United States Air Force

Report to Congressional Committees

Kirtland Air Force Base, NM Bulk Fuel Facility Spill Assessment Report

March 2011

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Conclusion

It is important to ensure the Air Force thoroughly characterizes the full extent of the BFF Spill for proper design and installation of remedial systems. The Air Force remains committed to removing fuel from the ground water as quickly as possible through the LNAPL containment plan and continued SVE operation. The performance-based contract approach provides the quickest, and most versatile tool possible for accomplishing our shared goal with all stakeholders of removing the fuel as quickly as possible. To be effective the effort will require the close cooperation and communication of all stakeholders to include the public, NMED, the Air Force, the City of Albuquerque and the Albuquerque Bernalillo County Water Utility Authority. The Air Force accepts responsibility for the spill and its remediation and is leading the effort to ensure it is completed as quickly as possible.

Press releases, meeting announcements, briefings, and documents related to this cleanup can be found on the Kirtland AFB public website:
http://www.kirtland.af.mil/environment.asp

Publicly available BFF Spill information is also available on the NMED website:
http://www.nmenv.state.nm.us/hwb/kafbperm.htm

Hard copies of the documents are also available in the information repository located at:
Central New Mexico Community College-Montoya Campus Library
4700 Morris NE
Albuquerque, NM 87111
(505) 224-5721

In addition to regular updates via teleconference with legislative staffers from New Mexico Senator Bingaman's office, Assistant Secretary Yonkers, SAF/IE, has met with and briefed New Mexico Congressman Martin Heinrich (District 1) on the PBA approach. Kirtland AFB leadership briefed state and federal congressional representatives in December 2010 and February 2011, respectively, on the BFF Spill as well as other topics of military readiness at Kirtland AFB.

As part of the performance-based effort, the Air Force will provide a revised community relations plan for NMED review.

Next Steps

Kirtland AFB continues to work with local permitting offices for approval to install off-base groundwater sampling wells, extraction wells, and additional SVE units. Kirtland AFB leadership will also continue to keep stakeholders apprised of cleanup progress. The current progress of well installation efforts is provided in Table 2. Installation of the LNAPL extraction and injection wells will begin after NMED approval of the LNAPL Interim Measures Work Plan.

Table 2: Well installation status for Kirtland AFB BFF Spill

	Completed to date*	Total Number	Percent Complete
Soil Vapor Monitoring Wells	23	35	65
Groundwater Wells	4	78	5

*6 wells in process

In addition, Kirtland will replace the bulk fuel storage facility, which includes a 4.2-million and 2.1-million gallon fuel tank. Replacing the existing bulk fuel storage facility with a state-of-the-art facility, including new tanks, a remodeled pump house and new fuel unload/fill stations, will greatly reduce the amount of hazardous waste generated at the base and greatly reduce the likelihood of any releases from the new system. Kirtland will also excavate, test and dispose of any contaminated soil at the site. The $10.5-million renovation project is scheduled to be completed by September 2011.

Table 1: Estimated Travel Times from the Kirtland BFF Spill to Production Wells

Production Well	Flow Path from Plume to Well	Travel Time for Best Case Scenario		Travel Time for Worst Case Scenario	
		(days)	(years)	(days)	(years)
Ridgecrest 5	Yes	13,510	37.0	6,755	18.5
Burton 5	Possible	8,222	22.5	4,111	11.3
VA Hospital	No				
KAFB-3	Seasonal	8,822	24.2	4,411	12.1
KAFB-15	No				
KAFB-16	No				

Indoor Air Quality Report (submitted September 7, 2010): The vapor phase of hydrocarbon-based fuel can potentially expose receptors through an indoor vapor-intrusion pathway. Based on samples taken, this report assesses the potential risk from fuel in the vadose zone or LNAPL at the groundwater table. Petroleum hydrocarbon fuel compounds were detected in the subslab soil vapor samples from Buildings 1032 and 1048. The detected fuel compound concentrations are below screening levels for the industrial use scenario except for benzene in Building 1048 where the concentration slightly exceeds the screening level; cumulative carcinogenic risk estimates and non-carcinogenic hazard index estimates based on the industrial scenario are at the low end or below the EPA's acceptable ranges. Further analysis will be completed in the site characterization efforts.

Critical Data Report (submitted October 2, 2010): Per NMED direction, Kirtland AFB compiled into a single volume BFF Spill sampling and other data previously collected and submitted in a number of routine reports.

Sampling efforts with Albuquerque Bernalillo County Water Utility Authority: Kirtland AFB has been providing funding for production well sampling for fuel constituents to the City of Albuquerque (COA) since 2008. The funding is used to allow for monthly sampling of the COA wells. This monthly sampling provides an additional level of security for drinking water to the local population served.

Public Outreach Efforts

Recognizing the high level of interest in the plume cleanup by all stakeholders, Kirtland AFB leadership has made efforts to provide full disclosure of its plans and information. To date, Kirtland personnel have given briefings on the BFF Spill to the Citizens Advisory Board at the Caesar Chaves Community Center on May 19, 2010, August 24, 2010, and November 23, 2010. Kirtland AFB also hosted a public meeting on January 20, 2011 to provide an update on the plans to place additional monitoring wells in neighborhoods near Kirtland AFB's northern boundary.

Air Force representatives attended NMED-sponsored public meetings on November 30, 2010 and January 12, 2011.

- Decontamination facilities and procedures to be used;
- Monitoring and sampling required;
- S&H work precautions and procedures;
- Site control measures;
- Onsite first aid and emergency equipment;
- Emergency response plans and contingency procedures (onsite and offsite); and
- Logs, reports, and record keeping.

Quarterly Monitoring Reports: This report provides an assessment of the performance of the existing systems. Based on the performance of the systems, the Air Force estimates that these units extracted approximately 186,000 gallons of fuel from 2003-2008. In 2008, additional SVE units were installed and have recovered approximately 137,000 gallons of fuel. The last report was submitted November 29, 2010. The next report is scheduled for May 23, 2011.

Transport Velocity and Travel Time Report (submitted September 7, 2010): Based on the best available information, the Air Force performed calculations to estimate the velocity and time from the known limits of the Kirtland BFF plume to the production wells in the area. Key results and conclusions of the analysis include:

- Flow paths from the Kirtland BFF plume are not expected to intercept production wells KAFB-15, KAFB-16, and the VA Hospital (see Figure 1 for locations). This suggests that migration of the plume toward these wells is not expected to occur provided pumping rates from the production wells do not change from recent conditions;

- Because the VA Hospital well is located near the FFOR and contamination is present in the vadose zone, continued monitoring of groundwater wells at this location is important to provide an early warning of any future changes in groundwater conditions;

- Flow paths do exist from the Kirtland BFF plume toward production wells Ridgecrest 5 and KAFB-3. Flow paths toward KAFB-3 may be active only seasonally. However, flow paths toward Ridgecrest 5 are active throughout the year. Existing data indicate that there are no flow paths from the plume toward production well Burton 5. However, data near Burton 5 are limited. As a worst-case scenario, it is appropriate to assume that flow paths from the plume to Burton 5 may exist; and

- The best estimate of transport velocity along flow paths from the Kirtland BFF plume toward production wells is 0.45 ft/day. Transport velocity under a worst-case scenario is 0.90 ft/day.

The calculations of travel time to each well for the best and worst case scenario is provided in Table 1.

Groundwater Investigation Work Plan (submitted 5 November 2010): Characterization of the dissolved plume in the groundwater is an urgent requirement due to potential impact to the City of Albuquerque water supply. The groundwater investigation effort is also the most expensive and time-sensitive effort required under NMED's April 2, 2010 letter due to NMED's prescribed well numbers, timing and locations. This work plan describes all activities associated with characterizing the nature, horizontal and vertical extent, and fate and rate of migration of groundwater contamination; the geology and hydrogeology at and below the water table; and groundwater flow and velocity. Groundwater investigation activities include installation of seventy-eight (78) shallow-, intermediate-, and deep-depth groundwater monitoring wells; collection and analysis of borehole soil samples; borehole geophysics; and analyses of the groundwater to determine the groundwater quality and to add to the knowledge base of groundwater chemistry. The groundwater investigation will be integrated with the vadose zone investigation to provide data necessary to supplement and optimize remedial efforts currently underway at the BFF. The enhancement of current removal operations will increase the contaminant mass removed from the vadose zone and groundwater, thus reducing the time required for cleanup.

LNAPL Interim Measures Work Plan (submitted 1 December 2010): This work plan defines activities and requirements for performing containment and capture of the LNAPL plume from the BFF Spill as part of phase-separated hydrocarbon remediation. The objective of the containment system is hydraulic control of the LNAPL plume in order to protect down gradient water users, both for the current groundwater flow regime and for potential future flow regime changes resulting from variations in water demand. This containment will enhance aquifer restoration down gradient of the plume. The scope of containment activities consists of the installation of two (2) groundwater extraction and one (1) injection wells, as well as a liquid-treatment system.

Other Work Plans and Reports:

Quality Assurance Project Plan (QAPP): To ensure the quality of sampling and analysis for chemical constituents, the Air Force will submit a project-specific, quality-assurance and quality-control plan to NMED for review and approval. The plan will follow EPA's Unified Federal Policy for Quality Assurance Project Plans Manual as the standard adopted by the Department of Defense.

Site Safety and Health (S&H) Plan: This plan will incorporate the requirements of 29 Code of Federal Regulations (CFR) §1910, including 29 CFR §1910.120 and 29 CFR §1926, especially §1926.65, where applicable. The plan contains sites specific information and details the minimum safety and health requirements to conduct work and addresses all of the following elements:

- Site description and contaminant characterization;
- S&H hazard(s) assessment and risk analysis;
- S&H staff organization and responsibilities;
- Site-specific training requirements and medical surveillance parameters;
- Personal protective equipment;

profiles will be most useful at locations where past migration of LNAPL from near-surface sources to the groundwater has occurred. All fieldwork will be fully documented in order to evaluate and interpret data to support remedial alternative decisions and/or additional interim actions.

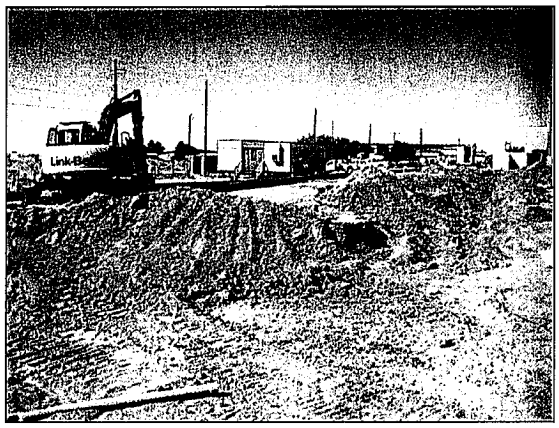

Figure 2: Excavation of contaminated soils at the Bulk Fuel Facility

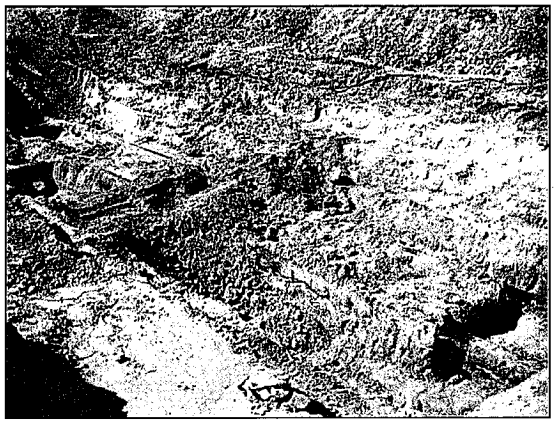

Figure 3: Piping leading to pumphouse at the Bulk Fuel Facility

Vadose Zone Characterization Work Plan (submitted 5 November 2010): This work plan describes all activities associated with the installation of thirty-eight (38) vapor monitoring wells including well installation methods, well development, initial sampling and testing, handling of investigative-derived waste, and borehole geophysical investigation. The geophysical investigation will provide information on subsurface geology and contaminant location and migration. Soil and vapor sampling will provide immediate, as well as long-term, sampling data of subsurface contaminant distribution in the vadose zone. The vadose zone investigation will be integrated with the groundwater investigation to provide data necessary to supplement and optimize remedial efforts currently underway at the BFF Spill. Enhancement of current remedial operations will increase the contaminant mass removed from the vadose zone and groundwater, thus reducing the time required for cleanup.

The Air Force will implement the work plans concurrently to reduce the time and address each requirement as efficiently as possible. Submission of these work plans demonstrates the Air Force's continuing commitment to address the fuel contamination resulting from past practices and events at the Kirtland AFB BFF in the most efficient and cost effective manner.

RIP is a Department of Defense milestone for the Defense Environmental Restoration Program (10 U.S.C. §2700 et. seq.) that indicates that the nature and extent of contamination is fully characterized, all the risks have been identified, and the system designed to address those risks has been installed and is functioning as intended. Once the SVE systems and LNAPL extraction system are in place, they are expected to achieve the objective of containing LNAPL and preventing contaminant migration by September 2017, three (3) years after achieving RIP for the interim measures. In this time period, model calculations project that the LNAPL removal rates will approach zero, the mobility of the LNAPL plume will be stabilized and the systems will no longer be required to contain the LNAPL. Completing the removal of the LNAPL, as a source of the dissolved plume, ensures protection of the drinking water wells for the City of Albuquerque. Groundwater modeling indicates that an additional eight (8) years (until 2025) will be required for microbial degradation to achieve MCLs for the dissolved constituents in the plume. The Air Force goal, however, is to achieve site completion with a remedy that requires no or minimal long-term costs. Contract options are available for continuing active treatment to achieve MCLs more quickly and can be exercised if feasible and cost effective and will be based on a business case analysis performed after removal of the LNAPL is completed and site conditions are known.

In summary, the Air Force proposes to achieve remedy-in place (RIP) for the interim measures by September 30, 2014, achieve plume stability in three (3) years, and, without further active treatment, reach MCLs in groundwater by 2025. A summary of the scope of the work plans, as well as other reports, submitted to the NMED follows.

Interim Measures Work Plan (submitted 5 November 2010): The Interim Measures Work Plan describes immediate actions that Kirtland AFB is taking to begin remediation at the BFF Spill. The Interim Measures Work Plan describes the methodology for removal of contaminated soils at the FFOR and investigation to determine if substantial residual or migrating LNAPL is present in the vadose zone. On September 27, 2010 the Air Force began removal of the leaking fuel stand and associated piping and excavation of contaminated soil (see Figures 2 and 3). This work plan establishes the procedures for analyzing the nature and extent of soil contamination, as well as the extent of any additional excavation. Kirtland AFB also proposes a focused and detailed characterization of the deep vadose zone in the vicinity of the past migration pathway from the FFOR to the main body of LNAPL located at the groundwater table. In complex heterogeneous soil, determining locations and depths of migrating LNAPL is difficult using standard investigative methods. The goal of identifying LNAPL in the vadose zone can be met by collecting and correlating detailed soil permeability and contaminant concentration logs or profiles. Relatively new investigative techniques, such as vertical profiling by pneumatic logging, have been developed and can provide this level of detail. At Kirtland AFB, these types of logs or

On September 30, 2010, the Air Force, through the United States Army Corps of Engineers, Huntsville, awarded a contract and issued a notice-to-proceed to Shaw Environmental and Infrastructure Inc., with the following performance milestones:

- Removal of contaminated soils by June 30, 2011
- Eliminate vapor intrusion pathway by September 30, 2012
- Stabilize the dissolved plume by September 30, 2014
- Achieve remedy-in-place (RIP) by September 30, 2014
- Complete active removal of LNAPL, by September 30, 2017, from the vadose zone and groundwater sufficient to, eventually, meet maximum contaminant levels (MCLs-drinking water limits) in groundwater (2025)

The maximum contract value is $49.1M. The basic contract award in FY10 was $22.9M for a term of five (5) years. The basic contract includes operating existing SVE units, completing site characterization, completing removal of contaminated soils, demonstrating dissolved plume stability, and installing additional SVE units and an LNAPL containment system. Various options can be awarded anytime from FY11 through FY15. Possible options include completing removal of LNAPL in the groundwater and vadose zone and completing a corrective measures evaluation, which considers remedy alternatives protective of human health and the environment and determines the preferred remedial option.

A contract kick-off meeting was held on October 7, 2010. The Air Force, the contractors and NMED representatives met on October 19, 2010 and November 2, 2010 to introduce the milestones and proposed approach. Following the November 2, 2010 meeting, NMED representatives provided positive feedback on the proposed methodologies for cleanup.

Cleanup Plans and Reports

Remediation is being conducted pursuant to the federal Resource Conservation and Recovery Act; Hazardous Waste Act, Chapter 74, New Mexico Statutes Annotated 1978; the Hazardous Waste Management Regulations, 20.4.1 New Mexico Annotated Code; and regulatory oversight of the NMED HWB. Work may require coordination with other Departments or Agencies, as necessary, to obtain environmental permits. In addition to the continued operation of four (4) SVE systems and removal of the fuel stand/pipe and contaminated soils, the Air Force submitted four (4) work plans. Three (3) work plans were required by NMED. The fourth (4th), the LNAPL Interim Measures Work Plan, was proposed by the contractor to meet the objectives the Air Force set forth in the performance-based contract solicitation to contain and remove the LNAPL plume. On December 10, 2010, NMED issued a partial approval of three (3) of the four (4) work plans; the contractor began mobilizing immediately and on December 13, 2010 began field work. Kirtland AFB will submit revised work plans by March 31, 2011, per NMED direction, to address identified deficiencies.

On April 2, 2010, the NMED GWQB notified Kirtland AFB of the transfer of regulatory authority to NMED Hazardous Waste Bureau (HWB). Concurrently, the HWB issued a memorandum to Kirtland which directed the Air Force to, in summary:

- Complete characterization of the contamination in the vadose zone (the unsaturated region above the water table),
- Complete characterization of dissolved-phased contaminants in groundwater,
- Take interim measures to address the fuel in the soil and retard plume migration, and;
- Conduct a corrective-measures evaluation.

On May 25, 2010, Mr. Terry Yonkers, the Assistant Secretary of the Air Force for Installations, Environment and Logistics (SAF/IE), met with NMED's Secretary Ron Curry and proposed a performance-based approach to focus on fuel cleanup rather than the traditional, step-by-step, process-intensive approach. Secretary Curry agreed to this approach. Performance-based acquisition (PBA) was designed to help federal agencies reap the benefits of private-sector innovation. Proponents of the initiative say that the government has for years tended to micromanage its contracts by spelling out every detail of how it wanted goals to be achieved. Under the PBA approach, an agency identifies the problem and allows contractors to make bids detailing their proposed solutions. The agency is charged with developing clear ways to measure the result as well as the contractors' performance over the course of the contract. Additionally, the PBA approach saves time and money when multiple phases are covered in the scope, rather than letting separate contracts for each phase. Historically, for example, contractors at later phases of cleanup have to re-accomplish earlier study efforts because data from the earlier efforts was too old or not sufficient to complete the design or installation of a cleanup system.

For the cleanup program, the performance-based concept focuses on achieving cleanup of contaminants and restoration of resources in the shortest timeframe by developing objectives for a desired end-state, rather than focusing on the intermediate steps in the process. The focus on performance, consistent with many of the federal reforms for cleanup under the Resource Conservation and Recovery Act, as presented in United States Environmental Protection Agency (EPA) guidance, is designed to ensure an efficient and economical approach that benefits all stakeholders. Compliance with applicable law is an essential part of performance-based cleanup, and the more flexible contract mechanism allows the Air Force to take advantage of the expertise in new technologies and approaches used in the private sector in its and New Mexico's decision-making process. For the cleanup of the BFF spill, the Air Force will direct the end point or performance objective, and the contractor bidding on the cleanup will propose their innovative ideas and technologies to meet the result the Air Force has directed. The Air Force is charged with developing clear performance objectives and metrics to measure cleanup success. SAF/IE intends to use this project as a template to implement performance-based cleanup throughout the Air Force. In meetings subsequent to the Yonkers/Curry agreement, NMED HWB staff tentatively supported the specific steps proposed by Air Force to implement the performance-based approach.

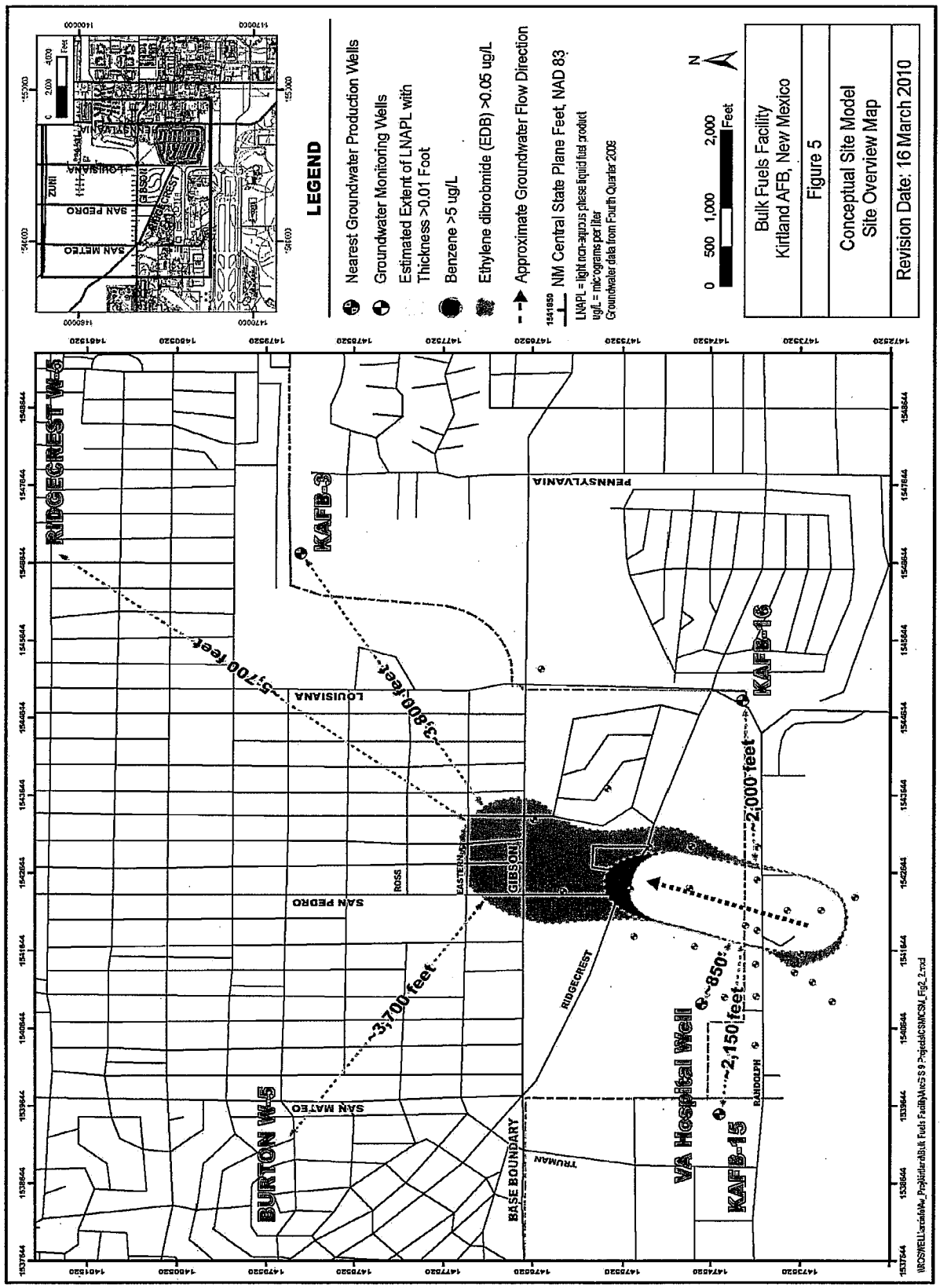

Figure 1: Horizontal extent of LNAPL and dissolved phase BFF Spill

facility. Kirtland AFB immediately stopped the fuel discharge and discontinued use of the facility. Due to the presence of multiple types of fuel contamination on the water table and the size of the LNAPL plume, it is likely that the primary pipeline had been in a state of failure for many years. The detected presence of LNAPL fuel hydrocarbons on the water table also indicates that the release was substantial because a range of fuel types were released (including AvGas, JP-4, and JP-8). On November 19, 1999, Kirtland AFB notified the New Mexico Environment Department (NMED) Groundwater Quality Bureau (GWQB) of the release and then conducted initial investigations and interim measures for cleanup under the GWQB's direction.

In 1999, the Air Force initiated a series of investigations, which were conducted over the next several years, to delineate the location of the fuel in the soil. A pilot test for a soil vapor extraction system (SVE) was conducted in 2003 and, in 2004, a full SVE system was installed to address fuel contamination in the soil and Kirtland began public outreach activities to keep stakeholders informed on the spill response activities. Although four (4) sentry wells were installed and groundwater monitoring had been ongoing since 2000, sampling conducted in a fifth (5th) well in 2007 found fuel on the surface of the groundwater located 500 feet below the ground surface. Investigations conducted since 2007 indicate that a large plume of LNAPL with its dissolved-phased constituents has migrated off the installation in the direction of Albuquerque's drinking-water wells. This discovery prompted increased local, regulatory and congressional interest. Additional sentry wells were installed to provide early detection of either LNAPL or dissolved-phase contaminants migration toward the drinking water wells. The vertical and lateral extent of the dissolved plume below the surface of the groundwater has not been fully characterized; however, Figure 1 depicts the known horizontal extent of the plume and its known relationship to Albuquerque drinking-water wells. The Air Force is working closely with NMED to complete the characterization and cleanup in the most efficient and cost effective manner.

Executive Summary

The Air Force is fully committed to the protection of human health and the environment, and to full compliance with applicable law, at all of its facilities, for all programs, including cleanup. The Air Force objective for the cleanup of the fuel spill at Kirtland Air Force Base (AFB) is to complete cleanup in the shortest timeframe and most cost efficient manner.

Three known jet fuel discharges at Kirtland AFB in November 1999, following pressure testing of the lines, lead to discovery of a large fuel plume on the surface of the groundwater. Subsequent investigations to determine the extent of the plume boundaries suggested that the fuel and the dissolved constituents migrated toward, but have not reached, drinking water wells in the City of Albuquerque. Since 1999, Kirtland AFB representatives have worked with the New Mexico Environment Department and the Albuquerque Bernalillo County Water Utility Authority to ensure protection of the City's drinking water.

In addition to initial investigations and efforts to remove the fuel, the Air Force invested $22.9M in FY10 to complete the necessary characterization to install removal systems and $10-million to replace the fuel tanks and piping systems. Using a performance-based acquisition approach, the current objectives for cleanup would stop the forward migration of the fuel plume by September 2014 and completely remove the fuel on the groundwater by September 2017. Removal of the fuel removes the source for the dissolved plume. However, dissolved constituents will still remain in the groundwater. Using natural processes without further active treatment, modeling indicates that the dissolved constituents would meet drinking water standards by 2025. Because containment and source removal provides sufficient protection for the drinking water of Albuquerque, further active treatment of the dissolved plume will depend on a business case analysis when site conditions post-removal are known. Replacement of the fuel system is scheduled to be completed by the end of 2011. Kirtland AFB will continue to keep the stakeholders informed of progress of the cleanup efforts.

Report

Fuel Spill History

Kirtland AFB is located in Bernalillo County in central New Mexico, southeast of and adjacent to the City of Albuquerque. Kirtland AFB is one of the largest installations in Air Force Materiel Command and the Air Force. The base occupies 52,000 acres and employs more than 20,000 people, including more than 3,000 active duty and 1,000 Guard and Reserve Airmen. The bulk fuel facility (BFF) is located in the western part of Kirtland AFB. Historical aerial photography has revealed that the area was utilized for fuel storage and processing as early as 1951. The exact history of releases is unknown.

The spill site is comprised of the Former Fuel Offloading Rack (FFOR) area and the associated light non-aqueous phase liquid (LNAPL) plume, and is collectively known as the BFF Spill. In November 1999, three known discharges were identified as a result of pressure testing of the lines that transfer fuel from the JP-8 offloading rack to the pump house at the

Introduction

This report is being provided to the Congressional Defense Committees as directed by the Senate Armed Services Committee Report (Report 111-201) accompanying the National Defense Authorization Act for Fiscal Year 2011 (S. 3454).

Kirtland Air Force Base jet fuel spill

Between 1950 and 1999, a 16-inch underground pipe used to offload jet fuel leaked an estimated two to eight million gallons of fuel into the soil at Kirtland Air Force Base in New Mexico. Investigations are underway on the exact size and location of the plume. However, the committee has been informed that this fuel has migrated over 400 feet downward to the aquifer used by the city of Albuquerque for its drinking water. One recent estimate puts the size of the fuel plume at over 1/3 of a mile in length and over a foot in height at its maximum point, with its leading edge within 3,700 feet of the first of several drinking wells used by the city of Albuquerque.

The committee directs the Secretary of the Air Force to report to the congressional defense committees on the Kirtland jet fuel spill by no later than 90 days after the date of the enactment of this Act. The report should provide the Department's assessment of the scope of the problem and the steps that the Department has taken or plans to take to address the problem.

The committee expects the Department of the Air Force and the other military departments to request sufficient funds to cover high priority (level one) remediation requirements and to prioritize these requirements on the basis of risk factors in accordance with established protocols.