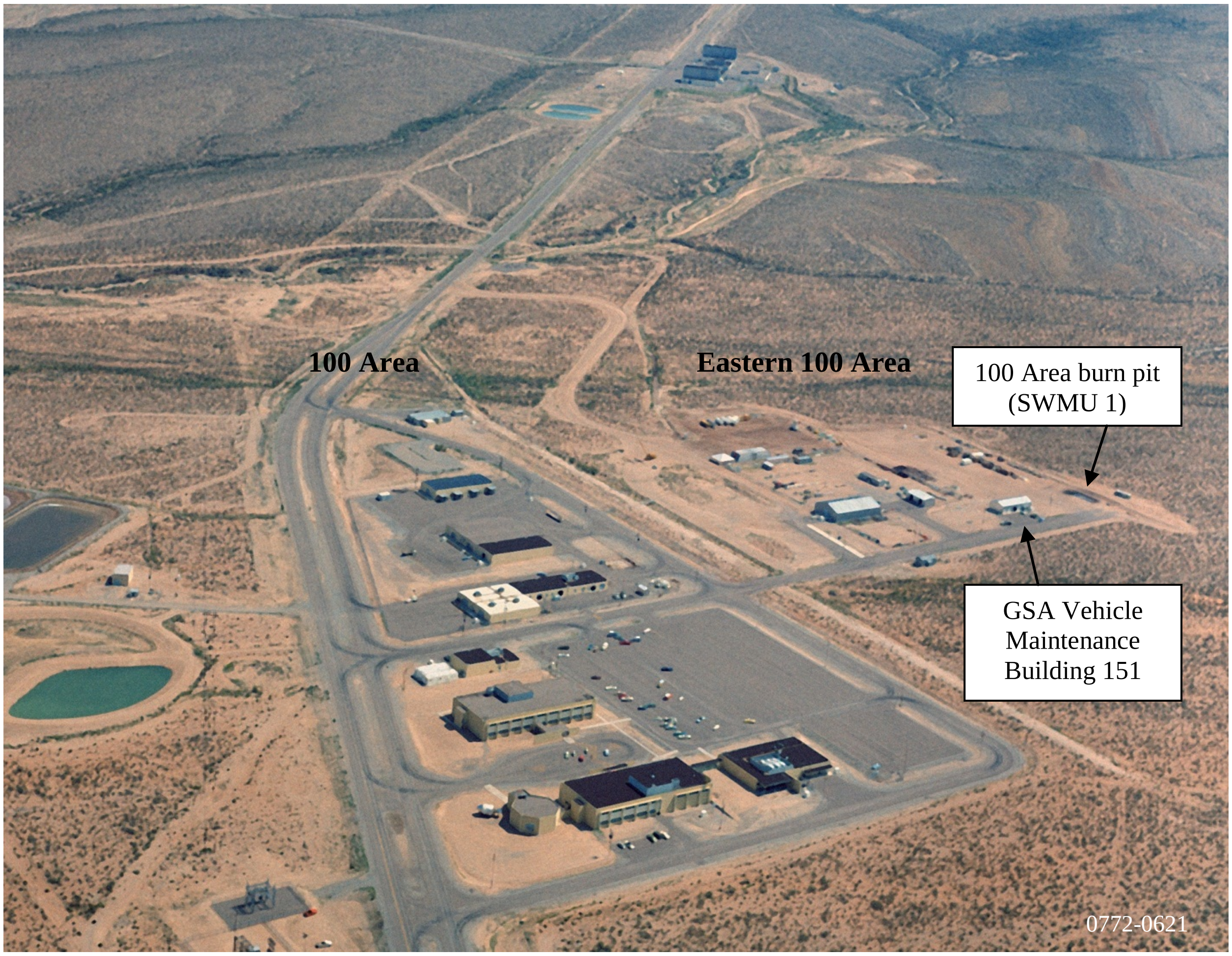


Figure 6.2 100 Area Burn Pit (SWMU 1) Sampling Locations 1983

(SEE NEXT PAGE)

FIRE TRAINING BURN PIT

SKETCH #1
PAGE 4 OF 5

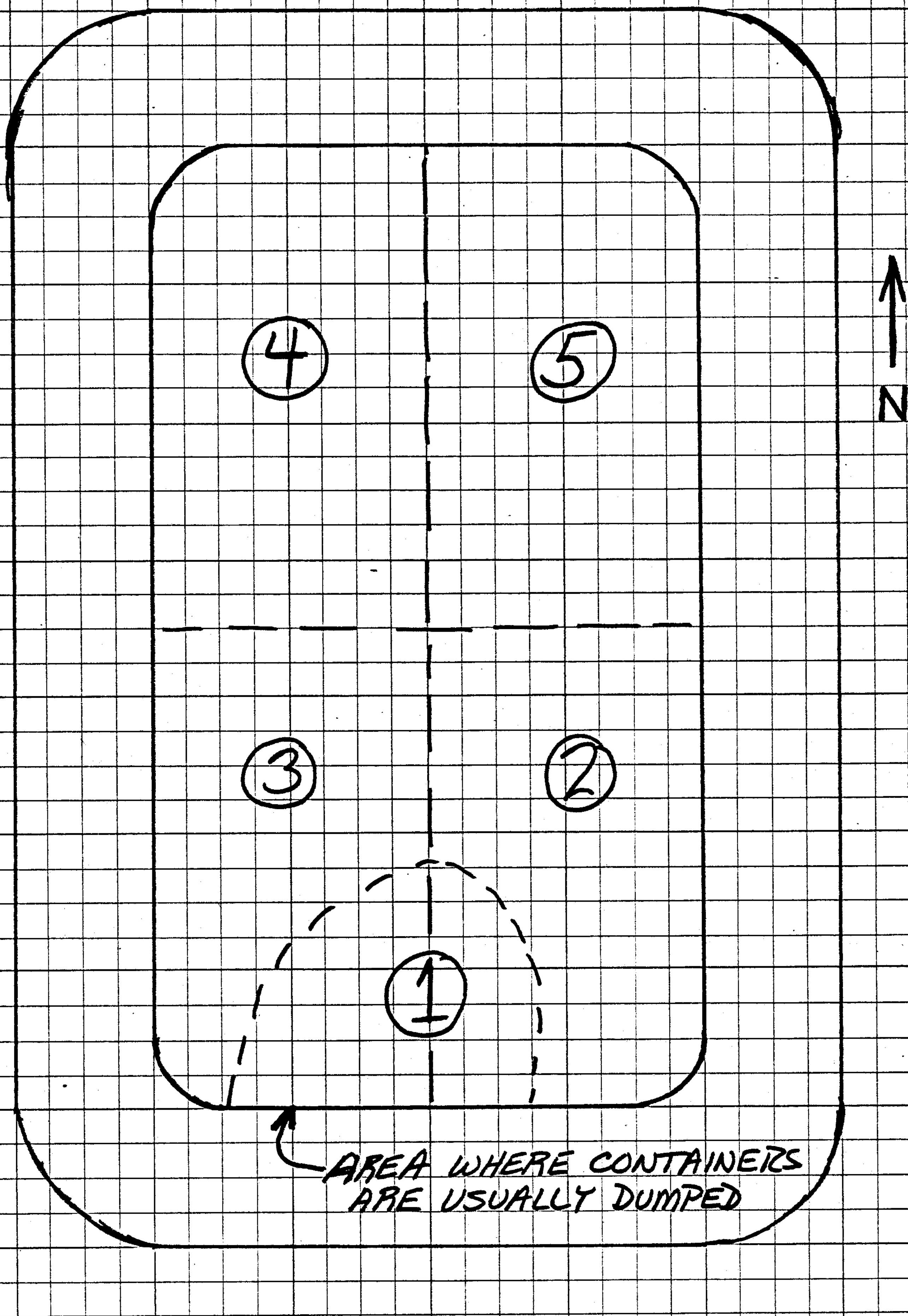


Figure 6.3 100 Area Burn Pit (SWMU 1) Sketch

(SEE NEXT PAGE)

ROUGH SKETCH OF BURN PIT
AND STAINED SURROUNDING SOILS

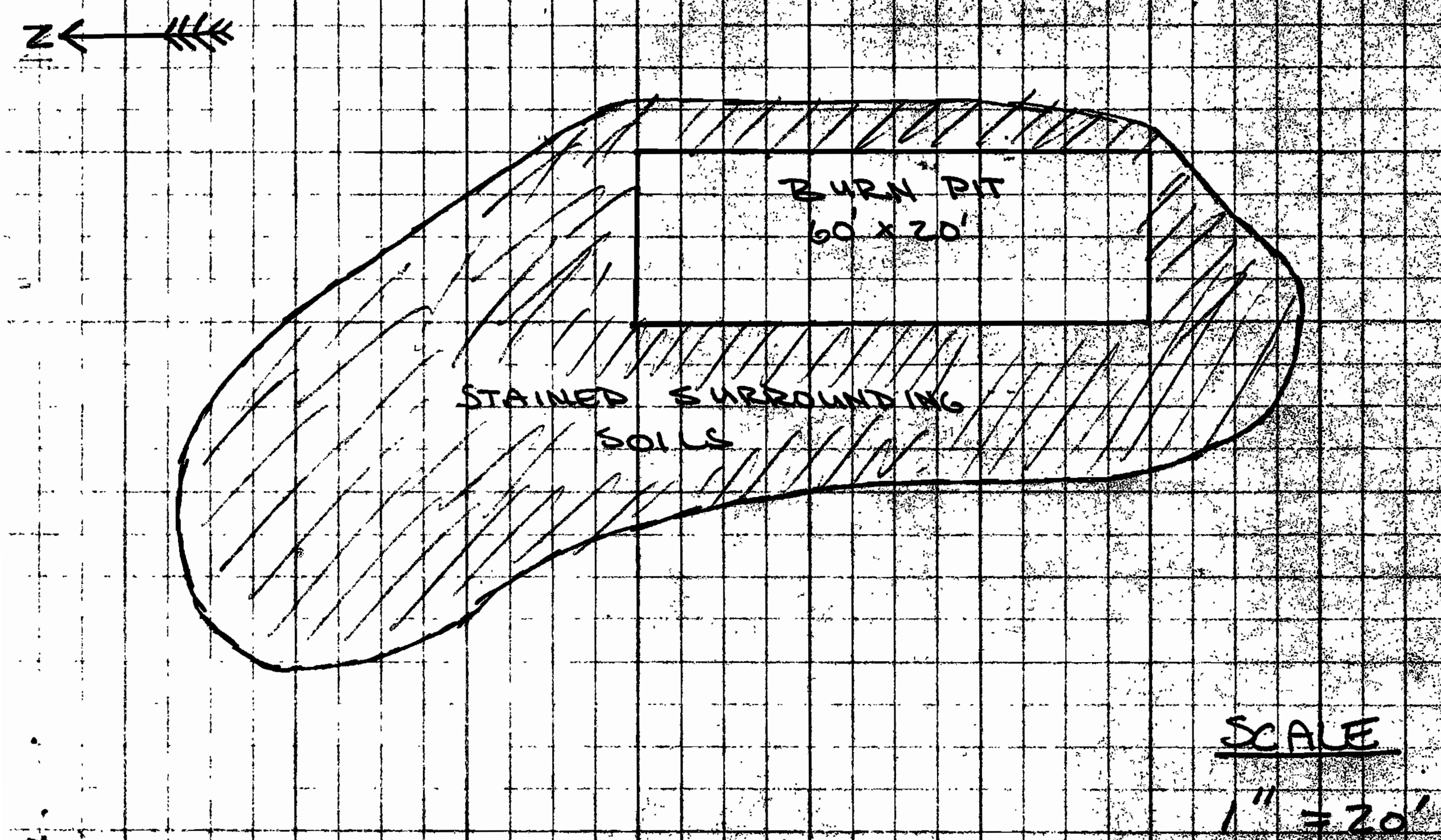
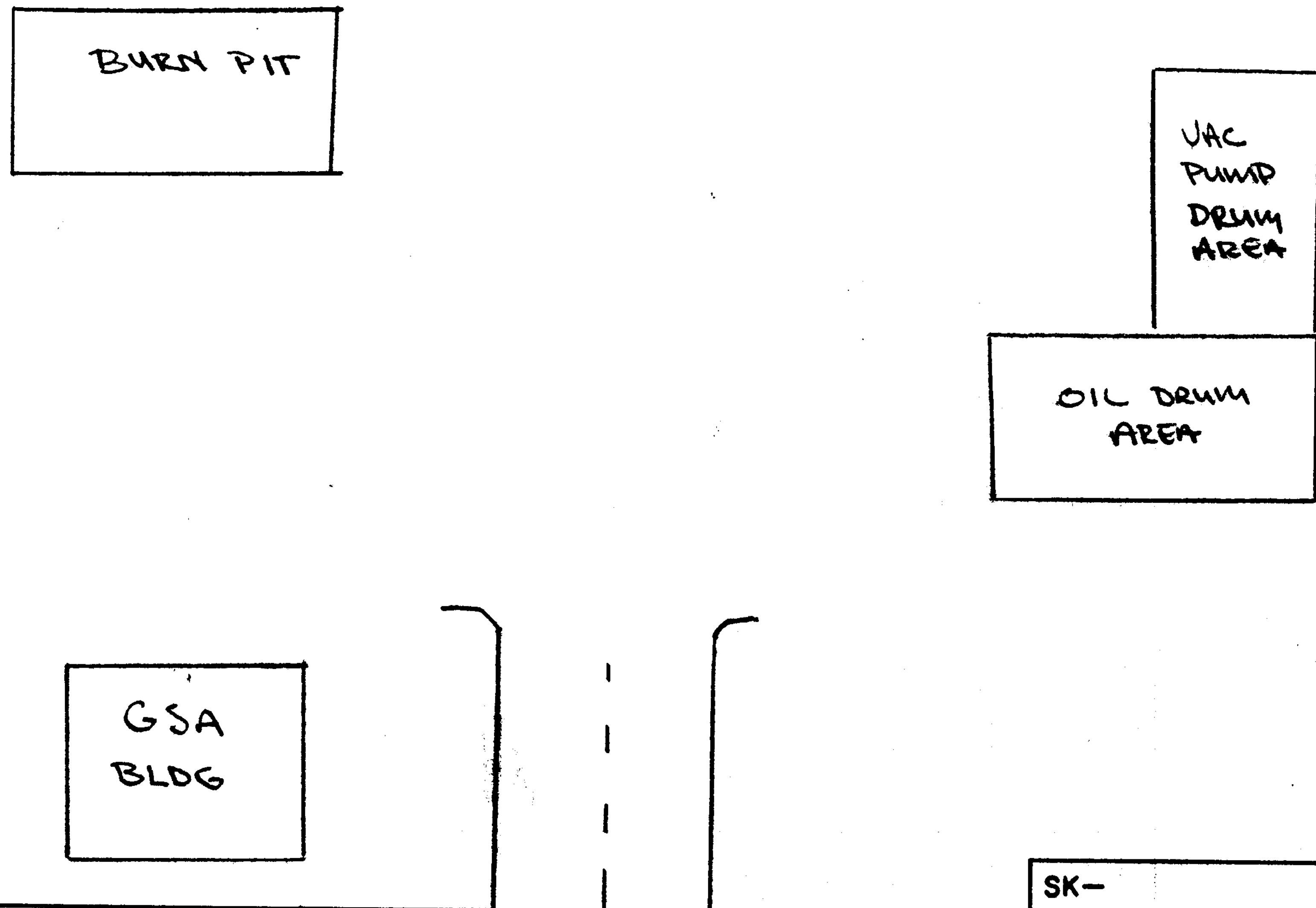


Figure 6.4 100 Container Storage Area (SWMU 3) Sketch

(SEE NEXT PAGE)

WSTF/ SKETCH	TITLE: 150 YD	TPS NO. EPA-FAC-051	SKETCH NO. SK -
CONTRACTOR AUTH. SIGNATURES	NASA AUTH. SIGNATURES	PAGE OF	BY: T Roome
G Boor	D Amidei 5/6/86	MOD.NO. DATE: MAY 6 '86	DATE: 5/6/86



SK–

Figure 6.5 Drum Storage Facility-Building 159 (1987)

(October 1987 – view to the north)

This photograph shows the modified radar dome of the drum storage facility in 1987 located north of the 100 Area burn pit. This facility was historically referred to as both Building 159 and Building 160 and is located directly to the east of the container storage unit, Building 161.

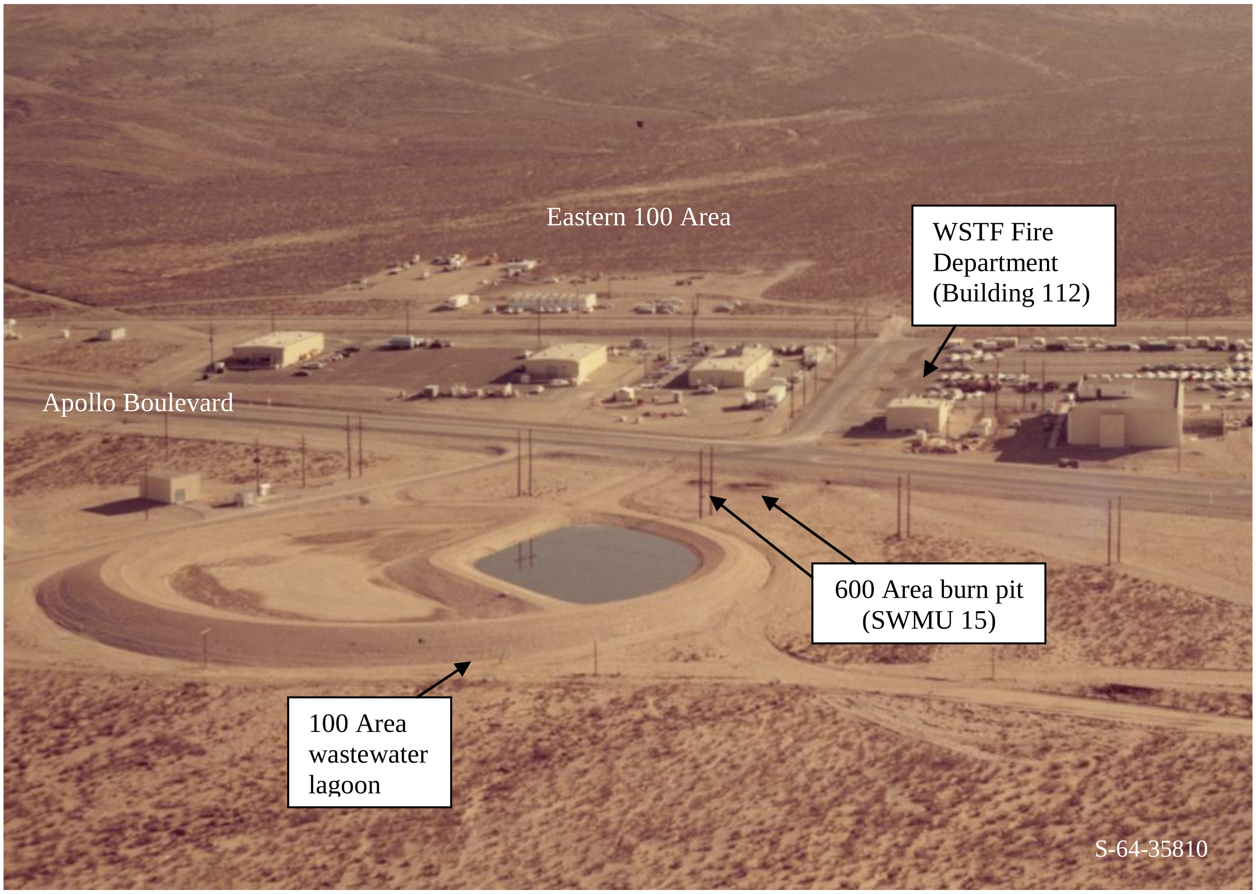
Figure 6.6 **Container Storage Unit-Building 161 (2003)**

(April 2003 – view to the northwest)

This photograph shows the container storage unit, Building 161, located directly west of the drum storage facility, Building 159, to the right of the photograph.

Figure 6.7 **600 Area Burn Pit (SWMU 15; 1964)**

(1964 – view to the east)



This photograph shows the 600 Area burn pit and surrounding 100/600 Areas in 1964. Notice there appears to be two small burn pits instead of one larger burn pit.

Figure 8.1 **Fire Department Training Area (1982)**

(August 1982 – view to the south)

This photograph shows the FD training area in August 1982. The photo shows the remains of the first smoke trailer, the additional 100 Area burn pit, a new smoke trailer, and the 100 container storage area. Notice there are two additional burned areas that may represent the first evidence of wood burning in the FD training area (other than the accidental burning of the first smoke trailer). One area is east of the 100 container storage area and the other is east of the smoke trailer remains. The fires may have been scrap wood or additional trailers used for firefighting practice. This photograph was taken three months prior to an EPA inspection of WSTF. The EPA noted numerous RCRA violations including evidence of fire near the 100 container storage area, no waste log for the 100 container storage area, and corroded drums in the 100 container storage area.

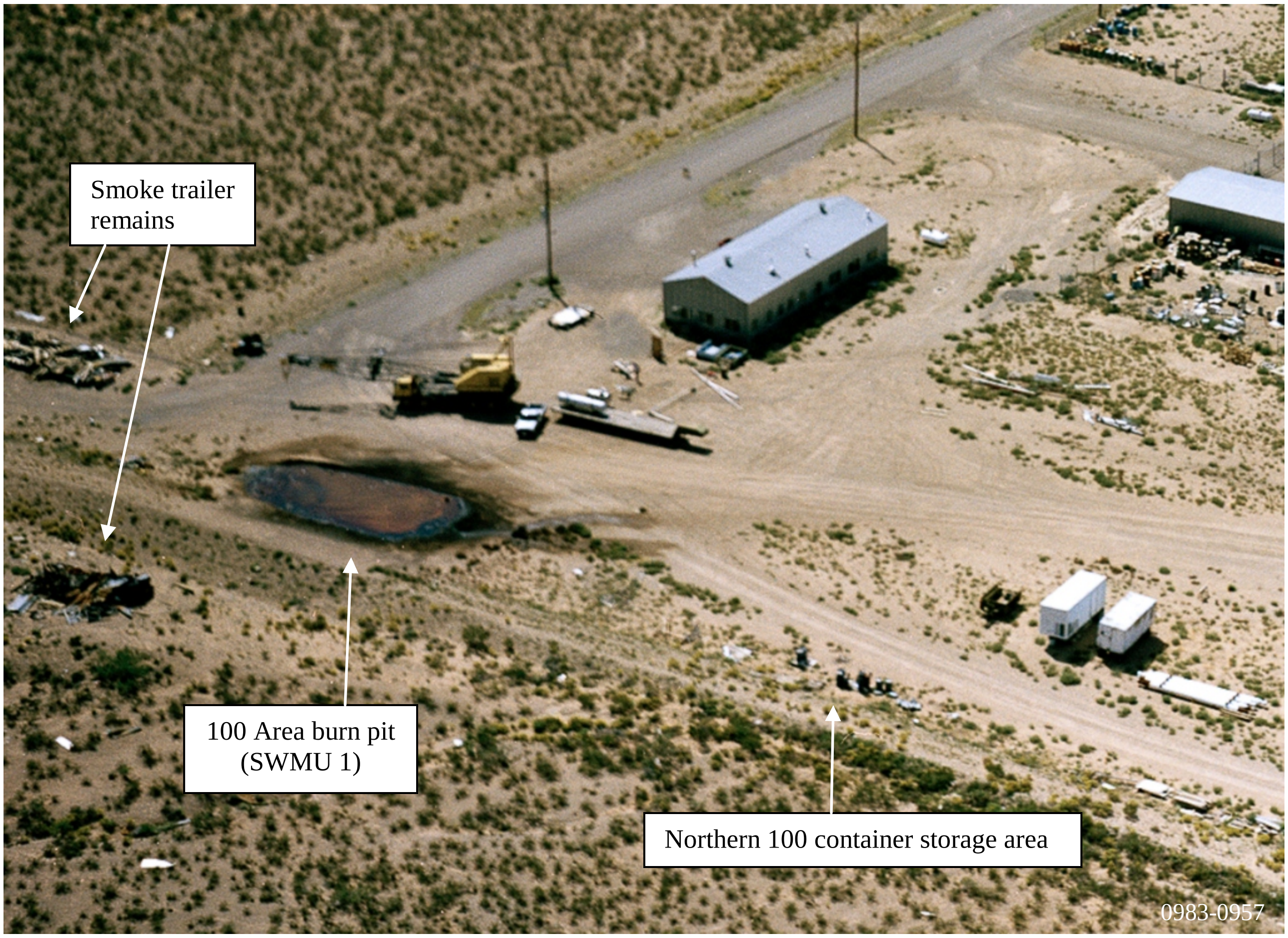
Figure 9.1 **Smoke Rescue Practice (2010)**

(February 2010 – view to the east)

This photograph shows WSTF FD personnel training in the 100 Area at WSTF in February 2010 using a smoke structure (a portable enclosed trailer). Personnel were practicing rescuing a person with reduced visibility caused by “smoke.” The “smoke” was formed with a smoke machine.

Figure 9.2 **Fire Department Training Area (1983)**

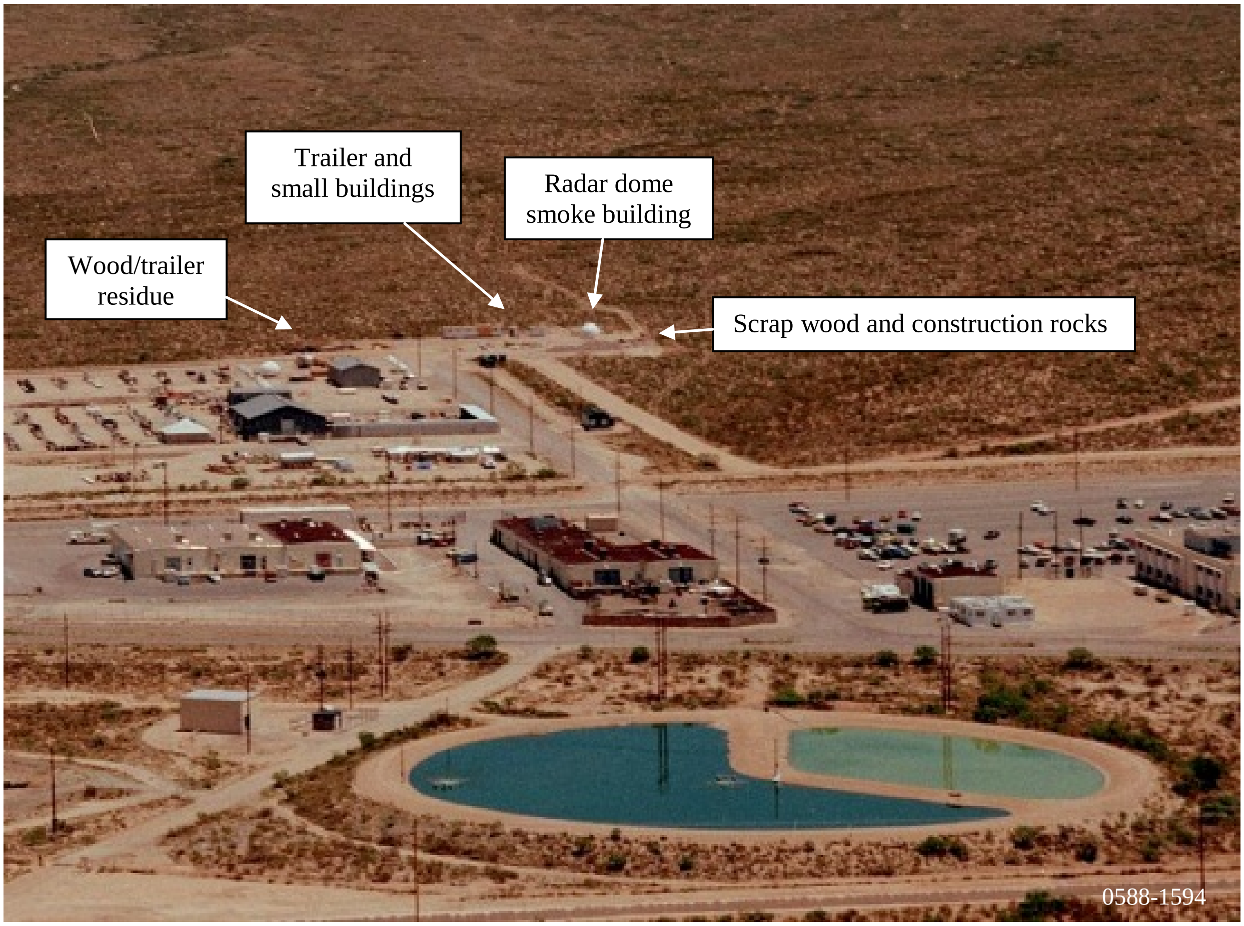
(September 1983 – view to the southwest)



This photograph from September 1983 shows a close up view of the 100 Area burn pit, the northern 100 container storage area, and the remains of the first two smoke trailers used in the FD training area at WSTF. The location of drums for the 100 container storage area to the south of the burn pit have been moved south and east of the burned smoke trailer located within the boundaries of the 100 container storage area and are not visible in the photograph.

Figure 9.3 **Fire Department Training Area (1988)**

(May 1988 – view to the east)



This photograph shows the FD training area in May 1988. Notice the radar dome smoke structure, the older trailer, several buildings, the pile of residual burned items to the north, and the addition of construction rock and wooden pallets being stored in the former SWMU 3, 100 container storage area.

Figure 9.4 **Fire Department Training Area (1993)**

(September 1993 – view to the west)

This photograph shows the FD Training Area in September 1993 with the original Firemen's quarters 4-plex trailers ready for burning at WSTF. These trailers were the last known trailers to be burned at WSTF.

Figure 10.1 **Areas of Interest**

(SEE NEXT PAGE)

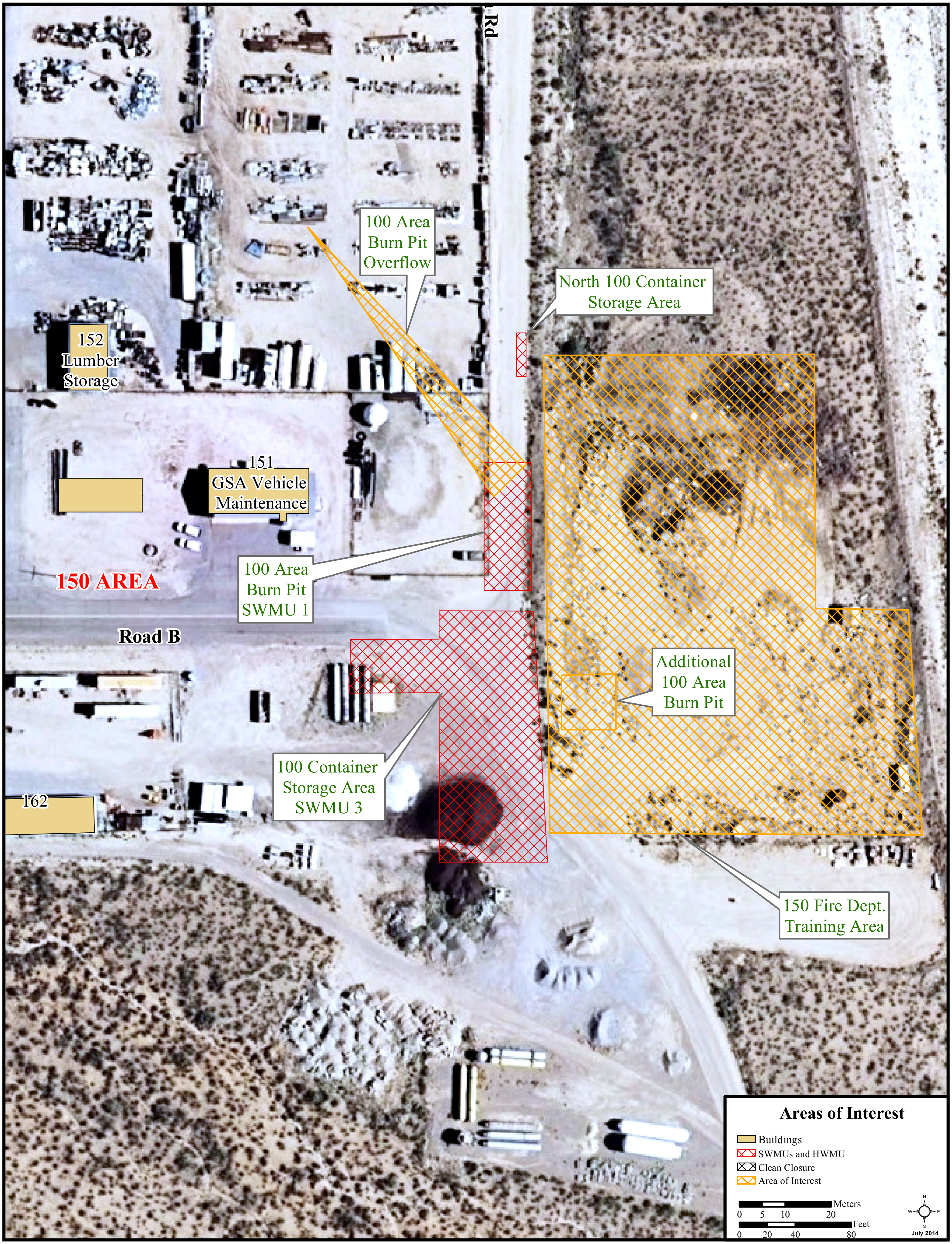

Rd
100 Area Burn Pit Overflow
North 100 Container Storage Area
152 Lumber Storage
151 GSA Vehicle Maintenance
150 AREA
100 Area Burn Pit SWMU 1
Road B
Additional 100 Area Burn Pit
100 Container Storage Area SWMU 3
162
150 Fire Dept. Training Area
Areas of Interest
Buildings
SWMUs and HWMU
Clean Closure
Area of Interest
Meters
0 5 10 20
Feet
0 20 40 80
July 2014

Figure 10.2 **100 Area Burn Pit (1977)**

(June 1977 – view to the west)

This photograph shows the eastern 100 Area in June 1977. The 100 Area burn pit is present with a large soil stain trending to the northwest from the pit. This is believed to be the result of overflowing of the 100 Area burn pit. The 100 container storage area is also visible with two separate areas containing 55-gal drums. Near the tip of the northwest-trending soil stain is a discolored area believed to be cinder piles (construction rock).

Figure 10.3 **Last Known Live Training Fire at WSTF (2007)**

(October 2007 – view to the east)

This photograph shows the last known live training fire conducted at WSTF. Wooden pallets were ignited by a torch in the FD training area and extinguished using water only.

Tables

Table 6.1 Summary of Drum/Container Storage Areas at WSTF

Area Name	SWMU Number/ Building Number	Description	Operational History	Current Use
100 container storage area	SWMU 3 / no building number	Outdoor accumulation of waste 55-gal drums/containers on wooden pallets or directly on soil	Operational 1969 to 1986. Drums removed 1985-1987. Spills occurred, but were not documented. Three soil borings were completed in October 1994 (Refer to the RFI). Will be investigated as part of SWMUs 1, 3, and 15 IWP.	Storage of construction materials
Drum storage facility or 100 Area drum storage facility	No SWMU number / historically listed as both Building 159 and Building 160	Indoor accumulation of waste drums/containers in a converted radar dome building; capacity 25 55-gal drums	Operational May 1986 to March 1993 under interim status. 1 Spill to secondary containment of < 10 gal shop oil with MEK and 1,1,1-trichloroethane in non-reportable quantities. Cleaned-up. NASA submitted closure plan 5/18/1993. NMED issued a notice of deficiency 5/12/1993. NASA submitted notice of deficiency response 6/14/1993. NASA submitted a revised closure plan 8/22/1994. NMED approved closure plan 9/29/1994. NASA completed clean closure 2/1995. NASA submitted closure report with certification of closure to NMED 2/28/1995. NMED approved clean closure 5/12/1995.	Storage of empty drums
Container storage unit or 100 Area container storage unit	No SWMU number / Building 161	Indoor accumulation of waste drums in a pre-fabricated metal rectangular building; capacity 48 55-gal drums	Operational March 1993 to February 2002. No spills or releases occurred during operation. NASA submitted container storage unit closure plan 10/30/2001. NMED provided a notice of administrative completeness of the container storage unit work plan 12/17/2001. NASA completed container storage unit clean closure 4/2/2002. NASA submitted container storage unit closure plan update documentation 4/24/2002. NMED approved container storage unit closure work plan and update documentation 1/21/2003. NASA submitted certification of final closure 2/11/2003. NMED approved clean closure but requested photographs 4/7/2003. NASA submitted photographs of closed container storage unit 5/8/2003. NMED provided container storage unit final closure verification 5/20/2003.	90-day accumulation area for hazardous waste storage; satellite accumulation area; Toxic Substances Control Act storage for PCBs

Table 7.1 List of Potential Substances Used or Stored in SWMUs 1, 3, and 15

Substance	SWMU Used/Stored					Source
	SWMU 1 and overflow	SWMU 3	SWMU 15	Additional 100 Area burn pit	Fire Training Area	
Propene	Possible	Possible	NA	Possible	NA	Potential flammable substance
1,1-Dichloroethane	X	Possible	NA	Possible	NA	Analyses
1,1,1-trichloroethane	Possible	Possible	NA	Possible	NA	Potential flammable substance
1,2-Dichloro-1,1,2-trifluoroethane (F123A)	X	NA	NA	Possible	NA	Analyses
1,1,2-Trichloro-1,2,2-trifluoroethane (F113)	X	X	NA	Possible	NA	WSTF personnel, documentation, analyses
2-Butanone (methyl ethyl ketone [MEK])	X	X	NA	Possible	NA	WSTF personnel, analyses
2-Propanol (isopropyl alcohol [IPA])	X	X	NA	Possible	NA	Analyses
Butanols (n-butanol, sec-butanol)	X	X	Possible	Possible	NA	Analyses
Acetic acid	Possible	Possible	NA	Possible	NA	Potential flammable substance
Acetone	X	Possible	NA	Possible	NA	WSTF personnel, analyses
Acetonitrile	Possible	Possible	NA	Possible	NA	Potential flammable substance
Alcohols	X	X	X	X	NA	WSTF personnel, documentation
Ammonium persulfate	Possible	Possible	NA	Possible	NA	Potential flammable substance
Benzene	X	X	NA	Possible	NA	WSTF personnel, documentation, analyses
Butyl cellusolve	Possible	Possible	NA	Possible	NA	Potential flammable substance
Carbon tetrachloride	Possible	Possible	NA	Possible	NA	Potential flammable substance
Chloroform	X	Possible	NA	Possible	NA	Analyses
Chromic acid	Possible	Possible	NA	Possible	NA	Potential flammable substance
Dichlorobenzenes	X	Possible	NA	Possible	NA	Analyses
Dichloroethylene (or 1,2-DCE)	X	Possible	NA	Possible	NA	Analyses
Dichlorofluoromethane (F21)	X	NA	NA	Possible	NA	Analyses
Dichloromethane (methylene chloride)	X	X	NA	Possible	NA	Documentation, analyses
Diesel	X	X	X	X	X	WSTF personnel, Analyses
Ethanol	X	X	Possible	Possible	NA	WSTF personnel, analyses
Ethyl benzene	Possible	Possible	NA	Possible	NA	Potential flammable substance
Ethylene glycol	X	X	NA	Possible	NA	Documentation
Formic acid	Possible	Possible	NA	Possible	NA	Potential flammable substance
Fuels (UDMH, A-50, MMH, hydrazine) – small amounts from	X	NA	NA	X	NA	WSTF personnel

Table 7.1 List of Potential Substances Used or Stored in SWMUs 1, 3, and 15 (cont.)

Substance	SWMU Used/Stored					Source
	SWMU 1 and overflow	SWMU 3	SWMU 15	Additional 100 Area burn pit	Fire Training Area	
fuel contaminated rags						
Gasoline	X	X	X	X	X	WSTF personnel
Hydraulic fluid	X	X	NA	Possible	NA	WSTF personnel, documentation
Hydrocarbons, C_7 Unsaturated	X	Possible	NA	Possible	Possible	Analyses
Isopropyl acetate	X	Possible	NA	Possible	NA	Analyses
Lubricating oils	X	X	NA	Possible	NA	WSTF personnel
Metals (cadmium, chromium, copper, lead, mercury)	X	X	NA	X	X	WSTF personnel (from lights, plumbing, or in wastes)
Methanol	X	X	Possible	Possible	NA	WSTF personnel, documentation
Methyl isobutyl ketone (MIBK)	X	Possible	NA	Possible	NA	Analyses
Motor oil	X	X	NA	Possible	NA	WSTF personnel, documentation
Dinitrogen tetroxide (N_2O_4 - small amounts used in burning)	X	NA	NA	NA	NA	WSTF personnel
Oils	X	X	NA	X	NA	WSTF personnel, documentation
Organic chemicals	X	X	NA	Possible	NA	WSTF personnel
PCBs	Possible	Possible	NA	NA	Possible	WSTF personnel
Perfluorooctanoic acid (PFOA)	Possible	Possible	NA	Possible	Possible	Potential substance in firefighting foams
Perfluorooctane sulfonate (PFOS)	Possible	Possible	NA	Possible	Possible	Potential substance in firefighting foams
Phthalates	NA	NA	NA	NA	Possible	WSTF personnel (from plastics)
Pyridine	Possible	Possible	NA	Possible	NA	Potential flammable substance
Surfactant	X	X	NA	Possible	NA	Analyses
Tar	X	X	NA	Possible	NA	WSTF personnel, documentation
Tetrachloroethene (PCE)	X	Possible	NA	Possible	NA	WSTF personnel, analyses
Tetrahydrofuran	Possible	Possible	NA	Possible	NA	Potential flammable substance
TOC (total organic carbon)	X	X	NA	Possible	NA	Analyses
Toluene	X	X	NA	Possible	Possible	WSTF personnel, analyses
Trichloroethene (TCE)	X	X	NA	Possible	NA	WSTF personnel
Trichlorofluoromethane (F11)	X	X	NA	Possible	NA	WSTF personnel, documentation, analyses
Vacuum pump oil contaminated with UDMH, A-50, MMH, hydrazine, and N_2O_4	X	X	NA	X	NA	WSTF personnel, documentation
Xylenes	X	Possible	NA	Possible	Possible	WSTF personnel, analyses

Note: X indicates verifiable usage/storage
NA indicates not applicable/no usage

Table 7.2 Analytical Summary 100 Area Burn Pit (7/26/85)

Analyte	Aqueous Result (mg/l)	Detection Limit (mg/l)	Sludge Result (μg/g)	Detection Limit (μg/g)	Soil at 2 ft Result (μg/g)	Soil at 5 ft Result (μg/g)	Detection Limit (μg/g)	Maximum Contaminant Level mg/l
Trichloroethene	ND	0.001	ND	0.001	ND	ND	0.01	0.005
Carbon Tetrachloride	ND	0.001	ND	0.001	ND	ND	0.01	0.005
Benzene	ND	0.001	ND	0.001	ND	ND	0.01	0.005
Antimony	ND	0.2	0.4	0.2	NA	NA	NA	0.006
Arsenic	ND	0.05	60	0.05	NA	NA	NA	0.010
Barium	2.3	0.005	1,200	0.005	NA	NA	NA	2
Bromine	ND	0.1	ND	0.1	NA	NA	NA	NA
Cadmium	ND	0.01	15	0.01	NA	NA	NA	0.005
Chlorine	79	1.0	152	1.0	NA	NA	NA	4
Chromium	ND	0.05	85	0.05	NA	NA	NA	0.1
Copper	0.04	0.002	2.71	0.002	NA	NA	NA	1.3
Fluorine	1.3	0.1	56	0.1	NA	NA	NA	NA
Lead	ND	0.05	600	0.05	NA	NA	NA	0.015
Manganese	0.46	0.005	8	0.005	NA	NA	NA	NA
Mercury	ND	0.002	0.2	0.002	NA	NA	NA	0.002
Phosphorous	0.19	0.06	20	0.06	NA	NA	NA	NA
Potassium	25	0.1	85	0.1	NA	NA	NA	NA
Selenium	ND	0.02	2.0	0.01	NA	NA	NA	0.05
Silicon	45.4	0.1	5	0.1	NA	NA	NA	NA
Silver	ND	0.05	0.6	0.05	NA	NA	NA	NA
Sodium	81	0.1	129	0.1	NA	NA	NA	NA
Sulfur	640	0.1	0.33%	NA	NA	NA	NA	NA
Tin	ND	0.1	2	0.1	NA	NA	NA	NA
Zinc	0.28	0.004	4,500	0.004	NA	NA	NA	NA

Notes: ND = non-detect
NA = not applicable or not analyzed
Maximum Contaminant Level from http://water.epa.gov/drink/contaminants/#List

Table 7.3 100 Container Storage Area Inventory circa 1986

Substance	Quantity	Container Type	Container Capacity	Volume
Halocarbon (unspecified, but could be carbon tetrachloride, TCE, PCE, trichloroethane)	6	Can	5 gal	unspecified
Paint (two part)	8	Can	1 gal	unspecified
Paint (lead-based)	5	Can	5 gal	unspecified
Oil (unspecified)	8	Glass bottle	2.75 liter	Empty
Ethanol	3	Glass bottle	1.75 liter	Empty
DuoSeal (unspecified but could be vacuum pump oil)	29	Can	5 gal	Empty
Freon (unspecified, but likely F113)	10	Can	5 gal	Empty
Freon (unspecified, but likely F113)	1	Drum	55 gal	10 gal
Roof Coat Paint	13	Drum	55 gal	Empty
Roof Coat Paint	1	Drum	55 gal	10 gal
Tar	10	Drum	55 gal	unspecified, but partially full
Methylene Chloride	1	Drum	55 gal	unspecified
Antifreeze	1	Drum	55 gal	20 gal
Hydraulic Oil	1	Drum	55 gal	15 gal
Unknown (specified as similar to karo syrup)	1	Drum	55 gal	5-10 gal
Unknown (specified as possibly tar or oil sludge)	5	Drum	55 gal	unspecified

Appendix A
SWMU 1, 3 and 15 Interview Summary

Appendix A
WSTF SWMUs 1, 3, and 15 Interview Summary

Position/ Location	Significant White Sands Test Facility (WSTF) Solid Waste Management Unit (SWMU) Information	Other Information or Comments
WSTF Fire Department (FD) December 1963-February 1996	**Auxiliary Fire-Fighters** • The employee stated that WSTF maintained and trained both full-time fire-fighters and auxiliary fire-fighters. Auxiliary fire-fighters consisted of WSTF workers from every industrial area and most departments on site and included WSTF chemists, technicians, electricians, plumbers, propulsion engineers, heavy equipment operators, administration workers, etc. Every discipline was represented. "That way if there ever was a fire in a particular area, I already had fire-fighters working there to help." There were approximately 35 auxiliary fire-fighting employees. Auxiliary fire-fighters were only WSTF employees, not from the Air Force or from TDRSS. • From 1964 to 1996, and the employee assumed after that as well, auxiliary fire-fighters were trained once per month for a day (usually a Saturday) and included practicing extinguishing large fires at the main 100 Area burn pit, practicing in "smoke" buildings/trailers, car rescues, ladder/equipment practice, etc. **SWMU 1 (100 Area burn pit)** • The employee stated that this burn pit was historically referred to as the "150 Area burn pit" or "the burn pit in the 150 Area." • Dimensions of the 100 Area burn pit were originally approximately 30 ft by 15 ft and 2 ft deep but got larger over time. Periodically, the 100 Area burn pit needed cleaning out. Heavy equipment operators would use a front end loader and "dig down a bit and push the sludge" to the north end of the pit. The water would evaporate from the sludge, and the pit would be longer over time. • Exact dates of use could not be recalled; however, the employee stated that usage of this pit began in the late 1960s or early 1970s and was the longest used and largest burn pit at WSTF. • "Fires were conducted a minimum of once per month (and up to 4 times per month) for a half day, burning [up to] 1,500 to 2,000 gallons of chemicals. These were big fires." Another estimate was 4-10 barrels burned at a time, which would be 220-550 gallons. • 2 to 3 times per month, a large training fire would be conducted at the main 100 Area burn pit for full-time fire-fighters, and once per month, a large training fire would be conducted at the main 100 Area burn pit for the auxiliary fire-fighters. • Chemicals were poured into the pit mostly from the south side, but sometimes from the north	• The employee stated that approximately 40 to 60 55-gallon drums had also been stored adjacent to the 200 Area main burn pit approximately 60 to 75 ft south of the pit when that pit was in use from 1964-1969; however no spills or leaks of drums/containers were ever witnessed. • The employee stated that the purpose of the two smaller 200 Area burn pits was to have the FD practice response time for arriving, getting equipment ready, and extinguishing the fires. • The employee also discussed memorable injuries of WSTF personnel, other WSTF areas, and historical locations of the WSTF FD and Dispensary.

Position/ Location	Significant White Sands Test Facility (WSTF) Solid Waste Management Unit (SWMU) Information	Other Information or Comments
(continued) WSTF Fire Department (FD) December 1963-February 1996	(continued) side, especially if it was going to be a large fire so that chemicals could be added from both sides at the same time. • Chemicals included alcohol, benzene, used vacuum pump oil (with unsymmetrical dimethylhydrazine [UDMH], hydrazine, monomethylhydrazine [MMH], and aerozine-50 [A-50]), Freons, gasoline, diesel, methyl ethyl ketone (MEK), etc. "basically anything [liquid] that would burn." The employee stated that although Freons are not considered flammable, they would burn, especially when mixed with other flammable chemicals. The 200 Area used a lot of carbon tetrachloride, which was also burned in the 100 Area burn pit. • When asked if paints were ever burned, the employee did not remember burning any paints, but stated other fire-fighters sometimes set up the fires, so it was possible. Other liquids burned were used motor oil, antifreeze, lubricating oil from the 100 Area machine shops, opaque white, vasoline-looking oils, grease, etc. The employee stated that each area at WSTF provided something to burn in the 100 Area burn pit. The Air Force and TDRSS also provided drums of used oil from when pumps were changed out. • Alcohols (IPA) were received when a tanker truck refilled site storage tanks. The alcohol left in the hoses was given to the WSTF FD. • "On a few occasions" nitrogen tetroxide (N_2O_4) was used in small quantities (a few liters) to ignite the large fires in the main 100 Area burn pit. • The employee stated that the 100 Area burn pit had overflowed historically. • Fire extinguisher training was conducted on the ground/soil adjacent to the main 100 Area burn pit. Small fires were set on wood pallets, wood crates, or scrap wood, using gasoline, diesel, or alcohols to help ignite the fires. The fires were very brief, since they were ignited and then immediately extinguished. The same wood could be used for up to 5 or 6 fires. • When asked the fate of the empty drums, the employee stated that personnel from the areas that delivered the drums collected the drums. He believed that some may have been reused and some may have been placed in the landfill. • Fuel-contaminated (UDMH, A-50, MMH, hydrazine) rags from the 200 Area chemistry and fuel laboratories had been burned in the 100 Area burn pits, and after use of this area ceased, rags had been burned in a steel half barrel. The employee stated that this practice ceased in approximately 1986. • The employee stated that one time, a "purple K" fire extinguisher (containing potassium bicarbonate) was used at the 100 Area burn pit because an employee had used it on a truck	

Position/ Location	Significant White Sands Test Facility (WSTF) Solid Waste Management Unit (SWMU) Information	Other Information or Comments
(continued) WSTF Fire Department (FD) December 1963-February 1996	(continued) that was "smoking" located "by the last pump on the well road by the JP4 and JP5 areas." Once the fire extinguisher had been used for the first time, the employee stated that it needed to be used completely. • The 100 Area burn pit began producing its own foam when it was ignited. "We would just stand there and watch the foam come across the pit and put out the fire before we even got a chance to fight it." **Additional 100 Area Burn Pit** • As a result of the main/original 100 Area burn pit foaming and extinguishing fires, a new 100 Area burn pit was initiated and used to the east and south of the original 100 Area burn pit "over the berm." • Dimensions were approximately 10-15 ft by 10-12 ft by 18 inches deep. This pit was basically a square, and much smaller than the original 100 Area burn pit. • This additional 100 Area burn pit began use "approximately the year before we stopped using the other pit," but these pits were not burned at the same time. • Chemicals were burned like in the main 100 Area burn pit. "But with new regulations towards the end, only gasoline, diesel, and sometimes alcohols were burned" in this pit. • Use of this second 100 Area burn pit ended when the first/main 100 Area burn pit was cleaned up. The employee stated that he believed this pit had been cleaned up when the original 100 Area burn pit was cleaned up. • The employee stated that some 55-gallon drums were stored near the second 100 Area burn pit. Never more than 20 drums, and there were no spills or leaks to the employee's knowledge. (Photographs show these drums were located within the 100 container storage area). • These drums had been moved to a former radar dome used as a drum storage area (Drum Storage Facility) to the north in the eastern 100 Area. **JP Area Fire-Fighting Training** • Following the conclusion of testing at the JP4 and JP5 test sites and the clean-up of the 100 Area burn pit, the employee stated that for large fires, the WSTF FD would ignite gasoline, diesel, and/or alcohols on the cement pads at the JP4 and JP5 testing areas located in the western 600 Area and extinguish the fires using only water. No auxiliary fire-fighters were trained here, only full-time fire-fighters.	

Position/ Location	Significant White Sands Test Facility (WSTF) Solid Waste Management Unit (SWMU) Information	Other Information or Comments
(continued) WSTF Fire Department (FD) December 1963-February 1996	(continued) • The employee stated that the edges of the cement pads had been bermed with sand, and no liquids or fires ever "reached the sand or spilled off the cement pads." If the fire was getting close to the edge/berms, the fire was allowed to "burn off" so that no fire or liquids reached the berms. • Fires were not extinguished using AFFF, but only water. • After the fire-fighters had extinguished the fires, the remaining liquids were re-ignited and allowed to burn to completion. • Approximately 5 to 6 fires total were conducted in the JP Area at the JP4 and JP5 pads for only a few years (up to the late-1980s). Fires were conducted sporadically with many months between fires. **Burning in Drums** • After discontinuing 100 Area burn pit usage, the WSTF FD burned liquids (only gasoline, diesel, and alcohols) in a steel "stock tank" and up to 5 or 6 modified (cut in half lengthwise) 55-gallon drums. At times, the half drums would be arranged in a square configuration for fire-fighting practice. • These stock tank and barrels were used in the cleared area east and to the south of the 100 Area burn pit. • The employee stated that the only chemicals burned were alcohols, diesel, and gasoline. The alcohol mostly burned was isopropyl alcohol (IPA). May have been methanol and ethanol or other alcohols. • Both fuel-contaminated (MMH, hydrazine) rags and sensitive documents were also burned in the steel modified half barrels. Burning of the rags ceased in approximately 1986. • Burning in these drums continued until approximately 1987. Wood was burned when fire-fighting training was conducted after 1987 (and sensitive documents were then shredded). **Fire Department training area (located east and south of the 100 Area burn pit)** • The employee stated that some trailers were used as "smoke" structures. The trailers would be filled with smoke (by placing a "smoke bomb" or "smoke grenade" into a barrel inside the trailer) and then fire-department or auxiliary fire-fighters would practice entering the structure and rescuing personnel/dummies. Fire-fighters wore breathing protection. • The employee stated that in the 1980s sometime, an old radar dome had been brought and was also used as a smoke building. This dome was used through 1996 (when the employee	

Position/ Location	Significant White Sands Test Facility (WSTF) Solid Waste Management Unit (SWMU) Information	Other Information or Comments
(continued) WSTF Fire Department (FD) December 1963-February 1996	(continued) retired), but was never set on fire. "Smoke grenades" were used inside the building obtained from WSMR. The smoke was gray, red, green, or yellow. • "Smoke trailers" were not burned on purpose, but occasionally through WSTF history, the smoke trailers were accidentally burned. This occurred when the "smoke grenade" did not get placed into the barrel inside the trailer. Then sparks from the grenade could set the trailer on fire and it would "burn down." • Trailers originally used as temporary offices or storage at WSTF (in the 1960s and 1970s) were later used for fire-fighting training at WSTF in the eastern 100 Area to the east and south of the main 100 Area burn pit. This occurred around the time the 100 Area burn pit was cleaned up, the employee stated. • Trailers were sometimes "packed full of wood" (old wooden pallets and scrap wood) to assist starting the fire and to provide a lasting fire. All trailers were burned 3 or 4 times to practice extinguishing the fires as much as possible before the trailers burned completely. • Fires were ignited using gasoline or diesel (up to 2 barrels-110 gallons, but mostly only a few gallons), the employee stated. • Trailer fires were conducted approximately every month for several years. The last trailer burned (in approximately 1994) had been the original firemen's quarters (from 1964). The employee believed that this was the last live burn that was conducted while this employee was working at WSTF. • Single trailers, duplex trailers, 4-plex, and 8-plex trailers had been burned, the employee stated. • The employee stated that all the trailers were old, from the 1950s and 1960s, and would have contained asbestos. To the employee's knowledge, the asbestos was not removed prior to the burning of the trailers. • Remains of the trailers were buried (using a front-end loader and a bull dozer for compaction) to the north of the cleared area used for fire-fighting training (east of the main 100 Area burn pit), except for the steel frames, which were disposed off-site as scrap metal. • The remains of trailers included ashes, some metal pipes, likely made of lead, electrical wires, etc. The fires would have melted some of the metal piping in the trailers. • The employee estimated that 20 to 25 trailers total were burned at WSTF.	

Position/ Location	**Significant White Sands Test Facility (WSTF) Solid Waste Management Unit (SWMU) Information**	**Other Information or Comments**
(continued) WSTF Fire Department (FD) December 1963-February 1996	(continued) • Smaller wood fires were also set using wood pallets, wood crates, or scrap wood. These fires were ignited using gasoline or diesel. • Besides trailers, many cars were also burned in the cleared area to the east of the 100 Area burn pit. • The cars had been brought from a local junkyard. Some cars were new-looking and some were mostly stripped-down. The employee preferred cars in good condition so that more realistic rescue practice could be conducted using the "jaws of life." • "After the car had been beat up from the 'jaws of life', we burned them for fire-fighting practice." • Each car was set on fire and extinguished many times, providing 2 to 3 months of training practice for the fire-fighters. • After the final burning of the car, the metal shell was collected by junkyard personnel. **SWMU 3 (100 container storage area)** • The employee stated that barrels for use at the 100 Area burn pit were stored to the south of the 100 Area burn pit at the end, near, or south of Road B. The barrels were mostly 55-gal drums, but were occasionally smaller containers. • "There were 75 to 150 barrels in the area at times" during the operational years of the 100 Area burn pit. More barrels/drums were located in this area through time. • In general, the barrels in the 100 container storage area were sorted and stored by what type of chemical/liquid was in them. There were separate areas for contaminated vacuum pump oil, other oils and antifreeze, alcohols, and other chemicals (Freons, TCE, PCE, etc.). • "I would go around to the different areas and ask for flammable liquids." If the employee did not take barrels/drums at that time, WSTF personnel bringing barrels/drums were requested to inform the FD when they were bringing barrels/drums, the number of barrels/drums being delivered, how much was in each barrel/drum, and what liquid/chemical was in them; however, WSTF personnel did not follow these guidelines routinely. "Barrels would just show up, and we didn't know where they came from or what was in them." • Employees commonly dropped barrels/drums off without informing the WSTF FD and with no labels on the barrels/drums. The employee stated that FD personnel did not know what chemical/liquid was in many of the drums, just that it was flammable. "Strange stuff would show up."	

Position/ Location	Significant White Sands Test Facility (WSTF) Solid Waste Management Unit (SWMU) Information	Other Information or Comments
(continued) WSTF Fire Department (FD) December 1963-February 1996	(continued) • As employees delivered the barrels/drums to the 100 container storage area, there were times when the drums would tip over and up to half of the liquid contents were spilled on the ground/soil. Other drums leaked. "Most of the time it was vacuum pump oil or alcohol." • The employee also stated that drums were commonly full (55-gallons), but were not always full. • Some drums were stored "for a long time" (for many years). • When asked if any barrels were stored to the north of the 100 area burn pit, the employee stated that the FD placed the empty barrels there sometimes after burning at the 100 Area burn pit. If the contents of all the barrels present at the storage area were used for a fire, then the empty barrels were left in the regular storage area; otherwise, empty barrels were placed to the north so that WSTF personnel could easily retrieve them. • There were other barrels stored approximately 100 to 150 ft northeast of the GSA building. These barrels were not part of the WSTF FD burning, but were overseen by the WSTF warehouse. Employees were supposed to provide the barrels directly to warehouse personnel, but many times would leave them outside in this area. • The employee stated that heavy equipment personnel moved the drums to a drum storage radar dome (Drum Storage Facility) located to the north in the mid-1980s. **SWMU 15 (600 Area burn pit)** • The employee stated that this was the first burn pit used on site at WSTF and was referred to as the "burn pit by the ponds." The pit was established at this location because it was close to the FD and convenient. • A photograph was located of the area. There appears to be two small burn pits in the photograph. The employee did not specifically remember there being two burn pits, but seeing the photograph, the employee agreed. • These pits were only used for fire extinguisher practice at WSTF. No large fires were conducted here. "These were small fires only." (Large fires were conducted at the 200 Area main burn pit until use of the 100 Area main burn pit began.) • The employee stated that approximately 10 gallons at a time were used for burning in the 600 Area burn pit(s). • WSTF site potable water was added to the pit prior to any flammable liquids, and any leftover liquids were allowed to burn off following fire extinguisher practice.	

Position/ Location	Significant White Sands Test Facility (WSTF) Solid Waste Management Unit (SWMU) Information	Other Information or Comments
(continued) WSTF Fire Department (FD) December 1963-February 1996	(continued) • In late 1964, the 600 Area burn pit(s) were “dug out a bit” using shovels due to residue/ash accumulation. The residue/sludge was placed towards the south end of the pit(s) “by two big telephone poles.” • The employee stated that the area had been graded later (after use of the pit had ended) by heavy equipment operators and the residue/ashes he believed were taken to the WSTF landfill. • The 600 Area burn pit was used from early 1964 until the 200 Area burn pit began use (in late 1964)-at least once per month and up to 4 times per month. Once the 200 Area burn pit was in use (in late 1964), this pit was used only rarely for new employees to practice using fire extinguishers. Once the main 100 Area burn pit began use (approximately in 1969), this pit was no longer used at all. (Fire extinguisher training was conducted adjacent to the main 200 Area burn pit and then adjacent to the main 100 Area burn pit using wood.) • The employee stated that only gasoline, diesel, and alcohols were ever used in the 600 Area burn pit(s). No wood, oils, or other chemicals or substances were ever used. **Fire Extinguishing Methods During Training** • The employee stated that fire extinguishers contained water, CO_2, baking soda, “purple K” (potassium bicarbonate). FD personnel conducted fire extinguisher practice once per year with CO_2 extinguishers “when they were about to go out of date.” Fires were conducted on the ground (with wood) adjacent to the burn pit, and in the 600 Area burn pits (with liquids) until use of the pits ended. Then fires were conducted in steel barrels (both liquid and wood). Excess liquids were allowed to burn off after extinguishing, and ashes were taken to the WSTF landfill. • There were never any fire extinguishers at WSTF that contained AFFF (aqueous film-forming foams). • For large fires, the fire truck, and hoses were used. This involved mostly using just water. • Occasionally, fire-fighting foam would be used to extinguish large fires at the main 200 Area and 100 Area burn pits. For the 200 Area burn pit, the employee stated that only the protein-based foams were ever used at that location. AFFF did not become available until use of the main 100 Area burn pit was initiated (in the late 1960s). • The employee believed that 3M may have been the manufacturer of the AFFF used at WSTF but could not be sure.	

Position/ Location	Significant White Sands Test Facility (WSTF) Solid Waste Management Unit (SWMU) Information	Other Information or Comments
(continued) WSTF Fire Department (FD) December 1963-February 1996	(continued) • AFFF was expensive, so the employee stated that it was not used very often for training fires and never used on a “real fire” at WSTF. • AFFF was stored at the WSTF FD in 5 gallon containers and when used, aspirated into large amounts of water to extinguish the large burn pit fires. • The employee stated that both AFFF and alcohol resistant (AR)-AFFF was available at WSTF historically. When asked when, the employee stated that AFFF was likely first purchased and used at WSTF in the late 1960s and AR-AFFF was likely first purchased in the late 1970s. The employee stated that while he was at WSTF, the AR-AFFF was only used once (in the 100 Area burn pit) for training and not used at WSTF for extinguishing a “real fire.” • The employee also stated that “light water” was used to put out some trailer and wood fires east of the main 100 Area burn pit occasionally when training. The employee stated that the soap in the “light water” helped the water to penetrate into the wood. **Fires at WSTF (not training) 1964-1996** • No actual fire at WSTF was ever extinguished with AFFF or AR-AFFF. • The employee stated that there had been many small brush fires, dumpster fires, trash can fires that were all easily extinguished. • The majority of the fires at WSTF were electrical fires, including transformers from lightning strikes. Personnel in the area many times had already extinguished the fires with local fire extinguishers. FD personnel shut off the power, and if necessary extinguished the fires with water. • The employee stated that there were approximately 23-30 fires, mostly minor in the labs or test stands. No large fires had occurred while the employee worked at WSTF. • The “purple K” fire extinguisher was used on a smoking truck “right by the last pump on the well road b the JP4 and JP5 areas.” The remainder of the extinguisher was used at the 100 Area burn pit. **Miscellaneous** • E85 gasoline was not in use at WSTF when the employee retired in 1996. • The employee stated that through time, firemen didn’t burn as often and “began practicing hazmat problems.” This included filling a leaking tanker with water and “plugging the holes” as well as other practice with a “hazmat” trailer. • Full-time fire-fighters trained daily at some aspect of their jobs, but not live burns.	

Position/ Location	Significant White Sands Test Facility (WSTF) Solid Waste Management Unit (SWMU) Information	Other Information or Comments
WSTF Fire Fighter 2001-present	**Fire Training at WSTF** • The employee stated that since 2001, there has only been one live fire conducted at WSTF. It was located in the "center of the training area across the berm to the east of Building 151." This fire was conducted somewhere between 2004 and 2007 and burned wooden pallets only. The fire was ignited using a fire torch. No flammable liquids were used. The fire was extinguished using Microblaze, a biodegradable foam (not an AFFF). Ashes from the fire were collected and disposed through the WSTF Environmental Department. • No live burns are currently conducted at WSTF; only simulated fire with smoke bombs or fog machines and practicing hooking up hoses and rescues, etc. • Current WSTF Fire Fighters train with live fires at the fire academy in Alamogordo, NM. • The employee stated that not conducting live fires at WSTF came about more from a dry climate perspective than from an environmental concern. Personnel were concerned that a training fire could spread to additional areas or structures. **AFFF Usage** • The employee stated that AR-AFFF is currently available for use at WSTF (since approximately 2008) due to the use of E85 gasoline, which burns much hotter than traditional gasoline. "Regular AFFF" is not effective against very hot fires. No fires have occurred at WSTF since the employee began working at WSTF, and there has been no AR-AFFF usage during this time. • E85 use at WSTF began in 2006 (reported by another employee). **Fire Extinguisher Training** • Fire extinguisher training was conducted at WSTF using a metal pan with a non-functioning motor and diesel fuel. The motor did not actually burn, but it was to simulate an electrical fire. Fires were extinguished with a CO_2 or a class ABC fire extinguisher. • This practice ended in approximately 2007 when the current "bullex" system was purchased. • The "bullex" system provides a propane-based fire, which personnel practice extinguishing using a water fire extinguisher.	• Employee had no knowledge of SWMUs 1, 3, or 15
WSTF Fire Fighter December 1995-present	**Fire Training at WSTF** • The employee stated that live fires using wood pallets and scrap wood at WSTF were still being conducted when the employee began working at WSTF. These fires had been	• Employee had no knowledge of SWMUs 1, 3, or 15

Position/ Location	Significant White Sands Test Facility (WSTF) Solid Waste Management Unit (SWMU) Information	Other Information or Comments
(continued) WSTF Fire Fighter December 1995-present	(continued) conducted in the “old training yard” located east of Building 151 across the berm. • A total of approximately 3 or 4 live fires were conducted at WSTF since the employee began working at WSTF (in 1995). • The employee remembered burning a temporary building made of tin with 2x4 wooden framing. • The employee could not recall exactly when live fires ended at WSTF, but it was after 1996. Ending live fires came about at WSTF due to new National Fire Protection Association standards, the employee believed. • Training, the employee stated, was not conducted exactly equally in the 1990s. When training was scheduled, that shift of workers was trained. Other shifts were not necessarily trained the same. Each FD employee may have a different memory of what trainings were conducted and when they occurred. • Currently, FD personnel go to the fire academy (in Alamogordo) to practice training with live fires. • The employee believed that the use and training of auxiliary fire-fighters at WSTF ceased in approximately 2008 or 2009. **Fire Extinguisher Training** • The employee stated that approximately ½ gallon of diesel with a very small amount of gasoline to ignite the diesel fuel was used for fire extinguisher practice. The fuel was placed in a steel half 55-gallon drum (cut in half shortwise). Burning was conducted in this modified drum “across the street from the FD in the paved area” (where the new security buildings are located now – Building 108). **Use of Foams** • The employee stated that he remembered having “Light Water” available at WSTF, described as a “soap,” similar to Microblaze (which is what is available at WSTF currently). • The employee could not remember exactly when “Light Water” was no longer used at WSTF, but thought it might have been when Microblaze was purchased. • The employee stated that to his knowledge, no foams had been used at WSTF since the employee began working here. The employee did recall using “wet water foam” on “mutual aid brush fire calls in the County and along Hwy 70.” Only water was used for fire extinguishing at WSTF, and CO_2 extinguishers for electrical fires.	

Position/ Location	Significant White Sands Test Facility (WSTF) Solid Waste Management Unit (SWMU) Information	Other Information or Comments
(continued) WSTF Fire Fighter December 1995-present	(continued) • The employee stated that there were no foam fire extinguishers at WSTF and to the employee's knowledge, no AFFF has been used at WSTF since the employee began working here. The few live fires conducted with wood were extinguished with water only.	
WSTF 250 Area 1990-present Auxiliary Fire Fighter 1994-2010	**Auxiliary Fire-Fighting** • The employee became a WSTF auxiliary fire-fighter in 1994 through approximately 2010 (when the auxiliary fire-fighter program ended at WSTF). • The employee stated that the auxiliary firemen were called the "fire brigade." • Only wood was ever burned for fire brigade training (since 1994). Wooden pallets, crates, and any scrap wood were delivered to the area east of the GSA Building 151. The wood could pile up to be as large as a building before being burned. • The WSTF FD was always present as back-up, but was never needed during practice fire training. • The employee stated that approximately 3 to 4 live fires (large ones using wood) were conducted at WSTF between 1994 and 2010. • The employee believed that the last live burn wood fire was conducted in 2007 (photographs were located). • Auxiliary fire personnel would "knock down" the fire, and then allow the fire to build back up in cycles to practice fighting the fires. • The employee stated that the location of the wood pile storage (south and east of Building 151) was not the location that they burned the wood. Wood was brought to the burning area (east of Building 151) when a fire was to be conducted. The wood pile was moved to the south over time due to flat tires from nails/metal in the burning area. • Practicing for entering burning buildings was conducted at WSTF in a "conex box" or semi-trailer located east of Building 151. The employee stated that straw and wood was placed at the far end of the box and lighted with gasoline. The fire brigade would practice entering the burning "building" (in fire gear) to become familiar with the heat, smoke, and low visibility associated with actual fires. Use of this conex box ended in the late 1990s or early 2000s. • Two times between 1994 and 2010, the auxiliary fire-fighters trained at the fire academy in Alamogordo in a "smoke house."	• Employee had no knowledge of SWMUs 1, 3, or 15

Position/ Location	Significant White Sands Test Facility (WSTF) Solid Waste Management Unit (SWMU) Information	Other Information or Comments
(continued) WSTF 250 Area 1990-present Auxiliary Fire Fighter 1994-2010	(continued) • Fire extinguisher training was conducted with either wood or gasoline. The gas was contained in a steel 55-gallon half drum. • A foaming product was used for one training session (with no fire). This product, the • employee believed, contained soap (like "Dawn") and water. It may have been called "wet water" or "water wet."	
WSTF 400 Area 1994-1998; Environmental Department 1998-present (2014); Auxiliary Fire-Fighter 2004~2011	**Auxiliary Fire-Fighters** • The employee became a WSTF auxiliary fire-fighter in 2004 and remained until the auxiliary fire-fighters ended at WSTF, the employee stated approximately 3 years ago. • The employee stated that he never participated in a live fire at WSTF; however the employee had been trained in Self-Contained Breathing Apparatus, rescue training, and fire-fighting in Alamogordo (at the fire academy). • At WSTF, the employee participated in practice personnel rescue in the 300 and 400 Area blockhouses using a smoke machine to simulate smoke from a fire. Auxiliary fire-fighters wore infrared goggles to assist in finding personnel.	• Employee had no knowledge of SWMUs 1, 3, or 15
WSTF 200 Area test engineer 1983-1988; WSTF Safety 1988-present (2014)	**Fire Department Training** • The employee stated that he did not remember the WSTF FD burning liquids, only scrap wood east of Building 151. • A "smoke tank" was also used where FD personnel would put smoke in and practice "crawling around over partitions and things" to simulate personnel rescue conditions. • Currently, the FD practices at WSTF for building rescues by filling the FD High Bay with smoke (not generated from an actual fire) and training there. • There are no live fires conducted at WSTF for FD training currently. The employee did not recall exactly when live burning at WSTF ceased; however, the employee was sure that since the current Fire Chief had been at WSTF (for the past 5 years, the employee believed), no live burns had been conducted. • Fire extinguisher training was currently conducted using the "Bullex" system. • Prior to the purchase of the "Bullex" system, the WSTF FD would simulate a burning motor by placing a non-working motor in a metal pan of fuel (the employee believed it was	• Employee had no knowledge of SWMUs 1, 3, or 15

Position/ Location	**Significant White Sands Test Facility (WSTF) Solid Waste Management Unit (SWMU) Information**	**Other Information or Comments**
(continued) WSTF 200 Area test engineer 1983-1988; WSTF Safety 1988-present (2014)	(continued) gasoline). The fuel was ignited and WSTF employees used a Class A, B, C fire extinguisher to extinguish the flames. The employee believed the extinguisher contained water. • The employee stated that no AFFF was ever used in fire extinguishers at WSTF. AFFF used at WSTF (if used at all) would have been aspirated into the water from the fire truck/hoses. • The employee knew that some sort of AFFF was purchased last year for WSTF. • The employee did not know what historical AFFF was used at WSTF, and stated that WSTF had not retained historical records. When contractors left, they usually destroyed or took their records.	
WSTF Facilities Department 1976-present (2014); Auxiliary Fire Fighter 1979-1989	**SWMU 1 (100 Area burn pit)** • The employee was a member of the WSTF auxiliary FD from approximately 1979 to approximately 1989 and participated in many fire trainings at the 100 Area burn pit. • The fires at the 100 Area burn pit were large, and the procedure for extinguishing the fires was to flood the pit with a large amount of water. The employee stated that this “commonly” resulted in overflowing the 100 Area burn pit. • There is a dark area of a 1977 photograph to the northwest of the 100 Area burn pit. The employee believed this may have been where cinders for construction use were stored historically. The employee stated that some cinders were still visible on the ground in that location currently. • Live fires for auxiliary fireman training were conducted approximately every three months. Smoke structures (trailers) were used for training approximately every six months. A smoke trailer could be used for 2-3 years before it was burned completely. • To the employee’s knowledge, no fire extinguishers were used at the 100 Area burn pit. • The employee did not know what chemicals/liquids were burned in the pit. The full-time FD personnel handled the burning preparations for the 100 Area burn pit. • The employee was not personally involved in any clean-up activities at the 100 Area burn pit or 100 container storage area, but did recall drums being stored in the “dome” to the north (Drum Storage Facility). • The employee did not recall a second 100 Area burn pit.	• Employee had no knowledge of SWMU 15 • The employee also participated in fire training at the 200 Area GOx pit.

Position/ Location	Significant White Sands Test Facility (WSTF) Solid Waste Management Unit (SWMU) Information	Other Information or Comments
(continued) WSTF Facilities Department 1976-present (2014); Auxiliary Fire Fighter 1979-1989	(continued) **SWMU 3 (100 container storage area)** • The employee remembered a few 55-gallon drums (approximately 10) filled with liquids to assist with lighting the fires (gasoline, diesel, oil, etc.) being stored in the area. • The employee did not know the fate of the empty drums following usage at the 100 Area burn pit. **Burning in Drums/Tank** • After use of the 100 Area burn pit ended, the employee recalled burning in a modified tank (open at the top) that could hold approximately 250 gallons. This tank had been located to the east of the 100 Area burn pit. • The employee remembers burning diesel fuel and oil in the modified tank. The liquids were ignited and then the auxiliary fire-fighters would practice extinguishing the fires with water only. **Fire Department Training Area (located east of the 100 Area burn pit)** • The employee remembered personnel burning wood (pallets, crates, scrap wood) and old trailers in the area to the east across the berm from the 100 Area burn pit. • There were 2 or 3 trailers located in the area used as smoke structures that had been burned completely “after a while.” • Cars were also used as part of the auxiliary firemen’s training at WSTF. Personnel would practice rescuing “dummies” using the “jaws of life.” When the cars were “all beat up,” they were burned to provide fire-fighting practice. The shells were returned to the junkyard after burning was completed. • Each car could provide 2 or 3 cycles of training. • To the employee’s knowledge, each car or trailer was burned “as is.” No materials were removed prior to burning. • The employee remembered loading up soil/ash remains with a front end loader and truck and taking it to the 700 Area landfill. The employee believed that this soil was some remains of burning trailers in the area east of Building 151. The employee could not recall the date of soil removal. • The last burn that the employee remembered was burning the old fireman’s quarters over a few hours in the early 1990s. • “Later, towards the end, we didn’t burn at all. We hooked up hoses to a fake fire hydrant and practiced rescue training in the trailers and dome with fake smoke.”	

Position/ Location	Significant White Sands Test Facility (WSTF) Solid Waste Management Unit (SWMU) Information	Other Information or Comments
(continued) WSTF Facilities Department 1976-present (2014); Auxiliary Fire Fighter 1979-1989	(continued) **JP Area Fires** • The employee remembered other WSTF personnel discussing fireman training at the JP Areas, but the employee did not participate in any fires at the JP Areas.	
WSTF Facilities 1985-1995; 2000-present (2014)	**SWMU 1 (100 Area burn pit)** • When the employee was hired, use of the 100 Area burn pit had ended, and the pit was cleaned up soon after the employee was hired; however, the employee did not recall seeing the 100 Area burn pit or stained soil in the area. The employee did recall other WSTF personnel discussing stained soil in the area. **Wood Burning Area (located east of the 100 Area burn pit)** • The employee remembered FD personnel conducting live burns in the area, including several old trailers, pallets of wood, excess wood, tree trimmings, and several cars. • The employee also remembered FD personnel using trailers and a building as “smoke trailers” that were ignited and personnel entered for training. The employee remembers that at least two of these smoke trailers were burned completely. • The employee also recalled fire personnel burning a building in the 1990s. • The employee had no knowledge of any asbestos or other materials in the buildings or trailers. • In the mid-1980s, the employee had built a “fake fire hydrant” in the FD training area that was not connected to any water supply in order for the WSTF FD to practice connecting and disconnecting hoses.	• Employee had no knowledge of SWMUs 3 and 15
STF 200 Area 1981-1987; Environmental Department 1987-present (2014)	**SWMU 1 (100 Area burn pit)** • The employee remembered WSTF FD personnel requesting that 200 Area personnel provide any liquids that would burn to the WSTF FD for fire-fighting practice. • Flammable liquids provided from the 200 Area included, but were not limited to, alcohol, MEK, TCE, Freons, organics, acetone, oils, fombyln oils, clean room cleaning solutions (oakites), ketones, toluene, and benzene.	• The employee had no personal knowledge of SWMU 15

Position/ Location	Significant White Sands Test Facility (WSTF) Solid Waste Management Unit (SWMU) Information	Other Information or Comments
(continued) STF 200 Area 1981-1987; Environmental Department 1987-present (2014)	(continued) • The employee had seen an historical photograph of the 100 Area burn pit with drums located nearby. • The clean-up of the 100 Area burn pit occurred in approximately 1985 or 1986. Soil had been removed and shipped off-site for disposal in many dump truck loads. There remained some stained soils that smelled of oils after the clean-up operations. • The employee also recalled FD personnel collecting fuel-contaminated (UDMH, A-50, MMH, hydrazine) rags from the 200 Area chemistry and fuel laboratories until 1987. The employee did not know the fate of these rags. **SWMU 3 (100 container storage area)** • The employee remembered seeing many 55-gallon drums stored just south (across Road B) from the 100 Area burn pit in the early to mid-1980s. The employee would guess that 20 to 30 drums were stored there. The employee did not remember seeing any stained soils in the area. • The employee stated that empty 55-gallon drums had been reused or taken to the landfill for disposal. **Interim or Permitted Drum Storage** • In the late 1980s, drums stored in the 100 container storage area had been moved from this area south of the 100 Area burn pit to the drum storage facility (an old radar dome located to the north in the eastern 100 Area) to await shipment off-site for disposal. The drum storage facility has been clean-closed by NMED. The area is currently a RCRA non-regulated unit. • The container storage unit was a square building constructed in the mid-1990s to replace the drum storage facility (dome) as a new hazardous waste storage facility for drums at WSTF. This unit was also clean-closed by NMED and is currently used as a less than 90 day storage facility now. **Fire Extinguisher Practice** • WSTF FD personnel used a cut steel half 55-gallon drum for training. Liquids (the employee assumed was gasoline) in the drum were ignited. • FD personnel would also light an electric motor on fire to simulate an electrical fire. This motor was in a metal tray. • WSTF workers would practice extinguishing the fires with A/B/C/D combination, CO_2, water, and halon (the employee believed, but no documentation of halon extinguishers was located) fire extinguishers.	

Position/ Location	**Significant White Sands Test Facility (WSTF) Solid Waste Management Unit (SWMU) Information**	**Other Information or Comments**
(continued) STF 200 Area 1981-1987; Environmental Department 1987-present (2014)	(continued) • No spills occurred to the employee's knowledge. • This fire extinguisher practice for site personnel was conducted from at least the time the employee began working at WSTF until at least 1996. **Auxiliary Fire-Fighters** • The employee stated that WSTF had trained and used auxiliary fire fighters that were workers in every area that had volunteered to be extra fire fighters. These auxiliary fire fighters trained with the WSTF fire fighters. • Training for auxiliary fire-fighters included practicing rescuing personnel from burning cars and trailers. The employee never witnessed the training (it was usually conducted on weekends not to interfere with regular WSTF working hours), but would see burned cars and trailers located to the east of the 100 Area burn pit after fires. • Auxiliary fire fighter training at WSTF ceased approximately 10 years ago.	
WSTF Environmental Department summers 1987 and 1989; 1990-2010	**Wood Burning Area (located to the east of the 100 Area burn pit)** • The employee stated that in the "150 Area", scrap wood was burned. The wood was lit with diesel or gasoline. • Mostly, no more than 15 gallons of fuel (diesel or gasoline) were used to light fires; however, on occasion, WSTF FD personnel used up to two 55-gallon drums. FD personnel would make a line of gasoline away from the wood pile. A torch would be lit and would light the line of gas to the wood pile. • The employee had witnessed the burning of several trailers and cars over time. The last trailer burned, the employee believed, was in the early 1990s and was the previous sleeping quarters for the WSTF FD. • The metal frames of the trailers and cars were sold as scrap metal after burning to completion. • Ashes and any leftover other parts of the trailers and cars were buried near the edge of the burn pile, east of the berm, close to Building 151, the employee believed. To the employee's knowledge, the buried debris was never relocated or moved. **SWMU 3 (100 container storage area)** • The employee did not have first-hand knowledge. When the employee was hired, the drum storage facility (an old radar dome) was in use to store hazardous waste before shipment off-	• The employee had no first-hand knowledge of SWMUs 1 and 15

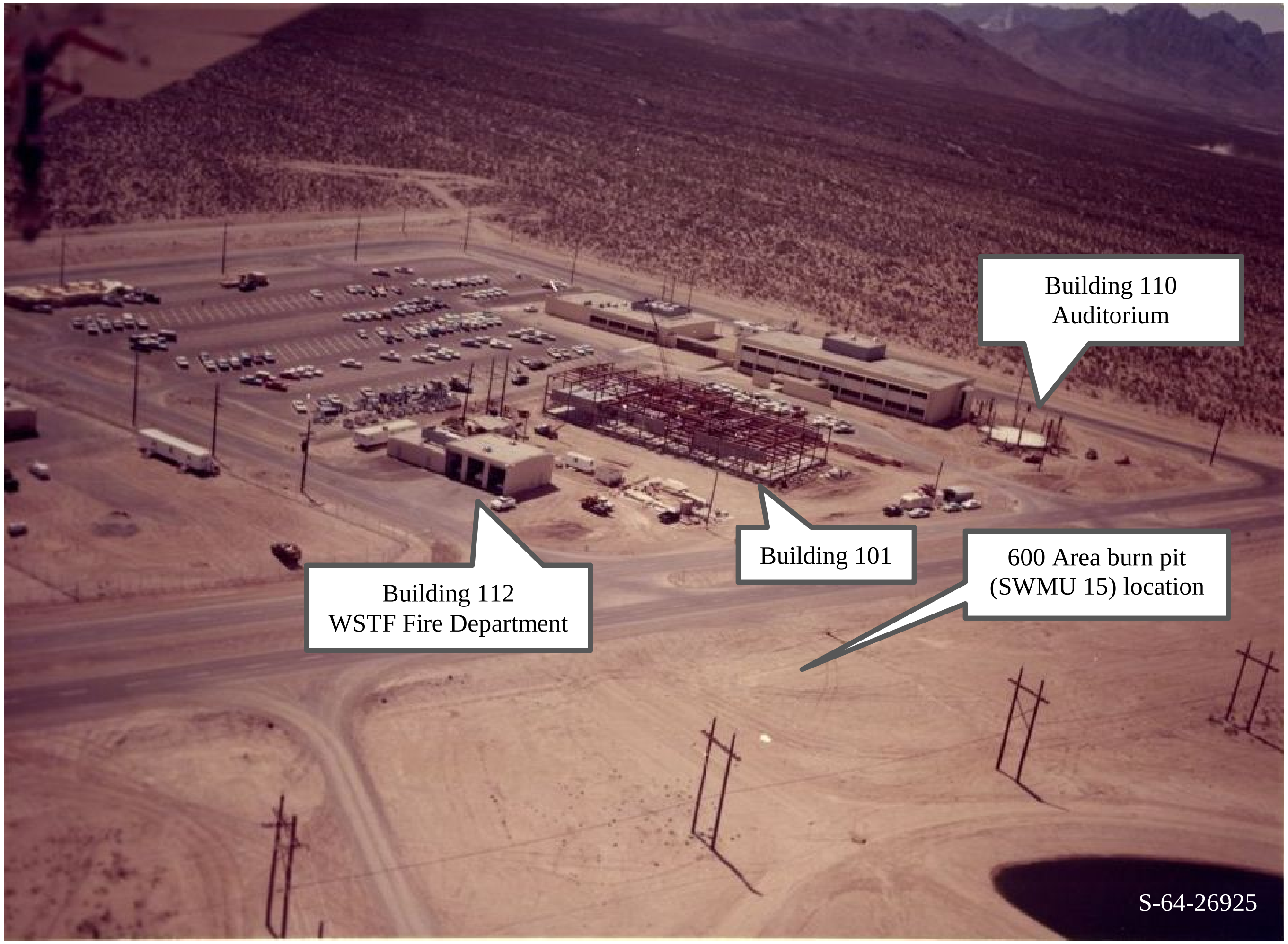
Position/ Location	Significant White Sands Test Facility (WSTF) Solid Waste Management Unit (SWMU) Information	Other Information or Comments
(continued) WSTF Environmental Department summers 1987 and 1989; 1990-2010	(continued) site for disposal. It was located in the eastern 100 Area to the north. • The employee had seen documents stating that the area had been inspected by NMED and been out of compliance. • The employee had also seen photographs of the area showing many drums (over 25) perhaps to the east of Building 151. • There were also piles of wooden pallets stored in the area, more to the south (and east).	
WSTF Environmental Department 1985-2005	**SWMU 1 (100 Area burn pit)** • The employee stated that when he was hired at WSTF in October 1985 the 100 Area burn pit had already been cleaned up (in September 1985). • There was soil staining visible at the 100 Area burn pit site for several years after the employee began working at WSTF. **Wood Burning Area (located to the east of Building 151)** • Older trailers were burned in the eastern 100 Area east of Building 151 as part of fire-fighting training. • These trailers could have contained many potentially hazardous substances such as asbestos, florescent light ballasts (could potentially contain PCBs), paints (could potentially contain lead), metal parts (could potentially contain chromium), metal plumbing (could potentially contain lead, cadmium, copper) and plastics. • Wood pallets had also been stored and burned at part of WSTF FD training to the south. **SWMU 3 (100 container storage area)** • The employee remembered many 55-gallon drums located south of the 100 Area burn pit, and some located to the north as well. The employee stated that the drums to the south of the 100 Area burn pit were removed and shipped off-site for disposal soon after the employee began working at WSTF. • Partially full drums of waste were stored in the container storage area brought from all over WSTF to let the WSTF FD perform fire-fighting training with the contents of the drums. Empty drums were cleaned and reused, or likely put in the WSTF landfill. • There was not a set timeframe for the removal of drums (full or empty) at the 100 container storage area, so many drums could accumulate over time.	• The employee had no personal knowledge of SWMU 15 • Historical PCB storage was also discussed

Position/ Location	Significant White Sands Test Facility (WSTF) Solid Waste Management Unit (SWMU) Information	Other Information or Comments
(continued) WSTF Environmental Department summers 1987 and 1989; 1990-2010	(continued) • Later, this area was used to store crusher fines (construction rock), concrete, and empty tanks/canisters. • The employee remembered seeing paint cans stored in the 100 container storage area, but had no knowledge if paint had been burned in the 100 Area burn pit or not. **Interim or Permitted Drum Storage** • When the employee began working at WSTF, drums were stored south of the 100 Area burn pit. • Wastes were stored in this way until 1986, when the drum storage facility (an old radar dome) began use as an interim hazardous waste storage facility. Hazardous wastes requiring shipment off-site for disposal were then stored in this drum storage facility until they were shipped off-site. • Waste drums were shipped to ENSCO (a hazardous waste incinerator located in El Dorado, Arkansas). • In the early 1990s, a rectangular building was built next to the drum storage facility radar dome. This building became known as the container storage unit. When it was first built, it was used as a less than 90 day hazardous storage area; however, it was permitted for use as a longer hazardous waste storage area when NASA received the Operating Permit. • Use of the radar dome (drum storage facility) ceased when the container storage unit began use as a permitted hazardous waste storage area. **Potential Releases to the Environment** • The employee stated that prior to 1985, no chemicals or wastes were ever shipped off-site for disposal. The 200 Area underground hazardous waste tanks were plumbed to some sinks within the 200 Area buildings. Wastes from regular working activities were poured down sinks, but there seems to have been no historical procedure to deal with occasional extra, leftover, or off-specification liquids or chemicals.	
WSTF 400 Area 1985-1992; Environmental Manager 1992-2001	**SWMU 1 (100 Area burn pit)** • When the employee was hired, the 100 Area burn pit was not in use; however, the employee had been told that any chemical that could burn had been used historically in the 100 Area burn pit.	• The employee had no first-hand knowledge of SWMUs 1, 3, or 15

Position/ Location	Significant White Sands Test Facility (WSTF) Solid Waste Management Unit (SWMU) Information	Other Information or Comments
(continued) WSTF 400 Area 1985-1992; Environmental Manager 1992-2001	(continued) • Shortly after the employee began working at WSTF, the 100 Area burn pit had been cleaned up and some soil had been removed. • The employee explained that if used vacuum pump oil from the propulsion areas had been used in the 100 Area burn pit, then the oil would also have contained combustion products, partial combustion products, and raw fuel (UDMH, A-50, MMH, hydrazine).	
18 Years in Propulsion	**Questionnaire** • In the mid-1980s, an insulated telescope cover was obtained from WSMR excess, installed at the north side of the 150 yard fence, and retrofitted to house hazardous waste prior to shipping off site.	• No additional comments

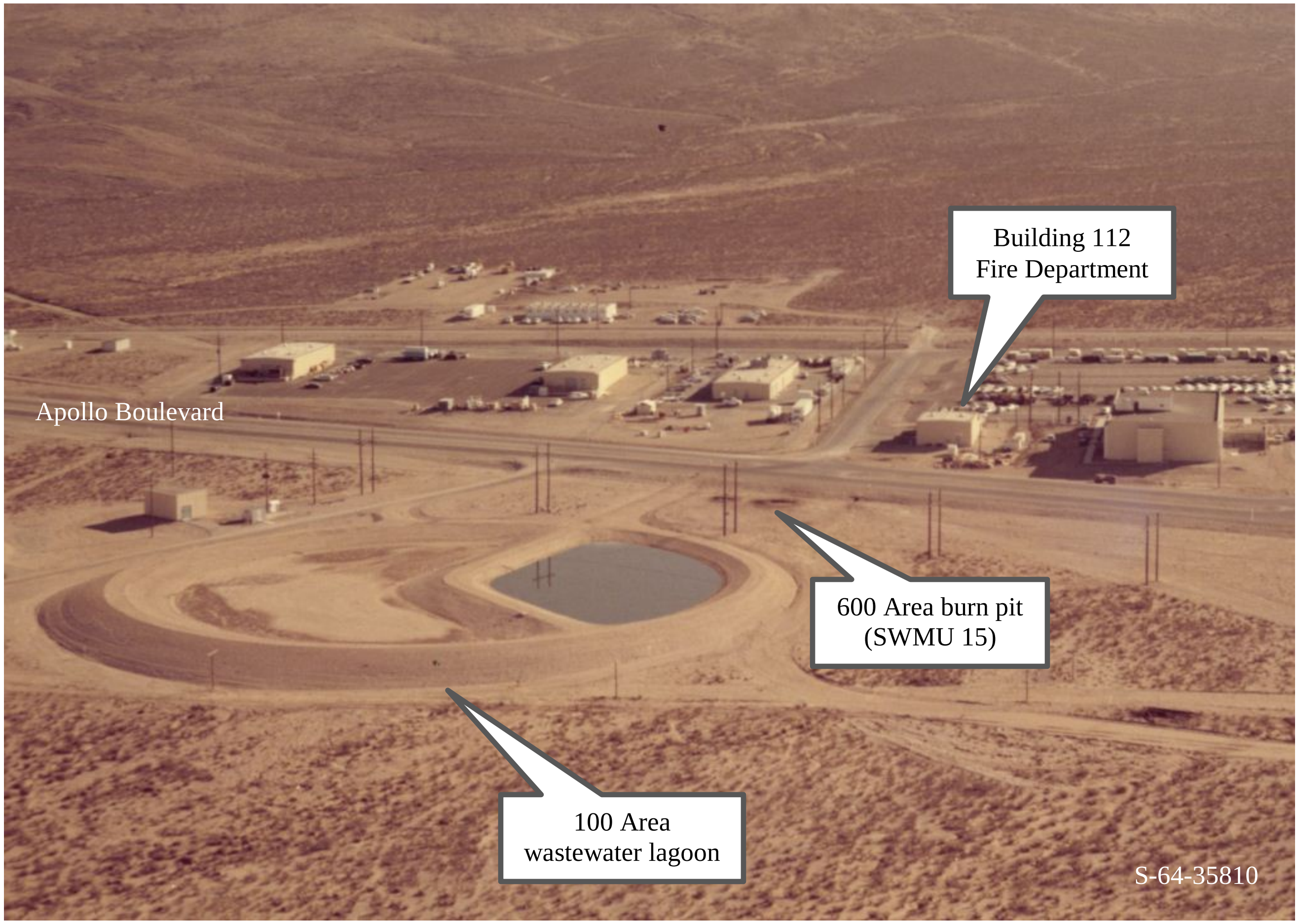
Appendix B
Historical Photographs

Figure B.1 **100 Area Under Construction (1964) – view to the southeast**



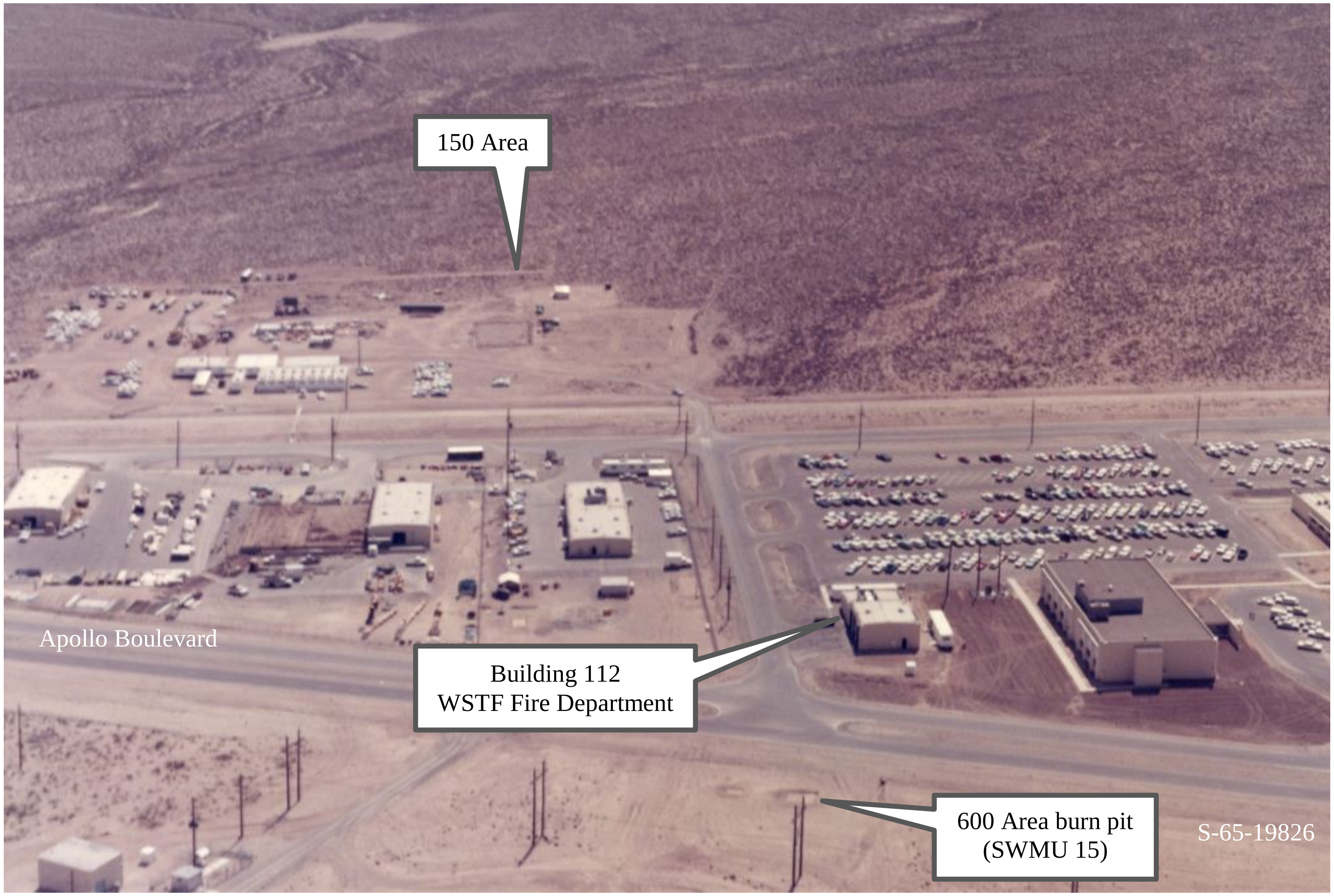
This photograph shows the 100 Area still under-going construction in 1964. The administration Building 101 and the auditorium, the Rotunda, are still being constructed. Notice the emergency services/Fire Department Building 112 has been completed, and the 600 Area burn pit has not been constructed yet.

Figure B.2 **WSTF 100 and 600 Areas (1964) – view to the east**



This photograph shows the 100 and eastern 600 Areas, including the 600 Area burn pit located just east of the 100 Area wastewater lagoon and just west of Apollo Boulevard. Notice there are two small burn areas instead of one larger burn pit and the location is close to the WSTF FD Building 112 for convenience.

Figure B.3 **600 Area Burn Pit (1965) – view to the east**

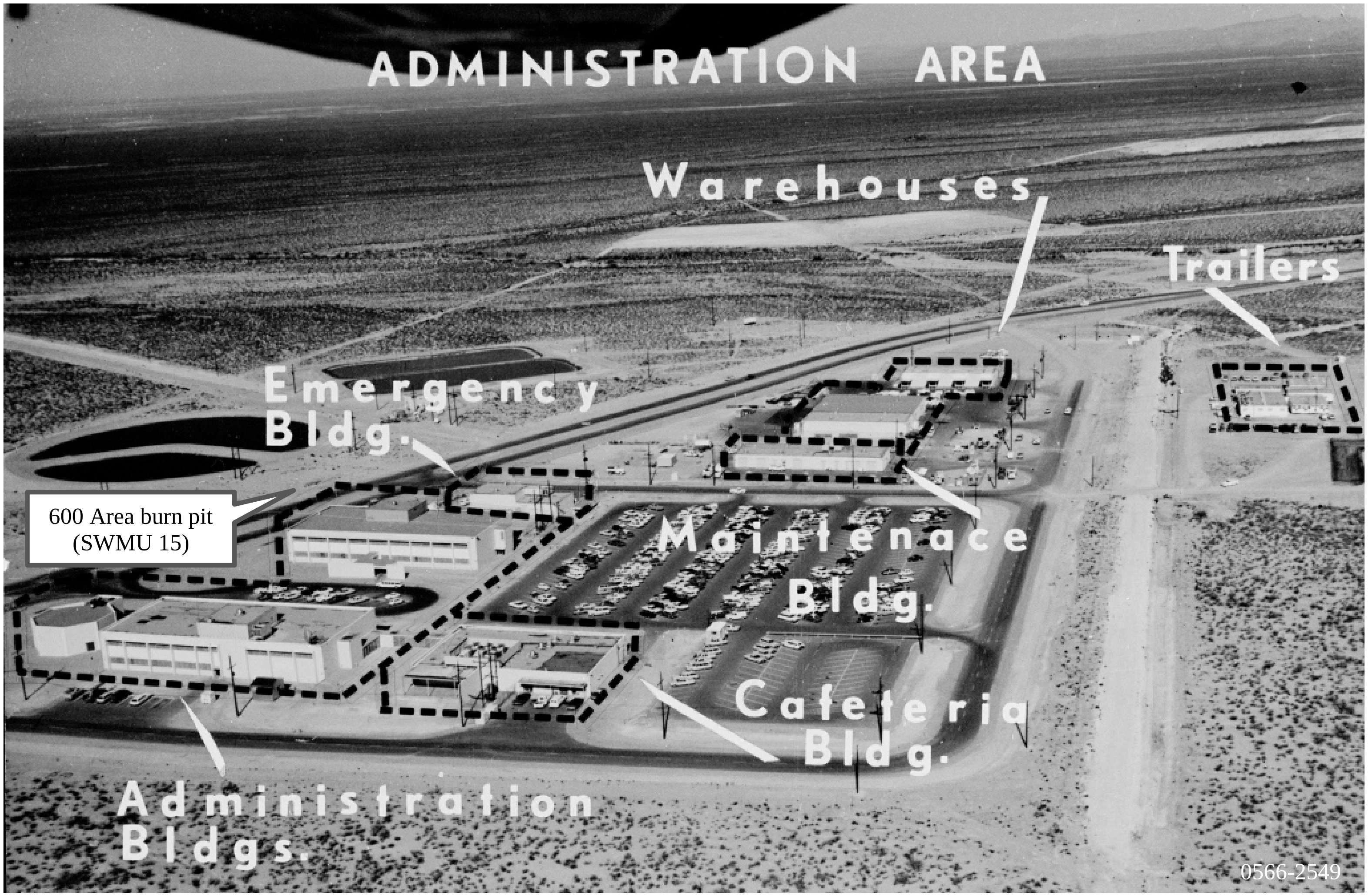


This photograph shows the 600 Area burn pit in 1965. Notice the dark staining from fires has faded, showing less use of the 600 Area burn pit.

Figure B.4 **600 Area burn pit (1966) – view to the east**

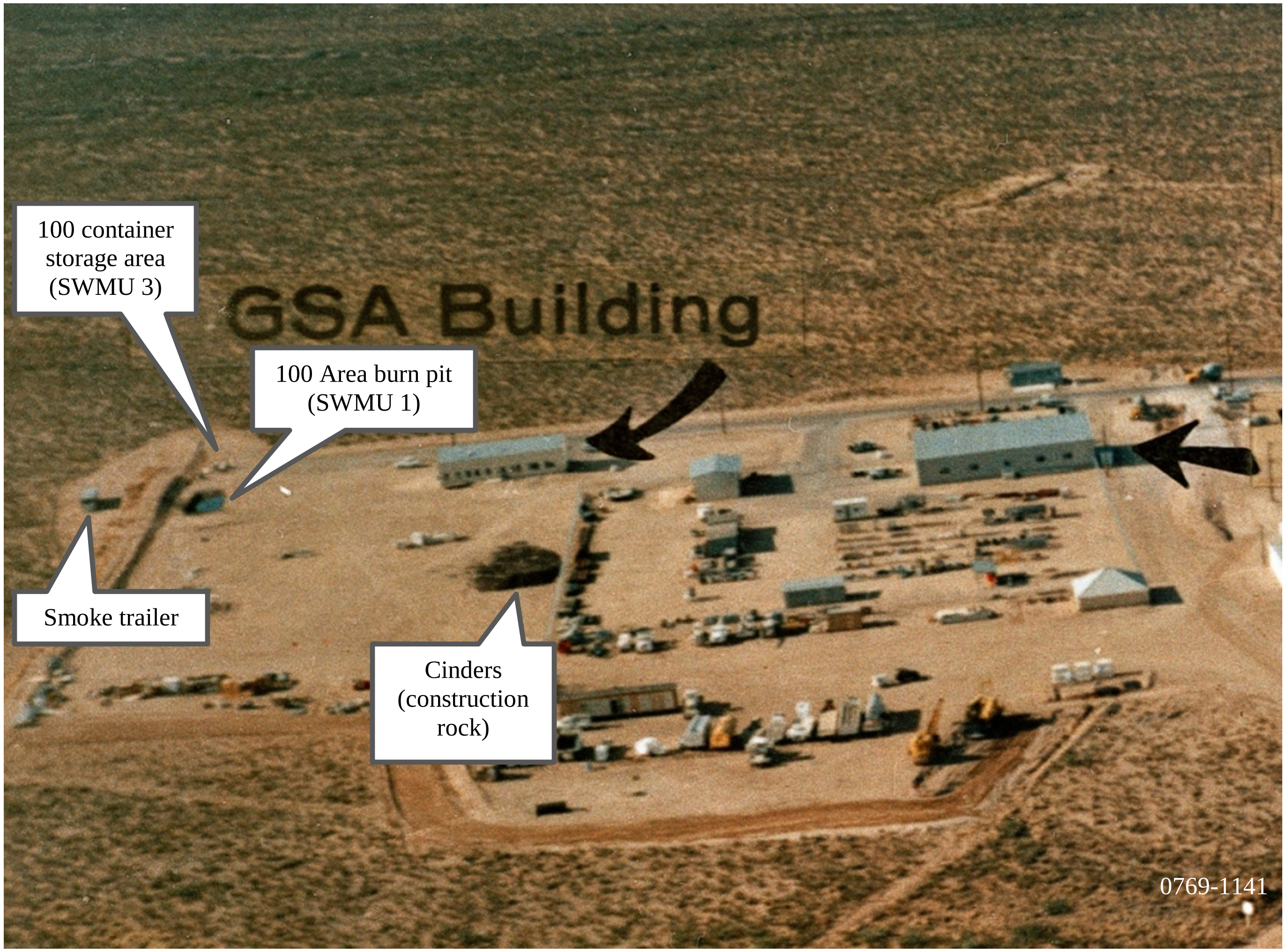
This photograph shows the 600 Area burn pit in April 1966. Notice the pit is hardly visible, showing continued disuse of the pit. Notice the two trailers located adjacent to the Fire Department (emergency services) Building 112. These were part of the trailers later burned in 1993/1994.

Figure B.4 **100 Area (1966) – view to the northwest**

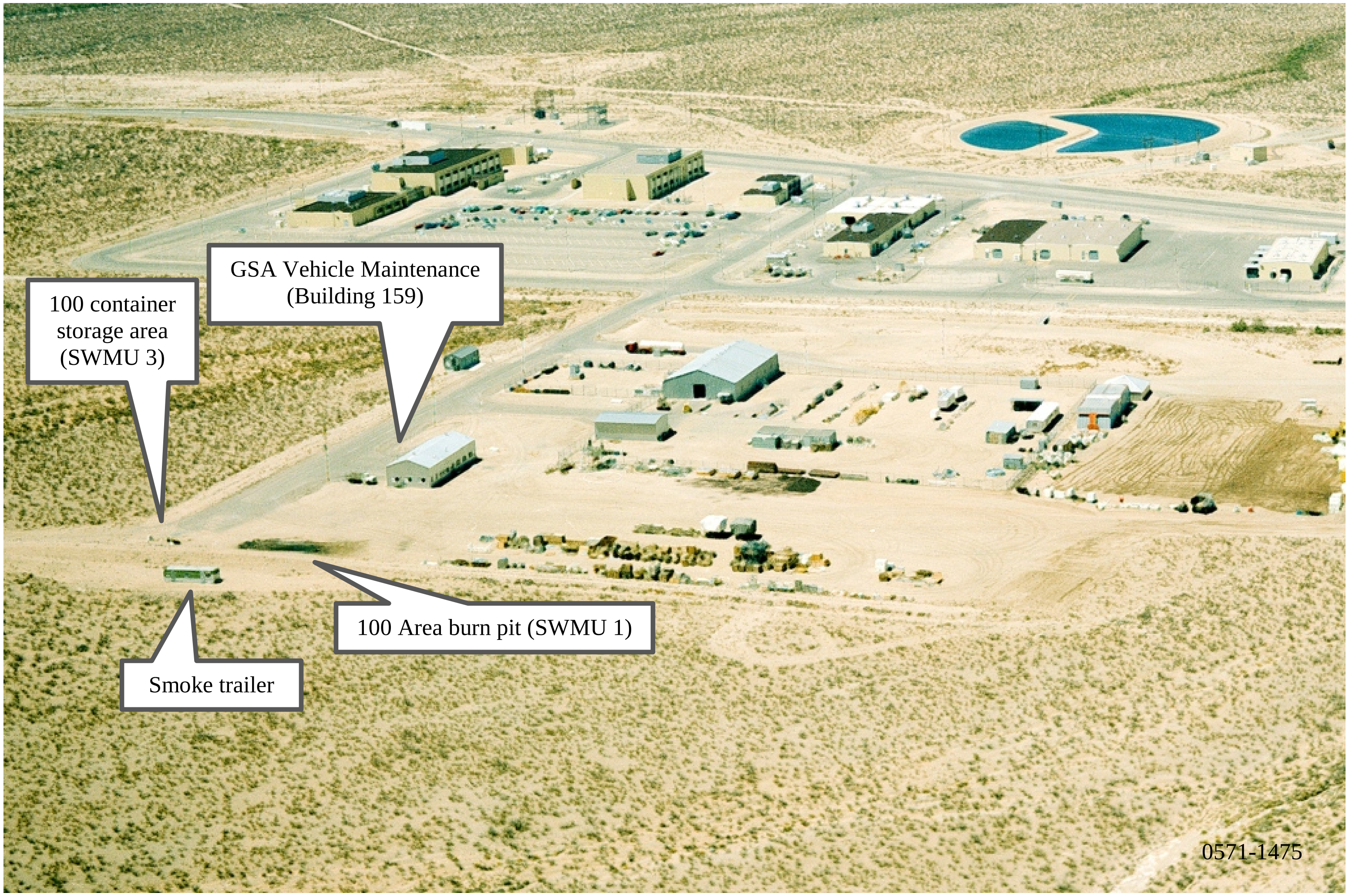


This photograph shows the 100 Area in May 1966 with all the buildings annotated. Notice the 600 Area burn pit as a dark spot near the 100 Area wastewater lagoon.

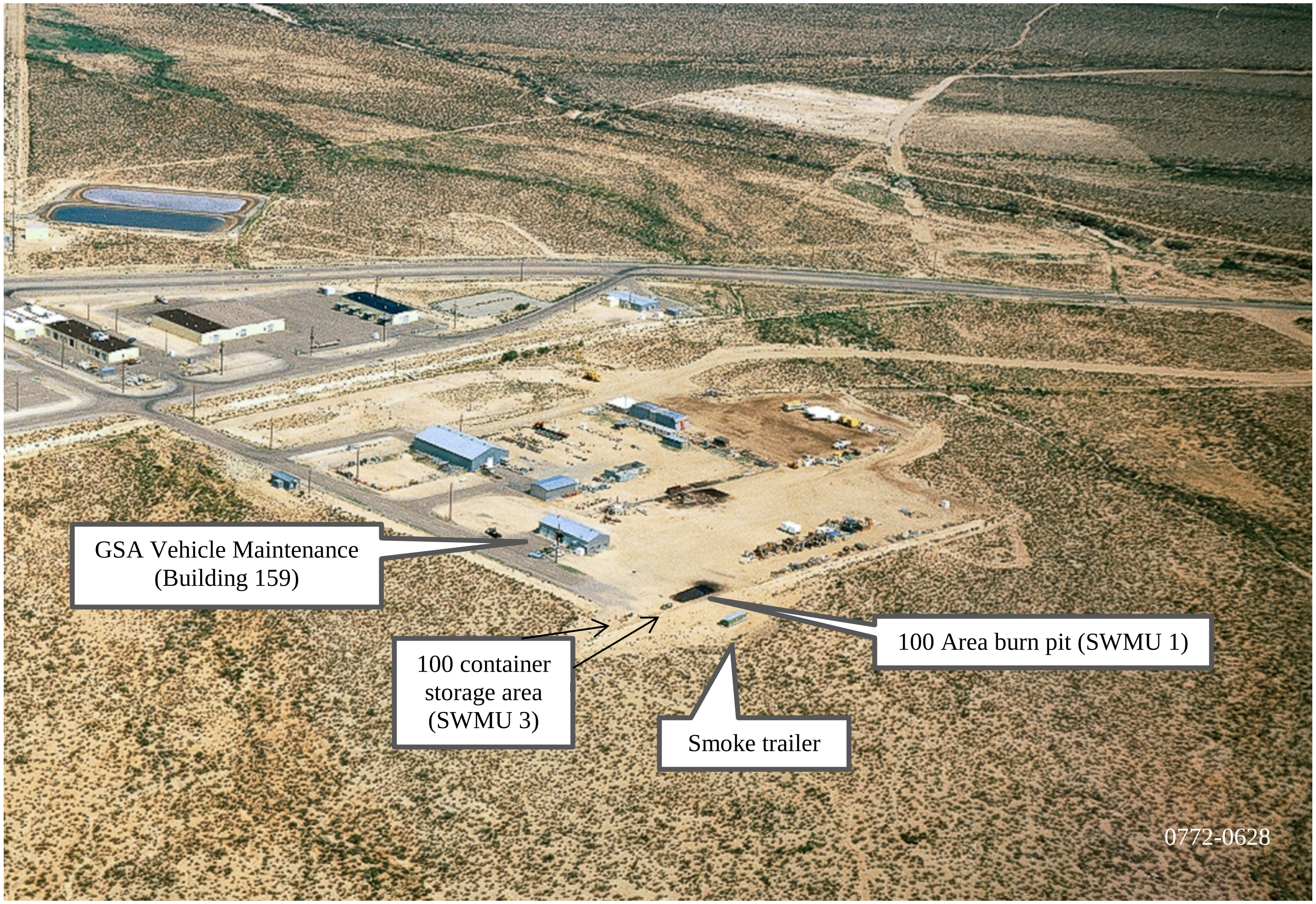
Figure B.6 **Eastern 100 Area (1969) – view to the south**



This photograph shows the eastern 100 Area in July 1969. Notice the 100 Area burn pit and a smoke trailer are present. Also visible are drums the 100 container storage area and cinders north of the GSA Building.

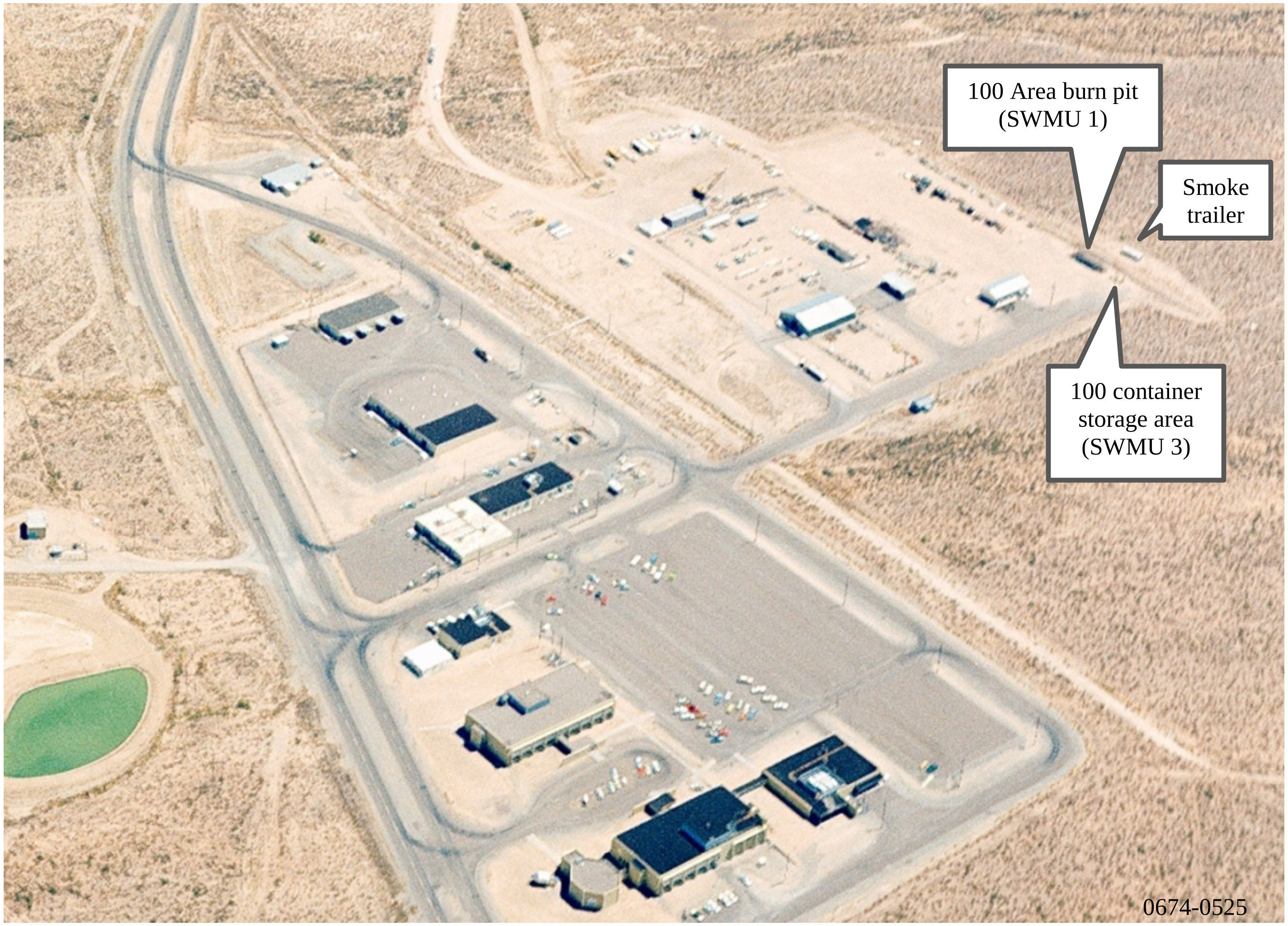


This photograph shows the 100 Area burn pit and 100 container storage area in May 1971. The original smoke trailer is present in the FD training area to the east of the burn pit. Notice the soil staining at the north end of the 100 Area burn pit.

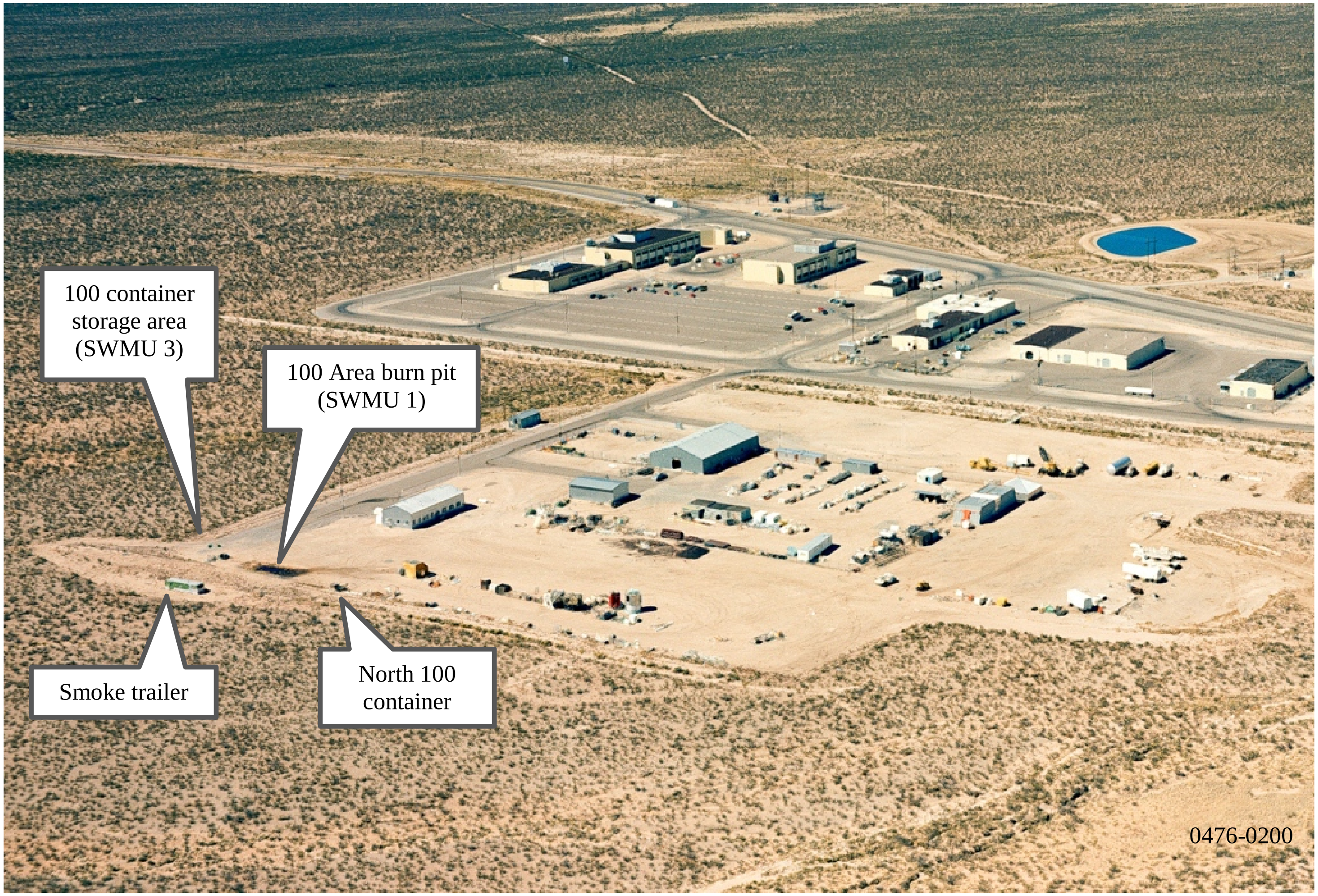


This photograph is the 100 Area in July 1972. Notice the slightly increased soil staining to the north of the 100 Area burn pit and the increased number of drums stored in two separate locations in the 100 container storage area.

Figure B.9 **100 Area (1974) – view to the northeast**

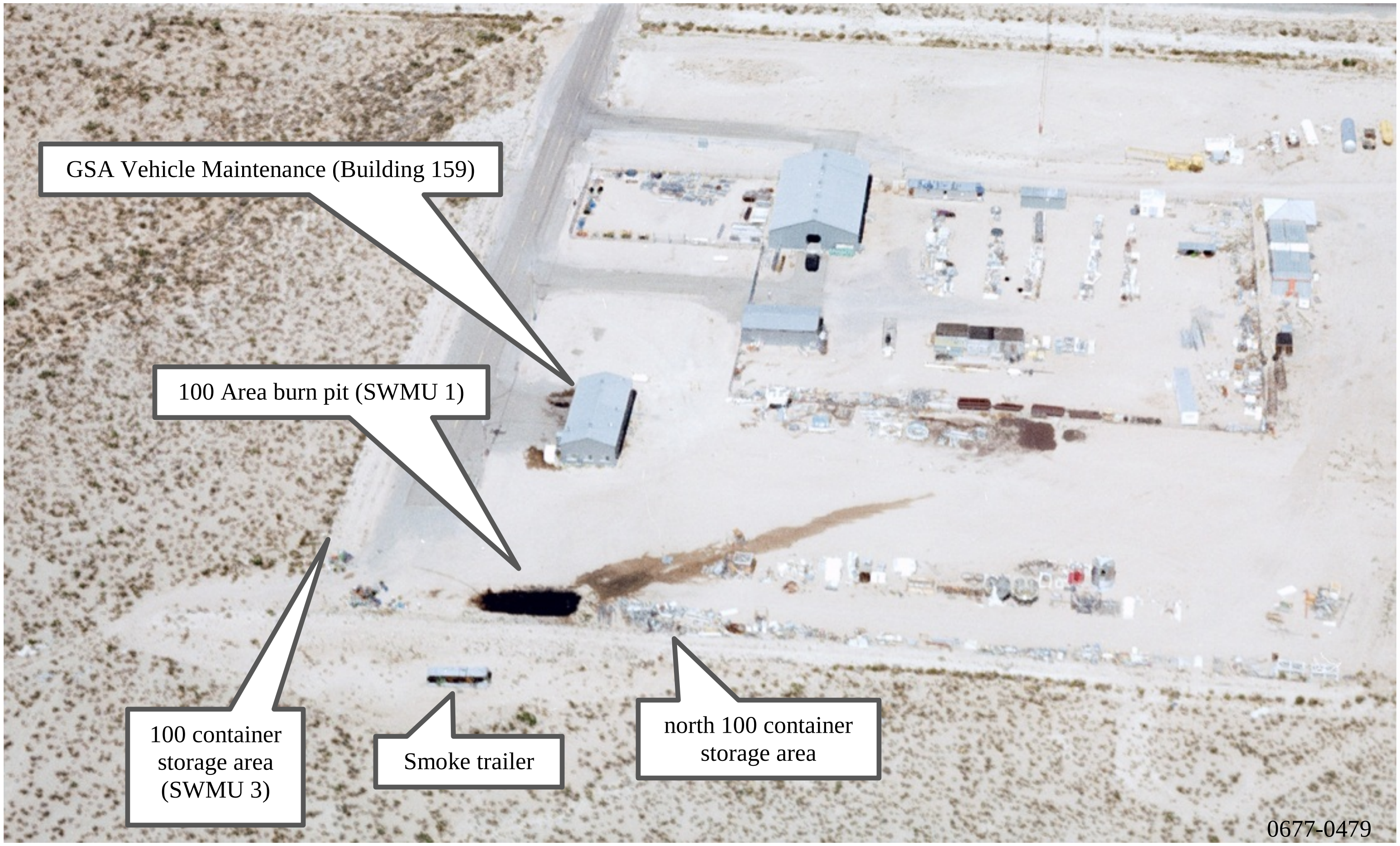


This photograph shows the 100 Area at WSTF in June 1974.

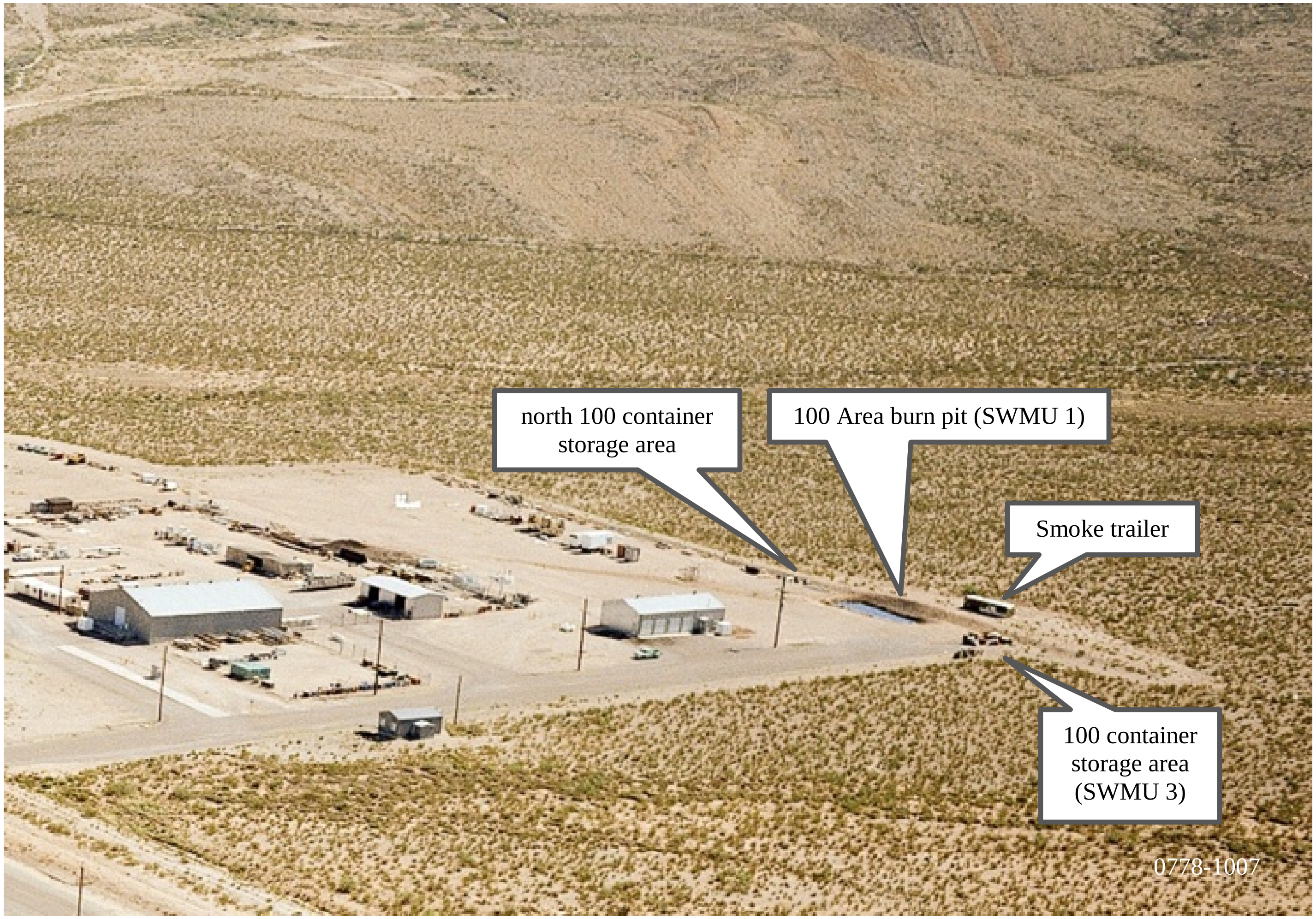


This photograph shows the 100 Area in April 1976. Notice the much larger soil staining to the northwest from the 100 Area burn pit. Notice also there are drums stored in the north 100 container storage area.

Figure B.11 **Eastern 100 Area (1977) – view to the west**

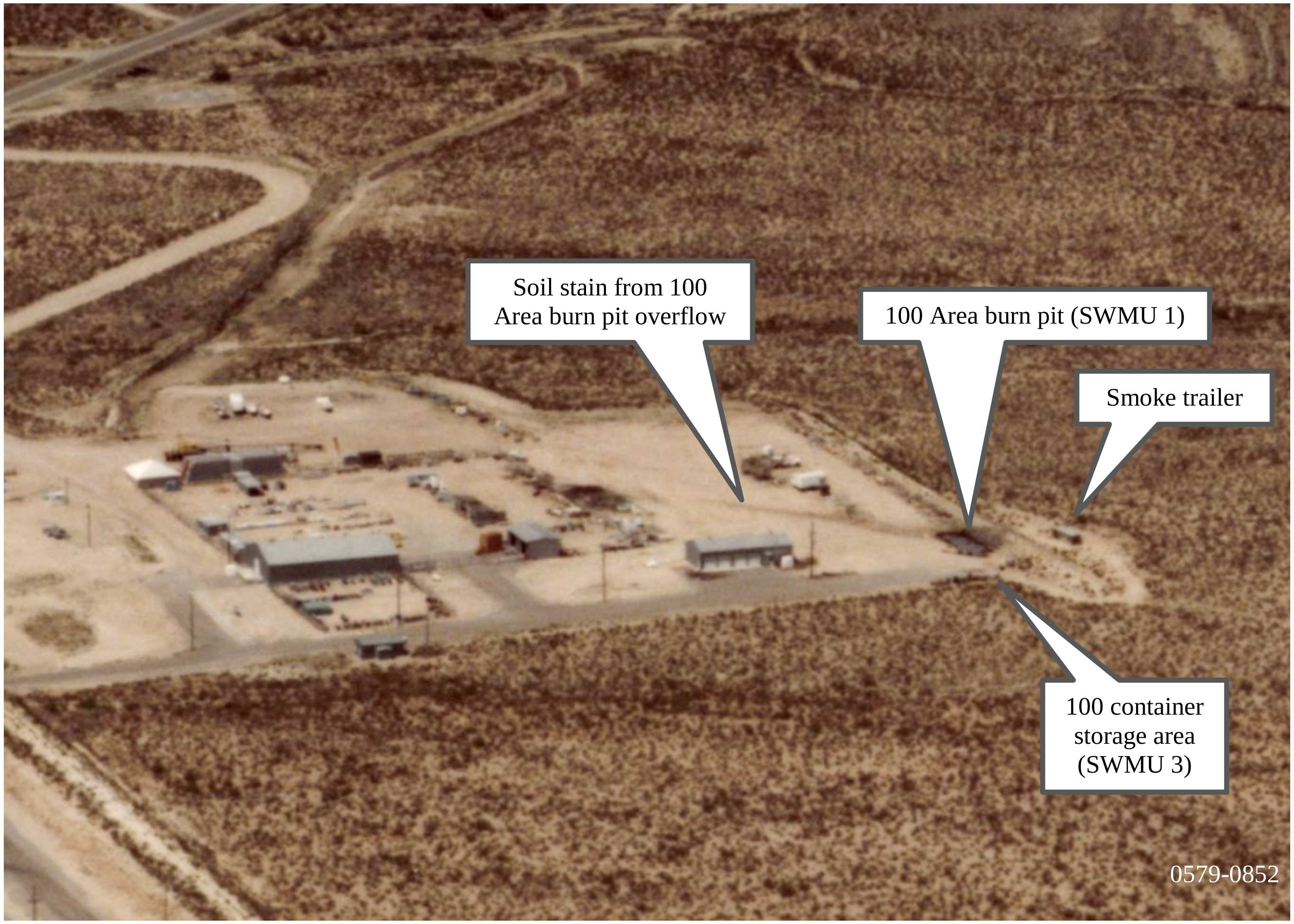


This photograph shows the greatest extent of the soil staining to the northwest of the 100 Area burn pit. Also notice soil has been bermed around the edges of the burn pit to try and prevent future overflows of the pit, there are many more containers present in the 100 container storage area, as well as containers in the north 100 container storage area.



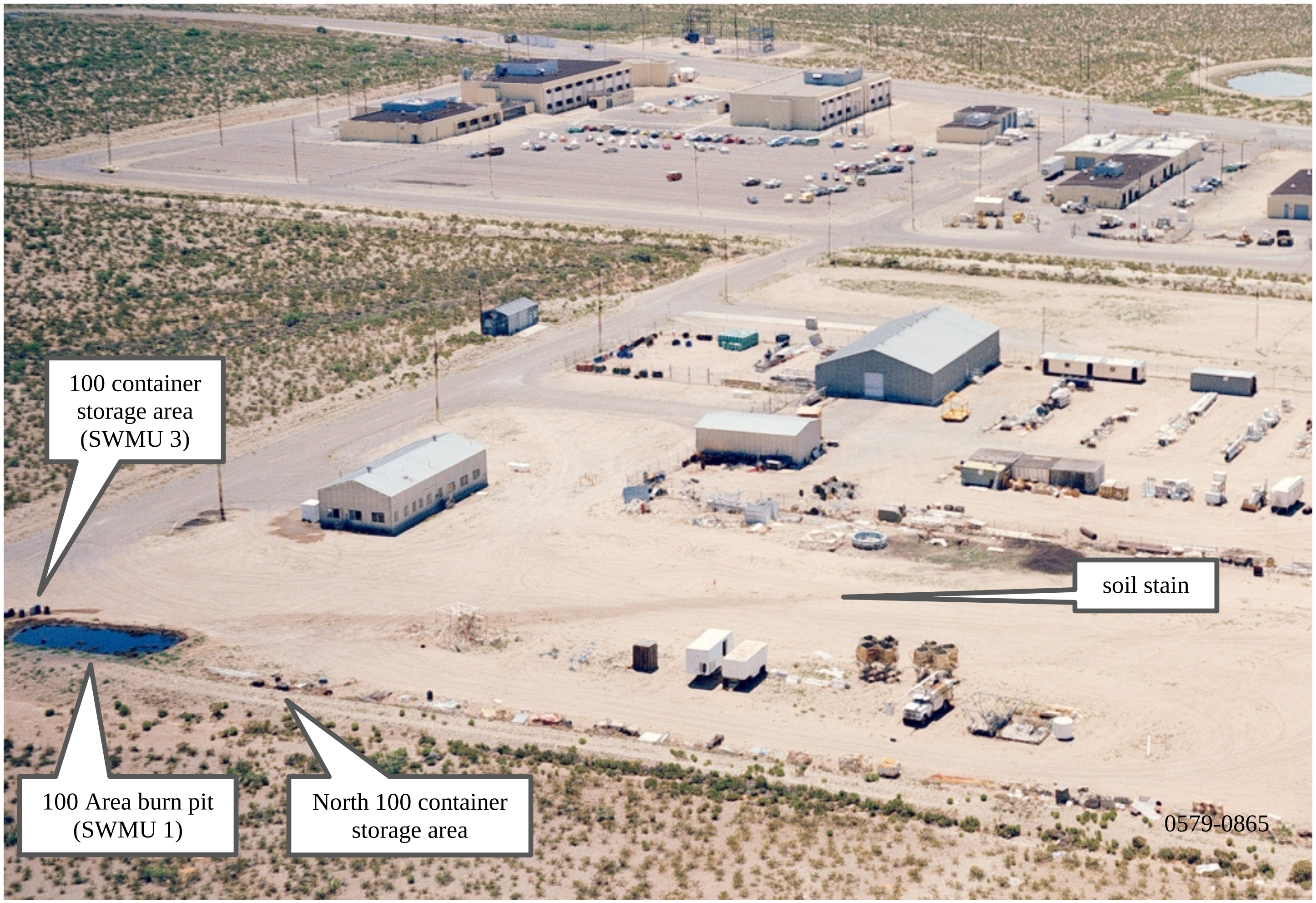
This photograph shows the 100 Area burn pit, smoke trailer, and 100 container storage area in July 1978. Notice the northwest-trending soil stain is still visible, there are drums stored in the north 100 container storage area, and there are many drums in separate areas in the 100 container storage area.

Figure B.13 **Eastern 100 Area (1979) – view to the north**



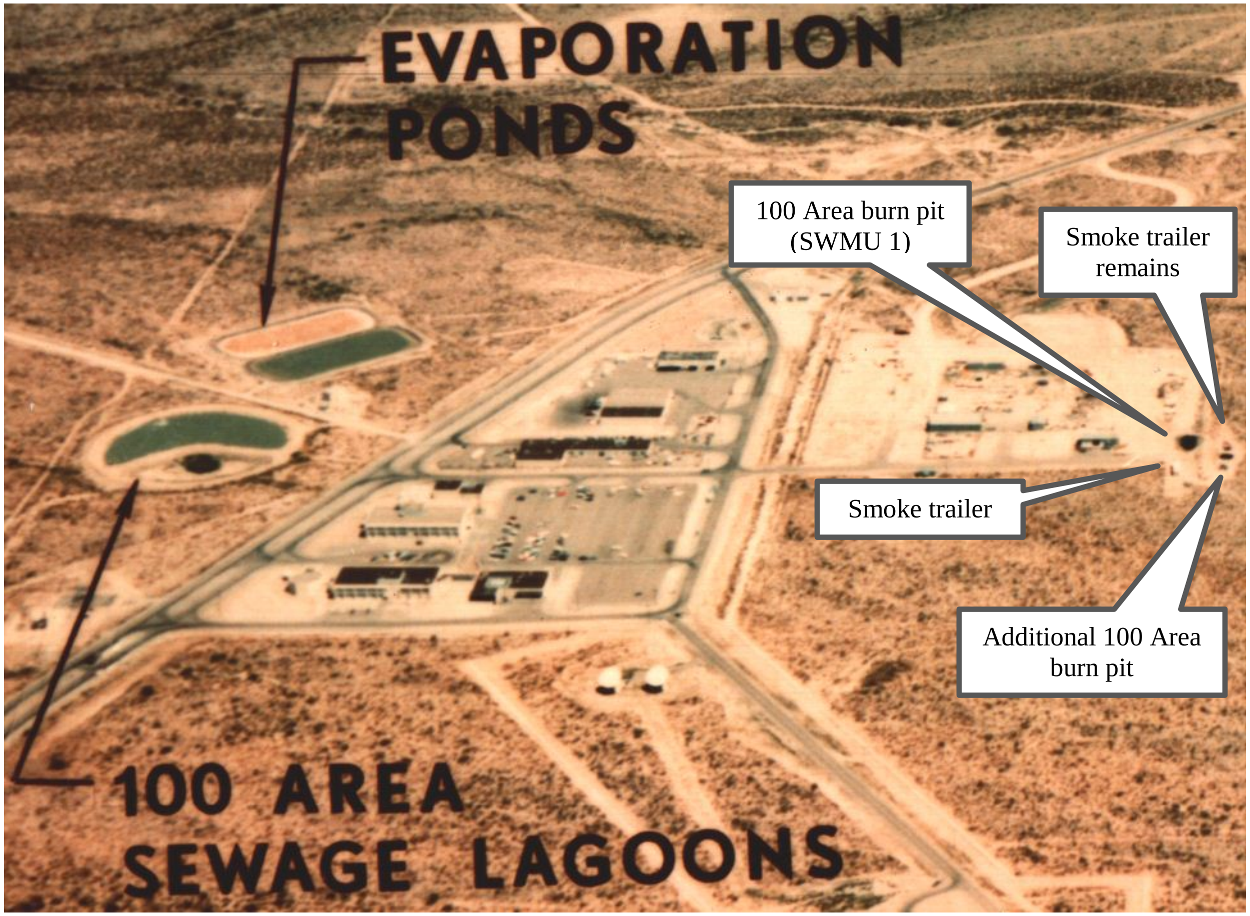
This photograph shows the eastern 100 Area in May 1979. Notice the 100 Area burn pit overflow soil stain is still present to the north and the original smoke trailer is still present to the east of the burn pit.

Figure B.14 **100 Area Close View (1979) – view to the west**



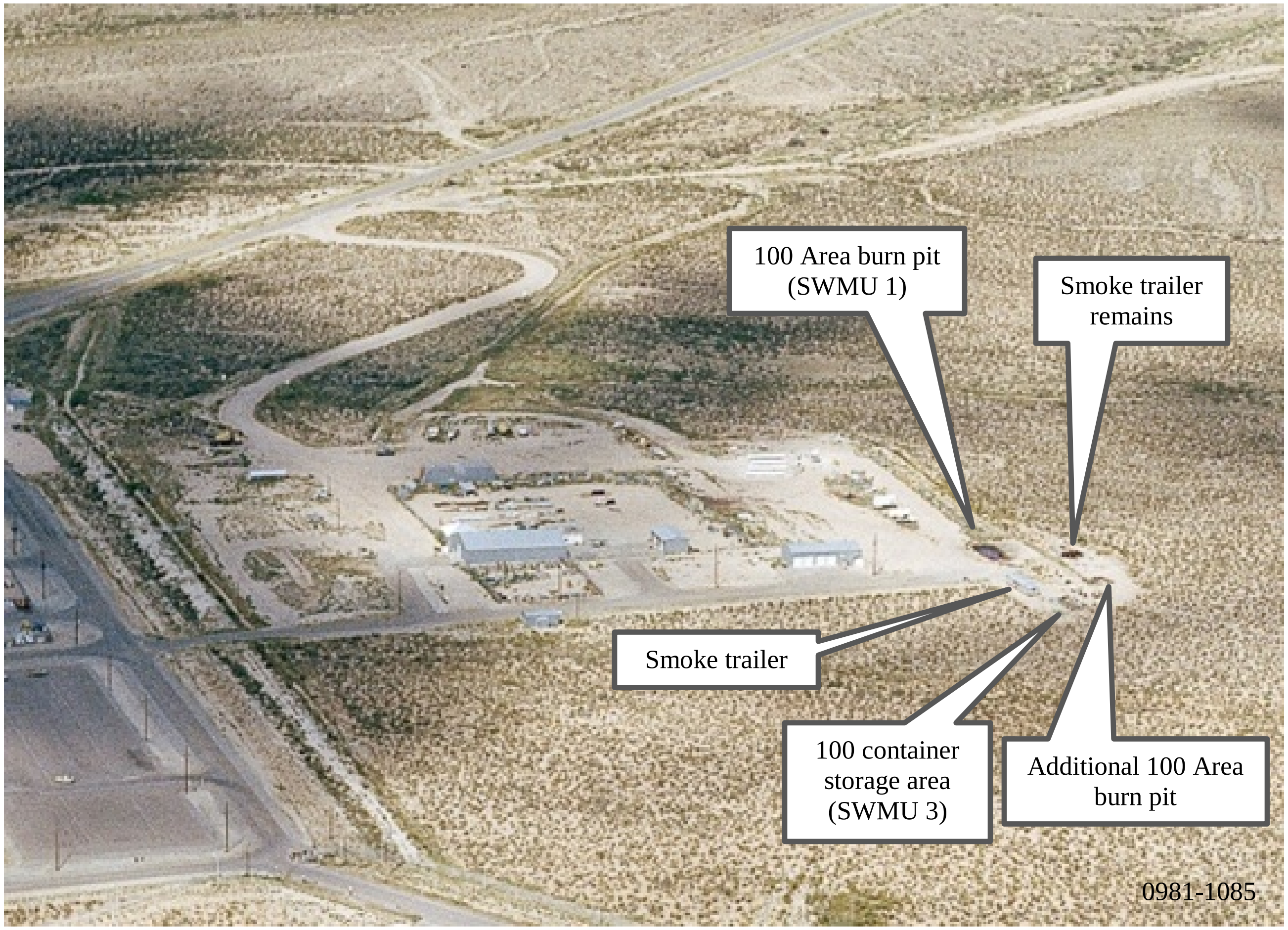
This photograph shows a closer view of the 100 Area burn pit and 100 container storage area in May 1979. Notice the northwest-trending soil stain is still visible, there is a soil berm around the 100 Area burn pit, drums are stored both to the north and south of the 100 container storage area.

Figure B.15 **100 Area (1981) – view to the north**



This photograph shows the 100 Area in March 1981. Notice that the additional burn pit may be present, the first smoke trailer has been burned, there is at least one other burned area, and a new smoke trailer has been placed in the 100 container storage area.

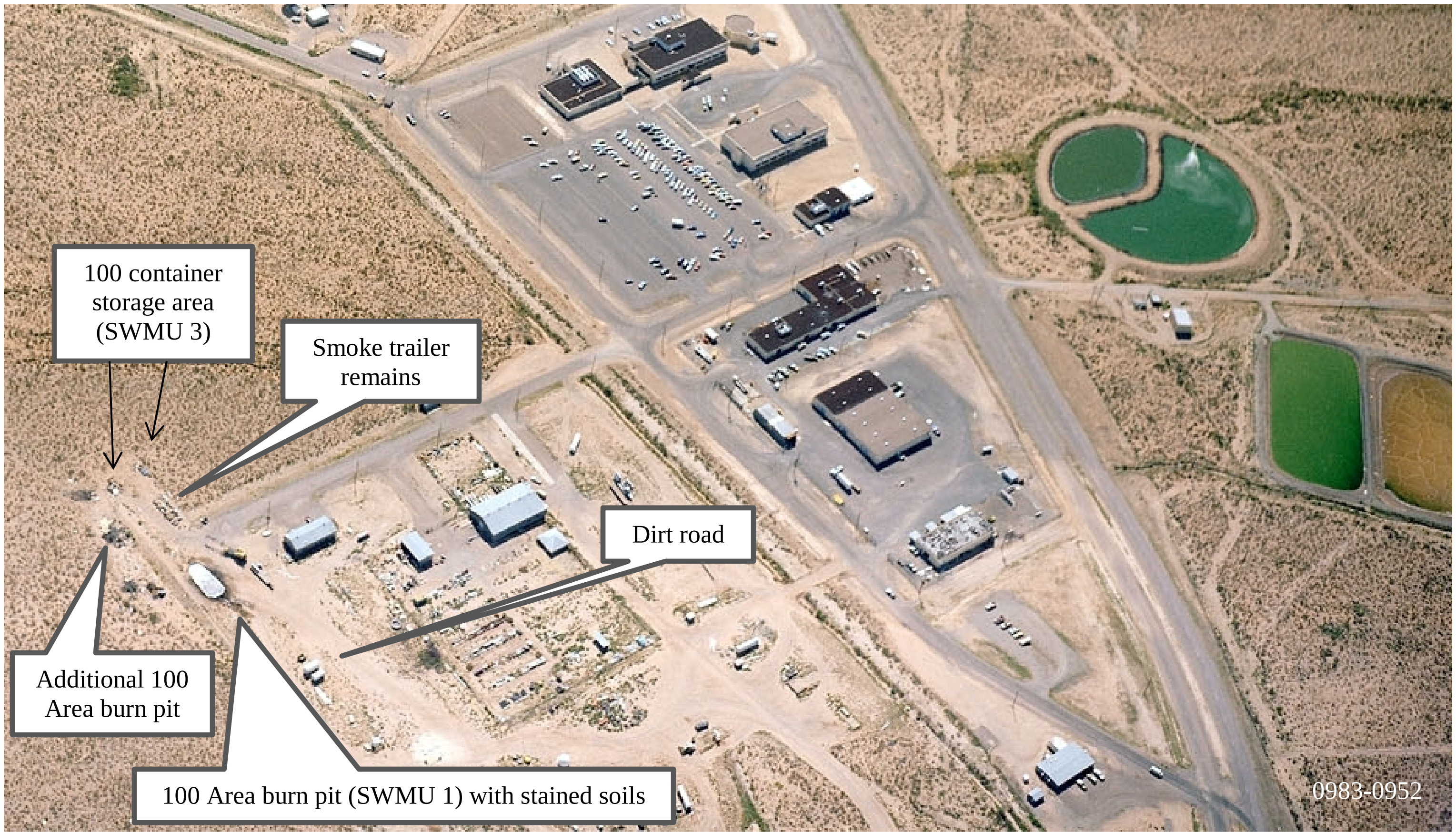
Figure B.16 **Eastern 100 Area (1981) – view to the north**



This photograph shows the eastern 100 Area in September 1981. Notice the square gray feature just east of the soil berm and the 100 container storage area. This is the additional 100 Area burn pit. Remains of the first smoke trailer can be seen as well.

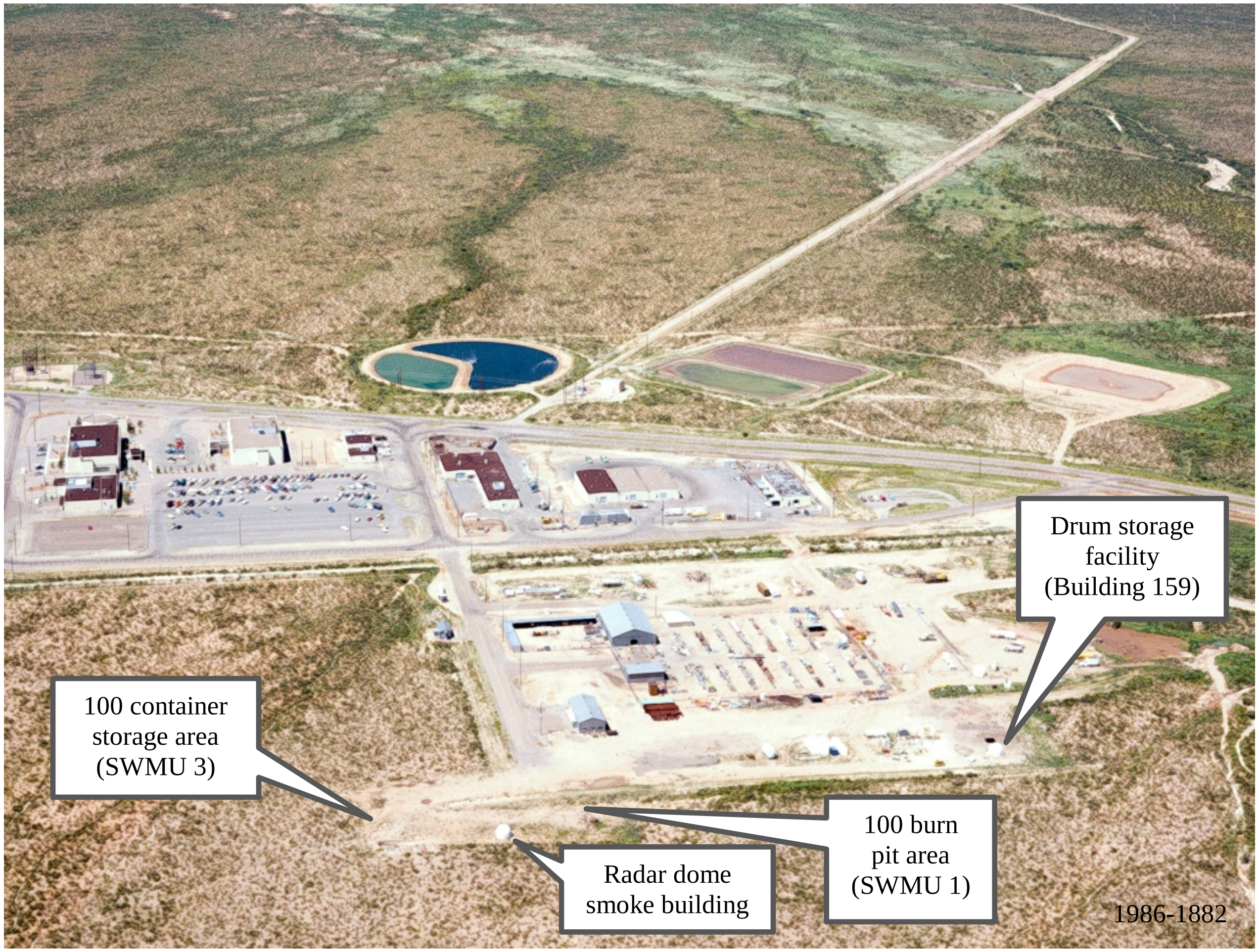
Figure B.17 **Eastern 100 Area (1982) – view to the south**

This photograph shows the eastern 100 Area in August 1982. The additional 100 Area burn pit, remains of the first smoke trailer, and three additional wood fire remains are present. Also notice there are a large number of drums in the 100 container storage area.



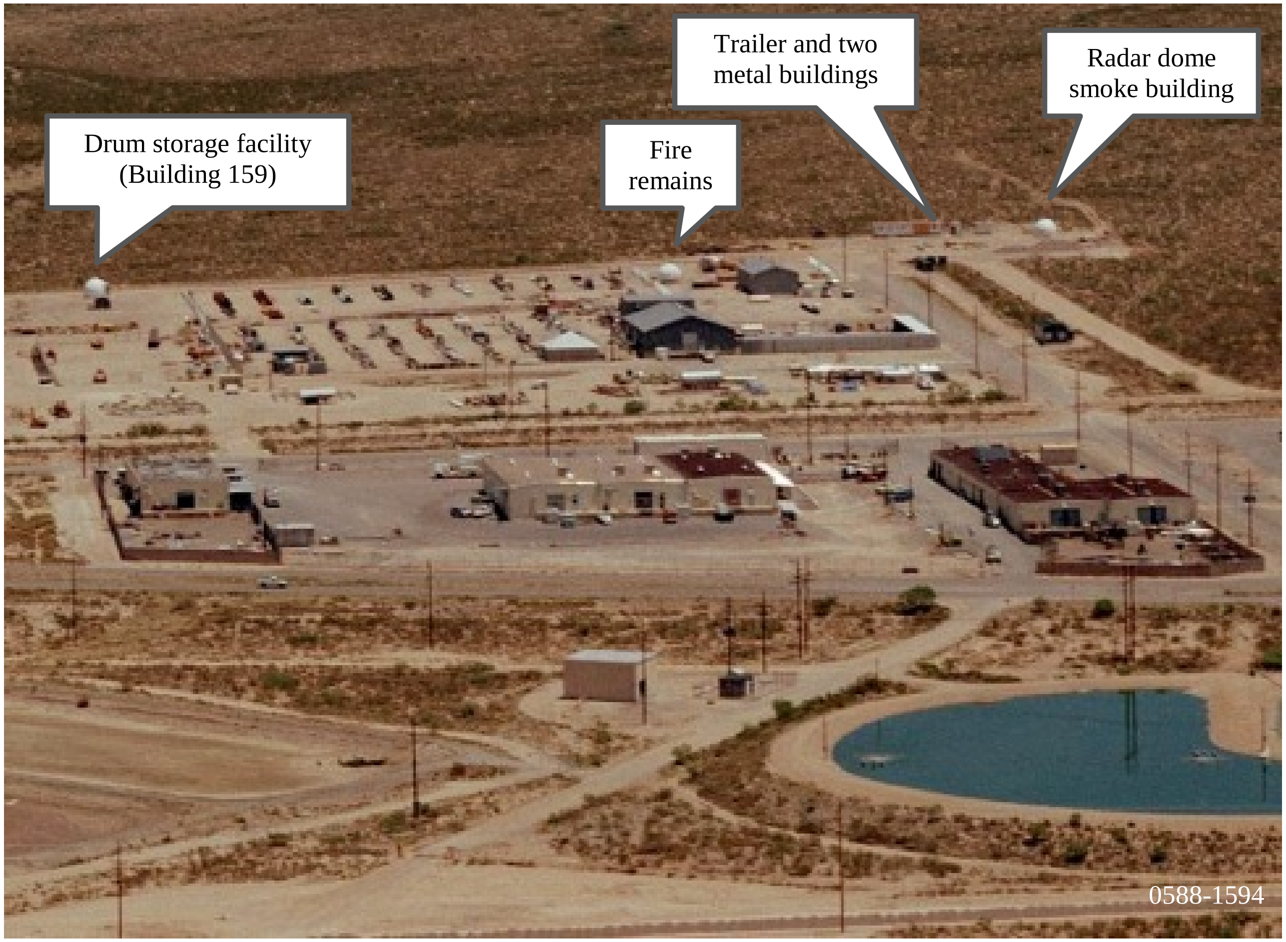
This photograph shows the 100 Area in September 1983. Notice 100 Area burn pit soil staining is still visible near the pit, but a dirt road has been constructed to the northwest, obscuring the previous soil staining that trended to the northwest. Also notice that the second smoke trailer located in the 100 container storage area has been burned.

Figure B.19 **100 Area (1986) – view to the west**

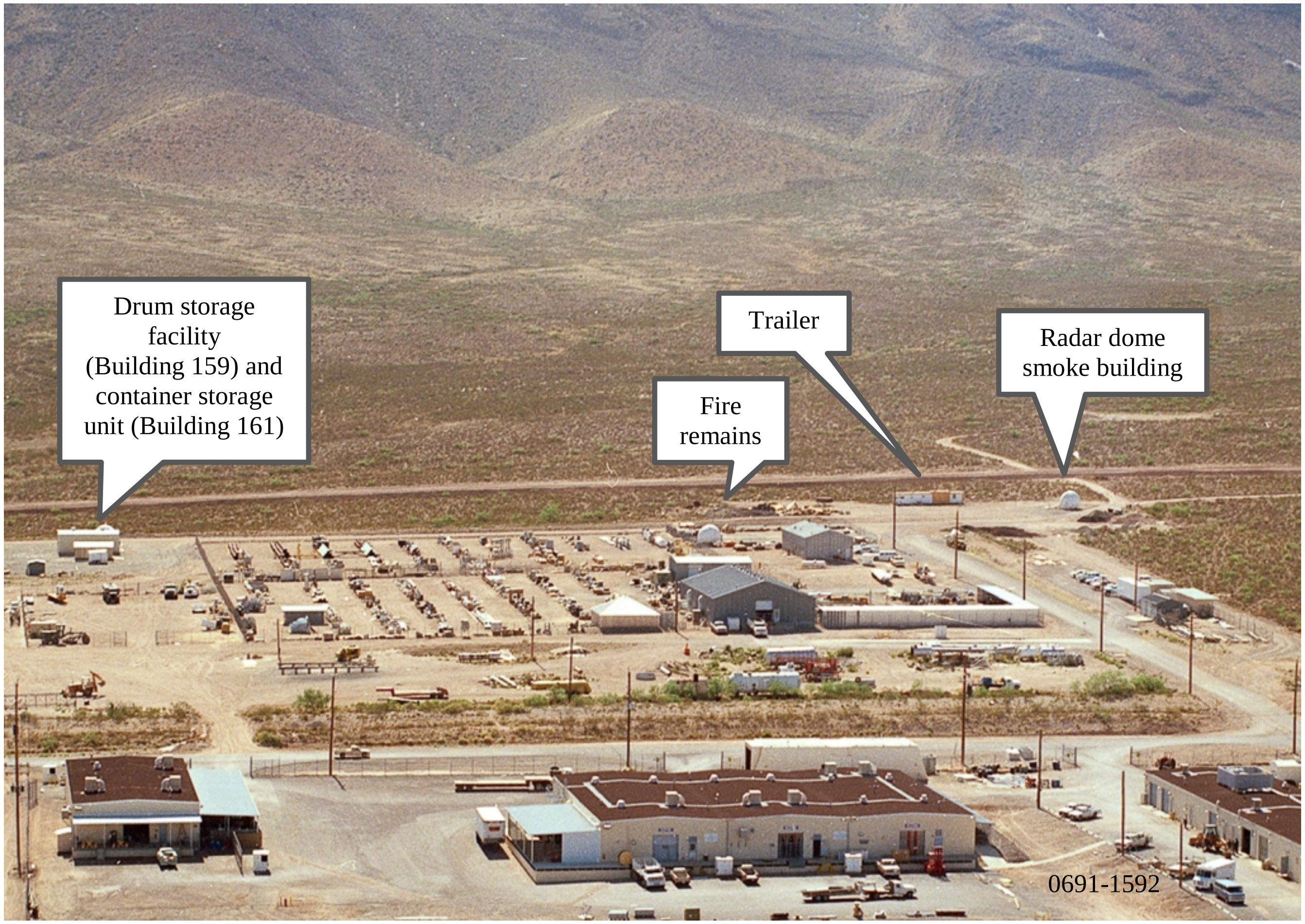


This is a photograph of the 100 Area one year after the 100 Area burn pit (and additional 100 Area burn pit) were cleaned up. Notice that a radar dome has been placed in the FD training area as a smoke building, remains of trailers and wood fires are gone, and the drum storage facility radar dome (Building 159) is in place to the north of the 100 Area burn pit. Also notice what appears to be soil staining where the 100 Area burn pit was located.

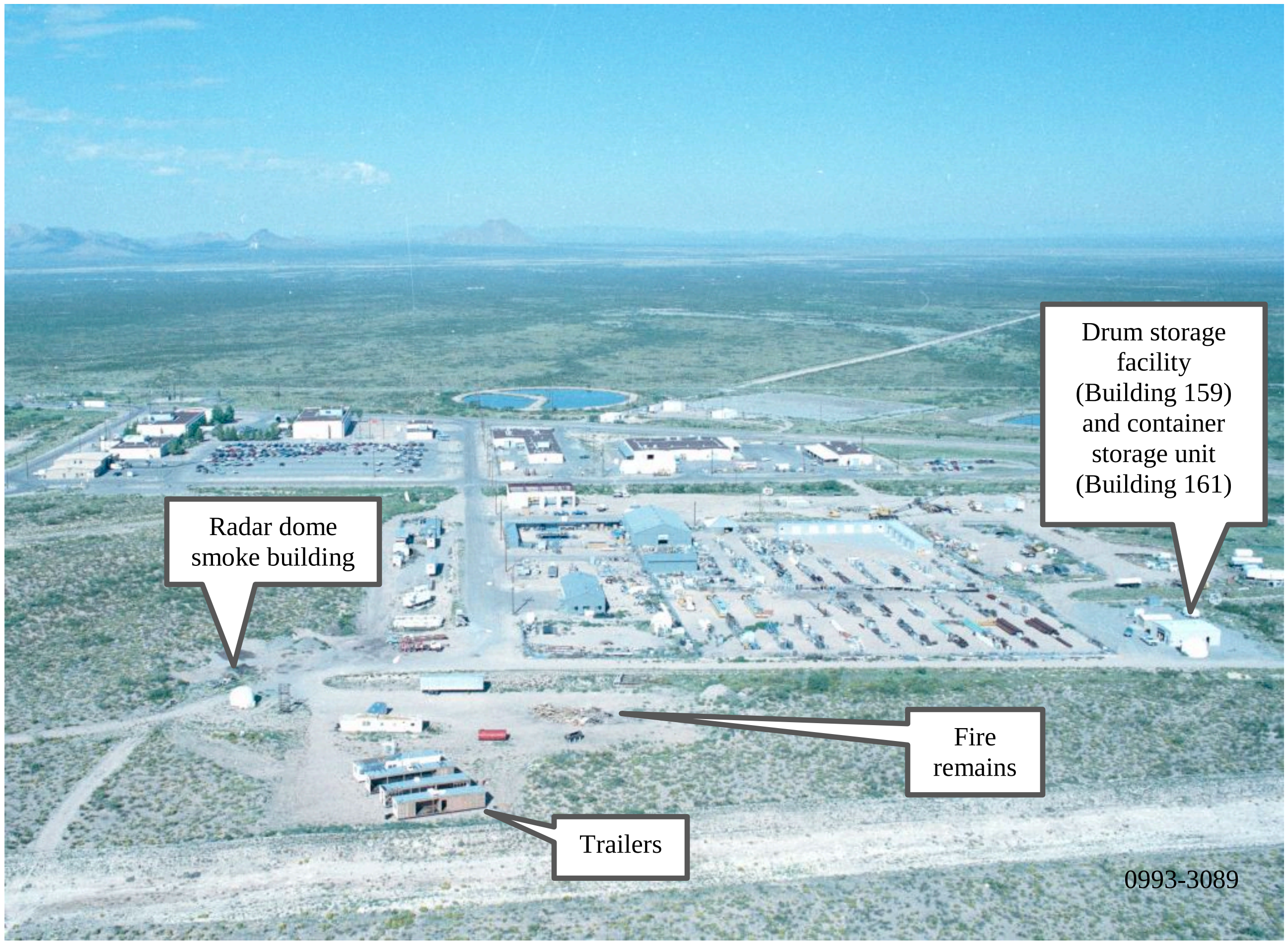
Figure B.20 **100 Area (1988) – view to the east**



This photograph shows the 100 Area in May 1988. Notice there is the radar dome smoke building, an additional trailer, two small metal buildings, and remains of a trailer or large wood fire are visible. Also notice crusher fine (construction rocks) are present in the former 100 container storage area.

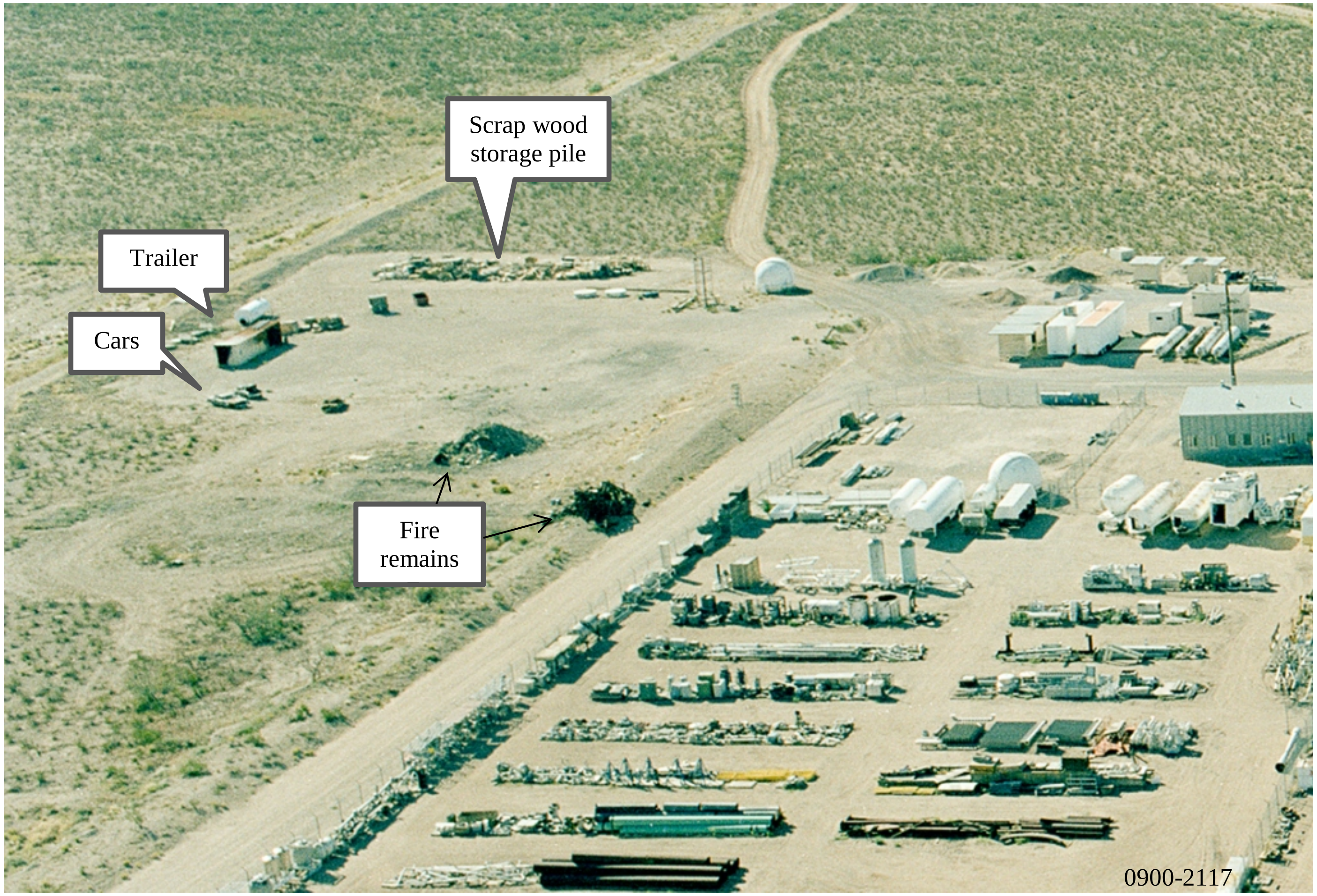


This photograph shows the 100 Area in June 1991. Notice the two metal buildings are gone. The large wood fire remains are still visible. Notice also the drum storage facility has been constructed adjacent to the drum storage facility.



This photograph shows the FD training area in September 1993. Notice the Firemen's original living quarter trailers are present. These trailers were reportedly the last trailers burned at WSTF. Also notice remains of other wood or trailer fires in line with the GSA Building 151.

Figure B.23 **FD Training Area Close View (2000) – view to the south**



This photograph shows the FD training area in September 2000. Notice there appear to be two piles of wood fire remains to the north, three cars and a rusted or burned trailer in the middle area, and a large scrap wood pile to the south. No fires were conducted at the southern wood pile location.

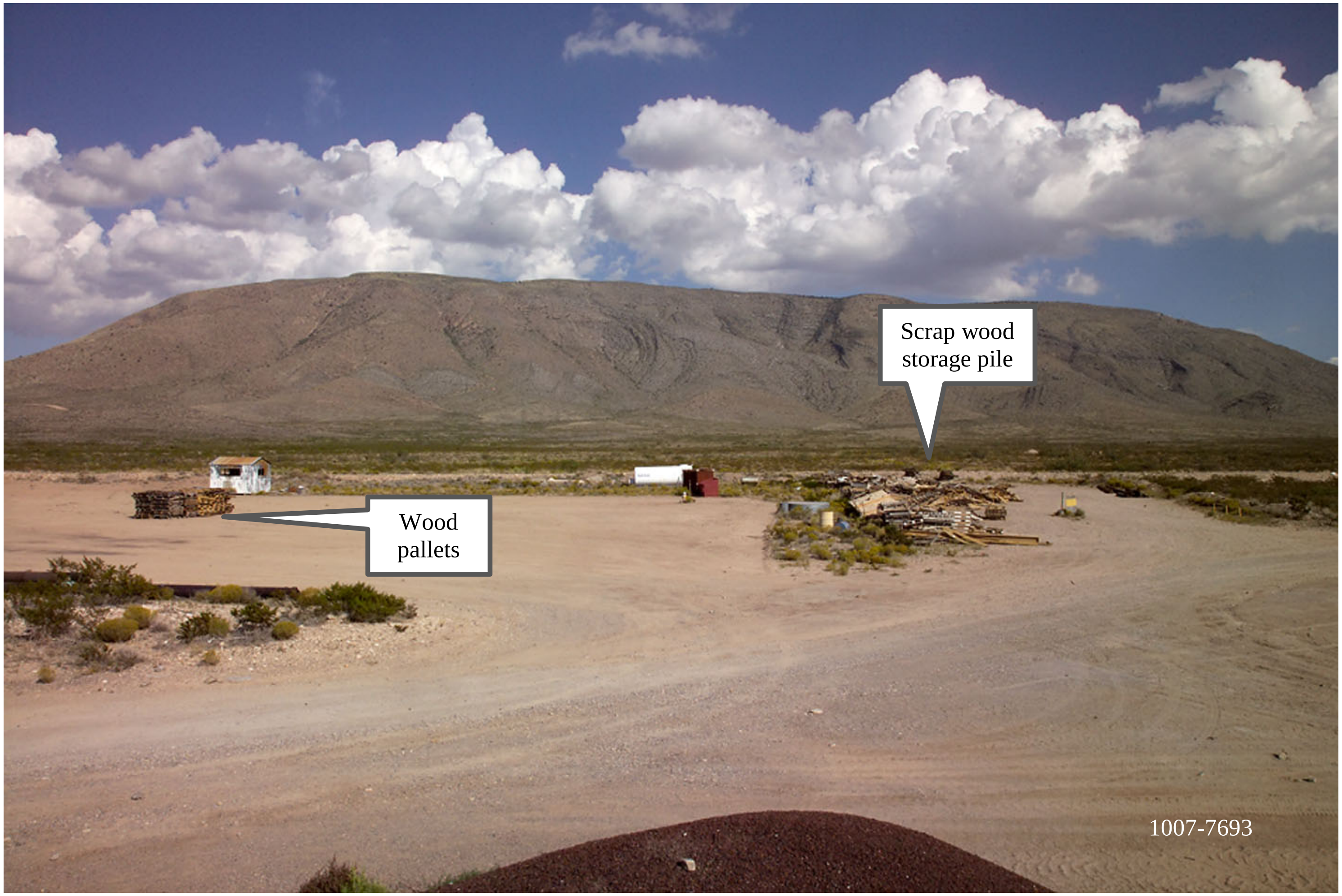
Figure B.24 WSTF Fire Department Car Rescue Training (2005) – view to the east

This photograph shows the WSTF FD practicing rescuing personnel from a car in October 2005.

Figure B.25 **100 Area (2006) – view to the east**

This photograph shows the 100 Area in June 2006. Notice there is a rusted or burned smoke trailer, an additional metal building, remains of large wood fires, and the scrap wood pile located in the area. Also notice the former 100 container storage area still contains construction rock, but is also used for storing large gas canisters.

Figure B.26 **FD Training Area Fire Preparations (2007) – view to the east**



This photograph shows the FD training area with a wood pile of pallets stacked up to the north in preparation to conduct the last known live fire training at WSTF in October 2007.

Figure B.27 Last WSTF Live Training Fire (2007) – view to the northeast

This photograph shows the last live training fire conducted at WSTF (October 2007).

Figure B.28 Fire Extinguishing (2007) – view to the northwest

This photograph shows the WSTF FD extinguishing the last live training fire conducted at WSTF using water only.

Appendix C
Analytical Data

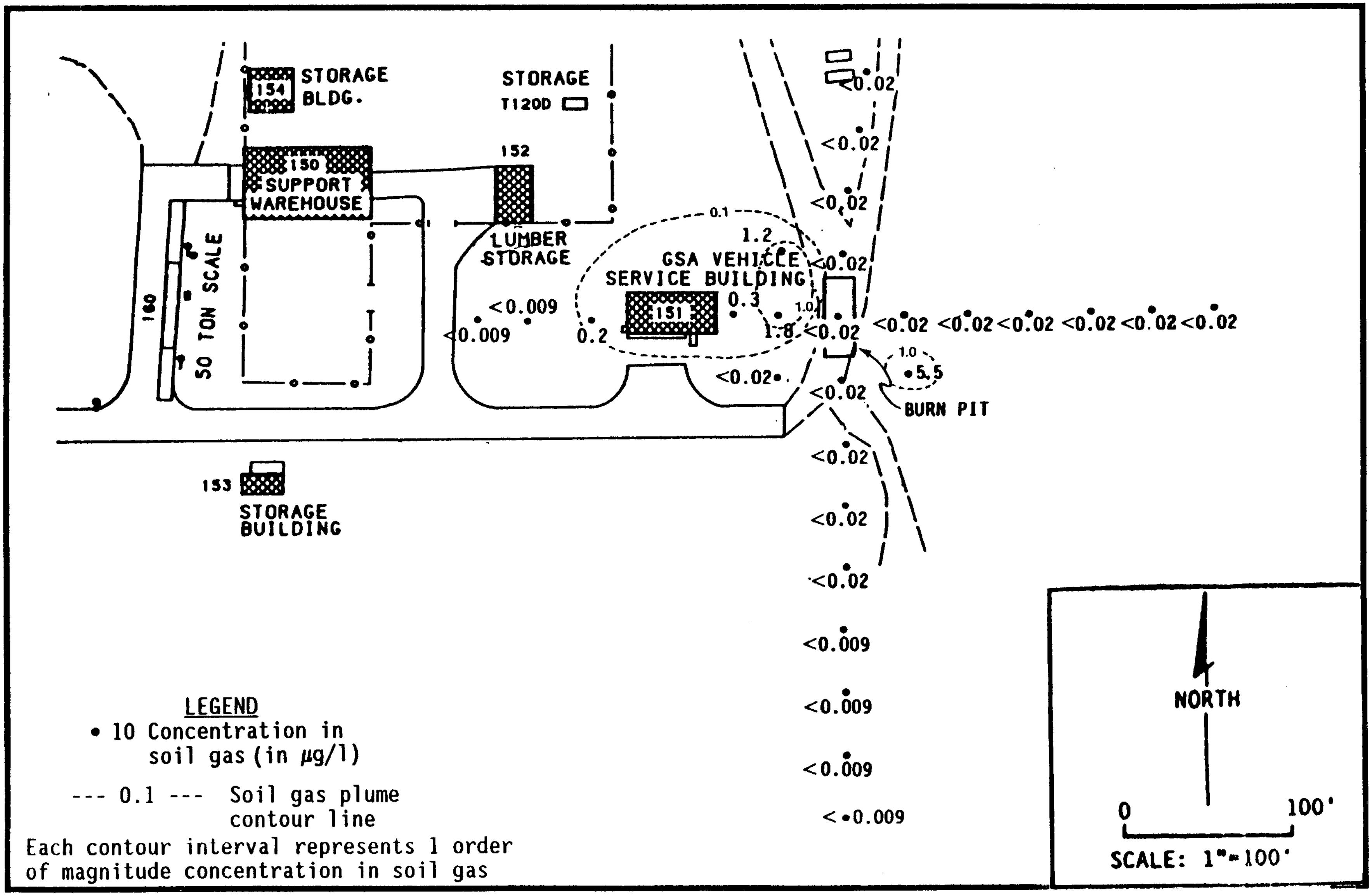


FIGURE 8-9

100 AREA BURN PIT
BENZENE CONCENTRATIONS (in µg/l)

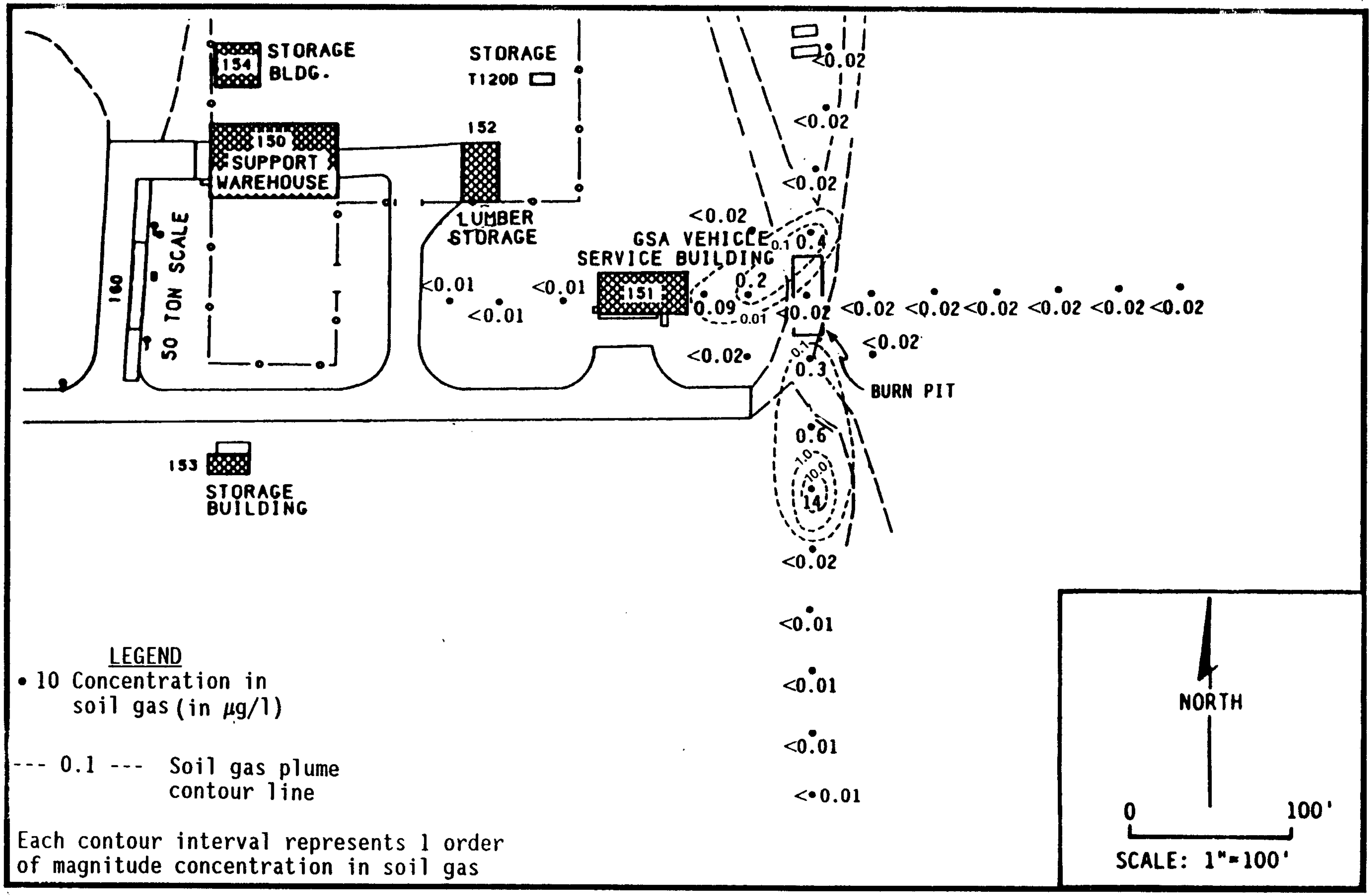


FIGURE 8-10

100 AREA BURN PIT
TOLUENE CONCENTRATIONS (in µg/l)

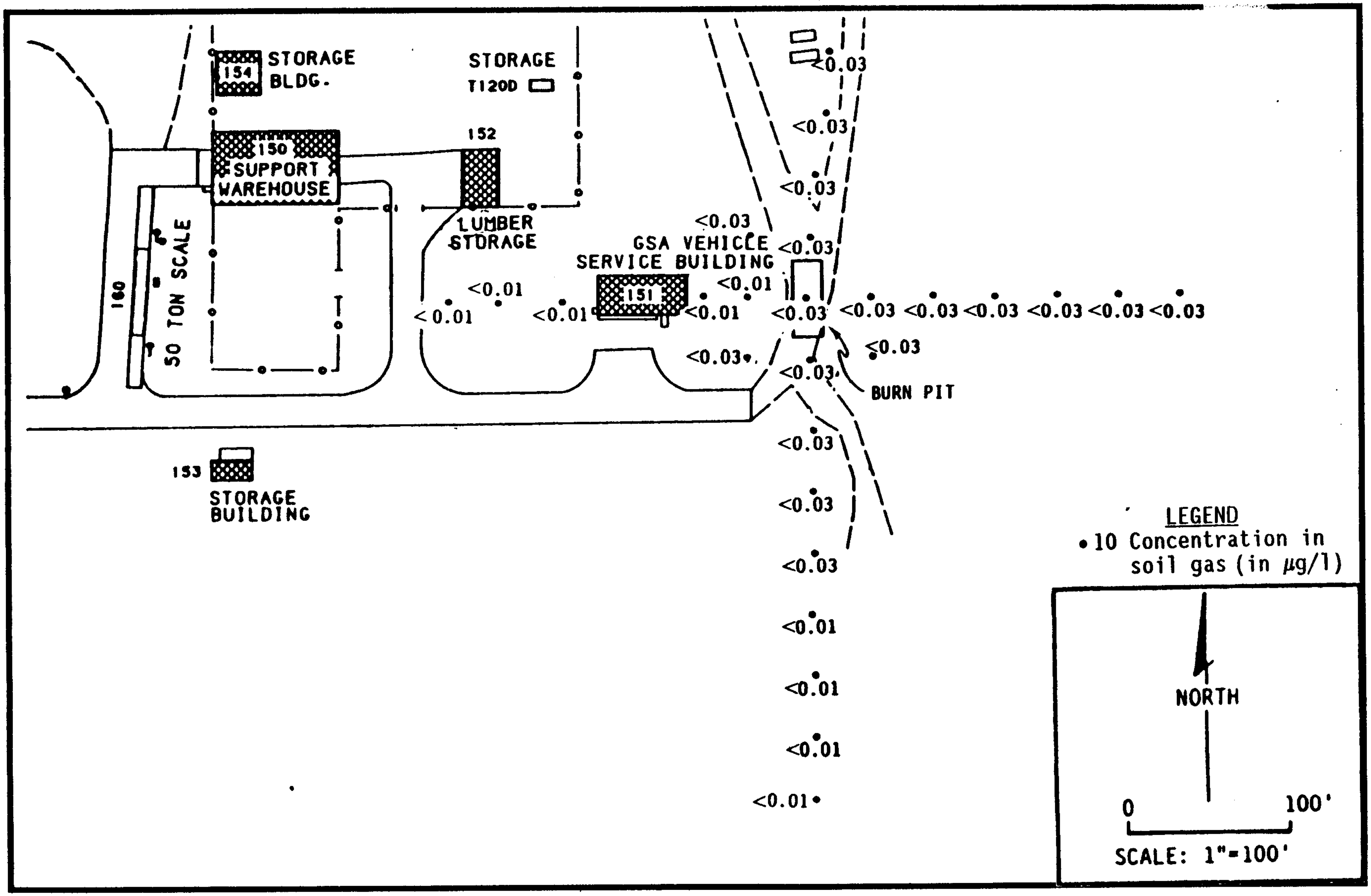


FIGURE 8-11

100 AREA BURN PIT
ETHYL BENZENE CONCENTRATIONS (in µg/l)

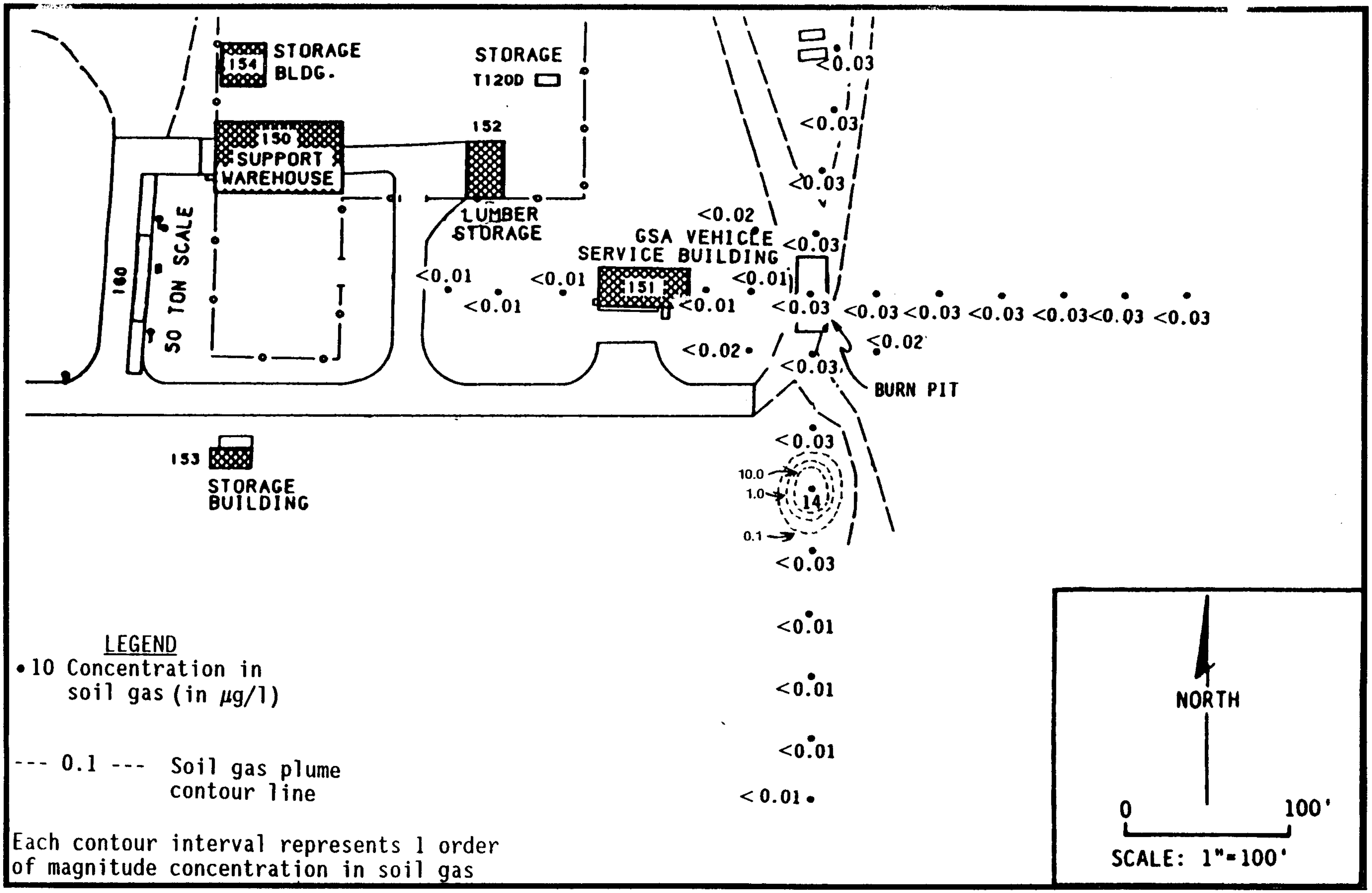


FIGURE 8-12

100 AREA BURN PIT
XYLENE CONCENTRATIONS (in μg/l)

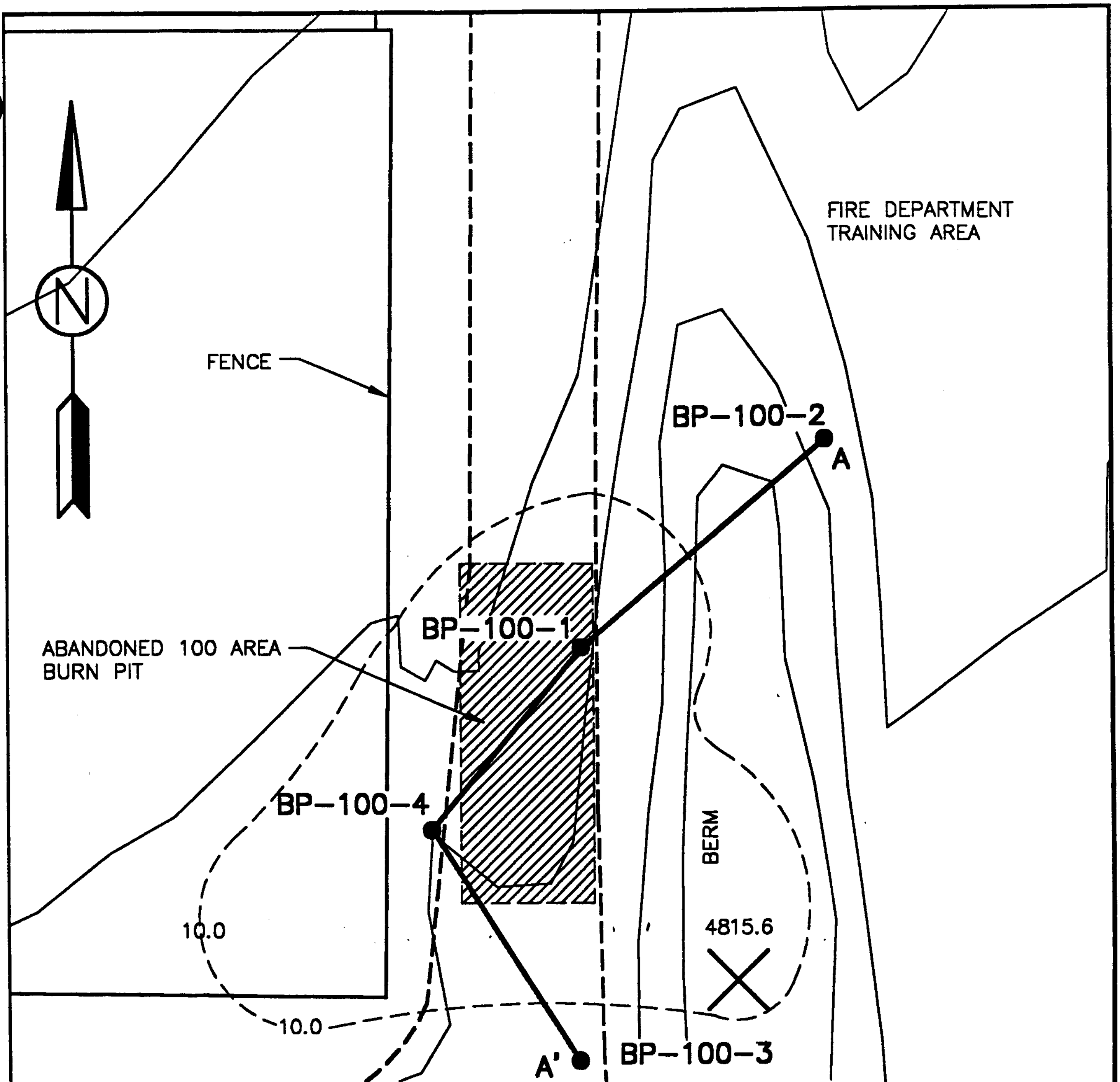


FIGURE 4.2
LOCATION OF PHASE II 100 AREA BURN PIT SOIL BORINGS AND CROSS-SECTION

1589

LEGEND:

●	PHASE II SOIL BORING
10.0	SOIL GAS CONTOUR WITH TOTAL HYDROCARBON CONCENTRATIONS (UG/L)
A–A'	LOCATION OF CROSS-SECTION

SCALE: 1"=30'

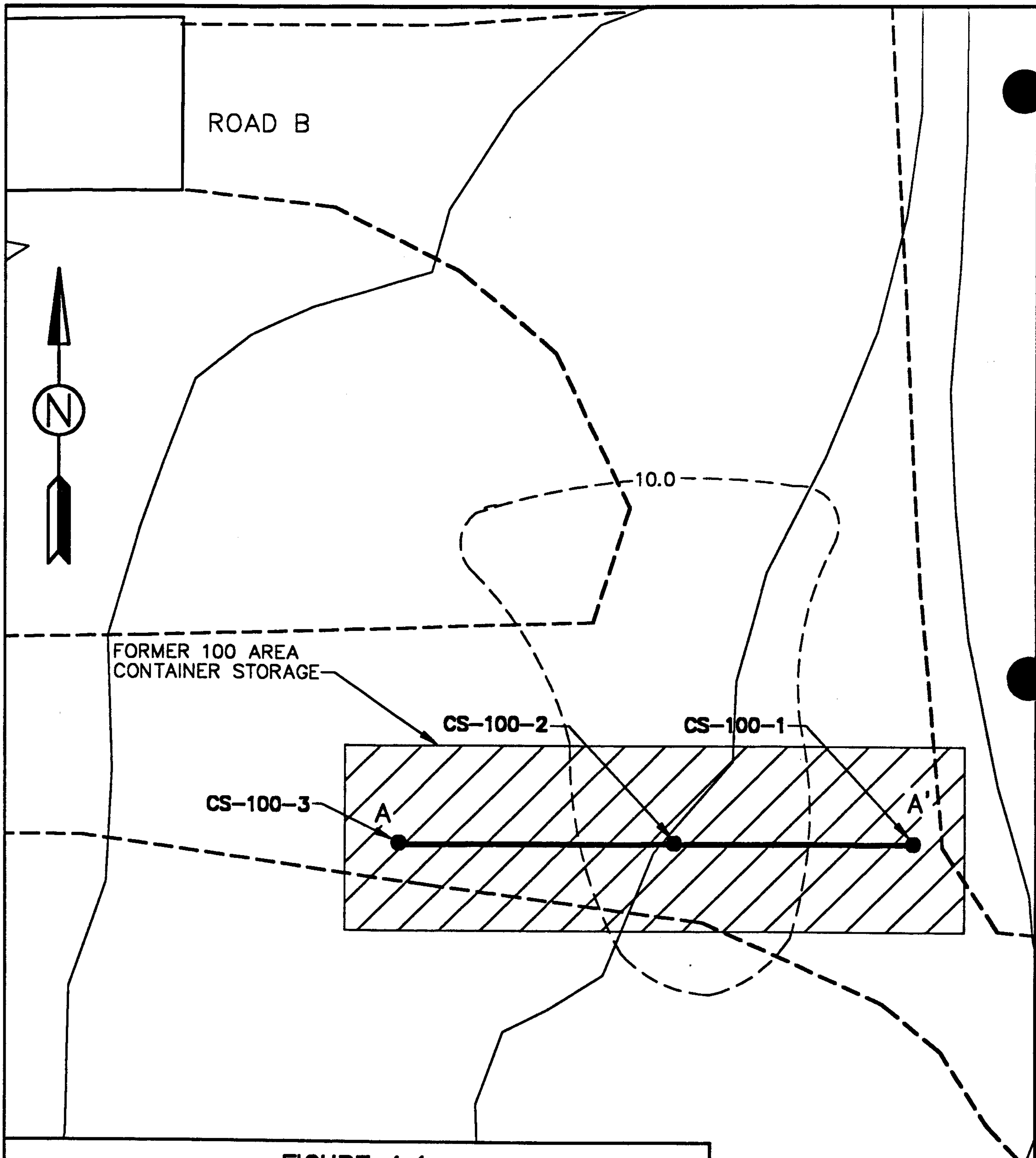


FIGURE 4.4
LOCATION OF PHASE II 100 AREA CONTAINER STORAGE SOIL BORINGS AND CROSS-SECTION

LEGEND:

FILE: 1646

● PHASE II SOIL BORING

10.0 SOIL GAS CONTOUR WITH TOTAL HYDROCARBON CONCENTRATIONS (UG/L)

A–A' LOCATION OF CROSS-SECTION

SCALE: 1"=20'

TABLE 3.3 - PHASE II 100 AREA BURN PIT SOIL RCRA METALS SUMMARY

SOIL BORING	DEPTH (ft)	SAMPLE NUMBER	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Cr (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	Se (mg/kg)	Ag (mg/kg)
BP-100-1: Located within 100 Area Burn Pit										
BP-100-1	0	9410040955	ND	92	1.0	ND	6	0.1	ND	ND
BP-100-1	5	9410041050	40	112	1.4	ND	ND	ND	30	ND
BP-100-1	5+	9410041052	ND	123	0.7	1	ND	ND	ND	1
BP-100-1	15	9410041510	5	102	1.1	ND	ND	ND	ND	ND
BP-100-1	25	9410041550	7	61	ND	ND	6	ND	ND	1
BP-100-1	30	9410041553	5	24	0.7	ND	5	ND	ND	1
BP-100-2: Located 60 Feet NE of 100 Area Burn Pit										
BP-100-2	0	9410050841	ND	96	0.5	2	ND	ND	ND	ND
BP-100-2	5	9410051245	ND	111	ND	4	6	ND	ND	ND
BP-100-2	15	9410051000	ND	46	ND	2	ND	ND	30	ND
BP-100-2	20	9410051033	5	95	0.7	5	6	ND	ND	1
BP-100-2	20+	9410051036	ND	50	0.6	5	6	ND	ND	ND
BP-100-2	25	9410051428	5	46	0.8	7	7	ND	ND	ND
BP-100-2	30	9410051443	ND	41	0.5	8	6	ND	ND	ND
BP-100-3: Located 35 Feet S of 100 Area Burn Pit										
BP-100-3	0	9410060945	14	93	ND	14	5	ND	ND	ND
BP-100-3	5	9410061509	ND	79	ND	13	ND	ND	ND	1
BP-100-3	5+	9410061510	12	60	ND	13	5	ND	ND	ND
BP-100-3	10	9410061537	ND	139	0.7	12	ND	ND	30	ND
BP-100-3	15	9410061042	7	81	ND	8	ND	ND	ND	ND
BP-100-3	20	9410061148	ND	69	ND	9	5	0.1	ND	5
BP-100-3	25	9410061322	10	90	ND	10	ND	ND	ND	2
BP-100-3	30	9410061355	ND	287	ND	15	6	ND	20	
BP-100-4: Located 5 Feet W of 100 Area Burn Pit										
BP-100-4	0	9410070935	7	85	0.7	15	18	ND	ND	ND
BP-100-4	5	9410071004	ND	57	0.8	11	7	ND	ND	ND
BP-100-4	10	9410071040	ND	46	0.6	19	10	ND	10	2
BP-100-4	15	9410071108	ND	83	0.5	9	6	ND	10	ND
BP-100-4	20	9410071242	ND	66	0.5	11	7	ND	ND	4
BP-100-4	25	9410071320	ND	47	ND	10	ND	ND	ND	ND
BP-100-4	30	9410071400	6	105	0.5	14	14	ND	ND	ND

Notes:
ND - Not Detected.
Detection limits are:

Arsenic	5.0 mg/kg
Barium	1.0 mg/kg
Cadmium	0.5 mg/kg
Chromium	1.0 mg/kg
Lead	5.0 mg/kg
Mercury	0.1 mg/kg
Selenium	10.0 mg/kg
Silver	1.0 mg/kg

+ QA/QC Duplicate.

TABLE 3.4 - PHASE II 100 AREA BURN PIT SOIL ORGANICS SUMMARY

			Method 8240			Method 8270			
SOIL BORING	DEPTH (ft)	SAMPLE NUMBER	METHYLENE CHLORIDE (µg/kg)	ACETONE (µg/kg)	TOLUENE (µg/kg)	BUTYL BENZYL PHTHALATE (µg/kg)	BIS(2-ETHYLHEXYL) PHTHALATE (µg/kg)	DI-N-BUTYL PHTHALATE (µg/kg)	DIETHYL PHTHALATE (µg/kg)
BP-100-1: Located within 100 Area Burn Pit									
BP-100-1	0	9410040955	ND	ND	ND	ND	ND	ND	ND
BP-100-1	5	9410041050	ND	ND	ND	ND	ND	ND	ND
BP-100-1	5+	9410041052	ND	ND	ND	ND	ND	ND	ND
BP-100-1	15	9410041510	ND	ND	ND	ND	380	ND	ND
BP-100-1	20	9410041525	6B	ND	ND	ND	ND	ND	ND
BP-100-1	25	9410041550	ND	ND	ND	ND	ND	ND	ND
BP-100-1	30	9410041553	ND	ND	ND	ND	ND	ND	ND
BP-100-2: Located 60 Feet NE of 100 Area Burn Pit									
BP-100-2	0	9410050841	ND	ND	ND	ND	ND	ND	ND
BP-100-2	5	9410051245	ND	ND	ND	ND	ND	ND	ND
BP-100-2	15	9410051000	ND	ND	ND	ND	ND	ND	ND
BP-100-2	20	9410051033	ND	ND	ND	ND	ND	ND	ND
BP-100-2	20	9410051036	ND	ND	ND	ND	ND	ND	ND
BP-100-2	25	9410051428	ND	ND	ND	ND	ND	ND	ND
BP-100-2	30	9410051443	ND	ND	ND	ND	ND	ND	ND
BP-100-3: Located 35 Feet S of 100 Area Burn Pit									
BP-100-3	0	9410060945	9	310	ND	ND	ND	ND	ND
BP-100-3	5	9410061509	ND	740	ND	ND	ND	ND	ND
BP-100-3	5+	9410061510	ND	440	ND	ND	ND	ND	ND
BP-100-3	10	9410061537	ND	ND	ND	ND	ND	ND	ND
BP-100-3	15	9410061042	8	650	ND	ND	ND	ND	ND
BP-100-3	20	9410061148	ND	730	ND	ND	ND	ND	ND
BP-100-3	25	9410061322	31B	ND	ND	ND	ND	ND	ND
BP-100-3	30	9410061355	7	130	ND	ND	ND	ND	ND
BP-100-4: Located 5 Feet W of 100 Area Burn Pit									
BP-100-4	0	9410070935	26B	ND	ND	ND	ND	ND	ND
BP-100-4	5	9410071004	ND	120	ND	ND	ND	ND	ND
BP-100-4	10	9410071040	20B	ND	ND	ND	ND	ND	ND

TABLE 3.4 - PHASE II 100 AREA BURN PIT SOIL ORGANICS SUMMARY (cont.)

			Method 8240			Method 8270			
SOIL BORING	DEPTH (ft)	SAMPLE NUMBER	METHYLENE CHLORIDE (µg/kg)	ACETONE (µg/kg)	TOLUENE (µg/kg)	BUTYL BENZYL PHTHALATE (µg/kg)	BIS(2-ETHYLHEXYL) PHTHALATE (µg/kg)	DI-N-BUTYL PHTHALATE (µg/kg)	DIETHYL PHTHALATE (µg/kg)
BP-100-4	15	9410071108	ND	ND	ND	ND	ND	ND	ND
BP-100-4	20	9410071242	14B	ND	ND	ND	ND	ND	ND
BP-100-4	25	9410071320	11B	ND	ND	ND	ND	ND	ND
BP-100-4	30	9410071400	7B	ND	ND	ND	ND	ND	ND

Notes:
ND - Not Detected.
Detection limits are:

Methylene Chloride	5 µg/kg
Acetone	100 µg/kg
Toluene	5 µg/kg
Butyl Benzyl Phthalate	330 µg/kg
Bis(2-ethylhexyl) Phthalate	330 µg/kg
Di-n-butyl Phthalate	330 µg/kg
Diethyl Phthalate	330 µg/kg

B - Analyte was present in the corresponding method blank.
+ - QA/QC Duplicate.

TABLE 3.5 - PHASE II 100 AREA CONTAINER STORAGE SOIL RCRA METALS SUMMARY

SOIL BORING	DEPTH (ft)	SAMPLE NUMBER	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Cr (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	Se (mg/kg)	Ag (mg/kg)
CS-100-1: Located 35 Feet E of Container Storage Area										
CS-100-1	0	9410080852	ND	90	1.7	14	11	ND	ND	ND
CS-100-1	5	9410080927	12	59	0.5	9	ND	ND	20	ND
CS-100-1	5+	9410080929	19	50	0.7	12	7	ND	ND	ND
CS-100-1	10	9410081008	10	43	ND	8	8	ND	ND	ND
CS-100-1	15	9410081052	ND	69	ND	55	5	ND	ND	ND
CS-100-1	20	9410081452	5	51	0.5	6	5	ND	ND	ND
CS-100-1	25	9410081318	5	954	0.8	8	8	ND	ND	ND
CS-100-1	29.5	9410081403	5	48	1.0	15	11	ND	ND	ND
CS-100-2: Located Within 100 Area Container Storage										
CS-100-2	0	9410090835	ND	87	0.5	5	6	ND	ND	ND
CS-100-2	5	9410090902	5	146	ND	5	5	ND	ND	ND
CS-100-2	10	9410090930	5	70	0.6	7	6	ND	ND	ND
CS-100-2	10+	9410090933	5	63	0.6	7	6	ND	ND	ND
CS-100-2	15	9410091014	ND	26	ND	3	ND	ND	ND	ND
CS-100-2	20	9410091102	ND	45	0.6	5	6	ND	ND	ND
CS-100-2	25	9410091217	ND	28	0.8	7	8	ND	ND	ND
CS-100-2	30	9410091238	5	42	0.6	6	7	ND	ND	ND
CS-100-3: Located 40 Feet W of Container Storage Area										
CS-100-3	0	9410101000	5	70	0.5	5	9	ND	ND	ND
CS-100-3	5	9410101027	5	26	0.5	4	6	ND	ND	ND
CS-100-3	5+	9410101029	15	106	ND	ND	ND	0.1	ND	ND
CS-100-3	10	9410101104	12	74	ND	ND	ND	ND	ND	ND
CS-100-3	15	9410101145	9	37	0.5	ND	ND	0.2	ND	2
CS-100-3	20	9410101318	7	29	0.5	ND	ND	ND	ND	ND
CS-100-3	25	9410101428	5	27	ND	4	ND	ND	ND	ND
CS-100-3	30	9410101505	ND	33	0.9	2	ND	ND	20	ND

Notes:
ND - Not Detected.
Detection limits are:

Arsenic	5.0 mg/kg
Barium	1.0 mg/kg
Cadmium	0.5 mg/kg
Chromium	1.0 mg/kg
Lead	5.0 mg/kg
Mercury	0.1 mg/kg
Selenium	10.0 mg/kg
Silver	1.0 mg/kg

+ - QA/QC Duplicate.

TABLE 3.6 - PHASE II 100 AREA CONTAINER STORAGE SOIL ORGANICS SUMMARY

			Method 8240			Method 8270			
SOIL BORING	DEPTH (ft)	SAMPLE NUMBER	METHYLENE CHLORIDE (µg/kg)	ACETONE (µg/kg)	TOLUENE (µg/kg)	BUTYL BENZYL PHTHALATE (µg/kg)	BIS(2-ETHYLHEXYL) PHTHALATE (µg/kg)	DI-N-BUTYL PHTHALATE (µg/kg)	DIETHYL PHTHALATE (µg/kg)
CS-100-1: Located 35 Feet E of Container Stoage Area									
CS-100-1	0	9410080852	15B	240	ND	ND	ND	ND	ND
CS-100-1	5	9410080927	11B	ND	ND	ND	560	ND	ND
CS-100-1	5+	9410080929	9B	ND	ND	ND	ND	ND	ND
CS-100-1	10	9410081008	11B	ND	ND	ND	ND	ND	ND
CS-100-1	15	9410081052	12B	ND	ND	ND	ND	ND	ND
CS-100-1	20	9410081452	ND	ND	ND	ND	ND	ND	ND
CS-100-1	25	9410081318	ND	ND	ND	ND	ND	ND	ND
CS-100-1	29.5	9410081403	ND	ND	ND	ND	ND	ND	ND
CS-100-2: Located Within 100 Area Container Storage									
CS-100-2	0	9410090835	6	ND	ND	ND	ND	ND	ND
CS-100-2	5	9410090902	ND	ND	ND	ND	3000	ND	ND
CS-100-2	10	9410090930	ND	ND	ND	ND	ND	ND	ND
CS-100-2	10+	9410090933	6	ND	ND	ND	ND	ND	ND
CS-100-2	15	9410091014	ND	ND	ND	ND	ND	ND	ND
CS-100-2	20	9410091102	ND	ND	ND	ND	ND	ND	ND
CS-100-2	25	9410091217	ND	ND	ND	ND	ND	ND	ND
CS-100-2	30	9410091238	ND	ND	ND	ND	ND	ND	ND
CS-100-3: Located 40 Feet W of Container Storage Area									
CS-100-3	0	9410101000	8	ND	ND	ND	ND	ND	ND
CS-100-3	5	9410101027	ND	ND	ND	ND	ND	ND	ND
CS-100-3	5+	9410101029	5B	ND	ND	ND	ND	ND	ND
CS-100-3	10	9410101104	6B	ND	ND	ND	ND	ND	ND
CS-100-3	15	9410101145	ND	ND	ND	ND	ND	ND	ND
CS-100-3	20	9410101318	ND	ND	ND	ND	ND	ND	ND
CS-100-3	25	9410101428	ND	ND	ND	ND	ND	ND	ND
CS-100-3	30	9410101505	ND	ND	ND	ND	ND	ND	ND

Notes:
ND - Not Detected.
Detection limits are:

Methylene Chloride	5 µg/kg
Acetone	100 µg/kg
Toluene	5 µg/kg
Butyl Benzyl Phthalate	330 µg/kg
Bis(2-ethylhexyl) Phthalate	330 µg/kg
Di-n-butyl Phthalate	330 µg/kg
Diethyl Phthalate	330 µg/kg

B - Analyte was present in the method blank as well as in the sample.
+ - QA/QC Duplicate.

Facility area: 100
Work area: 150 YARD
Responsible area: 40-51
Name of waste generated: DIESEL & WATER
Process Description: DIESEL AND WATER WITH SOME SOAP IN DRUMS. HAS BEEN IN 150 YARD FOR YEARS.

Waste Characteristics:
Description: LIQUID pH -0- Spec. grav. -0- FP -0-
Quantity generated yearly: -0-
MSDS #, or attach copy: -0-
Task order: UK
Hazard clasification: 1
Non-hazardous waste disposal method: N/A

The following information is only completed if the waste is hazardous

Waste handling, pt. of gen: N/A
Is waste stored in a satellite area: NO
Describe the satellite area: N/A
EPA waste ID numbers? -0-
Is the waste stored elsewhere onsite? YES
Storage unit: HW TANKER
Unit location: 200 AREA
Is the waste recycled? NO
Hazardous waste disposal method: INCINERTION
Facility name: ROLLINS/DEER PARK TX
Comments: -0-

Entered 3/8/88 KJS

Review Date ______________ Waste Stream ID No. 10-99-~~08~~ 07

WHITE SANDS TEST FACILITY
INDIVIDUAL WASTE STREAM PROFILE

KNOWLEDGEABLE AREA REPRESENTATIVE:

A. Facility area: 100

RESP. AREA: 40.51

B. Work area: 150 YARD

C. Name of waste stream generated: DIESEL + WATER

D. Describe the process(es) and the associated chemicals involved in the generation of this waste:

DIESEL + WATER w/ SOME SOAP IN DRUMS HAS BEEN IN 150 YARD FOR YEARS

E. Project name generating waste stream (if applicable):

UK

F. Task order associated with waste stream (if applicable):

UK

G. Waste Characteristics:

1. Physical state (liquid, solid, gas, slurry, sludge):

   LIQUID

2. Quantity generated yearly? 100 GAL 1 TIME

3. Is a chemical analysis or MSDS available? Which? MSDS #?

   ATTACHED

H. How is the waste handled at point of generation?

1. Describe the storage unit (container, tank, impoundment):

N/A

2. Unit location: ______

3. Size of unit: ______

4. Material of construction: ______

5. If a tank, is it aboveground or underground? ______

I. Is the waste stored temporarily in a satellite accumulation area? NO

If yes, describe the area and length of time the waste is stored here: N/A

J. Is the waste treated prior to temporary storage? ______

If yes, describe the treatment and applicable treatment units:

______

Form Completed By 3/8/88

Area Supervisor Joseph B. Horsley 3/8/88

Date

ENVIRONMENTAL SECTION REPRESENTATIVE:

K. Is the waste hazardous or non-hazardous? HAZ /
IGNITABLE

L. Is the waste stored elsewhere onsite prior to shipment off site or for onsite disposal? ~~NO~~ YES

If yes, describe the storage area:

1. Storage unit (container, tank, etc.): HW TANKER
2. Unit location: 200 AREA
3. Size of unit: 6000 GAL
4. Material of construction: SS
5. If a tank, is it above or underground? N/A

M. Is the waste recycled? NO

If no, is there a potential for recycling? NO

N. Is the waste disposed of onsite? NO

If yes, describe the disposal method.

1. Disposal method(thermal flare, sewer discharge, landfill): N/A
2. Flow rate(s):
3. Continuous or batch?

O. Offsite disposal of wastes (landfill, incineration, etc.)

1. Disposal method: INCINERATION
2. Frequency of transport/disposal: MONTHLY
3. Facility name/EPA ID No.: ROLLINS
4. Facility location: N/A
5. Associated costs for offsite transport and disposal:

P. Are there any wastes on site that could be incompatible with this waste stream? Describe:

STRONG OXIDIZERS

Q. Will changes in the mission affect waste management (e.g., increase or decrease in waste generated, change in characteristic)? N/A

R. Is this wasted stream a candidate for waste minimization?

If so, how?

S. Have there been changes in regulations which call for changes in the management of this waste stream? ______ Yes ______ No

If yes, what changes?

T. Other comments (e.g., PCB storage):

Environmental Section

3/8/88

Date

JBH 3/8/88

LABORATORY WORK ORDER

REQUESTED BY	NEED DATE	PRIORITY	W.O. NUMBER	T & D RECEIVED
Jim Henderson			659288	

ORGANIZATION	PHONE	PROMISED DATE	TASK NUMBER	T & D COMPLETED
LEMSCO	x 464		932 - JAE - 00	

SUPERVISOR	WORK CONTACT	PHONE	LABORATORY FILE NUMBER	DOCUMENTATION (1)
P. Pasche			659288	

DELIVERED TO Ben Greene	LAB (1)	HOURS	LAB (3)	HOURS	DOCUMENTATION (2)
DATE DELIVERED 2 - 24 - 88	LAB (2)	HOURS	LAB (4)	HOURS	DOCUMENTATION (3)

BRIEF DESCRIPTION (MFR - MODEL - SER. NO.) (IDENTIFY IF CHEMICAL/METALLIC ETC.)

COMMENTS

SERVICES REQUESTED

1. Surfactants (?)
2. TOC (?)
3. Need identification of constituents in order to ship to waste facility. Possibly aqueous phase.
4. pH

CHEM & MET. LABS ONLY

APPLICABLE SPECS	SAMPLE TAKEN FROM	TPS NO.
	Mystery Drum 150 yard	2-HWM-106

ADDITIONAL COMMENTS

SAMPLE RECEIVED BY | DATE | TIME

ITEM	LABORATORY OPERATION OR COMMENTS	TECH	QA	OTHER
1	Surfactant = 0.04 ug/ml (analysis performed on filtrate)			
2	Sample # 8802241032 TOC = 144 ppm			
4	pH = 7 by pH paper			

REMARKS Surfactant analysis performed on filtrate. Brownish residue smelled of hydrocarbon fuel.

See attached sheet.

RJol 03/02/88

(TECH APPROVED FOR WORK)

WSTF-122

Sample 8802241032 was thoroughly mixed, transferred to separatory funnel and allowed to stand for several hours. Only about two or three percent by volume upper phase was present.

The lower phase was drawn off through a glass wool plug and identified as water by FTIR and confirmed by Karl Fisher titration. The upper phase was present as an emulsion with a reddish brown solid. This emulsion was broken by gentle heating. The liquid portion was identified as a hydrocarbon by FTIR. A crude boiling point of 200 deg C was measured. These results indicate that the upper phase is probably diesel fuel or JP5 aviation fuel. A summary of the boiling points of several possible hydrocarbons are listed below for comparison.

FUEL	BOILING RANGE (Deg. C)
Kerosene	175 to 325
Diesel	150 to 270
JP4	100 to 205
JP5	198 to 245

No attempt was made to determine the composition of the reddish brown solid, it was assumed to be rust from inside the storage drum.

Karl Fisher on lower phase → > 70 % H_2O

Reviewed by: Bo Greene 3/02/88

Approved by: R. P. Joh 03/02/88

10-19-07

PRELIMINARY DRAFT

13. TPS No. 2-HWM-106 Lab Log # 659288

Mystery WASTE Drum

Samples were collected February 24, 1988; pending from USPCI.

Table 1. Waste Mystery Drum Analysis

Parameter	Level	Units
Methylene chloride	60	mg/kg[1]
TF Freon	130	mg/kg[1]
Surfactant	0.04	ug/mL
TOC	144	ug/mL
TCE, Oil, MEK		
Hg, Cr, Be	Pending RMAL Analysis???	

1 Because the components detected are at or near the minimum detectable limit for this analytical method concentrations are approximate.

---

14. TPS No. 2-HWM-099 Lab Log # 659177

BTX, Cr & Se in 600 Area Wells

PRELIMINARY

Report completed and transmitted 3/10/88; however, NO additional samples were ever taken for chromium(VI) analysis on NASA # 8 which had 2.8 mg/L of total chromium. Cr(VI) holding time is 24 hours.

---

15. TPS No. 2-HWM-096 Lab Log # 659178

BLM-2, JP-1, 300B, and WW-1

Report complete and transmitted 3/16/88.

---

16. TPS No. 2-HWM-092 Lab Log # 659165

200 Area Tanker

Report complete and transmitted 2/17/88.

---

17. TPS No. 2-HKM-53R Lab Log # None

Waste Tanker for 200 Area

No chemical analysis required to monitor levels and weights of shipment.

BKE-21 [STATUS.APR]

PRELIMINARY DRAFT

LABORATORY WORK ORDER

REQUESTED BY	NEED DATE	PRIORITY	W.O. NUMBER	T & D RECEIVED
Sheeley 2)K4Bul.				

ORGANIZATION	PHONE	PROMISED DATE	TASK NUMBER	T & D COMPLETED
Lemsco			032JAE0C	

SUPERVISOR	WORK CONTACT	PHONE	LABORATORY FILE NUMBER	DOCUMENTATION (1)
Johnson			659288(B)	

DELIVERED TO	LAB (1)	HOURS	LAB (3)	HOURS	DOCUMENTATION (2)
E. Leroky					

DATE DELIVERED	LAB (2)	HOURS	LAB (4)	HOURS	DOCUMENTATION (3)
3-2-88					

BRIEF DESCRIPTION (MFR - MODEL - SER. NO.) (IDENTIFY IF CHEMICAL/METALLIC ETC.)

MeoH extracts of waste drum sludge

COMMENTS

SERVICES REQUESTED

8240 analysis by direct injection of the following:

8802241115 (A)

1115 (B)

1115 (C)

CHEM & MET. LABS ONLY

APPLICABLE SPECS	SAMPLE TAKEN FROM	TPS NO.
		2-HWM-106

ADDITIONAL COMMENTS

Please analyze each of three. 1115(C) is a blank

SAMPLE RECEIVED BY	DATE	TIME

ITEM	LABORATORY OPERATION OR COMMENTS	TECH	QA	OTHER
	See attached copy for analytical results.			
	3/8/88			

REMARKS

R.P.J. 03/08/88

(TECH APPROVED FOR WORK)

WSTF-122

MOLECULAR ANALYSIS LABORATORY

CHEMICAL ANALYSIS REPORT

Date: Mar. 7, 1988
Lab Log #659288(B)

GC/Mass Spectrometer Analysis of Organic Compounds in Methanol Sludge Extract Sample From Mystery Waste Drum, EPA 8240 Direct Injection Method.

Sample Number	Methylene Chloride mg/kg[a]	TF Freon mg/kg[a]
880224-1115(A)	10	5
880224-1115(B)	10	5
880224-1115(C)	10	5

[a] Because the components detected are at or near the minimum detectable limits for this analytical method, concentrations are approximate.

R.P. J[illegible] 03/08/88

WSTF CHEMICAL - ANALYTICAL REPORT (GENERAL)

PAGE 1 OF

LOG NUMBER 665292

RESULTS OF ANALYSIS OR OTHER INFORMATION

RESULTS

Samples were collected from six drums on January 14, 1986. Three drums could not be opened and were not sampled. Those drums that were sampled were marked with a sample number and analyzed by FTIR. The results of that analysis identified the contents and indicated that water was present to some degree in all samples. The moisture content of each sample was then determined. The results of the analyses are presented below:

ID	CONTENTS
8601141350	IPA containing ~ 50% water
8601141355	IPA containing ~ 0.04% water
8601141400	IPA containing ~ 5% water
8601141405	This drum yielded a two-phase sample. The upper phase was a hydrocarbon liquid, possibly a fuel of some sort containing <0.01% water. The lower phase was ~ 60% water. The balance of this phase in unknown.
8601141410	IPA containing ~ 0.2% water
8601141430	Ethylene glycol containing ~ 42% water

send out

water content used or not

1407 antifreeze

1413 "

work request

ANALYST	APPROVED	DATE
Hall, Szydlowski	R.P. Job	2/13/86

WSTF-293 (9/83)

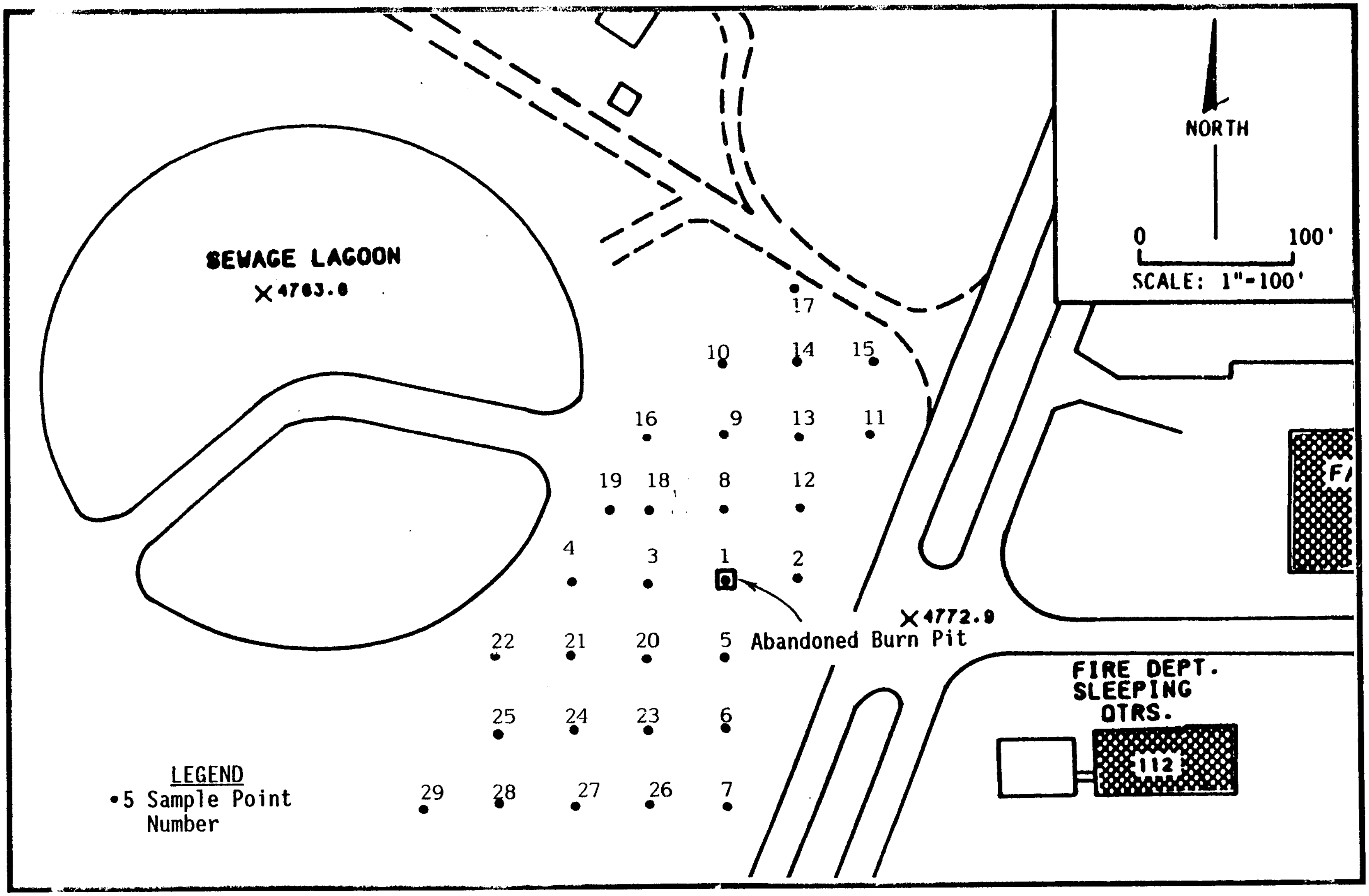


FIGURE 8-25

600 AREA BURN PIT SOIL GAS POINT LOCATION MAP

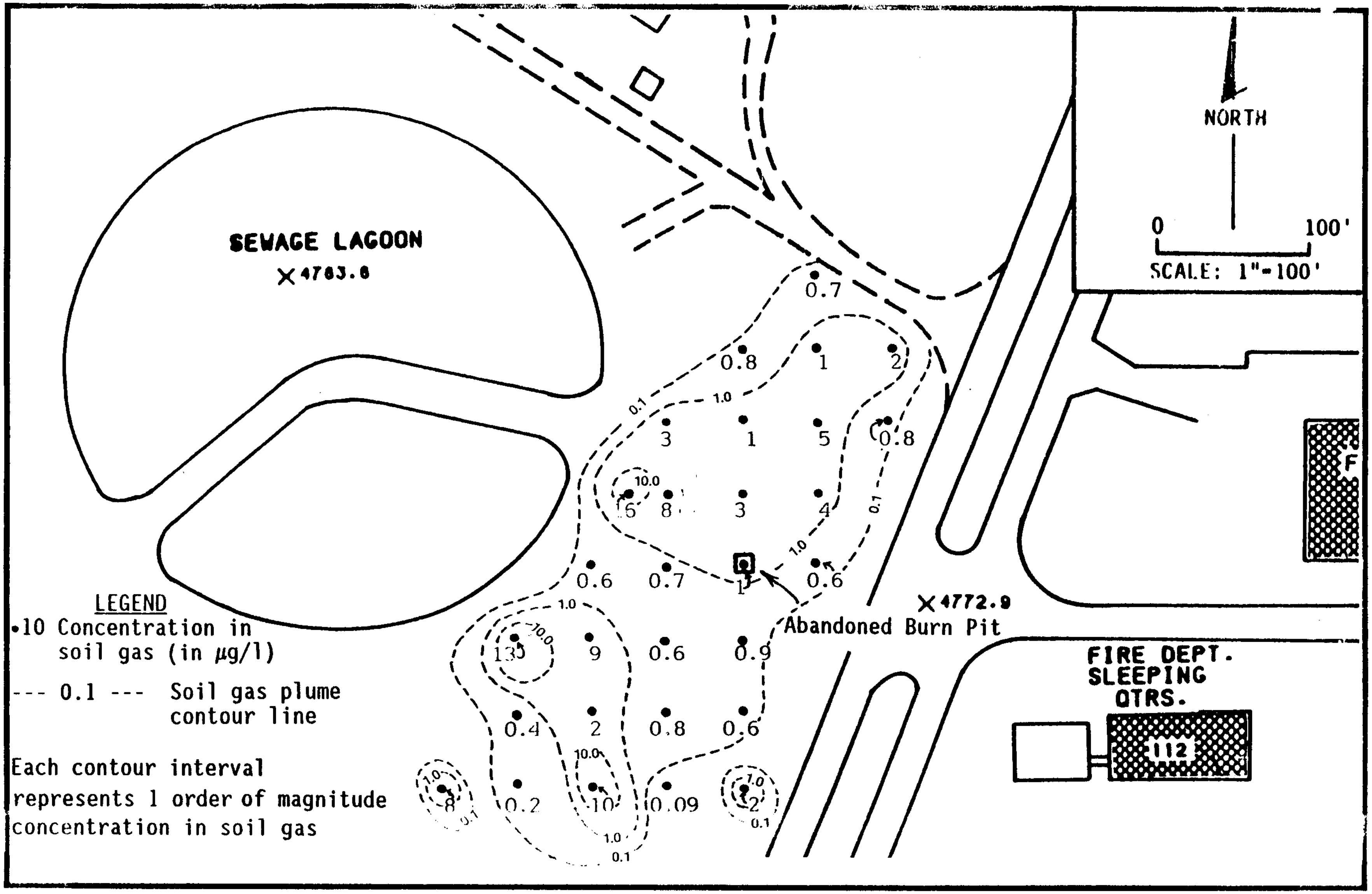


FIGURE 8-26

600 AREA BURN PIT
TOTAL HYDROCARBON CONCENTRATIONS
(in µg/l)

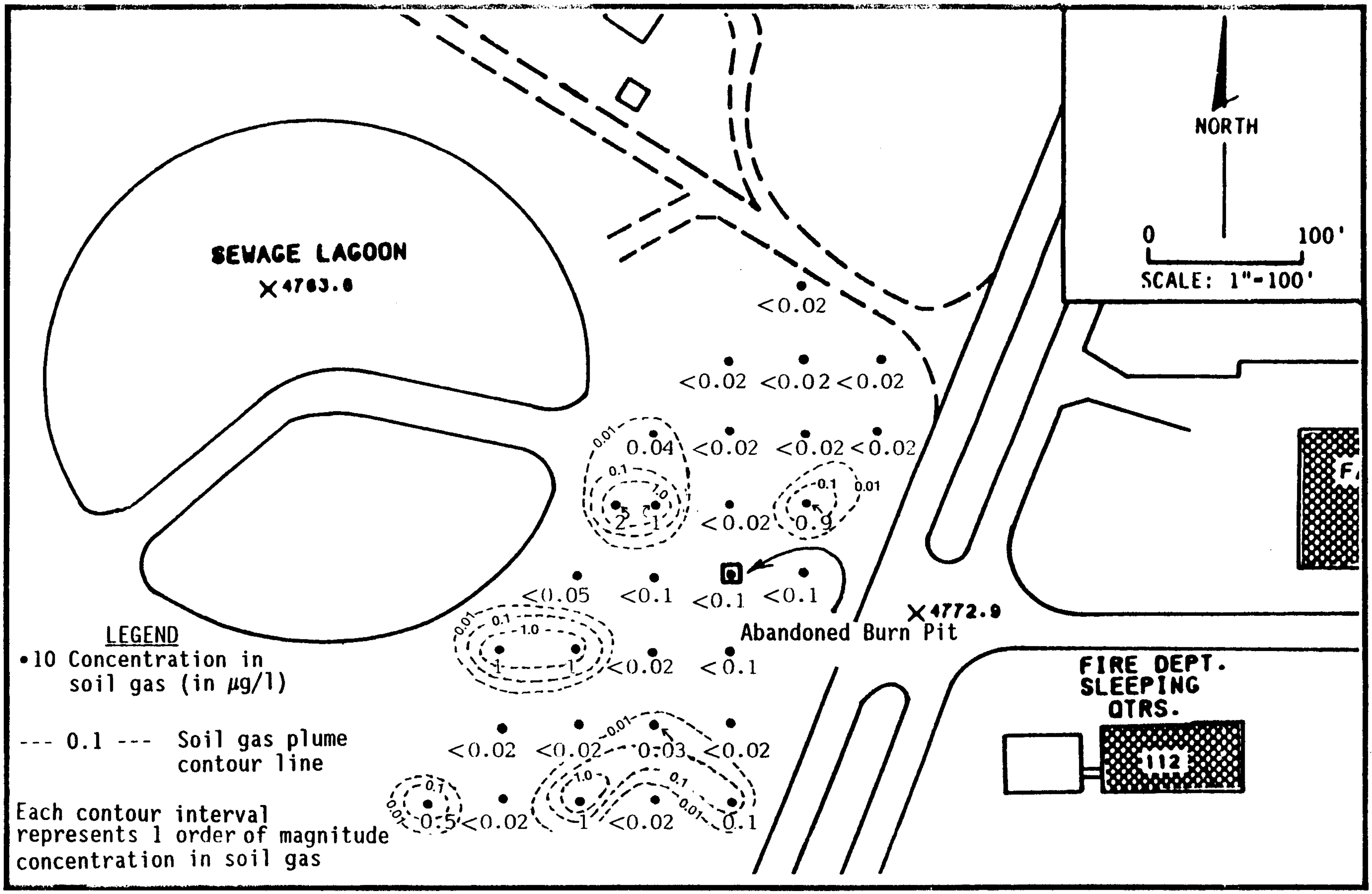


FIGURE 8-27

600 AREA BURN PIT
BENZENE CONCENTRATIONS
(in µg/l)

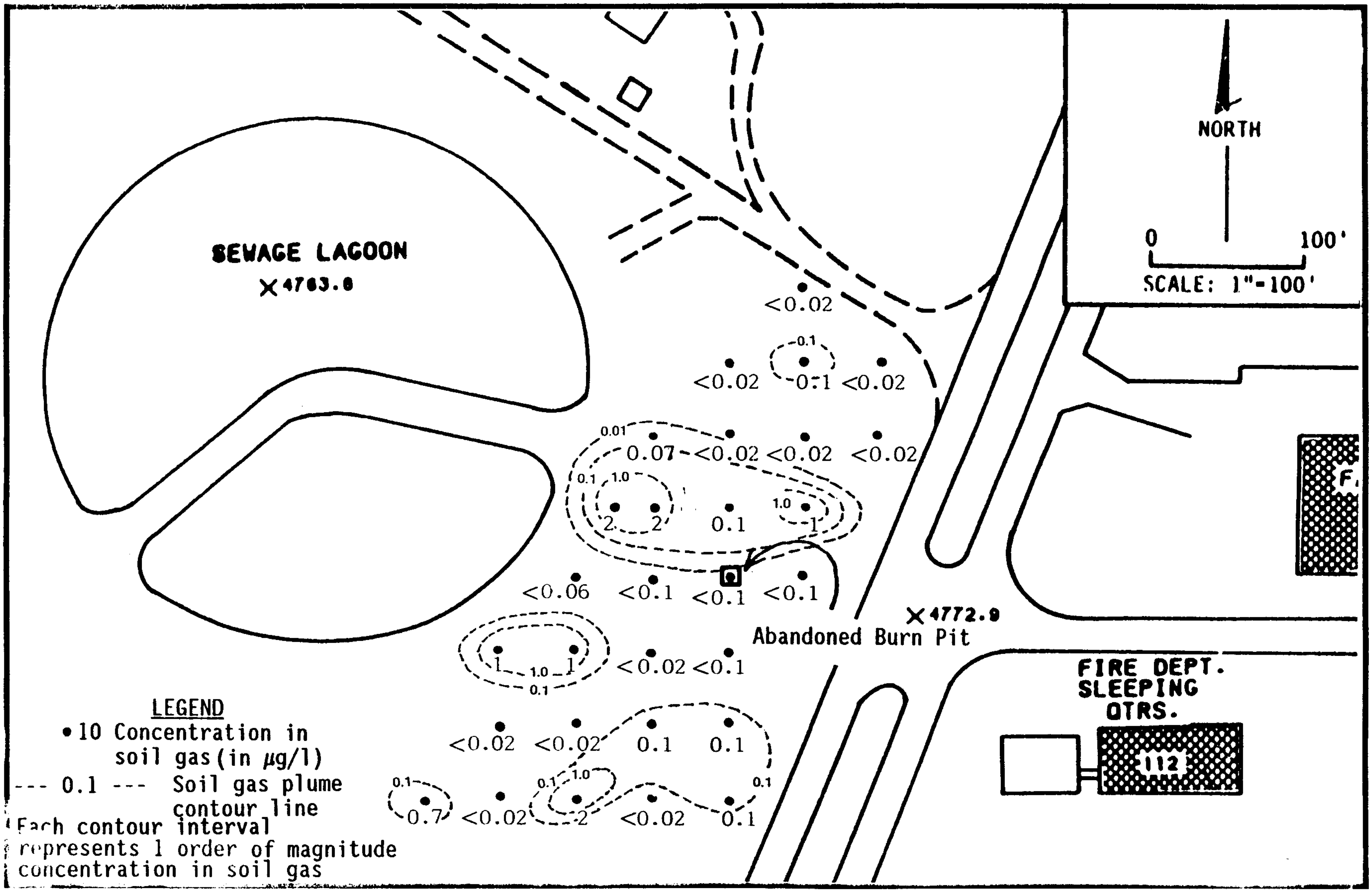


FIGURE 8-28

600 AREA BURN PIT
TOLUENE CONCENTRATIONS (in μg/l)

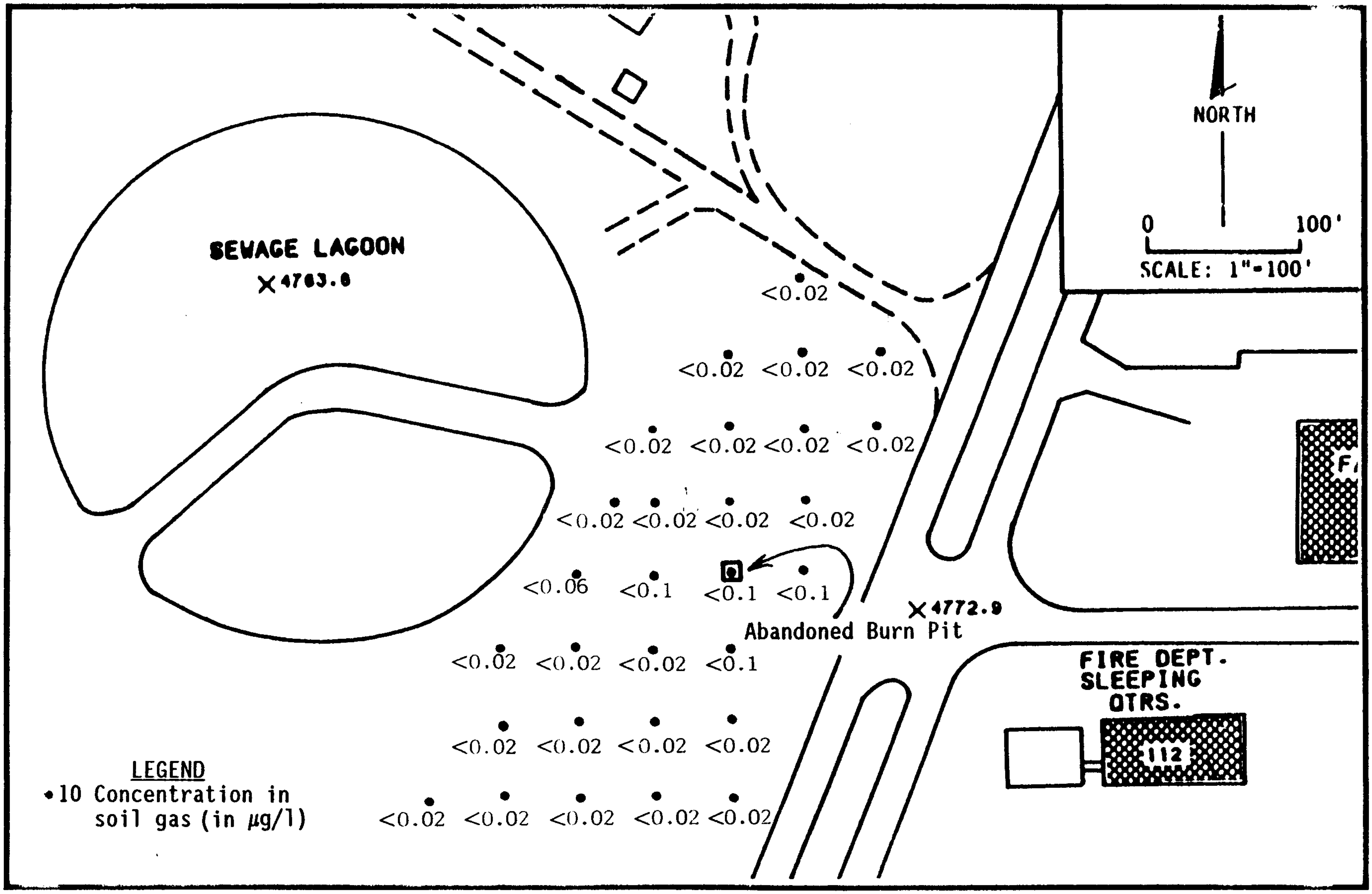


FIGURE 8-29

600 AREA BURN PIT
ETHYL BENZENE CONCENTRATIONS (in µg/l)

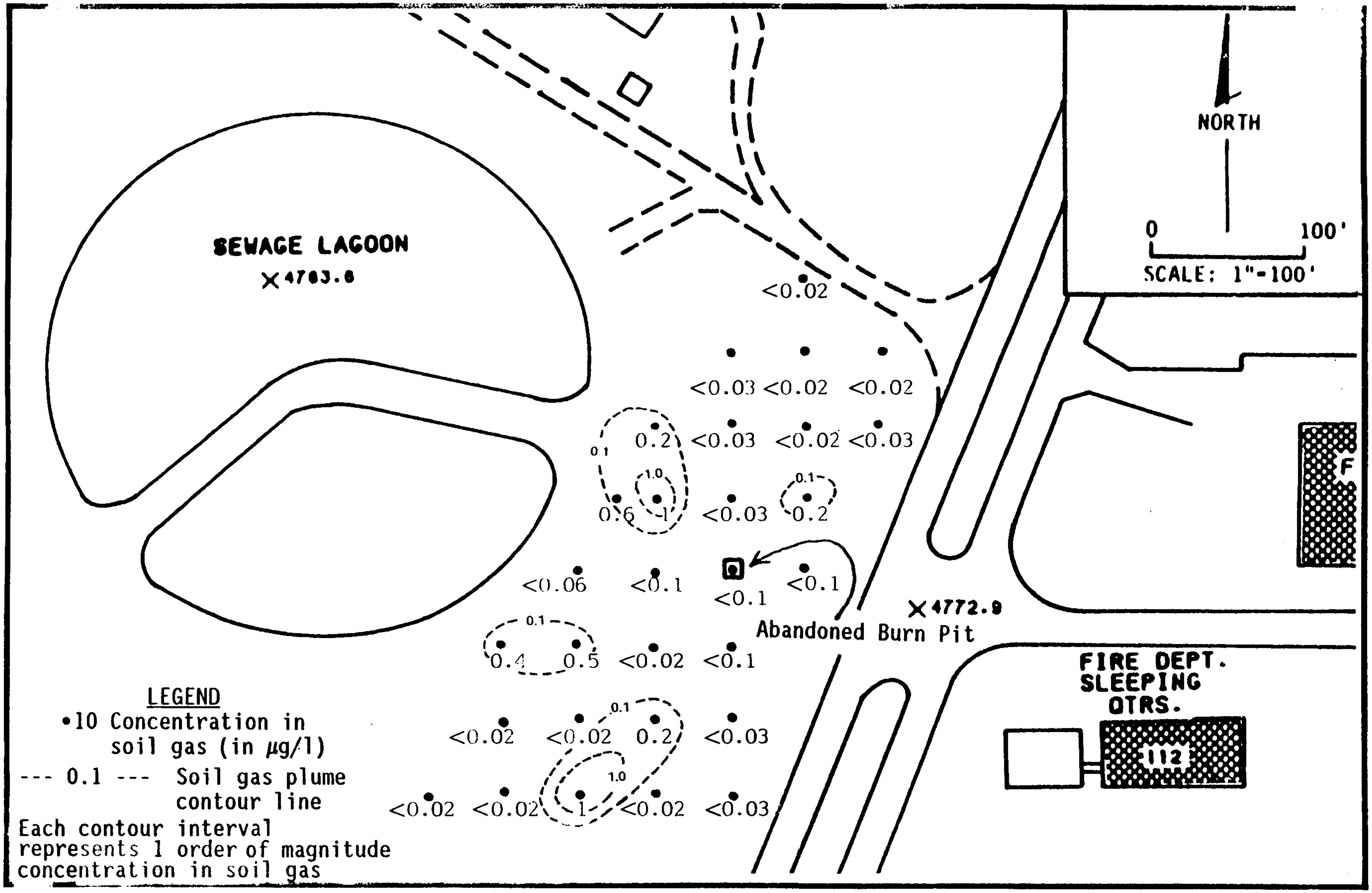


FIGURE 8-30

600 AREA BURN PIT
XYLENE CONCENTRATIONS (in µg/l)

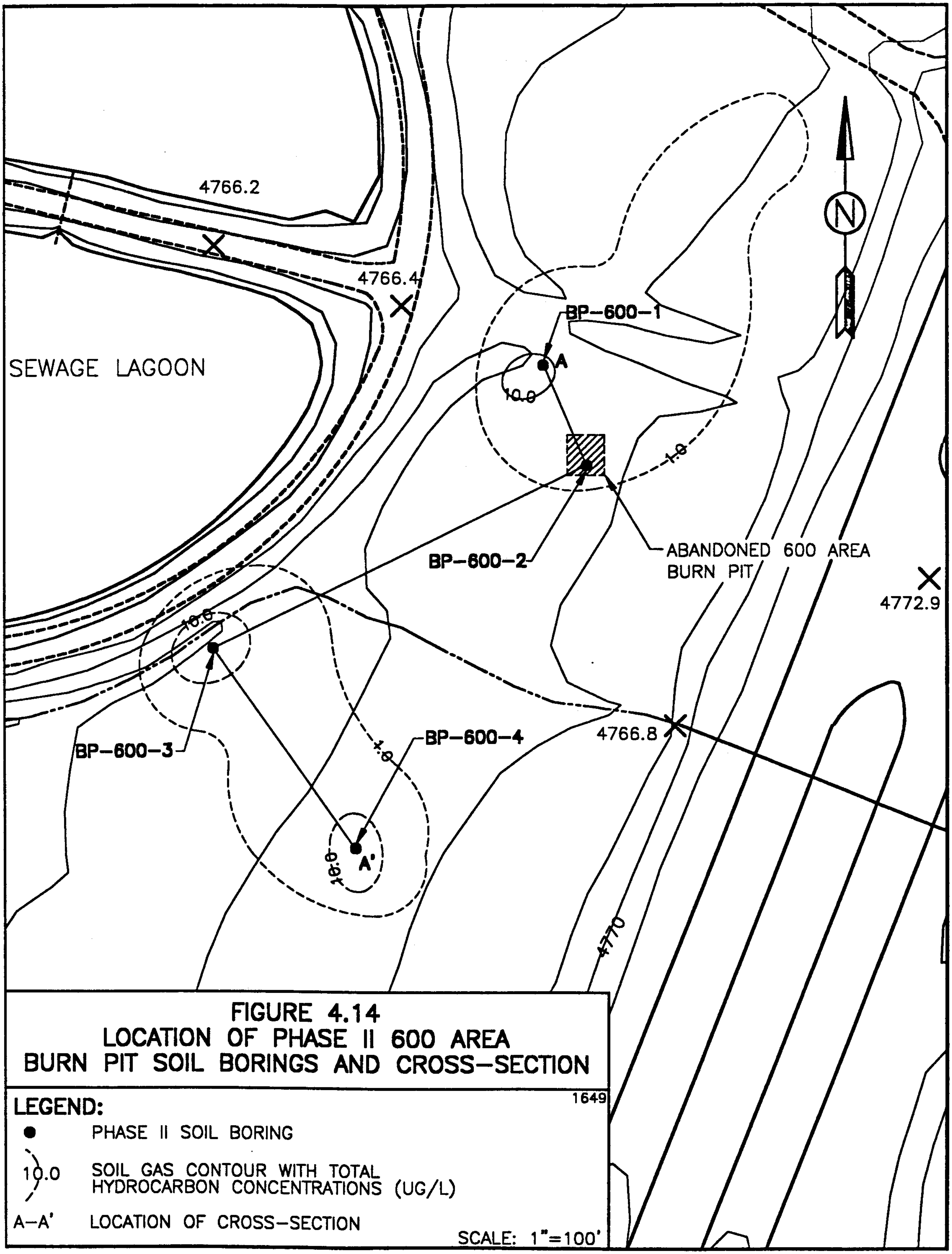


FIGURE 4.14
LOCATION OF PHASE II 600 AREA BURN PIT SOIL BORINGS AND CROSS-SECTION

1649

LEGEND:

● PHASE II SOIL BORING

10.0 SOIL GAS CONTOUR WITH TOTAL HYDROCARBON CONCENTRATIONS (UG/L)

A–A' LOCATION OF CROSS-SECTION

SCALE: 1"=100'

TABLE 3.15 - PHASE II 600 AREA BURN PIT SOIL RCRA METALS SUMMARY

SOIL BORING	DEPTH (ft)	SAMPLE NUMBER	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Cr (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	Se (mg/kg)	Ag (mg/kg)
BP-600-1: Located 60 Feet NNW of 600 Area Burn Pit										
BP-600-1	0	9410210925	ND	96	1.7	11	25	ND	ND	ND
BP-600-1	5	9410210955	ND	55	1.0	4	5	ND	ND	ND
BP-600-1	9	9410211129	ND	27	1.2	5	5	ND	ND	6
BP-600-1	15	9410211248	ND	33	1.7	6	7	ND	ND	ND
BP-600-1	20	9410211537	ND	18	1.3	6	5	ND	ND	ND
BP-600-1	25	9410211405	ND	80	0.7	3	5	ND	ND	ND
BP-600-1	30	9410211440	ND	14	0.9	3	ND	ND	ND	ND
BP-600-2: Located Within 600 Area Burn Pit										
BP-600-2	0	9410220850	5	83	1.6	10	11	ND	ND	ND
BP-600-2	5	9410220910	5	74	1.0	6	ND	ND	ND	ND
BP-600-2	5+	9410220912	ND	65	1.2	7	6	ND	ND	ND
BP-600-2	10	9410220925	5	172	1.5	8	8	ND	ND	ND
BP-600-2	15	9410220947	ND	77	1.3	8	9	ND	ND	ND
BP-600-2	20	9410221012	ND	61	1.3	6	31	ND	ND	ND
BP-600-2	25	9410221040	ND	44	1.1	4	ND	ND	ND	ND
BP-600-2	29	9410221109	5	314	1.6	6	6	ND	ND	ND
BP-600-3: Located 300 Feet SW of 600 Area Burn Pit										
BP-600-3	0	9410230855	ND	86	1.5	8	9	ND	ND	ND
BP-600-3	5	9410230908	ND	126	0.8	3	ND	ND	ND	ND
BP-600-3	10	9410230945	7	69	1.3	7	6	ND	ND	ND
BP-600-3	15	9410231014	ND	66	1.3	7	7	ND	ND	ND
BP-600-3	20	9410231031	ND	37	1.4	5	8	ND	ND	ND
BP-600-3	25	9410231057	6	56	1.4	8	8	ND	ND	ND
BP-600-3	30	9410231116	5	41	1.8	7	9	ND	ND	ND
BP-600-4: Located 350 Feet SSW of 600 Area Burn Pit										
BP-600-4	0	9410241040	ND	72	1.4	10	8	ND	ND	ND
BP-600-4	5	9410241127	5	85	1.4	7	8	ND	ND	ND
BP-600-4	10	9410241248	6	276	1.0	5	6	ND	ND	ND
BP-600-4	10+	9410241250	6	1480	0.9	6	6	ND	ND	ND
BP-600-4	15	9410241313	ND	117	1.6	9	9	ND	ND	ND

TABLE 3.15 - PHASE II 600 AREA BURN PIT SOIL RCRA METALS SUMMARY (cont.)

SOIL BORING	DEPTH (ft)	SAMPLE NUMBER	As (mg/kg)	Ba (mg/kg)	Cd (mg/kg)	Cr (mg/kg)	Pb (mg/kg)	Hg (mg/kg)	Se (mg/kg)	Ag (mg/kg)
BP-600-4	20	9410241427	ND	165	1.3	6	6	ND	ND	ND
BP-600-4	25	9410241504	ND	104	1.2	7	6	ND	ND	ND
BP-600-4	30	9410241542	6	65	1.4	8	7	ND	ND	ND

Notes:
ND - Not Detected.
Detection limits are:

Arsenic	5.0 mg/kg
Barium	1.0 mg/kg
Cadmium	0.5 mg/kg
Chromium	1.0 mg/kg
Lead	5.0 mg/kg
Mercury	0.1 mg/kg
Selenium	10.0 mg/kg
Silver	1.0 mg/kg

+ - QA/QC Duplicate.

TABLE 3.16 - PHASE II 600 AREA BURN PIT SOIL ORGANICS SUMMARY

			Method 8240			Method 8270			
SOIL BORING	DEPTH (ft)	SAMPLE NUMBER	METHYLENE CHLORIDE (µg/kg)	ACETONE (µg/kg)	TOLUENE (µg/kg)	BUTYL BENZYL PHTHALATE (µg/kg)	BIS(2-ETHYLHEXYL) PHTHALATE (µg/kg)	DI-N-BUTYL PHTHALATE (µg/kg)	DIETHYL PHTHALATE (µg/kg)
BP-600-1: Located 60 Feet NNW of 600 Area Burn Pit									
BP-600-1	0	9410210925	7B	ND	ND	ND	ND	ND	ND
BP-600-1	5	9410210955	6B	ND	ND	ND	ND	ND	ND
BP-600-1	9	9410211129	6B	ND	ND	ND	ND	ND	ND
BP-600-1	15	9410211248	6B	ND	ND	ND	ND	ND	ND
BP-600-1	20	9410211537	6B	ND	ND	ND	ND	ND	ND
BP-600-1	25	9410211405	5B	ND	ND	ND	340	ND	ND
BP-600-1	30	9410211440	6B	ND	ND	ND	ND	ND	ND
BP-600-2: Located Within 600 Area Burn Pit									
BP-600-2	0	9410220850	ND	ND	ND	ND	ND	ND	ND
BP-600-2	5	9410220910	6B	ND	ND	ND	ND	ND	ND
BP-600-2	5+	9410220912	6B	ND	ND	ND	ND	ND	ND
BP-600-2	10	9410220925	16B	ND	ND	ND	ND	ND	ND
BP-600-2	15	9410220947	17B	ND	ND	ND	ND	ND	ND
BP-600-2	20	9410221012	21B	ND	ND	ND	ND	340B	ND
BP-600-2	25	9410221040	20B	ND	ND	ND	ND	ND	ND
BP-600-2	29	9410221109	19B	ND	ND	ND	ND	ND	ND
BP-600-3: Located 300 Feet SW of 600 Area Burn Pit									
BP-600-3	0	9410230855	17B	ND	ND	ND	ND	ND	ND
BP-600-3	5	9410230908	19B	ND	ND	ND	ND	ND	ND
BP-600-3	10	9410230945	15B	ND	ND	ND	ND	ND	ND
BP-600-3	15	9410231014	24B	160	ND	ND	ND	ND	ND
BP-600-3	20	9410231031	22B	120	ND	ND	ND	ND	ND
BP-600-3	25	9410231057	17B	ND	ND	ND	ND	ND	ND
BP-600-3	30	9410231116	18B	ND	ND	ND	ND	ND	ND
BP-600-4: Located 350 Feet SSW of 600 Area Burn Pit									
BP-600-4	0	9410241040	14B	ND	ND	ND	ND	ND	ND
BP-600-4	5	9410241127	20B	ND	ND	ND	ND	580B	ND
BP-600-4	10	9410241248	18B	ND	ND	ND	ND	ND	ND

			Method 8240			Method 8270			
SOIL BORING	DEPTH (ft)	SAMPLE NUMBER	METHYLENE CHLORIDE (µg/kg)	ACETONE (µg/kg)	TOLUENE (µg/kg)	BUTYL BENZYL PHTHALATE (µg/kg)	BIS(2-ETHYLHEXYL) PHTHALATE (µg/kg)	DI-N-BUTYL PHTHALATE (µg/kg)	DIETHYL PHTHALATE (µg/kg)
BP-600-4	10	9410241250	17B	ND	ND	ND	ND	ND	ND
BP-600-4	15	9410241313	18B	100	ND	ND	ND	ND	ND
BP-600-4	20	9410241427	17B	ND	ND	ND	ND	ND	ND
BP-600-4	25	9410241504	17B	ND	ND	ND	ND	ND	ND
BP-600-4	30	9410241542	17B	ND	ND	ND	ND	660B	ND

Notes:
ND - Not Detected.
Detection limits are:

Methylene Chloride	5 µg/kg
Acetone	100 µg/kg
Toluene	5 µg/kg
Butyl Benzyl Phthalate	330 µg/kg
Bis(2-ethylhexyl) Phthalate	330 µg/kg
Di-n-butyl Phthalate	330 µg/kg
Diethyl Phthalate	330 µg/kg

B - Analyte was present in the method blank as well as in the sample.
$^{+}$ - QA/QC Duplicate.

Soil Boring	Depth (ft)	Sample Number	Analysis Method	Result	Report Limit	Units	QA Flag	Analyte
B203-200-2	5.00	9411021300	RCRA-COR	9.00	5.00	mg/Kg		Lead, Total (Pb)
B203-200-2	5.00	9411021300	RCRA-COR	89.00	1.00	mg/Kg		Barium, Total (Ba)
B203-200-2	10.00	9411021325	8240-COR	15.00	5.00	ug/Kg	B	Methylene chloride
B203-200-2	10.00	9411021325	8270-COR	480.00	330.00	ug/Kg		Di-n-butyl phthalate
B203-200-2	10.00	9411021325	RCRA-COR	1.30	0.50	mg/Kg		Cadmium, Total (Cd)
B203-200-2	10.00	9411021325	RCRA-COR	3.00	1.00	mg/Kg		Silver, Total (Ag)
B203-200-2	10.00	9411021325	RCRA-COR	7.00	1.00	mg/Kg		Chromium, Total (Cr)
B203-200-2	10.00	9411021325	RCRA-COR	7.00	5.00	mg/Kg		Lead, Total (Pb)
B203-200-2	10.00	9411021325	RCRA-COR	28.00	1.00	mg/Kg		Barium, Total (Ba)
B203-200-2	10.00	9411021327	8240-COR	14.00	5.00	ug/Kg	B	Methylene chloride
B203-200-2	10.00	9411021327	8270-COR	1,900.00	330.00	ug/Kg		Di-n-butyl phthalate
B203-200-2	10.00	9411021327	RCRA-COR	1.30	0.50	mg/Kg		Cadmium, Total (Cd)
B203-200-2	10.00	9411021327	RCRA-COR	3.00	1.00	mg/Kg		Silver, Total (Ag)
B203-200-2	10.00	9411021327	RCRA-COR	6.00	1.00	mg/Kg		Chromium, Total (Cr)
B203-200-2	10.00	9411021327	RCRA-COR	7.00	5.00	mg/Kg		Lead, Total (Pb)
B203-200-2	10.00	9411021327	RCRA-COR	59.00	1.00	mg/Kg		Barium, Total (Ba)
B203-200-2	15.00	9411021353	8240-COR	13.00	5.00	ug/Kg	B	Methylene chloride
B203-200-2	15.00	9411021353	8270-COR	1,700.00	330.00	ug/Kg		Di-n-butyl phthalate
B203-200-2	15.00	9411021353	RCRA-COR	1.30	0.50	mg/Kg		Cadmium, Total (Cd)
B203-200-2	15.00	9411021353	RCRA-COR	4.00	1.00	mg/Kg		Silver, Total (Ag)
B203-200-2	15.00	9411021353	RCRA-COR	6.00	1.00	mg/Kg		Chromium, Total (Cr)
B203-200-2	15.00	9411021353	RCRA-COR	9.00	5.00	mg/Kg		Lead, Total (Pb)
B203-200-2	15.00	9411021353	RCRA-COR	25.00	1.00	mg/Kg		Barium, Total (Ba)
B203-200-2	20.00	9411030855	8240-COR	12.00	5.00	ug/Kg	B	Methylene chloride
B203-200-2	20.00	9411030855	8270-COR	1,100.00	330.00	ug/Kg		Di-n-butyl phthalate
B203-200-2	20.00	9411030855	RCRA-COR	1.10	0.50	mg/Kg		Cadmium, Total (Cd)
B203-200-2	20.00	9411030855	RCRA-COR	2.00	1.00	mg/Kg		Silver, Total (Ag)
B203-200-2	20.00	9411030855	RCRA-COR	4.00	1.00	mg/Kg		Chromium, Total (Cr)
B203-200-2	20.00	9411030855	RCRA-COR	8.00	5.00	mg/Kg		Lead, Total (Pb)
B203-200-2	20.00	9411030855	RCRA-COR	30.00	1.00	mg/Kg		Barium, Total (Ba)
B203-200-2	25.00	9411031225	8240-COR	13.00	5.00	ug/Kg	B	Methylene chloride
B203-200-2	25.00	9411031225	8270-COR	1,000.00	330.00	ug/Kg		Di-n-butyl phthalate
B203-200-2	25.00	9411031225	RCRA-COR	0.90	0.50	mg/Kg		Cadmium, Total (Cd)
B203-200-2	25.00	9411031225	RCRA-COR	5.00	1.00	mg/Kg		Chromium, Total (Cr)
B203-200-2	25.00	9411031225	RCRA-COR	8.00	5.00	mg/Kg		Lead, Total (Pb)
B203-200-2	25.00	9411031225	RCRA-COR	13.00	1.00	mg/Kg		Silver, Total (Ag)
B203-200-2	25.00	9411031225	RCRA-COR	60.00	1.00	mg/Kg		Barium, Total (Ba)
B203-200-2	29.00	9411031329	8240-COR	16.00	5.00	ug/Kg	B	Methylene chloride
B203-200-2	29.00	9411031329	RCRA-COR	1.80	0.50	mg/Kg		Cadmium, Total (Cd)
B203-200-2	29.00	9411031329	RCRA-COR	4.00	1.00	mg/Kg		Silver, Total (Ag)
B203-200-2	29.00	9411031329	RCRA-COR	5.00	5.00	mg/Kg		Arsenic, Total (As)
B203-200-2	29.00	9411031329	RCRA-COR	8.00	5.00	mg/Kg		Lead, Total (Pb)
B203-200-2	29.00	9411031329	RCRA-COR	15.00	1.00	mg/Kg		Chromium, Total (Cr)
B203-200-2	29.00	9411031329	RCRA-COR	49.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-1	0.00	9410040955	RCRA-COR	0.12	0.10	mg/Kg		Mercury, Total (Hg)
BP-100-1	0.00	9410040955	RCRA-COR	1.00	0.50	mg/Kg		Cadmium, Total (Cd)
BP-100-1	0.00	9410040955	RCRA-COR	6.00	5.00	mg/Kg		Lead, Total (Pb)
BP-100-1	0.00	9410040955	RCRA-COR	92.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-1	5.00	9410041050	RCRA-COR	1.40	0.50	mg/Kg		Cadmium, Total (Cd)
BP-100-1	5.00	9410041050	RCRA-COR	30.00	10.00	mg/Kg		Selenium, Total (Se)
BP-100-1	5.00	9410041050	RCRA-COR	40.00	5.00	mg/Kg		Arsenic, Total (As)
BP-100-1	5.00	9410041050	RCRA-COR	112.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-1	5.00	9410041052	RCRA-COR	0.70	0.50	mg/Kg		Cadmium, Total (Cd)
BP-100-1	5.00	9410041052	RCRA-COR	1.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-100-1	5.00	9410041052	RCRA-COR	1.00	1.00	mg/Kg		Silver, Total (Ag)
BP-100-1	5.00	9410041052	RCRA-COR	123.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-1	15.00	9410041510	8270-COR	380.00	330.00	ug/Kg		Bis(2-ethylhexyl)phthalate
BP-100-1	15.00	9410041510	RCRA-COR	1.10	0.50	mg/Kg		Cadmium, Total (Cd)
BP-100-1	15.00	9410041510	RCRA-COR	5.00	5.00	mg/Kg		Arsenic, Total (As)
BP-100-1	15.00	9410041510	RCRA-COR	102.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-1	20.00	9410041525	8240-COR	6.00	5.00	ug/Kg	B	Methylene chloride
BP-100-1	25.00	9410041550	RCRA-COR	1.00	1.00	mg/Kg		Silver, Total (Ag)

Soil Boring	Depth (ft)	Sample Number	Analysis Method	Result	Report Limit	Units	QA Flag	Analyte
BP-100-1	25.00	9410041550	RCRA-COR	6.00	5.00	mg/Kg		Lead, Total (Pb)
BP-100-1	25.00	9410041550	RCRA-COR	7.00	5.00	mg/Kg		Arsenic, Total (As)
BP-100-1	25.00	9410041550	RCRA-COR	61.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-1	30.00	9410041553	RCRA-COR	0.70	0.50	mg/Kg		Cadmium, Total (Cd)
BP-100-1	30.00	9410041553	RCRA-COR	1.00	1.00	mg/Kg		Silver, Total (Ag)
BP-100-1	30.00	9410041553	RCRA-COR	5.00	5.00	mg/Kg		Arsenic, Total (As)
BP-100-1	30.00	9410041553	RCRA-COR	5.00	5.00	mg/Kg		Lead, Total (Pb)
BP-100-1	30.00	9410041553	RCRA-COR	24.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-2	0.00	9410050841	RCRA-COR	0.50	0.50	mg/Kg		Cadmium, Total (Cd)
BP-100-2	0.00	9410050841	RCRA-COR	2.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-100-2	0.00	9410050841	RCRA-COR	96.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-2	5.00	9410051245	RCRA-COR	4.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-100-2	5.00	9410051245	RCRA-COR	6.00	5.00	mg/Kg		Lead, Total (Pb)
BP-100-2	5.00	9410051245	RCRA-COR	111.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-2	15.00	9410051000	RCRA-COR	2.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-100-2	15.00	9410051000	RCRA-COR	30.00	10.00	mg/Kg		Selenium, Total (Se)
BP-100-2	15.00	9410051000	RCRA-COR	46.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-2	20.00	9410051033	RCRA-COR	0.70	0.50	mg/Kg		Cadmium, Total (Cd)
BP-100-2	20.00	9410051033	RCRA-COR	1.00	1.00	mg/Kg		Silver, Total (Ag)
BP-100-2	20.00	9410051033	RCRA-COR	5.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-100-2	20.00	9410051033	RCRA-COR	5.00	5.00	mg/Kg		Arsenic, Total (As)
BP-100-2	20.00	9410051033	RCRA-COR	6.00	5.00	mg/Kg		Lead, Total (Pb)
BP-100-2	20.00	9410051033	RCRA-COR	95.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-2	20.00	9410051036	RCRA-COR	0.60	0.50	mg/Kg		Cadmium, Total (Cd)
BP-100-2	20.00	9410051036	RCRA-COR	5.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-100-2	20.00	9410051036	RCRA-COR	6.00	5.00	mg/Kg		Lead, Total (Pb)
BP-100-2	20.00	9410051036	RCRA-COR	50.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-2	25.00	9410051428	RCRA-COR	0.80	0.50	mg/Kg		Cadmium, Total (Cd)
BP-100-2	25.00	9410051428	RCRA-COR	5.00	5.00	mg/Kg		Arsenic, Total (As)
BP-100-2	25.00	9410051428	RCRA-COR	7.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-100-2	25.00	9410051428	RCRA-COR	7.00	5.00	mg/Kg		Lead, Total (Pb)
BP-100-2	25.00	9410051428	RCRA-COR	46.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-2	30.00	9410051443	RCRA-COR	0.50	0.50	mg/Kg		Cadmium, Total (Cd)
BP-100-2	30.00	9410051443	RCRA-COR	6.00	5.00	mg/Kg		Lead, Total (Pb)
BP-100-2	30.00	9410051443	RCRA-COR	8.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-100-2	30.00	9410051443	RCRA-COR	41.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-3	0.00	9410060945	8240-COR	9.00	5.00	ug/Kg		Methylene chloride
BP-100-3	0.00	9410060945	8240-COR	310.00	100.00	ug/Kg		Acetone
BP-100-3	0.00	9410060945	RCRA-COR	5.00	5.00	mg/Kg		Lead, Total (Pb)
BP-100-3	0.00	9410060945	RCRA-COR	14.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-100-3	0.00	9410060945	RCRA-COR	14.00	5.00	mg/Kg		Arsenic, Total (As)
BP-100-3	0.00	9410060945	RCRA-COR	93.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-3	5.00	9410061509	8240-COR	740.00	100.00	ug/Kg		Acetone
BP-100-3	5.00	9410061509	RCRA-COR	1.00	1.00	mg/Kg		Silver, Total (Ag)
BP-100-3	5.00	9410061509	RCRA-COR	13.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-100-3	5.00	9410061509	RCRA-COR	79.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-3	5.00	9410061510	8240-COR	440.00	100.00	ug/Kg		Acetone
BP-100-3	5.00	9410061510	RCRA-COR	5.00	5.00	mg/Kg		Lead, Total (Pb)
BP-100-3	5.00	9410061510	RCRA-COR	12.00	5.00	mg/Kg		Arsenic, Total (As)
BP-100-3	5.00	9410061510	RCRA-COR	13.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-100-3	5.00	9410061510	RCRA-COR	60.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-3	10.00	9410061537	RCRA-COR	0.70	0.50	mg/Kg		Cadmium, Total (Cd)
BP-100-3	10.00	9410061537	RCRA-COR	12.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-100-3	10.00	9410061537	RCRA-COR	30.00	10.00	mg/Kg		Selenium, Total (Se)
BP-100-3	10.00	9410061537	RCRA-COR	139.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-3	15.00	9410061042	8240-COR	8.00	5.00	ug/Kg		Methylene chloride
BP-100-3	15.00	9410061042	8240-COR	650.00	100.00	ug/Kg		Acetone
BP-100-3	15.00	9410061042	RCRA-COR	7.00	5.00	mg/Kg		Arsenic, Total (As)
BP-100-3	15.00	9410061042	RCRA-COR	8.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-100-3	15.00	9410061042	RCRA-COR	81.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-3	20.00	9410061148	8240-COR	730.00	100.00	ug/Kg		Acetone
BP-100-3	20.00	9410061148	RCRA-COR	0.10	0.10	mg/Kg		Mercury, Total (Hg)

Soil Boring	Depth (ft)	Sample Number	Analysis Method	Result	Report Limit	Units	QA Flag	Analyte
BP-100-3	20.00	9410061148	RCRA-COR	5.00	1.00	mg/Kg		Silver, Total (Ag)
BP-100-3	20.00	9410061148	RCRA-COR	5.00	5.00	mg/Kg		Lead, Total (Pb)
BP-100-3	20.00	9410061148	RCRA-COR	9.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-100-3	20.00	9410061148	RCRA-COR	69.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-3	25.00	9410061322	8240-COR	31.00	5.00	ug/Kg	B	Methylene chloride
BP-100-3	25.00	9410061322	RCRA-COR	2.00	1.00	mg/Kg		Silver, Total (Ag)
BP-100-3	25.00	9410061322	RCRA-COR	10.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-100-3	25.00	9410061322	RCRA-COR	10.00	5.00	mg/Kg		Arsenic, Total (As)
BP-100-3	25.00	9410061322	RCRA-COR	90.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-3	30.00	9410061355	8240-COR	7.00	5.00	ug/Kg		Methylene chloride
BP-100-3	30.00	9410061355	8240-COR	130.00	100.00	ug/Kg		Acetone
BP-100-3	30.00	9410061355	RCRA-COR	6.00	5.00	mg/Kg		Lead, Total (Pb)
BP-100-3	30.00	9410061355	RCRA-COR	15.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-100-3	30.00	9410061355	RCRA-COR	20.00	10.00	mg/Kg		Selenium, Total (Se)
BP-100-3	30.00	9410061355	RCRA-COR	287.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-4	0.00	9410070935	8240-COR	26.00	5.00	ug/Kg	B	Methylene chloride
BP-100-4	0.00	9410070935	RCRA-COR	0.70	0.50	mg/Kg		Cadmium, Total (Cd)
BP-100-4	0.00	9410070935	RCRA-COR	7.00	5.00	mg/Kg		Arsenic, Total (As)
BP-100-4	0.00	9410070935	RCRA-COR	15.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-100-4	0.00	9410070935	RCRA-COR	18.00	5.00	mg/Kg		Lead, Total (Pb)
BP-100-4	0.00	9410070935	RCRA-COR	85.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-4	5.00	9410071004	8240-COR	120.00	100.00	ug/Kg		Acetone
BP-100-4	5.00	9410071004	RCRA-COR	0.80	0.50	mg/Kg		Cadmium, Total (Cd)
BP-100-4	5.00	9410071004	RCRA-COR	7.00	5.00	mg/Kg		Lead, Total (Pb)
BP-100-4	5.00	9410071004	RCRA-COR	11.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-100-4	5.00	9410071004	RCRA-COR	57.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-4	10.00	9410071040	8240-COR	20.00	5.00	ug/Kg	B	Methylene chloride
BP-100-4	10.00	9410071040	RCRA-COR	0.60	0.50	mg/Kg		Cadmium, Total (Cd)
BP-100-4	10.00	9410071040	RCRA-COR	2.00	1.00	mg/Kg		Silver, Total (Ag)
BP-100-4	10.00	9410071040	RCRA-COR	10.00	5.00	mg/Kg		Lead, Total (Pb)
BP-100-4	10.00	9410071040	RCRA-COR	10.00	10.00	mg/Kg		Selenium, Total (Se)
BP-100-4	10.00	9410071040	RCRA-COR	19.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-100-4	10.00	9410071040	RCRA-COR	46.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-4	15.00	9410071108	RCRA-COR	0.50	0.50	mg/Kg		Cadmium, Total (Cd)
BP-100-4	15.00	9410071108	RCRA-COR	6.00	5.00	mg/Kg		Lead, Total (Pb)
BP-100-4	15.00	9410071108	RCRA-COR	9.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-100-4	15.00	9410071108	RCRA-COR	10.00	10.00	mg/Kg		Selenium, Total (Se)
BP-100-4	15.00	9410071108	RCRA-COR	83.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-4	20.00	9410071242	8240-COR	14.00	5.00	ug/Kg	B	Methylene chloride
BP-100-4	20.00	9410071242	RCRA-COR	0.50	0.50	mg/Kg		Cadmium, Total (Cd)
BP-100-4	20.00	9410071242	RCRA-COR	4.00	1.00	mg/Kg		Silver, Total (Ag)
BP-100-4	20.00	9410071242	RCRA-COR	7.00	5.00	mg/Kg		Lead, Total (Pb)
BP-100-4	20.00	9410071242	RCRA-COR	11.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-100-4	20.00	9410071242	RCRA-COR	66.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-4	25.00	9410071320	8240-COR	11.00	5.00	ug/Kg	B	Methylene chloride
BP-100-4	25.00	9410071320	RCRA-COR	10.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-100-4	25.00	9410071320	RCRA-COR	47.00	1.00	mg/Kg		Barium, Total (Ba)
BP-100-4	30.00	9410071400	8240-COR	7.00	5.00	ug/Kg	B	Methylene chloride
BP-100-4	30.00	9410071400	RCRA-COR	0.50	0.50	mg/Kg		Cadmium, Total (Cd)
BP-100-4	30.00	9410071400	RCRA-COR	6.00	5.00	mg/Kg		Arsenic, Total (As)
BP-100-4	30.00	9410071400	RCRA-COR	14.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-100-4	30.00	9410071400	RCRA-COR	14.00	5.00	mg/Kg		Lead, Total (Pb)
BP-100-4	30.00	9410071400	RCRA-COR	105.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-1	0.00	9410210925	8240-COR	7.00	5.00	ug/Kg	B	Methylene chloride
BP-600-1	0.00	9410210925	RCRA-COR	1.70	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-1	0.00	9410210925	RCRA-COR	11.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-1	0.00	9410210925	RCRA-COR	25.00	5.00	mg/Kg		Lead, Total (Pb)
BP-600-1	0.00	9410210925	RCRA-COR	96.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-1	5.00	9410210955	8240-COR	6.00	5.00	ug/Kg	B	Methylene chloride
BP-600-1	5.00	9410210955	RCRA-COR	1.00	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-1	5.00	9410210955	RCRA-COR	4.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-1	5.00	9410210955	RCRA-COR	5.00	5.00	mg/Kg		Lead, Total (Pb)

Soil Boring	Depth (ft)	Sample Number	Analysis Method	Result	Report Limit	Units	QA Flag	Analyte
BP-600-1	5.00	9410210955	RCRA-COR	55.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-1	9.00	9410211129	8240-COR	6.00	5.00	ug/Kg	B	Methylene chloride
BP-600-1	9.00	9410211129	RCRA-COR	1.20	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-1	9.00	9410211129	RCRA-COR	5.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-1	9.00	9410211129	RCRA-COR	5.00	5.00	mg/Kg		Lead, Total (Pb)
BP-600-1	9.00	9410211129	RCRA-COR	6.00	1.00	mg/Kg		Silver, Total (Ag)
BP-600-1	9.00	9410211129	RCRA-COR	27.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-1	15.00	9410211248	8240-COR	6.00	5.00	ug/Kg	B	Methylene chloride
BP-600-1	15.00	9410211248	RCRA-COR	1.70	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-1	15.00	9410211248	RCRA-COR	6.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-1	15.00	9410211248	RCRA-COR	7.00	5.00	mg/Kg		Lead, Total (Pb)
BP-600-1	15.00	9410211248	RCRA-COR	33.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-1	20.00	9410211537	8240-COR	6.00	5.00	ug/Kg	B	Methylene chloride
BP-600-1	20.00	9410211537	RCRA-COR	1.30	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-1	20.00	9410211537	RCRA-COR	5.00	5.00	mg/Kg		Lead, Total (Pb)
BP-600-1	20.00	9410211537	RCRA-COR	6.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-1	20.00	9410211537	RCRA-COR	18.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-1	25.00	9410211405	8240-COR	5.00	5.00	ug/Kg	B	Methylene chloride
BP-600-1	25.00	9410211405	8270-COR	340.00	330.00	ug/Kg		Bis(2-ethylhexyl)phthalate
BP-600-1	25.00	9410211405	RCRA-COR	0.70	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-1	25.00	9410211405	RCRA-COR	3.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-1	25.00	9410211405	RCRA-COR	5.00	5.00	mg/Kg		Lead, Total (Pb)
BP-600-1	25.00	9410211405	RCRA-COR	80.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-1	30.00	9410211440	8240-COR	6.00	5.00	ug/Kg	B	Methylene chloride
BP-600-1	30.00	9410211440	RCRA-COR	0.90	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-1	30.00	9410211440	RCRA-COR	3.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-1	30.00	9410211440	RCRA-COR	14.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-2	0.00	9410220850	RCRA-COR	1.60	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-2	0.00	9410220850	RCRA-COR	5.00	5.00	mg/Kg		Arsenic, Total (As)
BP-600-2	0.00	9410220850	RCRA-COR	10.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-2	0.00	9410220850	RCRA-COR	11.00	5.00	mg/Kg		Lead, Total (Pb)
BP-600-2	0.00	9410220850	RCRA-COR	83.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-2	5.00	9410220910	8240-COR	6.00	5.00	ug/Kg	B	Methylene chloride
BP-600-2	5.00	9410220910	RCRA-COR	1.00	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-2	5.00	9410220910	RCRA-COR	5.00	5.00	mg/Kg		Arsenic, Total (As)
BP-600-2	5.00	9410220910	RCRA-COR	6.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-2	5.00	9410220910	RCRA-COR	74.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-2	5.00	9410220912	8240-COR	6.00	5.00	ug/Kg	B	Methylene chloride
BP-600-2	5.00	9410220912	RCRA-COR	1.20	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-2	5.00	9410220912	RCRA-COR	6.00	5.00	mg/Kg		Lead, Total (Pb)
BP-600-2	5.00	9410220912	RCRA-COR	7.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-2	5.00	9410220912	RCRA-COR	65.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-2	10.00	9410220925	8240-COR	16.00	5.00	ug/Kg	B	Methylene chloride
BP-600-2	10.00	9410220925	RCRA-COR	1.50	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-2	10.00	9410220925	RCRA-COR	5.00	5.00	mg/Kg		Arsenic, Total (As)
BP-600-2	10.00	9410220925	RCRA-COR	8.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-2	10.00	9410220925	RCRA-COR	8.00	5.00	mg/Kg		Lead, Total (Pb)
BP-600-2	10.00	9410220925	RCRA-COR	172.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-2	15.00	9410220947	8240-COR	17.00	5.00	ug/Kg	B	Methylene chloride
BP-600-2	15.00	9410220947	RCRA-COR	1.30	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-2	15.00	9410220947	RCRA-COR	8.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-2	15.00	9410220947	RCRA-COR	9.00	5.00	mg/Kg		Lead, Total (Pb)
BP-600-2	15.00	9410220947	RCRA-COR	77.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-2	20.00	9410221012	8240-COR	21.00	5.00	ug/Kg	B	Methylene chloride
BP-600-2	20.00	9410221012	8270-COR	340.00	330.00	ug/Kg	B	Di-n-butyl phthalate
BP-600-2	20.00	9410221012	RCRA-COR	1.30	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-2	20.00	9410221012	RCRA-COR	6.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-2	20.00	9410221012	RCRA-COR	31.00	5.00	mg/Kg		Lead, Total (Pb)
BP-600-2	20.00	9410221012	RCRA-COR	61.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-2	25.00	9410221040	8240-COR	20.00	5.00	ug/Kg	B	Methylene chloride
BP-600-2	25.00	9410221040	RCRA-COR	1.10	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-2	25.00	9410221040	RCRA-COR	4.00	1.00	mg/Kg		Chromium, Total (Cr)

Soil Boring	Depth (ft)	Sample Number	Analysis Method	Result	Report Limit	Units	QA Flag	Analyte
BP-600-2	25.00	9410221040	RCRA-COR	44.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-2	29.00	9410221109	8240-COR	19.00	5.00	ug/Kg	B	Methylene chloride
BP-600-2	29.00	9410221109	RCRA-COR	1.60	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-2	29.00	9410221109	RCRA-COR	5.00	5.00	mg/Kg		Arsenic, Total (As)
BP-600-2	29.00	9410221109	RCRA-COR	6.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-2	29.00	9410221109	RCRA-COR	6.00	5.00	mg/Kg		Lead, Total (Pb)
BP-600-2	29.00	9410221109	RCRA-COR	314.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-3	0.00	9410230855	8240-COR	17.00	5.00	ug/Kg	B	Methylene chloride
BP-600-3	0.00	9410230855	RCRA-COR	1.50	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-3	0.00	9410230855	RCRA-COR	8.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-3	0.00	9410230855	RCRA-COR	9.00	5.00	mg/Kg		Lead, Total (Pb)
BP-600-3	0.00	9410230855	RCRA-COR	86.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-3	5.00	9410230908	8240-COR	19.00	5.00	ug/Kg	B	Methylene chloride
BP-600-3	5.00	9410230908	RCRA-COR	0.80	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-3	5.00	9410230908	RCRA-COR	3.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-3	5.00	9410230908	RCRA-COR	126.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-3	10.00	9410230945	8240-COR	15.00	5.00	ug/Kg	B	Methylene chloride
BP-600-3	10.00	9410230945	RCRA-COR	1.30	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-3	10.00	9410230945	RCRA-COR	6.00	5.00	mg/Kg		Lead, Total (Pb)
BP-600-3	10.00	9410230945	RCRA-COR	7.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-3	10.00	9410230945	RCRA-COR	7.00	5.00	mg/Kg		Arsenic, Total (As)
BP-600-3	10.00	9410230945	RCRA-COR	69.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-3	15.00	9410231014	8240-COR	24.00	5.00	ug/Kg	B	Methylene chloride
BP-600-3	15.00	9410231014	8240-COR	160.00	100.00	ug/Kg		Acetone
BP-600-3	15.00	9410231014	RCRA-COR	1.30	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-3	15.00	9410231014	RCRA-COR	7.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-3	15.00	9410231014	RCRA-COR	7.00	5.00	mg/Kg		Lead, Total (Pb)
BP-600-3	15.00	9410231014	RCRA-COR	66.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-3	20.00	9410231031	8240-COR	22.00	5.00	ug/Kg	B	Methylene chloride
BP-600-3	20.00	9410231031	8240-COR	120.00	100.00	ug/Kg		Acetone
BP-600-3	20.00	9410231031	RCRA-COR	1.40	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-3	20.00	9410231031	RCRA-COR	5.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-3	20.00	9410231031	RCRA-COR	8.00	5.00	mg/Kg		Lead, Total (Pb)
BP-600-3	20.00	9410231031	RCRA-COR	37.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-3	25.00	9410231057	8240-COR	17.00	5.00	ug/Kg	B	Methylene chloride
BP-600-3	25.00	9410231057	RCRA-COR	1.40	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-3	25.00	9410231057	RCRA-COR	6.00	5.00	mg/Kg		Arsenic, Total (As)
BP-600-3	25.00	9410231057	RCRA-COR	8.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-3	25.00	9410231057	RCRA-COR	8.00	5.00	mg/Kg		Lead, Total (Pb)
BP-600-3	25.00	9410231057	RCRA-COR	56.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-3	30.00	9410231116	8240-COR	18.00	5.00	ug/Kg	B	Methylene chloride
BP-600-3	30.00	9410231116	RCRA-COR	1.80	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-3	30.00	9410231116	RCRA-COR	5.00	5.00	mg/Kg		Arsenic, Total (As)
BP-600-3	30.00	9410231116	RCRA-COR	7.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-3	30.00	9410231116	RCRA-COR	9.00	5.00	mg/Kg		Lead, Total (Pb)
BP-600-3	30.00	9410231116	RCRA-COR	41.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-4	0.00	9410241040	8240-COR	14.00	5.00	ug/Kg	B	Methylene chloride
BP-600-4	0.00	9410241040	RCRA-COR	1.40	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-4	0.00	9410241040	RCRA-COR	8.00	5.00	mg/Kg		Lead, Total (Pb)
BP-600-4	0.00	9410241040	RCRA-COR	10.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-4	0.00	9410241040	RCRA-COR	72.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-4	5.00	9410241127	8240-COR	20.00	5.00	ug/Kg	B	Methylene chloride
BP-600-4	5.00	9410241127	8270-COR	580.00	330.00	ug/Kg	B	Di-n-butyl phthalate
BP-600-4	5.00	9410241127	RCRA-COR	1.40	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-4	5.00	9410241127	RCRA-COR	5.00	5.00	mg/Kg		Arsenic, Total (As)
BP-600-4	5.00	9410241127	RCRA-COR	7.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-4	5.00	9410241127	RCRA-COR	8.00	5.00	mg/Kg		Lead, Total (Pb)
BP-600-4	5.00	9410241127	RCRA-COR	85.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-4	10.00	9410241248	8240-COR	18.00	5.00	ug/Kg	B	Methylene chloride
BP-600-4	10.00	9410241248	RCRA-COR	1.00	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-4	10.00	9410241248	RCRA-COR	5.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-4	10.00	9410241248	RCRA-COR	6.00	5.00	mg/Kg		Arsenic, Total (As)

Soil Boring	Depth (ft)	Sample Number	Analysis Method	Result	Report Limit	Units	QA Flag	Analyte
BP-600-4	10.00	9410241248	RCRA-COR	6.00	5.00	mg/Kg		Lead, Total (Pb)
BP-600-4	10.00	9410241248	RCRA-COR	276.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-4	10.00	9410241250	8240-COR	17.00	5.00	ug/Kg	B	Methylene chloride
BP-600-4	10.00	9410241250	RCRA-COR	0.90	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-4	10.00	9410241250	RCRA-COR	6.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-4	10.00	9410241250	RCRA-COR	6.00	5.00	mg/Kg		Arsenic, Total (As)
BP-600-4	10.00	9410241250	RCRA-COR	6.00	5.00	mg/Kg		Lead, Total (Pb)
BP-600-4	10.00	9410241250	RCRA-COR	1,480.00	5.00	mg/Kg		Barium, Total (Ba)
BP-600-4	15.00	9410241313	8240-COR	18.00	5.00	ug/Kg	B	Methylene chloride
BP-600-4	15.00	9410241313	8240-COR	100.00	100.00	ug/Kg		Acetone
BP-600-4	15.00	9410241313	RCRA-COR	1.60	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-4	15.00	9410241313	RCRA-COR	9.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-4	15.00	9410241313	RCRA-COR	9.00	5.00	mg/Kg		Lead, Total (Pb)
BP-600-4	15.00	9410241313	RCRA-COR	117.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-4	20.00	9410241427	8240-COR	17.00	5.00	ug/Kg	B	Methylene chloride
BP-600-4	20.00	9410241427	RCRA-COR	1.30	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-4	20.00	9410241427	RCRA-COR	6.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-4	20.00	9410241427	RCRA-COR	6.00	5.00	mg/Kg		Lead, Total (Pb)
BP-600-4	20.00	9410241427	RCRA-COR	165.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-4	25.00	9410241504	8240-COR	17.00	5.00	ug/Kg	B	Methylene chloride
BP-600-4	25.00	9410241504	RCRA-COR	1.20	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-4	25.00	9410241504	RCRA-COR	6.00	5.00	mg/Kg		Lead, Total (Pb)
BP-600-4	25.00	9410241504	RCRA-COR	7.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-4	25.00	9410241504	RCRA-COR	104.00	1.00	mg/Kg		Barium, Total (Ba)
BP-600-4	30.00	9410241542	8240-COR	17.00	5.00	ug/Kg	B	Methylene chloride
BP-600-4	30.00	9410241542	8270-COR	660.00	330.00	ug/Kg	B	Di-n-butyl phthalate
BP-600-4	30.00	9410241542	RCRA-COR	1.40	0.50	mg/Kg		Cadmium, Total (Cd)
BP-600-4	30.00	9410241542	RCRA-COR	6.00	5.00	mg/Kg		Arsenic, Total (As)
BP-600-4	30.00	9410241542	RCRA-COR	7.00	5.00	mg/Kg		Lead, Total (Pb)
BP-600-4	30.00	9410241542	RCRA-COR	8.00	1.00	mg/Kg		Chromium, Total (Cr)
BP-600-4	30.00	9410241542	RCRA-COR	65.00	1.00	mg/Kg		Barium, Total (Ba)
BSB-1	0.00	9411301150	RCRA-COR	7.00	5.00	mg/Kg		Arsenic, Total (As)
BSB-1	0.00	9411301150	RCRA-COR	12.00	5.00	mg/Kg		Lead, Total (Pb)
BSB-1	0.00	9411301150	RCRA-COR	15.00	1.00	mg/Kg		Chromium, Total (Cr)
BSB-1	0.00	9411301150	RCRA-COR	119.00	1.00	mg/Kg		Barium, Total (Ba)
BSB-1	5.00	9411301152	RCRA-COR	6.00	5.00	mg/Kg		Lead, Total (Pb)
BSB-1	5.00	9411301152	RCRA-COR	9.00	1.00	mg/Kg		Chromium, Total (Cr)
BSB-1	5.00	9411301152	RCRA-COR	171.00	1.00	mg/Kg		Barium, Total (Ba)
BSB-1	5.00	9411301155	RCRA-COR	6.00	5.00	mg/Kg		Lead, Total (Pb)
BSB-1	5.00	9411301155	RCRA-COR	8.00	1.00	mg/Kg		Chromium, Total (Cr)
BSB-1	5.00	9411301155	RCRA-COR	181.00	1.00	mg/Kg		Barium, Total (Ba)
BSB-1	10.00	9411301204	RCRA-COR	7.00	5.00	mg/Kg		Lead, Total (Pb)
BSB-1	10.00	9411301204	RCRA-COR	9.00	1.00	mg/Kg		Chromium, Total (Cr)
BSB-1	10.00	9411301204	RCRA-COR	61.00	1.00	mg/Kg		Barium, Total (Ba)
BSB-1	15.00	9411301209	RCRA-COR	6.00	5.00	mg/Kg		Arsenic, Total (As)
BSB-1	15.00	9411301209	RCRA-COR	7.00	5.00	mg/Kg		Lead, Total (Pb)
BSB-1	15.00	9411301209	RCRA-COR	9.00	1.00	mg/Kg		Chromium, Total (Cr)
BSB-1	15.00	9411301209	RCRA-COR	42.00	1.00	mg/Kg		Barium, Total (Ba)
BSB-1	20.00	9411301234	RCRA-COR	4.00	1.00	mg/Kg		Silver, Total (Ag)
BSB-1	20.00	9411301234	RCRA-COR	7.00	5.00	mg/Kg		Lead, Total (Pb)
BSB-1	20.00	9411301234	RCRA-COR	9.00	1.00	mg/Kg		Chromium, Total (Cr)
BSB-1	20.00	9411301234	RCRA-COR	32.00	1.00	mg/Kg		Barium, Total (Ba)
BSB-1	25.00	9411301243	8270-COR	1,500.00	330.00	ug/Kg		Di-n-butyl phthalate
BSB-1	25.00	9411301243	RCRA-COR	5.00	5.00	mg/Kg		Lead, Total (Pb)
BSB-1	25.00	9411301243	RCRA-COR	7.00	1.00	mg/Kg		Chromium, Total (Cr)
BSB-1	25.00	9411301243	RCRA-COR	31.00	1.00	mg/Kg		Barium, Total (Ba)
BSB-1	30.00	9411301254	RCRA-COR	5.00	5.00	mg/Kg		Lead, Total (Pb)
BSB-1	30.00	9411301254	RCRA-COR	8.00	1.00	mg/Kg		Chromium, Total (Cr)
BSB-1	30.00	9411301254	RCRA-COR	150.00	1.00	mg/Kg		Barium, Total (Ba)
BSB-2	0.00	9411301503	8270-COR	780.00	330.00	ug/Kg		Di-n-butyl phthalate
BSB-2	0.00	9411301503	RCRA-COR	13.00	1.00	mg/Kg		Chromium, Total (Cr)
BSB-2	0.00	9411301503	RCRA-COR	22.00	5.00	mg/Kg		Lead, Total (Pb)

Soil Boring	Depth (ft)	Sample Number	Analysis Method	Result	Report Limit	Units	QA Flag	Analyte
CR-200-3	13.50	9411061039	RCRA-COR	15.00	1.00	mg/Kg		Chromium, Total (Cr)
CR-200-3	13.50	9411061039	RCRA-COR	25.00	5.00	mg/Kg		Arsenic, Total (As)
CR-200-3	13.50	9411061039	RCRA-COR	35.00	1.00	mg/Kg		Barium, Total (Ba)
CS-100-1	0.00	9410080852	8240-COR	15.00	5.00	ug/Kg	B	Methylene chloride
CS-100-1	0.00	9410080852	8240-COR	240.00	100.00	ug/Kg		Acetone
CS-100-1	0.00	9410080852	RCRA-COR	1.70	0.50	mg/Kg		Cadmium, Total (Cd)
CS-100-1	0.00	9410080852	RCRA-COR	11.00	5.00	mg/Kg		Lead, Total (Pb)
CS-100-1	0.00	9410080852	RCRA-COR	14.00	1.00	mg/Kg		Chromium, Total (Cr)
CS-100-1	0.00	9410080852	RCRA-COR	90.00	1.00	mg/Kg		Barium, Total (Ba)
CS-100-1	5.00	9410080927	8240-COR	11.00	5.00	ug/Kg	B	Methylene chloride
CS-100-1	5.00	9410080927	8270-COR	560.00	330.00	ug/Kg		Bis(2-ethylhexyl)phthalate
CS-100-1	5.00	9410080927	RCRA-COR	0.50	0.50	mg/Kg		Cadmium, Total (Cd)
CS-100-1	5.00	9410080927	RCRA-COR	9.00	1.00	mg/Kg		Chromium, Total (Cr)
CS-100-1	5.00	9410080927	RCRA-COR	12.00	5.00	mg/Kg		Arsenic, Total (As)
CS-100-1	5.00	9410080927	RCRA-COR	20.00	10.00	mg/Kg		Selenium, Total (Se)
CS-100-1	5.00	9410080927	RCRA-COR	59.00	1.00	mg/Kg		Barium, Total (Ba)
CS-100-1	5.00	9410080929	8240-COR	9.00	5.00	ug/Kg	B	Methylene chloride
CS-100-1	5.00	9410080929	RCRA-COR	0.70	0.50	mg/Kg		Cadmium, Total (Cd)
CS-100-1	5.00	9410080929	RCRA-COR	7.00	5.00	mg/Kg		Lead, Total (Pb)
CS-100-1	5.00	9410080929	RCRA-COR	12.00	1.00	mg/Kg		Chromium, Total (Cr)
CS-100-1	5.00	9410080929	RCRA-COR	19.00	5.00	mg/Kg		Arsenic, Total (As)
CS-100-1	5.00	9410080929	RCRA-COR	50.00	1.00	mg/Kg		Barium, Total (Ba)
CS-100-1	10.00	9410081008	8240-COR	11.00	5.00	ug/Kg	B	Methylene chloride
CS-100-1	10.00	9410081008	RCRA-COR	8.00	1.00	mg/Kg		Chromium, Total (Cr)
CS-100-1	10.00	9410081008	RCRA-COR	8.00	5.00	mg/Kg		Lead, Total (Pb)
CS-100-1	10.00	9410081008	RCRA-COR	10.00	5.00	mg/Kg		Arsenic, Total (As)
CS-100-1	10.00	9410081008	RCRA-COR	43.00	1.00	mg/Kg		Barium, Total (Ba)
CS-100-1	15.00	9410081052	8240-COR	12.00	5.00	ug/Kg	B	Methylene chloride
CS-100-1	15.00	9410081052	RCRA-COR	5.00	5.00	mg/Kg		Lead, Total (Pb)
CS-100-1	15.00	9410081052	RCRA-COR	55.00	1.00	mg/Kg		Chromium, Total (Cr)
CS-100-1	15.00	9410081052	RCRA-COR	69.00	1.00	mg/Kg		Barium, Total (Ba)
CS-100-1	20.00	9410081452	RCRA-COR	0.50	0.50	mg/Kg		Cadmium, Total (Cd)
CS-100-1	20.00	9410081452	RCRA-COR	5.00	5.00	mg/Kg		Arsenic, Total (As)
CS-100-1	20.00	9410081452	RCRA-COR	5.00	5.00	mg/Kg		Lead, Total (Pb)
CS-100-1	20.00	9410081452	RCRA-COR	6.00	1.00	mg/Kg		Chromium, Total (Cr)
CS-100-1	20.00	9410081452	RCRA-COR	51.00	1.00	mg/Kg		Barium, Total (Ba)
CS-100-1	25.00	9410081318	RCRA-COR	0.80	0.50	mg/Kg		Cadmium, Total (Cd)
CS-100-1	25.00	9410081318	RCRA-COR	5.00	5.00	mg/Kg		Arsenic, Total (As)
CS-100-1	25.00	9410081318	RCRA-COR	8.00	1.00	mg/Kg		Chromium, Total (Cr)
CS-100-1	25.00	9410081318	RCRA-COR	8.00	5.00	mg/Kg		Lead, Total (Pb)
CS-100-1	25.00	9410081318	RCRA-COR	954.00	1.00	mg/Kg		Barium, Total (Ba)
CS-100-1	29.50	9410081403	RCRA-COR	1.00	0.50	mg/Kg		Cadmium, Total (Cd)
CS-100-1	29.50	9410081403	RCRA-COR	5.00	5.00	mg/Kg		Arsenic, Total (As)
CS-100-1	29.50	9410081403	RCRA-COR	11.00	5.00	mg/Kg		Lead, Total (Pb)
CS-100-1	29.50	9410081403	RCRA-COR	15.00	1.00	mg/Kg		Chromium, Total (Cr)
CS-100-1	29.50	9410081403	RCRA-COR	48.00	1.00	mg/Kg		Barium, Total (Ba)
CS-100-2	0.00	9410090835	8240-COR	6.00	5.00	ug/Kg		Methylene chloride
CS-100-2	0.00	9410090835	RCRA-COR	0.50	0.50	mg/Kg		Cadmium, Total (Cd)
CS-100-2	0.00	9410090835	RCRA-COR	5.00	1.00	mg/Kg		Chromium, Total (Cr)
CS-100-2	0.00	9410090835	RCRA-COR	6.00	5.00	mg/Kg		Lead, Total (Pb)
CS-100-2	0.00	9410090835	RCRA-COR	87.00	1.00	mg/Kg		Barium, Total (Ba)
CS-100-2	5.00	9410090902	8270-COR	3,000.00	330.00	ug/Kg		Bis(2-ethylhexyl)phthalate
CS-100-2	5.00	9410090902	RCRA-COR	5.00	1.00	mg/Kg		Chromium, Total (Cr)
CS-100-2	5.00	9410090902	RCRA-COR	5.00	5.00	mg/Kg		Arsenic, Total (As)
CS-100-2	5.00	9410090902	RCRA-COR	5.00	5.00	mg/Kg		Lead, Total (Pb)
CS-100-2	5.00	9410090902	RCRA-COR	146.00	1.00	mg/Kg		Barium, Total (Ba)
CS-100-2	10.00	9410090930	RCRA-COR	0.60	0.50	mg/Kg		Cadmium, Total (Cd)
CS-100-2	10.00	9410090930	RCRA-COR	5.00	5.00	mg/Kg		Arsenic, Total (As)
CS-100-2	10.00	9410090930	RCRA-COR	6.00	5.00	mg/Kg		Lead, Total (Pb)
CS-100-2	10.00	9410090930	RCRA-COR	7.00	1.00	mg/Kg		Chromium, Total (Cr)
CS-100-2	10.00	9410090930	RCRA-COR	70.00	1.00	mg/Kg		Barium, Total (Ba)
CS-100-2	10.00	9410090933	8240-COR	6.00	5.00	ug/Kg		Methylene chloride

Soil Boring	Depth (ft)	Sample Number	Analysis Method	Result	Report Limit	Units	QA Flag	Analyte
CS-100-2	10.00	9410090933	RCRA-COR	0.60	0.50	mg/Kg		Cadmium, Total (Cd)
CS-100-2	10.00	9410090933	RCRA-COR	5.00	5.00	mg/Kg		Arsenic, Total (As)
CS-100-2	10.00	9410090933	RCRA-COR	6.00	5.00	mg/Kg		Lead, Total (Pb)
CS-100-2	10.00	9410090933	RCRA-COR	7.00	1.00	mg/Kg		Chromium, Total (Cr)
CS-100-2	10.00	9410090933	RCRA-COR	63.00	1.00	mg/Kg		Barium, Total (Ba)
CS-100-2	15.00	9410091014	RCRA-COR	3.00	1.00	mg/Kg		Chromium, Total (Cr)
CS-100-2	15.00	9410091014	RCRA-COR	26.00	1.00	mg/Kg		Barium, Total (Ba)
CS-100-2	20.00	9410091102	RCRA-COR	0.60	0.50	mg/Kg		Cadmium, Total (Cd)
CS-100-2	20.00	9410091102	RCRA-COR	5.00	1.00	mg/Kg		Chromium, Total (Cr)
CS-100-2	20.00	9410091102	RCRA-COR	6.00	5.00	mg/Kg		Lead, Total (Pb)
CS-100-2	20.00	9410091102	RCRA-COR	45.00	1.00	mg/Kg		Barium, Total (Ba)
CS-100-2	25.00	9410091217	RCRA-COR	0.80	0.50	mg/Kg		Cadmium, Total (Cd)
CS-100-2	25.00	9410091217	RCRA-COR	7.00	1.00	mg/Kg		Chromium, Total (Cr)
CS-100-2	25.00	9410091217	RCRA-COR	8.00	5.00	mg/Kg		Lead, Total (Pb)
CS-100-2	25.00	9410091217	RCRA-COR	28.00	1.00	mg/Kg		Barium, Total (Ba)
CS-100-2	30.00	9410091238	RCRA-COR	0.60	0.50	mg/Kg		Cadmium, Total (Cd)
CS-100-2	30.00	9410091238	RCRA-COR	5.00	5.00	mg/Kg		Arsenic, Total (As)
CS-100-2	30.00	9410091238	RCRA-COR	6.00	1.00	mg/Kg		Chromium, Total (Cr)
CS-100-2	30.00	9410091238	RCRA-COR	7.00	5.00	mg/Kg		Lead, Total (Pb)
CS-100-2	30.00	9410091238	RCRA-COR	42.00	1.00	mg/Kg		Barium, Total (Ba)
CS-100-3	0.00	9410101000	8240-COR	8.00	5.00	ug/Kg		Methylene chloride
CS-100-3	0.00	9410101000	RCRA-COR	0.50	0.50	mg/Kg		Cadmium, Total (Cd)
CS-100-3	0.00	9410101000	RCRA-COR	5.00	1.00	mg/Kg		Chromium, Total (Cr)
CS-100-3	0.00	9410101000	RCRA-COR	5.00	5.00	mg/Kg		Arsenic, Total (As)
CS-100-3	0.00	9410101000	RCRA-COR	9.00	5.00	mg/Kg		Lead, Total (Pb)
CS-100-3	0.00	9410101000	RCRA-COR	70.00	1.00	mg/Kg		Barium, Total (Ba)
CS-100-3	5.00	9410101027	RCRA-COR	0.50	0.50	mg/Kg		Cadmium, Total (Cd)
CS-100-3	5.00	9410101027	RCRA-COR	4.00	1.00	mg/Kg		Chromium, Total (Cr)
CS-100-3	5.00	9410101027	RCRA-COR	5.00	5.00	mg/Kg		Arsenic, Total (As)
CS-100-3	5.00	9410101027	RCRA-COR	6.00	5.00	mg/Kg		Lead, Total (Pb)
CS-100-3	5.00	9410101027	RCRA-COR	26.00	1.00	mg/Kg		Barium, Total (Ba)
CS-100-3	5.00	9410101029	8240-COR	5.00	5.00	ug/Kg	B	Methylene chloride
CS-100-3	5.00	9410101029	RCRA-COR	0.10	0.10	mg/Kg		Mercury, Total (Hg)
CS-100-3	5.00	9410101029	RCRA-COR	15.00	5.00	mg/Kg		Arsenic, Total (As)
CS-100-3	5.00	9410101029	RCRA-COR	106.00	1.00	mg/Kg		Barium, Total (Ba)
CS-100-3	10.00	9410101104	8240-COR	6.00	5.00	ug/Kg	B	Methylene chloride
CS-100-3	10.00	9410101104	RCRA-COR	12.00	5.00	mg/Kg		Arsenic, Total (As)
CS-100-3	10.00	9410101104	RCRA-COR	74.00	1.00	mg/Kg		Barium, Total (Ba)
CS-100-3	15.00	9410101145	RCRA-COR	0.16	0.10	mg/Kg		Mercury, Total (Hg)
CS-100-3	15.00	9410101145	RCRA-COR	0.50	0.50	mg/Kg		Cadmium, Total (Cd)
CS-100-3	15.00	9410101145	RCRA-COR	2.00	1.00	mg/Kg		Silver, Total (Ag)
CS-100-3	15.00	9410101145	RCRA-COR	9.00	5.00	mg/Kg		Arsenic, Total (As)
CS-100-3	15.00	9410101145	RCRA-COR	37.00	1.00	mg/Kg		Barium, Total (Ba)
CS-100-3	20.00	9410101318	RCRA-COR	0.50	0.50	mg/Kg		Cadmium, Total (Cd)
CS-100-3	20.00	9410101318	RCRA-COR	7.00	5.00	mg/Kg		Arsenic, Total (As)
CS-100-3	20.00	9410101318	RCRA-COR	29.00	1.00	mg/Kg		Barium, Total (Ba)
CS-100-3	25.00	9410101428	RCRA-COR	4.00	1.00	mg/Kg		Chromium, Total (Cr)
CS-100-3	25.00	9410101428	RCRA-COR	5.00	5.00	mg/Kg		Arsenic, Total (As)
CS-100-3	25.00	9410101428	RCRA-COR	27.00	1.00	mg/Kg		Barium, Total (Ba)
CS-100-3	30.00	9410101505	RCRA-COR	0.90	0.50	mg/Kg		Cadmium, Total (Cd)
CS-100-3	30.00	9410101505	RCRA-COR	2.00	1.00	mg/Kg		Chromium, Total (Cr)
CS-100-3	30.00	9410101505	RCRA-COR	20.00	10.00	mg/Kg		Selenium, Total (Se)
CS-100-3	30.00	9410101505	RCRA-COR	33.00	1.00	mg/Kg		Barium, Total (Ba)
JP4-1	0.00	9410111240	RCRA-COR	0.60	0.50	mg/Kg		Cadmium, Total (Cd)
JP4-1	0.00	9410111240	RCRA-COR	5.00	5.00	mg/Kg		Lead, Total (Pb)
JP4-1	0.00	9410111240	RCRA-COR	7.00	5.00	mg/Kg		Arsenic, Total (As)
JP4-1	0.00	9410111240	RCRA-COR	90.00	1.00	mg/Kg		Barium, Total (Ba)
JP4-1	5.00	9410111245	RCRA-COR	2.00	1.00	mg/Kg		Chromium, Total (Cr)
JP4-1	5.00	9410111245	RCRA-COR	16.00	5.00	mg/Kg		Arsenic, Total (As)
JP4-1	5.00	9410111245	RCRA-COR	267.00	1.00	mg/Kg		Barium, Total (Ba)
JP4-1	10.00	9410111309	8270-COR	400.00	330.00	ug/Kg		Diethyl phthalate
JP4-1	10.00	9410111309	RCRA-COR	3.00	1.00	mg/Kg		Chromium, Total (Cr)

ASSAIGAI ANALYTICAL LABORATORIES

TO: Lockheed Corporation
Attn: Terry Boone
P.O. Drawer M-M
Las Cruces, NM 88004

DATE: 15 August 1985
1069
Page 1 of 3

SAMPLE ID: 8507261050 Burn Pit Water

ANALYTE	ANALYTICAL RESULTS	NOMINAL DETECTION LIMITS
Trichloroethylene	<0.001 mg/l	0.001 mg/l
Carbon Tetrachloride	<0.001 mg/l	0.001 mg/l
Benzene	<0.001 mg/l	0.001 mg/l
Flash Point	>60 o C	
S	640.0 mg/l	0.1 mg/l
Br	<0.1 mg/l	0.1 mg/l
Cl	79.0 mg/l	1.0 mg/l
F	1.3 mg/l	0.1 mg/l
Ag	<0.05 mg/l	0.05 mg/l
As	<0.05 mg/l	0.05 mg/l
Ba	2.3 mg/l	0.005 mg/l
Cd	<0.01 mg/l	0.01 mg/l
Cr	<0.05 mg/l	0.05 mg/l
Hg	<0.002 mg/l	0.002 mg/l
Pb	<0.05 mg/l	<0.05 mg/l
Se	<0.01 mg/l	<0.01 mg/l
Cu	0.04 mg/l	0.002 mg/l
K	25.0 mg/l	0.1 mg/l
Na	81.0 mg/l	0.1 mg/l
Mn	0.46 mg/l	0.005 mg/l
P	0.19 mg/l	0.06 mg/l
Sb	<0.2 mg/l	0.2 mg/l
Si	45.4 mg/l	0.1 mg/l
Sn	<0.1 mg/l	0.1 mg/l
Zn	0.28 mg/l	0.004 mg/l
Specific Gravity	1.0083	
Viscosity	N.A.	
Ash	0.07 %	
TSS	166.6 mg/l	1 mg/l
pH	6.0	
BTU	20 BTU/lb	

REFEREENCE: "Standard Methods for the Examination of Water and Wastewater", 15th Edition, APHA, N.Y., 1980.

TO: Lockheed Corporation
Attn: Terry Boone
P.O. Drawer M-M
Las Cruces, NM 88004

DATE: 15 August 1985
1069

SAMPLE ID: 8507261120 Burn Pit 12' (SLUDGE)

ANALYTE	ANALYTICAL RESULTS	NOMINAL DETECTION LIMITS
Trichloroethylene	<0.1 ug/g	0.1 ug/g
Carbon Tetrachloride	<0.1 ug/g	0.1 ug/g
Benzene	<0.1 ug/g	0.1 ug/g
Flash Point	>60 o C	
S	0.33 %	
Br	<0.1 ug/g	0.1 ug/g
Cl	152.0 ug/g	1.0 ug/g
F	56.0 ug/g	0.1 ug/g
Ag	0.6 ug/g	0.05 ug/g
As	60.0 ug/g	0.05 ug/g
Ba	1200.0 ug/g	0.005 ug/g
Cd	15.0 ug/g	0.01 ug/g
Cr	85.0 ug/g	0.05 ug/g
Hg	0.2 ug/g	0.002 ug/g
Pb	600.0 ug/g	<0.05 ug/g
Se	2.0 ug/g	<0.01 ug/g
Cu	2.71 ug/g	0.002 ug/g
K	85.0 ug/g	0.1 ug/g
Na	129.0 ug/g	0.1 ug/g
Mn	8.0 ug/g	0.005 ug/g
P	20.0 ug/g	0.06 ug/g
Sb	0.4 ug/g	0.2 ug/g
Si	5.0 ug/g	0.1 ug/g
Sn	2.0 ug/g	0.1 ug/g
Zn	4500.0 ug/g	0.004 ug/g
Specific Gravity	1.1074	
Viscosity	13940 centipois	
Ash	16.5 %	
TSS	NA	
pH	6.0	
BTU	7240 BTU/lb	

REFEREENCE: "Test Methods for the Evaluating Solid Waste, Physical/Chemical Methods", USEPA, SW 846, EMSL-Cincinnati, 1982.

TO: Lockheed Corporation
Attn: Terry Boone
P.O. Drawer M-M
Las Cruces, NM 88004

DATE: 15 August 1985
1069

ANALYTE	SAMPLE ID/ANALYTICAL RESULTS		NOMINAL DETECTION LIMITS
	8507251515 Burn Pit 2'	8507251530 Burn Pit 5'	
Trichloroethylene	<0.01 ug/g	<0.01 ug/g	0.01 ug/g
Carbon Tetrachloride	<0.01 ug/g	<0.01 ug/g	0.01 ug/g
Benzene	<0.01 ug/g	<0.01 ug/g	0.01 ug/g

REFEREENCE: "Test Methods for the Evaluating Solid Waste, Physical/Chemical Methods", USEPA, SW 846, EMSL-Cincinnati, 1982.

An invoice for services is enclosed. Thank you for contacting Assaigai Laboratories.

Sincerely,

Jennifer V. Smith

Jennifer V. Smith, Ph.D.
Laboratory Director

ASSAIGAI ANALYTICAL LABORATORIES

TO: Lockheed Corporation
Attn: Terry Boone
P.O. Drawer M-M
Las Cruces, NM 88004

DATE: 26 August 1985
1069

SAMPLE ID: Sludge extraction

ANALYTE	ANALYTICAL RESULTS	NOMINAL DETECTION LIMITS
Ag	0.004 ug/g	0.003 ug/g
As	0.034 ug/g	0.002 ug/g
Ba	5.1 ug/g	0.005 ug/g
Cd	0.024 ug/g	0.002 ug/g
Cr	0.040 ug/g	0.005 ug/g
Hg	0.2 ug/g	0.002 ug/g
Pb	4.4 ug/g	0.05 ug/g
Se	0.024 ug/g	0.002 ug/g

REFERENCE: "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", USEPA, SW 846, EMSL-Cincinnati, 1982.

An invoice for services is enclosed. Thank you for contacting Assaigai Laboratories.

Sincerely,

Jenifer V. Smith

Jenifer V. Smith, Ph.D.
Laboratory Director

TSI®

TRANSFORMER SERVICE, INC.

REGIONAL DR. • P.O. BOX 1077 • CONCORD, N.H. 03301
(603) 224-4006

January 5, 1984

395309

Mr. Al Puentes
Lockheed Engineering
Johnson Space Center
N.A.S.A. Building #120
Las Cruces, NM 88001

Re: PCB Analyses Results

Dear Mr. Puentes:

The following are the results of the PCB Analyses performed on your six oil samples which were received in our Laboratory on December 28, 1983 and tested on December 30, 1983:

SAMPLE IDENTIFICATION	PCB CONCENTRATION (PPM)
#1, BURN PIT, POUR AREA	<1
#2, BURN PIT, S/W QUAD	<1
#3, BURN PIT, S/E QUAD	<1
#4, BURN PIT, N/W QUAD	<1
#5, BURN PIT, N/E QUAD	<1
#6, NEW SIT OIL DUMP	80

Condon says this was the blank. 6/30/87

Should you have any questions concerning these results, please do not hesitate to contact me at our Concord, New Hampshire office.

Thank you very much for giving us the opportunity to perform this testing for you.

Sincerely,

L. E. La Salle sm

L.E. LaSalle
Asst. Mgr., Sales & Marketing

LEL/sem

ASSAIGAI
ANALYTICAL
LABORATORIES

TO: Lockheed
Attn. J.H. Creegan
P.O. Drawer M-M
Las Cruce, NM 88001

DATE: 27 September 1985
1347

ANALYTE: PCB, ppm

SAMPLE ID	ANALYTICAL RESULTS
Drum 1 8509101402	<1.0
Drum 2 8509101410	<1.0
Westinghouse Trans. 8509101427	90.8

(1) SN 6403716 or SN 2S
(2) Shipped on UKWM 85004
12/29/89 JMC

NOMINAL DETECTION LIMIT: 1.0 ppm

REFERENCE: EPA Method 608

An invoice for services is enclosed. Thank you for contacting Assaigai Laboratories.

Sincerely,

Jennifer V. Smith

Jennifer V. Smith, Ph.D.
Laboratory Director

7300 Jefferson, N.E. • Albuquerque, New Mexico 87409 • (505) 345-8964

Appendix D
MSDS

Material Safety Data Sheet

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: ATC-603 LIGHT WATER(TM) ATC(TM)3 AR-AFFF 3%
MANUFACTURER: 3M
DIVISION: Protective Materials & Consumer Specialties Division

ADDRESS: 3M Center
St. Paul, MN 55144-1000

EMERGENCY PHONE: 1-800-364-3577 or (651) 737-6501 (24 hours)

Issue Date: 01/18/2005
Supercedes Date: 01/13/2005

Document Group: 07-7904-1

Product Use:
Intended Use: 3x3 class B Fire Fighting Foam
Specific Use: FIRE CONTROL AGENT

SECTION 2: INGREDIENTS

Ingredient	C.A.S. No.	% by Wt
WATER	7732-18-5	78 - 82
DIPROPYLENE GLYCOL, MONOPROPYL ETHER	29911-27-1	4.5
N-[3-(DIMETHYLAMINO)PROPYL PERFLUOROOCTANE SULFONAMIDE, N'-OXIDE POTASSIUM SALT	178094-69-4	1 - 5
2-METHOXYMETHYLETHOXYPROPANOL	34590-94-8	1.5 - 2.5
FLUOROALIPHATIC POLYMER +(6151P)	Trade Secret	1 - 5
ALKYL SULFATE SALTS +(6154P, 6155P)	Trade Secret	1 - 3
TRIETHANOLAMINE	102-71-6	1
THICKENERS +(6156P, 6157P)	Trade Secret	1 - 5
SYNTHETIC DETERGENTS +(6152P, 6153P)	Trade Secret	1 - 5
RESIDUAL ORGANIC FLUOROCHEMICALS	Mixture	0 - 1

SECTION 3: HAZARDS IDENTIFICATION

3.1 EMERGENCY OVERVIEW

Odor, Color, Grade: Viscous amber solution with mild odor.
General Physical Form: Liquid

Immediate health, physical, and environmental hazards: May cause target organ effects. Contains a chemical or chemicals which can cause birth defects or other reproductive harm.

3.2 POTENTIAL HEALTH EFFECTS

Eye Contact:
Moderate Eye Irritation: Signs/symptoms may include redness, swelling, pain, tearing, and blurred or hazy vision.

Skin Contact:
Mild Skin Irritation: Signs/symptoms may include localized redness, swelling, and itching.

May be absorbed through skin and cause target organ effects.

Inhalation:
Upper Respiratory Tract Irritation: Signs/symptoms may include cough, sneezing, nasal discharge, headache, hoarseness, and nose and throat pain.

If thermal decomposition occurs:
May be harmful if inhaled.

May be absorbed following inhalation and cause target organ effects.

Ingestion:
Gastrointestinal Irritation: Signs/symptoms may include abdominal pain, nausea, diarrhea and vomiting.

May be absorbed following ingestion and cause target organ effects.

Target Organ Effects:
Central Nervous System (CNS) Depression: Signs/symptoms may include headache, dizziness, drowsiness, incoordination, nausea, slowed reaction time, slurred speech, giddiness, and unconsciousness.

Prolonged or repeated exposure may cause:
Liver Effects: Signs/symptoms may include loss of appetite, weight loss, fatigue, weakness, abdominal tenderness and jaundice.

May accumulate in the body.

Contains a chemical or chemicals which can cause birth defects or other reproductive harm.

3.3 POTENTIAL ENVIRONMENTAL EFFECTS

This product contains one or more organic fluorochemicals that have the potential to resist degradation and persist in the environment.

Biodegradation: Chemical Oxygen Demand (COD): 0.311 g/g 5-Day Biochemical Oxygen Demand (BOD5): 0.069 g/g 10-Day Biochemical Oxygen Demand (BOD10): 0.0868 g/g 20-Day Biochemical Oxygen Demand (BOD20): 0.119 g/g Aquatic Toxicity:Microtox (TM) (Photobacterium phosphoreum) 30-min. EC50: 107 mg/L

SECTION 4: FIRST AID MEASURES

4.1 FIRST AID PROCEDURES

The following first aid recommendations are based on an assumption that appropriate personal and industrial hygiene practices are followed.

Eye Contact: Flush eyes with large amounts of water. If signs/symptoms persist, get medical attention.

Skin Contact: Wash affected area with soap and water. If signs/symptoms develop, get medical attention.

Inhalation: Remove person to fresh air. If signs/symptoms develop, get medical attention.

If Swallowed: Do not induce vomiting. Give victim two glasses of water. Never give anything by mouth to an unconscious person. Get immediate medical attention.

SECTION 5: FIRE FIGHTING MEASURES

5.1 FLAMMABLE PROPERTIES

Autoignition temperature	*Not Applicable*
Flash Point	*Not Applicable*
Flammable Limits - LEL	*Not Applicable*
Flammable Limits - UEL	*Not Applicable*

5.2 EXTINGUISHING MEDIA

Product is a fire-extinguishing agent.

5.3 PROTECTION OF FIRE FIGHTERS

Special Fire Fighting Procedures: Exposure to extreme heat can give rise to thermal decomposition. Wear full protective equipment (Bunker Gear) and a self-contained breathing apparatus (SCBA).

Unusual Fire and Explosion Hazards: Not applicable.

Note: See STABILITY AND REACTIVITY (SECTION 10) for hazardous combustion and thermal decomposition information.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Accidental Release Measures: Refer to other sections of this MSDS for information regarding physical and health hazards, respiratory protection, ventilation, and personal protective equipment. Call 3M-HELPS line (1-800-364-3577) for more information on handling and managing the spill. Evacuate unprotected and untrained personnel from hazard area. The spill should be cleaned up by qualified personnel. Ventilate the area with fresh air. For large spill, or spills in confined spaces, provide mechanical ventilation to disperse or exhaust vapors, in accordance with good industrial hygiene practice. Warning! A motor could be an ignition source and could cause flammable gases or vapors in the spill area to burn or explode. Contain spill. For larger spills, cover drains and build dikes to prevent entry into sewer systems or bodies of water. Working from around the edges of the spill inward, cover with bentonite, vermiculite, or commercially available inorganic absorbent material. Mix in sufficient absorbent until it appears dry. Collect as much of the spilled material as possible. Clean up residue with detergent and water. Collect the resulting residue containing solution. Place in a closed container approved for transportation by appropriate authorities. Dispose of collected material as soon as possible.

In the event of a release of this material, the user should determine if the release qualifies as reportable according to local, state, and federal regulations.

SECTION 7: HANDLING AND STORAGE

7.1 HANDLING

For industrial or professional use only. Avoid breathing of vapors, mists or spray. Avoid skin contact. Do not eat, drink or smoke when using this product. Wash exposed areas thoroughly with soap and water. Do not breathe thermal decomposition products. Avoid contact with oxidizing agents. Use general dilution ventilation and/or local exhaust ventilation to control airborne exposures to below Occupational Exposure Limits. If ventilation is not adequate, use respiratory protection equipment.

7.2 STORAGE

Keep container in well-ventilated area. Store away from heat. Store away from acids. Store away from oxidizing agents. Store away from strong bases and alcohols.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 ENGINEERING CONTROLS

Provide appropriate local exhaust ventilation on open containers. Use with appropriate local exhaust ventilation. For those situations where the fluid might be exposed to extreme overheating due to misuse or equipment failure, use with appropriate local exhaust ventilation sufficient to maintain levels of thermal decomposition products below their exposure guidelines.

8.2 PERSONAL PROTECTIVE EQUIPMENT (PPE)

8.2.1 Eye/Face Protection

Avoid eye contact.
The following eye protection(s) are recommended: Indirect Vented Goggles.

8.2.2 Skin Protection

Avoid skin contact.

Select and use gloves and/or protective clothing to prevent skin contact based on the results of an exposure assessment. Consult with your glove and/or protective clothing manufacturer for selection of appropriate compatible materials.
Gloves made from the following material(s) are recommended: Butyl Rubber.

8.2.3 Respiratory Protection

Avoid breathing of vapors, mists or spray.
Select one of the following NIOSH approved respirators based on airborne concentration of contaminants and in accordance with OSHA regulations: Fullface supplied-air respirator, Half facepiece or fullface air-purifying respirator with organic vapor cartridges and N95 particulate prefilters. Consult the current 3M Respiratory Selection Guide for additional information or call 1-800-243-4630 for 3M technical assistance.

8.2.4 Prevention of Swallowing

Do not eat, drink or smoke when using this product. Wash exposed areas thoroughly with soap and water.

8.3 EXPOSURE GUIDELINES

Ingredient	Authority	Type	Limit	Additional Information
2-METHOXYMETHYLETHOXYPROPANOL	ACGIH	TWA	100 ppm	Skin Notation*****
2-METHOXYMETHYLETHOXYPROPANOL	ACGIH	STEL	150 ppm	Skin Notation*****
2-METHOXYMETHYLETHOXYPROPANOL	OSHA	TWA	100 ppm	Skin Notation*****; Table Z-1A
2-METHOXYMETHYLETHOXYPROPANOL	OSHA	STEL	150 ppm	Skin Notation*****; Table Z-1A
CERTAIN 3M FLUOROCHEMICALS	3M	TWA	0.1 mg/m3	Skin Notation*****
TRIETHANOLAMINE	ACGIH	TWA	5 mg/m3	

* Substance(s) refer to the potential contribution to the overall exposure by the cutaneous route including mucous membrane and eye, either by airborne or, more particularly, by direct contact with the substance. Vehicles can alter skin absorption.

SOURCE OF EXPOSURE LIMIT DATA:
ACGIH: American Conference of Governmental Industrial Hygienists
CMRG: Chemical Manufacturer Recommended Guideline
OSHA: Occupational Safety and Health Administration
AIHA: American Industrial Hygiene Association Workplace Environmental Exposure Level (WEEL)

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Odor, Color, Grade:	Viscous amber solution with mild odor.
General Physical Form:	Liquid
Autoignition temperature	*Not Applicable*
Flash Point	*Not Applicable*
Flammable Limits - LEL	*Not Applicable*
Flammable Limits - UEL	*Not Applicable*
Boiling point	Approximately 100 ºC [*Details:* CONDITIONS: Initial]
Density	1.04 g/ml
Vapor Density	Approximately 0.64 [*Ref Std:* AIR=1]
Vapor Pressure	Approximately 18 mmHg [@ 20 ºC]
Specific Gravity	1.04 [*Ref Std:* WATER=1]
Melting point	-4 ºC
Solubility in Water	Appreciable
Evaporation rate	*No Data Available*
Volatile Organic Compounds	Approximately 31 g/l [*Test Method:* South Cost Air Qual Mgmt Dist]
Percent volatile	Approximately 87 %
VOC Less H2O & Exempt Solvents	Approximately 193 g/l [*Test Method:* South Cost Air Qual Mgmt Dist]
Viscosity	<=1900 centipoise [@ 25 ºC]

SECTION 10: STABILITY AND REACTIVITY

Stability: Stable.

Materials and Conditions to Avoid: Strong acids; Strong bases; Strong oxidizing agents; Alcohols

Hazardous Polymerization: Hazardous polymerization will not occur.

Hazardous Decomposition or By-Products

Substance	Condition
Carbon monoxide	During Combustion
Carbon dioxide	During Combustion
Hydrogen Fluoride	During Combustion
Oxides of Nitrogen	During Combustion
Toxic Vapor, Gas, Particulate	During Combustion

Hazardous Decomposition: Hydrogen fluoride has an ACGIH Threshold Limit Value of 3 parts per million (as fluoride) as a Ceiling Limit and an OSHA PEL of 3 ppm of fluoride as an eight hour Time-Weighted Average and 6 ppm of fluoride as a Short Term Exposure Limit. The odor threshold for HF is 0.04 ppm, providing good warning properties for exposure.

SECTION 11: TOXICOLOGICAL INFORMATION

Component-Based Toxicology Information:

This product contains one or more organic fluorochemicals that have the potential to be absorbed and remain in the body for long periods of time, either as the parent molecule or as metabolites, and may accumulate with repeated exposures. There are no known human health effects from anticipated exposure to these organic fluorochemicals when used as intended and instructed.

The presence of organic fluorochemicals in the blood of the general population and subpopulations, such as workers, has been published dating back to the 1970s. 3M's epidemiological study of its own workers indicates no adverse effects.

Animal studies conducted on organic fluorochemicals which are present in this product indicate effects including liver disturbances, weight loss, loss of appetite, lethargy, and neurological, pancreatic, adrenal and hematologic effects. There are no known human health effects from anticipated exposure to these organic fluorochemicals when used as intended and instructed.

Please contact the address listed on the first page of the MSDS for Toxicological Information on this material and/or its components.

SECTION 12: ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL INFORMATION

Test Organism	Test Type	Result
Fathead Minnow, Pimephales promelas	96 hours Lethal Concentration 50%	177 mg/l
Water flea, Daphnia magna	48 hours Effect Concentration 50%	2030 mg/l
Green algae, Selenastrum capricornutum	96 hours Effect Concentration 50%	177 mg/l
Activated Sludge,	3 hours Effect Concentration 50%	>10000 mg/l

CHEMICAL FATE INFORMATION

Test Type	Result	Protocol
20 days Biological Oxygen Demand	38 % weight	

SECTION 13: DISPOSAL CONSIDERATIONS

Waste Disposal Method: To reclaim or return, contact your 3M sales representative.
Incinerate in an industrial or commercial facility in the presence of a combustible material. As a disposal alternative, dispose of waste product in a facility permitted to accept chemical waste. Combustion products will include HF. Facility must be capable of handling halogenated materials.

EPA Hazardous Waste Number (RCRA): Not regulated

Since regulations vary, consult applicable regulations or authorities before disposal.

SECTION 14:TRANSPORT INFORMATION

ID Number(s):
98-0211-9280-6, 98-0211-9281-4, 98-0211-9282-2, 98-0211-9297-0, 98-0211-9343-2, AZ-0002-1186-0, ZF-0002-1185-2, ZF-0002-1187-8, ZF-0002-1188-6

Please contact the emergency numbers listed on the first page of the MSDS for Transportation Information for this material.

SECTION 15: REGULATORY INFORMATION

US FEDERAL REGULATIONS

Contact 3M for more information.

311/312 Hazard Categories:
Fire Hazard - No Pressure Hazard - No Reactivity Hazard - No Immediate Hazard - Yes Delayed Hazard - Yes

This material contains a chemical which requires export notification under TSCA Section 12[b]:

Ingredient (Category if applicable)	C.A.S. No	Regulation	Status
FLUOROALIPHATIC POLYMER +(6151P) (Perfluoroalkyl Sulfonates)	Trade Secret	Toxic Substances Control Act (TSCA) 5 SNUR or Consent Order Chemicals	Applicable
N-[3-(DIMETHYLAMINO)PROPYL PERFLUOROOCTANE SULFONAMIDE, N'-OXIDE POTASSIUM SALT (Perfluoroalkyl Sulfonates)	178094-69-4	Toxic Substances Control Act (TSCA) 5 SNUR or Consent Order Chemicals	Applicable
2-METHOXYMETHYLETHOXYPROPANOL	34590-94-8	Toxic Substances Control Act (TSCA) 4 Test Rule Chemicals	Applicable

This material contains a chemical regulated by an EPA Significant New Use Rule (TSCA Section 5)

Ingredient (Category if applicable)	C.A.S. No	Reference

FLUOROALIPHATIC POLYMER +(6151P) (Perfluoroalkyl Sulfonates)	Trade Secret	67FR72854
N-[3-(DIMETHYLAMINO)PROPYL PERFLUOROOCTANE SULFONAMIDE, N'-OXIDE POTASSIUM SALT (Perfluoroalkyl Sulfonates)	178094-69-4	67FR72854

STATE REGULATIONS

Contact 3M for more information.

CHEMICAL INVENTORIES

The components of this product are in compliance with the chemical notification requirements of TSCA.

Contact 3M for more information.

Additional Information: New Jersey Trade Secret Registry Number (EIN) 04499600-+.

INTERNATIONAL REGULATIONS

Contact 3M for more information.

ADDITIONAL INFORMATION

On May 16, 2000, 3M announced the manufacturing phase out of products based on perfluorooctanyl chemistry. This product contains materials related to Perfluorooctyl Sulfonates (PFOS) and, subsequently, is the subject of a Significant New Use Rule (SNUR), 67 FR 72854, dated December 9, 2002, by the Environmental Protection Agency (EPA)

The components of this product are in compliance with the chemical registration requirements of TSCA and ELINCS.

This MSDS has been prepared to meet the U.S. OSHA Hazard Communication Standard, 29 CFR 1910.1200.

SECTION 16: OTHER INFORMATION

NFPA Hazard Classification

Health: 3 **Flammability:** 0 **Reactivity:** 0 **Special Hazards:** None

National Fire Protection Association (NFPA) hazard ratings are designed for use by emergency response personnel to address the hazards that are presented by short-term, acute exposure to a material under conditions of fire, spill, or similar emergencies. Hazard ratings are primarily based on the inherent physical and toxic properties of the material but also include the toxic properties of combustion or decomposition products that are known to be generated in significant quantities.

HMIS Hazard Classification

Health: 2 **Flammability:** 0 **Reactivity:** 0 **Protection:** X - See PPE section.

Hazardous Material Identification System (HMIS(r)) hazard ratings are designed to inform employees of chemical hazards in the workplace. These ratings are based on the inherent properties of the material under expected conditions of normal use and are not intended for use in emergency situations. HMIS(r) ratings are to be used with a fully implemented HMIS(r) program. HMIS(r) is a registered mark of the National Paint and Coatings Association (NPCA).

Revision Changes:
Section 15: WHMIS regulations comment was modified.
Section 16: Reason for reissue comment was deleted.
Section 16: Reason for reissue heading was deleted.

DISCLAIMER: The information in this Material Safety Data Sheet (MSDS) is believed to be correct as of the date issued. 3M MAKES NO WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR COURSE OF PERFORMANCE OR USAGE OF TRADE. User is responsible for determining whether the 3M product is fit for a particular purpose and suitable for user's method of use or application. Given the variety of factors that can affect the use and application of a 3M product, some of which are uniquely within the user's knowledge and control, it is essential that the user evaluate the 3M product to determine whether it is fit for a particular purpose and suitable for user's method of use or application.

3M provides information in electronic form as a service to its customers. Due to the remote possibility that electronic transfer may have resulted in errors, omissions or alterations in this information, 3M makes no representations as to its completeness or accuracy. In addition, information obtained from a database may not be as current as the information in the MSDS available directly from 3M.

3M MSDSs are available at www.3M.com

I. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

1.1. Identification of the preparation

Product Name:	"ANSULEX Low pH" – Liquid Fire Suppressant
Chemical Name:	N/A – This is a mixture/preparation.
CAS No.:	N/A – This is a mixture/preparation.
Chemical Formula:	N/A – This is a mixture/preparation.
EINECS Number:	N/A – This is a mixture/preparation.

1.2. Use of the preparation

The intended or recommended use of this preparation is as a FIRE EXTINGUISHING AGENT.

1.3. Company Identification

Manufacturer/Supplier:	ANSUL INCORPORATED
Address:	One Stanton Street, Marinette, WI 54143-2542
Prepared by:	Safety and Health Department
Phone:	715-735-7411
Internet/Home Page:	http://www.ansul.com
Date of Issue:	April, 2010

1.4. Emergency telephone

CHEMTREC 800-424-9300 or 703-527-3887

2. COMPOSITION/INFORMATION ON INGREDIENTS

This product does not contain any hazardous substances.

3. HAZARDS IDENTIFICATION

FOR HUMANS:
Product:

EU Classification:	Not classified as hazardous.	
S	26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S	36	Wear suitable protective clothing.

Limit Values for Exposure: None established.

Neither this preparation nor the substances contained in it have been listed as carcinogenic by National Toxicology Program, I.A.R.C., or OSHA.

SIGNS AND SYMPTOMS:
Acute Exposure:

Eye Contact:	May cause mild to moderate transient irritation.
Skin Contact:	May cause mild transient irritation and/or dermatitis..
Inhalation:	Not a likely route of entry. Can be irritating to mucous membranes.
Ingestion:	May cause mild transient irritation or gastric upset.
Chronic Overexposure:	None known.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: None known.

FOR ENVIRONMENT:
No data available.

4. FIRST AID MEASURES

Eye Contact:	Flush with water for a minimum of 15 minutes while holding lids open. If transient irritation exists, seek medical attention.
Skin Contact:	Wash affected area with soap and water. If transient irritation exists, seek medical attention.
Inhalation:	Remove from exposure. If transient irritation exists, seek medical attention.
Ingestion:	Dilute by drinking large quantities of water.

5. FIRE-FIGHTING MEASURES

This preparation is an extinguishing media.
There are NO extinguishing media which must not be used for safety reasons.
NO special protective equipment is needed for fire-fighters.

6. ACCIDENTAL RELEASE MEASURES

Turn off or disconnect electrical sources in the immediate area.
For personal protection: Prevent skin and eye contact, see Heading 8.
Clean up: Use an absorbent material such as diatomaceous earth, sawdust, etc., and sweep up, see Heading 13.
NO harm to the environment is expected from an accidental release of this preparation.

7. HANDLING AND STORAGE

7.1. Handling

Care should be taken in handling all chemical substances and preparations.
See incompatibility information in Heading 10.

7.2. Storage

NO special conditions are needed for safe storage.
See incompatibility information in Heading 10.
Store in original container. Keep tightly closed until used.
There is minimal danger to the environment from a storage release.

7.3. Specific use

The intended or recommended use of this preparation is as a FIRE EXTINGUISHING AGENT.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1. Exposure limit values

There are NO current occupational exposure limit values for this preparation or any of its components.

8.2. Exposure controls

8.2.1. Occupational exposure controls

8.2.1.1. Respiratory protection

Not expected to be needed. Vapors will be water.

8.2.1.2. Hand protection

Use chemical resistant gloves when handling the preparation.

8.2.1.3. Eye protection

Use safety glasses with side shields or safety goggles.

8.2.1.4. Skin protection

No special equipment is needed.

8.2.2. Environmental exposure controls

Dilute minor spills with water. Collect major spills and reuse or dispose. See Heading 12.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1. General information

Appearance:	Clear Fluorescent Yellow Liquid.
Odor:	Mild.

9.2. Important health, safety, and environmental information

pH:	7.7 to 8.7
Boiling point/boiling range:	113 °C.
Flash point:	None to boiling.
Flammability (solid/gas):	Not flammable.
Explosive properties:	Not explosive.

Oxidizing properties:	Not an oxidizer.
Vapor Pressure:	Not determined.
Relative Density (Water = 1):	1.33.
Solubility:	
– Water solubility:	Completely soluble.
– Fat solubility:	Not soluble.
Partition coefficient, n-octanol/water:	Not determined.
Viscosity:	Not determined.
Vapor density (Air = 1):	1.03.
Evaporation rate (Butyl Acetate =1):	0.13, water only evaporates.

9.3. Other information

Auto-ignition temperature: Does not ignite.

10. STABILITY AND REACTIVITY

10.1. Conditions to avoid

There are NO known conditions such as temperature, pressure, light, shock, etc., which may cause a dangerous reaction.

10.2. Materials to avoid

Reactive metals may react with the water in this preparation.
Energized electrical equipment may cause a shock hazard when this fire extinguishing agent is used.

10.3. Hazardous decomposition products

Normally stable.
Hazardous polymerization will NOT occur.
Combustion or decomposition products include CO_2, CO.

11. TOXICOLOGICAL INFORMATION

No data available.

12. ECOLOGICAL INFORMATION

12.1. Ecotoxicity
Not determined.

12.2. Mobility
Not determined.

12.3. Persistence and degradability
Not determined.

12.4. Bioaccumulative potential
Not determined.

12.5. Other adverse effects

Ozone depletion potential:	None
Photochemical ozone creation potential:	None
Global warming potential:	None

13. DISPOSAL CONSIDERATIONS

This preparation, if spilled, is NOT a hazardous waste.
No harm to the environment is expected from this preparation.
Dispose of in compliance with national, regional, and local provisions that may be in force.

14. TRANSPORT INFORMATION

Hazard Class or Division: Not hazardous.
There are NO special precautions known.
No harm to the environment is expected from this preparation.

15. REGULATORY INFORMATION

EU Classification:		Not classified as hazardous.
S	26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S	36	Wear suitable protective clothing.
Exposure Limit Values:		None.

EINECS Status: All components are included in EINECS inventories or are exempt from listing.
EPA TSCA Status All components are included in TSCA inventories or are exempt from listing.
Canadian DSL (Domestic Substances List): All components are included in the DSL or are exempt from listing.

Environmental restrictions: None are known.
Restrictions on Marketing and Use: None are known.
Refer to any other national measures that may be relevant.

16. OTHER INFORMATION

(HMIS) HAZARDOUS MATERIAL IDENTIFICATION SYSTEM RATINGS:

HEALTH:	1	4. Severe Hazard
FLAMMABILITY:	0	3. Serious Hazard
REACTIVITY:	0	2. Moderate Hazard
		1. Slight Hazard
		0. Minimal Hazard

Format is from directive 2001/58/EC.

EINECS data is from http://ecb.jrc.it/existing-chemicals/

Data used to compile the data sheet is from Ansul Material Safety Data Sheet, February, 2002.

The EU Classification has been changed in accordance with Directive 1999/45/EC and information in the EINECS ESIS files (Existing Substances Information System).

Toxicological information added from the EINECS ESIS (Existing Substances Information System).

17. DISCLAIMER

THE ABOVE INFORMATION IS BELIEVED TO BE CORRECT, BUT DOES NOT PURPORT TO BE ALL INCLUSIVE AND SHALL BE USED ONLY AS A GUIDE. ANSUL SHALL NOT BE HELD LIABLE FOR ANY DAMAGE RESULTING FROM HANDLING OR FROM CONTACT WITH THE ABOVE PRODUCT.

MSDS available at http://www.ansul.com

INTELLIGENT TRAINING SYSTEM

EXTINGUISHER TRAINING MADE SAFE, CLEAN & EFFECTIVE

For detailed information, submit the form below.

First Name:
Last Name:
Email:
Phone:
Company:
How did you find us:

Submit

(http://go.bullex.com/l/11472/2013-01-18/pmx6d)

LIVE-FIRE EXTINGUISHER TRAINING

Train your entire community, including high risk populations, on proper fire extinguisher use with a BullEx Intelligent Training System™ (I.T.S.). Using a controlled, propane-based fire to recreate an incipient stage fire, the I.T.S. is designed to teach the PASS method in the cleanest, safest way possible.

Designed with a unique flame-response technology that detects the trainee's aiming and sweeping motion, the system automatically varies the flame in response, providing a realistic training experience. Because the training extinguishers use readily available air and water, instead of costly dry chemical or CO_2, multiple trainees can safely train in a single session.

The I.T.S. is a simpler, safer way to provide live fire extinguisher training to everyone in your community. Offer your community regular and annual fire extinguisher training as part of your department's public education program. Safely provide employers with OSHA-required fire extinguisher training at the workplace. I.T.S. is ideal for these training opportunities and more.

(http://bullex.com/wp-content/uploads/2013/01/490x1-red-rule.jpg)

FEATURES AND BENEFITS

Training Made Easy

The I.T.S. comes complete with everything you will need for fire extinguisher training. A field rechargeable air/water SmartExtinguisher® eliminates extinguisher recharge costs and the need to clean up dry-chemical after a training session.

Effective Training
Extremely low operating costs mean you can train as many individuals as needed and train as often as you like. Select class A, B or C fires at four different difficulty levels to challenge trainees.

Safe Training
The trainer can control the intensity of the flames and utilize the emergency stop switch on the handheld controller at any time. A motion sensor shuts down the flames instantly if the system is bumped or knocked, making BullEx live-fire training systems the safest live-fire simulators available.

Cost Effective
Because there is no longer a need to discharge and recharge costly dry-chemical or CO_2 extinguishers, BullEx live-fire extinguisher training systems are often more cost effective.

Clean
Uses clean burning propane gas to generate flame output with no cleanup needed of dangerous and hazardous chemical associated with actual extinguishers.

Trackable results
A visual display shows the time of each successful training session, allowing you to track the performance of trainees each year.

Reliable and Durable
The I.T.S. System is constructed with stainless steel components and designed to withstand repeated use.

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Process (http://bullex.com/process/)

MATERIAL SAFETY DATA SHEET

CHEMGUARD 3%/6% AR-AFFF C-361

SECTION I: Identity

Manufacturer
Chemguard, Inc.
204 South Sixth Ave.
Mansfield, TX 76063
(817) 473-9964
Emergency telephone (817) 473-9964

Chemical name: mixture
Chemical family: N/A
Formula: N/A
CAS No.: N/A

Revision date: 9/16/00

SECTION II: Ingredients

Hazardous Ingredients	%	CAS No.	ACGIH TLV	Other Limits
NONE				

Other Ingredients
Proprietary mixture of fluorocarbon
and hydrocarbon surfactants and solvents.

SARA Title III reportable components
NONE

SECTION III: Physical/Chemical Characteristics

Boiling point:	212°-310° F.	**Flash point (PMCC):**	151° F.
Melting point:	28° F.	**Vapor density (air = 1):**	N/A
Specific gravity:	1.02	**Solubility in water:**	100%
Vapor pressure (mm Hg):	NA	Evaporation rate (butyl acetate = 1):	< 1
pH:	6.4 - 7.4	**Appearance and odor:**	Thick, opaque slightly yellow liquid

SECTION IV: Fire and Explosion Hazard Data

Flash point (PMCC): 151° F.
Flammable Limits: Not flammable
Extinguishing media: Compatible with CO_2, dry chemicals, foam, water and halon.
Special Fire Fighting Procedures: None
Unusual Explosion Hazards: None

SECTION V: Reactivity data

Stability: Stable
Hazardous Polymerization: Will not occur.
Incompatibility: Avoid strong oxidizers and strong acids.
Decomposition Products: CO_2, CO, possibly NH_3

SECTION VI: Health Hazard Data

Routes of entry - Eye: May cause eye irritation.
Inhalation: May cause mild irritation.
Skin: May cause mild irritation.
Ingestion: Not an expected route of entry.

Health Hazard - Acute: Irritation of eyes, skin and mucous membranes.
Chronic: None known.

Carcinogenicity: Not a carcinogen.
OSHA regulated? NO
Medical Conditions Generally
Aggravated by Exposure: Skin irritation to individuals with sensitive skin.
Signs and Symptoms of Exposure: Watering of eyes, reddening of skin.
Emergency and First Aid Procedures: **Eyes:** Flush with water and contact physician.
Skin: Rinse with water. Wash with soap and water.
Inhalation: Remove to fresh air.
Ingestion: Do not induce vomiting. Call Physician.

SECTION VII: Precautions for Safe Handling and Use

Precautions for Handling and Storage: Store in original container.
Release or Spill Measures: Contain and collect spill. Dispose according to Local, State and Federal Regulations.
Waste Disposal Method: Dispose according to Local, State and Federal Regulations. Send to local waste treatment plant only with permission.
Other Precautions: Areas on which a spill occurred may be slippery.

HMIS Rating:

	Health	1
	Flammability	1
	Reactivity	0

SECTION VIII: Control Measures

Respiratory Protection: Not generally needed
Ventilation: Use if available.
Protective Gloves: Latex or rubber.
Eye Protection: Use safety glasses with side shields, or goggles.
Other Protective Clothing or Equipment: None recommended.
Industrial Hygienic Practices: Clean spills.

Material Safety Data Sheet
May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910 1200. Standard must be consulted for specific requirements.

U.S. Department of Labor

Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072

IDENTITY) ***Micro-Blaze ® Emergency Liquid Spill Control***

Note: Blank spaces are not permitted. If any item is not applicable or no information is available, the space must be marked to indicate that.

Section I

Manufacturer's name	Verde Environmental, Inc.	Emergency Telephone Number	800 / 626-6598
Address	9223 Eastex Freeway	Telephone Number for Information	713 / 691-6468
	Houston, Texas 77093-7001	Date Prepared	01 / 01 / 13
		Signature of Preparer	William L. Scogin, President

Section II—Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity, Common Name(s)) CAS Number:	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)

****** NO HAZARDOUS COMPONENTS OR INGREDIENTS ******

Per OSHA –29 CFR 1910.1200 -- All ingredients are organic and completely biodegradable.

Components not listed are either proprietary, or non-hazardous.

Section III—Physical/Chemical Characteristics

Boiling Point	100°C	Specific Gravity (H_20 = 1)	1.0
Vapor Pressure (mm Hg)	Equiv. water	Melting Point	N / A
Vapor Density (AIR = 1)	Equiv. water	Evaporation Rate (Butyl Acetate = 1)	N / A

Solubility in Water: 99%

Appearance and Odor: Cream to tan, opaque liquid, perfumed

Section IV—Fire and Explosion Hazard Data

Flash Point (Method Used)	Flammable Limits	LEL	UEL
N / A	Non-flammable	----	----

Extinguishing Media: Non-flammable

Special Fire Fighting Procedures: None

Unusual Fire and Explosion Hazards: None - **NON-FLAMMABLE**

Section V—Reactivity Data

Stability	Unstable		Conditions to Avoid
	Stable XXXX		

Incompatibility *(Materials to Avoid)* Strong acids or alkali compounds may inactivate biological cultures.

Hazardous Decomposition or Byproducts

Hazardous Polymerization	May Occur		Conditions to Avoid
	Will Not Occur	XXXX	

Section VI—Health Hazard Data

Route(s) of Entry	Inhalation?	Skin?	Ingestion?

Health Hazards *(Acute and Chronic)* May cause diarrhea if ingested in large amounts. **NON-TOXIC**

Organisms used are non-pathogenic. These organisms are susceptible to commonly used antibiotics.

Carcinogenicity	NTP?	IARC Monographs?	OSHA Regulated?
N / A	N / A	N / A	N / A

Signs and Symptoms of Exposure Skin: slight redness on hands and forearms if individual has a history of dermal allergic reaction.

Medical Conditions Generally Aggravated by Exposure Dermal allergic reaction on skin if susceptible person has continual exposure.

Emergency and First Aid Procedures Ingestion: Drink water or milk to dilute. Induce vomiting only if advised by physician or poison control center.

Section VII—Precautions for Safe Handling and Use

Steps to Be Taken in Case Material Is Released or Spilled May mop up spills; may flush down sanitary drain into waste water treatment lines.

Waste Disposal Method Disposal of this product or its residue must be done in accordance with all local, state and federal requirements.

Precautions to Be Taken in Handling and Storing Avoid eye contact.

Other Precautions To maintain shelf life, avoid temperatures under 32° F or over 120° F for long periods of time. Microbes are viable up to 180° F. KEEP FROM PROLONGED FREEZING.

Section VII—Control Measures

Respiratory Protection *(Specify Type)* Avoid breathing mists; mask advised if spraying in enclosed, unventilated spaces.

Ventilation	Local Exhaust	Special
	Mechanical *(General)*	Other Normal room ventilation.

Protective Gloves Use if prolonged exposure or dermal sensitivity to surfactants.	Eye Protection Avoid splashing in eyes; may irritate.

Other Protective Clothing or Equipment None required, rubber or latex recommended.

Work/Hygienic Practices Minimize exposure in accordance with good hygiene practices.

Material Safety Data Sheet
May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910 1200. Standard must be consulted for specific requirements.

U.S. Department of Labor
Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072

IDENTITY) **Micro-Blaze Out®**	*Note: Blank spaces are not permitted. If any item is not applicable or no information is available, the space must be marked to indicate that.*

Section I

Manufacturer's name: Verde Environmental, Inc.	Emergency Telephone Number: 800 / 626-6598
Address: 9223 Eastex Freeway	Telephone Number for Information: 713 / 691-6468
Houston, Texas 77093-8501	Date Prepared: 01 / 01 / 13
	Signature of Preparer: *William L. Scogin, President*

Section II—Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity, Common Name(s))	CAS Number:	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)

****** NO HAZARDOUS COMPONENTS OR INGREDIENTS ******

Per OSHA –29 CFR 1910.1200 -- All ingredients are organic and completely biodegradable.

.

Components not listed are either proprietary, or non-hazardous.

Section III—Physical/Chemical Characteristics

Boiling Point	100°C	Specific Gravity (H_20 = 1)	1.0
Vapor Pressure (mm Hg)	Equiv. water	Melting Point	N / A
Vapor Density (AIR = 1)	Equiv. water	Evaporation Rate (Butyl Acetate = 1)	N / A

Solubility in Water: 99%

Appearance and Odor: Tan opaque liquid, perfumed.

Section IV—Fire and Explosion Hazard Data

Flash Point (Method Used)	Flammable Limits	LEL	UEL
N / A	Non-flammable	----	----

Extinguishing Media: Non-flammable

Special Fire Fighting Procedures: None – Micro-Blaze Out® is U/L Listed as a wetting agent for Class A and Class B Fire Fighting.

Unusual Fire and Explosion Hazards: None – **NON-FLAMMABLE**

Section V—Reactivity Data

Stability	Unstable		Conditions to Avoid
	Stable XXXX		

Incompatibility *(Materials to Avoid)* Strong acids or alkali compounds may inactivate biological cultures.

Hazardous Decomposition or Byproducts

Hazardous Polymerization	May Occur		Conditions to Avoid
	Will Not Occur	XXXX	

Section VI—Health Hazard Data

Route(s) of Entry	Inhalation? XXXX	Skin?	Ingestion? XXXX

Health Hazards *(Acute and Chronic* Ingestion may cause abdominal pains, nausea and vomiting if ingested in large amounts.

Organisms used are non-pathogenic. These organisms are susceptible to commonly used antibiotics. **NON-TOXIC**

Carcinogenicity N / A	NTP? N / A	IARC Monographs? N / A	OSHA Regulated? N / A

Signs and Symptoms of Exposure Eye: May cause eye irritation.

Medical Conditions
Generally Aggravated by Exposure Dermal allergic reaction on skin if susceptible person has continual exposure.

Emergency and First Aid Procedures *Ingestion:* Drink water or milk to dilute. Induce vomiting only if advised by physician or poison control center. *Eyes:* Immediately flush with water for at least 15 minutes and have examined by medical personnel. *Skin:* Wash material off the skin with soap and water. Wash clothing before reuse.

Section VII—Precautions for Safe Handling and Use

Steps to Be Taken in Case Material Is Released or Spilled May mop up spills; may flush down sanitary drain into waste water treatment lines.

Waste Disposal Method Disposal of this product or its residue must be done in accordance with all local, state and federal requirements.

Precautions to Be Taken in Handling and Storing Avoid eye contact. Wash hands with soap and water after use.

Other Precautions To maintain shelf life, avoid temperatures under 32° F or over 120° F for long periods of time. Microbes are viable up to 180° F. KEEP FROM PROLONGED FREEZING.

Section VII—Control Measures

Respiratory Protection *(Specify Type*) Avoid breathing mists; mask advised if spraying in enclosed, unventilated spaces.

Ventilation	Local Exhaust	Special
	Mechanical *(General)*	Other Normal room ventilation.

Protective Gloves Use if prolonged exposure or dermal sensitivity to surfactants.	Eye Protection Avoid splashing in eyes; may irritate.

Other Protective Clothing or Equipment None required, rubber or latex recommended.

Work/Hygienic Practices Minimize exposure in accordance with good hygiene practices.

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

1.1. Identification of the preparation

Product Name:	"ABC Multipurpose"
Chemical Name:	N/A – This is a mixture/preparation.
CAS No.:	N/A – This is a mixture/preparation.
Chemical Formula:	N/A – This is a mixture/preparation.
EINECS Number:	N/A – This is a mixture/preparation.

1.2. Use of the preparation

The intended or recommended use of this preparation is as a FIRE EXTINGUISHING AGENT.

1.3. Company identification

Manufacturer/Supplier:	ANSUL INCORPORATED
Address:	One Stanton Street, Marinette, WI 54143-2542
Prepared by:	Safety and Health Department
Phone:	715-735-7411
Internet/Home Page:	http://www.ansul.com
Date of Issue:	October, 2007

1.4. Emergency telephone

CHEMTREC 800-424-9300 or 703-527-3887

2. COMPOSITION/INFORMATION ON INGREDIENTS

2.1.

Ingredient Name:	Monoammonium Phosphate.
Chemical Formula:	$NH_4H_2PO_4$.
CAS No.:	7722-76-1.
EINECS Number:	231-764-5.
Concentration, Wt %:	80-95 %.
Hazard Identification:	See Heading 3.
Ingredient Name:	Calcium Carbonate
Chemical Formula:	$CaCO_3$.
CAS No.:	471-34-1.
EINECS Number:	207-439-9.
Concentration, Wt %:	1-4 %.
Hazard Identification:	See Heading 3.
Ingredient Name:	Magnesium Aluminum Silicate (Attapulgite Clay or Fuller's Earth).
Chemical Formula:	$Mg_xAl_y(SiO4)_z$.
CAS No.:	8031-18-3.
EINECS Number:	(b).
Concentration, Wt %:	1-4 %.
Hazard Identification:	See Heading 3.
Ingredient Name:	Mica, Muscovite.
Chemical Formula:	Mixture/preparation.
CAS No.:	12001-26-2.
EINECS Number:	(b).
Concentration, Wt %:	1-4 %.
Hazard Identification:	See Heading 3.
Ingredient Name:	Methyl Hydrogen Polysiloxane.
Chemical Formula:	Mixture/preparation.
CAS No.:	63148-57-2.
EINECS Number:	(a).
Concentration, Wt %:	0.3-1.5 %.
Hazard Identification:	See Heading 3.
Ingredient Name:	Amorphous Silica.
Chemical Formula:	$(SiO_2)_x$.
CAS No.:	7631-86-9.
EINECS Number:	231-545-4.
Concentration, Wt %:	0.2-1.5 %.
Hazard Identification:	See Heading 3.

(a) EINICS does not include synthetic polymers (these are registered in EINICS under their building blocks, monomers). See: 67/548/EEC, article 13; 79/831/EC; and 81/437/EC.

(b) EINICS does not include most naturally occurring raw materials. See: 67/548/EEC, article 13; 79/831/EC; and 81/437/EC.

NOTE: Unless a component presents a severe hazard, it does not need to be considered in the MSDS if the concentration is less than 1%. [According to Directive 1999/45/EC.]

3. HAZARDS IDENTIFICATION

FOR HUMANS:
Product:

EU Classification:		Harmful.
R Phrases:	22	Harmful if swallowed.
	36/37/38	Irritating to eyes, respiratory system, and skin.
S Phrases:	26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
	36	Wear suitable protective clothing.

Components:
Monoammonium Phosphate:

EU Classification:		Harmful.
R Phrases:	22	Harmful if swallowed.
	36/37/38	Irritating to eyes, respiratory system, and skin.
S Phrases:	26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
	36	Wear suitable protective clothing.

Ammonium sulfate:

EU Classification:		Irritant.
R Phrases:	36/37/38	Irritating to eyes, respiratory system, and skin.
S Phrases:	26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
	36	Wear suitable protective clothing.

Limit Values for Exposure:
Nuisance dust limit:

OSHA TWA:	15 mg/m^3
ACGIH TLV-TWA:	10 mg/m^3.

Neither this preparation nor the substances contained in it have been listed as carcinogenic by National Toxicology Program, I.A.R.C., or OSHA.

AS PART OF GOOD INDUSTRIAL AND PERSONAL HYGIENE AND SAFETY PROCEDURE, avoid all unnecessary exposure to the chemical substance and ensure prompt removal from skin, eyes, and clothing.

SIGNS AND SYMPTOMS:
Acute Exposure:

Eye Contact:	Mildly irritating for short periods of time.
Skin Contact:	May be mildly irritating.
Inhalation:	Treat as a mineral dust. Irritant to the respiratory tract. Transient cough, shortness of breath.
Ingestion:	Not an expected route of entry.

Chronic Overexposure:

Inhalation:	Chronic fibrosis of the lung, pneumoconiosis.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: None known.

FOR ENVIRONMENT:
No data available.

4. FIRST AID MEASURES

Eye Contact:	Wash with water for a minimum of 15 minutes. If irritation persists seek medical attention.
Skin Contact:	Wash affected area with soap and water. If irritation persists seek medical attention.
Inhalation:	Remove from exposure. If irritation persists seek medical attention.
Ingestion:	If patient is conscious, give large amounts of water and induce vomiting. Seek medical help.

5. FIRE-FIGHTING MEASURES

This preparation is an extinguishing media.
There are NO extinguishing media which must not be used for safety reasons.
NO special protective equipment is needed for fire-fighters. Wear protective equipment appropriate for the fire conditions.

6. ACCIDENTAL RELEASE MEASURES

For personal protection: Prevent skin and eye contact, see Heading 8.
Clean up: Sweep up and recover for use or place in closed container for disposal, see Heading 13.
NO harm to the environment is expected from an accidental release of this preparation.

7. HANDLING AND STORAGE

7.1. Handling

Care should be taken in handling all chemical substances and preparations.
See incompatibility information in Heading 10.

7.2. Storage

NO special conditions are needed for safe storage.
See incompatibility information in Heading 10.
Store in original container or ANSUL fire extinguisher. Keep tightly closed until used.
There is minimal danger to the environment from a storage release.

7.3. Specific use

The intended or recommended use of this preparation is as a FIRE EXTINGUISHING AGENT.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1. Exposure limit values

Nuisance dust limit:

OSHA TWA:	15 mg/m^3
ACGIH TLV-TWA:	10 mg/m^3

8.2. Exposure controls

8.2.1. Occupational exposure controls

8.2.1.1. Respiratory protection

Use local ventilation to minimize exposure to the substance.
Use mechanical ventilation for general area control.
Dust mask where dustiness is prevalent, or TLV is exceeded. Use mechanical filter respirator if exposure is prolonged.

8.2.1.2. Hand protection

None normally needed. Use chemical resistant gloves when handling the preparation.

8.2.1.3. Eye protection

Use safety glasses with side shields or safety goggles.

8.2.1.4. Skin protection

No special equipment is needed.

8.2.2. Environmental exposure controls

No special controls are needed.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1. General information

Appearance:	Fine Yellow Powder.
Odor:	None.

9.2. Important health, safety, and environmental information

pH:	Not determined.
Boiling point/boiling range:	Not applicable.
Flash point:	None.
Flammability (solid/gas):	Not flammable.
Explosive properties:	Not explosive.
Oxidizing properties:	Not an oxidizer.
Vapor Pressure:	Not applicable.
Relative Density:	Not applicable.
Solubility:	
– Water solubility:	Slight.
– Fat solubility:	Not soluble.
Partition coefficient, n-octanol/water:	Not determined.

Viscosity:	Not applicable.
Vapor density (Air = 1):	Not applicable.
Evaporation rate (Butyl Acetate):	Not applicable.

9.3. Other information

Auto-ignition temperature: Does not ignite.

10. STABILITY AND REACTIVITY

10.1. Conditions to avoid

There are NO known conditions such as temperature, pressure, light, shock, etc., which may cause a dangerous reaction.

10.2. Materials to avoid

Strong alkalis, magnesium, oxidizers that can release chlorine per NFPA 43A.

10.3. Hazardous decomposition products

Normally stable.

Hazardous polymerization will NOT occur.

Ammonia and/or phosphorous oxides can be evolved at very high temperatures.

11. TOXICOLOGICAL INFORMATION

This product has not been tested for toxicological effects. Product is treated as a nuisance dust.

Components:

Monoammonium Phosphate:

Material is irritating.

Harmful if swallowed.

Ammonium sulfate:

Toxicity Data:	Oral (rat) LD_{50}	2840 mg/kg.
Target Organs:	Lungs and gastrointestinal.	

12. ECOLOGICAL INFORMATION

12.1. Ecotoxicity

Not determined.

12.2. Mobility

Not determined.

12.3. Persistence and degradability

Not determined.

12.4. Bioaccumulative potential

Not determined.

12.5. Other adverse effects

Ozone depletion potential:	None.
Photochemical ozone creation potential:	None
Global warming potential:	None

13. DISPOSAL CONSIDERATIONS

No harm to the environment is expected from this preparation.

Dispose of in compliance with national, regional, and local provisions that may be in force.

14. TRANSPORT INFORMATION

Hazard Class or Division: Not a hazardous substance.

For additional transport information, contact ANSUL.

No harm to the environment is expected from this preparation.

15. REGULATORY INFORMATION

Product:

EU Classification:		Harmful.
R Phrases:	22	Harmful if swallowed.
	36/37/38	Irritating to eyes, respiratory system, and skin.
S Phrases:	26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
	36	Wear suitable protective clothing.

Limit Values for Exposure:
Nuisance dust limit:
OSHA TWA: 15 mg/m^3
ACGIH TLV-TWA: 10 mg/m^3

EINECS Status: All components are included in EINECS inventories or are exempt from listing.
EPA TSCA Status: All components are included in TSCA inventories or are exempt from listing.
Canadian DSL (Domestic Substances List): All components are included in the DSL or are exempt from listing.

Environmental Restrictions: None are known.
Restrictions on Marketing and Use: None are known.
Refer to any other national measures that may be relevant.

16. OTHER INFORMATION

(HMIS) HAZARDOUS MATERIAL IDENTIFICATION SYSTEM RATINGS:

HEALTH:	1	4. Severe Hazard
FLAMMABILITY:	0	3. Serious Hazard
REACTIVITY:	0	2. Moderate Hazard
		1. Slight Hazard
		0. Minimal Hazard

(WHMIS) CANADIAN WORKPLACE HAZARDOUS MATERIAL IDENTIFICATION SYSTEM RATINGS:
This product is rated **Not hazardous.**

Format is from directive 2001/58/EC.
EINECS data is from http://exb.jrc.it/existing-chemicals/
Data used to compile the data sheet is from Ansul Material Safety Data Sheet, January, 2002.

17. DISCLAIMER

THE ABOVE INFORMATION IS BELIEVED TO BE CORRECT, BUT DOES NOT PURPORT TO BE ALL INCLUSIVE AND SHALL BE USED ONLY AS A GUIDE. ANSUL INCORPORATED SHALL NOT BE HELD LIABLE FOR ANY DAMAGE RESULTING FROM HANDLING OR FROM CONTACT WITH THE ABOVE PRODUCT.

MSDS available at http://www.ansul.com

MATERIAL SAFETY DATA SHEET

by Tyco Fire Suppression & Building Products

PURPLE-K

Product Code: 2011-2-005 ANa Issue Date: 07-21-2010

1. Product and Company Identification

Material name	**PURPLE-K**
Version #	01
Revision date	07-21-2010
CAS #	Mixture
Product Code	2011-2-005 ANa
Product use	Fire extinguishing agent
Manufacturer / Importer / Supplier	
Name	Tyco Fire Suppression and Building Products
Address	One Stanton Street Marinette, WI 54143-2542
Phone	715-735-7411
Internet	http://www.ansul.com
Emergency Phone Number	CHEMTREC 800-424-9300 or 703-527-3887

2. Hazards Identification

Emergency overview	WARNING Irritating to eyes and skin. Prolonged exposure may cause chronic effects.
Potential health effects	
Routes of exposure	Eye contact. Skin contact. Inhalation. Ingestion.
Eyes	Contact with eyes may cause irritation.
Skin	Avoid contact with the skin. May cause skin irritation.
Inhalation	Inhalation of dusts may cause respiratory irritation.
Ingestion	Not a likely route of entry.
Target organs	Eyes. Respiratory system. Skin.
Signs and symptoms	Irritation of eyes and mucous membranes.

3. Composition / Information on Ingredients

Non-hazardous components	**CAS #**	**Percent**
Silicone fluid	63148-57-2	0.5 - 1.5
Purple Pigment	68647-14-3	1 - 5
MICA	12001-26-2	1 - 5
FULLERS EARTH	8031-18-3	1 - 5
POTASSIUM BICARBONATE	298-14-6	60 - 100

4. First Aid Measures

First aid procedures	
Eye contact	Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention if irritation persists after washing.
Skin contact	Wash off with warm water and soap. Get medical attention if irritation develops and persists.
Inhalation	Move to fresh air.
Ingestion	Rinse mouth. Do not induce vomiting without advice from poison control center. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.

General advice	If you feel unwell, seek medical advice (show the label where possible). Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Show this safety data sheet to the doctor in attendance.

5. Fire Fighting Measures

Extinguishing media

Suitable extinguishing media	This product is not flammable. Use extinguishing agent suitable for type of surrounding fire.

Protection of firefighters

Specific hazards arising from the chemical	None known.
Protective equipment for firefighters	None known.
Special protective equipment for fire-fighters	None known.

Explosion data

Sensitivity to mechanical impact	Not available.
Sensitivity to static discharge	Not available.
Hazardous combustion products	Carbon monoxide and carbon dioxide.

6. Accidental Release Measures

Personal precautions	Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Avoid inhalation of dust from the spilled material. Wear a dust mask if dust is generated above exposure limits.
Environmental precautions	Do not contaminate water.
Methods for containment	If sweeping of a contaminated area is necessary use a dust suppressant agent which does not react with the product. Prevent entry into waterways, sewer, basements or confined areas.
Methods for cleaning up	Should not be released into the environment. Sweep up or vacuum up spillage and collect in suitable container for disposal. Collect dust using a vacuum cleaner equipped with HEPA filter. Avoid the generation of dusts during clean-up. Clean up in accordance with all applicable regulations. Following product recovery, flush area with water.
Other information	Clean up in accordance with all applicable regulations.

7. Handling and Storage

Handling	Minimize dust generation and accumulation. Provide appropriate exhaust ventilation at places where dust is formed. Do not breathe dust. Avoid contact with eyes. Wash thoroughly after handling. Wear personal protective equipment.
Storage	Store in a well-ventilated place. Guard against dust accumulation of this material. Use care in handling/storage.

8. Exposure Controls / Personal Protection

Occupational exposure limits

Canada - British Columbia

Components	Type	Value	Form
MICA (12001-26-2)	TWA	3.0000 mg/m3	Respirable.

Canada - Ontario

Components	Type	Value	Form
MICA (12001-26-2)	TWA	3.0000 mg/m3	Respirable.

Canada - Quebec

Components	Type	Value	Form
MICA (12001-26-2)	TWA	3.0000 mg/m3	Respirable dust.

Personal protective equipment

Eye / face protection	Wear safety glasses with side shields (or goggles).
Skin protection	Wear chemical protective equipment that is specifically recommended by the manufacturer. It may provide little or no thermal protection.
Respiratory protection	In the case of respirable dust and/or fumes, use self-contained breathing apparatus.

9. Physical & Chemical Properties

Appearance

Form	Powder.
Color	Violet.
Odor	Odorless.
Physical state	Solid.
pH	Not available.
Melting point	Not available.
Freezing point	Not available.
Boiling point	Not available.
Flash point	Not available.
Evaporation rate	Not available.
Flammability limits in air, upper, % by volume	Not available.
Flammability limits in air, lower, % by volume	Not available.
Vapor pressure	Not available.
Vapor density	Not available.
Specific gravity	Not available.
Relative density	Not available.
Solubility (water)	Not available.
Partition coefficient (n-octanol/water)	Not available
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.

10. Chemical Stability & Reactivity Information

Chemical stability	Material is stable under normal conditions.
Incompatible materials	Strong acids.
Hazardous decomposition products	Carbon oxides.

11. Toxicological Information

Toxicological information	The toxicity of this product has not been tested.
Chronic effects	Prolonged inhalation may be harmful. Not expected to be hazardous by WHMIS criteria.

12. Ecological Information

Ecotoxicity	This product has no known eco-toxicological effects.
Persistence and degradability	Not available.
Partition coefficient (n-octanol/water)	Not available

13. Disposal Considerations

Disposal instructions	Dispose of contents/container in accordance with local/regional/national/international regulations. Dispose of waste material according to Local, State, Federal, and Provincial Environmental Regulations.
Waste from residues / unused products	Dispose of in accordance with local regulations.

14. Transport Information

TDG

Not regulated as dangerous goods.

15. Regulatory Information

Canadian regulations	This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.
WHMIS status	Non-controlled

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	No
Canada	Domestic Substances List (DSL)	No
Canada	Non-Domestic Substances List (NDSL)	Yes
China	Inventory of Existing Chemical Substances in China (IECSC)	No
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	No
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

16. Other Information

Further information	HMIS® is a registered trade and service mark of the NPCA.
HMIS® ratings	Health: 1 Flammability: 0 Physical hazard: 0
NFPA ratings	Health: 1 Flammability: 0 Instability: 0
Disclaimer	The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.
Issue date	07-21-2010

MATERIAL SAFETY DATA SHEET

3M
3M Center
St. Paul, Minnesota
55144-1000
1-800-364-3577 or (651) 737-6501 (24 hours)

DIVISION: 3M SPECIALTY MATERIALS
TRADE NAME:
FC-170C FLUORAD Brand Fluorochemical Surfactant
ID NUMBER/U.P.C.:

98-0211-0638-4	00-51135-09287-3	98-0211-0639-2	00-51135-09288-0
98-0211-0892-7	00-51135-09731-1	98-0211-6607-3	00-51135-10426-2
98-0211-7221-2	00-51135-10636-5	ZF-0002-1021-9	- - -
ZF-0002-1027-6	- - -	ZF-0002-6052-9	- - -

ISSUED: June 09, 1999
SUPERSEDES: June 04, 1999
DOCUMENT: 10-3809-0

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1. INGREDIENT	C.A.S. NO.	PERCENT
PERFLUOROALKYLSULFONAMIDO OXYETHYLENE ADDUCT	29117-08-6	68.0
POLYETHYLENE GLYCOL	25322-68-3	12
WATER	7732-18-5	7
PERFLUOROALKYLSULFONAMIDO OXYETHYLENE ADDUCT	56372-23-7	3.0 - 7.0
PERFLUOROALKYLSULFONAMIDO OXYETHYLENE ADDUCT	68298-79-3	3.0 - 7.0
RESIDUAL ORGANIC FLUOROCHEMICALS	Mixture	< 4
PERFLUOROALKYLSULFONAMIDO OXYETHYLENE ADDUCT	68298-81-7	1.0 - 5.0
PERFLUOROALKYLSULFONAMIDO OXYETHYLENE ADDUCT	68298-80-6	0.5 - 1.5
1,4-DIOXANE	123-91-1	< 0.3

The components of this product are in compliance with the chemical notification requirements of TSCA. All applicable chemical ingredients in this material are listed on the European Inventory of Existing Chemical Substances (EINECS), or are exempt polymers whose monomers are listed on EINECS.

This product contains the following toxic chemical or chemicals subject to the reporting requirements of Section 313 of Title III of the Emergency Planning and Community Right-To-Know Act of 1986 and 40 CFR Part 372:
1,4-DIOXANE

Abbreviations: N/D - Not Determined N/A - Not Applicable CA - Approximately

2. PHYSICAL DATA

BOILING POINT:................. 210 C
Typical
VAPOR PRESSURE:................ 18 mmHg
calc @ 20C
VAPOR DENSITY:................. 0.64 Air=1
calc @ 20C
EVAPORATION RATE:.............. < 1.0 BuOAc=1
SOLUBILITY IN WATER:........... apprec.
SPECIFIC GRAVITY:.............. 1.31 - 1.34 Water=1
(1.33 nominal)
PERCENT VOLATILE:.............. 7 % by wt
pH:............................ 5.5 - 8.4
VISCOSITY:..................... ca. 100 centipoise
MELTING POINT:................. N/A

APPEARANCE AND ODOR:
Amber liquid

3. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT:................... > 148 C Setaflash
FLAMMABLE LIMITS - LEL:........ N/A
FLAMMABLE LIMITS - UEL:........ N/A
AUTOIGNITION TEMPERATURE:...... N/A

EXTINGUISHING MEDIA:
Water, Carbon dioxide, Dry chemical, Foam

SPECIAL FIRE FIGHTING PROCEDURES:
Wear full protective clothing, including helmet, self-contained, positive pressure or pressure demand breathing apparatus, bunker coat and pants, bands around arms, waist and legs, face mask, and protective covering for exposed areas of the head.

UNUSUAL FIRE AND EXPLOSION HAZARDS:
See Hazardous Decomposition section for products of combustion.

NFPA HAZARD CODES: HEALTH: 1 FIRE: 0 REACTIVITY: 0
UNUSUAL REACTION HAZARD: none

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4. REACTIVITY DATA

STABILITY: Stable

INCOMPATIBILITY - MATERIALS/CONDITIONS TO AVOID:
None known.

None Known

HAZARDOUS POLYMERIZATION: Hazardous polymerization will not occur.

HAZARDOUS DECOMPOSITION PRODUCTS:
Carbon Monoxide and Carbon Dioxide, Oxides of Nitrogen, Oxides of Sulfur, Hydrogen Fluoride, Toxic Vapors, Gases or Particulates.

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5. ENVIRONMENTAL INFORMATION

SPILL RESPONSE:
Observe precautions from other sections. Ventilate area. Contain spill. Cover with absorbent material. Collect spilled material. Clean up residue with water. Place in a closed container.

RECOMMENDED DISPOSAL:
Incinerate in an industrial or commercial facility in the presence of a combustible material. Combustion products will include HF.

ENVIRONMENTAL DATA:
Bluegill sunfish (Lepomis macrochirus) 96-hr LC50 = 285 mg/L

REGULATORY INFORMATION:
Volatile Organic Compounds: 4 gms/liter South Coast Air Quality Mgmt Dist Method (Grams/Liter of Material).
VOC Less H2O & Exempt Solvents: N/A.

Since regulations vary, consult applicable regulations or authorities before disposal. In the event of an uncontrolled release of this material, the user should determine if the release qualifies as a reportable quantity. U.S. EPA Hazardous Waste Number = None (Not U.S. EPA Hazardous).

The components of this product are in compliance with the chemical registration requirements of TSCA, EINECS, CDSL, AICS and MITI.

OTHER ENVIRONMENTAL INFORMATION:
This substance has minimal toxicity to aquatic organisms (100 mg/L < Lowest LC50, EC50, or IC50 < or = 1000 mg/L).

Bioassays have been run on organisms from less than three phyla. Organisms from taxa that were not tested may show greater sensitivity.

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5. ENVIRONMENTAL INFORMATION (continued)

This product contains one or more organic fluorochemicals that have the potential to resist degradation and persist in the environment.

EPCRA HAZARD CLASS:
FIRE HAZARD: No PRESSURE: No REACTIVITY: No ACUTE: Yes CHRONIC: Yes

6. SUGGESTED FIRST AID

EYE CONTACT:
Immediately flush eyes with large amounts of water. Get immediate medical attention.

SKIN CONTACT:
Flush skin with large amounts of water. If irritation persists, get medical attention.

INHALATION:
If signs/symptoms occur, remove person to fresh air. If signs/symptoms continue, call a physician.

IF SWALLOWED:
If swallowed, call a physician immediately. Only induce vomiting at the instruction of a physician. Never give anything by mouth to an unconscious person.

7. PRECAUTIONARY INFORMATION

EYE PROTECTION:
Avoid eye contact with vapor, spray, or mist. Wear vented goggles.

SKIN PROTECTION:
Avoid skin contact. Wear appropriate gloves when handling this material. A pair of gloves made from the following material(s) are recommended: butyl rubber.

RECOMMENDED VENTILATION:
Curing ovens must be exhausted to outdoors or to a suitable emission control device. If exhaust ventilation is not adequate, use appropriate respiratory protection. Provide ventilation adequate to control vapor concentrations below recommended exposure limits and/or control spray or mist.

7. PRECAUTIONARY INFORMATION (continued)

RESPIRATORY PROTECTION:
Avoid breathing of vapors created during the cure cycle. Avoid breathing of airborne material. Select one of the following NIOSH approved respirators based on airborne concentration of contaminants and in accordance with OSHA regulations: Half-mask organic vapor respirator with dust/mist prefilter.

PREVENTION OF ACCIDENTAL INGESTION:
Do not eat, drink or smoke when using this product. Wash exposed areas thoroughly with soap and water. Wash hands after handling and before eating.

RECOMMENDED STORAGE:
Store away from areas where product may come into contact with food or pharmaceuticals. Store at temperatures below 120 degrees F (49 degrees C). Store at temperatures above 32 degrees F (O degrees C). Store out of direct sunlight. Keep container dry. Keep container closed when not in use. Keep container in well-ventilated area.

FIRE AND EXPLOSION AVOIDANCE:
Keep container tightly closed. Nonflammable.

OTHER PRECAUTIONARY INFORMATION:
No smoking: Smoking while using this product can result in contamination of the tobacco and/or smoke and lead to the formation of the hazardous decomposition products mentioned in the Reactivity Data section of this MSDS.

HMIS HAZARD RATINGS: HEALTH: 2 FLAMMABILITY: 0 REACTIVITY: 0
PERSONAL PROTECTION: X (See precautions, section 7.)

EXPOSURE LIMITS

INGREDIENT	VALUE	UNIT	TYPE	AUTH	SKIN*
PERFLUOROALKYLSULFONAMIDO OXYETHYLENE ADDUCT.................	NONE	NONE	NONE	NONE	
POLYETHYLENE GLYCOL..................	10 AS PARTICULATE	MG/M3	TWA	AIHA	
WATER.................................	NONE	NONE	NONE	NONE	
PERFLUOROALKYLSULFONAMIDO OXYETHYLENE ADDUCT.................	NONE	NONE	NONE	NONE	
PERFLUOROALKYLSULFONAMIDO OXYETHYLENE ADDUCT.................	NONE	NONE	NONE	NONE	
RESIDUAL ORGANIC FLUOROCHEMICALS.....	0.1	MG/M3	TWA	3M	Y
PERFLUOROALKYLSULFONAMIDO OXYETHYLENE ADDUCT.................	NONE	NONE	NONE	NONE	
PERFLUOROALKYLSULFONAMIDO OXYETHYLENE ADDUCT.................	NONE	NONE	NONE	NONE	
1,4-DIOXANE..........................	25	PPM	TWA	ACGIH	Y

Abbreviations: N/D - Not Determined N/A - Not Applicable CA - Approximately

EXPOSURE LIMITS (continued)

INGREDIENT	VALUE	UNIT	TYPE	AUTH	SKIN*
1,4-DIOXANE.........................	25	PPM	TWA	OSHA	Y

* SKIN NOTATION: Listed substances indicated with 'Y' under SKIN refer to the potential contribution to the overall exposure by the cutaneous route including mucous membrane and eye, either by airborne or, more particularly, by direct contact with the substance. Vehicles can alter skin absorption.

SOURCE OF EXPOSURE LIMIT DATA:
- 3M: 3M Recommended Exposure Guidelines
- ACGIH: American Conference of Governmental Industrial Hygienists
- AIHA: American Industrial Hygiene Assoc. Workplace Environmental Exposure Level Guideline
- OSHA: Occupational Safety and Health Administration

- NONE: None Established

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8. HEALTH HAZARD DATA

EYE CONTACT:
Mild Eye Irritation: signs/symptoms can include redness, swelling, pain, and tearing.

SKIN CONTACT:
Mild Skin Irritation (after prolonged or repeated contact): signs/symptoms can include redness, swelling, and itching.

May be absorbed through the skin in harmful amounts.

INHALATION:
Prolonged or repeated exposure may cause:

Irritation (upper respiratory): signs/symptoms can include soreness of the nose and throat, coughing and sneezing.

IF SWALLOWED:
Animal studies conducted on organic fluorochemicals which are present in this product indicate effects including liver disturbances, weight loss, loss of appetite, lethargy, and neurological, pancreatic, adrenal and hematologic effects. There are no known human health effects from anticipated exposure to these organic fluorochemicals when used as intended and instructed.

Ingestion may cause:

Aspiration Pneumonitis: signs/symptoms can include coughing, difficulty breathing, wheezing, coughing up blood and pneumonia, which can be fatal.

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8. HEALTH HAZARD DATA (continued)

CANCER:
WARNING: Contains a chemical which can cause cancer. (123-91-1) (NTP anticipated human carcinogen, IARC possible human carcinogen 2B, Calif. Proposition 65)

MUTAGENICITY:
Mutagenicity assays indicate the product is not mutagenic.

OTHER HEALTH HAZARD INFORMATION:
A Product Toxicity Summary Sheet is available.

This product contains one or more organic fluorochemicals that have the potential to be absorbed and remain in the body for long periods of time, either as the parent molecule or as metabolites, and may accumulate with repeated exposures. There are no known human health effects from anticipated exposure to these organic fluorochemicals when used as intended and instructed.

The presence of organic fluorochemicals in the blood of the general population and subpopulations, such as workers, has been published dating back to the 1970's. 3M's epidemiological study of its own workers indicates no adverse effects.

SECTION CHANGE DATES

ENVIRONMENTAL INFO. SECTION CHANGED SINCE June 04, 1999 ISSUE

The information in this Material Safety Data Sheet (MSDS) is believed to be correct as of the date issued. 3M MAKES NO WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR COURSE OF PERFORMANCE OR USAGE OF TRADE. User is responsible for determining whether the 3M product is fit for a particular purpose and suitable for user's method of use or application. Given the variety of factors that can affect the use and application of a 3M product, some of which are uniquely within the user's knowledge and control, it is essential that the user evaluate the 3M product to determine whether it is fit for a particular purpose and suitable for user's method of use or application.

3M provides information in electronic form as a service to its customers. Due to the remote possibility that electronic transfer may have resulted in errors, omissions or alterations in this information, 3M makes no representations as to its completeness or accuracy. In addition, information obtained from a database may not be as current as the information in the MSDS available directly from 3M.

MATERIAL SAFETY DATA SHEET

3M
3M Center
St. Paul, Minnesota
55144-1000
1-800-364-3577 or (651) 737-6501 (24 hours)

DIVISION: 3M SPECIALTY MATERIALS
TRADE NAME:
FC-171 FLUORAD Brand Fluorochemical Surfactant
ID NUMBER/U.P.C.:

98-0211-0604-6	00-51135-09276-7	98-0211-0605-3	00-51135-09277-4
98-0211-0893-5	00-51135-09366-5	98-0211-6415-1	00-51135-10244-2
98-0211-7222-0	00-51135-10637-2	ZF-0002-1090-4	- - -
ZF-0002-1091-2	- - -		

ISSUED: December 17, 1999
SUPERSEDES: October 14, 1999
DOCUMENT: 10-3810-8

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1. INGREDIENT

1. INGREDIENT	C.A.S. NO.	PERCENT
FLUORINATED ALKYL ALKOXYLATES...........	68958-61-2	87.0 - 93.0
FLUORINATED ALKYL SULFONAMIDE...........	4151-50-2	4.0 - 10.0
FLUORINATED ALKYL ALKOXYLATES...........	68958-60-1	2.0 - 4.0
RESIDUAL ORGANIC FLUOROCHEMICALS........	Mixture	< 4
FLUORINATED ALKYL SULFONAMIDE...........	68957-62-0	0.1 - 1.0

The components of this product are in compliance with the chemical notification requirements of TSCA. All applicable chemical ingredients in this material are listed on the European Inventory of Existing Chemical Substances (EINECS), or are exempt polymers whose monomers are listed on EINECS.

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2. PHYSICAL DATA

BOILING POINT:................. > 148 C
VAPOR PRESSURE:................ N/A
VAPOR DENSITY:................. N/A
EVAPORATION RATE:.............. < 1.0 BuOAc=1
SOLUBILITY IN WATER:........... neglig.
SPECIFIC GRAVITY:.............. ca. 1.4 Water=1
PERCENT VOLATILE:.............. 0 %
pH:............................ ca. 6
(1% Aqueous)
VISCOSITY:..................... N/D

Abbreviations: N/D - Not Determined N/A - Not Applicable CA - Approximately

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2. PHYSICAL DATA (continued)

MELTING POINT:................. N/A

APPEARANCE AND ODOR:
Amber liquid with oil type odor.

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3. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT:................... > 148 C Setaflash
FLAMMABLE LIMITS - LEL:........ N/A
FLAMMABLE LIMITS - UEL:........ N/A
AUTOIGNITION TEMPERATURE:...... N/A

EXTINGUISHING MEDIA:
Water, Carbon dioxide, Dry chemical, Foam

SPECIAL FIRE FIGHTING PROCEDURES:
Wear full protective clothing, including helmet, self-contained, positive pressure or pressure demand breathing apparatus, bunker coat and pants, bands around arms, waist and legs, face mask, and protective covering for exposed areas of the head.

UNUSUAL FIRE AND EXPLOSION HAZARDS:
See Hazardous Decomposition section for products of combustion.

NFPA HAZARD CODES: HEALTH: 1 FIRE: 0 REACTIVITY: 0
UNUSUAL REACTION HAZARD: none

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4. REACTIVITY DATA

STABILITY: Stable

INCOMPATIBILITY - MATERIALS/CONDITIONS TO AVOID:
Not applicable.

HAZARDOUS POLYMERIZATION: Hazardous polymerization will not occur.

HAZARDOUS DECOMPOSITION PRODUCTS:
Carbon Monoxide and Carbon Dioxide, Oxides of Nitrogen, Oxides of Sulfur, Hydrogen Fluoride.

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5. ENVIRONMENTAL INFORMATION

SPILL RESPONSE:
Observe precautions from other sections. Ventilate area. Contain spill. Cover with absorbent material. Collect spilled material. Clean up residue with an appropriate organic solvent. Read and follow safety precautions on the solvent label and MSDS. Place in a closed container.

RECOMMENDED DISPOSAL:
Do not release to waterways or sewer. Do not use in products or processes that could result in aquatic concentrations greater than 1/10 of the lowest EC50 or LC50 concentration. Incinerate in an industrial or commercial facility in the presence of a combustible material. Combustion products will include HF.

ENVIRONMENTAL DATA:
A Product Environmental Data Sheet (PED) is available.

COD=0.72 g/g; BOD28=0.08 g/g; 96-Hr. LC50, Fathead Minnow=359 mg/l; 48-Hr. EC50, Daphnia magna=0.27 mg/l; 96-Hr. LC50, Rainbow trout=6.2 mg/L; 48-Hr. LC50, Brine shrimp= 9.7 mg/L; 96-Hr. LC50,Mysid shrimp= 0.11 mg/L; IC50, Green Alga=837 mg/L; IC50, activated sludge respiration >1000 mg/L.

REGULATORY INFORMATION:
Volatile Organic Compounds: 0 gms/liter.
VOC Less H2O & Exempt Solvents: 0 gms/liter.

Since regulations vary, consult applicable regulations or authorities before disposal. U.S. EPA Hazardous Waste Number = None (Not U.S. EPA Hazardous).

The components of this product are in compliance with the chemical registration requirements of TSCA, EINECS, CDSL, CICS, PICCS, AND KECI.

OTHER ENVIRONMENTAL INFORMATION:
This product contains one or more organic fluorochemicals that have the potential to resist degradation and persist in the environment.

EPCRA HAZARD CLASS:
FIRE HAZARD: No PRESSURE: No REACTIVITY: No ACUTE: Yes CHRONIC: No

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6. SUGGESTED FIRST AID

EYE CONTACT:
Immediately flush eyes with large amounts of water. Get immediate medical attention.

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6. SUGGESTED FIRST AID (continued)

SKIN CONTACT:
Flush skin with large amounts of water. If irritation persists, get medical attention.

INHALATION:
If signs/symptoms occur, remove person to fresh air. If signs/symptoms continue, call a physician.

IF SWALLOWED:
Drink two glasses of water. Call a physician.

7. PRECAUTIONARY INFORMATION

EYE PROTECTION:
Avoid eye contact with vapor, spray, or mist. Wear vented goggles.

SKIN PROTECTION:
Avoid skin contact. Wear appropriate gloves when handling this material. A pair of gloves made from the following material(s) are recommended: butyl rubber. Use one or more of the following personal protection items as necessary to prevent skin contact: head covering, coveralls.

RECOMMENDED VENTILATION:
If exhaust ventilation is not adequate, use appropriate respiratory protection. Provide ventilation adequate to control vapor concentrations below recommended exposure limits and/or control spray or mist.

RESPIRATORY PROTECTION:
Avoid breathing of airborne material. Select one of the following NIOSH approved respirators based on airborne concentration of contaminants and in accordance with OSHA regulations: half-mask high-efficiency filter respirator, half-mask supplied air respirator.

PREVENTION OF ACCIDENTAL INGESTION:
Do not eat, drink or smoke when using this product. Wash exposed areas thoroughly with soap and water. Wash hands after handling and before eating.

RECOMMENDED STORAGE:
Store away from areas where product may come into contact with food or pharmaceuticals. Allow material to return to room temperature before use. Keep container closed when not in use.

7. PRECAUTIONARY INFORMATION (continued)

FIRE AND EXPLOSION AVOIDANCE:
Nonflammable.

OTHER PRECAUTIONARY INFORMATION:
No smoking: Smoking while using this product can result in contamination of the tobacco and/or smoke and lead to the formation of the hazardous decomposition products mentioned in the Reactivity Data section of this MSDS.

HMIS HAZARD RATINGS: HEALTH: 1 FLAMMABILITY: 0 REACTIVITY: 0
PERSONAL PROTECTION: X (See precautions, section 7.)

EXPOSURE LIMITS

INGREDIENT	VALUE	UNIT	TYPE	AUTH	SKIN*
FLUORINATED ALKYL ALKOXYLATES........	0.1	MG/M3	TWA	3M	Y
FLUORINATED ALKYL SULFONAMIDE........	0.1	MG/M3	TWA	3M	Y
FLUORINATED ALKYL ALKOXYLATES........	0.1	MG/M3	TWA	3M	Y
RESIDUAL ORGANIC FLUOROCHEMICALS.....	0.1	MG/M3	TWA	3M	Y
FLUORINATED ALKYL SULFONAMIDE........	0.1	MG/M3	TWA	3M	Y

* SKIN NOTATION: Listed substances indicated with 'Y' under SKIN refer to the potential contribution to the overall exposure by the cutaneous route including mucous membrane and eye, either by airborne or, more particularly, by direct contact with the substance. Vehicles can alter skin absorption.

SOURCE OF EXPOSURE LIMIT DATA:
- 3M: 3M Recommended Exposure Guidelines

8. HEALTH HAZARD DATA

EYE CONTACT:
Mild Eye Irritation: signs/symptoms can include redness, swelling, pain, and tearing.

SKIN CONTACT:
Product is not expected to be irritating to the skin.

May be absorbed through the skin and produce effects similiar to those caused by inhalation and/or ingestion.

INHALATION:
No information was found regarding effects from inhalation exposure.

8. HEALTH HAZARD DATA (continued)

IF SWALLOWED:
Animal studies conducted on organic fluorochemicals which are present in this product indicate effects including liver disturbances, weight loss, loss of appetite, lethargy, and neurological, pancreatic, adrenal and hematologic effects. There are no known human health effects from anticipated exposure to these organic fluorochemicals when used as intended and instructed.

OTHER HEALTH HAZARD INFORMATION:
A Product Toxicity Summary Sheet is available.

This product contains one or more organic fluorochemicals that have the potential to be absorbed and remain in the body for long periods of time, either as the parent molecule or as metabolites, and may accumulate with repeated exposures. There are no known human health effects from anticipated exposure to these organic fluorochemicals when used as intended and instructed.

The presence of organic fluorochemicals in the blood of the general population and subpopulations, such as workers, has been published dating back to the 1970's. 3M's epidemiological study of its own workers indicates no adverse effects.

SECTION CHANGE DATES

PRECAUTIONARY INFO. SECTION CHANGED SINCE October 14, 1999 ISSUE

FireDos® GmbH

Admixing Systems for Fire-fighting

Wetting agent – A brief guideline for greater fire-fighting effectiveness

This guideline provides answers to the following questions:

- What is wetting agent?
- How is it generated?
- Why use wetting agent for fire-fighting?
- Does wetting agent make fire-fighting more expensive?
- Does wetting agent affect the environment?
- What distinguishes the appropriate admixing technology?

There are good reasons for the ever-increasing use of wetting agent in fighting fires. Information in this regard is set out below for fire brigades which do not yet have experience in this field.

What is wetting agent?

Wetting agent is water with a reduced surface tension, used for fighting fires.

How is it generated?

The reduction in surface tension is achieved by adding a foaming agent to the water in an admixture rate between 0.1 to 0.5% (the precise figure will depend on the foaming agent used). A pressure proportioner system is required in order to mix the foaming agent with the water.

Why is fire-fighting with wetting agent useful?

Wetting agent has a number of crucial advantages over normal water when fighting fires. The reduced surface tension means that the water can penetrate deeper into the burning materials and can increase the effectiveness of the water by up to 100%!

With this greater effectiveness a fire can be extinguished more rapidly and using less water. A particularly welcome side-effect of this is a reduction in the damage caused by water, as well as the amount of contaminated water which needs to be disposed of safely. Furthermore, the logistics involved in obtaining an adequate water supply will be reduced because less water is required.

Does wetting agent make fire-fighting more expensive?

Quite the opposite: the greater effectiveness reduces costs.
Wetting agent is produced by mixing the foaming agent with water in an admixture rate of around 0.1 to 0.5% (the precise figure will depend on the foaming agent used).

Between 1 and 5 litres of foaming agent will be required for 1000 litres of water. The expense involved is significantly less than the cost of fighting the fire without using wetting agent.

Does wetting agent affect the environment?

Modern foaming agents are biologically degradable. In any case, only very small quantities of foaming agent are needed to generate wetting agent.

On the other hand, fighting fires with ordinary water generates much more contaminated water because the operation takes much longer. More smoke and fumes escape from the burning materials and the motors and pumps on the fire truck run for a longer time. The greater the quantity of water required for fighting a fire, the more time-consuming are the logistics in ensuring an adequate supply. On balance, the environment is better served by using wetting agents.

What distinguishes the appropriate admixing technology?

In generating wetting agents it is important to maintain the low admixture rate precisely and reliably. An admixing system where the concept cannot ensure a precise admixture rate even at low water flow rates, or which depends on slow-reaction control devices, will not meet practical requirements.

Good reasons for choosing *FireDos*®

- ***FireDos*** units are powered exclusively by the flow of water and need no electrical power supply. There is no load on the vehicle‘s electrical system.
- ***FireDos*** always maintains the admixture rate which has been set, no matter of the water flow rate, within the system‘s performance specification.
- ***FireDos*** is not affected by the length or layout of the hose. The type of branch (nozzle) or differences in height are also immaterial.
- ***FireDos*** is not affected by the water flow rate or pressure in the line. Fluctuations in water pressure and/or flow rate also have no affect on the admixture rate or operation.
- ***FireDos*** does not need to be flushed. The foaming agent remains within the pressure proportioner system and is instantly available when the system is set in operation.
- ***FireDos*** requires practically no maintenance. The device is simple to install and operate, even where it is retro-fitted into an existing extinguishing system.
- ***FireDos*** units are available in a range of variants, providing admixture rates from 0.1 to 6% with water flow rates from 40 to 20 000 l/min. A comprehensive range of options can be supplied to meet the individual user‘s needs.
- ***FireDos*** will admix all standard foaming agents. Special versions are available to handle special additives such as gel and oil binding agents, decontamination substances, etc.
- ***FireDos*** units make it possible to change an empty foaming agent container without breaking off operations.
- ***FireDos*** is also available as special variants for use with sea water.
- ***FireDos*** is the only positive pressure foam system which can generate wetting agents accurately and reliably even at low water flow rates.

We can prove all our claims!
Please ask for a demonstration.

FireDos® GmbH Auf der Kaulbahn 6, 61200 Wölfersheim, Germany
Phone: +49 (0) 6036/9796-27 or e-mail vorfuehrung@firedos.com for a demonstration.

PRPE-005-1

ANSUL® ANSUL INCORPORATED
MARINETTE, WI 54143-2542

MATERIAL SAFETY DATA SHEET

SILV-EX FOAM CONCENTRATE
QUICK IDENTIFIER (In Plant Common Name)

Manufacturer's Name:	ANSUL INCORPORATED	Emergency Telephone No.:	CHEMTREC (800) 424-9300 or (703) 527-3887
Address:	One Stanton Street, Marinette, WI 54143-2542	Other Information Calls:	(715) 735-7411
Prepared By:	Safety and Health Department	Date Prepared:	June, 2001

SECTION 1 – IDENTITY

Common Name: (used on label) (Trade Name and Synonyms)	SILV-EX Foam Concentrate	CAS No.:	N/A
Chemical Name:	N/A This is a Mixture	Chemical Family:	Mixture
Formula:	N/A		

SECTION 2 – INGREDIENTS

PART A – HAZARDOUS INGREDIENTS

Principal Hazardous Component(s) (chemical and common name(s)):	Wt. %	CAS No.	ACGIH TLV	Acute Toxicity Data
Diethylene Glycol Monobutyl Ether (Butyl Carbitol) Chemical listed under SARA Title III – Section 313 under generic heading ‘‘Glycol Ethers’’	18	112-34-5	N/E	Oral LD_{50} (rat) 6560 mg/kg Dermal LD_{50} (Rabbit) 4120 mg/kg
Ethyl Alcohol (Ethanol)	8	64-17-5	1000 ppm (OSHA TLV-TWA)	Oral LD_{50} (rat) 21,000 mg/kg

PART B – OTHER INGREDIENTS

Other Component(s) (chemical and common name(s)):	Wt. %	CAS No.	ACGIH TLV	Acute Toxicity Data
Proprietary mixture consisting of sodium and ammonium salts of fatty alcohol ether sulfates (C_8 – C_{18}), and higher alcohols; not otherwise specified.	20-25	N/A	N/E	NDA
Water	55-65	7732-18-5	N/E	NDA

SECTION 3 – PHYSICAL AND CHEMICAL CHARACTERISTICS (Fire and Explosion Data)

Boiling Point:	65 °C – 70 °C			Specific Gravity (H_2O = 1):	1.01 g/ml	Vapor Pressure (mm Hg):	Not Determined
Percent Volatile by Volume (%):	Approx. 70	Vapor Density (Air = 1):	Below 1	Evaporation Rate (Butyl Acetate = 1):	Approximately 0.005		
Solubility in Water:	100%			Reactivity in Water:	Unreactive		
Appearance and Odor:	Clear pale straw colored liquid; mild sweet odor.						
Flash Point:	104 °F PMCC	Flammable Limits in Air % by Volume:	Not Determined	Extinguisher Media:	Dry Chemical, Water Spray, Foam, CO_2	Auto-Ignition Temperature:	None to boiling
Special Fire Fighting Procedures:	None						
Unusual Fire and Explosion Hazards:	None						

SECTION 4 – PHYSICAL HAZARDS

Stability:	Unstable ☐ Stable ☒	Conditions to Avoid:	N/A
Incompatibility (Materials to Avoid):	Reactive metals, electrically energized equipment, any materials reactive with water, strong oxidizers.		
Hazardous Decomposition Products:	None known; however carbon monoxide and oxides of nitrogen and sulfer may be produced during fire conditions.		
Hazardous Polymerization:	May Occur ☐ Will Not Occur ☒	Conditions to Avoid:	N/A

SECTION 5 – HEALTH HAZARDS

Threshold Limit Value:	None established by ACGIH or OSHA.
Routes of Entry: Eye Contact:	May cause mild to moderate transient irritation.
Skin Contact:	May cause mild transient irritation and/or dermatitis.
Inhalation:	Not an expected route of entry.
Ingestion:	Irritating to mucous membranes. Large oral doses could produce narcosis.
Signs and Symptoms: Acute Overexposure:	Irritation of the eyes, skin and mucous membranes.
Chronic Overexposure:	None known. Possible delayed kidney injury or liver damage.
Medical Conditions Generally Aggravated by Exposure:	Prior diseases of the kidney or liver may be aggravated.
Chemical Listed as Carcinogen or Potential:	National Toxicology Program: Yes ☐ No ☒ I.A.R.C. Monographs: Yes ☐ No ☒ OSHA: Yes ☐ No ☒

SECTION 6 – EMERGENCY AND FIRST AID PROCEDURES

Eye Contact:	Flush with large amounts of water; if irritation persists, seek Medical attention.
Skin Contact:	Wash with soap and water; if irritation persists, seek Medical attention.
Inhalation:	Remove victim to fresh air. Seek Medical attention if discomfort continues.
Ingestion:	If patient is conscious, give large amounts of water and induce vomiting. Seek Medical help.

SECTION 7 – SPECIAL PROTECTION INFORMATION

Respiratory Protection (Specify Type):	Not normally necessary.		
Ventilation:	Local Exhaust: N/A	Mechanical (General):	Recommended
Protective Gloves:	Rubber or Latex gloves recommended	Eye Protection:	Chemical goggles recommended.
Other Protective Clothing or Equipment:	Standard fire fighting safety equipment should provide all protection which is necessary. Eye wash and safety showers are good safety practice.		

SECTION 8 – SPECIAL PRECAUTIONS AND SPILL/LEAK PROCEDURES

Precautions to be Taken in Handling and Storage:	Store in original container. Note incompatibility information in Section 4.
Other Precautions:	Do not mix with other fire fighting agents.
Steps to be Taken in Case Material is Released or Spilled:	Rinse floor thoroughly with water as material is slippery. Prevent material from reaching sewers or waterways to avoid nuisance foaming.
Waste Disposal Methods:	Dispose of in compliance with local, state, and federal regulations.

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM RATINGS

HAZARD INDEX:
4 Severe Hazard
3 Serious Hazard
2 Moderate Hazard
1 Slight Hazard
0 Minimal Hazard

1 HEALTH
2 FLAMMABILITY
0 REACTIVITY

WHMIS RATING: D2B – Product may cause skin or eye irritation.

N/A = Not Applicable NDA = No Data Available N/E = None Established

MSDS AVAILABILITY

MSDS AVAILABLE AT www.ansul.com **MSDS FAX ON DEMAND: 1-800-323-8493 or 715-735-7411, extension 3091**

AGENT	**INDEX NUMBER**
SILV-EX FOAM CONCENTRATE	8742