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14 Feb 02

MEMORANDUM FOR MS. MARCY LEAVITT, CHIEF
GROUNDWATER QUALITY BUREAU
NEW MEXICO ENVIRONMENT DEPARTMENT
PO BOX 26
SANTA FE, NM 87502

FROM: 377 SPTG/CEVR
2050 Wyoming Blvd SE, Suite 122
Kirtland AFB NM 87117-5270

SUBJECT: Stage 2 Abatement Plan for the Bulk Fuels Facility, Kirtland AFB

1. We are forwarding one copy of the subject plan. Included is an electronic version in Word on a compact disc. We are hand delivering one copy of the plan today to Mr. Baird Swanson of your staff, the project manager for this site, to comply with the submittal date of 14 Feb 02.

2. The plan has been proposed as a multiple phase project. The first phase is a pilot test to determine design parameters for the proposed soil vapor extraction (SVE) system. The second phase will be the design of the system. The third phase will be the installation and operation of the SVE system, which may include a reversal of the airflow to promote bioremediation, if required or determined to be feasible. The fourth phase will be soil and groundwater sampling and long term vapor monitoring to determine if additional system operation is required. Groundwater sampling will continue on a quarterly basis during the entire project.

3. This project will be funded by the Department of Defense's Defense Energy Support Center (DESC). The DESC funding is based on a first come first serve basis from a limited fund established at the beginning of each fiscal year. As a result, funding availability may vary due to the time of the year and value of the request, requiring more limited project phases than outlined above.

KAFB2366

4. Please contact me at 505-846-9005, if you have any questions on this matter.

MARK D. HOLMES
Project Manager, Restoration Section
Environmental Management Branch

Attachment:
Stage 2 Abatement Plan

cc:
NMED-HWB (Mr. Kieling) w/ atch
NMED-HWB KAFB (Mr. Moats) w/o atch
NMED-GWQB (Mr. Swanson) w/atch
EPA Region 6 (Ms. Tellez) w/atch
HQ AFMC/CEVC (Mr. Fort) w/o atch
HQ AFMC/CEPD (Mr. McLaughlin) w/o atch
DESC/DESC-FQ (Mr. Kennedy) w/ atch
AFCEE (Mr. Arnold) w/o atch
CH2MHILL (Ms. Halloran) w/o atch
377 SPTG/CEVC (Mr. Montano) w/o atch

Kirtland Air Force Base
Albuquerque, New Mexico

Stage 2 Abatement Plan for the Bulk Fuels Facility (ST-106)

February 14, 2002

377 ABW/EMC
2050 Wyoming Blvd. SE
Kirtland AFB, New Mexico 87117-5670

ENVIRONMENTAL COMPLIANCE PROGRAM
KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO

STAGE 2 ABATEMENT PLAN
FOR THE BULK FUELS FACILITY (ST-106)

FEBRUARY 14, 2002

Prepared For

HQ AFCEE/ERD
ENVIRONMENTAL RESTORATION DIVISION
BROOKS AFB, TEXAS 78235-5363
DSN: 240-5288 COMM: (210) 536-5288
USAF CONTRACT NO. F41624-00-D-8021 TASK ORDER NO. 0136

Prepared By

CH2M HILL
ALBUQUERQUE, NEW MEXICO

NOTICE

This Stage 2 Abatement Plan has been prepared for the U.S. Air Force by CH2M HILL for the purpose of aiding in the implementation of a final remedial action plan under the Environmental Compliance Program (ECP). As the plan relates to actual or possible releases of potentially hazardous substances, its release prior to an Air Force final decision on remedial action may be in the public's interest. The limited objectives of this plan and the ongoing nature of the ECP, along with the evolving knowledge of site conditions and chemical effects on the environment and health, must be considered when evaluating this plan, since subsequent facts may become known which may make this plan premature or inaccurate.

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Non-government agencies may purchase copies of this document from: National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161.

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This Stage 2 Abatement Plan is prepared to select and design an abatement option for ST-106, Bulk Fuels Facility at Kirtland AFB, New Mexico.

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CERTIFICATION

This document has been approved for public release.

ROBERT S. MILLIGAN
Environmental Public Affairs Officer

PREFACE

This Stage 2 Abatement Plan is prepared to select and design an abatement option that will be conducted at site ST-106, Bulk Fuels Facility at Kirtland Air Force Base (AFB). The plan addresses the requirements of the U.S. Air Force (USAF) statement of work, dated 26 September 2001.

This Stage 2 Abatement Plan was prepared by CH2M HILL in February 2002. Mr. Bassim D. Shebaro of the Air Force Center for Environmental Excellence was the Restoration Team Chief and Mr. Rodney Arnold served as the Contracting Officer's Representative.

Amy R. Halloran, P.E.
CH2M HILL Vice President

Sharon L. Minchak
CH2M HILL Project Manager

CONTENTS

CONTENTS (Concluded)

Section **Page**

FIGURES

TABLES

ACRONYMS

AFB	Air Force Base
ARCH	air rotary casing hammer
av gas	aviation gas
bgs	belowground surface
BTEX	benzene, toluene, ethylbenzene, and xylene
CAU	Corrective Action Unit
CMS	Corrective Measures Study
cu yds	cubic yards
DRO	diesel range organics
EPA	U.S. Environmental Protection Agency
FIR	Facility Investigation Report
GRO	gasoline range organics
HHRB	human health risk-based (EPA Region 6 Human Health Media-Specific Screening Levels)
HSA	hollow stem auger
IRP	Installation Restoration Program
JP	jet fuel
KAFB	Kirtland Air Force Base
µg/L	microgram per liter
MCL	maximum contaminant level
mg/kg	milligram per kilogram
mg/L	milligrams per liter
mi	mile
N/A	not applicable
ND	not detected
NMED	New Mexico Environment Department
PID	photoionization detector
ppm	parts per million
PVC	polyvinyl chloride

RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SVMW	soil-vapor monitoring well
SVOC	semi-volatile organic compound
TPH	total petroleum hydrocarbon
USAF	U.S. Air Force
USCS	Unified Soil Classification System
UST	underground storage tank
USTB	Underground Storage Tank Bureau
VOC	volatile organic compound
WRRI	Water Resources Research Institute

EXECUTIVE SUMMARY

CH2M HILL has prepared this Stage 2 Abatement Plan to select and design an abatement option that will address the contamination present at site ST-106, the Kirtland Air Force Base (AFB) Bulk Fuels Facility. The Plan calls for the installation of an offsite groundwater monitoring well to help delineate the extent of the volatile organic compound (VOC) and ethylene dibromide contamination detected in the existing onsite well and to verify that the groundwater contamination will not reach the drinking water supply wells located at Kirtland AFB.

It also specifies the requirements for a soil vapor extraction (SVE) pilot-scale test to determine the appropriate design parameters for a full-scale SVE remediation system. The full-scale SVE system will be designed, installed, and operated to remove the VOC-contaminated soil gas from the subsurface and to create a pneumatic barrier between the contaminated soil gas and the groundwater beneath the site. This plan has been prepared in accordance with the New Mexico Water Quality Control Commission Regulations, NMAC 20.6.2.4106.D.

1. INTRODUCTION

CH2M HILL prepared this Investigation Stage 2 Abatement Plan to select and design an abatement option that will be conducted at site ST-106, Kirtland Air Force Base (AFB) Bulk Fuels Facility (Figure 1-1). The abatement option will result in attainment of the abatement standards and requirements set forth in Section 4103 of 20 NMAC 6.2, including post-closure maintenance activities. This Abatement Plan will serve as a guide while the abatement is being conducted. The Abatement Plan includes:

1. Description of current situation
2. Development and assessment of abatement options
3. Description, justification, and design of preferred abatement options
4. Pre- and Post-Closure sampling activities
5. Site maintenance activities
6. Site schedule
7. Public notification proposal

The abatement will be conducted in accordance with the Kirtland AFB Base-Wide Plans for the Installation Restoration Program (IRP) (USAF, 1995) and the New Mexico Environment Department (NMED) Ground and Surface Water Protection Regulations.

1.1 Other Issues

This Stage 2 Abatement Plan serves as the scoping document for the site cleanup. The following documents will serve as additional project scoping documents during this project:

- IRP Base-Wide Final Project Management Plan
- IRP Base-Wide Final Data Collection Quality Assurance Plan (DCQAP) consisting of Part I: Field Sampling Plan (FSP), and Part II: Quality Assurance Project Plan (QAPP)
- IRP Base-Wide Final Data Management Plan (DMP)
- IRP Base-Wide Final Site Safety and Health Plan (SSHP)
- IRP Base-Wide Final Investigation-Derived Waste Management Plan (IDWMP)
- IRP Base-Wide Final Community Relations Plan (CRP)

The procedures detailed in the Base-Wide Plans will be adhered to for all aspects of the investigation activities unless they are specifically modified by this Stage 2 Abatement Plan or the site-specific Health and Safety Plan (HSP) included in Appendix A to this Plan. A copy of the Kirtland AFB Base-Wide Plan was provided with the Stage 1 Abatement Plan as a reference for the documents referred to in the bullets above.

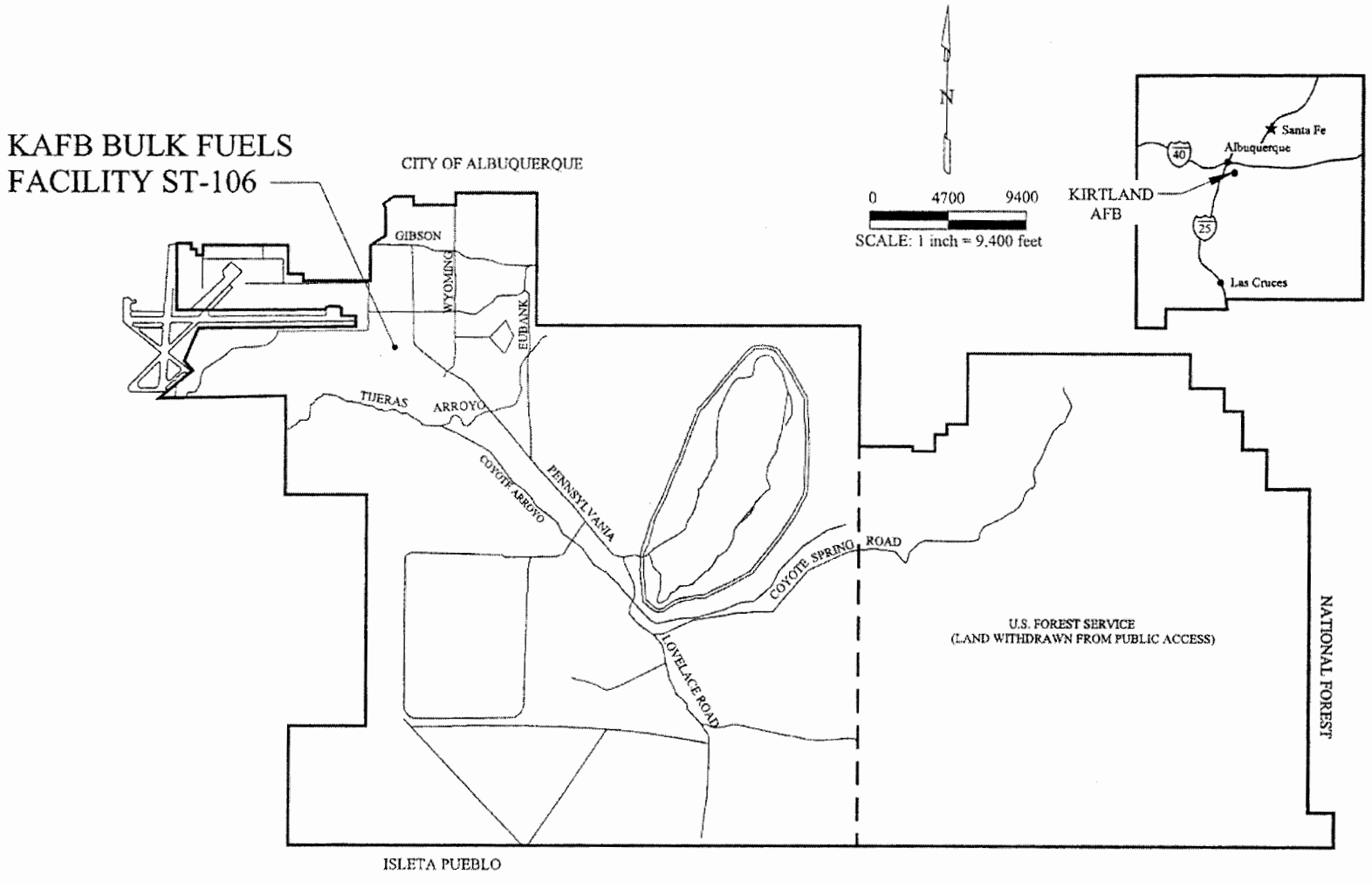


Figure 1-1. Kirtland AFB and Site Locations

1.2 Data Quality Objectives Process

The data quality objectives (DQOs) development process and data quality indicators detailed in the Base-Wide Plan will be adhered to for all aspects of the investigation activities unless they are specifically modified by this Stage 2 Abatement Plan or the site-specific HSP.

2.0 CURRENT SITUATION

A Stage 1 site investigation was conducted at the Bulk Fuels Facility located on Kirtland AFB (Figure 2-1). The results of the investigation were presented in the Stage 1 Abatement Plan Report for the Bulk Fuels Facility (ST-106) dated May 21, 2001. The following sections present a description of the current situation at the Bulk Fuels Facility as presented in the Stage 1 Abatement Plan Report. The sections discuss the geology, hydrogeology, and surface water hydrology of the site; the waste characteristics of JP4 and JP8; and the horizontal and vertical extent of the contamination that was delineated at the site.

2.1 Geology

The lithostratigraphy observed at the Bulk Fuels Facility (Table 2-1) corresponds well with the regional hydrostratigraphy presented in previously published reports (Hawley, Haase, and Lozinsky in Water Resources Research Institute [WRRI], 1994) as shown in Table 2-2.

- The top 85 ft of fine-grained materials corresponds to the USF-1 subunit of Upper Santa Fe (USF) Formation. Subunit USF-1 is distal alluvial piedmont fan deposits from the Sandia uplift.
- The sands found below about 144 ft below ground surface (bgs) correspond to the USF-2 subunit of the Upper Santa Fe Formation. The USF-2 subunit is a stacked sequence of braided river-channel deposits (Ancestral Rio Grande) and interbedded fine- to medium-grained sediments of diverse (alluvial-lacustrine-eolian) origin.
- The alternating sands and clayey materials from about 86 ft bgs to about 144 ft bgs are probably a transition zone between USF-1 and USF-2.
- The clay zone dividing USF-2 at about 270 ft bgs may be over-bank fines deposited as the Ancestral Rio Grande channel briefly meandered away from the site or distal alluvial fan deposits.

The site-specific zones described above are a generalization of the subsurface geology and as such do not suggest that individual layers are continuous across the site. The significance of the clay zone at 270 ft bgs was suggested by the rather distinct bottom-hole limit of contaminants in SB-26.

2.2 Hydrogeology

Groundwater at the Bulk Fuels Facility is contained in a regional unconfined alluvial aquifer. The depth to the regional groundwater table in well KAFB-106-1 (see Figure 2-1) is about 483 ft bgs. Minor water-bearing zones are present above the regional aquifer. Moist zones observed between 400 and 500 ft bgs at location SB-27 during the monitoring well installation may be remnants of the regional aquifer left perched as regional groundwater levels declined from municipal groundwater pumping. Shallower moist units may be water accumulated from infiltrating surface water. None of the observed moist units in the vadose zone appear to be part of the better-defined perched water-bearing system observed on the eastern portions of Kirtland AFB approximately 1 mile from the site.

Table 2-1. Lithostratigraphic Zones at the Bulk Fuels Facility

Site-Specific Lithostratigraphic Zones	Description	Thickness	Approximate Depth Interval
Fine Zone – 1	Thick discontinuous intervals of silt (ML) and silty or sandy clays (CL) w/minor lean clays (CL)	74' to 94'	Surface to ≈86' bgs
Sand Zone – 1	Poorly graded sand (SP) buff colored, fine-grained	15' to 25'	≈86' bgs to ≈107' bgs
Fine Zone – 2	Primarily silty, sandy, and lean clays (CL) with minor silt (ML) zones	13' to 25'	≈107' bgs to ≈125' bgs
Sand Zone – 2	Poorly graded sand (SP) buff colored, fine-grained	3' to 15'	≈125' bgs to ≈140' bgs
Fine Zone – 3	Primarily silty, sandy, and lean clays (CL)	0' to 10'	≈140' bgs to ≈144' bgs
Sand Zone – 3	Poorly graded fine-grained sands (SP) and well-graded fine- to coarse-grained sands (SW) buff colored, w/trace of gravels	117' to 140'	≈144' bgs to ≈270' bgs
Clay Zone	Lean clay (CL) brown, moist to wet, very stiff w/minor sandy and silty clay (CL)	0' to 15'	≈270' bgs to ≈280' bgs
Sand Zone – 4	Poorly graded fine-grained sands (SP) and well-graded fine- to coarse-grained sands (SW) buff colored, w/higher fraction of gravel (GW) and fine-grained (GM) zones	>137'	≈280' bgs to >517' bgs

Table 2-2. Hydrostratigraphic Units and Correspondence to Site-Specific Units at the Bulk Fuels Facility

Regional Unit (Depositional Facies)	Site-Specific Zones	Description	Thickness	Approximate Depth Interval
USF-1 (Distal alluvial piedmont fan deposits from the Sandia uplift)		Thick discontinuous intervals of silt (ML) and silty or sandy clays (CL) w/minor lean clays (CL)	74' to 94'	Surface to ≈86' bgs
Transition Zone (Inter-tongued USF-1 and USF-2)	Upper transition sands (USF-2)	Poorly graded sand (SP) buff colored, fine-grained	15' to 25'	≈86' bgs to ≈107' bgs
	Upper transition fines (USF-1)	Primarily silty, sandy, and lean clays (CL) with minor silt (ML) zones	13' to 25'	≈107' bgs to ≈125' bgs
	Lower transition sands (USF-2)	Poorly graded sand (SP) buff colored, fine-grained	3' to 15'	≈125' bgs to ≈140' bgs
	Lower transition fines (USF-1)	Primarily silty, sandy, and lean clays (CL)	0' to 10'	≈140' bgs to ≈144' bgs
USF-2 (Stacked sequence of braided river-channel deposits [Ancestral Rio Grande] and inter-bedded fine- to medium-grained sediments of diverse origin)	Upper Ancestral Rio Grande deposits	Poorly graded fine-grained sands (SP) and well-graded fine- to coarse-grained sands (SW) buff colored, w/trace of gravels	117' to 140'	≈144' bgs to ≈270' bgs
	Clay Zone	Lean clay (CL) brown, moist to wet, very stiff w/minor sandy and silty clay (CL)	0' to 15'	≈270' bgs to ≈280' bgs
	Lower Ancestral Rio Grande deposits	Poorly graded fine-grained sands (SP) and well-graded fine- to coarse-grained sands (SW) buff colored, w/higher fraction of gravel (GW) and fine-grained (GM) zones	>137'	≈280' bgs to >517' bgs

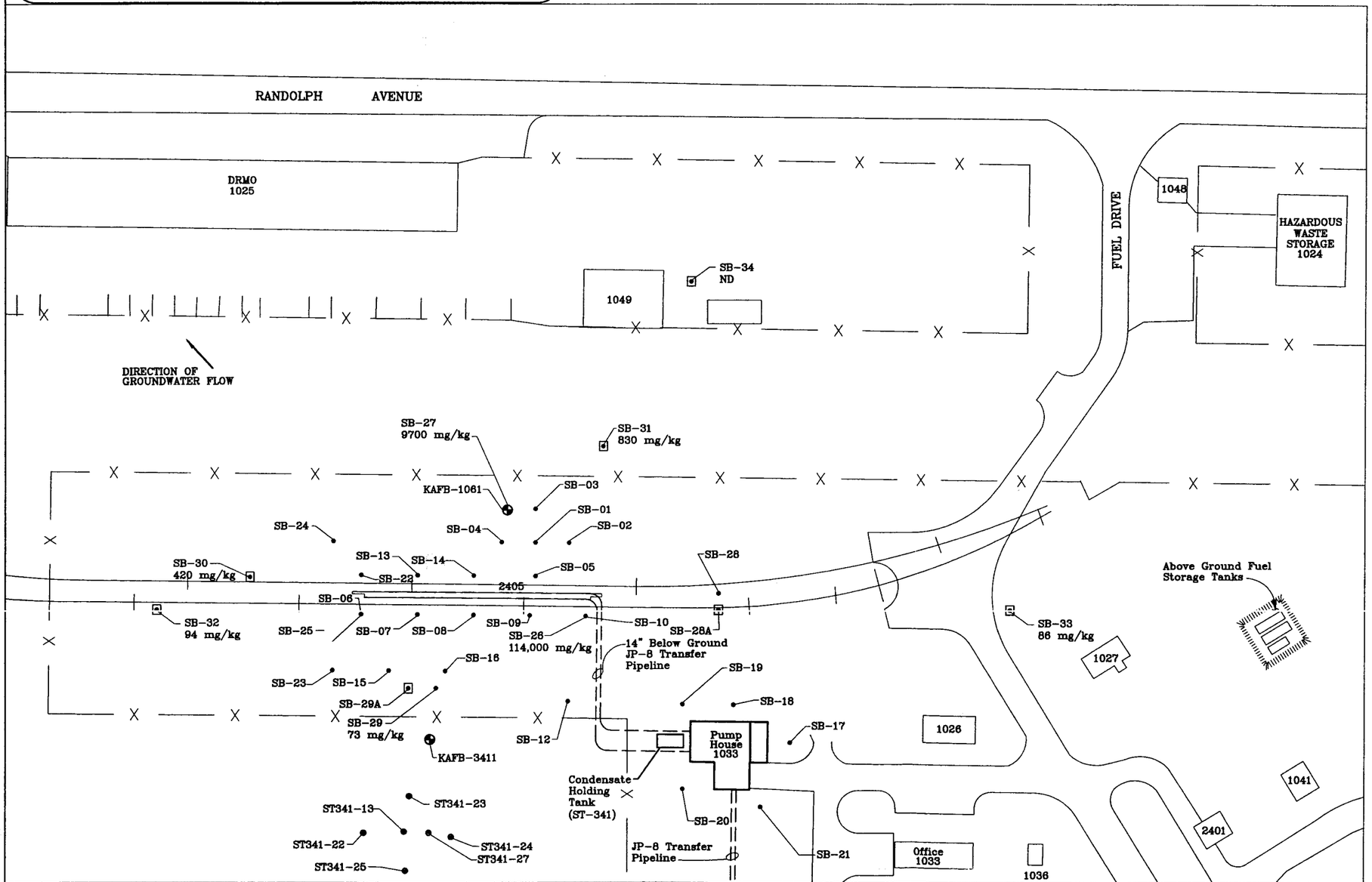


Figure 2-1. KAFB Bulk Fuels Facility (ST-106)

FIGURE_2-2.dwg

Site-specific hydraulic parameters have not been determined. According to WRRI Water Resources Report 98-4172 "Application of Nonlinear-regression methods to a Ground-water Flow Model of the Albuquerque Basin, New Mexico" (1998), there are no specific yield estimates from aquifer tests for the Albuquerque basin aquifer materials but the specific yield of USF-2 type deposits ranges from 0.10 to 0.25. Groundwater beneath the Bulk Fuels Facility flows to the northwest, and is believed to do so due to the gradient induced by a City of Albuquerque wellfield. There are three production wells located within a mile in a downgradient direction from the Bulk Fuels Facility. The Veterans Administration Hospital well is located approximately 1,400 ft north of the site. Kirtland AFB production wells 15 and 16 are located approximately 1,000 ft northwest and 3,600 ft northeast, respectively, of the site. The Kirtland AFB production wells each produce up to 2,000 gallons per minute and are in continuous use by the base.

2.3 Surface Water Hydrology

Surface water runoff from the Bulk Fuels Facility drains to the southwest through two unlined drainage ditches. Drainage from these two ditches is eventually captured by a storm sewer that discharges into the base's Outfall C north of Tijeras Arroyo. The area is fairly well graded and therefore much of the precipitation and storm water that runs onto the site remains onsite and either evaporates or percolates into the site soils.

2.4 Waste Characteristics

As shown in Table 2-3, the contaminants detected in the deep borings included benzene, toluene, ethylbenzene and xylene (BTEX) compounds. The three fuels known to have been used at the loading rack are AVGAS and the jet fuels, JP4 and JP8.

AVGAS was handled by the facility until approximately 1975. AVGAS is a mixture of hydrocarbons between C4 and C10 with a predominance in the C8 range. According to a Chevron document, *Aviation Fuels Technical Review* (2000), toluene is the only aromatic compound typically found in AVGAS. It does, however, contain tetraethyl lead and the lead scavenger ethylene dibromide (EDB).

JP4 is roughly a mixture of 50 percent gasoline and 50 percent kerosene and it has a hydrocarbon distribution between C4 and C16 with a predominance in the C6 range. JP4 is known to contain the BTEX compounds.

JP8 (also known as Jet Fuel A-1) is a heavier, less volatile mixture than JP4 and typically has a hydrocarbon distribution between C10 and C19 with a predominance in the C13 range. JP8 does not contain significant concentrations of BTEX. The contamination detected at ST-106 contained significant concentrations of volatile compounds (e.g., 630-milligrams per kilograms [mg/kg] benzene) indicating that the source of some of the contamination is either JP4 or JP8 and AVGAS. The source cannot be solely AVGAS because AVGAS does not have significant concentrations of benzene, although it does contain other volatile organic compounds (VOCs) detected at the site, such as toluene.

The base stopped using JP4 in 1993; based on this, a portion of the contamination is concluded to have occurred before 1993. Likewise, the detection of EDB in the groundwater at the site indicates that a portion of the contamination occurred before 1975.

2.5 Degree and Extent of Contamination

Petroleum contamination associated with the Bulk Fuels Facility has been identified in subsurface soils and in groundwater. Contamination appears to be a result of various releases that have occurred over the operational history of the facility. Some releases are more specifically defined whereas others are not well documented and are inferred to have been ongoing for unknown periods of time.

In November 1999 three known discharges occurred from the lines that transfer fuel from the JP8 offloading rack (Building 2405) to the pump house at the facility. The discharges included a failure of one of the 14-inch-diameter belowground transfer pipelines (pipeline #22) during a hydrostatic pressure test, failure of a cam-lock coupling during pressure test of the second belowground transfer pipeline (pipeline #23), and failure of the second belowground transfer pipeline (pipeline #23) during a hydrostatic pressure test after the cam-lock coupling problem had been corrected. The testing revealed that the primary belowground transfer pipeline (pipeline #22) had been in a state of failure for an unknown duration and therefore the total amount of fuel released is unknown. The volumes of the second two discharges were estimated to be approximately 200 to 400 gallons, and 30 gallons, respectively. For all discharges documented in November 1999 the product released was JP8. However, due to the unknown amount of time the primary pipeline had been in a state of failure, it is unknown if previously used products at the base may have been discharged. The following subsections discuss the nature and extent of the contamination that has been identified at the site.

2.5.1 Soil Contamination

2.5.1.1 Shallow Soil Contamination Associated with the November 1999 Releases

Shallow subsurface (≈4 ft bgs) soil samples collected from SB-02 through SB-04 contained no detectable petroleum hydrocarbons. This suggests that the emergency response to the November 1999 spills was successful at limiting the subsurface transport of contamination in soil.

2.5.1.2 Deep Soil Contamination

In the soil investigations, contamination was detected in several shallow soil borings (SB-01 through SB-24 are ≤40 ft bgs) at the ST-106 site (Table 2-3 and Figures 2-2 to 2-4). Contamination was found along the JP8 offloading rack that supplies the 300-ft-long belowground pipeline. The horizontal extent of the shallow (<40 ft bgs) contamination was delineated during the June 2000 direct push investigation portion of the Phase 1 investigation. This contamination appeared to be limited to within 50 ft of the belowground pipelines.

Subsurface petroleum fuel contamination also was identified in two deep soil borings (SB-25 and SB-26) installed using hollow stem auger drilling during July 2000. These two borings were located on the eastern and western ends of the offloading rack. The maximum concentration detected in boring SB-25 was 81,000 parts per million (ppm) total petroleum hydrocarbon (TPH) in the sample from 105 ft bgs, which is just below the Transition Zone between USF-1 and USF-2. The maximum concentration detected in boring SB-26 was 114,000 ppm TPH in the sample from 270 ft bgs, which is just above the Clay Zone that divide the USF-2 hydrostratigraphic unit and is thought to be acting as a vertical barrier for the contamination. Additional borings were installed to determine the horizontal extent of the soils that have TPH concentrations greater than 100 mg/kg.

Table 2-3. Summary of Reportable Soil Sampling Results for the Soils Investigation at ST-106, Bulk Fuels Facility

Compound Class	Analyte	HHRB Screening Level [a] or Action Level (mg/kg)		Sample Number (Concentrations given in mg/kg)													
				ST-106 SB-01		ST-106 SB-02		ST-106 SB-03		ST-106 SB-04		ST-106 SB-05		ST-106 SB-06		ST-106 SB-07	
				40'	55'	4'	62'	4'	30'	4'	35'	8'	40'	20'	40'	35'	40'
Petroleum Hydrocarbons	DRO	100 Combined		ND [b]	ND	ND	ND	ND	ND	ND	ND	ND	**19,000**	**4,800**	**12,000**	ND	ND
	GRO			0.73	4.1	ND	3.5	ND	ND	ND	ND	0.46	**16,000**	**5,900**	**39,000**	1.5	0.66
		Actual	Adjusted [e]														
SVOCs	Dibenzofuran	230	23	ND	---[d]	---	ND	---	---	---	---	ND	---	---	1.4	---	---
	Benzo(b&k)fluoranthene	6.2 [g]	---	ND	---	---	ND	---	---	---	---	0.032	---	---	ND	---	---
	Chrysene	610	---	ND	---	---	ND	---	---	---	---	0.034	---	---	ND	---	---
	Fluorene	2100	210	ND	---	---	ND	---	---	---	---	ND	---	---	0.56	---	---
	Fluoranthene	2300	230	ND	---	---	ND	---	---	---	---	0.094	---	---	ND	---	---
	1-methylnaphthalene	NA [h]	NA	ND	---	---	ND	---	---	---	---	ND	---	---	36	---	---
	2-methylnaphthalene	NA	NA	ND	---	---	ND	---	---	---	---	ND	---	---	43	---	---
	Naphthalene	53	5.3	ND	---	---	ND	---	---	---	---	ND	---	---	**32**	---	---
	Phenanthrene	1,800	180	ND	---	---	ND	---	---	---	---	0.12	---	---	ND	---	---
	Diethylphthalate	49,000	4900	0.073	---	---	0.042	---	---	---	---	0.095	---	---	ND	---	---
	bis (2-Ethylhexyl)phthalate	350	---	ND	---	---	ND	---	---	---	---	ND	---	---	ND	---	---
	Di-n-Butylphthalate	6,100	610	1.3	---	---	0.63	---	---	---	---	1.5	---	---	ND	---	---
	n-Nitroso-diphenyl-amine	990	---	ND	---	---	ND	---	---	---	---	ND	---	---	ND	---	---
	n-Nitroso-dimethyl-amine	0.0950	---	ND	---	---	ND	---	---	---	---	ND	---	---	ND	---	---
VOCs	Benzene	6.40	---	ND	0.039	0.078	0.061	ND	ND	0.006	ND	ND	1.4	ND	**13**	0.043	ND
	Ethylbenzene	68	6.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	**30**	**9.1**	**220**	ND	ND
	o-Xylene	63	6.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	**45**	**29**	**180**	ND	ND
	p/m-Xylenes	63	6.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	**130**	**68**	**470**	ND	ND
	Toluene	180	18	0.005	ND	0.038	ND	ND	ND	0.16	ND	ND	**79**	1.8	**360**	ND	ND
	1,2,4-Trimethylbenzene	52	5.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	**130**	**79**	**220**	ND	ND
	1,3,5-Trimethylbenzene	21	2.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	**42**	**25**	**72**	ND	ND
	1,2-Dibromoethane (EDB)	0.053	---	0.006	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1,1,2,2 Tetrachloroethane	3.6	---	0.012	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Chloromethane	12.0	---	ND	ND	0.028	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	2-Butanone (MEK)	37000	700	4.1	8.7	ND	0.61	ND	ND	ND	ND	ND	3.2	ND	ND	ND	ND
	2-Hexanone (MBK)	NA	NA	0.045	0.45	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4-Methyl-2-pentanone (MIBK)	760	76	0.075	0.14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Acetone	1500	150	17	50	0.078	33	0.053	0.056	ND	0.070	0.12	25	ND	ND	0.062	ND
	Naphthalene	53	5.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	**46**	**8.8**	**22**	ND	ND

Notes:

a) For TPH compounds the action level is the NMED 100 mg/kg combined DRO and GRO action level. The NMED action levels do not take into account other petroleum hydrocarbon ranges such as hydraulic ranges. The non-TPH compound screening levels are NMED residential soil screening levels (or EPA Region 6 residential HHRB levels if no NMED level is available). For non-carcinogenic compounds both the adjusted and unadjusted screeening levels are shown.

b) ND - non-detect

c) Concentrations shown in **bold** exceed the applicable screening level or action level.

d) Not analyzed for.

e) HHRB screening level adjusted to 10% of actual level for non-carcinogenic compounds to account for exposure to multiple non-carcinogens per NMED guidance

f) The sample from SB27-505' was a grab sample from drill cuttings and was analyzed after aproved holding times had expired.

g) The HHRB Screening Level listed here is for Benzo(b)fluoranthene only and is 1/10 the standard for benzo(k)fluoranthene.

h) An HHRB Screening Level is not available for these compounds

Table 2-3. Summary of Reportable Soil Sampling Results for the Soils Investigation at ST-106, Bulk Fuels Facility

Compound Class	Analyte	HHRB Screening Level [a] or Action Level (mg/kg)		Sample Number											
				ST-106 SB-08		ST-106 SB-09		ST-106 SB-10		ST-106 SB-12	ST-106 SB-13		ST-106 SB-14		ST-106 SB-16	
				30'	38'	10'	40'	25'	40'	30'	20'	42'	35'	41'	25'	32'
Petroleum Hydrocarbons	DRO	100 Combined		ND	ND	ND	ND	**12,000**	**19,000**	ND	65	ND	ND	ND	ND	ND
	GRO			ND	ND	ND	0.53	**16,000**	**30,000**	ND	1.1	0.37	0.40	ND	ND	ND
		Actual	Adjusted [c]													
SVOCs	Dibenzofuran	230	23	---	---	ND	---	---	ND	---	ND	---	---	---	---	---
	Benzo(b&k)fluoranthene	6.2 [g]	---	---	---	ND	---	---	ND	---	ND	---	---	---	---	---
	Chrysene	610	---	---	---	ND	---	---	ND	---	ND	---	---	---	---	---
	Fluorene	2100	210	---	---	ND	---	---	ND	---	ND	---	---	---	---	---
	Fluoranthene	2300	230	---	---	ND	---	---	ND	---	ND	---	---	---	---	---
	1-methylnaphthalene	NA [h]	NA	---	---	ND	---	---	130	---	ND	---	---	---	---	---
	2-methylnaphthalene	NA	NA	---	---	ND	---	---	170	---	ND	---	---	---	---	---
	Naphthalene	53	5.3	---	---	ND	---	---	**93**	---	ND	---	---	---	---	---
	Phenanthrene	1,800	180	---	---	ND	---	---	ND	---	ND	---	---	---	---	---
	Diethylphthalate	49,000	4900	---	---	0.066	---	---	ND	---	0.085	---	---	---	---	---
	bis (2-Ethylhexyl)phthalate	350	---	---	---	ND	---	---	ND	---	ND	---	---	---	---	---
	Di-n-Butylphthalate	6,100	610	---	---	1.1	---	---	ND	---	1.3	---	---	---	---	---
	n-Nitroso-diphenyl-amine	990	---	---	---	ND	---	---	ND	---	ND	---	---	---	---	---
	n-Nitroso-dimethyl-amine	0.0950	---	---	---	ND	---	---	ND	---	ND	---	---	---	---	---
VOCs	Benzene	6.40	---	ND	ND	ND	ND	2.8	1.7	ND	ND	ND	ND	ND	ND	ND
	Ethylbenzene	68	6.8	ND	ND	ND	ND	**37**	**37**	ND	ND	ND	ND	ND	ND	ND
	o-Xylene	63	6.3	ND	ND	ND	ND	**54**	**44**	ND	ND	ND	ND	ND	ND	ND
	p/m-Xylenes	63	6.3	ND	ND	ND	ND	**150**	**100**	ND	ND	ND	ND	ND	ND	ND
	Toluene	180	18	ND	ND	ND	ND	**40**	**38**	ND	ND	ND	ND	ND	ND	ND
	1,2,4-Trimethylbenzene	52	5.2	ND	ND	ND	ND	**140**	**330**	ND	ND	ND	ND	ND	ND	ND
	1,3,5-Trimethylbenzene	21	2.1	ND	ND	ND	ND	**46**	**79**	ND	ND	ND	ND	ND	ND	ND
	1,2-Dibromoethane (EDB)	0.053	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	1,1,2,2 Tetrachloroethane	3.6	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Chloromethane	12.0	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	2-Butanone (MEK)	37000	700	ND	ND	ND	0.36	ND	ND	ND	0.028	ND	ND	ND	ND	ND
	2-Hexanone (MBK)	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	4-Methyl-2-pentanone (MIBK)	760	76	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Acetone	1500	150	ND	ND	0.078	1.6	ND	14	ND	0.15	ND	ND	ND	ND	ND
	Naphthalene	53	5.3	ND	ND	ND	ND	**34**	**61**	ND	ND	ND	ND	ND	ND	ND

Notes:

a) For TPH compounds the action level is the NMED 100 mg/kg combined DRO and GRO action level. The NMED action levels do not take into account other petroleum hydrocarbon ranges such as hydraulic ranges. The non-TPH compound screening levels are NMED residential soil screening levels (or EPA Region 6 residential HHRB levels if no NMED level is available). For non-carcinogenic compounds both the adjusted and unadjusted screeening levels are shown.

b) ND - non-detect

c) Concentrations shown in **bold** exceed the applicable screening level or action level.

d) Not analyzed for.

e) HHRB screening level adjusted to 10% of actual level for non-carcinogenic compounds to account for exposure to multiple non-carcinogens per NMED guidance

f) The sample from SB27-505' was a grab sample from drill cuttings and was analyzed after aproved holding times had expired.

g) The HHRB Screening Level listed here is for Benzo(b)fluoranthene only and is 1/10 the standard for benzo(k)fluoranthene.

h) An HHRB Screening Level is not available for these compounds

Table 2-3. Summary of Reportable Soil Sampling Results for the Soils Investigation at ST-106, Bulk Fuels Facility

Compound Class	Analyte	HHRB Screening Level [a] or Action Level (mg/kg)		Sample Number (Concentrations												
				ST-106 SB-17		ST-106 SB-18		ST-106 SB-19	ST-106 SB-20	ST-106 SB-21	ST-106 SB-22			ST-106 SB-23 42'	ST-106 SB-24	
				4'	40'	4'	59'	40'	40'	34'	15'	20'	32'	42'	28'	40'
Petroleum Hydrocarbons	DRO	100 Combined		ND	ND	ND	ND	ND	ND	ND	**2,600**	**3,000**	**14,000**	ND	ND	ND
	GRO			ND	ND	ND	ND	ND	ND	ND	**1,200**	**2,300**	**20,000**	ND	ND	ND
		Actual	Adjusted [e]													
SVOCs	Dibenzofuran	230	23	---	---	ND	---	---	---	---	---	---	0.98	---	---	---
	Benzo(b&k)fluoranthene	6.2 [g]	---	---	---	ND	---	---	---	---	---	---	ND	---	---	---
	Chrysene	610	---	---	---	ND	---	---	---	---	---	---	ND	---	---	---
	Fluorene	2100	210	---	---	ND	---	---	---	---	---	---	ND	---	---	---
	Fluoranthene	2300	230	---	---	ND	---	---	---	---	---	---	ND	---	---	---
	1-methylnaphthalene	NA [h]	NA	---	---	ND	---	---	---	---	---	---	24	---	---	---
	2-methylnaphthalene	NA	NA	---	---	ND	---	---	---	---	---	---	29	---	---	---
	Naphthalene	53	5.3	---	---	ND	---	---	---	---	---	---	**22**	---	---	---
	Phenanthrene	1,800	180	---	---	ND	---	---	---	---	---	---	ND	---	---	---
	Diethylphthalate	49,000	4900	---	---	0.072	---	---	---	---	---	---	ND	---	---	---
	bis (2-Ethylhexyl)phthalate	350	---	---	---	ND	---	---	---	---	---	---	ND	---	---	---
	Di-n-Butylphthalate	6,100	610	---	---	0.98	---	---	---	---	---	---	ND	---	---	---
	n-Nitroso-diphenyl-amine	990	---	---	---	ND	---	---	---	---	---	---	ND	---	---	---
	n-Nitroso-dimethyl-amine	0.0950	---	---	---	ND	---	---	---	---	---	---	ND	---	---	---
VOCs	Benzene	6.40	---	ND	ND	ND	ND	ND	ND	ND	**17**	ND	**8.6**	0.063	ND	ND
	Ethylbenzene	68	6.8	ND	ND	ND	ND	ND	ND	ND	3.5	**13**	**160**	ND	ND	ND
	o-Xylene	63	6.3	ND	ND	ND	ND	ND	ND	ND	**38**	**25**	**140**	ND	ND	ND
	p/m-Xylenes	63	6.3	ND	ND	ND	ND	ND	ND	ND	**32**	**47**	**380**	ND	ND	ND
	Toluene	180	18	ND	ND	ND	ND	ND	ND	ND	5.7	6.0	**300**	ND	ND	0.006
	1,2,4-Trimethylbenzene	52	5.2	ND	ND	ND	ND	---	---	---	**38**	**44**	**180**	ND	ND	ND
	1,3,5-Trimethylbenzene	21	2.1	ND	ND	ND	ND	---	---	---	**67**	**14**	**61**	ND	ND	ND
	1,2-Dibromoethane (EDB)	0.053	---	ND	ND	ND	ND	---	---	---	ND	ND	ND	ND	ND	ND
	1,1,2,2 Tetrachloroethane	3.6	---	ND	ND	ND	ND	---	---	---	ND	ND	ND	ND	ND	ND
	Chloromethane	12.0	---	ND	ND	ND	ND	---	---	---	**27**	ND	ND	ND	ND	ND
	2-Butanone (MEK)	37000	700	ND	ND	ND	ND	---	---	---	ND	ND	ND	ND	ND	ND
	2-Hexanone (MBK)	NA	NA	ND	ND	ND	ND	---	---	---	ND	ND	ND	ND	ND	ND
	4-Methyl-2-pentanone (MIBK)	760	76	ND	ND	ND	ND	---	---	---	ND	ND	ND	ND	ND	ND
	Acetone	1500	150	0.053	0.072	ND	ND	---	---	---	ND	ND	ND	ND	0.098	0.11
	Naphthalene	53	5.3	ND	ND	ND	ND	---	---	---	**8.3**	ND	ND	ND	ND	ND

Notes:

a) For TPH compounds the action level is the NMED 100 mg/kg combined DRO and GRO action level. The NMED action levels do not take into account other petroleum hydrocarbon ranges such as hydraulic ranges. The non-TPH compound screening levels are NMED residential soil screening levels (or EPA Region 6 residential HHRB levels if no NMED level is available). For non-carcinogenic compounds both the adjusted and unadjusted screeening levels are shown.

b) ND - non-detect

c) Concentrations shown in **bold** exceed the applicable screening level or action level.

d) Not analyzed for.

e) HHRB screening level adjusted to 10% of actual level for non-carcinogenic compounds to account for exposure to multiple non-carcinogens per NMED guidance

f) The sample from SB27-505' was a grab sample from drill cuttings and was analyzed after aproved holding times had expired.

g) The HHRB Screening Level listed here is for Benzo(b)fluoranthene only and is 1/10 the standard for benzo(k)fluoranthene.

h) An HHRB Screening Level is not available for these compounds

Table 2-3. Summary of Reportable Soil Sampling Results for the Soils Investigation at ST-106, Bulk Fuels Facility

Compound Class	Analyte	HHRB Screening Level [a] or Action Level (mg/kg)		Sample Number (Concentrations ST-106 SB-25									
				50'	80'	105'	125'	145'	175'	200'	225'	230'	250'
Petroleum Hydrocarbons	DRO	100 Combined		**7,700**	**8,000**	**29,000**	**2,200**	**12,000**	ND [b]	ND	ND	ND	ND
	GRO			**45,000**	**7,200**	**52,000**	**4,100**	**45,000**	0.41	0.25	ND	ND	ND
		Actual	Adjusted [e]										
SVOCs	Dibenzofuran	230	23	---[d]	---	4.7	---	---	ND	---	---	---	ND
	Benzo(b&k)fluoranthene	6.2 [g]	---	---	---	ND	---	---	ND	---	---	---	ND
	Chrysene	610	---	---	---	ND	---	---	ND	---	---	---	ND
	Fluorene	2100	210	---	---	ND	---	---	ND	---	---	---	ND
	Fluoranthene	2300	230	---	---	ND	---	---	ND	---	---	---	ND
	1-methylnaphthalene	NA [h]	NA	---	---	170	---	---	ND	---	---	---	ND
	2-methylnaphthalene	NA	NA	---	---	180	---	---	ND	---	---	---	ND
	Naphthalene	53	5.3	---	---	**120**	---	---	ND	---	---	---	ND
	Phenanthrene	1,800	180	---	---	ND	---	---	ND	---	---	---	ND
	Diethylphthalate	49,000	4900	---	---	ND	---	---	ND	---	---	---	ND
	bis (2-Ethylhexyl)phthalate	350	---	---	---	ND	---	---	ND	---	---	---	ND
	Di-n-Butylphthalate	6,100	610	---	---	ND	---	---	ND	---	---	---	ND
	n-Nitroso-diphenyl-amine	990	---	---	---	ND	---	---	ND	---	---	---	ND
	n-Nitroso-dimethyl-amine	0.0950	---	---	---	ND	---	---	ND	---	---	---	ND
VOCs	Benzene	6.40	---	**14**	**9.8**	5.6	2.2	ND	ND	ND	ND	ND	ND
	Ethylbenzene	68	6.8	**180**	**57**	**62**	4.2	**32**	ND	ND	ND	ND	ND
	o-Xylene	63	6.3	**190**	**55**	**38**	**12**	**69**	ND	ND	ND	ND	ND
	p/m-Xylenes	63	6.3	**610**	**150**	**85**	**38**	**120**	ND	ND	ND	ND	ND
	Toluene	180	18	**220**	**110**	**47**	**25**	**84**	ND	ND	ND	ND	ND
	1,2,4-Trimethylbenzene	52	5.2	---	**74**	**130**	**8.3**	---	ND	---	ND	---	ND
	1,3,5-Trimethylbenzene	21	2.1	---	**24**	**42**	**6.0**	---	ND	---	ND	---	ND
	1,2-Dibromoethane (EDB)	0.053	---	---	ND	ND	ND	---	ND	---	ND	---	ND
	1,1,2,2 Tetrachloroethane	3.6	---	---	ND	ND	ND	---	ND	---	ND	---	ND
	Chloromethane	12.0	---	---	ND	ND	ND	---	ND	---	ND	---	ND
	2-Butanone (MEK)	37000	700	---	3.2	ND	13	---	0.19	---	ND	---	ND
	2-Hexanone (MBK)	NA	NA	---	ND	ND	ND	---	0.032	---	ND	---	ND
	4-Methyl-2-pentanone (MIBK)	760	76	---	ND	ND	ND	---	ND	---	ND	---	ND
	Acetone	1500	150	---	7.1	ND	27	---	0.64	---	0.064	---	ND
	Naphthalene	53	5.3	---	**7.5**	**68**	ND	---	ND	---	ND	---	ND

Notes:

a) For TPH compounds the action level is the NMED 100 mg/kg combined DRO and GRO action level. The NMED action levels do not take into account other petroleum hydrocarbon ranges such as hydraulic ranges. The non-TPH compound screening levels are NMED residential soil screening levels (or EPA Region 6 residential HHRB levels if no NMED level is available). For non-carcinogenic compounds both the adjusted and unadjusted screeening levels are shown.

b) ND - non-detect

c) Concentrations shown in **bold** exceed the applicable screening level or action level.

d) Not analyzed for.

e) HHRB screening level adjusted to 10% of actual level for non-carcinogenic compounds to account for exposure to multiple non-carcinogens per NMED guidance

f) The sample from SB27-505' was a grab sample from drill cuttings and was analyzed after aproved holding times had expired.

g) The HHRB Screening Level listed here is for Benzo(b)fluoranthene only and is 1/10 the standard for benzo(k)fluoranthene.

h) An HHRB Screening Level is not available for these compounds

Table 2-3. Summary of Reportable Soil Sampling Results for the Soils Investigation at ST-106, Bulk Fuels Facility

Compound Class	Analyte	HHRB Screening Level [a] or Action Level (mg/kg)		Sample Number ST-106 SB-26												
				45'	75'	100'	125'	150'	175'	175' Dup	200'	200' Dup	270'	285'	295'	310'	315'
Petroleum Hydrocarbons	DRO	100 Combined		**23,000**	**31,000**	**22,000**	**27,000**	**5,500**	**4,300**	**3,300**	**17,000**	**15,000**	**24,000**	ND	**230**	ND	ND
	GRO			**21,000**	**25,000**	**24,000**	**25,000**	**16,000**	**3,100**	**5,000**	**14,000**	**14,000**	**90,000**	ND	**210**	0.54	ND
		Actual	Adjusted [c]														
SVOCs	Dibenzofuran	230	23	---	---	1.6	---	---	---	---	ND	ND	---	---	---	---	---
	Benzo(b&k)fluoranthene	6.2 [g]	---	---	---	ND	---	---	---	---	ND	ND	---	---	---	---	---
	Chrysene	610	---	---	---	ND	---	---	---	---	ND	ND	---	---	---	---	---
	Fluorene	2100	210	---	---	ND	---	---	---	---	ND	ND	---	---	---	---	---
	Fluoranthene	2300	230	---	---	ND	---	---	---	---	ND	ND	---	---	---	---	---
	1-methylnaphthalene	NA [h]	NA	---	---	130	---	---	---	---	66	66	---	---	---	---	---
	2-methylnaphthalene	NA	NA	---	---	ND	---	---	---	---	91	92	---	---	---	---	---
	Naphthalene	53	5.3	---	---	**100**	---	---	---	---	**52**	**52**	---	---	---	---	---
	Phenanthrene	1,800	180	---	---	ND	---	---	---	---	ND	ND	---	---	---	---	---
	Diethylphthalate	49,000	4900	---	---	ND	---	---	---	---	ND	ND	---	---	---	---	---
	bis (2-Ethylhexyl)phthalate	350	---	---	---	ND	---	---	---	---	ND	ND	---	---	---	---	---
	Di-n-Butylphthalate	6,100	610	---	---	ND	---	---	---	---	ND	ND	---	---	---	---	---
	n-Nitroso-diphenyl-amine	990	---	---	---	ND	---	---	---	---	ND	ND	---	---	---	---	---
	n-Nitroso-dimethyl-amine	0.0950	---	---	---	ND	---	---	---	---	15	ND	---	---	---	---	---
VOCs	Benzene	6.40	---	ND	ND	ND	**6.4**	**21**	ND	ND	**19**	**13**	**630**	ND	ND	ND	ND
	Ethylbenzene	68	6.8	**22**	**42**	**28**	**58**	**45**	2.0	**33**	**35**	**31**	**930**	ND	0.77	ND	ND
	o-Xylene	63	6.3	**22**	**44**	**32**	**51**	**55**	5.0	**48**	**45**	**39**	**640**	ND	1.1	ND	ND
	p/m-Xylenes	63	6.3	**46**	**120**	**70**	ND	**160**	**12**	**160**	**130**	**110**	**1,900**	ND	3.9	ND	ND
	Toluene	180	18	14	**19**	**35**	**34**	**150**	0.49	**28**	**130**	**100**	**3,600**	ND	ND	ND	ND
	1,2,4-Trimethylbenzene	52	5.2	**150**	---	**190**	---	**81**	---	---	**130**	**120**	**560**	---	---	---	---
	1,3,5-Trimethylbenzene	21	2.1	**37**	---	**49**	---	**28**	---	---	**38**	**33**	**220**	---	---	---	---
	1,2-Dibromoethane (EDB)	0.053	---	ND	---	ND	---	ND	---	---	ND	ND	ND	---	---	---	---
	1,1,2,2 Tetrachloroethane	3.6	---	ND	---	ND	---	ND	---	---	ND	ND	ND	---	---	---	---
	Chloromethane	12.0	---	ND	---	ND	---	ND	---	---	ND	ND	ND	---	---	---	---
	2-Butanone (MEK)	37000	700	ND	---	ND	---	ND	---	---	ND	ND	ND	---	---	---	---
	2-Hexanone (MBK)	NA	NA	ND	---	ND	---	ND	---	---	ND	ND	ND	---	---	---	---
	4-Methyl-2-pentanone (MIBK)	760	76	ND	---	ND	---	ND	---	---	ND	ND	ND	---	---	---	---
	Acetone	1500	150	ND	---	ND	---	120	---	---	120	**170**	**380**	---	---	---	---
	Naphthalene	53	5.3	**59**	---	**78**	---	ND	---	---	**43**	**36**	**72**	---	---	---	---

Notes:

a) For TPH compounds the action level is the NMED 100 mg/kg combined DRO and GRO action level. The NMED action levels do not take into account other petroleum hydrocarbon ranges such as hydraulic ranges. The non-TPH compound screening levels are NMED residential soil screening levels (or EPA Region 6 residential HHRB levels if no NMED level is available). For non-carcinogenic compounds both the adjusted and unadjusted screeening levels are shown.

b) ND - non-detect

c) Concentrations shown in **bold** exceed the applicable screening level or action level.

d) Not analyzed for.

e) HHRB screening level adjusted to 10% of actual level for non-carcinogenic compounds to account for exposure to multiple non-carcinogens per NMED guidance

f) The sample from SB27-505' was a grab sample from drill cuttings and was analyzed after aproved holding times had expired.

g) The HHRB Screening Level listed here is for Benzo(b)fluoranthene only and is 1/10 the standard for benzo(k)fluoranthene.

h) An HHRB Screening Level is not available for these compounds

Table 2-3. Summary of Reportable Soil Sampling Results for the Soils Investigation at ST-106, Bulk Fuels Facility

Compound Class	Analyte	HHRB Screening Level [a] or Action Level (mg/kg)		Sample Number (Concentrations ST-106 SB-27																				
				5'	15'	25'	35'	45'	55'	65'	75'	85'	95'	105'	125'	145'	165'	185'	205'	225'	245'	265'	285'	305'	345'	505'
Petroleum Hydrocarbons	DRO	100 Combined		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**4,100**	ND	ND	ND	56	32	ND	ND	ND	ND	ND	ND
	GRO			ND	ND	ND	ND	ND	ND	ND	0.31	ND	1.2	0.72	**5,600**	ND	ND	0.49	0.64	1.1	0.4	ND	ND	ND	ND	ND
		Actual	Adjusted [c]																							
SVOCs	Dibenzofuran	230	23	---	---	---	---	---	---	ND	---	---	---	---	---	ND	---	---	---	---	---	ND	ND	---	---	---
	Benzo(b&k)fluoranthene	6.2 [g]	---	---	---	---	---	---	---	ND	---	---	---	---	---	ND	---	---	---	---	---	ND	ND	---	---	---
	Chrysene	610	---	---	---	---	---	---	---	ND	---	---	---	---	---	ND	---	---	---	---	---	ND	ND	---	---	---
	Fluorene	2100	210	---	---	---	---	---	---	ND	---	---	---	---	---	ND	---	---	---	---	---	ND	ND	---	---	---
	Fluoranthene	2300	230	---	---	---	---	---	---	ND	---	---	---	---	---	ND	---	---	---	---	---	ND	ND	---	---	---
	1-methylnaphthalene	NA [h]	NA	---	---	---	---	---	---	ND	---	---	---	---	---	ND	---	---	---	---	---	ND	ND	---	---	---
	2-methylnaphthalene	NA	NA	---	---	---	---	---	---	ND	---	---	---	---	---	ND	---	---	---	---	---	ND	ND	---	---	---
	Naphthalene	53	5.3	---	---	---	---	---	---	ND	---	---	---	---	---	ND	---	---	---	---	---	ND	ND	---	---	---
	Phenanthrene	1,800	180	---	---	---	---	---	---	ND	---	---	---	---	---	ND	---	---	---	---	---	ND	ND	---	---	---
	Diethylphthalate	49,000	4900	---	---	---	---	---	---	ND	---	---	---	---	---	ND	---	---	---	---	---	ND	ND	---	---	---
	bis (2-Ethylhexyl)phthalate	350	---	---	---	---	---	---	---	ND	---	---	---	---	---	ND	---	---	---	---	---	ND	ND	---	---	---
	Di-n-Butylphthalate	6,100	610	---	---	---	---	---	---	ND	---	---	---	---	---	ND	---	---	---	---	---	ND	ND	---	---	---
	n-Nitroso-diphenyl-amine	990	---	---	---	---	---	---	---	ND	---	---	---	---	---	ND	---	---	---	---	---	ND	ND	---	---	---
	n-Nitroso-dimethyl-amine	0.0950	---	---	---	---	---	---	---	ND	---	---	---	---	---	ND	---	---	---	---	---	ND	ND	---	---	---
VOCs	Benzene	6.40	---	---	---	---	ND	ND	---	ND	---	---	---	---	**85**	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	---
	Ethylbenzene	68	6.8	---	---	---	ND	ND	---	ND	---	---	---	---	**150**	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	---
	o-Xylene	63	6.3	---	---	---	ND	ND	---	ND	---	---	---	---	**110**	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	---
	p/m-Xylenes	63	6.3	---	---	---	ND	ND	---	ND	---	---	---	---	**340**	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	---
	Toluene	180	18	---	---	---	ND	ND	---	ND	---	---	---	---	**810**	---	ND	ND	ND	ND	ND	ND	ND	ND	0.007	---
	1,2,4-Trimethylbenzene	52	5.2	---	---	---	---	---	---	ND	---	---	---	---	**74**	---	---	---	---	---	ND	ND	ND	---	---	---
	1,3,5-Trimethylbenzene	21	2.1	---	---	---	---	---	---	ND	---	---	---	---	**32**	---	---	---	---	---	ND	ND	ND	---	---	---
	1,2-Dibromoethane (EDB)	0.053	---	---	---	---	---	---	---	ND	---	---	---	---	**7.0**	---	---	---	---	---	ND	ND	ND	---	---	---
	1,1,2,2 Tetrachloroethane	3.6	---	---	---	---	---	---	---	ND	---	---	---	---	ND	---	---	---	---	---	ND	ND	ND	---	---	---
	Chloromethane	12.0	---	---	---	---	---	---	---	ND	---	---	---	---	ND	---	---	---	---	---	ND	ND	ND	---	---	---
	2-Butanone (MEK)	37000	700	---	---	---	---	---	---	ND	---	---	---	---	ND	---	---	---	---	---	1.2	ND	ND	---	---	---
	2-Hexanone (MBK)	NA	NA	---	---	---	---	---	---	ND	---	---	---	---	ND	---	---	---	---	---	0.046	ND	ND	---	---	---
	4-Methyl-2-pentanone (MIBK)	760	76							ND	---	---	---	---	ND	---	---	---	---	---	0.030	ND	ND	---	---	---
	Acetone	1500	150	---	---	---	---	---	---	ND	---	---	---	---	28	---	---	---	---	---	2.4	0.13	ND	---	---	---
	Naphthalene	53	5.3	---	---	---	---	---	---	ND	---	---	---	---	**18**	---	---	---	---	---	ND	ND	ND	---	---	---

Notes:

a) For TPH compounds the action level is the NMED 100 mg/kg combined DRO and GRO action level. The NMED action levels do not take into account other petroleum hydrocarbon ranges such as hydraulic ranges. The non-TPH compound screening levels are NMED residential soil screening levels (or EPA Region 6 residential HHRB levels if no NMED level is available). For non-carcinogenic compounds both the adjusted and unadjusted screeening levels are shown.

b) ND - non-detect

c) Concentrations shown in **bold** exceed the applicable screening level or action level.

d) Not analyzed for.

e) HHRB screening level adjusted to 10% of actual level for non-carcinogenic compounds to account for exposure to multiple non-carcinogens per NMED guidance

f) The sample from SB27-505' was a grab sample from drill cuttings and was analyzed after aproved holding times had expired.

g) The HHRB Screening Level listed here is for Benzo(b)fluoranthene only and is 1/10 the standard for benzo(k)fluoranthene.

h) An HHRB Screening Level is not available for these compounds

Table 2-3. Summary of Reportable Soil Sampling Results for the Soils Investigation at ST-106, Bulk Fuels Facility

Compound Class	Analyte	HHRB Screening Level [a] or Action Level (mg/kg)		Sample Number ST-106 SB28 30'	50'	60'	70'	80'	100'	110'	130'	170'	200'	220	250'	270'	320'	330'	340'
Petroleum Hydrocarbons	DRO	100 Combined		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	43	ND	**1,700**	59	ND	ND
	GRO			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.43	ND	**4,400**	ND	ND	ND
		Actual	Adjusted [e]																
SVOCs	Dibenzofuran	230	23	---	---	---	---	---	---	---	---	---	---	---	---	ND	ND	---	---
	Benzo(b&k)fluoranthene	6.2 [g]	---	---	---	---	---	---	---	---	---	---	---	---	---	ND	ND	---	---
	Chrysene	610	---	---	---	---	---	---	---	---	---	---	---	---	---	ND	ND	---	---
	Fluorene	2100	210	---	---	---	---	---	---	---	---	---	---	---	---	ND	ND	---	---
	Fluoranthene	2300	230	---	---	---	---	---	---	---	---	---	---	---	---	ND	ND	---	---
	1-methylnaphthalene	NA [h]	NA	---	---	---	---	---	---	---	---	---	---	---	---	0.16	ND	---	---
	2-methylnaphthalene	NA	NA	---	---	---	---	---	---	---	---	---	---	---	---	0.18	ND	---	---
	Naphthalene	53	5.3	---	---	---	---	---	---	---	---	---	---	---	---	0.044	ND	---	---
	Phenanthrene	1,800	180	---	---	---	---	---	---	---	---	---	---	---	---	ND	ND	---	---
	Diethylphthalate	49,000	4900	---	---	---	---	---	---	---	---	---	---	---	---	ND	ND	---	---
	bis (2-Ethylhexyl)phthalate	350	---	---	---	---	---	---	---	---	---	---	---	---	---	ND	ND	---	---
	Di-n-Butylphthalate	6,100	610	---	---	---	---	---	---	---	---	---	---	---	---	ND	ND	---	---
	n-Nitroso-diphenyl-amine	990	---	---	---	---	---	---	---	---	---	---	---	---	---	ND	ND	---	---
	n-Nitroso-dimethyl-amine	0.0950	---	---	---	---	---	---	---	---	---	---	---	---	---	ND	ND	---	---
VOCs	Benzene	6.40	---	---	---	---	---	---	0.018	ND	---	ND	---	---	---	0.64	ND	ND	---
	Ethylbenzene	68	6.8	---	---	---	---	---	ND	ND	---	ND	---	---	---	0.48	ND	ND	---
	o-Xylene	63	6.3	---	---	---	---	---	ND	ND	---	ND	---	---	---	0.28	ND	ND	---
	p/m-Xylenes	63	6.3	---	---	---	---	---	ND	ND	---	ND	---	---	---	0.74	ND	ND	---
	Toluene	180	18	---	---	---	---	---	0.035	ND	---	ND	---	---	---	2.2	ND	0.008	---
	1,2,4-Trimethylbenzene	52	5.2	---	---	---	---	---	ND	ND	---	---	---	---	---	0.27	ND	---	---
	1,3,5-Trimethylbenzene	21	2.1	---	---	---	---	---	ND	ND	---	---	---	---	---	0.098	ND	---	---
	1,2-Dibromoethane (EDB)	0.053	---	---	---	---	---	---	0.026	ND	---	---	---	---	---	**0.12**	ND	---	---
	1,1,2,2 Tetrachloroethane	3.6	---	---	---	---	---	---	ND	ND	---	---	---	---	---	ND	ND	---	---
	Chloromethane	12.0	---	---	---	---	---	---	ND	ND	---	---	---	---	---	ND	ND	---	---
	2-Butanone (MEK)	37000	700	---	---	---	---	---	0.24	ND	---	---	---	---	---	0.85	ND	---	---
	2-Hexanone (MBK)	NA	NA	---	---	---	---	---	ND	ND	---	---	---	---	---	ND	ND	---	---
	4-Methyl-2-pentanone (MIBK)	760	76	---	---	---	---	---	ND	ND	---	---	---	---	---	ND	ND	---	---
	Acetone	1500	150	---	---	---	---	---	1.8	0.17	---	---	---	---	---	4.2	ND	---	---
	Naphthalene	53	5.3	---	---	---	---	---	ND	ND	---	---	---	---	---	ND	ND	---	---

Notes:

a) For TPH compounds the action level is the NMED 100 mg/kg combined DRO and GRO action level. The NMED action levels do not take into account other petroleum hydrocarbon ranges such as hydraulic ranges. The non-TPH compound screening levels are NMED residential soil screening levels (or EPA Region 6 residential HHRB levels if no NMED level is available). For non-carcinogenic compounds both the adjusted and unadjusted screeening levels are shown.

b) ND - non-detect

c) Concentrations shown in **bold** exceed the applicable screening level or action level.

d) Not analyzed for.

e) HHRB screening level adjusted to 10% of actual level for non-carcinogenic compounds to account for exposure to multiple non-carcinogens per NMED guidance

f) The sample from SB27-505' was a grab sample from drill cuttings and was analyzed after aproved holding times had expired.

g) The HHRB Screening Level listed here is for Benzo(b)fluoranthene only and is 1/10 the standard for benzo(k)fluoranthene.

h) An HHRB Screening Level is not available for these compounds

Table 2-3. Summary of Reportable Soil Sampling Results for the Soils Investigation at ST-106, Bulk Fuels Facility

Compound Class	Analyte	HHRB Screening Level [a] or Action Level (mg/kg)		Sample Number ST-106 SB-29													
				90'	100'	110'	120'	130'	160'	170'	210'	220'	230'	240'	260'	270'	290'	300'
Petroleum Hydrocarbons	DRO	100 Combined		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	73
	GRO			ND	ND	ND	ND	ND	ND	ND	ND	ND	0.29	ND	0.50	ND	ND	ND
		Actual	Adjusted [c]															
SVOCs	Dibenzofuran	230	23	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
	Benzo(b&k)fluoranthene	6.2 [g]	---	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
	Chrysene	610	---	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
	Fluorene	2100	210	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
	Fluoranthene	2300	230	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
	1-methylnaphthalene	NA [h]	NA	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
	2-methylnaphthalene	NA	NA	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
	Naphthalene	53	5.3	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
	Phenanthrene	1,800	180	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
	Diethylphthalate	49,000	4900	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
	bis (2-Ethylhexyl)phthalate	350	---	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
	Di-n-Butylphthalate	6,100	610	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
	n-Nitroso-diphenyl-amine	990	---	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
	n-Nitroso-dimethyl-amine	0.0950	---	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
VOCs	Benzene	6.40	---	---	---	ND	---	---	ND	ND	---	ND	---	ND	ND	---	ND	---
	Ethylbenzene	68	6.8	---	---	ND	---	---	ND	ND	---	ND	---	ND	ND	---	ND	---
	o-Xylene	63	6.3	---	---	ND	---	---	ND	ND	---	ND	---	ND	ND	---	ND	---
	p/m-Xylenes	63	6.3	---	---	ND	---	---	ND	ND	---	ND	---	ND	ND	---	ND	---
	Toluene	180	18	---	---	ND	---	---	ND	ND	---	ND	---	ND	ND	---	ND	---
	1,2,4-Trimethylbenzene	52	5.2	---	---	ND	---	---	---	ND	---	---	---	---	ND	---	---	---
	1,3,5-Trimethylbenzene	21	2.1	---	---	ND	---	---	---	ND	---	---	---	---	ND	---	---	---
	1,2-Dibromoethane (EDB)	0.053	---	---	---	ND	---	---	---	ND	---	---	---	---	ND	---	---	---
	1,1,2,2 Tetrachloroethane	3.6	---	---	---	ND	---	---	---	ND	---	---	---	---	ND	---	---	---
	Chloromethane	12.0	---	---	---	ND	---	---	---	ND	---	---	---	---	ND	---	---	---
	2-Butanone (MEK)	37000	700	---	---	0.030	---	---	---	ND	---	---	---	---	0.058	---	---	---
	2-Hexanone (MBK)	NA	NA	---	---	ND	---	---	---	ND	---	---	---	---	ND	---	---	---
	4-Methyl-2-pentanone (MIBK)	760	76	---	---	ND	---	---	---	ND	---	---	---	---	ND	---	---	---
	Acetone	1500	150	---	---	0.34	---	---	---	0.068	---	---	---	---	0.59	---	---	---
	Naphthalene	53	5.3	---	---	ND	---	---	---	ND	---	---	---	---	ND	---	---	---

Notes:

a) For TPH compounds the action level is the NMED 100 mg/kg combined DRO and GRO action level. The NMED action levels do not take into account other petroleum hydrocarbon ranges such as hydraulic ranges. The non-TPH compound screening levels are NMED residential soil screening levels (or EPA Region 6 residential HHRB levels if no NMED level is available). For non-carcinogenic compounds both the adjusted and unadjusted screeening levels are shown.

b) ND - non-detect

c) Concentrations shown in **bold** exceed the applicable screening level or action level.

d) Not analyzed for.

e) HHRB screening level adjusted to 10% of actual level for non-carcinogenic compounds to account for exposure to multiple non-carcinogens per NMED guidance

f) The sample from SB27-505' was a grab sample from drill cuttings and was analyzed after aproved holding times had expired.

g) The HHRB Screening Level listed here is for Benzo(b)fluoranthene only and is 1/10 the standard for benzo(k)fluoranthene.

h) An HHRB Screening Level is not available for these compounds

Table 2-3. Summary of Reportable Soil Sampling Results for the Soils Investigation at ST-106, Bulk Fuels Facility

Compound Class	Analyte	HHRB Screening Level [a] or Action Level (mg/kg)		Sample Number															
				ST-106 SB-30											ST-106 SB-31				
				40'	110'	160'	220'	250'	270'	305'	310'	320'	325'	330'	70'	120"	130'	140'	150'
Petroleum Hydrocarbons	DRO	100 Combined		ND	ND	31	ND	ND	63	**420**	**210**	35	ND	ND	ND	ND	**830**	ND	ND
	GRO			ND	ND	ND	ND	0.84	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		Actual	Adjusted [c]																
SVOCs	Dibenzofuran	230	23	---	---	---	ND	---	ND	---	---	---	---	---	---	---	ND	---	---
	Benzo(b&k)fluoranthene	6.2 [g]	---	---	---	---	ND	---	ND	---	---	---	---	---	---	---	ND	---	---
	Chrysene	610	---	---	---	---	ND	---	ND	---	---	---	---	---	---	---	ND	---	---
	Fluorene	2100	210	---	---	---	ND	---	ND	---	---	---	---	---	---	---	ND	---	---
	Fluoranthene	2300	230	---	---	---	ND	---	ND	---	---	---	---	---	---	---	ND	---	---
	1-methylnaphthalene	NA [h]	NA	---	---	---	ND	---	ND	---	---	---	---	---	---	---	ND	---	---
	2-methylnaphthalene	NA	NA	---	---	---	ND	---	ND	---	---	---	---	---	---	---	ND	---	---
	Naphthalene	53	5.3	---	---	---	ND	---	ND	---	---	---	---	---	---	---	ND	---	---
	Phenanthrene	1,800	180	---	---	---	ND	---	ND	---	---	---	---	---	---	---	ND	---	---
	Diethylphthalate	49,000	4900	---	---	---	ND	---	ND	---	---	---	---	---	---	---	ND	---	---
	bis (2-Ethylhexyl)phthalate	350	---	---	---	---	ND	---	0.40	---	---	---	---	---	---	---	1.6	---	---
	Di-n-Butylphthalate	6,100	610	---	---	---	ND	---	ND	---	---	---	---	---	---	---	ND	---	---
	n-Nitroso-diphenyl-amine	990	---	---	---	---	ND	---	ND	---	---	---	---	---	---	---	0.075	---	---
	n-Nitroso-dimethyl-amine	0.0950	---	---	---	---	ND	---	ND	---	---	---	---	---	---	---	ND	---	---
VOCs	Benzene	6.40	---	---	ND	---	ND	ND	ND	ND	---	---	---	---	ND	ND	ND	ND	---
	Ethylbenzene	68	6.8	---	ND	---	ND	ND	ND	ND	---	---	---	---	ND	ND	ND	ND	---
	o-Xylene	63	6.3	---	ND	---	ND	ND	ND	ND	---	---	---	---	ND	ND	ND	ND	---
	p/m-Xylenes	63	6.3	---	ND	---	ND	ND	ND	ND	---	---	---	---	ND	ND	ND	ND	---
	Toluene	180	18	---	ND	---	ND	ND	ND	ND	---	---	---	---	ND	ND	ND	ND	---
	1,2,4-Trimethylbenzene	52	5.2	---	ND	---	ND	---	ND	---	---	---	---	---	ND	ND	ND	ND	---
	1,3,5-Trimethylbenzene	21	2.1	---	ND	---	ND	---	ND	---	---	---	---	---	ND	ND	ND	ND	---
	1,2-Dibromoethane (EDB)	0.053	---	---	ND	---	ND	---	ND	---	---	---	---	---	ND	ND	ND	ND	---
	1,1,2,2 Tetrachloroethane	3.6	---	---	ND	---	ND	---	ND	---	---	---	---	---	ND	ND	ND	ND	---
	Chloromethane	12.0	---	---	ND	---	ND	---	ND	---	---	---	---	---	ND	ND	ND	ND	---
	2-Butanone (MEK)	37000	700	---	ND	---	ND	---	ND	---	---	---	---	---	ND	ND	ND	ND	---
	2-Hexanone (MBK)	NA	NA	---	ND	---	ND	---	ND	---	---	---	---	---	ND	ND	ND	ND	---
	4-Methyl-2-pentanone (MIBK)	760	76	---	ND	---	ND	---	ND	---	---	---	---	---	ND	ND	ND	ND	---
	Acetone	1500	150	---	ND	---	ND	---	ND	---	---	---	---	---	ND	0.12	ND	ND	---
	Naphthalene	53	5.3	---	ND	---	ND	---	ND	---	---	---	---	---	ND	ND	ND	ND	---

Notes:

a) For TPH compounds the action level is the NMED 100 mg/kg combined DRO and GRO action level. The NMED action levels do not take into account other petroleum hydrocarbon ranges such as hydraulic ranges. The non-TPH compound screening levels are NMED residential soil screening levels (or EPA Region 6 residential HHRB levels if no NMED level is available). For non-carcinogenic compounds both the adjusted and unadjusted screeening levels are shown.

b) ND - non-detect

c) Concentrations shown in **bold** exceed the applicable screening level or action level.

d) Not analyzed for.

e) HHRB screening level adjusted to 10% of actual level for non-carcinogenic compounds to account for exposure to multiple non-carcinogens per NMED guidance

f) The sample from SB27-505' was a grab sample from drill cuttings and was analyzed after aproved holding times had expired.

g) The HHRB Screening Level listed here is for Benzo(b)fluoranthene only and is 1/10 the standard for benzo(k)fluoranthene.

h) An HHRB Screening Level is not available for these compounds

Table 2-3. Summary of Reportable Soil Sampling Results for the Soils Investigation at ST-106, Bulk Fuels Facility

Compound Class	Analyte	HHRB Screening Level [a] or Action Level (mg/kg)		Sample Number																	
				ST-106 SB-32						ST-106 SB-33								ST-106 SB-34			
				130'	270'	300'	310'	320'	330'	90'	100'	170'	230'	250'	270'	280'	310'	110'	130'	140'	150'
Petroleum Hydrocarbons	DRO	100 Combined		ND	ND	94	88	ND	ND	ND	ND	ND	ND	86	ND	ND	65	ND	ND	ND	ND
	GRO			ND	ND	ND	ND	ND	ND	ND	ND	ND	1.5	ND	ND	ND	ND	ND	ND	ND	ND
		Actual	Adjusted [c]																		
SVOCs	Dibenzofuran	230	23	---	---	---	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
	Benzo(b&k)fluoranthene	6.2 [g]	---	---	---	---	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
	Chrysene	610	---	---	---	---	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
	Fluorene	2100	210	---	---	---	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
	Fluoranthene	2300	230	---	---	---	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
	1-methylnaphthalene	NA [h]	NA	---	---	---	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
	2-methylnaphthalene	NA	NA	---	---	---	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
	Naphthalene	53	5.3	---	---	---	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
	Phenanthrene	1,800	180	---	---	---	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
	Diethylphthalate	49,000	4900	---	---	---	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
	bis (2-Ethylhexyl)phthalate	350	---	---	---	---	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
	Di-n-Butylphthalate	6,100	610	---	---	---	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
	n-Nitroso-diphenyl-amine	990	---	---	---	---	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
	n-Nitroso-dimethyl-amine	0.0950	---	---	---	---	---	---	ND	---	---	---	---	---	---	---	---	---	---	---	---
VOCs	Benzene	6.40	---	---	---	---	ND	---	ND	---	---	---	ND	ND	ND	ND	---	---	ND	---	---
	Ethylbenzene	68	6.8	---	---	---	ND	---	ND	---	---	---	ND	ND	ND	ND	---	---	ND	---	---
	o-Xylene	63	6.3	---	---	---	ND	---	ND	---	---	---	ND	ND	ND	ND	---	---	ND	---	---
	p/m-Xylenes	63	6.3	---	---	---	ND	---	ND	---	---	---	ND	ND	ND	ND	---	---	ND	---	---
	Toluene	180	18	---	---	---	ND	---	ND	---	---	---	ND	ND	ND	ND	---	---	ND	---	---
	1,2,4-Trimethylbenzene	52	5.2	---	---	---	ND	---	ND	---	---	---	ND	ND	ND	ND	---	---	ND	---	---
	1,3,5-Trimethylbenzene	21	2.1	---	---	---	ND	---	ND	---	---	---	ND	ND	ND	ND	---	---	ND	---	---
	1,2-Dibromoethane (EDB)	0.053	---	---	---	---	ND	---	ND	---	---	---	ND	ND	ND	ND	---	---	ND	---	---
	1,1,2,2 Tetrachloroethane	3.6	---	---	---	---	ND	---	ND	---	---	---	ND	ND	ND	ND	---	---	ND	---	---
	Chloromethane	12.0	---	---	---	---	ND	---	ND	---	---	---	ND	ND	ND	ND	---	---	ND	---	---
	2-Butanone (MEK)	37000	700	---	---	---	ND	---	ND	---	---	---	ND	ND	ND	ND	---	---	ND	---	---
	2-Hexanone (MBK)	NA	NA	---	---	---	ND	---	ND	---	---	---	ND	ND	ND	ND	---	---	ND	---	---
	4-Methyl-2-pentanone (MIBK)	760	76	---	---	---	ND	---	ND	---	---	---	ND	ND	ND	ND	---	---	ND	---	---
	Acetone	1500	150	---	---	---	ND	---	ND	---	---	---	ND	0.16	ND	0.091	---	---	ND	---	---
	Naphthalene	53	5.3	---	---	---	ND	---	ND	---	---	---	ND	ND	ND	ND	---	---	ND	---	---

Notes:

a) For TPH compounds the action level is the NMED 100 mg/kg combined DRO and GRO action level. The NMED action levels do not take into account other petroleum hydrocarbon ranges such as hydraulic ranges. The non-TPH compound screening levels are NMED residential soil screening levels (or EPA Region 6 residential HHRB levels if no NMED level is available). For non-carcinogenic compounds both the adjusted and unadjusted screeening levels are shown.

b) ND - non-detect

c) Concentrations shown in **bold** exceed the applicable screening level or action level.

d) Not analyzed for.

e) HHRB screening level adjusted to 10% of actual level for non-carcinogenic compounds to account for exposure to multiple non-carcinogens per NMED guidance

f) The sample from SB27-505' was a grab sample from drill cuttings and was analyzed after aproved holding times had expired.

g) The HHRB Screening Level listed here is for Benzo(b)fluoranthene only and is 1/10 the standard for benzo(k)fluoranthene.

h) An HHRB Screening Level is not available for these compounds

Data from these additional borings demonstrate that the soils contaminated in excess of the NMED action level are limited to within about 310 ft of the surface, and within the area 65 ft south (SB-29A), 280 ft north (SB-34), 400 ft east (SB-32), and 175 ft west (SB-33) of the offloading rack. The total area of soil affected by the petroleum hydrocarbon contamination is estimated to be roughly 6.5 acres with depths of contamination as deep at 310 ft bgs. This extent is presented visually in Figures 2-2, 2-3, and 2-4.

During the field investigations, the soil samples were screened using a photoionization detector (PID). Readings from the PID indicated that soil samples that had no contaminants detected in the laboratory analyses did have VOC concentrations in the interstitial soil gas that could be detected by the PID. Although the PID does not provide a quantitative analysis of the contaminants present in the soil, it does indicate that there were VOCs present in the soil gas at the site at depths greater than any actual soil contamination was detected.

2.5.2 Groundwater Contamination

Low levels of VOCs have been detected in the groundwater at ST-106 and to the south in the well at ST-341 (Table 2-4). The concentrations of benzene and toluene detected are less than the applicable U.S. Environmental Protection Agency (EPA) maximum contaminant levels (MCLs), but do indicate that the contaminants have migrated to the drinking water aquifer. The concentrations of EDB, however, have exceeded both the EPA MCL and the NMED groundwater standards. None of the contaminants have been detected in the nearest Kirtland AFB water-supply wells, KAFB-15 and KAFB-16.

Table 2-4. Summary of Reportable Groundwater Sampling Results at Bulk Fuels Facility (ST-106)

Compound Class	Analyte	EPA MCL (µg/L)	NMED Groundwater Standard (µg/L)	Detected Concentration (µg/L)				
				KAFB-106-1			KAFB-341-1	
				March 2001	June 2001	Sept 2001	March 2001	Sept 2001
VOCs	Benzene	5	10	4.7	0.5	1.2	ND	ND
	Toluene	1,000	750	8.6	1.8	2.4	ND	ND
	Ethylene dibromide	0.05	0.1	0.21	0.11	0.047	ND	ND

Note: µg\L = microgram per liter.
ND = not detected above the method detection limit.

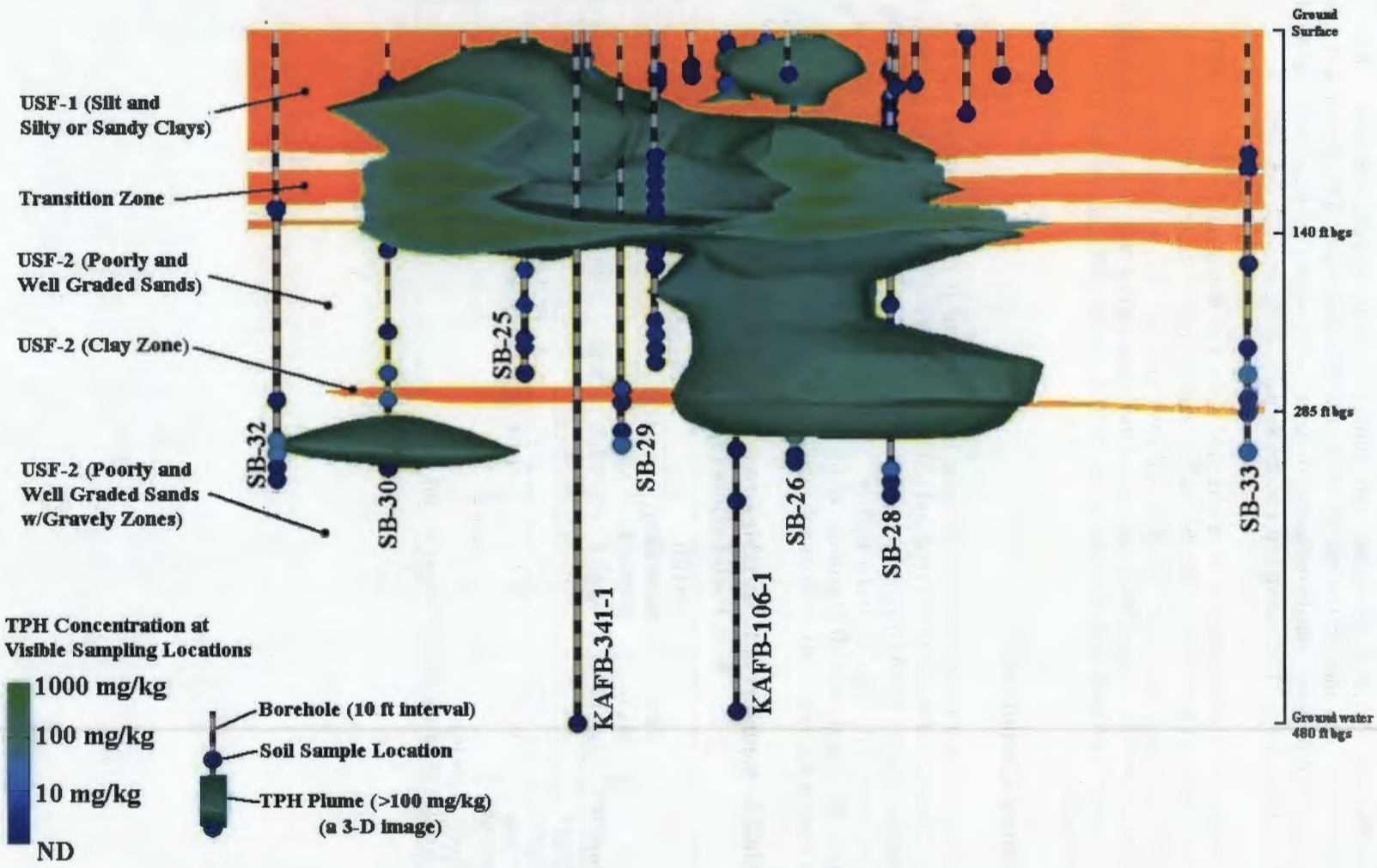


Figure 2 - 2. Geologic Cross Section and Estimated Extent of Subsurface Contamination

Iso-surface illustrates the Total Recoverable Petroleum Hydrocarbon (TPH) >100 mg/kg
View is horizontal from the south. No vertical exageration.

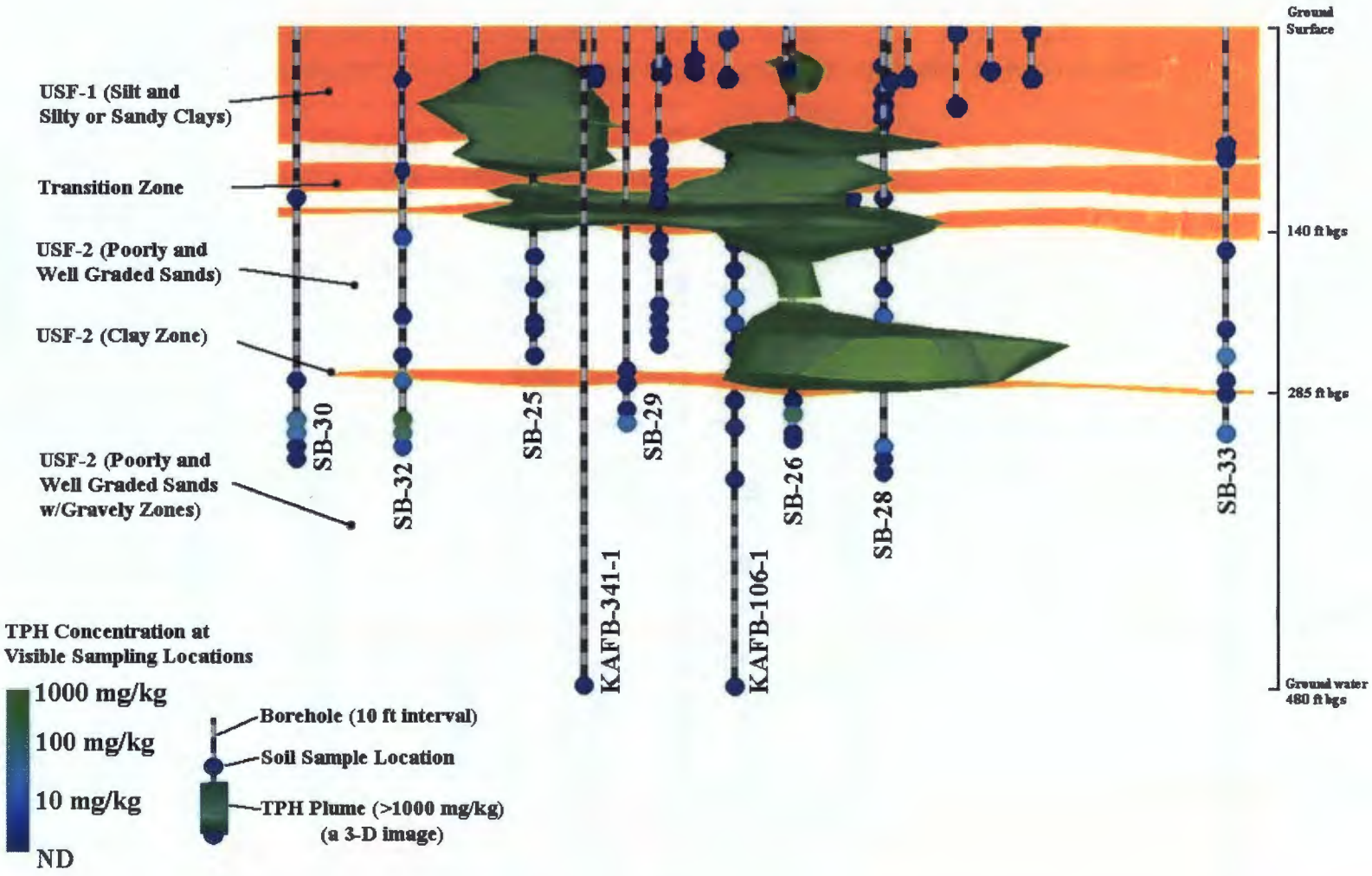


Figure 2 - 3. Geologic Cross Section and Estimated Extent of Subsurface Contamination

Iso-surface illustrates the Total Recoverable Petroleum Hydrocarbon (TPH) >1,000 mg/kg
View is horizontal from the south. No vertical exageration.

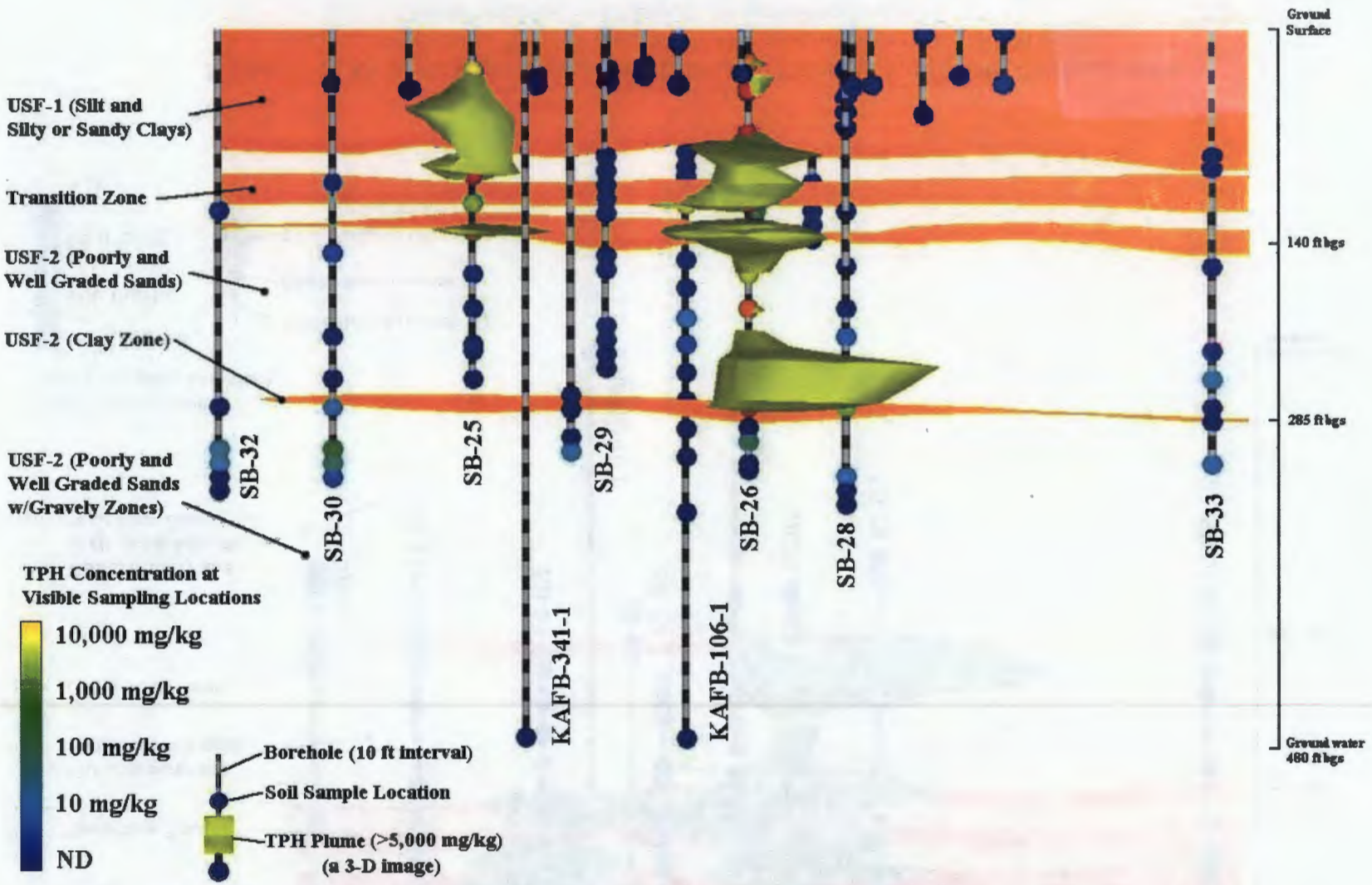


Figure 2 - 4. Geologic Cross Section and Estimated Extent of Subsurface Contamination

Iso-surface illustrates the Total Recoverable Petroleum Hydrocarbon (TPH) >5,000 mg/kg
View is horizontal from the south. No vertical exageration.

A rule of thumb that is used to evaluate the potential presence of free product in or near the saturated zone if concentrations in groundwater exceed approximately 1 percent of chemical solubility limits for the specific dissolved contaminants (Table 2-5), then there may be a potential for free product to be present at a site. Since the highest detected groundwater concentration at the site is much less than the solubility shown on Table 2-5 for the indicator compounds, it is unlikely that free product is in direct contact with the groundwater. This suggests that vapor-phase transport is the major route for the contamination that has reached the site groundwater.

Table 2-5. Screening Level for Presence of Free-Phase Hydrocarbons Using Solubility Limits Bulk Fuel Facility (ST-106)

Compound	Water Solubility (mg/L)	Screening Level for Potential Presence of Product at the Groundwater Table (mg/L)	Maximum Observed Groundwater Concentration (mg/L)
Benzene	1,790 mg/L	17.9 mg/L	0.0012 mg/L
Toluene	526 mg/L	5.6 mg/L	0.0038 mg/L
Note: mg/L = milligrams per liter.			

2.6 Contaminant Source

The high TPH concentrations detected at each end of the offloading rack (SB-05 and SB-10 at the east end and SB-06 and SB-22 at the west end) without similar detections midway along the rack suggests that there were at least two separate release points in the underground pipelines serving the offloading rack. The detection of both diesel range organics (DRO) and gasoline range organics (GRO) (and therefore JP4 and JP8) in the soils and EDB in the groundwater at ST-106 indicates that the source of the fuel contamination at the Bulk Fuels Facility was most likely a long-term, on-going source rather than a one-time recent release, since AVGAS and JP4 have not been used at Kirtland AFB since 1975 and 1993, respectively. It is unlikely that VOCs can be accounted for as by-products of the weathering of the JP8 because the arid nature of the soils at Kirtland AFB and the lack of biological activity seen at other TPH sites at the base suggest that little weathering occurs in the soils at the Bulk Fuels Facility. Likewise, the EDB in the groundwater indicates that at least one of the sources is a leaded fuel, which JP4 and JP8 are not.

The fuel offloading rack is no longer in use and will be replaced thereby eliminating the source of soil contamination. The remaining contaminated soil continues to be a potential source for groundwater contamination.

2.7 Fate and Transport

As discussed above, the TPH contamination at ST-106 appears to be from two separate leaks in the piping at each end of the offloading rack. This contamination has traveled through the granular subsurface soils beneath the site and then accumulated on the surface of the clay layers. Since these clay layers were of varying thicknesses in the soil borings installed at the site, it is likely that they are discontinuous. As the contamination spread out over these clay layers, the TPH most likely encountered zones with greater permeability, which then allowed the contamination (in liquid and vapor phase) to migrate deeper into the subsurface. The deepest detection of contamination at the site has been of VOCs in the soil gas as indicated by PID readings collected in the field. From this, it is inferred that the VOC contamination detected in the two wells at the site has probably migrated in vapor phase from the zone of deepest soil detection to the groundwater.

The source of the contamination (the leaking piping) has been eliminated. Therefore, any future fate and transport of the contamination will be only the contaminant mass that is present in the subsurface today. This contamination (VOCs, EDB, and semivolatile organic compounds [SVOCs]) could be expected to continue to disperse by volatilization (VOCs) and diffusion as it has done up until this point. Naphthalene, the only SVOC detected at significant concentrations at the site in the deeper borings, has a high enough volatility to volatalize along with the VOCs. If no remediation is implemented at the site, there is a chance that free-phase soil contamination, if any exists above the clay layer at approximately 300 to 320 ft bgs, could reach an area of greater permeability, which would allow it to migrate to the water table if no further clay layers are encountered. Because of the depth of the contamination, the lack of oxygen, and the lack of moisture in much of the subsurface soils, the reduction in contaminant concentrations by unenhanced, passive biodegradation would not be expected to be significant.

Very low levels of these contaminants have been detected in the groundwater at the site. This groundwater is the source of the base's drinking water. Although the contaminants have not been detected in the drinking water wells less than 1 mile downgradient from ST-106, a remedial strategy needs to be developed to address the contamination to prevent further migration of the contaminants to the groundwater. The results of this investigation have been used to develop this Stage 2 Abatement Plan for the remediation of contaminated soils to prevent the further degradation of the groundwater beneath the site.

3.0 DEVELOPMENT AND ASSESSMENT OF ABATEMENT OPTIONS

3.1 Proposed Abatement Goals

The contaminants of concern (COCs) detected during the Stage 1 investigation of the Bulk Fuels Facility include the VOCs benzene, ethylbenzene, xylene, toluene, trimethylbenzene, naphthalene, and EDB as well as TPH. The applicable cleanup standards for the remediation of these contaminants include:

- 20MAC.2 3103, *Standards for the Protection of Groundwater of 10,000 mg/L TDS or less*. This regulation requires that groundwater concentrations not exceed:
    - 0.01 mg/L benzene
    - 0.75 mg/L ethylbenzene
    - 0.75 mg/L toluene
    - 0.62 mg/L total xylenes
    - 0.03 mg/L naphthalene and
    - 0.0001 mg/L ethylene dibromide.
- NMED's Soil Screening Levels. These risk-based guidelines currently limit soil concentrations to the following assuming no adjustments to levels are required due to co-contaminants:
    - 6.4 mg/kg benzene
    - 68 mg/kg ethylbenzene
    - 180 mg/kg toluene
    - 63 mg/kg xylenes
    - 41 mg/kg naphthalene

Currently, only one of the groundwater standards has been exceeded at the site: 0.21 mg/L of EDB have been detected during quarterly monitoring activities at the site. All of the soil standards have been exceeded in one or more soil samples from the site, which is why these compounds have been selected as COCs. However, the majority of the VOC and TPH contamination at ST-106 is greater than 100 ft bgs. Because of this depth, there are no pathways for exposure to humans or the environment other than groundwater. Therefore, the goals of the proposed remedial strategy are to prevent further migration of the VOC-contaminated soil gas to the groundwater and to inhibit the possible migration of any free-phase soil contamination (if any exists) below the clay layer at 285 ft bgs.

3.2 Potential Abatement Options

The contamination at the Bulk Fuels Facility exists in two areas: contaminated soil and soil gas in the vadose zone and contaminated groundwater in the saturated zone. The following subsections discuss the potential abatement options for these two zones.

3.2.1 Vadose Zone Abatement Options

There are numerous remediation technologies that are available for VOC-contaminated soils. However, because of the depth of the contamination present at the Bulk Fuels Facility, none of the conventional remedial strategies that require excavation such as offsite disposal, land farming, incineration, soil washing, or solvent extraction are applicable to the site. Likewise, the depth of the soil contamination precludes the use of in situ remediation strategies such as soil flushing, heat-assisted soil vapor extraction (SVE), solidification/stabilization, and vitrification. Technologies that may be applicable to the site are natural attenuation, SVE, and bioventing.

Natural attenuation is a process that allows a site's naturally occurring processes to reduce the concentrations of the COCs to acceptable levels. These processes include diffusion, biodegradation, volatilization, and adsorption. Because of the relatively high concentrations and depth of VOCs present in the vadose zone of the Bulk Fuels Facility and the potential for contamination of the drinking water aquifer, natural attenuation cannot be relied upon as the sole abatement option for the site.

SVE is a process in which vapor wells are installed at a site and soil gasses are drawn from the vadose zone to the ground surface and either released into the atmosphere or delivered to a treatment system prior to discharge. It is a proven technology that is readily available. Because it relies on contaminants being present in the soil gasses, SVE is most applicable to VOCs. It would also be applicable to the SVOC detected at the site, naphthalene. Since the contaminants are removed from the subsurface, it is a permanent solution and has a high degree of long-term effectiveness. Disadvantages of SVE include the time required to complete a site cleanup and the potential need to periodically alter the extraction scenario to optimize the removal of contaminants.

Bioventing is a process that uses naturally occurring microorganisms to biodegrade contaminants adsorbed to soils in the vadose zone. The process includes the addition of air and other nutrients into the vadose zone to stimulate the naturally occurring biological processes. The air can be introduced using either injection wells that pump air into the subsurface or extraction wells that pull air through the contaminated media. When extraction wells are used, the process is similar to SVE; however, the primary mechanism of contaminant removal is biodegradation instead of volatilization. Bioventing has been used at a number of sites at Kirtland AFB. However, because of the lack of moisture and nutrients that are present in the site soils, moisture and nutrients have needed to be added to achieve an active bioventing system. This is not an option at the Bulk Fuels Facility because of the depth of the contamination and the potential that the addition of moisture to the deep soils could force some of the existing contamination deeper into the substrate and closer to the drinking water aquifer.

SVE is therefore the preferred abatement option for the contamination present in the site soils.

3.2.2 Saturated Zone Abatement Options

As with VOCs in the vadose zone, there are numerous technologies that are available for remediation of VOCs in groundwater. However, because of the great depth of the contaminated groundwater (almost 500 ft bgs), in situ remediation technologies such as treatment walls, enhanced biodegradation, and steam stripping are not practical for this site. Natural attenuation, however, may be an in situ treatment option for the VOCs present in the groundwater at this site. The source of the contaminants to the groundwater will be addressed by the SVE system. The existing concentrations of contaminants are very low and could be expected to decrease to

concentrations below the applicable regulatory standards through the natural processes of volatilization, diffusion, and biodegradation. For the effectiveness of a natural attenuation option to be monitored, however, an additional monitoring well would be required between the site and the Kirtland AFB drinking water production wells.

Ex-situ treatment processes for VOCs in groundwater include the installation of groundwater extraction wells and pumping the extracted groundwater to a treatment system. These treatment systems may include a combination of biological systems, air stripping, carbon adsorption, ultraviolet (UV) oxidation, and/or discharge to an existing treatment plant. The selected treatment plant would be one portion of the overall treatment system capital costs. Following treatment the treated water would need to be disposed of which will incur additional costs. The least expensive disposal option would be the discharge of the untreated groundwater to wastewater sewers for treatment at the City of Albuquerque's wastewater treatment plant. This option would require approval from the City of Albuquerque and has the disadvantages of removing water from the drinking water aquifer and requiring design and construction of an extraction system and additional sewer lines. The option would also require periodic maintenance and the collection of samples to verify that the water being discharged met the City of Albuquerque's discharge limits.

The next most cost-effective ex-situ option would be the treatment of the extracted groundwater in an air stripper and then the re-injection of the treated water into the aquifer. This option has the advantages of being a long-term and permanent abatement option that preserves the area's declining groundwater resources. It has the disadvantages of requiring periodic maintenance of the air stripper (to remove scale buildup), potentially requiring offgas treatment, and requiring a groundwater discharge permit.

The very low concentrations and limited extent of contaminants detected in the groundwater at the Bulk Fuels Facility do not warrant the cost of an active groundwater extraction and treatment system. Therefore, the proposed remedial strategy for the groundwater at the Bulk Fuels Facility is a monitored natural attenuation system. This system would include:

- Installation of an additional monitoring well (KAFB-106-2) between the site well (KAFB-106-1) and Kirtland AFB production wells 15 and 16.
- Continued quarterly monitoring of the concentrations of VOCs in the groundwater at wells KAFB-106-1, 106-2, and 341-1.
- Implementation of the vadose zone SVE abatement option to remove the source of future contaminants to the groundwater.

Natural attenuation processes such as volatilization and diffusion should allow the contaminant concentrations to drop below the EPA MCLs before the groundwater reaches the Kirtland AFB production wells. However, if contamination is detected in KAFB-106-2 or if concentrations in KAFB-106-1 or 341-1 continue to increase, then an active pump and treat system may be justified for the site and this Abatement Plan will be modified to include an evaluation of an active system.

3.3 Proposed Abatement Strategy

The proposed abatement strategy for the Bulk Fuels Facility is to install an additional groundwater monitoring well and to install SVE wells at several depths and to use these to remove VOCs from the subsurface. The concentrations of VOCs in the groundwater will be

monitored quarterly in wells KAFB-106-1, 106-2, and 341-1. The concentration of VOCs in the extracted soil gas will be monitored and the blowers will be used until the concentration in the extracted soil gas has reached an asymptotic concentration indicating that the system is no longer effective. The system will then be evaluated to determine if the SVE system should be run in a pulsed mode (turn the blowers off, allow the soil gas concentrations to build up in the subsurface, turn the blowers on until the concentration in the offgas once again reaches its asymptotic concentration) or if the blowers should be reversed to pump oxygen-containing air into the subsurface to stimulate biodegradation of the remaining hydrocarbons.

The steps for implementing this strategy include:

- Install groundwater monitoring well KAFB-106-2 and collect a sample for VOCs. Add the monitoring well to Kirtland's quarterly groundwater sampling program.

- Perform pump tests on the existing soil vapor monitoring wells at the site to determine both the zone of pressure influence within the various soil horizons as well as to predict the concentrations of VOCs that could be extracted in the SVE system. Using the predicted offgas concentrations, determine if offgas treatment will be required at the site.

- Use these data to design an extraction system that can provide a pneumatic curtain to prevent migration of contaminated vapors below the clay layer that exists at about 285 ft bgs at the site as well as to extract VOCs from this zone and the shallower zones at the site.

- Install the extraction well(s) and the blowers and any required offgas treatment. During installation, collect soil samples for biological analyses to determine if there is an existing population of microbes that could support biodegradation of the hydrocarbons if they were provided oxygen.

- Operate the system. Monitor the effluent concentrations of VOCs in the offgas. Continue to monitor the groundwater for VOCs using the two wells at the site.

- Once the concentrations of VOCs in the offgas appear to have reached an asymptote, evaluate the data and the operation of the system to determine if a pulsed mode or an air injection mode would be more efficient.

4.0 DESIGN OF PREFERRED ABATEMENT OPTION

As discussed in Section 3 of this Plan, the detailed design for the SVE system at the Bulk Fuels Facility will be completed once the initial pump tests have been performed at the site. Sections 4.1 and 4.2 will be completed and a revised Section 4.0 submitted to NMED once the initial pump tests have been completed.

4.1 Design

4.1.1 Groundwater Monitoring Well Installation

Well KAFB-106-2 will be installed approximately 600 ft north of onsite well KAFB-106-1 (Figure 4-1). This location was chosen because it should intercept any contaminated groundwater leaving the Bulk Fuels Facility before it reaches the Veterans Administration well and/or Kirtland's drinking water production well 15, which is the closest production well to the site. Because of the unconsolidated nature of the sediments in the ST-106 area, the monitoring well will be installed with an air rotary over-reaming bit technique. The well will be constructed with 4-inch-diameter, Schedule 80 polyvinyl chloride (PVC) with 25 ft of 0.010-inch slot well screen placed to cross the unconfined groundwater surface. A coarse gravel pack (10-20 Colorado silica sand) will be placed from about 2 ft below to 5 ft above the screen. Five (5) ft of hydrated granular bentonite will be placed above the gravel pack. The remainder of the well annulus will be grouted with a Quick Grout bentonite slurry with a concrete surface seal from 0 to 35 ft bgs. The well will be completed with 3 ft of stickup and a locking steel surface casing in a 4-ft-square concrete pad and surrounded by four concrete-filled bumper posts.

Well KAFB-106-2 will be developed by bailing, swabbing, and pumping approximately 1 week after construction. The well will be swabbed and bailed until sands were no longer produced and then pumped at approximately 5 gallons per minute until field parameters (temperature, conductivity, and pH) stabilize and turbidity approaches zero. Within several hours of development, one borehole volume, including sand pack, volumes of groundwater will be purged and groundwater samples will be collected through the electric submersible pump from well KAFB-106-2. Samples will be collected and analyzed for DRO, GRO, SVOCs, 2 VOCs, EDB, lead, and tetraethyllead.

4.1.2 SVE System

4.1.2.1 Soil Vapor Extraction System Pump Testing

To select appropriate permanent SVE hardware for site installation, some site-specific vapor extraction data will need to be collected prior to specifying that equipment. To accomplish this, a mobile SVE unit will be used initially to conduct an expected 3- to 5-day pilot operation. This will allow the collection of site-specific data to enable accurate sizing of the blower, estimates of offgas treatment requirements and a measurement of the radius of pressure influence and a development of the design radius that will result from extraction at varying flowrates.

Data collection during the pilot operation will include:

- Collection of vacuum measurements from each of the screened horizons in the seven existing vapor monitoring wells.

- Collection of grab vapor samples from the system offgas while the system is running.

The vacuum measurements from the monitoring wells are used to develop a relationship between flow and vacuum pressure at the wellhead. The ambient intake and flow control valve will be adjusted to create several flow conditions to assist in selecting an optimal operating vacuum condition and assist in final blower sizing selection for the final design.

Collected vapor samples will be analyzed for VOCs and EDB to allow evaluation of expected contaminant concentrations in the system effluent and provide a basis for selecting offgas treatment needs for the final system design.

4.1.2.2 Extraction System Design

This section will present the design for the SVE system at the Bulk Fuels Facility. It will be prepared after the initial pump tests have been performed at the site.

4.1.2.3 Extraction System Operation

This section will present the operation plan for the SVE system at the Bulk Fuels Facility. It will be prepared after the initial pump tests have been performed.

4.2 Site Maintenance Activities

Once the abatement activities have been completed at the Bulk Fuels Facility (i.e., operation of the SVE system has terminated because concentrations in the extracted soil gas have reached 1 percent of the initial concentrations) Kirtland AFB will continue to monitor the concentrations of COCs in the site soils and groundwater. Kirtland AFB will install deep soil borings near borings 25 and 26 to confirm that contaminant concentrations in the soils have been reduced by the treatment system. Kirtland AFB will collect quarterly groundwater samples from wells KAFB-106-1, 106-2, and 341-1. Kirtland AFB will also collect soil gas samples from the seven vapor monitoring wells that were installed during the Stage 1 investigation twice a year for 2 years. These samples will be monitored for VOCs, carbon dioxide (CO_2), and oxygen. If after 2 years the concentrations in the soil gas do not appear to be increasing, the monitoring frequency will be decreased to annual. If the concentrations do increase, then the SVE system will be turned back on and operated in a pulsed mode until concentrations of the VOCs in the soil gas appear to have stabilized again.

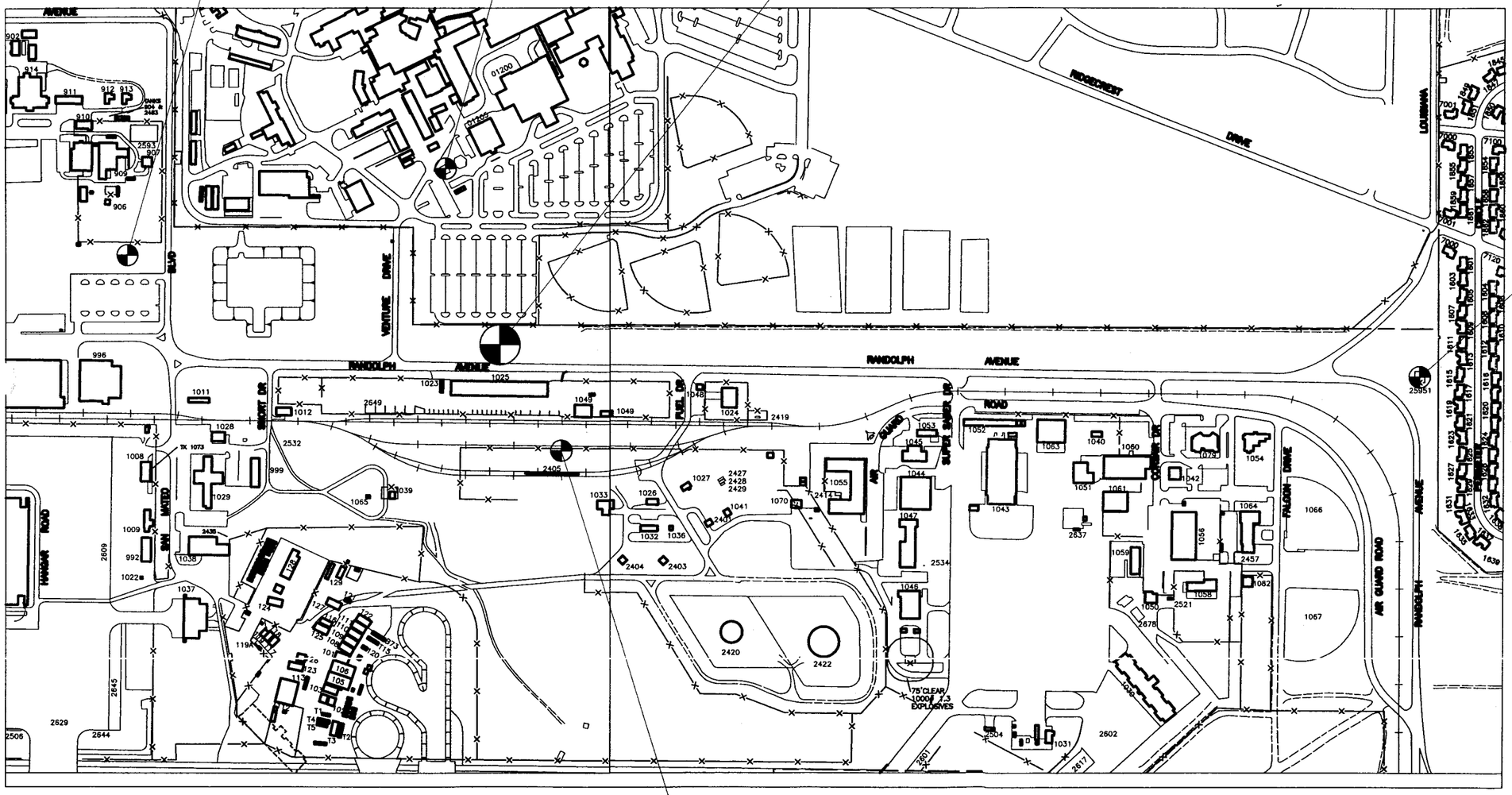
4.3 Schedule for Abatement Activities

Figure 4.2 presents the proposed schedule for the abatement activities at the Bulk Fuels Facility. These activities include site activities as well as the submission of Quarterly Progress Reports to NMED by Kirtland AFB. This schedule will be dependent on several factors, such as the availability of funding and regulatory review schedules.

KAFB-15

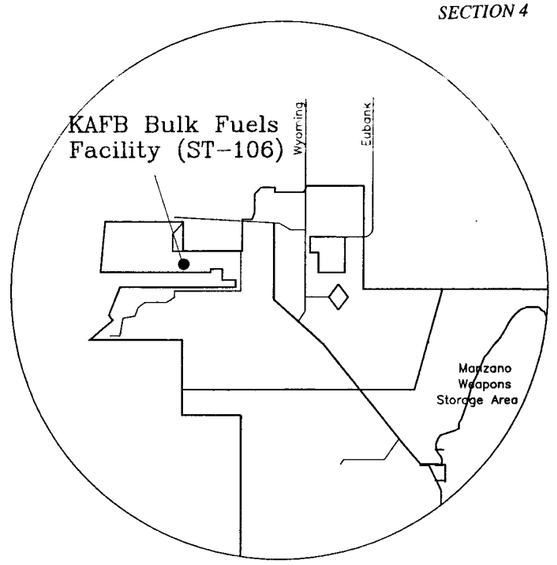
VA WELL

PROPOSED LOCATION OF KAFB 106-2



ST-106-01

KAFB-16



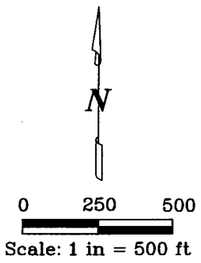
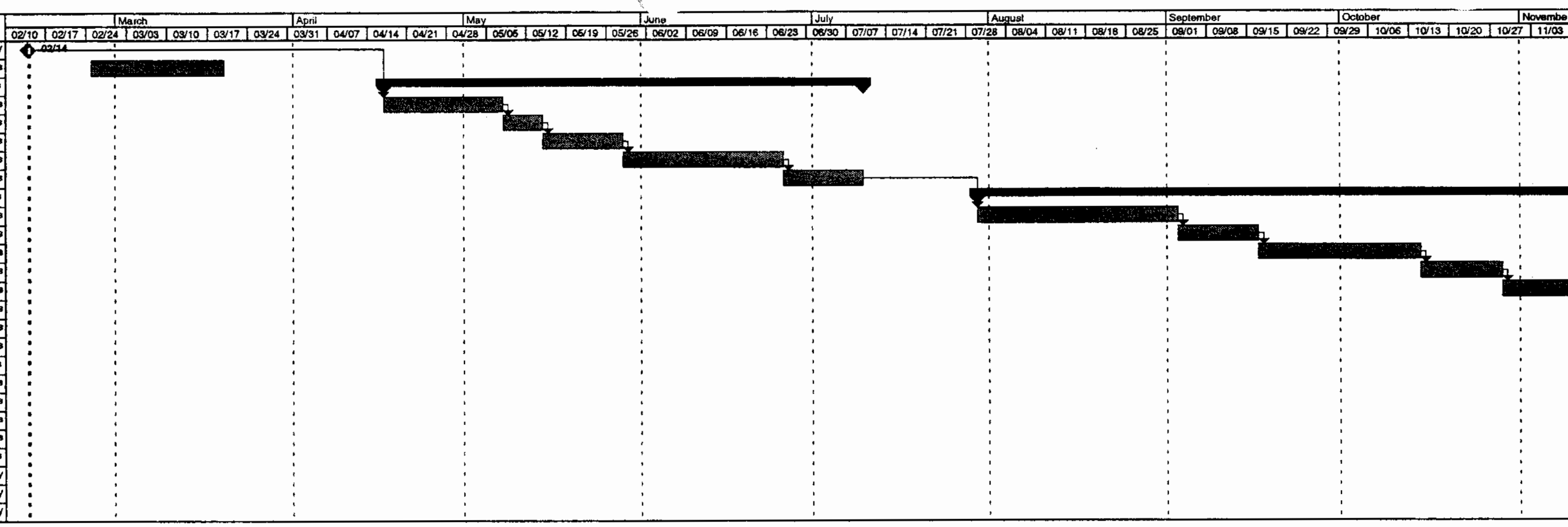


FIGURE 4-1. KAFB BULK FUELS FACILITY (ST-106) PROPOSED GROUNDWATER MONITORING WELL

ID	Task Name	Duration
1	Stage 2 Abatement Plan Submit	1 day
2	Groundwater Monitoring Well In:	17 days
3	**SVE Pilot Scale Test**	**60 days**
4	SVE Pilot Test Planning	15 days
5	SVE Pilot Test Mobilization	5 days
6	SVE Pilot Scale Testing	10 days
7	Laboratory Sample Analysi	20 days
8	Data Analysis	10 days
9	**SVE Design**	**125 days**
10	Preliminary Design	25 days
11	Review	10 days
12	60% Design	20 days
13	Review	10 days
14	90% Design	30 days
15	Review	10 days
16	Final Design	20 days
17	Contractor Procurement	30 days
18	**SVE Implementation**	**70 days**
19	Well Installation	20 days
20	Building Construction	20 days
21	Blower/Extraction System I	30 days
22	Off-Gas System Installation	20 days
23	**SVE Operation**	**43 days**
24	Sample Collection	1 day
25	Sample Collection	1 day
26	Sample Collection	1 day



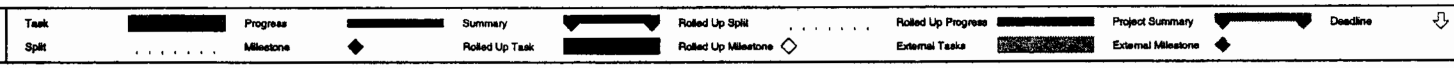


Figure 4-1. Proposed Stage 2 Abatement Plan Schedule
Kirtland AFB Bulk Fuels Facility

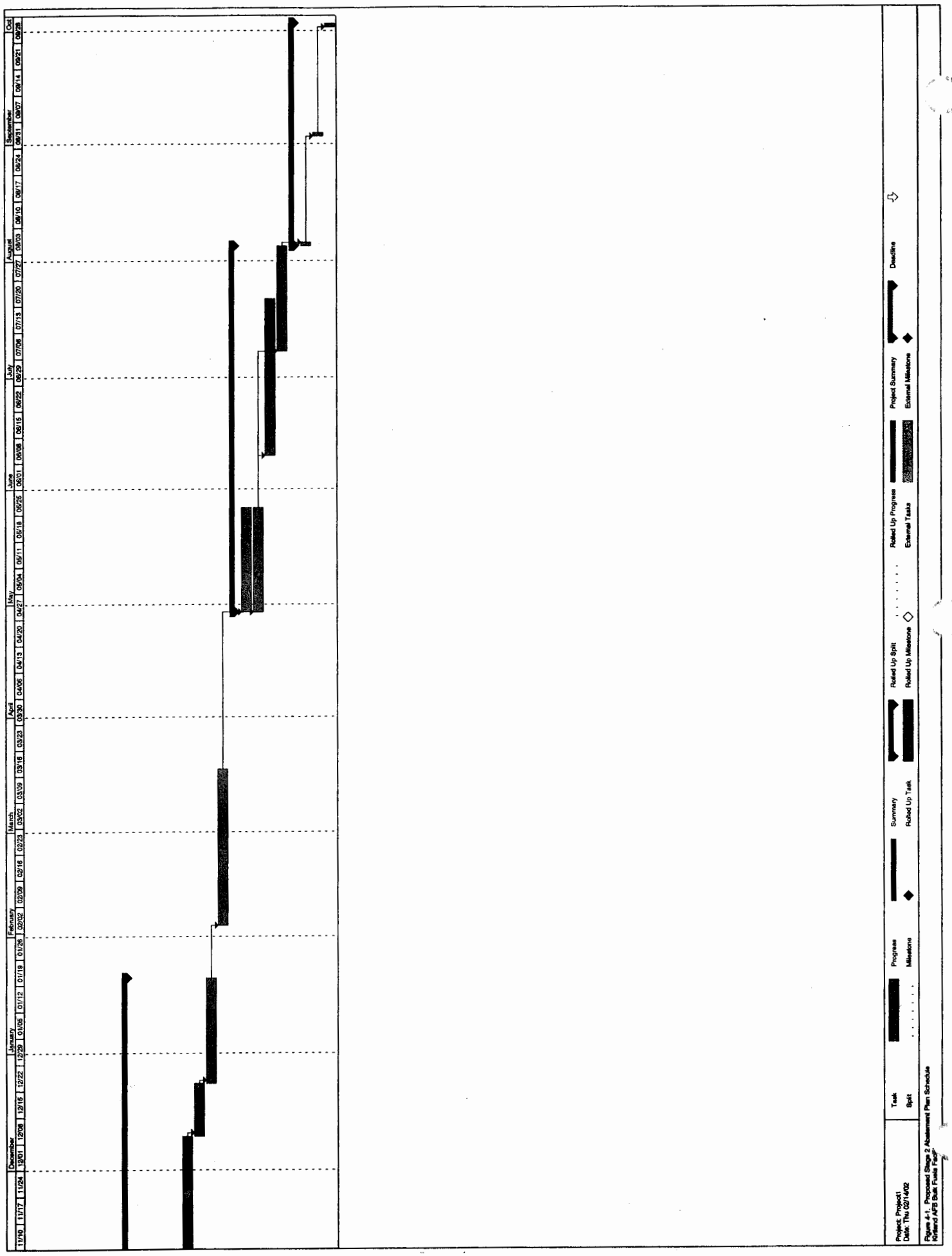


Figure 4-1. Proposed Stage 2 Abatement Plan Schedule
Kirtland AFB Bulk Fuels Facility

5.0 PUBLIC NOTIFICATION PROPOSAL

Within 30 days of filing this Stage 2 Abatement Plan, Kirtland AFB will submit a public notice (attached) that includes the following information:

- Name and address of responsible person
- Location of proposed abatement
- Brief description of the nature of pollution and the proposed abatement action
- Brief description of the procedures followed by the secretary in making a final determination
- Statement on the comment period
- Statement that a copy of the abatement plan can be viewed by the public
- Statement that written comments on the abatement plan will be accepted for consideration if sent to the secretary within 60 days after the determination of administrative completeness
- Address and phone number for further information

The public notice will be published in the *Albuquerque Journal* and will be submitted to radio station KKOB and Television Channel 41 and to any other stations recommended by the Hispano Chamber of Commerce with a request that it be aired as a public service announcement for non-English speaking persons in the Kirtland area. The public notice will also be sent to the New Mexico Trustee for Natural Resources; the Governor or President of each Indian Tribe, Pueblo, or Nation within the state of New Mexico; and residents on Kirtland AFB who reside in base housing within 1 mile of the Bulk Fuels Facility. There are no offbase residents located within 1 mile of the site.

The information presented in this Stage 2 Abatement Plan was also presented at a public meeting, the January 17, 2002, Kirtland AFB Restoration Advisory Board Meeting.

Stage 2 Abatement Plan Public Notification

Name and Address of Responsible Person

Mr. Brent Wilson, Director
377 CES/CE
2050 Wyoming Blvd SE
Kirtland AFB, NM 87117

Location of the Proposed Abatement

Bulk Fuels Facility
Randolph Ave SE
Kirtland AFB, NM 87117

Description of the Pollution and Proposed Abatement

Jet Fuel that was released from leaks in below ground piping at Kirtland Air Force Base's Bulk Fuels facility have contaminated the soils and groundwater at the site with volatile organic compounds. The compounds benzene, ethylbenzene, toluene, xylene, xylene, and naphthalene have all be detected in one or more samples from soils beneath the site in concentrations that exceed the New Mexico Environment Department's standards. The compound ethylene dibromide (a fuel additive) has been detected in the groundwater beneath the site in concentrations above the US Environmental Protection Agency's drinking water standards. The contaminants detected in the soils are located more than 30 feet beneath the site and therefore do not pose a threat to human health or the environment. However, the contaminants could continue to migrate to the groundwater 500 feet beneath the site and therefore Kirtland AFB has developed a plan to remediate the contamination. The plan includes the installation of an additional groundwater monitoring well to ensure that contaminated groundwater does not reach Kirtland's drinking water wells and the treatment of the contaminated soils using a technique called soil vapor extraction (SVE). The SVE system will be operated until it is determined by Kirtland AFB and the New Mexico Environment Department that the site soils no longer pose a threat to the drinking water.

Procedures Followed by the Secretary in Making a Final Determination for this Site

To be provided by NMED.

Comment Period

The comment period for this proposed abatement is from now until 60 days after this plan has been determined to be administratively complete.

The Stage 2 Abatement Plan for the Bulk Fuels Facility can be viewed at Kirtland AFB or the TVI Montoya Campus Library Reference Desk, 4700 Morris NE.

Written Comments on the Abatement Plan and requests for a public meeting or hearing (that include the reasons why a meeting or hearing should be held) will be accepted for consideration if sent to the secretary within sixty (60) days after the determination of administrative completeness.

For Further Information

Please contact Steve Milligan at 505-846-9003.

REFERENCES

Chevron Products Company, 2000. *Aviation Fuels Technical Review.* http://www.chevron.com/prodserv/fuels/bulletin/aviationfuel/toc.shtm. January 23, 2002 update.

Hawley, Haase, and Lozinsky, WRRI, 1994. An Underground View of the Albuquerque Basin, Proceedings of the 39th Annual New Mexico Water Conference, Las Cruces, NM. November.

USAF, 1995. *Kirtland Air Force Base-Wide Plans for the Installation Restoration Program,* Kirtland Air Force Base, Albuquerque, New Mexico. March.

USAF, 2001. *Stage 1 Abatement Plan Report for Bulk Fuels Facility (ST-106),* Kirtland Air Force Base, Albuquerque, New Mexico. May, 2001.

Water Resources Research Institute (WRRI), 1998. *Application of Nonlinear-Regression Methods to a Ground-Water Flow Model of the Albuquerque Basin, New Mexico.* Water Resources Report 98-4172.

Appendix A

Base-Wide Health and Safety Plan

CH2MHILL

CH2M HILL ADDENDUM TO THE KIRTLAND AIR FORCE BASE BASE-WIDE HEALTH AND SAFETY PLAN

Kirtland AFB Bulk Fuels Storage Facility

KIRTLAND AIR FORCE BASE, NEW MEXICO

January 2002

INTRODUCTION

This Addendum must accompany the **Kirtland Air Force Base Base-Wide Health and Safety Plan.** CH2M HILL adopts the Kirtland AFB Base-Wide Health and Safety Plan (HASP). The purpose of this Addendum is to provide site-specific health and safety plan information for activities to be performed at the Bulk Fuels Storage Facility. Where the amendment contains information different from the Base-Wide HASP, the amendment will take precedence for the specified task. The amendment includes new information or revises existing HASP information. Sections of the HASP that are not addressed in the amendments do not have changes; therefore, the HASP will be followed. All CH2M HILL employees performing tasks covered by this Addendum must read the Base-Wide HASP, and this CH2M HILL Addendum and agree to abide by their provisions (see Attachment 1).

PROJECT INFORMATION AND DESCRIPTION

Client or Owner: Kirtland AFB Restoration Group/Chris DeWitt

Project Number: 168206.FF.FI

Project Manager: Amy R. Halloran

Office: ABQ

Site Name: Kirtland AFB, Bulk Fuels Storage Facility

Site Address: Kirtland AFB, Albuquerque, New Mexico

Date Addendum Prepared: January 2002

Dates of Site Work: February 1, 2002 through December 31, 2002

DESCRIPTION OF TASKS

CH2M HILL will be installing a groundwater monitoring well using down-hole air hammer conducting soil vapor extraction pilot test activities at the Kirtland AFB Bulk Fuels Storage Facility at Kirtland Air Force Base.

The following sections of the **Kirtland Air Force Base Base-Wide Health and Safety Plan** are addended by this document. It is the responsibility of the Project Manager (PM) to forward copies of this Addendum to the field crew to be inserted into the field copies of the Base-Wide Health and Safety Plan. It is the responsibility of the Field Operations Leader (FOL) to ensure that all members of the field crew review this Addendum.

Section	2.0	Health and Safety Personnel
	3.0	Site History and Description
	4.1	Chemcical Hazards
	4.3	Physical Hazards
	5.0	Training
	6.2	Personal Protective Equipment Selection
	7.0	Monitoring
	7.2	Personal Monitoring Procedures
	7.4	Medical Surveillance
	8.0	Safe Considerations for Site Operations
	10.0	Emergency Response Plan

2.0 HEALTH AND SAFETY PERSONNEL

Section 2.0 is addended by adding the following discussion on personnel assignments for activities to be performed at the Bulk Fuels Storage Facility.

The following CH2M HILL personnel assignments apply to site activities covered under this Addendum. Refer to Section 2 of the Kirtland AFB Base-Wide Health and Safety Plan for the specific roles and responsibilities of project personnel.

Project Manager (PM) Amy R. Halloran	Phone: 505/884-5600 ext. 236 Mobile: 505/239-9671
Field Operations Leader (FOL)/Site Health and Safety Officer (SHSO) Sharon L. Minchak	Phone: 505/884-5600 ext. 240
Project Health and Safety Manager (PHSM) Rick Cavil / Las Vegas NV	Phone: 702/369-6175 Mobile: 408/896-0140
Alternate FOL/SHSO William LeFevre	Phone: 505/884-5600 ext. 237 Mobile: 505/239-1519

CH2M HILL Subcontractors (Reference CH2M HILL SOP HS-55, *Subcontractor, Contractor, and Owner*)

DRILLING
Subcontractor: Water Development Corp.
Subcontractor Contact: Brian Nydowski
Telephone: 800/914-7506

SOIL VAPOR EXTRACTION PILOT TEST
Subcontractor: TBD
Subcontractor Contact: TBD
Telephone: TBD

The subcontractors listed above are covered by this HSP and must be provided a copy of this plan. However, this plan does not address hazards associated with the tasks and equipment that the subcontractor has expertise in (e.g., drilling, excavation work, electrical). Subcontractors are responsible for the health and safety procedures specific to their work, and are required to submit these procedures to CH2M HILL for review before the start of field work. Subcontractors must comply with the established health and safety plan(s). The CH2M HILL SSC should verify that subcontractor employee training, medical clearance, and fit test records are current and must monitor and enforce compliance with the established plan(s). CH2M HILL's oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established plan(s).

CH2M HILL should continuously endeavor to observe subcontractors' safety performance. This endeavor should be reasonable, and include observing for hazards or unsafe practices that are both readily observable and occur in common work areas. CH2M HILL is not responsible for exhaustive observation for hazards and unsafe practices. In addition to this level of observation, the SSC is responsible for confirming CH2M HILL subcontractor performance against the subcontractor's safety plan.

Health and safety related communications with CH2M HILL subcontractors should be conducted as follows:

- Brief subcontractors on the provisions of this plan, and require them to sign the Employee Signoff Form included in Attachment 1.
- Request subcontractor(s) to brief the project team on the hazards and precautions related to their work.
- When apparent non-compliance/unsafe conditions or practices are observed, notify the subcontractor safety representative and require corrective action – the subcontractor is responsible for determining and implementing necessary controls and corrective actions.
- When repeat non-compliance/unsafe conditions are observed, notify the subcontractor safety representative and stop affected work until adequate corrective measures are implemented.

- When an apparent imminent danger exists, immediately remove all affected CH2M HILL employees and subcontractors, notify subcontractor safety representative, and stop affected work until adequate corrective measures are implemented. Notify the Project Manager and HSM as appropriate.
- Document all oral health and safety related communications in project field logbook, daily reports, or other records.

3.0 SITE HISTORY AND DESCRIPTION

Section 3.0 is addended by adding the following description of Bulk Fuels Storage Facility.

Bulk Fuels Storage Facility

This Kirtland AFB Bulk Fuels Facility is located in the western part of Kirtland AFB. The site contains bulk storage for jet fuel (JP8), diesel fuel, and unleaded gasoline. Jet fuel is stored in two aboveground storage tanks (2.1 and 4.2 million gallons), diesel fuel is stored in two aboveground storage tanks (5,000 and 10,000 gallons), and unleaded gasoline is stored in one 10,000 gallon aboveground storage tank. The site has one JP8 off-loading rack (Building 2405) that has an annual throughput of approximately 20 to 25 million gallons of product. A second smaller off-loading rack location is used for the delivery of diesel and unleaded gasoline fuels. This rack is smaller and has a considerably smaller product throughput.

The fuel delivered to the JP8 off-loading rack (Building 2405) is conveyed to a pump house (Building 1033) via two 14-inch-diameter belowground transfer lines. The fuel is then pumped to the aboveground JP8 storage tanks by piping of varying sizes that is partially above and belowground.

The primary contaminant of concern at the site is jet fuel range (JP8 and JP4) fuels, diesel range organics (DRO) and gasoline range organics (GRO) petroleum hydrocarbons in the soils. Groundwater contamination (benzene, toluene, and ethylene-dibromide) has also been detected. Known discharges of JP8 fuel occurred in November 1999 during integrity testing of the 14-inch diameter belowground transfer lines. The observed November releases were immediately remediated but it is unknown how long the pipelines had been in a state of failure.

4.1 CHEMICAL HAZARDS

Section 4.1 is addended by adding the specific chemical hazard issues associated with the Bulk Fuels Storage Facility as addressed in Table 4-2 "Potential Contaminants of Concern"..

4.3 PHYSICAL HAZARDS

Section 4.3 is addended by adding the specific physical hazard issues associated with the Bulk Fuels Storage Facility as addressed in Table 4-6 "General Physical (Safety) Hazards and Controls".

TABLE 4-2 POTENTIAL CONTAMINANTS OF CONCERN (REFER TO PROJECT FILES FOR MORE-DETAILED CONTAMINANT INFORMATION)

Contaminant	Location and Highest[a] Concentration	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)
Benzene	630 mg/kg in SB-26 @ 270 ft bgs	0.1 ppm	500 ppm Ca	Irritation to eyes, skin, nose and respiratory system; giddiness, headache, nausea, staggered gait, fatigue, anorexia, lassitude,dermatitis; bone marrow depression	9.24
Naphthalene	120 mg/kg in SB-25 @ 105 ft bgs	10 ppm	250 ppm	Eye irritation, headache, confusion, excitement, nausea, , bladder irritation, profuse sweating, dermatitis, corneal damage, optical neuritis	8.12
Toluene	3,600 mg/kg in SB-26 @ 270 ft bgs	50 ppm	500 ppm	Eye and nose irritation, fatigue, weakness, confusion, dizziness, headache, dilated pupils, excessive tearing, nervousness, muscle fatigue, paresthesia, dermatitis, liver and kidney damage	8.82
Ethylene dibromide	0.21 mg/kg in GW at KAFB –106-1	20 ppm 8-hr PEL	2A Potential Human Carcinogen	Eye, skin, and mucous membrane irritation, vomiting, abdominal pain, dermatitis	9.45
Ethyl Benzene	930 mg/kg in SB-26 @ 270 ft bgs	100 ppm	800 ppm	Eye, skin, and mucous membrane irritation; headache; dermatitis; narcotic; coma	8.76
Xylenes	2,540 mg/kg in SB-26 @ 270 ft bgs	100 ppm	900 ppm	Irritated eyes, skin, nose, throat; dizziness; excitement; drowsiness; incoherence; staggering gait; corneal vacuolization; anorexia; nausea; vomiting; abdominal pain; dermatitis	8.56
Total Petroleum Hydrocarbons (JP-4 & JP-8)	114,000 mg/kg in SB-26 @ 270 ft bgs	NL	NL	Irritation to eyes, skin, and nose; dermatitis; headache; nausea	UK

Footnotes:

a: Specify sample-designation and media: SB (Soil Boring), A (Air), D (Drums), GW (Groundwater), L (Lagoon), TK (Tank), SS (Surface Soil), SL (Sludge), SW (Surface Water),

b: Appropriate value of PEL, REL, or TLV listed

c: IDLH = immediately dangerous to life and health (units are the same as specified "Exposure Limit" units for that contaminant); NL = No limit found in reference materials; Ca = Potential occupational carcinogen

d: PIP = photoionization potential; NA = Not applicable; UK = Unknown,.

Table 4-2 continued. POTENTIAL ROUTES OF EXPOSURE

DERMAL: Contact with contaminated media. This route of exposure is minimized through proper use of PPE, as specified in Section 5.	**INHALATION:** Vapors and contaminated particulates. This route of exposure is minimized through proper respiratory protection and monitoring, as specified in sections 5 and 6, respectively.	**OTHER:** Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before eating, drinking, or smoking).

TABLE 4-6 GENERAL PHYSICAL (SAFETY) HAZARDS AND CONTROLS

Engineering and administrative controls are to be implemented by the party in control of the site or the hazard (i.e., CH2M HILL, subcontractor, or contractor). CH2M HILL employees and subcontractors must, at a minimum, remain aware of hazards affecting them regardless of who is responsible for controlling the hazards. Specialty subcontractors are responsible for the safe operation of their equipment (e.g., drill rig, heavy equipment). CH2M HILL employees are not to operate, or assist in the operation of, any subcontractor or contractor equipment.

Hazard (Refer to SOP, or HSP Section)	Engineering Controls, Administrative Controls, and Work Practices	Air Rotary Drilling and Soil Sampling	Groundwater Sampling
Flying debris/objects (HS-07)	Provide shielding and PPE; maintain distance.	X	
Noise > 85 Db(A)	Noise protection and monitoring required.	X	
Gas cylinders (HS-21)	Instruct employees in the safe use of compressed gases. Make certain gas cylinders are properly anchored and chained. Keep cylinders away from ignition sources. Cap cylinders when not in use.	X	
Electrical	• Make certain third wire is properly grounded. Do not tamper with electrical wiring unless qualified to do so. Ground as appropriate. • Project field sites should have ground fault circuit interrupters (GFCIs) installed for all wiring, including extension cords. • Heavy equipment (e.g., drill rig) should remain at least 15 feet from overhead power line for power lines of 50 kV or less. For each 10 kV > 50, increase distance by ½ foot. • Operate and maintain equipment according to manufacturer's instructions. • Use only extension cords that are three-wire grounded. Cords passing through work areas must be covered or elevated to protect from damage. • Use only electrical tools and equipment that are either effectively grounded or double-insulated UL approved. • Properly label switches, fuses, and circuit breakers. • Remove cord from an outlet by grasping the plug, not pulling the cord. • Protect all electrical equipment, tools, switches, etc., from elements. • Avoid physical contact with power circuit. • Only qualified electricians are to install and work on electrical circuits and equipment.	X	X
Suspended loads	Work not permitted under suspended loads.	X	
Buried utilities, drums, tanks, etc. (Section 3.3)	Locate buried utilities, drums, tanks, etc., before digging or drilling and mark location.	X	
Slip, trip, fall hazards (e.g., wet/muddy surface, inadequate railing, unstable surface)	Provide slip-resistant surfaces, ropes, and/or other devices to be used. Brace and shore equipment	X	X
Back injury (HS-29)	Use proper lifting techniques, or provide mechanical lifting aids.	X	
Protruding objects	Flag visible objects.	X	X
Visible lightning	Stop work.	X	X
Vehicle traffic (HS-24)	Provide temporary traffic controls, including trained flaggers and lookouts. Implement traffic control program when required.	X	X
Stairways, ladders, and scaffolds (HS-25)	Stairways and ladders are generally required when there is a break in elevation of 19 inches or more. Keep access ways clear. Equipment must meet OSHA specifications. Document employee training.	X	
Fire prevention and control (HS-22)	• No spark sources are allowed within exclusion or decontamination zones. • Appropriate firefighting equipment must be available on the site. • Extinguishers are to be inspected visually every month and undergo an annual maintenance check. • Post "Exit" signs over exiting doors, and post "Fire Extinguisher" signs over extinguisher locations. Keep areas near exits and extinguishers clear. Open flames are prohibited in the vicinity of flammable materials. • Combustible materials stored outside should be at least 10 feet from the building. • Unnecessary combustible materials and flammable or combustible liquids must not be allowed to accumulate. • Flammable or combustible liquids must be kept in approved containers, and must be stored in an approved storage cabinet.	X	X
Inadequate illumination	Site work will be performed during daylight hours whenever possible. Work conducted during hours of darkness will require enough illumination intensity "to read a newspaper without difficulty."	X	X
Entanglement in rotating equipment	• Prohibit loose clothing and hair • Prohibit wearing jewelry	X	X

TABLE 4-6 GENERAL PHYSICAL (SAFETY) HAZARDS AND CONTROLS

Engineering and administrative controls are to be implemented by the party in control of the site or the hazard (i.e., CH2M HILL, subcontractor, or contractor). CH2M HILL employees and subcontractors must, at a minimum, remain aware of hazards affecting them regardless of who is responsible for controlling the hazards. Specialty subcontractors are responsible for the safe operation of their equipment (e.g., drill rig, heavy equipment). CH2M HILL employees are not to operate, or assist in the operation of, any subcontractor or contractor equipment.

Hazard (Refer to SOP, or HSP Section)	Engineering Controls, Administrative Controls, and Work Practices	Air Rotary Drilling and Soil Sampling	Groundwater Sampling
Drilling	• The drill rig is not to be operated in inclement weather. • The driller is to verify that the rig is properly leveled and stabilized before raising the mast. • Personnel should be cleared from the sides and rear of the rig before the mast is raised. • The driller is not to drive the rig with the mast in the raised position. • The driller must check for overhead power lines before raising the mast. A minimum distance of 15 feet between mast and overhead lines (<50 kV) is recommended. Increased separation may be required for lines greater than 50 kV. • Personnel should stand clear before rig startup. • The driller is to verify that the rig is in neutral when the operator is not at the controls. • Become familiar with the hazards associated with the drilling method used (cable tool, air rotary, hollow-stem auger, etc.). • Do not wear loose-fitting clothing, watches, etc., that could get caught in moving parts. • Do not smoke or permit other spark-producing equipment around the drill rig. • The drill rig must be equipped with a kill wire or switch, and personnel are to be informed of its location. • Be aware and stand clear of heavy objects that are hoisted overhead. • The driller is to verify that the rig is properly maintained in accordance with the drilling company's maintenance program. • The driller is to verify that all machine guards are in place while the rig is in operation. • The driller is responsible for housekeeping (maintaining a clean work area). • The drill rig should be equipped with at least one fire extinguisher. • If the drill rig comes into contact with electrical wires and becomes electrically energized, do not touch any part of the rig or any person in contact with the rig, and stay as far away as possible. Notify emergency personnel immediately.	X	
Heavy equipment	• Become familiar with hazards specific to the equipment being used. • Always confirm that the operator is aware of your location, particularly when you approach or pass by equipment. • Backup alarm is required for heavy equipment. Do not count on backup alarms always functioning. Look around when alarm sounds. • Do not ride equipment not designed for passengers. • Do not climb on operating equipment. • Do not place yourself between fixed and moving parts or objects. • Do not stand adjacent to the equipment. • Stay clear of equipment on cross slopes and unstable terrain. • Stay clear of pile-driving operations. • Stay outside the turning radius of the equipment. • Operators using all-terrain vehicles (ATV) must be trained; other ATV requirements may apply. • Observer must remain in contact with operator and signal safe backup. • Personnel must remain outside the turning radius.	X	

5.0 TRAINING

Section 5.0 is addended by adding the following CH2M HILL personnel information associated with the Bulk Fuels Storage Facility.

CH2M HILL EMPLOYEE MEDICAL SURVEILLANCE AND TRAINING

(Reference CH2M HILL SOP HS-01, Medical Surveillance, and HS-02, Health and Safety Training)

The employees listed below are enrolled in the CH2M HILL Comprehensive Health and Safety Program and meet state and federal hazardous waste operations requirements for 40-hour initial training, 3-day on-the-job experience, and 8-hour annual refresher training. Employees designated "SSHO" have received 8 hours of supervisor and instrument training and can serve as site safety and health officer (SSHO) for the level of protection indicated. An SSHO with a level designation (D, C, B) equal to or greater than the level of protection being used must be present during all tasks performed in exclusion or decontamination zones that involve the potential for exposure to health and safety hazards. Employees designated "FA-CPR" are currently certified by the American Red Cross, or equivalent, in first aid and CPR. At least one FA-CPR designated employee must be present during all tasks performed in exclusion or decontamination zones that involve the potential for exposure to health and safety hazards. The employees listed below are currently active in a medical surveillance program that meets state and federal regulatory requirements for hazardous waste operations. Certain tasks (e.g., confined-space entry) and contaminants (e.g., lead) may require additional training and medical monitoring.

Pregnant employees are to be informed of and are to follow the procedures in CH2M HILL's SOP HS-04, *Reproduction Protection*, including obtaining a physician's statement of the employee's ability to perform hazardous activities, before being assigned fieldwork.

Employee Name	Office	Responsibility	SSHO/FA-CPR
Amy R. Halloran	ABQ	Project Manager	SSHO; FA-CPR
Sharon L. Minchak	ABQ	Task Manager, FOL/SSHO	SSHO; FA-CPR
Rick Cavil	LAS	Project Health and Safety Manager	SSHO; FA-CPR
Celina Salazar	ABQ	Alternate FOL/SSHO, Field Team Member	SSHO; FA-CPR
Bill LeFevre	ABQ	Alternate FOL/SSHO, Field Team Member	SSHO; FA-CPR
Greg Gates	ABQ	Alternate FOL/SSHO, Field Team Member	SSHO; FA-CPR
Duncan Boss-Walker	ABQ	Field Team Member	FA-CPR

6.2 PERSONAL PROTECTIVE EQUIPMENT SELECTION

Section 6.2 is addended by adding the following personal protective equipment (PPE) specifications associated with the Bulk Fuels Storage Facility for CH2M HILL personnel.

PPE SPECIFICATIONS[a]

Task	Level	Body	Head	Respirator[b]
• Drilling • Soil sampling • Groundwater sampling • SVE Pilot Testing	Modified D	**COVERALLS:** Cotton; or uncoated Tyvek® if cotton cannot be kept clean. **BOOTS:** Steel-toe, steel-shank chemical-resistant boots OR steel-toe, steel-shank leather work boots. **GLOVES:** Inner surgical-style nitrile glove AND outer chemical-resistant nitrile glove.	Hardhat[c] Splash shield[c] Safety glasses Ear protection[d]	None required
For all activities when Action Levels in Section 7 are exceeded.	C	**COVERALLS:** Polycoated Tyvek® **BOOTS:** Steel-toe, chemical-resistant boots OR steel-toe, leather work boots with outer rubber boot covers **GLOVES:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat[c] Splash shield[c] Ear protection[d] Spectacle inserts	APR, full face, Advantage 1000 or equivalent; with GME-H cartridges or equivalent[e].

[a] Modifications are as indicated. CH2M HILL will provide PPE to only CH2M HILL employees.
[b] No facial hair that would interfere with respirator fit is permitted.
[c] Hardhat and splash-shield areas are to determined by the SSHO.
[d] Ear protection should be worn while working around drill rigs or other noise-producing equipment or when conversations cannot be held at distances of 3 feet or less without shouting. Refer to Section 6 for other requirements.
[e] Cartridge change-out schedule is at least every 8 hours (or one work day), except if relative humidity is > 85%, or if organic vapor measurements are > midpoint of Level C range (refer to Section 5)--then at least every 4 hours. If encountered conditions are different than those anticipated in this HSP, contact the HSM.

REASONS FOR UPGRADING OR DOWNGRADING LEVEL OF PROTECTION

Upgrade *	Downgrade
• Request from individual performing task. • Change in work task that will increase contact or potential contact with hazardous materials. • Occurrence or likely occurrence of gas or vapor emission. • Known or suspected presence of dermal hazards. • Instrument action levels (Section 6) exceeded.	• New information indicating that situation is less hazardous than originally thought. • Change in site conditions that decreases the hazard. • Change in work task that will reduce contact with hazardous materials.

* Performing a task that requires an upgrade to a higher level of protection (e.g., level D to level C) is permitted only when the PPE requirements have been specified in Section 5 and an SSHO who meets the requirements specified in subsection 4.1 is present.

7.0 MONITORING

Section 7.0 is addended by adding Table 7-1 "Air Monitoring Specifications" and Table 7-2 "Calibration Specifications" associated with the Bulk Fuels Storage Facility.

TABLE 7-1 AIR MONITORING SPECIFICATIONS (Reference CH2M HILL SOP HS-06, Air Monitoring)

Instrument	Tasks	Action Levels[a]	Frequency[b]	Calibration
PID: OVM, MiniRAE, or MultiRAE with 10.0 eV lamp or greater	• Drilling • Sub-surface soil sampling • Groundwater sampling • SVE Pilot Testing	<1 ppm → Level D ≥1 ppm → Collect colormetric tubes, if Benzene **IS NOT** detected, then: 1-10 ppm → Level D 10-50 ppm → Level C >50 ppm → Stop work; Notify HSM If Benzene **IS** detected, then: Stop work; reevaluate; Notify HSM	Initially and continuously during task; record every 30-60 minutes	Daily
Colormetric tubes: Benzene specific	All tasks when PID action levels are exceeded	No Color Change → See PID Color Change → See PID	Initially and periodically when PID ≥1 ppm	N/A
O_2 Meter: MSA model 260 or 261 or equivalent	All Invasive Tasks	>25.0%[c] O_2: Explosion hazard; evacuate or vent 20.9%[c] O_2: Normal O_2 <19.5%[c] O_2: O_2 deficient; vent or use SCBA	Continuous during advancement of boring; record every 30-60 minutes	Daily
CGI: MSA model 260 or 261 or equivalent	All Invasive Tasks	0-10%[c] LEL: No explosion hazard 10-25%[c] LEL: Potential explosion hazard >25%[c] LEL: Explosion hazard; evacuate or vent	Continuous during advancement of boring; record every 30-60 minutes	Daily
Dust Monitor: Visual assessment	All tasks	No visible dust → Level D Visible dust → Implement control measures	Initially and continuously during task	NA

Note a: Action levels apply to sustained breathing-zone measurements above background for 5 minutes.

Note b: The exact frequency of monitoring depends on field conditions and is to be determined by the SSC; generally, every 5 to 15 minutes is acceptable; more frequently may be appropriate. Monitoring results should be recorded. Documentation should include instrument and calibration information, time and measurement result, personnel monitored, and place/location where measurement is taken (e.g., "Breathing Zone/MW-3," "at surface/SB-2," etc.).

Note c: If the measured percent of O_2 is less than 10, an accurate LEL reading will not be obtained. Percent LEL and percent O_2 action levels apply to only ambient working atmospheres, and do not apply to confined-space entry. More-stringent percent LEL and O_2 action levels are required for confined-space entry; refer to Section 9.

Table 7.2 CALIBRATION SPECIFICATIONS
(Refer to the respective manufacturer's instructions for proper instrument-maintenance procedures)

Instrument	Gas	Span	Reading	Method
PID: OVM, 10.0eV bulb	100 ppm isobutylene	RF = 0.68	68 ppm	1.5 lpm reg T-tubing
PID: MiniRAE, 10.6 eV bulb	100 ppm isobutylene	CF=53	53 ppm ±5 ppm	1.5 lpm REG T-Tubing
PID: MultiRAE 10.6 eV bulb		Per Manufacturer's Specification		
CGI: MSA 260, 261, 360, or 361	0.75% pentane	N/A	50% LEL ± 5 % LEL	1.5 lpm reg direct tubing
O_2 Meter: MSA 260 or 261		Per Manufacturer's Specification		
Colometric tubes: Benzene specific		Per Manufacturer's Specification		

8.0 SAFETY CONSIDERATIONS FOR SITE OPERATIONS

Section 8.0 is addended by adding the "Jobsite Safety Inspection Checklist" associated with the Bulk Fuels Storage Facility. The checklist in located in Attachment 2 of this addendum, and is to be completed by the SSHO for activities specific to CH2M HILL personnel.

10.0 EMERGENCY RESPONSE PLAN

Section 10.0 is addended by adding the following CH2M HILL emergency procedures information associated with Bulk Fuels Storage Facility.

Additionally, the following emergency medical procedures apply to CH2M HILL personnel:

- The SSHO will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.
- Prevent further injury.
- Initiate first aid and CPR where feasible[1].
- Get medical attention immediately.
- Perform decontamination where feasible; lifesaving and first aid or medical treatment take priority.
- Notify the Field Team Leader and the Project Manager of the injury.
- Make certain that the injured person is accompanied to the emergency room.
- Notify the Health and Safety Manager.

- Notify the injured person's Human Resources Department within 24 hours.
- Prepare an incident report -- refer to CH2M HILL SOP 12, *Emergency Response and First Aid*, and Section 6 of *Site Safety Notebook*. Submit the report to the Corporate Director of Health and Safety and the Corporate Human Resources Department (COR) within 48 hours.
- When contacting the medical consultant, state that you are calling about a CH2M HILL matter, and give your name, your telephone number, the name of the injured person, the extent of the injury or exposure, and the name and location of the medical facility where the injured person was taken.

Note 1: Exposure to bloodborne pathogens may occur when rendering first aid or CPR. Training is required before a task involving potential exposure is performed. Exposure controls and personal protective equipment (PPE) are required as specified in CH2M HILL SOP HS-36, *Bloodborne Pathogens*. Hepatitis B vaccination must be offered before the person participates in a task where exposure is a possibility.

CH2M HILL EMERGENCY CONTACTS

If an injury occurs, notify the injured person's personnel office as soon as possible after obtaining medical attention for the injured person. Notification **MUST** be made within 24 hours of the injury.

CH2M HILL Medical Consultant

Peter P. Greaney, M.D.
WorkCare, Inc.
333 S. Anita Drive
Orange, CA 92868
800/455-6155
6 a.m. to 6 p.m.
(After-hours calls will be returned within 20 minutes.)

Occupational Physician (Regional or Local)

Occupational Health Center
801 Encino Pl. NE Suite E-12
Albuquerque, NM 87110

505/842-5151

Corporate Director Health and Safety

Name: Mollie Netherland/SEA
Phone: 425/453-5000

Site Safety and Health Officer (SSHO)

Name: Sharon Minchak/ABQ
Phone: 505/884-5600 ext. 240

Medical and Training Administrator

Name: Petra Scotti/SEA
Phone: 425/453-5005 ext. 5073

Regional Manager

Name: Phil Hall/SFO
Phone: 510/251-2888 ext. 2000

Health and Safety Manager (HSM)

Name: Trish Danby/SAC
Phone: 425/453-5000 x 287

Project Manager

Name: Amy R. Halloran/ABQ
Phone: 505/884-5600 ext. 236

Radiation Health Manager (RHM)

Name: David McCormack/SEA
Phone: 206/453-5005 ext. 5417

Regional Human Resources Department

Name: Holly Meyer/DEN
Phone: 303/771-0900 ext. 5264

Client

Name: Chris DeWitt/KAFB Environ. Restoration
Phone: 505/846-0053

Corporate Human Resources Department

Name: Julie Zimmerman/COR
Phone: 303/771-0900 ext. 2375

Federal Express Dangerous Goods Shipping
Phone: 800/238-5355

CH2M HILL Emergency Number for Shipping Dangerous Goods
Phone: 800/255-3924

Worker's Compensation and Auto Claims

Sterling Administration Services
Phone: 800/420-8926
After hours phone: 800/497-4566

Report fatalities AND report vehicular accidents involving pedestrians, motorcycles, or more than two cars.

Have emergency medical services for occupational injuries billed to Sterling Administration Services

APPROVAL

This Health and Safety Plan Addendum has been written for use by CH2M HILL only. CH2M HILL claims no responsibility for its use by others unless specified and defined in project or contract documents. The plan is written for the specific site conditions, purposes, dates, and personnel specified and must be amended if those conditions change.

Addendum Written By: William LeFevre/ABQ **Date:** October 2000

Addendum Approved By: **Date: October 6, 2000**

DISTRIBUTION

Name	Office	Responsibility	Number of Copies
John Culley	SCO	Health and Safety Manager/Approver	1
Amy R. Halloran	ABQ	Project Manager	1
Sharon L. Minchak	ABQ	Task Manager, FOL, SSHO	1
Celina Salazar	ABQ	Field Team Member, Alternate FOL/SHSO	1
Bill LeFevre	ABQ	Field Team Member, Alternate FOL/SHSO	1
Greg Gates	ABQ	Field Team Member, Alternate FOL/SHSO	1
Duncan Boss-Walker	ABQ	Field Team Member	1

ATTACHMENTS

Attachment 1: Employee signoff

Attachment 2: Jobsite Safety Inspection Checklist

Attachment 3: Material Safety Data Sheets

Attachment 1
Employee Signoff

EMPLOYEE SIGNOFF

The employees listed below have been given a copy of this health and safety plan, have read and understood it, and agree to abide by its provisions.

EMPLOYEE NAME	EMPLOYEE SIGNATURE/DATE

Attachment 2
Jobsite Safety Inspection Checklist

CH2MHILL

CH2MHILL ***JOBSITE SAFETY INSPECTION CHECKLIST*** Revision.: 03

STANDARD OF PRACTICE HS-18 - HEALTH AND SAFETY CHECKLIST Date: 05/01/96

Note: The following jobsite safety inspection checklist is to be used only at locations where CH2M HILL controls the work. It is not to be used at locations where others control the work.

Project Name: _____ Project No.: _____

Location: _____ Project Manager: _____

Inspector: _____ Date: _____

This checklist has been divided into two sections. The first section (I through XXVI) are applicable to all projects. The second section (XXVII through XXIX) addresses specific situations such as hazardous waste, construction activities, and office trailers. There may be some duplication between the first and second sections.

If an item is not applicable, the column titled "N/A" should be checked. If an item is applicable but the auditor does not observe it during the inspection, the "N/O" column should be checked. For each deficiency noted, a Health and Safety Audit Finding Form must be completed. The Corporate Health and Safety Director must be copied on the results of all audits.

Check "Yes" for Items Completed	**Yes**	**No**	**N/A**	**N/O**

I. HAZARDOUS WASTE

Certification and Training of CH2M HILL Personnel

1.	Medical exam within last 12 months	☐	☐	☐	☐
2.	40-hour initial training, 3 days supervised field activities, 8-hour annual refresher	☐	☐	☐	☐
3.	First aid and CPR certification	☐	☐	☐	☐
4.	Quantitatively fit tested (preferred method per NIOSH Publication 87-116, Appendix B.3)	☐	☐	☐	☐
5.	Attend pre-entry safety meeting	☐	☐	☐	☐
6.	Site Safety Coordinator with appropriate training	☐	☐	☐	☐

Certification and Training of Subcontractor Personnel

1.	Medical exam within last 12 months	☐	☐	☐	☐
2.	40-hour initial training, 3 days supervised field activities, 8-hour annual refresher	☐	☐	☐	☐
3.	First aid and CPR certification	☐	☐	☐	☐
4.	Quantitatively fit tested (preferred method per NIOSH Publication 87-116,	☐	☐	☐	☐

Check "Yes" for Items Completed	**Yes**	**No**	**N/A**	**N/O**
(Appendix B.3)				
5. Attend pre-entry safety meeting	☐	☐	☐	☐
Site Safety Documentation				
1. Site safety plan (SSP) prepared and approved	☐	☐	☐	☐
2. SSP onsite	☐	☐	☐	☐
3. All personnel onsite identified in SSP	☐	☐	☐	☐
4. Documentation of safety briefing	☐	☐	☐	☐
5. Hospital map posted	☐	☐	☐	☐
6. Phone numbers posted	☐	☐	☐	☐
7. Emergency vehicle identified	☐	☐	☐	☐
8. Material Safety Data Sheets (MSDSs) onsite	☐	☐	☐	☐
9. Work zones delineated (How? _____)	☐	☐	☐	☐
10. Wind direction flags in use	☐	☐	☐	☐
11. Documentation of calibration of monitoring equipment in clean environment	☐	☐	☐	☐
12. Monitoring conducted and recorded as specified in SSP (Frequency? _____)	☐	☐	☐	☐
13. Monitoring for heat/cold stress	☐	☐	☐	☐
14. Buddy system in use	☐	☐	☐	☐
15. Decontamination procedures established as specified in SSP	☐	☐	☐	☐
16. No eating, drinking, or smoking in exclusion and contamination reduction zones	☐	☐	☐	☐
17. Toilet facilities provided	☐	☐	☐	☐
18. No contact lenses	☐	☐	☐	☐
19. Work conducted during daylight hours only Emergency equipment available as specified in SSP (What?) _____	☐	☐	☐	☐

CH2M HILL JOBSITE SAFETY INSPECTION CHECKLIST

Revision.:

STANDARD OF PRACTICE HS-18 - HEALTH AND SAFETY CHECKLIST

Date:

Check "Yes" for Items Completed	**Yes**	**No**	**N/A**	**N/O**
Safety Briefing				
1. All personnel attended (including new personnel)	☐	☐	☐	☐
2. Documentation of meetings	☐	☐	☐	☐
3. Chemical hazards and toxicology reviewed	☐	☐	☐	☐
4. Physical hazards reviewed	☐	☐	☐	☐
5. Biological hazards reviewed	☐	☐	☐	☐
6. Heat/cold stress information reviewed	☐	☐	☐	☐
7. Air monitoring requirements	☐	☐	☐	☐
8. Levels of protection reviewed	☐	☐	☐	☐
9. Work zones reviewed	☐	☐	☐	☐
10. Decontamination procedures reviewed	☐	☐	☐	☐
11. Emergency response procedures reviewed	☐	☐	☐	☐
12. Site communications	☐	☐	☐	☐
Personal Protective Equipment (PPE)				
1. Levels of protection being worn as specified in SSP	☐	☐	☐	☐
2. All appropriate PPE available onsite	☐	☐	☐	☐
3. Hard hats being worn	☐	☐	☐	☐
4. Appropriate hand protection being used (What?) _____	☐	☐	☐	☐
5. Appropriate body protection being used (What?) _____	☐	☐	☐	☐
6. Appropriate eye protection begin used (What?) _____	☐	☐	☐	☐
7. Appropriate ear protection being used	☐	☐	☐	☐
8. If personal protective equipment (PPE) is not onsite, prepared to halt work	☐	☐	☐	☐
9. Disposal methods in place for disposable PPE	☐	☐	☐	☐

Check "Yes" for Items Completed	**Yes**	**No**	**N/A**	**N/O**
Decontamination Procedures				
1. Decontamination procedure established as specified in the SSP	☐	☐	☐	☐
2. Decontamination zone clearly defined	☐	☐	☐	☐
3. PPE properly decontaminated (How?) _____	☐	☐	☐	☐
4. Sampling equipment properly decontaminated (How?) _____	☐	☐	☐	☐
5. Monitoring equipment properly decontaminated (How?) _____	☐	☐	☐	☐
6. Heavy equipment properly decontaminated (How?) _____	☐	☐	☐	☐
7. Samples properly decontaminated (How?) _____	☐	☐	☐	☐
8. Decontamination fluids appropriately disposed of	☐	☐	☐	☐
II. DRILLING				
1. Prior to installation, gas lines, conduit, etc., located	☐	☐	☐	☐
2. "Tailgate Safety Meeting" conducted by the "competent person" and all employees are aware of hazards.	☐	☐	☐	☐
3. Minimum distances are kept from overhead power lines.	☐	☐	☐	☐
4. First aid supplies and fire extinguisher are onsite.	☐	☐	☐	☐
5. Drill rig inspected and tested daily to ensure working, safe conditions.	☐	☐	☐	☐
6. Rig secured prior to moving, raising the mast, and during drilling operations.	☐	☐	☐	☐
7. Personnel keeping safe distance from all moving parts.	☐	☐	☐	☐
8. Hand tools used properly to maintain, repair, and clean the rig and drilling	☐	☐	☐	☐
9. Proper personal protective worn (i.e. safety shoes, safety glasses, gloves, body protection, hearing protection, and respirators)	☐	☐	☐	☐
10. Loose clothing and jewelry tucked in or removed.	☐	☐	☐	☐
11. The use of hands and feet for securing ropes and hoisting equipment is avoided.	☐	☐	☐	☐

DRILLING Health and Safety Self Assessment Checklist

This self assessment is only to be used at locations where CH2M HILL controls the work. It is not to be used at locations where others control the work. The project HSP/FSI specifies the frequency in which to complete this checklist.

Project Name:		Project No.:	
Location		PM	
Auditor / Title		Date	

SECTION 1

Check "Yes" if an assessment item is complete/correct.
Check "No" if an item is incomplete or deficient. CH2M HILL has the authority and obligation to require remedy of all deficient items. The driller must determine how to remedy and CH2M HILL must carefully rely on their expertise. CH2M HILL must not direct the details of the remedy. Items considered to be imminently dangerous (possibility of serious injury or death) must be corrected immediately or all exposed personnel must be removed from the hazard until corrected. All deficiencies shall be brought to the attention of the appropriate party that is responsible for correcting the deficiency.
Check "N/A" if an item is not applicable.
Check "N/O" if an item is applicable but was not observed during the assessment.

	Yes	No	N/A	N/O
GENERAL				
1. Daily safety briefing/meeting conducted with crew	☐	☐	☐	☐
2. Daily inspection of drill rig and equipment conducted before use	☐	☐	☐	☐
3. Fire extinguisher available	☐	☐	☐	☐
4. First aid kit available	☐	☐	☐	☐
DRILL RIG PLACEMENT				
5. Location of underground utilities identified	☐	☐	☐	☐
6. Overhead power lines deenergized and grounded, insulating barriers installed or safe clearance maintained	☐	☐	☐	☐
7. Drilling pad established, when necessary	☐	☐	☐	☐
8. Drill rig leveled and stabilized	☐	☐	☐	☐
DRILL RIG TRAVEL				
9. Rig shut down and mast lowered and secured prior to rig movement	☐	☐	☐	☐
10. Tools and equipment secured prior to rig movement	☐	☐	☐	☐
11. Only personnel seated in cab are riding on rig during movement	☐	☐	☐	☐
12. Safe distance is maintained with traveling under power lines	☐	☐	☐	☐
13. Backup alarm or spotter used when backing rig	☐	☐	☐	☐

DRILLING Health and Safety Self Assessment Checklist

	Yes	No	N/A	N/O
DRILL RIG OPERATION				
14. Only authorized personnel operating drill rig	☐	☐	☐	☐
15. Personnel cleared during rig start-up	☐	☐	☐	☐
16. Kill switch clearly identified and operational	☐	☐	☐	☐
17. Personnel wearing appropriate PPE, per HSP/FSI	☐	☐	☐	☐
18. Loose clothing and jewelry removed	☐	☐	☐	☐
19. All machine guards are in place	☐	☐	☐	☐
20. Personnel clear of rotating parts	☐	☐	☐	☐
21. Rig ropes not wrapped around body parts	☐	☐	☐	☐
22. Pressurized lines and hoses secured from whipping hazards	☐	☐	☐	☐
23. Drill operation stopped during inclement weather	☐	☐	☐	☐
24. Rig placed in neutral when operator not at controls	☐	☐	☐	☐
25. Loads are not hoisted overhead of personnel	☐	☐	☐	☐
26. Smoking is prohibited around drilling operation	☐	☐	☐	☐
DRILL RIG MAINTENANCE				
27. Defective components repaired immediately	☐	☐	☐	☐
28. Lockout/tagout procedures used prior to maintenance	☐	☐	☐	☐
29. Cathead in clean, sound condition	☐	☐	☐	☐
30. Drill rig ropes in clean, sound condition	☐	☐	☐	☐
31. Fall protection used for fall exposures of 6 feet or greater	☐	☐	☐	☐
32. Rig in neutral and augers stopped rotating before cleaning	☐	☐	☐	☐
33. Good housekeeping maintained on and around rig	☐	☐	☐	☐
DRILLING AT HAZARDOUS WASTE SITES				
34. Waste disposed off according to HSP	☐	☐	☐	☐
35. Appropriate decontamination procedures being followed, per HSP	☐	☐	☐	☐

SECTION 2 This section must be completed for all items checked "No" in Section 1.		
Item #	**Corrective action taken**	**Date corrected**

Send completed checklist to appropriate Regional Health and Safety Program Manager.

Attachment 3
Material Safety Data Sheets