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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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Sharon L. Minchak and William LeFevre, CH2M HILL

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

CH2M HILL
6001 Indian School Road NE, Suite 350
Albuquerque, New Mexico 87110

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Air Force Center for Environmental Excellence (AFCEE)
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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.

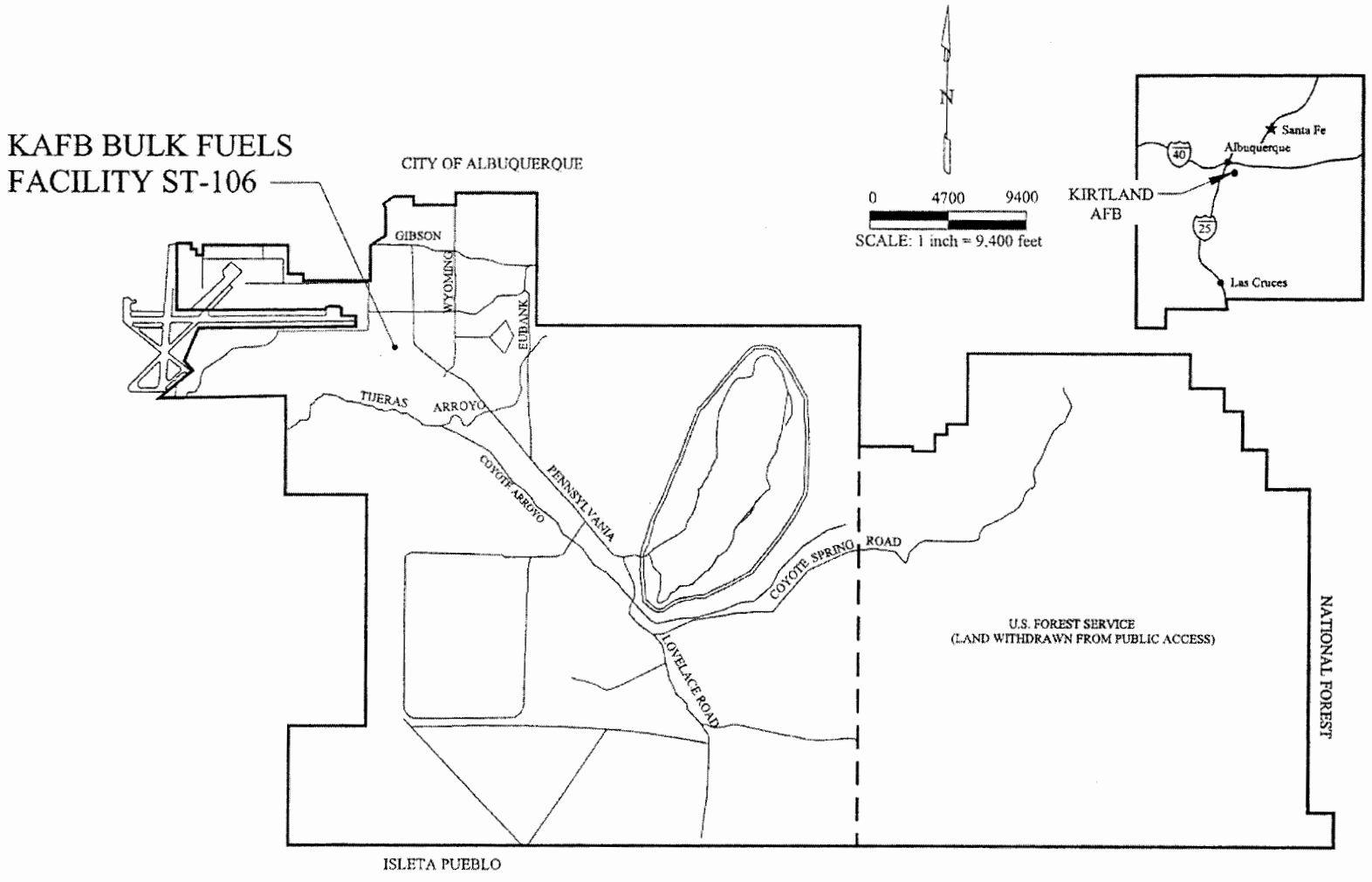

Figure 1-1. Kirtland AFB and Site Locations

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

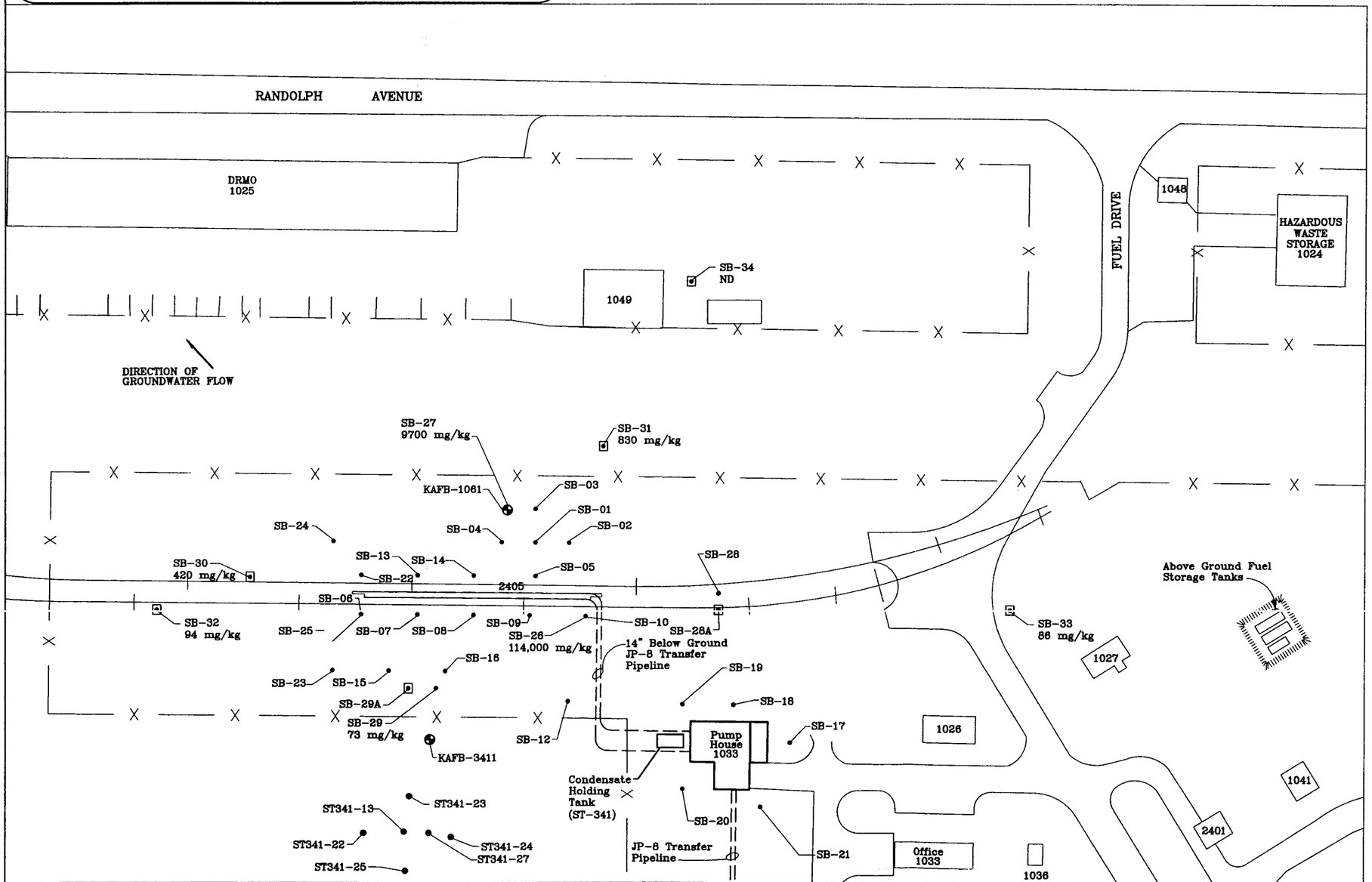

Figure 2-1. KAFB Bulk Fuels Facility (ST-106)

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.