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Final
Record of Decision
Open Burning/Open Detonation Ground (Range 16)
Operable Unit 006
Fort Riley, Kansas

U.S. Army Corps of Engineers
Kansas City District

Project No. 78954
June 2016

June 2016

Final Record of Decision Open Burning/Open Detonation Ground (Range 16) Operable Unit 006 Fort Riley, Kansas

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Louis Berger

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June 2016

prepared by

The Louis Berger Group, Inc.
Elmsford, New York
and
Burns & McDonnell Engineering Company, Inc.
Kansas City, Missouri

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LIST OF ABBREVIATIONS

Abbreviation	Term/Phrase/Name
AR	Army Regulation
ARAR	Applicable or Relevant and Appropriate Requirements
BER	Bureau of Environmental Remediation
bgs	below ground surface
BMcD	Burns & McDonnell Engineering Company, Inc.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CFI	WWI Incinerator, Northwest Camp Funston
CFLA2	Camp Forsyth Landfill Area 2
cis-1,2-DCE	cis-1,2-Dichloroethene
COC	Chemical of Concern
COPC	Chemical of Potential Concern
COPEC	Chemical of Potential Ecological Concern
cm^2	square centimeters
cm/sec	centimeters per second
CSM	Conceptual Site Model
DA	United Stated Depart of the Army
DCFA	Dry Cleaning Facilities Area
DoD	United States Department of Defense
EOD	Explosive Ordnance Disposal
FFA	Federal Facility Agreement
FFTA	Former Fire Training Area
FS	Feasibility Study
°F	degrees Fahrenheit
GRA	General Response Action
HI	Hazard Index
HQ	Hazard Quotient
IC	Institutional Control
IRP	Installation Restoration Program
IRIS	Integrated Risk Information System
IWSA	Installation-Wide Site Assessment
K.A.R.	Kansas Administrative Regulations
KDHE	Kansas Department of Health and Environment
kg	Kilogram

Abbreviation	Term/Phrase/Name
K.S.A.	Kansas Statutes Annotated
KSWQS	Kansas Surface Water Quality Standards
L/day	liters per day
L/m3	liters per cubic meter
LBA	Louis Berger & Associates
LBG	The Louis Berger Group, Inc.
LRC	Long-Range Component
MAAF	Marshall Army Airfield
MEC	Munitions and Explosives of Concern
MCL	Maximum Contaminant Level
m^3/kg	cubic meters per kilogram
mg/cm^2	milligrams per square centimeter
mg/kg	milligrams per kilogram
MNA	Monitored Natural Attenuation
MP	Malcolm Pirnie
MPEO	Master Plan Environmental Overlay
NCP	National Oil and Hazardous Substance Pollution Contingency Plan
NPL	National Priorities List
O&M	Operation & Maintenance
OB/OD	Open Burning / Open Detonation Ground
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PP	Proposed Plan
PCA	1,1,2,2-Tetrachloroethane
PCE	Tetrachloroethene
PWE	Fort Riley Directorate of Public Works – Environmental Division
RAB	Restoration Advisory Board
RAO	Remedial Action Objective
RD/RA	Remedial Design/Remedial Action
RCRA	Resource Conservation and Recovery Act
RG	Remediation Goal
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
RPMP	Real Property Master Plan
ROD	Record of Decision

Abbreviation	Term/Phrase/Name
ROI	Radius of Influence
SARA	Superfund Amendments and Reauthorization Act
SEMS	Superfund Enterprise Management System
SHSAR-IS	Sherman Heights Small Arms Range – Impact Slope
SI	Site Investigation
SVE	Soil Vapor Extraction
SVOC	Semivolatile Organic Compound
TCE	Trichloroethene
UCL	Upper Confidence Limit
US Army	United States Army
USC	United States Code
USEPA	United States Environmental Protection Agency
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound
WP	Work Plan
354 Area	354 Area Solvent Detections
µg/L	micrograms per liter
%	percent

* * * * *

1.0 DECLARATION

1.1 Site Name and Location

SITE NAME:	Fort Riley, Kansas, Open Burning/Open Detonation Ground Range 16
USEPA IDENTIFICATION (FFA) NUMBER:	KS6214020756; Federal Facility Agreement Docket Number VII-90-F-0015
LOCATION:	Fort Riley, Kansas
SITE TYPE:	Federal Facility
LEAD AGENCY:	The United States Department of the Army (DA)
SUPPORTING AGENCIES:	The United States Environmental Protection Agency (USEPA), Region VII and the State of Kansas, Kansas Department of Health and Environment (KDHE) - Bureau of Environmental Remediation (BER)
OPERABLE UNIT:	Operable Unit (OU) 006

1.2 Statement of Basis and Purpose

This Record of Decision (ROD) presents the Selected Remedy for the Fort Riley, Kansas, KS6214020756, Open Burning/Open Detonation Ground (OB/OD) (Range 16) (OU 006) site under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended, 42 United States Code (USC) §9601 et. seq. The remedy was chosen in accordance with CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and to the extent practical, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) 40 Code of Federal Regulations (CFR) Part 300. The remedy was selected based upon the Administrative Record file for the OB/OD (OU 006). This ROD is consistent with previous RODs for other OUs at Fort Riley discussed in Section 2.4 and is expected to be consistent with any likely final site remedy. Documents supporting this ROD are identified in Section 4.0.

This remedy was selected by the DA (Fort Riley) in consultation with the USEPA, Region VII, and the KDHE-BER. The State of Kansas (KDHE-BER) and the USEPA concur with the selected remedy.

1.3 Assessment of the Site

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

1.4 Description of the Selected Remedy

The Fort Riley National Priorities List (NPL) site currently encompasses nine OUs located at the post. The OUs have been designated by the DA (Fort Riley) based on the results of prior investigations. The nine OUs include: the Southwest Funston Landfill Site (OU 001); the Pesticides Storage Facility Site (OU 002); the Dry Cleaning Facilities Area (DCFA) Site (OU 003); the Former Fire Training Area (FFTA) – Marshall Army Airfield (MAAF) Site (OU 004); the 354 Area Solvent Detections (354 Area) Site (OU 005); the OB/OD (OU 006); the World War I Incinerator, Northwest Camp Funston (CFI) Site (OU 007); the Sherman Heights Small Arms Range – Impact Slope (SHSAR-IS) Site (OU 008); and the Camp Forsyth Landfill Area 2 (CFLA2) Site (OU 009).

The selected remedy (identified as Alternative 2 in the Feasibility Study [FS] and Proposed Plan [PP]) for the OB/OD (OU 006) is: soil removal with disposal or treatment, groundwater/surface water monitoring, and institutional controls (ICs) through the Fort Riley Real Property Master Plan (RPMP). The selected remedy addresses the contaminated soil, groundwater, and surface water at the OB/OD (OU 006). There is no principal threat waste present at the OB/OD (OU 006). The principal source of contamination at the OB/OD (OU 006) is the trichloroethene (TCE)-contaminated soil located in the area of the metal debris pits (source area). The source area is likely contributing to the groundwater and surface water contamination present at the site. There is no known historical or current use of solvents or knowledge of solvent disposal at the OB/OD (OU 006).

The selected remedy reflects the long-term site management plan for the OB/OD (OU 006). The selected remedy relies on source area removal to prevent contamination present in the soil from leaching into the groundwater and migrating to the surface water. Secondarily, impacted groundwater and surface water will be treated through natural processes such as volatilization, biodegradation, advection, and dispersion. TCE-impacted soil with contaminant concentrations exceeding its calculated risk-based Remedial Goal (RG) of 10.72 milligrams per kilogram (mg/kg) will be excavated and treated on site by land farming. The excavated material will be treated in a land-farm treatment cell until contaminant concentrations are below the calculated RG of 10.72 mg/kg. Monitoring of groundwater and surface water will be conducted to ensure contaminant concentrations present in the groundwater and surface water are continuing to decrease in concentration, the contaminant plumes are continuing to decrease in size, and the remedy is not adversely impacting water quality. ICs implemented through the Fort Riley RPMP will control and limit development, and other activities at the site. ICs include restricting changes in land use; limiting access; prohibiting the installation of drinking water wells and groundwater/surface water use; and involving Fort Riley Directorate of Public Works – Environmental Division (PWE) personnel in the

proposed future plans. Furthermore, because the OB/OD (OU 006) is an active range located within the Impact Area and is currently used for ordnance disposal, the site is gated with severely restricted access that is controlled through range controls.

Progress at the OB/OD (OU 006) will be monitored through groundwater and surface water sampling at the site. A Remedial Design/Remedial Action (RD/RA) Work Plan (WP) for the OB/OD (OU 006) will be completed upon ROD approval. The RD/RA WP will include the preparation and implementation of plans and specifications for applying site remedies.

The main components of the selected remedy include:

- Removal of the TCE-impacted soil source area located in the area of the metal debris pits which exceed the calculated risk-based RG of 10.72 mg/kg;
- Treatment of TCE-impacted soil using an on-site land-farm treatment cell to concentrations below the calculated risk-based RG of 10.72 mg/kg;
- Disposal of treated soil for use as landfill cover or spread on site;
- Monitoring of groundwater and surface water to ensure contaminant concentrations present in the groundwater and surface water are continuing to decrease in concentration and the contaminant plumes are continuing to decrease in size.
- Implementation of ICs to restrict changes in land use, limit site access, prohibit the installation of drinking water wells and groundwater/surface water use, and involve the Fort Riley PWE in proposed future plans of the site.

The remediation goals are to remove the soil source area at the site, to the extent practical, and reduce groundwater and surface water contamination to below remedial cleanup levels. Currently, the contaminant source area serves as a reservoir of contamination that can migrate to the groundwater and surface water and act as a source for direct exposure for potentially exposed populations (current/future site worker and current/future demolition worker). Monitoring of groundwater and surface water will be conducted to ensure contaminant concentrations present in the groundwater and surface water are continuing to decrease in concentration and the contaminant plumes are continuing to decrease in size.

When groundwater and surface water samples have not exceeded remedial cleanup levels (calculated RGs and/or maximum contaminant levels [MCLs]) within the OB/OD (OU 006) monitoring well network and surface water sampling points for a period of time to be determined in the RD/RA WP, the

cleanup/remediation of the site to industrial standards will be considered complete with respect to the chemicals of concern (COCs) identified at the OB/OD (OU 006) and will recommend discontinuation of groundwater and surface water monitoring. The OB/OD (OU 006) monitoring well network, surface sampling points, and monitoring frequency will be identified and defined in the RD/RA WP. Site closure for the OB/OD (OU 006) will be unobtainable because the site is an active range located within the Impact Area currently used for ordnance disposal and as such may pose risks due to the potential presence of unexploded ordnance (UXO), and munitions and explosives of concern (MEC).

1.5 Statutory Determinations

The DA (Fort Riley), USEPA, and KDHE have determined that the selected remedy meets the requirements of CERCLA §121 and the NCP. Based on the information available at this time, the DA (Fort Riley), USEPA, and KDHE believe the selected remedy will be protective of human health and the environment, will comply with Applicable or Relevant and Appropriate Requirements (ARARs), will be cost-effective, and will utilize permanent solutions to the maximum extent practicable. This selected remedy also satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment).

The NCP 40 CFR §300.430(f)(4)(ii) requires a five-year review if the remedial action results in hazardous substances remaining on-site at concentrations greater than those that allow for unlimited use and unrestricted exposure. Because the remedy will take longer than five years to achieve cleanup levels, a review will be conducted within five years of initiation of the remedial action to ensure the remedy is, or will be, protective. A five-year review will be conducted to evaluate the effectiveness of the selected remedy as a matter of USEPA **policy**, until cleanup levels are achieved, allowing unlimited use and unrestricted exposure (*OSWER No. 9355.7-03B-P, Table 1-1*). The review will ensure that the remedy continues to provide adequate protection of human health and the environment.

1.6 ROD Data Certification Checklist

In accordance with *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents* (USEPA, 1999), the following information is included in the Decision Summary section of this ROD (Section 2.0). Additional information can be found in the Administrative Record file for the OB/OD (OU 006).

- COCs and their respective concentrations (Section 2.7.1.1 and Tables 2-4 through 2-12)
- Baseline risk represented by the COCs (Section 2.7.1.2 through 2.7.1.4 and Table 2-23)

- Remedial cleanup levels (calculated risk-based RGs and/or MCLs) established for COCs and the basis for these levels (Section 2.9 and Tables 2-40 through 2-42)
- Current and reasonably-anticipated, future, land-use assumptions and current and potential, future, beneficial uses of groundwater as defined in the Baseline Risk Assessment (BLRA) and ROD (Section 2.6)
- Potential land (Section 2.6.1) and groundwater (Section 2.6.2) use that will be available at the OB/OD (OU 006) site as a result of the selected remedy
- Estimated capital costs, annual operation and maintenance (O&M) costs, periodic costs, and total present value costs, discount rate, and the number of years over which the selected remedy cost estimates are projected (Section 2.13.3, Table 2-43, and Tables 2-45 through 2-48)
- Key factors that led to selecting the remedy (i.e., describe how the selected remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision) (Section 2.13.1 and Table 2-44)

1.7 Authorizing Signatures

On the basis of the Remedial Investigation (RI) and FS that were performed for the OB/OD (OU 006), the selected remedy, soil removal with disposal or treatment, groundwater/surface water monitoring, and ICs through the Fort Riley RPMP, meets the requirements for remedial action set forth in CERCLA, as confirmed by the following signature pages.

Lead and Support Agency Acceptance of the
ROD Fort Riley Army Installation
Open Burning/Open Detonation Ground (Range 16), OU 006

Signature sheet to the ROD for the OB/OD (OU 006) final action at the Fort Riley Installation between the DA, Fort Riley and the USEPA, Region VII, with concurrence by the State of Kansas acting through KDHE-BER.

Mary P. Peterson

Ms. Mary Peterson
Superfund Division Director, USEPA, Region VII

9/30/2016

Date

Lead and Support Agency Acceptance of the ROD
Fort Riley Army Installation
Open Burning/Open Detonation Ground (Range 16), OU 006

Signature sheet to the ROD for the OB/OD (OU 006) final action at the Fort Riley Installation between the DA, Fort Riley and the USEPA, Region VII, with concurrence by the State of Kansas acting through KDHE-BER.

30 SEP 16

TIMOTHY M. GREENHAW
COL, CM
Commanding

Date

* * * * *

2.0 DECISION SUMMARY

This Decision Summary provides an overview of the soil, groundwater, and surface water conditions at the OB/OD (OU 006), the remedial alternatives, and the analysis of those options. In addition, this section explains the rationale for the remedy selection and describes how the selected remedy satisfies statutory requirements.

2.1 Site Name, Location, and Description

The Fort Riley Military Reservation is centrally located between the cities of Salina and Topeka in north central Kansas (see Figure 2-1). The reservation is over 100,000 acres in size and includes portions of Riley, Clay, and Geary Counties. The developed areas of Fort Riley are divided into six cantonment areas: Main Post, Camp Forsyth, Camp Funston, Camp Whitside, MAAF, and Custer Hill. The OB/OD (OU 006) is located approximately 2.5 miles to the northeast of Custer Hill, in the Impact Area, and outside of the developed areas of Fort Riley (see Figure 2-1).

The OB/OD (OU 006) is located within Range 16 in the southern part of the Impact Area; approximately 2,300 feet north of Vinton School Road (see Figures 2-2 and 2-3). The active portion of the site is an inverted L-shaped area and consists of an area approximately 700 feet by 550 feet. The OB/OD (OU 006) is a sparsely vegetated area underlain by rocky soil (regolith) and bedrock that consists of alternating shale and limestone beds. Controlled burning is conducted by Fort Riley on a regular basis to prevent the buildup of vegetation and resulting wildfires. Ephemeral streams are present to both the east and west of the active portion of the OB/OD (OU 006). A wet weather spring is also present within the active portion of the site.

Bedrock at the OB/OD (OU 006) consists of alternating limestone and shale units of the Permian Chase and Council Grove Groups. Bedrock dips gently to the southwest. Two sets of joints, one set orientated east-northeast and one set orientated north-northwest, are present; the joints are more prominent in the limestone beds. At some locations, fractures are also present in the top of bedrock due to the discharge of explosives.

Groundwater is present at the OB/OD (OU 006) in the regolith and the upper weathered bedrock in the upper aquifer, and in bedrock units within the lower aquifer. Groundwater within the area is not used. As the OB/OD (OU 006) is located within an isolated portion of Fort Riley and access is severely restricted by the Army through range controls, there is no plan for groundwater use at the site in the near future.

Fort Riley is identified by the USEPA as Superfund Enterprise Management System (SEMS) site KS6214020756. This document is issued by the DA, the lead agency for the activities at Fort Riley, with consultation with the USEPA, Region VII and KDHE-BER, the support agencies. Cleanup work at the OB/OD (OU 006) has been funded by the DA (Fort Riley) through the Installation Restoration Program (IRP).

The Fort Riley NPL site currently encompasses nine OUs located at the post. The OUs have been designated by the DA (Fort Riley) based on the results of prior investigations. The nine OUs include: the Southwest Funston Landfill Site (OU 001); the Pesticides Storage Facility Site (OU 002); the DCFA Site (OU 003); the FFTA–MAAF Site (OU 004); the 354 Area Site (OU 005); the OB/OD (OU 006); the CFI Site (OU 007); the SHSAR-IS Site (OU 008); and the CFLA2 Site (OU 009).

2.2 Site History and Enforcement Activities

Prior to 1942, the OB/OD (OU 006) area was used for ranching and farming. The land was obtained by the military in 1942 and has been in use by the United States Army (US Army) from 1942 to the present. Historic and present site use has not changed, although detonation activities have diminished. Currently, the 774th Explosive Ordnance Disposal (EOD) Detachment at Fort Riley handles ordnance materials from Fort Riley, the United States Department of Defense (DoD), and other state and federal agencies. Since 1991, the 774th EOD Detachment has been responsible for providing support to military installations, operations, and exercises; and to civilian and federal authorities within an operational area that includes the states of Kansas, Nebraska, Missouri, and South Dakota.

Ordnance was formerly disposed of by the 774th EOD Detachment at the OB/OD (OU 006) by open burning and open detonation. Currently, only open detonations for emergency disposal of ordnance and training are conducted. Open detonation occurs on open ground and creates crater-like pits, which typically reach a maximum size of 25 feet in diameter and 10 to 15 feet in depth. Open burning was formerly conducted within a specific area that was characterized by a small pit with a metal grating surrounded by a 9-foot high, horseshoe-shaped embankment (South Burn Pit). The open burn pit was primarily used to dispose of black powder and phosphorus-based munitions. At present, there are three active detonation pit areas, two metal debris pits, and two non-active burn pits at the OB/OD (OU 006) (see Figure 2-2). Open detonation is currently being conducted at the Northwest, West, and East Demolition Pits. Open detonation at the site is dynamic; generally, detonations are conducted within the same area but may not be within the same pit.

Effective June 1991, the DA (Fort Riley) entered into a FFA, Docket No. VII-90-F-0015, with the State of Kansas KDHE-BER and USEPA, Region VII to address environmental pollution subject to CERCLA, the NCP, and /or the Resource Conservation and Recovery Act (RCRA) (USEPA, 1991a). On July 14, 1989, the USEPA proposed inclusion of Fort Riley on the NPL pursuant to CERCLA.

Pursuant to the FFA, Fort Riley conducted an Installation-Wide Site Assessment (IWSA) in 1992 (Louis Berger & Associates [LBA], 1992) to identify sites having the potential to release hazardous substances to the environment. The IWSA identified the OB/OD (OU 006) as a potential area of concern requiring further evaluation. Based on the findings of the IWSA, a number of environmental investigations were conducted at the OB/OD (OU 006). In February 2011, the US Army Environmental Command performed a Program Management Review of the IRP at Fort Riley and requested that a RI/FS be performed at the OB/OD (OU 006). As a result, the OB/OD (OU 006) was formally designated as an OU (OU 006) on May 12, 2011.

Environmental investigations that have been conducted at the OB/OD (OU 006) are detailed in the following discussion. A chronology of environmental investigations conducted and associated documents for the OB/OD (OU 006) is presented in Table 2-1.

- **Fall 1993** – An initial Site Investigation (SI) was conducted at the OB/OD (OU 006) to evaluate the presence or absence of contamination by LBA. This SI was conducted and reported in the *SI Report for High Priority Sites at Fort Riley, Kansas* (LBA, 1994). Field activities conducted during this investigation included the collection of surface soil samples from the pits used for the burning and detonation of ordnance; soil samples from subsurface borings; sediment and surface water samples from ephemeral streams; and the installation, development, and sampling of Monitoring Wells OB-93-01 through OB-93-04. Soil samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), total petroleum hydrocarbons, explosives, priority metals, and uranium. Surface water and sediment samples were analyzed for explosives and priority metals, and uranium. Groundwater samples were analyzed for VOCs, SVOCs, explosives, priority metals, uranium, and water quality parameters TCE was not detected in soil, sediment, and surface water samples. TCE was found in groundwater above its MCL of 5 micrograms per liter (µg/L) in Monitoring Well OB-93-04 (29 µg/L).
- **December 1995** – Confirmation sampling of Monitoring Wells OB-93-01 through OB-93-04 was conducted in December 1995. Groundwater samples were analyzed for VOCs, SVOCs, explosives, priority metals, uranium, and water quality parameters. Analytical results were

reported in the *Data Summary Report for Confirmation Groundwater Sampling Multi-Sites, Fort Riley, Kansas* (LBA, 1996a) and the *Quality Control Summary Report Confirmation Groundwater Sampling at the Multi-Sites, Fort Riley, Kansas* (LBA, 1996b). The only TCE detection above the 5 µg/L MCL was in the sample from Monitoring Well OB-93-04 (17 µg/L).

- **March/April 1997** – Mobilization #1: Additional SI activities were conducted to evaluate possible sources and extent of contamination at the OB/OD (OU 006). Descriptions of the field activities are presented in the *Technical Memorandum, Overview of Mobilization # 1, Preliminary Findings and Proposed Mobilization # 2 Activities, Open Burn/Open Detonation Area, Fort Riley, Kansas* (LBA, 1997a). During this field effort, Monitoring Wells OB-97-05 through OB-97-08 were installed and groundwater samples were collected. Samples were also collected from the spring and hand-dug well. Samples were analyzed for VOCs (and explosives and water quality parameters at one monitoring well). Concentrations of TCE exceeding the MCL were detected in the groundwater sample from Monitoring Well OB-97-07 (490 µg/L). Monitoring Wells OB-93-01 through OB-93-04 were not sampled during this field effort.

- **June 1997** – Mobilization #2: Additional investigation activities were conducted to further characterize subsurface hydrogeology at the OB/OD (OU 006). Field activities are summarized in the *Supplemental Technical Memorandum, Mobilization #2 Activities, Open Burn/Open Detonation Area, Fort Riley, Kansas* (LBA, 1997b) and the Technical Memorandum, Mobilization # 2 Activities, Open Burn/Open Detonation Area, Fort Riley, Kansas (LBA, 1998). Five sets of nested piezometers OB-97-09PZ through OB-97-13PZ were installed. One piezometer, the spring, and the hand-dug well were sampled. Samples were analyzed for VOCs. Water samples collected that exceeded the TCE MCL included the spring (190 µg/L) and the hand-dug well (230 µg/L).

- **September 1997** – Groundwater Sampling Event: Groundwater samples were collected from all monitoring wells, piezometers, and the hand-dug well. One surface water sample was collected. Samples were analyzed for VOCs. Monitoring Well OBHD-97-14 was installed at the location of the hand-dug well. Analytical results were reported in the *Data Summary Report for Groundwater Sampling and Groundwater Elevations at the Open Burn/Open Detonation Area, Fort Riley, Kansas* (LBA, 1999). TCE concentrations above the MCL of 5 µg/L were reported in groundwater samples collected from Monitoring Wells OB-93-04 (17 µg/L), OB-97-07 (400 µg/L), OB-97-08 (200 µg/L), OBHD-97-14 (440 µg/L), and the hand dug well (260 µg/L). TCE concentrations above the MCL were also reported in groundwater samples collected from Piezometers OB-97-10PZ (3), OB-97-11PZ (0), OB-97-11PZ (1), OB-97-11PZ (4), OB-97-12PZ,

and all five of OB-97-13PZs. Each piezometer location had multiple nested piezometers at varying depths noted as piezometer 0 (deep) through 4 (shallow). Tetrachloroethene (PCE) concentrations above the MCL of 5 µg/L were also reported in samples collected from Monitoring Wells OB-97-07 (14 µg/L), OB-97-08 (8 µg/L), and OBHD-97-14 (11 µg/L).

- **December 1997** – Groundwater Sampling Event: Groundwater samples were collected from all monitoring wells, the hand-dug well, and the spring. Two surface water samples were also collected. The groundwater and surface water samples were analyzed for VOCs and SVOCs. Analytical results were reported in the *Data Summary Report for Groundwater Sampling and Groundwater Elevations at the Open Burn/Open Detonation Area, Fort Riley, Kansas* (LBA,1999). TCE concentrations above the MCL of 5 µg/L were reported for groundwater samples collected from Monitoring Wells OB-93-04 (15 µg/L), OB-97-07 (530 µg/L), OB-97-08 (110 µg/L), OBHD-97-14 (63 µg/L), and the hand dug well (110 µg/L). TCE concentrations above the MCL were also reported in the sample from the spring (110 µg/L). A PCE concentration above the 5 µg/L MCL was reported in the sample from Monitoring Well OB-97-07 (14 µg/L). The piezometer clusters were not sampled during this field effort.

- **April 1998** – Groundwater Sampling Event: Groundwater samples were collected from all monitoring wells, two spring locations, and five surface water locations. The groundwater and surface water samples were analyzed for VOCs and SVOCs. Analytical results were reported in the *Data Summary Report for Groundwater Sampling and Groundwater Elevations at the Open Burn/Open Detonation Area, Fort Riley, Kansas* (LBA, 1999). TCE concentrations above the 5 µg/L MCL were reported for samples collected from Monitoring Wells OB-93-04 (12.8 µg/L), OB-97-07 (223 µg/L), OB-97-08 (32.4 µg/L), and OBHD-97-14 (34.3 µg/L). TCE concentrations above the MCL were also reported for the spring (62.5 µg/L). A PCE concentration at the MCL of 5 µg/L was reported for the groundwater sample collected from Monitoring Well OB-97-07 (5 µg/L). The piezometer clusters were not sampled during this field effort.

- **August 1998** – Groundwater Sampling Event: Groundwater samples were collected from all monitoring wells, the spring, and five surface water locations. The groundwater and surfacewater samples were analyzed for VOCs and SVOCs. Analytical results were reported in the *Data Summary Report for Groundwater Sampling and Groundwater Elevation at the Open Burn/Open Detonation Area, Fort Riley, Kansas* (LBA, 1999). TCE concentrations above the MCL of 5 µg/L were reported for samples collected from Monitoring Wells OB-93-04 (14.1 µg/L), OB-97-07 (246 µg/L), OB-97-08 (65.3 µg/L), and OBHD-97-14 (89.6 µg/L). A TCE concentration above

the MCL was also reported for the sample collected from the spring (145 µg/L). The piezometer clusters were not sampled during this field effort.

- **January 1999** – Groundwater Sampling Event: Groundwater samples were collected from all monitoring wells, the spring, and four surface water locations. The groundwater and surface water samples were analyzed for VOCs and SVOCs. Analytical results were reported in the *Data Summary Report for Groundwater Sampling and Groundwater Elevations at the Open Burn/Open Detonation Area, Fort Riley, Kansas* (LBA, 1999). TCE concentrations above the MCL of 5 µg/L were reported for samples collected from Monitoring Wells OB-93-04 (13.1 µg/L), OB-97-07 (78.1 µg/L), OB-97-08 (9.3 µg/L), and OBHD-97-14 (49 µg/L). A TCE concentration above the MCL was also reported for the sample collected from the spring (51.4 µg/L). A concentration of cis-1,2-dichloroethene (cis-1,2-DCE) above the MCL of 70 µg/L was reported for the groundwater sample collected from Monitoring Well OBHD-97-14 (151 µg/L). The piezometer clusters were not sampled during this field effort.

- **June 1999** - Site Analysis Report: A site analysis was conducted regarding the geology, stratigraphy, structure, and hydrology of the OB/OD (OU 006). This information was presented in the *Analysis of Geological Stratigraphy, Structure, and Hydrology of the OB/OD Site, Fort Riley, Kansas* (Archer and Martin, 1999). This analysis included a historical report review, site reconnaissance in April, May, and August of 1998, an examination of existing rock cores, and an evaluation of hydrogeologic and analytical data from 1997 and 1998. It was concluded that the OB/OD (OU 006) is underlain by alternating Permian limestone and shale units with joints running east-northeast and north-northwest.

- **April 2003** – Auto Sampler Event: A surface water sample was collected on April 23, 2003, from an auto sampler located on the western ephemeral stream. The surface water sample wasanalyzed for VOCs. No VOCs were detected in this sample. This information was presented in the *Quality Control Summary Report April 2003 Surface Water Sampling Event, OB/OD Site, Fort Riley, Kansas* (Burns & McDonnell Engineering Company, Inc. [BMcD], 2003).

- **March 2004** – Auto Sampler Event: A surface water sample was collected on March 4, 2004, from an auto sampler located on the western ephemeral stream. The surface water sample was analyzed for VOCs. No VOCs were detected in this sample. This information was presented in the *Quality Control Summary Report March 2004 Surface Water Sampling Event, Open Burning/Open Detonation (Range 16), Fort Riley, Kansas* (Malcolm Pirnie (MP)-BMcD, 2004a).

- **August 2005** – Monitoring Well Installation: Monitoring Well OB-05-15 was installed down gradient of the active portion of Range 16 in the southwestern portion of the OB/OD (OU 006). Monitoring Well OB-05-15 is screened within the regolith with the bottom of the well setting on the Havensville Shale Member.

- **July 2006** – Direct-Push Investigation: Seven locations were pushed for the collection of groundwater samples for VOC analysis. Exceedances of the TCE MCL were reported for groundwater samples collected from Direct-Push Locations DP-3 (12.6 µg/L) and DP-5 (5.9 µg/L). Locations DP-8 through DP-11 were pushed south of the DP-7 location, but these locations were dry. Locations DP-1, DP-2, DP-4, and DP-6 were not probed because TCE had been detected at a down gradient location (MP-BMcD, 2007-2011).

- **2004 - 2011**– Groundwater Sampling Events: Groundwater samples were collected from the site monitoring wells with available sample volume and surface water locations during multiple sampling events. Samples were collected for one or more of the following analyses: VOCs, priority metals, perchlorate, natural attenuation parameters, and water quality parameters. Groundwater and spring samples were also collected for dioxins during the April 2004 sampling event. Analytical results were reported in the *Quality Control Summary Report April 2004 Sampling Event, Open Burning/Open Detonation (Range 16), Fort Riley, Kansas* (MP-BMcD, 2004b) and *Data Summary Reports for Groundwater, Spring, and Seep Sampling for Open Burn/Open Detonation Ground (Range 16) at Fort Riley, Kansas* (MP-BMcD, 2007-2011).

- **2011 - 2013** – RI Field Activities: The RI field activities included: monitoring well installation; piezometer abandonment; and the collection and analysis of soil, dry sediment, surface water, and groundwater samples for VOC, SVOCs, perchlorate, explosives, and metals. The findings of the RI field activities were reported in the *Remedial Investigation Report, Open Burning/Open Detonation Ground (Range 16), Operable Unit 006 at Fort Riley, Kansas* (The Louis Berger Group, Inc. [LBG]-BMcD, 2013) and are presented below.

    - **VOCs** – TCE and 1,1,2,2-tetrachloroethane (PCA) were the most common exceedances of the screening levels. Exceedances for these two VOCs are concentrated in the area of the metal debris pits for the surface and subsurface soil media, down gradient of the pits for the groundwater, and in the surface water at locations where the groundwater discharges to the surface water. Field screening results and laboratory results indicated the majority of TCE exceedances in soil were in the subsurface interval in the area of the metal debris pits, with the highest laboratory results at locations MD-25 (10 feet below ground surface [bgs]; 181 mg/kg) and ME-26 (11.5 feet bgs; 84.5 mg/kg). Within the area of the metal debris pits and directly up gradient of the soil VOC exceedances, there was an approximate 10 foot by 10

foot area that could not be sampled due to the indication of metal when sounded by a magnetic locator which could indicate the presence of munitions.

- **SVOCs** – There were no exceedances of SVOCs in the surface or subsurface soils. In groundwater, bis(2-ethylhexyl)phthalate was detected sporadically with two detections above the screening level and benzo(a)pyrene was detected once at a level slightly above the screening level.
- **Explosives** – There were no exceedances of explosives in any of the media sampled.
- **Perchlorate** – There were no exceedances of perchlorate in any of the media sampled.
- **Metals** – There were no exceedances of metals in any of the media sampled.

The *Feasibility Study Report, Open Burning/Open Detonation Ground (Range 16), Operable Unit 006 at Fort Riley, Kansas* (LBG-BMcD, 2014a), developed and evaluated remedial alternatives to allow for the selection of an appropriate remedy for remediating the contamination associated with the OB/OD (OU 006). The FS Report was accepted by the KDHE and USEPA on February 28, 2014, and July 23, 2014, respectively.

The *Proposed Plan, Open Burning/Open Detonation Ground (Range 16), Operable Unit 006, Fort Riley, Kansas* (LBG-BMcD, 2014b), was issued to inform the public of Fort Riley's, USEPA's, and KDHE's preferred remedy based on information in the RI and FS Reports. The intention was to solicit public comments pertaining to the remedial alternatives evaluated, including the preferred alternative. Submitted on June 9, 2014, the PP was accepted by the KDHE and USEPA on June 12, 2014, and June 30, 2014, respectively, with no comments, as presented in the Responsiveness Summary (Section 3.0 of this document).

2.3 Highlights of Community Participation

The RI/FS process was conducted in accordance with CERCLA requirements to document the comprehensive remedial activities and proposed remedial plan for the OB/OD (OU 006). Primary documents developed during the CERCLA process included the RI Report (containing the human health baseline risk assessment and ecological risk assessment), FS Report, and PP for the OB/OD (OU 006) (LBG-BMcD, 2013, 2014a, and 2014b, respectively). These reports were released to the public between September 2013, and June 2014, and have been made available for public review as part of the Administrative Record file at the Fort Riley PWE offices. The Administrative Record is the set of supporting information used to determine the preferred alternative. These reports were also made available to potentially affected persons and the public in the Hale Library, Kansas State University and Manhattan Public Library.

Notices of availability of these documents and the notice for the public meeting to discuss the PP were published in the Manhattan Mercury, and Junction City Daily Union newspapers on September 11, 2014, and the Fort Riley Post newspaper on September 12, 2014, and October 3, 2014. A public comment period for the PP was declared from September 10, 2014, through October 10, 2014, to provide a reasonable opportunity for comments and to disseminate information regarding the document. No comments were received from the public.

A public meeting was held at the Fort Riley PWE office, Building 407 Pershing Court, Fort Riley, Kansas at 7:00 pm local time on October 6, 2014, in conjunction with the Fort Riley Restoration Advisory Board (RAB) meeting to discuss the PP. At this meeting, representatives for the DA (Fort Riley), KDHE, and USEPA were available to inform the public about the OB/OD (OU 006) and the remedial options under consideration. The official transcript for the public meeting was recorded and transcribed verbatim by Sergeant First Class Garrett Harms, court reporter. There were no comments made by the public during the meeting.

2.4 Scope and Role of Operable Unit

As with many Superfund sites, the problems at Fort Riley are complex and are site-specific in nature. As a result, the DA (Fort Riley) and USEPA have organized the work into separate OUs. Fort Riley currently encompasses nine OUs located at the post. The OUs have been designated by the DA (Fort Riley) based on the results of prior investigations. The nine OUs include: the Southwest Funston Landfill Site (OU 001), the Pesticide Storage Facility Site (OU 002); the DCFA Site (OU 003); the FFTA – MAAF Site (OU 004); the 354 Area Site (OU 005); the OB/OD (OU 006); the CFI Site (OU 007); the SHSAR-IS Site (OU 008); and the CFLA2 Site (OU 009). The remedy selected by USEPA for each site includes landfill capping for the Southwest Funston Landfill Site (OU 001); capping, soil excavation, and removal for the Pesticide Storage Facility Site (OU 002); monitored natural attenuation (MNA) and ICs for the DCFA Site (OU 003); MNA and ICs for the FFTA – MAAF Site (OU 004); and MNA and ICs for the 354 Area Site (OU 005). The CFI Site (OU 007) and the CFLA2 Site (OU 009) are currently in the RI phase and the SHSAR-IS Site (OU 008) is currently in the ROD phase of the CERCLA process; therefore, remedies have not been selected/implemented for these OUs.

Contamination present in soil, groundwater, and surface water at the OB/OD (OU 006) is being addressed and is summarized in this ROD and other supporting documents. The OB/OD (OU 006) is a discrete area of contamination that does not affect or is not affected by the other OUs at the Fort Riley NPL site. The principal source of contamination at the OB/OD (OU 006) is TCE-contaminated soil located in the area of the metal debris pits (source area). The source area is likely contributing to the groundwater and surface

water contamination present at the site. Secondary threats at the OB/OD (OU 006) refer to the groundwater and surface water contaminants present at the site in excess of their respective remedial cleanup levels (calculated risk-based RGs and/or MCLs). The selected response action addresses the Remedial Action Objectives (RAOs) established for the OB/OB (OU 006). Refer to Sections 2.8 and 2.9 for more information on RAOs and remedial cleanup goals, respectively.

2.5 Site Characteristics

This section presents a discussion of the following: physical setting; climatology; demography; ecology; Conceptual Site Model (CSM); sampling strategy; known or suspected sources of contamination; affected media; location of contamination; and known routes of migration.

2.5.1 Physical Setting

2.5.1.1 Site Features

The topography of Fort Riley and the surrounding area consists of a low plain that has been eroded by streams and rivers. The area is designated as the Osage Plains section of the Central Lowlands physiographic province (Schoewe, 1949). Sedimentary bedrock strata dip gently to the west-northwest. East-facing escarpments of more resistant rock units are separated by gentle, westward sloping plains. The resulting topography can be divided into upland areas with bluffs along alluvial valleys, and lowland areas that consist of alluvial plains and associated terraces. The upland areas are dissected by numerous ephemeral, intermittent, and perennial streams; the lowlands areas occur along the banks of the major rivers in the area: the Republican, Smoky Hill, and Kansas Rivers (Jewett, 1941).

The geology of Fort Riley and the surrounding area consists of Pennsylvanian and Permian Age sedimentary rock overlain by eolian and fluvial deposits of Pleistocene and Recent Age (Jewett, 1941). The Nemaha Anticline is the prominent structural feature in the area, and Fort Riley is situated on the western limb of this fold within the Salina Basin (Merriam, 1963). Bedrock dips gently (approximately 30 feet per mile) to the west-northwest and consists of alternating beds of limestone and shale of the Permian Chase and Council Grove Groups. The Barneston Formation of the Chase Group (composed of the Fort Riley Limestone, Oketo Shale, and Florence Limestone Members) is the uppermost bedrock in the upland areas. This sequence of interbedded limestones and shales continues to depths of several hundred feet. The bedrock surface has been eroded by the major rivers and streams. The major streams tend to flow to the east and south due to topography. The rivers are broad, shallow, and slow-moving.

In the major river valleys, alluvial sand, silt, and gravel deposits reach a thickness of approximately one hundred feet near the rivers and decrease in thickness toward the margins of the floodplain. Alluvium and loess cover portions of the upland areas, including terraces underlain by Buck Creek terrace deposits (Fader, 1974). These terrace deposits include both alluvium and loess. Eudora and Kenesaw soils are developed throughout Fort Riley (Jantz et al., 1975). Eudora silt loams are well drained, have moderate permeability, and normally form in coarse, silty alluvium on high flood plains or low terraces.

2.5.1.2 Site-Specific Soil

The OB/OD (OU 006) is underlain by regolith (the layer of soil and loose rock overlying the bedrock) consisting of residual silty clays that grade into weathered bedrock. The regolith is composed of the Smolan silty loam and the Wymore silty clay loam (Jantz et al., 1975). The Smolan soils are commonly found in terrace and upland areas adjacent to the Kansas and Republican River valleys and are formed from loess deposits. The Wymore silt, also formed from loess deposits, is also found in the upland areas. Soils originating from the weathering of terrace bedrock formations are also found in the upland areas.

2.5.1.3 Site-Specific Geology

The OB/OD (OU 006) is underlain by an alternating sequence of limestone and shale of the Permian Chase and Council Grove Groups. Bedrock present at the OB/OD (OU 006) includes the Blue Springs Shale Member, Kinney Limestone Member, Wymore Shale Member, Schroyer Limestone Member, and Havensville Shale Member. The Threemile Limestone Member and Speiser Shale Member underlie the Havensville Shale Member. The bedrock at the OB/OD (OU 006) generally dips toward the southwest. The localized bedrock dip is slightly steeper toward the southwest in the eastern portion of the site, but levels out in the western portion of the site. Descriptions of the specific bedrock units encountered at the OB/OD (OU 006) are provided below.

- **Florence Limestone Member** – The Florence Limestone generally consists of a fossiliferous light to yellowish-gray limestone with chert and shale (Zeller, 1994). The Florence Limestone was not observed at the OB/OD (OU 006) during RI field activities but outcrops north of the study area.
- **Blue Springs Shale Member** – The Blue Springs Shale generally consists of a red to gray shale with minor amounts of limestone (Zeller, 1994). A description of the Blue Springs at the OB/OD (OU 006) Area is a greenish-gray to dark reddish-brown, dry, slightly-calcareous shale with a measured thickness of 21 feet. At the OB/OD (OU 006), the three detonation pits, two metal debris pits, and a portion of the north burn pit are located within the Blue Springs Shale Member.

- **Kinney Limestone Member** – The Kinney Limestone generally consists of two gray, fossiliferous, limestone beds separated by gray, fossiliferous shale (Zeller, 1994). The Kinney Limestone at the OB/OD (OU 006) is a pale-yellow, moist to wet, slightly-weathered, cherty limestone with an approximate thickness of 4 feet. A portion of the north burn pit is located within the Kinney Limestone Member.

- **Wymore Shale Member** – The Wymore Shale consists of gray and yellowish-gray shale with varicolored red, green, and purple beds, and limestone and fossiliferous beds in the lower portions (Zeller, 1994). The Wymore Shale at the OB/OD (OU 006) is a gray to greenish-gray, calcareous shale that is wet in the upper zone, dry in the middle portion, and moist to wet in the lower portion. The Wymore has an approximate thickness of 25 feet. The south burn pit and spring are located within the Wymore Shale Member.

- **Schroyer Limestone Member** – The Schroyer Limestone consists of a chert-bearing, light-gray to nearly white limestone with a 3-foot, non-cherty section in the upper portion (Zeller, 1994). The Schroyer at the OB/OD (OU 006) is a wet, crystalline, medium-hard to dense, gray to pale-yellow limestone with an average thickness of 9 feet. A majority of the western ephemeral stream and the southern portion of the eastern ephemeral stream lie in the Schroyer Limestone Member.

- **Havensville Shale Member** – The Havensville Shale consists of gray calcareous shale with thin limestone beds (Zeller, 1994). The Havensville Shale at the OB/OD (OU 006) is a dark gray, dry, calcareous, subplaty shale with an average thickness of 15 feet. The Havensville underlies the southern portion of the OB/OD (OU 006).

- **Threemile Limestone Member** – The Threemile Limestone consists of a light-gray to nearly white limestone with chert-bearing zones. Massive non-cherty beds are located in the middle and lower portions of the member (Zeller, 1994). The Threemile Limestone at the OB/OD (OU 006) is a dark gray limestone with interbedded shales with a measured thickness of 12 to 20 feet.

- **Speiser Shale** – The Speiser Shale consists of fossiliferous shale underlain by a limestone in the upper portion of the unit while the remainder of the unit is composed of varicolored beds with red as the predominant color (Zeller, 1994). The Speiser Shale has a measured thickness of 15 to18 feet.

Three cross sections for the OB/OD (OU 006) were constructed using geologic logs produced during various field activities since 1993. Figure 2-4 indicates where the three cross sections cut the site. Cross Section A to A' cuts east west through the northern portion of the OB/OD (OU 006). As shown on Figure

2-5, topography and the underlying bedrock surface slope to the south and to the west. The uppermost bedrock is the Kinney Limestone Member on the eastern portion of the cross section and the Havensville on the western portion. Cross Section B to B' cuts the OB/OD (OU 006) area from the northeast to the southwest (see Figure 2-5). As seen on this figure the metal debris pit is located between OB-97-09PZ and OB-97-11PZ and is up gradient from the spring. As seen on this cross section, the thickness of the Kinney Limestone Member is thickening locally to the southwest. Cross Section C to C' cuts the site from the north to the south (see Figure 2-6). As seen on this cross section, the Schroyer Limestone Member is bisected by the east ephemeral stream.

2.5.1.4 Site-Specific Hydrogeology

Groundwater at the OB/OD (OU 006) is present from up gradient aquifer recharge and through precipitation. Precipitation that falls on the site infiltrates downward through the soil into the underlying bedrock. During rain events, overland flow also occurs from the higher elevation portions of the site to the two ephemeral streams located to the east and west of the site. Groundwater moves horizontally along bedding planes in the shale and limestone formations and vertically through joints and fractures. Joint sets running east northeast and north northwest are present at the site in the bedrock. Additional fractures are also possible at the site due to the historical and continued use of the site as a range for detonation of explosives. Spring and wet weather seeps are present at the OB/OD (OU 006). The wet weather seeps, which are located within or near the drainage areas, produce water mainly after heavier precipitation events. The spring produces water on a more consistent basis; however, it is more commonly dry than flowing.

Groundwater at the OB/OD (OU 006) is found mainly within two horizons, the regolith/weathered bedrock horizon and the Threemile Limestone Member. Groundwater typically flows toward the south southwest within the regolith. Hydraulic conductivity testing at Monitoring Well OB-05-15, which is screened within the regolith, resulted in a conductivity value of 4.05×10^{-3} centimeters per second (cm/sec) and at Monitoring Well OB-97-06, which is screened within the Schroyer Limestone Member, resulted in a conductivity value of 5.30×10^{-2} cm/sec (LBG-BMcD, 2013).

Groundwater within the Threemile Limestone has a significantly lower piezometric level, as shown in Monitoring Wells OB-93-03, OB-93-04, OB-12-19D, and OB-12-20D. Hydraulic conductivity testing at Monitoring Well OB-12-19D resulted in a conductivity value of 7.30×10^{-2} cm/sec (LBG-BMcD, 2013).

2.5.1.5 Site-Specific Surface Water Drainage

During rainfall events, surface runoff from the surrounding area travels into one of the two ephemeral streams bordering the OB/OD (OU 006) on the east and west based on topographic elevation. These two ephemeral streams join approximately 1,500 feet south of the OB/OD (OU 006). This ephemeral stream intercepts the Threemile Creek approximately 3,700 feet south of the site and eventually enters the Kansas River to the southeast.

Surface water in the ephemeral streams generally occurs following precipitation events. During these events, surface water flows in the stream bed while precipitation infiltrates the overlying regolith and migrates into bedrock through fractures, joints, and bedding planes. Where the bedrock outcrops along the stream beds, temporary seeps are developed which allow water to seep from the outcropping bedrock into the streams. Following the precipitation events, the stream flow gradually reduces until flow no longer occurs and ponded areas are formed, which eventually dry up. Additionally, seeps and springs dry up when there is no longer any infiltration to support a continuing flow. Examples of this are the spring located at the base of the Kinney Limestone and the seeps along the western ephemeral stream located within the outcropping Schroyer Limestone.

2.5.2 Climatology

The average temperature for the area (measured at Station 144972, located at Manhattan, Kansas) is 55 degrees Fahrenheit (ºF). Temperature extremes range from a record low of -31 ºF (January 1947) to a record high of 116 ºF (August 1936). Annual precipitation from 1893 through 2012 ranged from a minimum of 15.42 inches to a maximum of 60.38 inches, with an average of approximately 33 inches per year. The maximum 24-hour rain event during the same period was reported at 6.28 inches. Annual precipitation for 2010, 2011, and 2012 was 33.34, 33.05, and 21.88 inches, respectively. Average annual snowfall is approximately 18 inches, with a maximum annual snowfall during the reporting period of 49.5 inches in 1960. The maximum 24-hour snowfall event during this same period was reported at 18 inches (High Plains Regional Climate Center, 2013). Pan evaporation, measured by the USACE at Tuttle Creek Lake north of Manhattan, averaged 47.13 inches/year between 1980 and 1997, with extremes of 37.39 inches/year and 58.66 inches/year. Prevailing wind directions are variable. Winds are predominantly from the south and southwest during March through December, and winds are predominantly from the north during the months of January and February. Wind speeds generally range from seven to ten miles per hour (personal communication, First Weather Group, Detachment 8, Fort Riley MAAF, 1998).

2.5.3 Demography

The lands surrounding OB/OD (OU 006) consist of undeveloped wooded and grassy lands. No residential or commercial structures exist near the site. The only personnel within a 1-mile radius of OB/OD (OU 006) are US Army personnel. Access to the Impact Area is severely restricted due to the nature of the training. Access to OB/OD (OU 006) is limited to EOD/Range personnel during detonation of ordnance and maintenance.

In addition to the other cantonment areas of Fort Riley (all of which are within eight miles of the OB/OD (OU 006)), the following towns are within fifteen miles of the OB/OD (OU 006): Junction City and Grandview Plaza (to the south) and Ogden (approximately seven miles to the southeast). The approximate populations of the surrounding major towns are: Junction City (23,353), Grandview Plaza (1,560), and Ogden (2,087) (United States Department of Commerce, 2010).

2.5.4 Ecology

Fort Riley lies within a transitional zone between deciduous forests of Eastern Kansas and the grass prairies of the Great Plains. The area supports a wide variety of wildlife, adapted to a variety of habitat types. Habitat types found throughout Fort Riley consist of a mosaic of upland and riparian woodland, cropland, tall grass prairie, pasture/hayfield, revegetated grassland, and lawn based upon previous investigations performed. The Kansas River provides additional wildlife habitat.

The Fort Riley PWE Conservation Branch has identified 28 listed and rare species that have been identified or could potentially exist in the Fort Riley area. A list of these species is provided on Table 2-2. Many of the species have recently been documented at Fort Riley.

Habitat types found at the OB/OD (OU 006) consist of woodland areas near the banks of the ephemeral streams and grasslands with low lying plants comprising most of the active portion of the site. No known rare or endangered species inhabit the OB/OD (OU 006) site area.

2.5.5 Conceptual Site Model

Figure 2-7 and 2-8 presents the human health and ecological CSMs for the OB/OD (OU 006). Reasonable exposure scenarios were developed based on how the OB/OD (OU 006) is currently used and assumptions about its future use and physical site features.

2.5.6 Sampling Strategy

A number of field investigations have been conducted at the OB/OD (OU 006). These investigations, beginning in 1993, included collection and chemical analysis of soil, dry sediment, groundwater, and surface water samples. Monitoring wells were also installed and sampled at the OB/OD (OU 006). The data substantiate that VOCs and SVOCs are present in one or more of the soil, groundwater, and surface water media at the OB/OD (OU 006). Details regarding the historical sampling events are discussed in Section 2.2 and presented on Table 2-1.

2.5.7 Known or Suspected Sources of Contamination

The principal source of contamination at the OB/OD (OU 006) is the TCE-contaminated soil located in the area of the metal debris pits (source area). The source area is likely contributing to the groundwater and surface water contamination present at the site. There is no known historical or current use of solvents or knowledge of solvent disposal at the OB/OD (OU 006).

2.5.8 Types of Contamination, Affected Media, Location of Contamination, and Known Routes of Migration

COCs that were identified in subsurface soil, groundwater, and/or surface water at the OB/OD (OU 006) in the RI Report included VOCs and SVOCs (LBG-BMcD, 2013).

Surface and subsurface soil, dry sediment, surface water and groundwater samples were collected from the OB/OD (OU 006) during RI field activities and analyzed for VOCs, SVOCs, perchlorate, explosives, and metals. The results of the analyses were compared to appropriate screening levels (see Table 2-3). Nature and extent of contaminants at the OB/OD (OU 006) are summarized below:

- **VOCs** – Exceedances of TCE were detected in subsurface soil. Exceedances of PCA, naphthalene, and TCE were detected in groundwater. Exceedances of PCA and TCE were detected in surface water.
- **SVOCs** – Exceedances of bis(2-ethylhexyl)phthalate and benzo(a)pyrene were detected in groundwater. Surface water had one exceedance of benzo(a)pyrene.
- **Explosives** – There were no exceedances of explosives in any of the media sampled.
- **Perchlorate** – There were no exceedances of perchlorate in any of the media sampled.
- **Metals** – There were no exceedances of metals in any of the media sampled.

Screening levels used and results of detected analytes for soil, dry sediment, surface water, and groundwater are presented in Tables 2-3 through 2-12. Soil, groundwater, and surface water detections which exceed their respective remedial cleanup levels are shown on Figures 2-9 through 2-15.

Soil

The metal debris pits, located in the north central portion of the site, were identified in the RI Report as the probable contaminant source area. Within this area, soil results are the highest in the eastern portion of the metal debris pits near the area with a metallic signature. VOCs are present within both the surface and subsurface soil in this area. VOC results for soil samples directly down gradient of this area are higher for the deeper soils near the bedrock interface (see Figures 2-9 and 2-10). TCE exceedances in soil are near or immediately down gradient of the metal debris pits as shown on Figures 2-9 and 2-10. Based on the data from the RI, it is estimated that approximately 7,500 cubic yards of TCE-impacted soil are present at the site above the calculated risk-based RG of 10.72 mg/kg. Due to the presence of a metallic signature, the central portion of the northern metal debris pit was not sampled for chemical analysis. Based upon the pattern of contamination detected, it is probable that the soil within this area also has exceedances (LBG-BMcD, 2014a).

Groundwater

Groundwater within this area is primarily recharged through precipitation. Precipitation is transported along the ground surface via overland flow and also migrates downward by infiltration and percolation through micro- and macro-fractures within the regolith. Following infiltration and percolation, precipitation then moves downward by preferential and non-preferential pathways into the weathered bedrock mass through fractures and joints. As the infiltrated precipitation moves through the VOC-contaminated soil, the water dissolves and transports the VOCs. The VOC-impacted fluids migrate downward into the uppermost groundwater surface located within the regolith and weathered bedrock at the OB/OD (OU 006). Results from groundwater samples indicate that the VOCs are migrating down gradient within this aquifer and also downward into the lower aquifer in some locations.

Vertically, groundwater contamination at the OB/OD (OU 006) extends from the regolith/weathered bedrock aquifer down to the lower aquifer (Threemile Limestone) as depicted on the geologic cross sections (see Figures 2-4, 2-5, and 2-6). Horizontally, groundwater contamination at the OB/OD (OU 006) extends down gradient (southwest) from the metal debris pits toward the western ephemeral stream as shown on Figures 2-11, 2-12, 2-13, and 2-14. The TCE groundwater contamination plume as shown on Figures 2-11 and 2-13 encompasses an area of approximately 17 acres. The PCA groundwater contamination plume shown on Figures 2-12 and 2-14 encompasses an area of approximately 7.5 acres.

The TCE and PCA concentrations exceeding remedial cleanup levels (5 µg/L for TCE [MCL] and 2.55 µg/L for PCA [calculated risk-based RG]) extend to the south and west of the presumed source area, with concentrations declining with distance away from the presumed source area (LBG-BMcD, 2014a).

Surface Water

During periods of heavier precipitation, wet weather seeps (including the spring) flow as the fracture and joint network within the weathered bedrock mass reach maximum pore volume/fracture aperture capacities. This allows wet weather features like ephemeral streams, springs, and seeps to flow and weep. Samples collected from the seeps, spring, and the western ephemeral stream located during wetter weather conditions down gradient of the soil source contain chlorinated VOCs as found in the soil and groundwater samples. This flow path along the top of more resistant units in the soil/weathered bedrock interface is also the probable source of the VOC detections within the deeper soils near the bedrock interface located down gradient of the metal debris pits (see Figure 2-15).

Historically, the only detection (benzo(a)pyrene) in surface water that exceeded its RG was collected at Stream-11. Benzo(a)pyrene exceeded its calculated risk-based RG of 0.0374 µg/L in December of 2011. (LBG-BMcD, 2013).

Water in the spring is only present part time, generally in the spring when groundwater elevations are higher or following large precipitation events, and thus appears linked to fluctuations in the groundwater. With respect to benzo(a)pyrene, the exceedance at the Stream-11 location, water has only been observed once in the eastern ephemeral stream and has not been replicated during previous or subsequent events. Because of the variable nature of the surface water at the OB/OD (OU 006) and its apparent link to groundwater, especially at the spring, it is not possible to estimate the area and volume of surface water exceeding calculated risk-based RGs (LBG-BMcD, 2014a).

2.6 Current and Potential Future Site and Resource Uses

2.6.1 Land Uses

The OB/OD (OU 006) is part of the Fort Riley reservation and is not zoned by Riley County. The OB/OD (OU 006) is currently used for open detonation to destroy UXO. The lands surrounding OB/OD (OU 006) consist of undeveloped wooded and grassy lands. No residential or commercial structures exist near the site. Land use at the OB/OD (OU 006) is classified as “training/ranges” under the Fort Riley RPMP (Black & Veatch, 2007), and it is anticipated that land use activities will remain unchanged into the foreseeable future.

2.6.2 Water Uses

OB/OD (OU 006) is located in an isolated part of Fort Riley. This area is part of the Impact Area for weapons training at Fort Riley and access is restricted by the US Army due to the nature of the training. The only personnel within a 1-mile radius of OB/OD (OU 006) are US Army personnel. Access to the OB/OD (OU 006) is limited to EOD/Range personnel during detonation of ordnance and maintenance. The two streams that border the site on the east and west sides are classified as ephemeral streams as these streams are dry except during precipitation events.

A water supply well is located on the military reservation at Range 18, approximately 4,200 feet toward the east, up gradient of OB/OD (OU 006). This well is only used for non-potable purposes. A potable water supply well is also located on the former Range 19, approximately 5,000 feet to the east and up gradient of the OB/OD (OU 006). No other supply wells are located on or within one mile of the site. The nearest potable public water supply well is the City of Ogden well field located approximately three miles away to the southeast and screened in the Kansas River alluvium. Based on the Fort Riley RPMP, the mission for OB/OD (OU 006) will not change for the foreseeable future and water at Range 16 will not be used for either potable or non-potable purposes. ICs will prohibit the installation of water supply wells at the OB/OD (OU 006) or affected down gradient, until remediation is complete.

2.7 Summary of Site Risks

The BLRA (human health and ecological risk assessments) that was completed for the OB/OD (OU 006) in 2013, determined that chemicals present at the OB/OD (OU 006) in soil, groundwater, and surface water could pose risks to human health, but are not thought to pose risk to ecological receptors. The DA's (Fort Riley) remedy decision is based on the presence of site-related contaminants in the soil, groundwater, and surface water that exceed their respective remedial cleanup levels (calculated risk-based RGs and MCLs). The potential risks to human health provide the basis for remedial action at the OB/OD (OU 006). The response action selected in this ROD is necessary to protect human health and the environment. The following subsection of the ROD summarizes the human health and ecological risk assessments that were conducted as part of the RI at the OB/OD (OU 006).

2.7.1 Summary of Human Health Baseline Risk Assessment

The human health baseline risk assessment estimates what risks the site poses to humans if no action were taken. The results of the baseline risk assessment generally determine if an unacceptable risk exists and provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This subsection provides a brief summary of the four primary

components of the human health baseline risk assessment: identification of COCs, the exposure assessment, the toxicity assessment, and the risk characterization. Details regarding each of these components can be found in Section 6 of the RI Report (LBG-BMcD, 2013).

2.7.1.1 Identification of Chemicals of Concern

At the start of the risk assessment process, all data are reviewed and chemicals of potential concern (COPCs) are selected, usually by comparing risk-based screening values to site concentrations of contaminants. In general, if site concentrations of contaminants exceeded their respective screening concentrations, then the contaminants were retained as COPCs for further evaluation in the risk assessment. COCs, on the other hand, are those chemicals, at the end of the risk assessment process, that exceed target health goals and are also the risk drivers upon which remedial actions should be focused in order to reduce concentrations to the point where human health and/or ecological receptors are protected from the COCs.

Based on the results of the human health baseline risk assessment performed, the following chemicals were selected as COCs at the OB/OD (OU 006):

Soil

TCE

Groundwater

PCA Naphthalene TCE Benzo(a)pyrene bis(2-ethylhexyl)phthalate

Surface Water

PCA TCE Benzo(a)pyrene

The results of detected analytes for soil, dry sediment, surface water, and groundwater are presented in Tables 2-4 through 2-12.

2.7.1.2 Exposure Assessment

Health risks may occur when there is contact with a chemical by a receptor population. Exposed populations must then either ingest, inhale, or dermally absorb COCs to complete an exposure pathway and possibly experience a health risk, as shown in the human health CSM, presented in Figure 2-7. The risk assessment evaluated potential exposures to current and future site worker and current and future demolition worker. Based on the human health CSM, the potentially completed exposure pathways evaluated for each population as presented in the RI Report are as follows:

- **Current Site Worker** – The current site worker population was assumed to consist of workers engaged in regular site maintenance activities, as well as ordnance disposal. Since most common maintenance activities would not include subsurface excavation, it was assumed that current site workers would not directly contact subsurface media. Given the presence of VOCs and SVOCs in soil, inhalation of chemical vapors in outdoor air was considered a potentially completed pathway.

  Contact with contaminated surface water is possible if site activities are conducted in the spring and/or streams. Contact with surface water could lead to chemical absorption through dermal contact and inhalation of chemical vapors in outdoor air. Therefore, contact with surface water was considered a potentially completed pathway.

  In summary, the potentially completed exposure pathways for the current site worker include: inhalation of outdoor vapors from soil; absorption through dermal contact with surface water; and inhalation of outdoor vapors from surface water.

- **Future Site Worker** – The future site worker population was assumed to consist of workers engaged in regular site maintenance activities, as well as ordnance disposal. Since most common maintenance activities would not include subsurface excavation, it was assumed that future site workers would not directly contact subsurface media. Given the presence of VOCs and SVOCs in soil, inhalation of chemical vapors in outdoor air was considered a potentially completed pathway.

  Contact with contaminated surface water is possible if site activities are conducted in the spring and/or streams. Contact with surface water could lead to chemical absorption through dermal contact and inhalation of chemical vapors in outdoor air. Therefore, contact with surface water was considered a potentially completed pathway. Contact with contaminated groundwater is considered unlikely and unrealistic due to the implementation of prohibitions on the installation of groundwater wells per ICs and the Installation Master Plan.

  In summary, the potentially completed exposure pathways for the future site worker are: inhalation of outdoor vapors from soil, absorption through dermal contact with surface water; inhalation of outdoor vapors from surface water.

- **Current and Future Demolition Worker** – Current and future demolition workers could be present if trenching and/or digging activities are required at the site, and could directly contact

contaminated shallow and subsurface soil. Direct contact with soil could lead to incidental ingestion of soil and chemical absorption through dermal contact. Digging activities could disturb soils and generate fugitive dusts that could be inhaled. Therefore, direct contact with soil was considered a potentially completed pathway. Given the presence of VOCs and SVOCs in soil and groundwater, inhalation of chemical vapors in outdoor air was considered a potentially completed pathway.

Contact with contaminated surface water is possible if trenching and/or digging activities are conducted in the spring and/or streams. Contact with surface water could lead to chemical absorption through dermal contact and inhalation of chemical vapors in outdoor air. Therefore, contact with surface water was considered a potentially completed pathway. Although the average depth to groundwater at the site (30.25 feet bgs) is deeper than what would normally be contacted during demolition work, several monitoring wells at the site have groundwater elevations shallower than 15 feet bgs (a typical demolition depth). Therefore, there is potential for current/future demolition workers to directly contact impacted groundwater. Additionally, contact with contaminated groundwater is possible via ingestion if a potable water supply well is installed at the site in the future.

In summary, the potentially completed exposure pathways for the current and future demolition worker are: incidental ingestion of shallow and subsurface soil; absorption through dermal contact with shallow and subsurface soil; inhalation of fugitive dust from shallow and subsurface soil; inhalation of outdoor vapors from soil and/or groundwater; absorption through dermal contact with surface water; inhalation of outdoor vapors from surface water; ingestion of groundwater as a drinking water source; and absorption through dermal contact with groundwater.

The potential for human health risk due to exposure to chemicals at the site was considered for soil, groundwater, and surface water media.

In situations when an upper confidence limit (UCL) exceeds the maximum, which tends to happen when there are not a large number of samples collected, it is common practice (both by DOD, EPA and their contractors) to sometimes use the maximum.

The maximum detected concentrations and the 95% UCLs are shown in Tables 2-13 through 2-16, with the values used in calculations specified. Exposure concentrations were based on actual data from the

OB/OD (OU 006). Intake assumptions were based on USEPA guidance and are described in detail in the RI Report (LBG-BMcD, 2013). Major assumptions used to calculate intake are presented below:

- **Current Site Worker** – Inhalation of outdoor vapors from soil and/or groundwater, absorption through dermal contact with surface water, and inhalation of outdoor vapors from surface water.
  - Body Weight – 70 kilograms (kg)
  - Skin Surface Area – 3,330 square centimeters (cm2)
  - Event Frequency for Dermal Contact with Surface Water – 1 event per day
  - Exposure Time, Exposure Frequency, and Exposure Duration - Considered a regular full-time worker at the OB/OD (OU 006) 8 hours a day, 250 days per year, for 25 years
- **Future Site Worker** – Inhalation of outdoor vapors from soil and/or groundwater, absorption through dermal contact with surface water; inhalation of outdoor vapors from surface water; ingestion of groundwater as a drinking source; absorption through dermal contact with groundwater; and inhalation of vapors from groundwater use.
  - Body Weight – 70 kg
  - Skin Surface Area – 3,300 cm2
  - Event Frequency for Dermal Contact with Groundwater and Surface Water – 1 event per day
  - Exposure Time, Exposure Frequency, and Exposure Duration - Considered a regular full-time worker at the OB/OD (OU 006) 8 hours a day, 250 days per year, for 25 years
  - Ingestion Rate for Water – 2 liters per day (L/day)
  - Volatilization Factor from Water Use – 0.5 liters per cubic meter (L/m3)
- **Current and Future Demolition Worker** – Incidental ingestion of shallow and subsurface soil; absorption through dermal contact with shallow and subsurface soil; inhalation of fugitive dust from shallow and subsurface soil; inhalation of outdoor vapors from soil and/or groundwater; absorption through dermal contact with surface water; inhalation of outdoor vapors from surface water; ingestion of groundwater as a drinking water source; and absorption through dermal contact with groundwater.
  - Body Weight – 70 kg
  - Skin Surface Area – 3,300 cm2

- Soil to Skin Adherence Factor – 0.3 milligrams per square centimeters (mg/cm2)
- Event Frequency for Dermal Contact with Groundwater and Surface Water – 1 event per day
- Exposure Time, Exposure Frequency, and Exposure Duration - Considered a regular full-time worker at the OB/OD (OU 006) 8 hours a day, 120 days per year, for 1 year
- Ingestion Rate for Soil – 330 mg/kg
- Particulate Emission Factor – cubic meter per kilogram (m3/kg)
- Ingestion Rate for Water – 2 L/day
- Variable Fraction of Soil Ingested from Contaminated Source - 1

2.7.1.3 Toxicity Assessment

The toxicity of COCs is evaluated for both carcinogenic potential and non-carcinogenic adverse health effects. Data regarding health effects are then used by various agencies to derive numerical toxicity values. The USEPA gathers toxicological information from a variety of sources including experimental animal studies, epidemiological investigations, and clinical human studies. Well-conducted epidemiological studies that show a positive correlation between an agent and a disease represent the most convincing evidence about human risk. At present, human data adequate to serve as the sole basis for the development of toxicity values are available for only a few chemicals. In most cases where there are insufficient direct human data, USEPA uses toxicity information developed from experiments conducted on non-human mammals such as rats, mice, dogs, or rabbits.

Toxicity values were compiled following the USEPA's Memorandum *Human Health Toxicity Values in Superfund Risk Assessments* (USEPA, 2003). The primary source of toxicological information for this report was the USEPA-sponsored *Integrated Risk Information System (IRIS)* (USEPA, 2013a). If toxicity values were not found in IRIS, the USEPA National Center for Environmental Assessment's list of Provisional Peer-Reviewed Toxicity Values was consulted for provisional information. If neither of these sources provided toxicity values, other state or federal agencies were consulted.

2.7.1.4 Risk Characteristics

The non-carcinogenic risk value, the hazard quotient (HQ), represents the ratio of the chemical specific intake rate to the toxicity value for that chemical. HQs are summed within each pathway and then for all pathways for a total hazard index (HI). If the total HI is not more than one, it is unlikely for even sensitive populations to experience adverse health effects within the described scenario. Tables 2-17, 2-18, and

2-19 show the intakes, reference values, and HQs for the current and future site worker and current and future demolition worker at the OB/OD (OU 006).

Carcinogenic risk represents the probability of developing cancer as a result of exposure to a given chemical. The chemical-specific risks are summed within each pathway and then for all pathways to yield total excess cancer risk posed by a site. This represents the probability of developing cancer that is solely attributable to exposure from the site and is in excess of the general background risk. USEPA has established the risk range of one in 10,000 to one in a million (1E-04 to 1E-06 in scientific notation) as a commonly-accepted remediation goal. An excess, lifetime, cancer risk greater than one in 10,000 would generally be considered above the CERCLA cancer risk range, while risks within the range would be acceptable depending upon site use. Risks of one in a million or less are generally considered insignificant. Tables 2-20, 2-21, and 2-22 show the intakes, slope factors, and the excess, lifetime, cancer risk associated with chemical exposure for the current and future site worker and current and future demolition worker at the OB/OD (OU 006).

A summary of the human health baseline risk assessment non-carcinogenic and carcinogenic risk results are presented on Table 2-23. The following HIs exceed the USEPA acceptable risk level of one:

- Future site worker ingestion of groundwater (HI = 10);
- Future site worker inhalation of vapors from groundwater use (HI = 4);
- Current/Future demolition worker inhalation of outdoor vapors (HI = 17); and
- Current/Future demolition worker ingestion of groundwater (HI = 11).

The following carcinogenic risk values exceed the USEPA risk management range of 1E-04 to 1E-06:

- Current site worker dermal contact with surface water (6E-04);
- Future site worker dermal contact with surface water (6E-04);
- Future site worker ingestion of groundwater (2E-04); and
- Future site worker dermal contact with groundwater (3E-04).

Please note that the tables show that the non-carcinogenic HIs exceed the USEPA acceptable level for the future site worker and current and future demolition worker exposure scenarios evaluated, but not the current site worker. The carcinogenic risk values did exceed the USEPA acceptable range for the current and future site worker exposure scenarios evaluated, but not the current and future demolition worker.

2.7.1.5 Uncertainties

Conducting a risk assessment requires making a number of assumptions that serve to introduce degrees of uncertainty in the final result. Uncertainties are inherent in the chemical identification, toxicity assessment, and exposure assessment processes. However, the cumulative effect is generally that risk has been overestimated, not underestimated. Section 6.6 of the RI Report (LBG-BMcD, 2013) provides a detailed discussion of the uncertainties and their potential effect on the risk assessment.

2.7.2 Summary of Ecological Risk Assessment

The purpose of the ecological evaluation was to assess possible adverse effects to ecological receptors that may come in contact with contaminated media. Qualitative observations, calculated exposure estimates, and best professional judgment were used to determine whether further evaluation of ecological risk is necessary (LBG-BMcD, 2013).

Chemicals that may elicit adverse effects to ecological receptors or that had detection limits above the ecological screening level for that chemical are considered chemicals of potential ecological concern (COPECs).

The following constituents were detected in surface soils above applicable USEPA ecological screening levels for soils and selected as COPECs for surface soils.

- PCA
- 2,4-Dinitrotoluene
- 2,6-Dinitrotoluene
- Di-n-butyl phthalate
- N-Nitrosodiphenylamine
- Antimony
- Cadmium
- Chromium
- Copper
- Lead
- Nickel
- Selenium
- Thallium
- Zinc

The following constituents were detected in surface soils and selected as a COPEC for surface soils due to a lack of an applicable ecological screening level.

- 1,2,4-Trimethylbenzene
- Isopropylbenzene
- Perchlorate
- 4-Amino-2,6-dintirotoluene

- p-Isopropyltoluene
- sec-Butylbenzene
- tert-Butylbenzene
- 4-Nitrotoluene
- Nitroglycerin

The following constituents, were detected in surface soil samples, did not exceed USEPA ecological screening levels for soils, but were selected as COPECs for surface soils because they are bioaccumulative.

- Arsenic
- Mercury

The following constituents were detected in subsurface soils above applicable USEPA ecological screening levels for soils and selected as COPECs for subsurface soils.

- PCA
- cis-1,2-DCE
- TCE
- Antimony
- Cadmium
- Chromium
- Copper
- Lead
- Nickel
- Selenium
- Thallium
- Zinc

The following constituent was detected in subsurface soils and selected as a COPEC for subsurface soil due to a lack of an applicable ecological screening level.

- Perchlorate

The following constituents, were detected in subsurface soil samples, did not exceed USEPA ecological screening levels for soils, but were selected as COPECs for subsurface soils because they are bioaccumulative.

- Arsenic
- Mercury

The following constituents were detected in surface water above applicable USEPA ecological screening levels for water and selected as COPECs for surface water.

- TCE
- Copper

- Benzo(a)pyrene
- bis(2-ethylhexyl) phthalate
- Lead
- Mercury

The following constituent was selected as a COPEC for surface water due to a lack of an applicable ecological screening level.

- Perchlorate

The following constituents, were detected in surface water samples, did not exceed USEPA ecological screening levels for water, but were retained as COPECs for surface water because they are bioaccumulative.

- Nickel
- Selenium
- Zinc

The following constitutes were detected in sediments above applicable USEPA ecological screening levels for sediment and selected as COPECs for sediments.

- Beryllium
- Cadmium
- Copper
- Nickel
- Selenium

The following constituents, were detected in sediment samples, did not exceed USEPA ecological screening levels for water, but were selected as COPECs for sediments because they are bioaccumulative.

- Antimony
- Arsenic
- Chromium
- Lead
- Mercury
- Zinc

COPECs were evaluated and compared to toxicological benchmarks in the preliminary semi-quantitative screening.

Ecological surveys were conducted at the OB/OD (OU 006) to identify any wildlife or potential habitat affected by site-related constituents. The entire OB/OD (OU 006) was evaluated for the presence of completed ecological exposure pathways. Based on the site visit, it was concluded that flora and fauna

could be exposed to site-related constituents through direct contact and/or ingestion of soil, surface water, and sediments and that area fauna could be exposed through the bioaccumulation of site-related constituents in benthic invertebrates, aquatic and terrestrial invertebrates, aquatic and terrestrial plants, small mammal prey, and fish. No significant effects were observed during the ecological surveys.

Based on the available habitat at the OB/OD (OU 006), wildlife receptors potentially present were identified and compared to a list of species for which benchmarks have been established. Benchmarks for the receptors were obtained from the Oak Ridge National Laboratories' (ORNL) *Toxicological Benchmarks for Wildlife: 1996 Revision* (ORNL, 1996) and the USEPA ECOTOX Database (USEPA, 2013b). Natural history characteristics (See Tables 2-24, 2-25, and 2-26) used to calculate exposures were obtained from the *Wildlife Exposure Factors Handbook Vol. I & II* (USEPA, 1993a), Preliminary Remediation Goals for Ecological Endpoints (Efroymson et. al., 1997), *Toxicological Benchmarks for Wildlife: 1996 Revision* (ORNL, 1996), and *The Wild Mammals of Missouri* (Schwartz and Schwartz, 1981).

Factors affecting wildlife exposure may include home range size; the amount of time a given species spends in a given area; bioavailability; and food, water, soil, and sediment ingestion rates. Assumptions were made regarding receptor species with home ranges larger than the OB/OD (OU 006). Smaller receptor species with home range areas less than the total area of the OB/OD (OU 006) and sessile receptor species such as terrestrial and aquatic plants were assumed to spend 100 percent of their time within the OB/OD (OU 006). It was assumed that all of the chemical ingested or absorbed by the representative wildlife or plant species was absorbed into the organism's tissue (100 percent bioavailability for each chemical detected at the OB/OD (OU 006)).

Currently, the OB/OD (OU 006) is being used as an ordnance disposal area with plans to continue to use the site as an ordnance disposal area. The OB/OD (OU 006) consists of managed and unmanaged grasslands with open riparian corridors occurring along the two ephemeral stream drainages along the western, eastern and southern edges of the OB/OD (OU 006). The lands surrounding OB/OD (OU 006) consist of undeveloped wooded and grassy lands. The current disturbed nature of the OB/OD (OU 006)

is unlikely to attract populations of rare or protected species. Common wildlife species that are tolerant of humans and disturbances will remain in the area and continue to use the OB/OD (OU 006). It was assumed that, regardless of the future of the OB/OD (OU 006), the existing representative wildlife species would continue to enter the OB/OD (OU 006) when human disturbances are minimal and continue to come into contact with COPECs through various daily activities. However, a wildlife species actual risk

would be less than predicted if it spends less time on the OB/OD (OU 006) because of regular human disturbances or the lack of prey or forage due to regular human disturbances.

Based on the results of the semi-quantitative evaluations to assess risk to ecological receptors, ecological receptors exposed to soils experienced the most potential risk and ecological receptors exposed to surface water experienced the least amount of potential risk (Table 2-27). The American robin, which is an omnivore consuming soil invertebrates (earthworms), vegetation, and some surface soils from the OB/OD (OU 006), experienced the greatest potential risk of all the terrestrial wildlife species. The eastern cottontail rabbit, which was assumed to feed exclusively on plants from the OB/OD (OU 006), had relatively high rates of surface soil ingestion and experienced the second greatest potential risk of any mammalian species evaluated. Among the terrestrial wildlife species, the species that have large home ranges, experienced the least potential risk. Among invertebrates, aquatic invertebrates experienced the greatest potential risk but this could be due to fewer toxicity benchmarks for the COPECs detected in sediments than for the COPECs detected in surface water. Soil invertebrates experienced the least amount of potential risk. Plants exposed to soils at the OB/OD (OU 006) experienced a greater amount of potential risk from the surface soils than subsurface soils. Fish experienced the least amount of potential risk.

Based upon the qualitative and semi-quantitative evaluations, ecological risk is insignificant at the OB/OD (OU 006).

2.7.3 Basis for Action

The BLRA (human health and ecological risk assessments) that was completed for the OB/OD (LBG-BMcD, 2013), found that the estimated risks to human health and the environment were above the USEPA acceptable levels. The potential risks to human health provide the basis for remedial action at the OB/OD (OU 006). The following HIs exceeded the USEPA acceptable risk level of one:

- Future site worker ingestion of groundwater (HI = 10);
- Future site worker inhalation of vapors from groundwater use (HI = 4);
- Current/Future demolition worker inhalation of outdoor vapors (HI = 17); and
- Current/Future demolition worker ingestion of groundwater (HI = 11).

The following carcinogenic risk values exceeded the USEPA risk management range of 1E-04 to 1E-06:

- Current site worker dermal contact with surface water (6E-04);

- Future site worker dermal contact with surface water (6E-04);
- Future site worker ingestion of groundwater (2E-04); and
- Future site worker dermal contact with groundwater (3E-04).

2.8 Remedial Action Objectives

As identified in the USEPA guidance *Rules of Thumb for Superfund Remedy Selection* (USEPA, 1997a), a remedial action is generally warranted if one or more of the following conditions apply:

- Cumulative excess carcinogenic risk to an individual exceeds 10-4.
- Non-carcinogenic HI is greater than one.
- Chemical-specific standards (i.e., ARARs [MCLs]) or other measures (i.e., calculated risk-based RGs) that define acceptable levels are exceeded and exposure to contaminants above these levels is predicted for the RME identified in the risk assessment.
- Site contaminants cause adverse environmental impacts.

For the OB/OD (OU 006), the first three listed items above apply, in that the cumulative excess carcinogenic risk for the current and future site worker scenarios exceeds 10-4, the non-carcinogenic HI for the current and future site worker and current and future demolition worker scenarios are greater than one, chemical-specific ARARs (MCLs) and calculated risk-based RGs are exceeded in groundwater, and calculated risk-based RGs are exceeded in soil and surface water.

RAOs provide a general description of what remedial action is anticipated to accomplish. RAOs are developed based on protection of human health and the environment including consideration of the goals of the CERCLA program.

Based on the BLRA (human health and ecological risk assessments), the preliminary ARARs, the media of interest, the COCs in soil, groundwater, and surface water at this site, and the anticipated land and beneficial groundwater use, the RAOs for the OB/OD (OU 006) are:

Soil

- Prevent/minimize migration of COCs that would result in groundwater with concentrations of chemicals in excess of MCLs or risk-based cleanup goals for the current and future site worker and current and future demolition worker.

- Prevent/minimize inhalation of vapors from soil with COCs that exceed risk-based cleanup goals and/or have a total excess cancer risk greater than the USEPA 1E-04 to 1E-06 risk management range or a HI greater than one for the current and future site worker and current and future demolition worker.

Groundwater

- Prevent/minimize ingestion of or direct contact with groundwater with COCs that exceed MCLs or risk-based cleanup goals for COCs without MCLs, and/or have a total excess cancer risk greater than the USEPA 1E-04 to 1E-06 risk management range for the current and future site worker and current and future demolition worker.
- Prevent/minimize ingestion of groundwater with COCs that exceed MCLs or risk-based cleanup goals for COCs without MCLs, and/or have a HI greater than one for the future site worker and current and future demolition worker.
- Prevent/minimize inhalation of vapors from groundwater that has COCs that exceed MCLs or risk-based cleanup goals and/or have a total excess cancer risk greater than the USEPA 1E-04 to 1E-06 risk management range or a HI greater than one for current and future site worker and current and future demolition worker.

Surface Water

- Prevent/minimize direct contact with surface water with COCs that exceed the risk-based cleanup goals and/or have a total excess cancer risk greater than the USEPA 1E-04 to 1E-06 risk management range for the current and future site worker and current and future demolition worker.
- Meet the criteria of the Kansas Surface Water Quality Standards (KSWQS) (Kansas Administrative Regulations [K.A.R.] 28-16-28c and 28-16-28e (b).

The RAOs are listed in the general sequence in which they should be addressed (USEPA, 1997a).

2.9 Remedial Cleanup Levels

Remedial cleanup levels (calculated risk-based RGs and MCLs) are based upon existing federal and state action levels groundwater (i.e., ARARs [MCLs]) or, for those COCs for which that are no existing levels, are calculated as being protective of human health and the environment under a reasonable use scenario

(i.e., calculated risk-based RGs). The remedial cleanup levels (calculated risk-based RGs and MCLs) for the COCs at the OB/OD (OU 006) are as follows:

Soil

Due to the unique nature of the OB/OD (OU 006), a risk-based RG for TCE in soil was calculated for a future demolition worker. Considerations for the calculation included the type of work that would be done - training and disposal of ordnance, and the total hours per year and number of years that a worker would be expected to be at the OB/OD (OU 006). The remedial cleanup level for TCE in soil is:

- TCE – 10.72 mg/kg (calculated risk-based RG) (The remedial cleanup level for TCE in soil is based on non-cancer risk.)

Groundwater

Although groundwater at the OB/OD (OU 006) is not currently being used as a drinking water source nor is planned to be used as a drinking water source in the future, the groundwater at the site could be used as a drinking water source. Therefore, the MCLs are considered ARARs for those COCs in groundwater that have MCLs. For those COCs for which there are no MCLs, risk-based RGs were calculated. The remedial cleanup levels for groundwater COCs are:

- PCA – 2.55 µg/L (calculated risk-based RG) (The remedial cleanup level for PCA in groundwater is based on cancer risk.)
- TCE – 5 µg/L (USEPA MCL)
- Naphthalene – 2.61 µg/L (calculated risk-based RG) (The remedial cleanup level for naphthalene in groundwater is based on cancer risk.)
- Benzo(a)pyrene – 0.2 µg/L (USEPA MCL)
- bis(2-ethylhexyl)phthalate – 6 µg/L (USEPA MCL)

Surface Water

For surface water, risk-based RG were calculated based on the dermal contact of surface water by a future demolition worker. The remedial cleanup levels for surface water COCs are:

- PCA – 236 µg/L (calculated risk-based RG) (The remedial cleanup level for PCA in surface water is based on cancer risk.)

- TCE – 613 µg/L (calculated risk-based RG) (The remedial cleanup level for TCE in surface water is based on non-cancer risk.)

- Benzo(a)pyrene – 0.0374 µg/L (calculated risk-based RG) (The remedial cleanup level for benzo(a)pyrene in surface water is based on cancer risk.)

The risk-based calculation tables used to calculate the risk-based RGs for each of the COCs in soil, groundwater, and surface water are provided on Tables 2-28 through 2-39. A summary of the calculated risk-based RGs for each media of concern are provided on Tables 2-40, 2-41, and 2-42.

2.10 Applicable or Relevant and Appropriate Requirements

ARARs were identified for the OB/OD (OU 006) during the remedial process in accordance with CERCLA and the NCP. During development of the ARARs, KDHE's *Potential Applicable or Relevant and Appropriate Requirements, BER Policy # BER-RS-015* (KDHE, 2005) were reviewed in accordance with CERCLA Compliance with Other Laws Manual, Parts I and II (USEPA, 1989a and USEPA, 1989b). The list of ARARs identified for the OB/OD (OU 006) is shown in the subsections below.

Remedial actions may have to comply with three functional groups of ARARs:

- Chemical-specific ARARs are health- or risk-based restrictions on the amount or concentration of a chemical that may be found in or discharged to the environment. The chemical ARARs may be used to set cleanup levels for the chemicals of concern in the designated media, or to set a safe level of discharge (e.g., air emission or wastewater discharge) where a discharge occurs as a part of the remedial action.

- Action-specific ARARs generally set performance, design, or other similar operational controls or restrictions on particular activities related to management of hazardous substances or pollutants. These requirements address specific activities that are used to accomplish a remedy. Action-specific requirements do not in themselves determine the remedial action; rather, they indicate how a selected remedial action alternative must be designed, operated, or managed.

- Location-specific ARARs are restrictions placed on the types of activities that may occur in particular locations. Location-specific ARARs generally prevent damage to unique or sensitive areas, such as flood plains, historic places, wetlands, and fragile ecosystems, and restrict other activities that are potentially harmful because of where they take place.

2.10.1 Chemical-Specific ARARs

Regulation	Applicable Section	Applicability
Federal Water Quality Standards	National Primary Drinking Water Regulations and Standards: 40 CFR §141.61 40 CFR §141.62 40 CFR §141.63	Sets maximum concentrations allowed for organic, inorganic and microbiological contaminants in sources of drinking water. -ARAR if action addresses groundwater.
	National Secondary Drinking Water Standards: 40 CFR §143.3	- Secondary maximum contaminant levels -ARAR if action addresses groundwater.
Clean Air Act	40 CFR §61.01 40 CFR §61.14	Establishes limits on the amounts of pollutants that can be discharged to the air from Hazardous Waste Processes. -An ARAR if emissions trigger a need for air pollution control.
	40 CFR §264; subparts AA, BB, and CC	Establishes limits on the amounts of pollutants that can be discharged to the air from hazardous waste processes. -An ARAR if emissions trigger the need for air pollution control.
Kansas Primary Drinking Water Regulations	K.A.R., 28-15a-23	Contaminants not subject to an MCL but required to be monitored. -An ARAR if the State is more stringent than the Federal requirements.
Kansas Surface Water Quality Standards	K.A.R., 28-16-28c K.A.R., 28-16-28e(b),	Antidegradation – maintaining and protecting existing uses and surface water quality criteria. -An ARAR if surface water quality is affected.

2.10.2 Location-Specific ARARs

Location Specific	None	N/A

2.10.3 Action-Specific ARARs

Action Specific	Applicable Section	
Clean Water Act	40 CFR §122.26	Excavation and Runoff and land farm treatment – stormwater storage and runoff. -An ARAR in the event of excavation and runoff from land farm treatment.
Safe Drinking Water Act	40 CFR §144, §146, §147, §148	Underground Injection Control Program. Regulates the subsurface emplacement of fluids (including air) with standards for the design and operation of 5 classes of injection wells -ARAR if action uses underground injection control.
Federal Water Quality Standards	40 CFR §131.10 – 131.13; §131.20-131.22	Best Management Practices for stormwater management during soil disturbance -An ARAR water for Stormwater Management.
RCRA	40 CFR §264.171-175 42 USC §6921 - §6939g	Provides standards for the management of hazardous wastes -An ARAR when onsite hazardous waste management is anticipated.
	40 CFR §258	Provides standards for management of nonhazardous wastes –An ARAR for on-site waste management.
	40 CFR §262	Standards Applicable to Transporters of Hazardous Wastes -An ARAR for transportation of Hazardous Waste
	40 CFR §262.11	Criteria for listing hazardous waste. -An ARAR for transportation of Hazardous Waste
	40 CFR §263	Manifesting, Record Keeping and Reporting Requirements -An ARAR for transportation of Hazardous Waste
	40 CFR §268	Specifies Treatment standards and technologies for specific hazardous wastes. -An ARAR if hazardous wastes will undergo onsite treatment
Kansas Drinking Water Quality Standards ––	K.A.R, 28-15a-23	Contaminants not subject to an MCL, but required to be monitored -An ARAR if more stringent than Federal requirements.
Kansas Solid Waste Regulations	K.S.A., 65-3407c(2)	Temporary projects to remediate soils using landfarming requiring a project operating plan and site closure plan. -An ARAR for on-site landfarming.

2.11 Description of Remedial Alternatives

Following the initial screening of alternatives, the DA (Fort Riley) evaluated and selected a range of alternatives to consider for the OB/OD (OU 006). The following remedial alternatives were considered for the OB/OD (OU 006):

- Alternative 1 – No Action
- Alternative 2 – Soil Removal with Treatment and Disposal, Groundwater/Surface Water Monitoring, and IC through the Fort Riley RPMP
- Alternative 3 – In-Situ Treatment by Soil Vapor Extraction (SVE), Groundwater/Surface Water Monitoring, and IC through the Fort Riley RPMP
- Alternative 4 – Soil Removal with Treatment and Disposal, In-Situ Groundwater Treatment, Surface Water Monitoring, and IC through the Fort Riley RPMP

2.11.1 Description of Remedy Components

During the FS, identifying and screening remedial technologies, general response actions were identified for each contaminated media. General Response Actions (GRAs) that satisfy one or more of the RAOs for the OB/OD (OU 006) included: ICs; soil removal and disposal or treatment; ex-situ biological treatment; in situ treatment; groundwater monitoring; containment, extraction, and treatment; surface water monitoring; and surface capture, treatment, and discharge. The GRAs were then broken down further to remedial technology types and process options. The identified remedial technology types and process options underwent a preliminary screening step based on technical implementability; the retained technologies and process options underwent a more detailed screening based on effectiveness, implementability, and cost.

Following the two screening steps, the more promising remedial technologies were included in the media-specific remedial alternatives developed for the site. The retained process options for soil and sediment included the following media-specific alternatives:

Soil

S1 No Action

S2 IC through the Fort Riley RPMP

S3 Removal and Disposal or Treatment:
- S3a Off-Site Disposal in a Landfill
- S3b On-Site Land Farming

S3c Off-Site Thermal Incineration and Disposal

S4 In-Situ Treatment: SVE

Groundwater

GW1 No Action

GW2 ICs through the Fort Riley RPMP

GW3 Groundwater Monitoring

GW4 MNA

GW5 In-Situ Treatment: Chemical Reagent Injection

Surface Water

SW1 No Action

SW2 ICs through the Fort Riley RPMP

SW3 Surface Water Monitoring

As no single media-specific alternative developed adequately addressed the issues and concerns within the OB/OD (OU 006) site area, these media-specific alternatives were combined into four site-specific remedial alternatives during the development of the PP. The following site-specific remedial alternatives were identified during the PP by the DA (Fort Riley) for the OB/OD (OU 006):

- Alternative 1 – No Action
- Alternative 2 – Soil Removal with Treatment and Disposal, Groundwater/Surface Water Monitoring, and ICs through the Fort Riley RPMP
- Alternative 3 – In-Situ Treatment by SVE, Groundwater/Surface Water Monitoring, and ICs through the Fort Riley RPMP
- Alternative 4 – Soil Removal with Treatment and Disposal, In-Situ Groundwater Treatment, Surface Water Monitoring, and ICs through the Fort Riley RPMP

These alternatives are described in the following subsections.

2.11.1.1 Alternative 1 – Not Action

This alternative is the "No Action" Alternative, a requirement of the NCP, which provides a baseline for the comparison of active remedial alternatives developed for the OB/OD (OU 006). Under this

alternative, ICs are not implemented, remedial actions are not performed, and site monitoring is not conducted. By definition, this alternative requires that any current monitoring under CERCLA will be discontinued. At a minimum, whenever contaminants are left in place, NCP requires the following: *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less than every five years after initiation of the remedial action.*

Although under the "No Action" Alternative ICs are generally not enacted, it should be acknowledgedthat access restriction via range controls are currently in place due to the location of the OB/OD (OU 006) on a military base within the limits of the Impact Area. Range controls will remain in effect as long as the Impact Area remains active.

Residual risks for Alternative 1 will be identical to existing risks because no actions will be implemented with this alternative, although risks will decline with time because the contaminant concentrations present in media of concern will continue to degrade naturally. Soil, groundwater, and surface water remedial cleanup levels are expected to be met over time, but no monitoring will be performed for confirmation. There are no costs associated with this alternative.

2.11.1.2 Alternative 2 – Soil Removal with Treatment and Disposal, Groundwater/Surface Water Monitoring, and ICs through the Fort Riley RPMP

Alternative 2 is a combination of media-specific Alternatives S2/GW2/SW2 – ICs through the Fort Riley RPMP; S3b – Removal and Disposal or Treatment: On-Site Land Farming; and GW3/SW3 – Groundwater and Surface Water Monitoring.

Soil Removal with Treatment and Disposal

This component of Alternative 2 will address the TCE-contaminated soil located in the area of the metal debris pits (source area) which currently serves as a reservoir of contamination that can migrate to the groundwater and surface water and act as a source for direct exposure for potentially exposed populations at the site. The TCE-contaminated soil exceeding the calculated risk-based RG of 10.72 mg/kg will be removed by excavation and treated on site by land farming to below actionable levels and the area restored by backfilling, grading, and reseeding. The land-farm treatment cell will consist of a lined bermed area with a leachate collection system installed to collect and store contact water collected from within the treatment cell limits. In the treatment cell, excavated soil will be placed in windrows and periodically disked. Solar radiation, wind, and disking of the soil will promote volatilization and

biodegradation of the TCE in the soil. After remediation is completed the soil will either be spread on site or transported to the Campbell Hill construction/debris landfill for use as landfill cover. Soil treatment via land farming has proven to be effective at other Fort Riley sites.

Groundwater and Surface Water Monitoring

The groundwater and surface water monitoring component of Alternative 2 will be implemented to ensure that contamination present in the groundwater and surface water at the site are continuing to decrease in concentration, the contaminant plumes are continuing to decrease in size, and the remedy is not adversely impacting water quality. Groundwater and surface water monitoring (sampling, analysis, and contaminant trend analysis) will be conducted at monitoring wells in the OB/OD (OU 006) monitoring well network and at locations where surface water is present (ephemeral streams, seeps and spring) to determine if the contaminant concentration are continuing to decrease. Additional monitoring wells will be installed at the site to increase the resolution of the contaminant plumes. Trend analysis of the groundwater and surface water results will be used as evidence that the source removal results in successfully reducing groundwater and surface water contamination. Over time, due to the anticipated changes in contaminant plume sizes, additional monitoring wells may be installed on an as needed basis based on analytical results from the groundwater monitoring. It is possible that following the installation of new monitoring wells, some of the existing wells could be eliminated. Should a statistically significant upward trend in concentrations of COCs occur, potential actions that may be needed, such as increased monitoring and assessment, will be addressed in the RD/RA WP.

Groundwater monitoring will be conducted at monitoring wells within the OB/OD (OU 006) monitoring well network and surface water monitoring will be conducted at surface water sampling points until their respective remedial cleanup levels have not been exceeded for a period of time to be determined in the RD/RA WP. Monitoring details, including sample locations and monitoring frequency will be included in the RD/RA WP.

ICs through the Fort Riley RPMP

ICs will be applied through the Fort Riley RPMP. The Fort Riley RPMP is the means the post authorities have to control and limit development and other activities on the post. This includes overall controls on restricting changes in land use; limiting access; prohibiting the installation of drinking water wells and groundwater/surface water use; and involving Fort Riley PWE personnel in the proposed future plans. The Fort Riley RPMP ensures compatibility of land uses are considered when planning for locations of functions or facilities. It is the equivalent of a city or county zoning plan. It also serves as a framework for maintenance and repair resource allocation, and development activities. Master planning for US

Army installations is required by Army Regulation (AR) 210-20 which establishes a relationship between environmental planning and real property master planning to ensure that the environmental factors are included in planning decisions and land use. This is accomplished by the long-range component (LRC) in the Fort Riley RPMP. It consists of a variety of narratives and supporting graphics. One of these graphic representations is the Master Plan Environmental Overlay (MPEO). This graphic reflects operational and environmental constraints. The OB/OD (OU 006) will be designated as restricted land use in the Fort Riley RPMP.

The restricted designation in the Fort Riley RPMP directs users to the MPEO that subsequently identifies the restrictions. Restrictions will limit exposure at the OB/OD (OU 006) by:

- Restricting change of land use;
- Limiting access;
- Prohibiting the installation of drinking water wells and groundwater/surface water use in the area; and
- Involving Fort Riley PWE personnel in the proposed future plans for the OB/OD (OU 006). The OB/OD (OU 006) is an active range located within the Impact Area and is currently used for ordnance disposal; therefore, the site is gated with severely restricted access controlled through range controls.

ICs with respect to site-related contamination will continue until the soil, groundwater, and surface water is no longer a threat to human health or the environment; however, because the OB/OD (OU 006) is an active range located within the Impact Area, the range controls are anticipated to remain in place for the foreseeable future.

2.11.1.3 Alternative 3 – In-Situ Treatment by SVE, Groundwater/Surface Water Monitoring, and IC through the Fort Riley RMPM

Alternative 3 is a combination of media-specific Alternatives S2/GW2/SW2 – ICs through the Fort Riley RPMP; S4 – In-Situ Treatment: SVE; and GW3/SW3 – Groundwater and Surface Water Monitoring.

In-Situ Treatment by SVE

This component of Alternative 3 will address the TCE-contaminated soil located in the area of the metal debris pits (source area) which currently serves as a reservoir of contamination that can migrate to the

groundwater and surface water and act as a source for direct exposure for potentially exposed populations at the site. The TCE soil contamination would be treated in situ (in place) by SVE; however, prior to

SVE remediation, a site investigation and removal action will be conducted to remove the source of the metallic anomaly. This removal action will be focused on conditions directly surrounding the metallic signature but would not address elevated levels of contaminants in the surrounding soil. The TCE contaminated soil removed as part of this removal action would be disposed of in either a RCRA Subtitle D (municipal) landfill or RCRA Subtitle C (hazardous) landfill depending on the contaminant concentrations and whether or not they exceed regulatory thresholds.

Pilot-scale testing will be required to determine design criteria, radius of influence (ROI), and requirements for the exhaust treatment system. SVE involves applying a vacuum to a well installed in the contaminated soil to induce a controlled flow of air through the soil. The air flow assists in stripping VOCs, and some SVOCs, from the soil. The contaminated air will be collected and treated at a central location to remove the contaminants prior to discharge to the atmosphere in accordance with local and state air quality regulations. This alternative will require installing approximately 15 to 20 SVE extraction wells throughout the contaminated zone.

Because the OB/OD (OU 006) is an active range located within the Impact Area and is used in the emergency detonation of ordnance, this alternative will require an extensive amount of O&M over the life span of the SVE treatment system. Furthermore, SVE wells and pipeline systems could impact use of the site by restricting military operations in areas of the OB/OD (OU 006). The O&M required by the system could impact the use of the OB/OD (OU 006) and the surrounding ranges. The surrounding ranges could also be impacted by construction activities which would include running buried power and communications lines to the site. Range and demolition operations at the OB/OD (OU 006) or the surrounding area could impact the integrity of the SVE treatment system.

The SVE system would operate until contaminant concentrations in gas samples collected in the extraction wells remain below remedial cleanup levels when the blower is turned off and conditions in the wells are allowed to equilibrate. Soil samples would be collected throughout the treatment zone to confirm that contaminant concentration levels are below remedial cleanup levels. Given the low permeability soils in the area, the current contaminant concentrations, and professional experience at other sites, it is anticipated that the SVE treatment system would be required to operate for 10 years or more to achieve remedial cleanup levels in soil.

Groundwater and Surface Water Monitoring

The groundwater and surface water monitoring component of Alternative 3 would be the same as Alternative 2.

ICs through the Fort Riley RPMP

The ICs through the Fort Riley RPMP component of Alternative 3 would be the same as Alternative 2.

2.11.1.4 Alternative 4 – Soil Removal Treatment and Disposal, In-Situ Groundwater Treatment, Surface Water Monitoring, and ICs through the Fort Riley RPMP

Alternative 4 is a combination of media-specific Alternatives S2/GW2/SW2 – ICs through the Fort Riley RPMP; S3b – Removal and Disposal or Treatment: On-Site Land Farming; GW5 – In Situ Treatment: Chemical Reagent Injection; and SW3 – Surface Water Monitoring.

Soil Removal with Treatment and Disposal

The soil removal with treatment and disposal component of Alternative 4 would be the same as Alternative 2.

In-Situ Groundwater Treatment

This alternative involves injection of one or more reactive media into the aquifer to promote conditions that are effective in the treatment of the chlorinated solvents plume(s). A wide range of reagents are available ranging from relatively common products such as edible oils and lactose to special formulations developed to treat specific contaminants under both aerobic and anaerobic conditions. While a wide range of products have been used to treatment TCE in situ, less work has been done on in-situ treatment options for PCA. Treatability studies will be conducted during the design phase to identify the appropriate reagent(s) for treating each of the COCs.

The chemical reagent can be injected into the groundwater using a fluid delivery system such as direct-push technology or through the use of specially constructed injection wells targeting the regolith/weathered bedrock formations.

Treatability testing during the design phase will establish the anticipated ROI for the injections wells. It is estimated that the injection wells will have an ROI of approximately 15 feet. Two to three rows of wells will be placed at the down gradient edge of the primary area of concern in a staggered pattern to ensure coverage of the plume. The wells will extend to the bottom of the contaminant plume (assumed depth of

25 feet bgs). Depending on the results of the treatability study and the selected reagent(s), separate injection wells may be used to treatment the PCA plume.

Periodic access to the site will be required for future injections and for post-injection monitoring of groundwater conditions. The post-injection monitoring of the groundwater would be nearly the same as the groundwater monitoring components of the other alternatives except this alternative will require additional analyses of groundwater quality parameters.

Post-injection monitoring will be conducted at monitoring wells within the OB/OD (OU 006) monitoring well network until their respective remedial cleanup levels have not been exceeded for a period of three consecutive monitoring events.

Surface Water Monitoring

The surface water monitoring component of Alternative 4 would be the same as Alternative 2.

ICs through the Fort Riley RPMP

The ICs through the Fort Riley RPMP component of Alternative 3 would be the same as Alternative 2.

2.11.2 Common Elements and Distinguishing Features of Each Alternative

Many of the alternatives evaluated for the OB/OD (OU 006) include common components, while certain characteristics of some of the alternatives clearly distinguish them from the others. Table 2-43 presents the estimated time for design and construction, as well as the estimated time to reach remedial cleanup levels for each of the alternatives. In addition, Table 2-43 presents the estimated capital costs, O&M costs, periodic costs, and total present value costs associated with each of the alternatives. Following are lists of many of these common elements and distinguishing features of Alternatives 2, 3, and 4. Alternative 1 is not included because no remedial action is performed at the site.

Common Elements

- Alternatives 2, 3, and 4 all contain the same ICs.
- Alternatives 2, 3, and 4 all actively remediate the source area.
- Alternatives 2 and 4 involve source area removal as the primary means of contaminant reduction.
- Alternatives 2 and 3 treat groundwater through natural processes such as volatilization, biodegradation, advection, and dispersion.

- Alternatives 2, 3, and 4 treat surface water through natural processes such as volatilization, biodegradation, advection, and dispersion.
- Alternatives 2, 3, and 4 include groundwater and surface water monitoring.
- Alternatives 2, 3, and 4 are anticipated to meet remedial cleanup levels.
- Alternatives 2, 3, and 4 are anticipated to meet chemical-specific ARARs.
- Alternatives 2, 3, and 4 are anticipated to meet action-specific ARARs.
- Alternatives 2 and 3 are comparable in regards to cost.
- Alternatives 2, 3, and 4 require at least one five-year review and a closure report.

Distinguishing Features

- Alternative 3 remediates the source area with SVE.
- Alternative 4 is the only alternative that actively treats the groundwater.
- Alternative 4 involves the injection of foreign material into the groundwater plume.\
- Alternative 2 is considered the easiest to implement.
- Alternative 4 is considered to be the most expensive alternative.

2.11.2.1 Long-Term Reliability of the Alternatives

Alternative 1 – No Action

There is no long-term reliability of this alternative. Remediation, ICs, or groundwater/surface monitoring are not implemented under this alternative.

Alternative 2 – Soil Removal with Treatment and Disposal, Groundwater/Surface Water Monitoring, and ICs through the Fort Riley RPMP

Under this alternative, the soil source area will be removed and treated in an on-site land-farm treatment cell. Once soil removal is completed, residual risks will be acceptable in the source area. Groundwater and surface water monitoring in conjunction with the ICs are effective reliable methods of protecting human health and the environment. Risks associated with groundwater and surface water contamination will decline with time because the contaminants will degrade through natural processes such as volatilization, biodegradation, advection, and dispersion. The current estimated time to achieve remedial cleanup levels is 30 years; however, after the soil removal action is completed and contaminant trend

analysis for groundwater and surface water is performed, the estimated time to achieve remedial cleanup levels may be refined.

Alternative 3 – In-Situ Treatment by SVE, Groundwater/Surface Water Monitoring, and ICs through the Fort Riley RPMP

Under this alternative, the soil source area will be treated using a SVE treatment system. Active remediation will continue until chlorinated solvent concentrations in soil meet remedial cleanup levels. Therefore, once SVE treatment is completed, residual risks will be acceptable in the treated area. Groundwater and surface water monitoring in conjunction with the ICs are effective reliable methods of protecting human health and the environment. Risks associated with groundwater and surface water contamination will decline with time because the contaminants will degrade through natural processes such as volatilization, biodegradation, advection, and dispersion. The current estimated time to achieve remedial cleanup levels is 30 years; however, after the soil remediation is completed and contaminant trend analysis for groundwater and surface water is performed, the estimated time to achieve remedial cleanup levels may be refined.

This alternative has the longest source area treatment time of the other alternatives that include remediation as a component. The source area treatment with this alternative does not immediately remove the source area thus continues to allow the source area to serve as a reservoir for contamination to migrate to the groundwater and surface water, which ultimately will increase the time needed for groundwater and surface water to achieve remedial cleanup levels and decrease its long-term reliability. Additionally, the extensive amount of O&M that would be required for the SVE treatment system will also make this alternative less reliable long-term.

Alternative 4 – Soil Removal with Treatment and Disposal, In-Situ Groundwater Treatment, Surface Water Monitoring, and ICs through the Fort Riley RPMP

Under this alternative the soil source area will be removed and treated in an on-site land-farm treatment cell and groundwater will be treated using chemical reagent injection. Once soil removal is completed, residual risks will be acceptable in the source area. Chemical reagent injection provides an effective solution to treating groundwater contaminated with chlorinated solvents; however, due to the low permeability soils present at the site, this may create uncertainty in the reliability of this alternative. Surface water monitoring in conjunction with the ICs are effective reliable methods of protecting human health and the environment. Chemical reagent injection will reduce the risks associated with groundwater at the site. Surface water risks will decline with time because the contaminants will degrade through natural processes such as volatilization, biodegradation, advection, and dispersion. The current estimated

time to achieve remedial cleanup levels is 30 years; however, after the soil removal action and groundwater treatment are completed and contaminant trend analysis for groundwater and surface water is performed, the estimated time to achieve remedial cleanup levels may be refined.

2.11.2.2 Expected Outcomes of the Alternatives

Alternative 1 – No Action

Confirmation samples will not be collected to show when soil, groundwater, and surface water have met remedial cleanup levels. Potential adverse risks will not be addressed with alternative.

Alternative 2 – Soil Removal with Treatment and Disposal, Groundwater/Surface Water Monitoring, and ICs through the Fort Riley RPMP

Soil, groundwater, and surface water are expected to meet remedial cleanup levels for all COCs at the end of the remedial action. Confirmation samples will be collected from each of the media of concern to demonstrate remedial cleanup levels have been met.

Alternative 3 – In-Situ Treatment by SVE, Groundwater/Surface Water Monitoring, and ICs through the Fort Riley RPMP

Soil, groundwater, and surface water are expected to meet remedial cleanup levels for all COCs at the end of the remedial action. Confirmation samples will be collected from each of the media of concern to demonstrate remedial cleanup levels have been met.

Alternative 4 – Soil Removal with Treatment and Disposal, In-Situ Groundwater Treatment, Surface Water Monitoring, and ICs through the Fort Riley RPMP

Soil, groundwater, and surface water are expected to meet remedial cleanup levels for all COCs at the end of the remedial action. Confirmation samples will be collected from each of the media of concern to demonstrate remedial cleanup levels have been met.

2.12 Summary of Comparative Analysis of Alternatives

The nine CERCLA remedy selection criteria as presented in NCP 40 CFR §300.430(e)(9)(iii) were used to evaluate the different remediation alternatives individually and against each other in order to select a remedy. The alternatives were first evaluated as either compliant or non-compliant with the threshold criteria (Protection of Human Health and the Environment, and Compliance with ARARs). The "No Action" Alternative was the only alternative that does not comply with the threshold criteria (not protective of human health of the environment and non-compliant with ARARs), and it was removed from further consideration in the ranking of alternatives. Each alternative that met the threshold criteria was then compared using the five balancing criteria. Table 2-44 summarizes the rankings of the

alternatives with respect to threshold and primary balancing criteria. As shown on Table 2-44, the alternative with the most favorable ranking is Alternative 2, the preferred alternative. The favorable rating was due to the good (generally favorable) evaluation scores for long term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; and implementability. Alternative 2 also received the best evaluation score for cost relative to Alternatives 3 and 4.

2.12.1 Threshold Criteria

Threshold criteria include those criterion that address protection of human health and the environment and compliance with ARARs. Any alternative that does not satisfy both of the following criteria is dropped from further consideration in the remedy selection process:

- Overall Protectiveness of Human Health and the Environment and
- Compliance with ARARs.

Overall Protectiveness of Human Health and the Environment

This criterion addresses whether each alternative provides adequate protection of human health and the environment. It also describes how potential risks posed through each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls, and/or ICs.

Each of the alternatives, with the exception of the "No Action" Alternative, will be protective of human health and the environment once ICs are implemented to control exposure to soil, groundwater, and surface water contaminants. However, ICs can only provide partial protection; overall protection is contingent on the effectiveness of the treatment technologies.

Alternatives 2, 3, and 4 apply additional protection with the addition of other treatment technologies to eliminate contaminants in the source area. Alternative 2 reduces risk by excavating the TCE contaminated soil and treating it in an on-site land-farm treatment cell and relying on natural processes such as volatilization, biodegradation, advection, and dispersion to treat groundwater and surface water. Alternative 3 reduces risk by removing the TCE from the soil using a SVE treatment system and relying on natural processes such as volatilization, biodegradation, advection, and dispersion to treat groundwater and surface water. Alternative 4 reduces risk by excavating the TCE contaminated soil and treating it in an on-site, land-farm treatment cell, treating groundwater via chemical reagent injection, and relying on natural processes such as volatilization, biodegradation, advection, and dispersion to treat the surface water.

The "No Action" Alternative (Alternative 1) is not protective of human health and the environment; therefore, it was eliminated from consideration under the primary balancing criteria.

Compliance with ARARs

Section 121(d) of CERCLA and NCP 40 CFR §300.430(f)(1)(ii)(B) states that on-site remedial actions selected in a ROD must attain those ARARs that are identified at the time of ROD signature or provide grounds for invoking a waiver under §300.430(f)(1)(ii)(C).

Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. NCP 40 CFR §300.400(g)(4) states that only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable or relevant and appropriate. For purposes of identification and notification of promulgated state standards, the term promulgated means that the standards are of general applicability and are legally enforceable. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site so that their use is well suited to the particular site. (40 CFR §300.5).

The "compliance with ARARs" criterion addresses whether a remedy will meet the ARARs of other federal and state environmental statutes or provides grounds for invoking a waiver. Overall protection of human health and the environment and compliance with ARARs (unless a specific ARAR is waived) are threshold requirements that each alternative must meet in order to be eligible for selection. (40 CFR §300.430(f)(1)(i)(A).

Alternatives 2, 3, and 4 attain their respective federal and state ARARs (MCLs for groundwater). Alternatives 2, 3, and 4 also attain their respective calculated risk-based RGs for soil, groundwater (for chemicals without MCLs), and surface water.

The "No Action" Alternative (Alternative 1) does not meet threshold requirements and ; therefore, it was eliminated from consideration under the primary balancing criteria.

2.12.2 Primary Balancing Criteria

Five "primary balancing" criteria are then used to make comparisons and to identify the major trade-offs between the remedial alternatives. Alternatives that satisfy the threshold criteria are therefore evaluated using the following balancing criteria:

- Long-Term Effectiveness and Permanence;
- Reduction of Toxicity, Mobility, or Volume through Treatment;
- Short-Term Effectiveness;
- Implementability; and
- Cost.

Long-Term Effectiveness and Permanence

The "long-term effectiveness and permanence" criterion refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time once remedial cleanup levels have been met. This criterion includes the consideration of residual risk that will remain on site following remediation and the adequacy and reliability of controls.

Each of the alternatives provide relatively good long-term protection and permanence. Alternatives 2 and4 both rely on soil excavation to remove the source area, while Alternative 3 relies on SVE to treat the soil source area. Alternative 4 ranks highest for this criterion because it actively treats the groundwater contamination instead of relying on natural processes such as volatilization, biodegradation, advection, and dispersion to treat it, as do Alternatives 2 and 3.

Reduction of Toxicity, Mobility, or Volume through Treatment

The "reduction of toxicity, mobility, or volume of contaminants through treatment" criterion evaluates an alternative's use of treatment to reduce the harmful effects of contaminants, their ability to move in the environment, and the amount of contamination present.

Alternatives 2, 3, and 4 include treatment of the source area as a component of the remedy. Therefore, each of the alternatives reduces the toxicity, mobility, or volume of contamination at the site.

Alternatives 2 and 4 will remove the source area thereby providing a reduction in toxicity, mobility, and volume of contaminants at the site. Alternative 3 will treat the soil in place using SVE to remove the source area to provide a reduction in toxicity, mobility, and volume of contaminants at the site.

Short-Term Effectiveness

The "short-term effectiveness" criterion considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation until remedial cleanup levels are achieved. Since there are no nearby residents or sensitive environments, noneof the alternatives are expected to pose an unacceptable risk to these targets during implementation. The exposures to site workers that may result from exposures during implementation of Alternatives 2, 3, and 4 which can be mitigated through proper engineering controls, health and safety planning, and use of personal protective equipment. Alternatives 2 and 4 provide good short-term effectiveness as the contaminated soil would be immediately removed by excavation while Alternative 3 will require a longer time frame to remove contamination from the soil.

Implementability

Implementability addresses the technical and administrative feasibility of a design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other government entities are also considered.

Alternative 2 would be the simplest alternative to implement because once the soil removal is completed additional time would not be required to be spent on site other than groundwater and surface water monitoring activities which were also part of Alternatives 3 and 4.

Alternative 3 was scored poorly for implementability. A SVE treatment system will require both above and a below ground supporting infrastructure that could be damaged during the remediation timeframe as the OB/OD (OU 006) is an active range. Additionally, regular required maintenance will require UXO support and could only be conducted when the area is not in use.

Alternative 4 scored only fair for implementability because low permeability soils present at the OB/OD (OU 006) would require more oxidant, tight spacing, and multiple injection events. UXO support will also be required for each injection event.

Cost

Cost includes estimated capital costs, annual O&M costs, and periodic costs as well as present value costs. Present value cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30%. Alternative 3 is the only alternative which requires a significant O&M costs with respect to soil treatment. Alternative 4 will require additional injections of chemical reagents. While cost estimates are sound, unexpected costs could occur

during implementation of Alternatives 2, 3, or 4. The estimated present value costs for the alternatives, not including the "No Action" Alternative, range from $6,935,000 for Alternative 2 to $25,100,000 for Alternative 4. The cost of each alternative increases as the degree of treatment and complexity increases. Cost summaries for each alternative are presented in Table 2-43.

2.12.3 Modifying Criteria

The remaining two criteria are "modifying" factors and are to be evaluated in the ROD. The evaluation of these two factors can only be complete after the PP is published for comment and the public comment period is completed. These modifying factors are:

- State Acceptance and
- Community Acceptance.

State Acceptance

Based on the information currently available, the DA (Fort Riley), KDHE and USEPA believe Alternative 2 – soil removal with treatment and disposal, groundwater/surface water monitoring, and ICs through the Fort Riley RPMP meets the threshold criteria (Criteria 1 and 2) and provides the best balance of tradeoffs among the other alternatives with respect to the five primary balancing and two modifying criteria.

Community Acceptance

Community acceptance considers whether the local community agrees with DA's (Fort Riley's) analyses and preferred alternative. No comments were received on the PP (LBG-BMcD, 2014b) which is an important indicator of community acceptance. Based on the lack of comments from the public on the PP (LBG-BMcD, 2014b), the selected remedy for the OB/OD (OU 006) appears acceptable to the community. The comparative analyses for the four alternatives are presented on Table 2-44.

2.13 Selected Remedy

The selected remedy for the OB/OD (OU 006) is Alternative 2 – soil removal with treatment and disposal, groundwater/surface water monitoring, and ICs through the Fort Riley RPMP. The overall effectiveness of the selected remedy for soil, groundwater, and surface water was demonstrated in the summary of comparative analysis of the alternatives discussed in Section 2.12. The selected remedy satisfies the threshold criteria (i.e., overall protectiveness and compliance with chemical-specific ARARs), while being the most favorable alternative with respect to the five primary balancing criteria (i.e., long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; short-term effectiveness; implementability; and cost). The selected remedy meets soil, groundwater, and surface

water RAOs through (1) removal of chlorinated contaminants and source material in soil; (2) treatment of groundwater and surface water using natural processes such as volatilization, biodegradation, advection, and dispersion; and (3) implementation of ICs.

This section expands upon the details of the selected remedy discussed above.

2.13.1 Summary of the Rationale for the Selected Remedy

The DA (Fort Riley), KDHE, and USEPA believe the selected remedy meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the primary balancing and modifying criteria. The remedy is expected to satisfy the following statutory requirements of CERCLA §121(b): (1) be protective of human health and the environment; (2) comply with ARARs identified at the time of ROD signature or provide grounds for invoking a waiver under; (3) be cost effective; and (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

Selecting Alternative 2– soil removal with treatment and disposal, groundwater/surface water monitoring, and ICs through the Fort Riley RPMP as the remedy for the OB/OD (OU 006) was based upon the foregoing analysis of the nine CERCLA remedy selection criteria presented in NCP 40 CFR §300.430(e)(9)(iii) and on the following benefits:

- The cleanup action is protective of human health and complies with chemical-specific ARARs and/or calculated RGs. TCE-contaminated soil at the OB/OD (OU 006) will be removed, which will eliminate the TCE-contaminated soils from continuing to leach into the groundwater and will prevent risk to human health and the environment through direct contact with this medium.
- Removal of approximately 7,500 cubic yards of TCE-contaminated soils is expected to reduce the source of contamination in groundwater and surface water. Source material is treated on site in a land-farm treatment cell, meeting the CERCLA preference for treatment and eliminating the principal source of contamination in soil and continuing threat to groundwater and surface water. The removal of source material and on-site treatment of excavated TCE-contaminated soil also reduces the volume of contamination in a short time frame, and reduces the long-term time frame necessary for natural processes such as volatilization, biodegradation, advection, and dispersion to reduce contaminant concentrations below remedial cleanup levels.

- The technology provides proven and active treatment to the area that has the highest concentration of TCE in the soil and is relatively straightforward to implement when compared to the other alternatives.
- In the long-term, the remedy is expected to achieve substantial risk reduction through the treatment of groundwater and surface water using natural processes such as volatilization, biodegradation, advection, and dispersion at a reasonable cost. It is expected to cause the least impacts to the overall operations at the OB/OD (OU 006).
- The DA (Fort Riley), KDHE, and USEPA, and the public believe the selected remedy would be protective of human health and the environment, would comply with ARARs, would be cost effective, and would utilize permanent solutions and alternative treatment technologies to the maximum extent practicable.

2.13.2 Description of the Selected Remedy

The DA (Fort Riley) shall be responsible for implementing, maintaining, monitoring, reporting and enforcing the remedial actions identified for the duration of the remedy selected in this ROD. It will exercise this responsibility in accordance with CERCLA and the NCP. The RAOs for the OB/OD (OU 006) are as follows:

Soil

- Prevent/minimize migration of COCs that would result in groundwater with concentrations of chemicals in excess of MCLs or risk-based cleanup goals for the current and future site worker and current and future demolition worker.
- Prevent/minimize inhalation of vapors from soil with COCs that exceed risk-based cleanup goals and/or have a total excess cancer risk greater than the USEPA 1E-04 to 1E-06 risk management range or a HI greater than one for the current and future site worker and current and future demolition worker.

Groundwater

- Prevent/minimize ingestion of or direct contact with groundwater with COCs that exceed MCLs or risk-based cleanup goals for COCs without MCLs, and/or have a total excess cancer risk greater than the USEPA 1E-04 to 1E-06 risk management range for the current and future site worker and current and future demolition worker.

- Prevent/minimize ingestion of groundwater with COCs that exceed MCLs or risk-based cleanup goals for COCs without MCLs, and/or have a HI greater than one for the future site worker and current and future demolition worker.
- Prevent/minimize inhalation of vapors from groundwater that has COCs that exceed risk-based cleanup goals and/or have a total excess cancer risk greater than the USEPA 1E-04 to 1E-06 risk

Surface Water

- Prevent/minimize direct contact with surface water with COCs that exceed the risk-based cleanup goals and/or have a total excess cancer risk greater than the USEPA 1E-04 to 1E-06 risk management range for the current and future site worker and current and future demolition worker.
- Meet the criteria of the KSWQS ([K.A.R.] 28-16-28c and 28-16-28e(b)).

Meeting the RAOs shall be the primary and fundamental indicator of performance, the ultimate aim of which is protecting human health and the environment.

The selected remedy for remediation of the soil, groundwater, and surface water contamination at the OB/OD (OU 006) is Alternative 2– soil removal with treatment and disposal, groundwater/surface water monitoring, and ICs through the Fort Riley RPMP. The selected remedy addresses the soil, groundwater, and surface water contaminated with solvents at the OB/OD (OU 006) without adversely impacting water quality. The principal source of contamination at the OB/OD (OU 006) pertains to TCE-contaminated soil located in the area of the metal debris pits (source area). The source area is likely contributing to the groundwater and surface water contamination present at the site. There is no known historical or current use of solvents or knowledge of solvent disposal at the OB/OD (OU 006). The major components of the selected remedy are described below:

Soil Removal with Treatment and Disposal

This component of Alternative 2 will address the TCE-contaminated soil located in the area of the metal debris pits (source area) which currently serves as a reservoir of contamination that could migrate to the groundwater and surface water and act as a source for direct exposure for potentially exposed populations at the site. The TCE-contaminated soil exceeding its calculated risk-based RG of 10.72 mg/kg will be removed by excavation and treated on site by land farming to below actionable levels. The area will be restored by backfilling, grading, and reseeding. The land-farm treatment cell will consist of a lined bermed area with a leachate collection system installed to collect and store contact water collected within

the treatment cell limits. In the treatment cell, excavated soil will be placed in windrows and periodically disked. Solar radiation, wind, and disking of the soil will promote volatilization and biodegradation of the TCE in the soil. After remediation is complete the soil could be either spread on site or transported to the Campbell Hill construction/debris landfill for use as landfill cover. Soil treatment via land farming has proven to be effective at other Fort Riley sites.

Groundwater and Surface Water Monitoring

The groundwater and surface water monitoring component of Alternative 2 will be implemented to ensure that contamination present in the groundwater and surface water at the site are continuing to decrease in concentration and the contaminant plumes are continuing to decrease in size. Groundwater and surface water monitoring (sampling, analysis, and contaminant trend analysis) will be conducted at wells in the OB/OD (OU 006) monitoring well network and at locations where surface water is present (ephemeral streams, seeps and spring) to determine if the contaminant concentration are continuing to decrease. Trend analysis of the groundwater and surface water results will be used as evidence that the source removal is successfully reducing groundwater and surface water contamination. Due to the decrease the groundwater contaminant plume size, additional monitoring wells will be installed at the OB/OD (OU 006) on an as needed basis based on analytical results from the groundwater monitoring.

Groundwater monitoring will be conducted at monitoring wells within the OB/OD (OU 006) monitoring well network and surface water monitoring will be conducted at surface water sampling points until their respective remedial cleanup levels have not been exceeded for a period of three consecutive monitoring events.

ICs through the Fort Riley RPMP

ICs will be applied through use of the Fort Riley RPMP. The Fort Riley RPMP is the means the post authorities have to control and limit development and other activities on the post. This includes overall controls on restricting changes in land use; limiting access; prohibiting the installation of drinking water wells and groundwater/surface water use; and involving Fort Riley Directorate of Public Works – Environmental Division (PWE) personnel in the proposed future plans. The Fort Riley RPMP ensures compatibility of land uses are considered when planning for locations of functions or facilities. It is the equivalent of a city or county zoning plan. It also serves as a framework for maintenance and repair resource allocation, and development activities. Master planning for US Army installations is required by AR 210-20 which establishes a relationship between environmental planning and real property master planning to ensure that the environmental factors are included in planning decisions and land use. This is accomplished by the LRC in the Fort Riley RPMP. It consists of a variety of narratives and supporting

graphics. One of these graphic representations is the MPEO. This graphic reflects operational and environmental constraints. The OB/OD (OU 006) is designated as restricted land use in the Fort Riley RPMP as Training/Ranges.

The restricted designation in the Fort Riley RPMP directs users to the MPEO that subsequently identifies the restrictions. Restrictions will limit exposure at the OB/OD (OU 006) by:

- Restricting change of land use;
- Limiting access;
- Prohibiting the installation of drinking water wells and groundwater/surface water use in the area; and
- Involving Fort Riley PWE personnel in the proposed future plans for the OB/OD (OU 006).

The OB/OD (OU 006) is an active range located within the Impact Area and is currently used for ordnance disposal; therefore, the site is gated with severely restricted access controlled through range controls.

ICs with respect to site-related contamination will continue until the soil, groundwater, and surface water are no longer a threat to human health or the environment. Additionally, as the OB/OD (OU 006) is an active range located within the Impact Area, the range controls are anticipated to remain in place for the foreseeable future.

2.13.3 Summary of the Estimated Remedy Costs

The costs for the selected remedy of soil removal with treatment and disposal, groundwater/surface water monitoring, and ICs through the Fort Riley RPMP are summarized below:

Total Present Value Cost:	$6,935,000.00
Total Capital Cost:	$ 5,150,000.00
Total O&M Cost:	$ 1,499,000.00
Total Periodic Costs:	$ 286,000.00

Detailed cost analysis tables for capital cost, O&M cost, periodic cost, and present value cost for the selected remedy is presented in Tables 2-45 through 2-48. For the cost estimation process, data were gathered from cost estimation software (RS MEAN), vendor quotations, prior expenses, and professional

judgment. The present value cost was calculated following USEPA guidelines (USEPA, 1993b and 2000). The discount rate for federal projects under CERCLA is set at 7% in compliance with the Office of Management and Budget.

The information in this cost estimate summary table is based on the best available information regarding the anticipated scope of the remedial alternative. This is an order-of-magnitude engineering cost estimate that is expected to be within +50% to –30% of the actual project cost. Changes in the cost elements are likely to occur as a result of new information collected during the life of the project. Major changes may be documented in the form of a memorandum in the Administrative Record file, an explanation of significant differences, or a ROD amendment.

2.13.4 Expected Outcomes of the Selected Remedy

The selected remedy is expected to control exposure to contaminated media through removal and treatment of TCE-contaminated soil, through groundwater/surface water monitoring, and through the implementation of ICs, which will prevent human exposure to remaining contaminated soil, groundwater, and surface water. Upon meeting RAOs, identified COCs at the OB/OD (OU 006) will have been remediated to their respective cleanup goals. The remedial cleanup levels were developed from chemical-specific ARARs and/or calculated risk-based RGs and are determined to be sufficiently stringent and protective of human health and the environment. The remedial cleanup levels for the OB/OD (OU 006) are as follows:

Soil

- TCE – 10.72 mg/kg (calculated risk-based RG)

Groundwater

- PCA – 2.55 µg/L (calculated risk-based RG)
- TCE – 5 µg/L (USEPA MCL)
- Naphthalene – 2.61 µg/L (calculated risk-based RG)
- Benzo(a)pyrene – 0.2 µg/L (USEPA MCL)
- bis(2-ethylhexyl)phthalate – 6 µg/L (USEPA MCL)

Surface Water

- PCA – 236 µg/L (calculated risk-based RG)

- TCE – 613 µg/L (calculated risk-based RG)
- Benzo(a)pyrene – 0.0374 µg/L (calculated risk-based RG)

2.14 Statutory Determinations

Under CERCLA §121 and the NCP, the lead agency must select remedies that are protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified), are cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practical. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous waste as a principal element and a bias against off-site disposal of untreated wastes. The following sections discuss how the selected remedy meets these statutory requirements.

2.14.1 Protection of Human Health and the Environment

The selected remedy, Alternative 2, is protective of human health and the environment through the removal and treatment of TCE-contaminated soil in an on-site land-farm treatment cell. The selected remedy complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable, and satisfies the statutory preference for remedies that employ treatment that reduce toxicity, mobility, or volume as a principal element. The selected remedy (source removal of TCE-contaminated soil and on-site treatment via land farming, groundwater and surface water monitoring, and ICs through the Fort Riley RPMP) includes the necessary measures to minimize harm to the environment and existing military facilities. The statutory preference for treatment is satisfied because treatment of excavated soil is part of the selected remedy.

2.14.2 Compliance with ARARs

On-site remedial actions selected under CERCLA in a ROD must attain those ARARs that are identified at the time of ROD signature or provide grounds for invoking a waiver under §300.430(f)(1)(ii)(C). Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable. Where a state has been delegated the authority to enforce a federal statute, such as RCRA, the delegated portions of the statute are considered to be a federal ARAR unless the state law is broader or more stringent than the federal law.

ARARs are placed into three categories: chemical-, location-, and action-specific.

The KDHE list of potential ARARs was evaluated according to each statutory program and the regulations specific to each program. The ARAR evaluation was conducted in accordance with the *CERCLA Compliance with Other Laws Manual, Parts I and II* (USEPA, 1989a and USEPA, 1989b). The chemical-, location-, and action-specific ARARs identified for the OB/OD (OU 006) and are discussed in Section 2.10.

Based on the RI Report, soil, groundwater, and surface water media at the OB/OD (OU 006) have constituent levels above their corresponding remedial cleanup levels. The selected remedy will achieve compliance with soil remedial cleanup levels through the source area removal action. The selected remedy will achieve compliance with groundwater and surface water remedial cleanup levels through natural processes such as volatilization, biodegradation, advection, and dispersion. ICs will prevent exposure to soil, groundwater and surface water with contamination levels in excess of remedial cleanup levels. The selected remedy is in compliance with the action- and location-specific ARARs at the OB/OD (OU 006).

2.14.3 Cost Effectiveness

In the DA's (Fort Riley's) judgment, the selected remedy is cost-effective and represents a reasonable value for the money to be spent. In making this determination, the following definition was used: "A remedy shall be cost-effective if its cost are proportional to its overall effectiveness" (NCP 40 CFR

§300.430(f)(1)(ii)(D)). This was accomplished by evaluating the "overall effectiveness" of those alternatives that satisfied the threshold criteria (i.e., were both protective of human health and the environment and ARAR-compliant). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness). Overall effectiveness was then compared to cost to determine cost effectiveness. The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its cost and hence this alternative represents a reasonable value for the money to be spent.

The estimated present value of the selected remedy is $6,935,000. The selected remedy (Alternative 2) is projected to cost approximately $10,800,000.00 and $18,200,000.00 less than Alternatives 3 and 4, respectively, in terms of present value cost.

2.14.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The DA (Fort Riley) has determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the OB/OD (OU 006). The DA (Fort Riley) has determined that the selected remedy provides the best balance of trade-offs in terms of the five balancing criteria while also considering the statutory preference for treatment as a principal element and bias against off-site treatment and disposal and by considering State and community acceptance.

With the selected remedy, the OB/OD (OU 006) will undergo groundwater and surface water sampling to monitor progress, and ICs to eliminate or minimize the chance of a receptor being exposed to the contaminated media at the OB/OD (OU 006). Once RAOs are achieved at the OB/OD (OU 006), groundwater and surface water contaminant levels are anticipated to remain below remedial cleanup levels because there is no on-going source at the OB/OD (OU 006). Therefore, the magnitude of risk to human health and the environment is anticipated to be less than current potential risk conditions. ICs will serve to limit exposure to present and future populations at the OB/OD (OU 006).

2.14.5 Preference for Treatment as a Principal Element

By removing the TCE soil source area, the selected remedy addresses potential risks posed by the contamination through the use of treatment technologies. The selected remedy uses treatment and thus satisfies the statutory preference for treatment as well as the NCP's modifying remedy evaluation criterion to use treatment to reduce the toxicity, mobility or volume of contamination as a principal element.

2.14.6 Five-Year Review Requirements

The NCP 40 CFR §300.430(f)(4)(ii) requires a five-year review if the remedial action results in hazardous substances remaining on site at concentrations greater than those that allow for unlimited use and unrestricted exposure. Because the remedy will take longer than five years to achieve cleanup levels, a review will be conducted within five years after initiation of remedial action to ensure the remedy is, or will be, protective. A five-year review will be conducted to evaluate the effectiveness of the selected remedy as a matter of USEPA **policy**, until cleanup levels are achieved, allowing unlimited use and unrestricted exposure *(OSWER No. 9355.7-03B-P, Table 1-1).* The review will ensure that the remedy continues to provide adequate protection of human health and the environment.

2.15 Documentation of Signature Changes

The Final PP was submitted to the USEPA and KDHE on June 9, 2014, and was available to the public at the Fort Riley IRP administrative library located at 407 Pershing Court, Fort Riley, Kansas; the Hale Public Library, Kansas State University located at 1100 Mid-Campus Drive, Manhattan, Kansas; and the Manhattan Public Library located at 629 Poyntz Avenue, Manhattan, Kansas. The PP was released to the public on July 1, 2014. The public comment period was from September 11, 2014, through October 10, 2014, which included the October 6, 2014, public meeting held concurrently with the public Fort Riley RAB meeting. Announcements regarding the OB/OD (OU 006) were published in the Junction City Daily Union and the Manhattan Mercury newspapers on September 11, 2014, and the Fort Riley Post newspaper on September 12, 2014, and October 3, 2014. The PP identified Alternative 2 (Soil Removal with Disposal or Treatment, Groundwater/Surface Water Monitoring, and ICs through the Fort Riley RPMP) as the preferred remedy. Fort Riley received no public comments on the PP during the designated public comment period. No significant changes to the remedy as it was originally identified in the PP are necessary.

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3.0 RESPONSIVENES SUMMARY

3.1 Stakeholder Comments and Lead Agency Responses

During the public comment period from September 11, 2014, through October 10, 2014, for the PP (LBG-BMcD, 2014b) no public comments regarding the selected remedy for the OB/OD (OU 006) were received. No comments were conveyed at the public meeting held on October 6, 2014. Because there was no public response to the selected remedy of the PP, this Responsiveness Summary contains no comments.

3.2 Technical and Legal Issues

3.2.1 Technical Issues

Based on comments issued during a final review of the ROD by the USEPA, a Memorandum for Record was developed by the DA (Fort Riley) and is provided in Appendix A. Responses to the USEPA comments on the Final ROD are provided in Appendix B.

3.2.2 Legal Issues

There are currently no outstanding legal issues at the OB/OD (OU 006). The DA (Fort Riley) will continue to coordinate with the USEPA and the State of Kansas acting through the KDHE-BER regarding implementation of appropriate ICs which include:

- Restricting change of land use;
- Limiting access;
- Prohibiting the installation of drinking water wells and groundwater/surface water use in the area; and
- Involving Fort Riley PWE personnel in the proposed future plans for the OB/OD (OU 006).

Based on the evaluation of the data, if the groundwater and surface water samples have not exceeded remedial cleanup levels (calculated RGs and/or MCLs) for a period of three consecutive monitoring events a recommendation for discontinuing sampling will be made.

* * * * *

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TABLES

Table 2-1
Chronology of Environmental Investigations
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Date	Activity	Reports/References
Fall 1993	Collection of surface soils samples from burning and detonation pits. Collection of soil samples from subsurface borings, sediment samples, and surface water samples from ephemeral streams. Installation, development, and sampling of Monitoring Wells OB-93-01 through OB-93-04.	*Site Investigation Report for High Priority Sites*, (LBA, 1994)
December 1995	Confirmation sampling of Monitoring Wells OB-93-01 through OB-93-04.	*DSR and QCSR for Confirmation Groundwater Sampling Multi-Sites*, (LBA, 1996)
March/April 1997	Installation of Monitoring Wells OB-97-05 through OB-97-08. Sampling of Monitoring Wells OB-97-05 through OB-97-08, hand dug well, and Spring 1.	*Technical Memorandum, Overview of Mobilization #1, Preliminary Findings and Proposes Mobilization #2 Activities, Open Burn/Open Detonation Area, Fort Riley, Kansas* (LBA, 1997a)
June 1997	Collection of sample from the spring and hand dug well. Installation of nested piezometers OB-97-09PZ through OB-97-13PZ.	*Supplemental Technical Memorandum, Mobilization #2 Activities, Open Burn/Open Detonation Area, Fort Riley, Kansas* (LBA, 1998)
September 1997	Collection of groundwater samples from Monitoring Wells OB-93-01 through OB-97-08, Piezometers OB-97-09PZ through OB-97-13PZ, and a hand dug well. Collection of surface water samples. Installation of Monitoring Well OBHD-97-14 at the hand dug well location.	*DSR for Groundwater Sampling and Groundwater Elevations at the Open Burn/Open Detonation Area*, (LBA, 1999)
December 1997	Collection of groundwater samples from Monitoring Wells OB-93-01 through OB-97-08 and a hand dug well. Collection of two surface water samples. Collection of sample from Spring 1.	*DSR for Groundwater Sampling and Groundwater Elevations at the Open Burn/Open Detonation Area*, (LBA, 1999)
April 1998	Collection of groundwater samples from Monitoring Wells OB-93-01 through OBHD-97-14. Collection of five surface water samples. Collection of sample from Spring 1 and Spring 2.	*DSR for Groundwater Sampling and Groundwater Elevations at the Open Burn/Open Detonation Area*, (LBA, 1999)
August 1998	Collection of groundwater samples from Monitoring Wells OB-93-01 through OBHD-97-14. Collection of five surface water samples.	*DSR for Groundwater Sampling and Groundwater Elevations at the Open Burn/Open Detonation Area*, (LBA, 1999)

Table 2-1
Chronology of Environmental Investigations
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Date	Activity	Reports/References
January 1999	Collection of groundwater samples from Monitoring Wells OB-93-01 through OBHD-97-14. Collection of four surface water samples. Collection of sample from Spring 1.	*DSR for Groundwater Sampling and Groundwater Elevations at the Open Burn/Open Detonation Area*, (LBA, 1999)
June 1999	Site analysis regarding geology, stratigraphy, structure, and hydrology of the OB/OD Area.	*Analysis of Geological Stratigraphy, Structure, and Hydrology of the OB/OD Site, Fort Riley, Kansas*, (Archer and Martin, 1999)
April 2003	Collection of surface water sample.	*QCSR April 2003 Surface Water Sampling Event, OB/OD Site, Fort Riley, Kansas*, (BMcD, 2003)
March 2004	Collection of surface water sample.	*QCSR March 2004 Surface Water Sampling Event, OB/OD Site, Fort Riley, Kansas*, (MP-BMcD, 2004a)
April 2004	Collection of groundwater samples from Monitoring Wells OB-93-01 through OBHD-97-14, Piezometers OB-97-09PZ(0), OB-97-10PZ(1) through (3), OB-97-11PZ(0) and (1), OB-97-12PZ(1) and (3), OB-97-13PZ(0) through (3). Collection of samples from Spring 1, Surface 1, Seep 1, and Seep 2.	*QCSR April 2004 Sampling Event, OB/OD Site, Fort Riley, Kansas*, (MP-BMcD, 2004b)
August 2005	Installation of Monitoring Well OB-05-15	*Data Summary Report For Groundwater, Spring, and Seep Sampling, Fort Riley, Kansas, (MP-BMcD, 2006)*
July 2006	Collection of groundwater samples from seven direct-push locations	*Data Summary Reports For Ground Water, Spring, and Seep Sampling, Fort Riley, Kansas, (MP-BMcD, 2007-2011)*
2007-2011	Collection of groundwater samples from Monitoring Wells OB-93-01 through OBHD-97-14, Piezometers OB-97-09PZ(0), OB-97-10PZ(1) through (3), OB-97-11PZ(0) and (1), OB-97-12PZ(1) and (3), OB-97-13PZ(0) through (3). Collection of samples from Spring 1, Surface 1, Seep 1, and Seep 2.	*Data Summary Reports For Ground Water, Spring, and Seep Sampling, Fort Riley, Kansas*, (MP-BMcD, 2007-2011)

Table 2-1
Chronology of Environmental Investigations
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Date	Activity	Reports/References
2011-2013	Collection of soil, dry sediment, and surface water samples, installation of six monitoring wells, abandonment of piezometers, and four rounds of quarterly sampling of sixteen monitoring wells	Results are included in the *Remedial Investigation Report for the OB/OD (Range 16) – Operable Unit 006 at Fort Riley, Kansas*, (LBG-BMcD, 2013).

DSR = Data Summary Report
BMcD = Burns & McDonnell
LBA = Louis Berger & Associates
LBG = The Louis Berger Group, Inc.
OB = Open Burning
OB/OD = Open Burning/Open Detonation
OBHD = Open Burning Hand Dug
PZ = Piezometer
QCSR = Quality Control Summary Report

Table 2-2
Listed and Rare Species Occurring and Potentially Occurring in the Fort Riley Area
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Common Name	Scientific Name	Federal Status	State Status	Known to Occur in Geary County	Known to Occur in Riley County
American Burying Beetle	*Nicrophorus americanus*	E	E	Yes	Yes
Black Rail	*Laterallus jamaicensis*	None	SINC	No	Yes
Black Tern	*Chlidonias niger*	None	SINC	Yes	Yes
Bobolink	*Dolichonyx oryzivorus*	None	SINC	No	Yes
Common Shiner	*Luxilus cornutus*	None	SINC	Yes	No
Eastern Hognose Snake	*Heterodon platirhinos*	None	SINC	Yes	Yes
Eastern Spotted Skunk	*Spilogale putorius*	None	T	Yes	Yes
Eskimo Cerlew	*Numenius borealis*	E	E	Yes	Yes
Franklin's Ground Squirrel	*Spermophilus franklinii*	None	SINC	No	Yes
Golden Eagle	*Aquila chrysaetos*	None	SINC	Yes	Yes
Henslow's Sparrow	*Ammodramus henslowii*	None	SINC	Yes	Yes
Highfin Carpsucker	*Carpiodes velifer*	None	SINC	No	Yes
Least Tern	*Sterna antillarum*	E	E	Yes-Critical Habitat Designated[1]	Yes-Critical Habitat Designated[1]
Long-billed Curlew	*Numenius americanus*	None	SINC	No	Yes
Piping Plover	*Charadrius melodus*	T	T	Yes-Critical Habitat Designated[1]	Yes-Critical Habitat Designated[1]
Plains Minnow	*Hybognathus placitus*	None	T	Yes-Temporary Critical Habitat Designated[2]	Yes-Temporary Critical Habitat Designated[2]
Shoal Chub	*Macrhybopsis histoma*	None	T	Yes-Temporary Critical Habitat Designated[3]	No
Short-Eared Owl	*Asio flammeus*	None	SINC	Yes	Yes
Silver Chub	*Macrhybopsis storeriana*	None	E	Yes-Critical Habitat Designated[4]	Yes
Snowy Plover	*Charadrius alexandrinus*	None	T	Yes	Yes
Southern Bog Lemming	*Synaptomys copperi*	None	SINC	No	Yes
Sturgeon Chub	*Macrhybopsis gelida*	None	T	Yes-Critical Habitat Designated[5]	Yes-Critical Habitat Designated[5]
Timber Rattlesnake	*Crotalus horridus*	None	SINC	Yes	Yes
Topeka Shiner	*Notropis topeka*	E	T	Yes-Critical Habitat Designated[6]	Yes-Critical Habitat Designated[6]
Western Hognosed Snake	*Heterodon nasicus*	None	SINC	Yes	Yes
Whip-Poor-Will	*Caprimulgus vociferus*	None	SINC	Yes	Yes
Whooping Crane	*Grus americana*	E	E	No	Yes
Yellow-throated Warbler		None	SINC	No	Yes

Notes:

[1] All the waters within a corridor along the main stem of the Kansas River from the confluence of the Republican River and Smoky Hill River on Fort Riley in Geary County to the confluence of the Missouri River in Kansas City, Wyandotte County.

[2] The Kansas River in Geary and Riley Counties.

[3] The Kansas River in Geary County.

[4] The Kansas River from the confluence of the Republican and Smoky Hill Rivers to the Missouri River (Section 1 & 2, Township 11 South, Range 25 East).

[5] The main stem of the Kansas River from its start at the confluence of the Republican River and Smoky Hill River on Fort Riley in Geary County to the confluence of the Missouri River in Kansas City, Wyandotte County.

[6] Cary Creek and its tributaries in Dickinson County from where it crosses the Dickinson/Geary County line (Sec. 6, T14S, R5E) upstream to its headwaters (Sec. 33, T15S, R3E); Thomas Creek and Dry Creek in Geary County; Little Arkansas Creek and Sevenmile Creek in Riley County; Deep Creek main stem in Riley County from where it crosses the Riley/Wabaunsee County line (Sec. 22, T10S, R9E) upstream to Interstate Highway 70 (Sec. 25, T11S, R9E).

E = Endangered SINC = Species in Need of Conservation T = Threatened

Table 2-3
Screening Levels Used During RI and Sources
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Groundwater and/or Surface Water[1]			
Detected Parameter	**Units**	**Screening Level**	**Source[3]**
Volatile Organic Compounds			
1,1,1,2-Tetrachloroethane	µg/L	9.91	RSK
1,1,2,2-Tetrachloroethane	µg/L	1.28	RSK
1,2,3-Trichlorobenzene	µg/L	5.2	RSL
1,2,4-Trichlorobenzene	µg/L	70	MCL
1,2,4-Trimethylbenzene	µg/L	17.4	RSK
1,2-Dichloroethene, Total	µg/L	NA	--
2-Butanone (MEK)	µg/L	11,800	RSK
2-Hexanone	µg/L	34	RSL
4-Methyl-2-pentanone (MIBK)	µg/L	4,170	RSK
Acetone	µg/L	45,500	RSK
Benzene	µg/L	5	MCL
Bromoform	µg/L	80	MCL
Carbon disulfide	µg/L	1,660	RSK
cis-1,2-Dichloroethene	µg/L	70	MCL
Dibromochloromethane	µg/L	80	MCL
Ethylbenzene	µg/L	700	MCL
m-Xylene & p-Xylene	µg/L	190	RSL
Naphthalene	µg/L	2.11	RSK
n-Propylbenzene	µg/L	1,910	RSK
o-Xylene	µg/L	190	RSL
Tetrachloroethene	µg/L	5	MCL
Toluene	µg/L	1,000	MCL
trans-1,2-Dichloroethene	µg/L	100	MCL
Trichloroethene	µg/L	5	MCL
Semi-volatile Organic Compounds			
Benzo(a)pyrene	µg/L	0.2	MCL
Benzo(ghi)perylene	µg/L	NA	--
bis(2-Ethylhexyl)phthalate	µg/L	6	MCL
Perchlorate			
Perchlorate	µg/L	70.9	RSK
Explosives			
2,4-Dinitrotoluene	µg/L	8.98	RSK
4-Amino-2,6-dinitrotoluene	µg/L	30	RSL
HMX	µg/L	5,110	RSK
Nitroglycerin	µg/L	1.5	RSL
RDX	µg/L	25.9	RSK
Tetryl	µg/L	407	RSK
Metals			
Antimony	µg/L	6	MCL
Arsenic	µg/L	10	MCL
Beryllium	µg/L	4	MCL
Cadmium	µg/L	5	MCL
Chromium	µg/L	100	MCL
Copper	µg/L	1,300	MCL
Lead	µg/L	15	MCL
Mercury	mg/L	0.002	MCL
Nickel	µg/L	2,040	RSK
Selenium	µg/L	50	MCL
Silver	µg/L	508	RSK
Zinc	µg/L	30,500	RSK
Groundwater Quality Package			
Ammonia	mg/L	NA	--
Chloride	mg/L	NA	(Secondary Standard)[4]
Nitrate as N	mg/L	10	MCL
Orthophosphate as P	mg/L	NA	--
Sulfate	mg/L	NA	(Secondary Standard)[4]
Sulfide	mg/L	NA	--
Monitored Natural Attenuation Package			
Methane	µg/L	NA	--
Ethane	µg/L	NA	--
Total Organic Carbon	mg/L	NA	--

Soil[2]			
Detected Parameter	**Units**	**Screening Level**	**Source[3]**
Volatile Organic Compounds			
1,1,1,2-Tetrachloroethane	µg/kg	48,800	RSK
1,1,2,2-Tetrachloroethane	µg/kg	15,200	RSK
1,1,2-Trichloroethane	µg/kg	27,600	RSK
1,2,4-Trimethylbenzene	µg/kg	126,000	RSK
1,3-Dichlorobenzene	µg/kg	NA	--
Acetone	µg/kg	406,000,000	RSK
Bromochloromethane	µg/kg	680,000	RSL
Chlorobenzene	µg/kg	740,000	RSK
Chloroform	µg/kg	7,140	RSK
cis-1,2-Dichloroethene	µg/kg	194,000	RSK
Isopropylbenzene	µg/kg	5,680,000	RSK
Methylene chloride	µg/kg	267,000	RSK
p-Isopropyltoluene	µg/kg	NA	--
sec-Butylbenzene	µg/kg	654,000	RSK
Styrene	µg/kg	20,400,000	RSK
tert-Butylbenzene	µg/kg	NA	--
Tetrachloroethene	µg/kg	210,000	RSK
Toluene	µg/kg	29,800,000	RSK
trans-1,2-Dichloroethene	µg/kg	333,000	RSK
Trichloroethene	µg/kg	9,910	RSK
Semivolatile Organic Compounds			
2,4-Dinitrotoluene	µg/kg	79,600	RSK
2,6-Dinitrotoluene	µg/kg	881,000	RSK
Di-n-butyl phthalate	µg/kg	62,000,000	RSL
N-Nitrosodiphenylamine	µg/kg	350,000	RSL
Perchlorate			
Perchlorate	µg/kg	1,430,000	RSK
Explosives			
2,4,6-Trinitrotoluene	mg/kg	440	RSK
2,4-Dinitrotoluene	mg/kg	79.6	RSK
2,6-Dinitrotoluene	mg/kg	881	RSK
4-Amino-2,6-dinitrotoluene	mg/kg	1,900	RSL
4-Nitrotoluene	mg/kg	110	RSL
HMX	mg/kg	44,000	RSK
Nitroglycerin	mg/kg	62	RSL
RDX	mg/kg	224	RSK
Metals			
Antimony	mg/kg	817	RSK
Arsenic	mg/kg	38	RSK
Beryllium	mg/kg	3,650	RSK
Cadmium	mg/kg	965	RSK
Chromium	mg/kg	111	RSK
Copper	mg/kg	81,700	RSK
Lead	mg/kg	1,000	RSK
Mercury	mg/kg	20	RSK
Nickel	mg/kg	32,400	RSK
Selenium	mg/kg	10,200	RSK
Silver	mg/kg	10,200	RSK
Thallium	mg/kg	10	RSL
Zinc	mg/kg	613,000	RSK

Dry Sediment[2]			
Detected Parameter	**Units**	**Screening Level**	**Source[3]**
Volatile Organic Compounds			
Tetrachloroethene	µg/kg	210,000	RSK
Toluene	µg/kg	29,800,000	RSK
Metals			
Antimony	mg/kg	817	RSK
Arsenic	mg/kg	38	RSK
Beryllium	mg/kg	3,650	RSK
Cadmium	mg/kg	965	RSK
Chromium	mg/kg	111	RSK
Copper	mg/kg	81700	RSK
Lead	mg/kg	1000	RSK
Mercury	mg/kg	20	RSK
Nickel	mg/kg	32400	RSK
Selenium	mg/kg	10200	RSK
Silver	mg/kg	10200	RSK
Thallium	mg/kg	10	RSL
Zinc	mg/kg	613000	RSK

Notes:

[1] Screening levels for groundwater and/or surface water samples are EPA MCL, KDHE RSK (non-residential groundwater), or EPA RSL (tapwater).

[2] Screening levels for soil samples are KDHE RSK (non-residential soil pathway) or EPA RSL (industrial soil).

[3] Sources are as follows:
MCL - United States Environmental Protection Agency, National Primary Drinking Water Regulations, EPA 816-F-09-004, May 2009.
Access: http://water.epa.gov/drink/contaminants/upload/mcl-2.pdf
RSK - Kansas Department of Health and Environment, Risk-Based Standards for Kansas, RSK Manual - 5th Version, Appendix A, October 2010.
Access: http://www.kdheks.gov/remedial/download/RSK_Manual_10.pdf
RSL - United States Environmental Protection Agency, Regional Screening Level (RSL) Summary Table, November 2012.
Access: http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/master_sl_table_bwrun_NOV2012.pdf

[4] The secondary standard for chloride in 250 mg/L and for sulfate is 250 mg/L. Secondary standards are based on aesthetic considerations and not risk to human health. Therefore these levels are not being applied as screening levels.

EPA = United States Environmental Protection Agency
KDHE = Kansas Department of Health and Environment
MCL = Maximum Contaminant Level
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
NA = Not available
RSK = Risk-Based Standards for Kansas
RSL = Regional Screening Level
µg/kg = micrograms per kilogram
µg/L = micrograms per liter

Table 2-4
RI Field GC Soil Results, Metal Debris Pits
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	MD-12/SS01-0.5'	MD-12/SB01-2.0'	MD-12/SB02-6.5'	MD-12/SB03-10.5'	MD-15/SS01-0.5'	MD-15/SB01-2.0'
		Date Sampled:	01/29/2013	01/29/2013	01/29/2013	01/29/2013	01/29/2013	01/29/2013
		Medium:	Surface Soil	Surface Soil	Subsurface Soil	Subsurface Soil	Surface Soil	Surface Soil
Parameter	**Units**	**Screening Level[1]**						
Volatile Organic Compounds								
cis-1,2-Dichloroethene	µg/kg	194,000	10 U	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	µg/kg	210,000	10 U	10 U	***32***	***11***	10 U	10 U
Trichloroethene	µg/kg	9,910	***36***	10 U	***378***	***38***	***302***	***80***

		Sample ID:	MD-15/SB02-7.0'	MD-16/SS01-1.0'	MD-16/SB01-3.0'	MD-16/SB02-6.0'	MD-20/SS01-0.9'	MD-20/SB01-3.0'
		Date Sampled:	01/29/2013	01/30/2013	01/30/2013	01/30/2013	01/29/2013	01/29/2013
		Medium:	Subsurface Soil	Surface Soil	Subsurface Soil	Subsurface Soil	Surface Soil	Subsurface Soil
Parameter	**Units**	**Screening Level[1]**						
Volatile Organic Compounds								
cis-1,2-Dichloroethene	µg/kg	194,000	10 U	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	µg/kg	210,000	10 U	10 U	***12***	10 U	***16***	10 U
Trichloroethene	µg/kg	9,910	***121***	***144***	***620***	***111***	***430***	***74***

		Sample ID:	MD-20/SB02-6.5'	MD-20/SB03-10.0'	MD-21/SS01-1.0'	MD-21/SB01-3.0'	MD-21/SB02-8.0'	MD-21/SB03-11.0'
		Date Sampled:	01/29/2013	01/29/2013	01/29/2013	01/29/2013	01/29/2013	01/29/2013
		Medium:	Subsurface Soil	Subsurface Soil	Surface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil
Parameter	**Units**	**Screening Level[1]**						
Volatile Organic Compounds								
cis-1,2-Dichloroethene	µg/kg	194,000	10 U	10 U	10 U	10 U	***10***	***17***
Tetrachloroethene	µg/kg	210,000	10 U	10 U	***500***	***22***	***64***	***117***
Trichloroethene	µg/kg	9,910	***428***	***144***	***9,700 J***	***540***	***4,200 J***	***11,000 J***

Notes:

[1] For source of screening level, see Table 2-3.

Bold / Italics = compound was detected

Highlighted = Concentration exceeds screening level

GC = Gas Chromatograph

ID = Identification

J = estimated value

U = compound was not detected (or qualified as not detected during QA/QC review)

µg/kg = micrograms per kilogram

Table 2-4
RI Field GC Soil Results, Metal Debris Pits
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	MD-22/SS01-1.0'	MD-22/SB01-3.0'	MD-22/SB02-8.0'	MD-22/SB03-11.0'	MD-25/SS01-1.0'	MD-25/SB01-2.0'
		Date Sampled:	01/29/2013	01/29/2013	01/29/2013	01/29/2013	01/28/2013	01/28/2013
		Medium:	Surface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Surface Soil	Surface Soil
Parameter	**Units**	**Screening Level[1]**						
Volatile Organic Compounds								
cis-1,2-Dichloroethene	µg/kg	194,000	***57***	***15***	***310***	***540***	***190***	***28***
Tetrachloroethene	µg/kg	210,000	***1,500 J***	***108***	***3,900 J***	***39,000 J***	***490***	***17***
Trichloroethene	µg/kg	9,910	***24,000 J***	***4,300 J***	***790,000 J***	***2,000,000 J***	***9,100 J***	***640***

		Sample ID:	MD-25/SB02-7.0'	MD-25/SB03-10.0'	MD-25/SB04-13'	MD-26/SS01-0.9'	MD-26/SB01-3.0'	MD-26/SB02-7.0'
		Date Sampled:	01/28/2013	01/28/2013	01/28/2013	01/29/2013	01/29/2013	01/29/2013
		Medium:	Subsurface Soil	Subsurface Soil	Subsurface Soil	Surface Soil	Subsurface Soil	Subsurface Soil
Parameter	**Units**	**Screening Level[1]**						
Volatile Organic Compounds								
cis-1,2-Dichloroethene	µg/kg	194,000	***980***	***4,400 J***	***1,000 J***	10 U	10 U	***89***
Tetrachloroethene	µg/kg	210,000	***230***	***1,000 J***	***1,500 J***	***58***	***18***	***222***
Trichloroethene	µg/kg	9,910	***28,000 J***	***43,000 J***	***1,200,000 J***	***1,400 J***	***875***	***27,000 J***

		Sample ID:	MD-26/SB03-11.5'	MD-27/SS01-0.5'	MD-27/SB01-3.0'	MD-27/SB02-6.0'	MD-28/SS01-0.5'	MD-28/SB01-3.0'
		Date Sampled:	01/29/2013	01/28/2013	01/28/2013	01/28/2013	01/28/2013	01/28/2013
		Medium:	Subsurface Soil	Surface Soil	Subsurface Soil	Subsurface Soil	Surface Soil	Subsurface Soil
Parameter	**Units**	**Screening Level[1]**						
Volatile Organic Compounds								
cis-1,2-Dichloroethene	µg/kg	194,000	***290***	10 U	10 U	10 U J	10 U	10 U
Tetrachloroethene	µg/kg	210,000	***720***	10 U	10 U	10 U	***10***	10 U
Trichloroethene	µg/kg	9,910	***200,000 J***	10 U	10 U	10 U	***78***	***62***

Notes:

[1] For source of screening level, see Table 2-3.

Bold / Italics = compound was detected

Highlighted = Concentration exceeds screening level

GC = Gas Chromatograph

ID = Identification

J = estimated value

U = compound was not detected (or qualified as not detected during QA/QC review)

µg/kg = micrograms per kilogram

Table 2-4
RI Field GC Soil Results, Metal Debris Pits
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	MD-28/SB02-7.0'	MD-29/SS01-0.9'	MD-29/SB01-3.0'	MD-29/SB02-7.0'	MD-29/SB03-11.9'	MD-31/SS01-0.9'
		Date Sampled:	01/28/2013	01/29/2013	01/29/2013	01/29/2013	01/29/2013	01/28/2013
		Medium:	Subsurface Soil	Surface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Surface Soil
Parameter	**Units**	**Screening Level[1]**						
Volatile Organic Compounds								
cis-1,2-Dichloroethene	µg/kg	194,000	10 U	10 U	10 U	10 U	***15***	10 U
Tetrachloroethene	µg/kg	210,000	10 U	10 U	10 U	10 U	***23***	10 U
Trichloroethene	µg/kg	9,910	***170***	***51***	***105***	***169***	***6,700 J***	***400***

		Sample ID:	MD-31/SB01-3.0'	MD-31/SB02-7.5'	MD-31/SB03-10.0'	MD-32/SS01-1.0'	MD-32/SB01-3.0'	MD-32/SB02-6.0'
		Date Sampled:	01/28/2013	01/28/2013	01/28/2013	01/29/2013	01/29/2013	01/29/2013
		Medium:	Subsurface Soil	Subsurface Soil	Subsurface Soil	Surface Soil	Subsurface Soil	Subsurface Soil
Parameter	**Units**	**Screening Level[1]**						
Volatile Organic Compounds								
cis-1,2-Dichloroethene	µg/kg	194,000	10 U	***30***	***44***	10 U	10 U	10 U
Tetrachloroethene	µg/kg	210,000	10 U	***20***	***28***	***45***	10 U	10 U
Trichloroethene	µg/kg	9,910	***180***	***2,800 J***	***4,700 J***	***1,400 J***	***79***	***256***

		Sample ID:	MD-32/SB03-11.0'	MD-33/SS01-1.0'	MD-33/SB01-3.0'	MD-33/SB02-7.0'	MD-33/SB03-12.0'	MD-34/SS01-1.0'
		Date Sampled:	01/29/2013	01/30/2013	01/30/2013	01/30/2013	01/30/2013	01/30/2013
		Medium:	Subsurface Soil	Surface Soil	Subsurface Soil	Subsurface Soil	Subsurface Soil	Surface Soil
Parameter	**Units**	**Screening Level[1]**						
Volatile Organic Compounds								
cis-1,2-Dichloroethene	µg/kg	194,000	***16***	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	µg/kg	210,000	***43***	10 U	10 U	10 U	***10***	10 U
Trichloroethene	µg/kg	9,910	***4,600 J***	***109***	***201***	***155***	***6,200 J***	10 U

Notes:

[1] For source of screening level, see Table 2-3.

Bold / Italics = compound was detected

Highlighted = Concentration exceeds screening level

GC = Gas Chromatograph

ID = Identification

J = estimated value

U = compound was not detected (or qualified as not detected during QA/QC review)

µg/kg = micrograms per kilogram

Table 2-4
RI Field GC Soil Results, Metal Debris Pits
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	MD-34/SB01-12.0'	MD-35/SS01-1.0'	MD-35/SB01-7.0'	MD-36/SS01-1.0'	MD-36/SB01-6.0'	MD-37/SS01-1.0'
		Date Sampled:	01/30/2013	01/30/2013	01/30/2013	01/30/2013	01/30/2013	01/30/2013
		Medium:	Subsurface Soil	Surface Soil	Subsurface Soil	Surface Soil	Subsurface Soil	Surface Soil
Parameter	**Units**	**Screening Level[1]**						
Volatile Organic Compounds								
cis-1,2-Dichloroethene	µg/kg	194,000	10 U	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	µg/kg	210,000	10 U	10 U	10 U	10 U	10 U	10 U
Trichloroethene	µg/kg	9,910	10 U	10 U	10 U	10 U	10 U	10 U

		Sample ID:	MD-37/SB01-3.0'	MD-37/SB02-7.8'	MD-38/SS01-0.9'	MD-38/SB01-3.0'	MD-38/SB02-8.0'	MD-39/SS01-0.9'
		Date Sampled:	01/30/2013	01/30/2013	01/30/2013	01/30/2013	01/30/2013	01/30/2013
		Medium:	Subsurface Soil	Subsurface Soil	Surface Soil	Subsurface Soil	Subsurface Soil	Surface Soil
Parameter	**Units**	**Screening Level[1]**						
Volatile Organic Compounds								
cis-1,2-Dichloroethene	µg/kg	194,000	10 U	10 U	10 U	10 U	10 U	10 U
Tetrachloroethene	µg/kg	210,000	10 U	10 U	10 U	10 U	10 U	10 U
Trichloroethene	µg/kg	9,910	10 U	10 U	10 U	10 U	***86***	10 U

		Sample ID:	MD-39/SB01-7.0'	MD-39/SB02-11.5'
		Date Sampled:	01/30/2013	01/30/2013
		Medium:	Subsurface Soil	Subsurface Soil
Parameter	**Units**	**Screening Level[1]**		
Volatile Organic Compounds				
cis-1,2-Dichloroethene	µg/kg	194,000	10 U	10 U
Tetrachloroethene	µg/kg	210,000	10 U	10 U
Trichloroethene	µg/kg	9,910	10 U	***35***

Notes:

[1] For source of screening level, see Table 2-3.

Bold / Italics = compound was detected

Highlighted = Concentration exceeds screening level

GC = Gas Chromatograph

ID = Identification

J = estimated value

U = compound was not detected (or qualified as not detected during QA/QC review)

µg/kg = micrograms per kilogram

Table 2-5
RI Surface Soil Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	BDSS-01/SS01	BDSS-02/SS01	BDSS-03/SS01	BDSS-04/SS01	BDSS-05/SS01	BDSS-06/SS01	BDSS-07/SS01	BDSS-08/SS01	BDSS-09/SS01	BDSS-10/SS01	BDSS-11/SS01	BDSS-12/SS01	BDSS-13/SS01
		Lab Number(s):	G1L210482-001	G1L210482-002	G1L210482-005	G1L210482-004	G1L210482-003	G1L160529-002	G1L160529-003	G1L160529-004	G1L160529-001	G1L160527-015	G1L190422-005	G1L190422-003	G1L190422-006
		Date(s) Sampled:	12/19/2011	12/19/2011	12/19/2011	12/19/2011	12/19/2011	12/14/2011	12/14/2011	12/14/2011	12/14/2011	12/14/2011	12/16/2011	12/16/2011	12/16/2011
		Depth (feet bgs):	0.5 - 1.5	1.0 - 2.0	1.0 - 2.0	1.0 - 2.0	1.0 - 2.0	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	0.0 - 0.5	1.0 - 2.0	0.0 - 1.0	0.5 - 1.5
Parameter	**Units**	**Screening Level[1]**													
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	µg/kg	48,800	6.3 U	6.3 U	6.2 U	6.1 U	6.2 U	6.4 U J	6.4 U	6.6 U J	6.5 U	6.4 U J	6 U J	6.3 U J	6.8 U
1,1,2,2-Tetrachloroethane	µg/kg	15,200	6.3 U	6.3 U	6.2 U	6.1 U	6.2 U	6.4 U J	6.4 U	6.6 U J	6.5 U	6.4 U J	6 U J	***29 J***	6.8 U
1,1,2-Trichloroethane	µg/kg	27,600	6.3 U	6.3 U	6.2 U	6.1 U	6.2 U	6.4 U J	6.4 U	6.6 U J	6.5 U	6.4 U J	6 U J	6.3 U J	6.8 U
1,2,4-Trimethylbenzene	µg/kg	126,000	6.3 U	6.3 U	6.2 U	6.1 U	6.2 U	6.4 U J	6.4 U	6.6 U J	6.5 U	6.4 U J	6 U J	6.3 U J	6.8 U
1,3-Dichlorobenzene	µg/kg	NA	6.3 U	6.3 U	6.2 U	6.1 U	6.2 U J	6.4 U J	6.4 U	6.6 U J	6.5 U	6.4 U J	6 U J	6.3 U J	6.8 U
Acetone	µg/kg	406,000,000	25 U	25 U	25 U	25 U	25 U	26 U J	26 U	26 U J	26 U	25 U J	24 U J	25 U J	27 U
Bromochloromethane	µg/kg	680,000	6.3 U	6.3 U	6.2 U	6.1 U	6.2 U	6.4 U J	6.4 U	6.6 U J	6.5 U	6.4 U J	6 U J	6.3 U J	6.8 U
Chlorobenzene	µg/kg	740,000	6.3 U	6.3 U	6.2 U	6.1 U	6.2 U	6.4 U J	6.4 U	6.6 U J	6.5 U	6.4 U J	6 U J	6.3 U J	6.8 U
cis-1,2-Dichloroethene	µg/kg	194,000	6.3 U	6.3 U	6.2 U	6.1 U	6.2 U	6.4 U J	6.4 U	6.6 U J	6.5 U	6.4 U J	6 U J	***2.6 J***	6.8 U
Isopropylbenzene	µg/kg	5,680,000	6.3 U	6.3 U	6.2 U	6.1 U	6.2 U	6.4 U J	6.4 U	6.6 U J	6.5 U	6.4 U J	6 U J	6.3 U J	6.8 U
p-Isopropyltoluene	µg/kg	NA	6.3 U	6.3 U	6.2 U	6.1 U	6.2 U J	***1.1 J***	6.4 U	6.6 U J	***2 J***	6.4 U J	6 U J	6.3 U J	6.8 U
sec-Butylbenzene	µg/kg	654,000	6.3 U	6.3 U	6.2 U	6.1 U	6.2 U	6.4 U J	6.4 U	6.6 U J	6.5 U	6.4 U J	6 U J	6.3 U J	6.8 U
tert-Butylbenzene	µg/kg	NA	6.3 U	6.3 U	6.2 U	6.1 U	6.2 U	6.4 U J	6.4 U	6.6 U J	6.5 U	6.4 U J	6 U J	6.3 U J	6.8 U
Tetrachloroethene	µg/kg	210,000	6.3 U	6.3 U	6.2 U	6.1 U	6.2 U	6.4 U J	6.4 U	6.6 U J	6.5 U	6.4 U J	6 U J	***2.6 J***	6.8 U
Toluene	µg/kg	29,800,000	6.3 U	6.3 U	6.2 U	6.1 U	6.2 U	6.4 U J	6.4 U	6.6 U J	6.5 U	6.4 U J	6 U J	6.3 U J	6.8 U
trans-1,2-Dichloroethene	µg/kg	333,000	6.3 U	6.3 U	6.2 U	6.1 U	6.2 U	6.4 U J	6.4 U	6.6 U J	6.5 U	6.4 U J	6 U J	***1.2 J***	6.8 U
Trichloroethene	µg/kg	9,910	6.3 U	6.3 U	6.2 U	6.1 U	6.2 U	***2.2 J***	***2 J***	***2.3 J***	***2.1 J***	6.4 U J	6 U J	***79 J***	6.8 U
Semivolatile Organic Compounds															
2,4-Dinitrotoluene	µg/kg	79,600	400 U	420 U	400 U	400 U	400 U	***2,100***	***3,700***	420 U	410 U	***5,900***	***37,000***	***19,000***	450 U
2,6-Dinitrotoluene	µg/kg	881,000	400 U	420 U	400 U	400 U	400 U	420 U	***150 J***	420 U	410 U	***130 J***	***2,800***	***290 J***	450 U
Di-n-butyl phthalate	µg/kg	62,000,000	400 U	420 U	400 U	400 U	400 U	***2,000***	***3,300***	***490***	***1,400***	***6,600***	***29,000***	***8,400***	450 U
N-Nitrosodiphenylamine	µg/kg	350,000	400 U	420 U	400 U	400 U	400 U	***350 J***	***410***	420 U	***280 J***	***980***	***1,300***	***1,700 J***	450 U
Perchlorate															
Perchlorate	µg/kg	1,430,000	6.2 U	6 U	6 U	6.1 U	***0.4 J***	6.3 U	***0.33 J***	***0.34 J***	6.3 U	***2.4 J***	***0.74 J***	***0.42 J***	6.6 U
Explosives															
2,4,6-Trinitrotoluene	mg/kg	440	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	***0.027 J***	***0.043 J***	0.25 U
2,4-Dinitrotoluene	mg/kg	79.6	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	***0.025 J***	***0.034 J***	0.25 U	0.25 U	***0.022 J***	***0.45***	***0.043 J***	0.25 U
4-Amino-2,6-dinitrotoluene	mg/kg	1,900	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	***0.16 J***	0.25 U
HMX	mg/kg	44,000	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	***0.04 J***	0.25 U
Nitroglycerin	mg/kg	62	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	***0.31 J***	0.5 U	0.5 U	***0.98***	***11***	0.5 U	0.5 U
RDX	mg/kg	224	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	***0.064 J***	0.25 U
Metals															
Antimony	mg/kg	817	***0.32 J***	***0.27 J***	***0.26 J***	***0.3 J***	***0.31 J***	***0.92***	***0.77***	***0.45 J***	***0.94***	***1.6***	***1.3***	***6.2***	0.81 U
Arsenic	mg/kg	38	***5.3***	***4.8***	***5.1***	***5.1***	***5.7 J***	***4.9***	***5.3***	***4.6***	***4.7***	***8.8***	***4.5***	***6.6***	***3.6***
Beryllium	mg/kg	3,650	***0.91***	***0.94***	***0.85***	***0.87***	***0.95***	***0.72***	***0.86***	***0.81***	***0.8***	***0.63***	***0.75***	***1***	***1.3***
Cadmium	mg/kg	965	***0.58***	***0.54***	***1***	***0.88***	***0.87 J***	***0.53***	***1.1***	***0.67***	***0.74***	***0.79***	***3.1***	***16.8***	***0.45***
Chromium	mg/kg	111	***19.7***	***20.9***	***18.3***	***20.1***	***18.9***	***24.5***	***29.4***	***27.5***	***30.1***	***23.3***	***22.2***	***33.4***	***22.6***
Copper	mg/kg	81,700	***20.7***	***11.3***	***11.6***	***11.5***	***11.4 J***	***37.4***	***48.5***	***33.9***	***36.5***	***47.4***	***68.7***	***207***	***14.3***
Lead	mg/kg	1,000	***14.4***	***13.2***	***16.5***	***16.4***	***18.3 J***	***33***	***45.5***	***24***	***48.2***	***59.6***	***54.9***	***231***	***13.4***
Mercury	mg/kg	20	***0.015 J***	0.05 U	***0.012 J***	0.049 U	***0.013 J***	***0.025 J***	***0.023 J***	***0.011 J***	***0.011 J***	***0.03 J***	***0.036 J***	***0.023 J***	***0.019 J***
Nickel	mg/kg	32,400	***12.8***	***14.8***	***24.7***	***17.5***	***19.2 J***	***20.2***	***25.2***	***22.4***	***22.4***	***17.3***	***18.2***	***20.7***	***27.5***
Selenium	mg/kg	10,200	***0.52***	***0.59***	***0.34 J***	***0.53***	***0.51***	***0.93***	***0.9***	***0.78***	***0.71***	***0.51***	***0.54***	***0.45***	***0.55***
Silver	mg/kg	10,200	***0.3***	***0.12 J***	***0.11 J***	***0.093 J***	***0.12***	***0.087 J***	***0.14***	***0.095 J***	***0.095 J***	***0.073 J***	***0.27***	***0.19***	***0.1 J***
Thallium	mg/kg	10	***0.26***	***0.25***	***0.33***	***0.31***	***0.33 J***	***0.16 J***	***0.2***	***0.17 J***	***0.16 J***	***0.13 J***	***0.22***	***0.24***	***0.33***
Zinc	mg/kg	613,000	***41.9***	***34.5***	***30.4***	***42.9***	***31.5 J***	***899***	***155***	***286***	***109***	***191***	***116***	***500***	***44.7***

Notes:
Bold / Italics = compound was detected
Highlighted = Concentration exceeds screening level
bgs = below ground surface
ID = Identification
J = estimated value
mg/kg = milligrams per kilogram
NA = Not analyzed
NS = Not sampled
U = compound was not detected (or qualified as not detected during QA/QC review)
µg/kg = micrograms per kilogram
[1] For source of screening level, see Table 2-3.

Table 2-5
RI Surface Soil Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	BDSS-14/SS01	BDSS-15/SS01	BDSS-16/SS01	BDSS-17/SS01	BDSS-18/SS01	BDSS-19/SS01	BDSS-20/SS01	BDSS-21/SS01	BDSS-22/SS01	BDSS-23/SS01	BDSS-24/SS01	MD-25/SB01	MD-34/SS01
		Lab Number(s):	G1L190422-004	G1L190420-014	G1L190422-001	G1L190422-002	G1L190420-009	G1L190420-010	G1L160505-007	G1L160522-012	G1L160505-001	G1L160522-010	G1L160522-011	13011888	13012081
		Date(s) Sampled:	12/16/2011	12/16/2011	12/16/2011	12/16/2011	12/16/2011	12/16/2011	12/13/2011	12/13/2011	12/13/2011	12/13/2011	12/13/2011	1/28/2013	1/30/2013
		Depth (feet bgs):	1.0 - 2.0	0.0 - 1.0	0.0 - 1.0	1.0 -2.0	0.0 - 0.5	0.0 - 1.0	1.5 - 2.5	1.0 -2.0	1.0 -2.0	1.5 - 2.5	1.0 - 2.0	2.0	1.0
Parameter	**Units**	**Screening Level[1]**													
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	µg/kg	48,800	6.4 U	6.9 U	6.5 U J	***2 J***	6.7 U	6.1 U	6.3 U	6.3 U	5.8 U	6.4 U	6.3 U	30 U	6.3 U J
1,1,2,2-Tetrachloroethane	µg/kg	15,200	6.4 U	6.9 U	6.5 U J	***3,100 J***	6.7 U	6.1 U	6.3 U	6.3 U	5.8 U	6.4 U	6.3 U	***2,080***	6.3 U J
1,1,2-Trichloroethane	µg/kg	27,600	6.4 U	6.9 U	6.5 U J	***3.7 J***	6.7 U	6.1 U	6.3 U	6.3 U	5.8 U	6.4 U	6.3 U	30 U	6.3 U J
1,2,4-Trimethylbenzene	µg/kg	126,000	6.4 U	6.9 U	6.5 U J	6.3 U J	6.7 U	6.1 U	6.3 U	6.3 U	5.8 U	6.4 U	6.3 U	30 U	6.3 U J
1,3-Dichlorobenzene	µg/kg	NA	6.4 U	6.9 U	6.5 U J	6.3 U J	6.7 U	6.1 U	6.3 U	***0.42 J***	5.8 U	6.4 U	6.3 U	30 U	6.3 U J
Acetone	µg/kg	406,000,000	26 U	28 U	26 U J	25 U J	27 U	24 U	25 U	25 U	23 U	25 U	25 U	600 U	31 U J
Bromochloromethane	µg/kg	680,000	6.4 U	6.9 U	6.5 U J	6.3 U J	6.7 U	6.1 U	6.3 U	6.3 U	5.8 U	6.4 U	6.3 U	***10 J***	***10 J***
Chlorobenzene	µg/kg	740,000	6.4 U	6.9 U	6.5 U J	***2 J***	6.7 U	6.1 U	6.3 U	6.3 U	5.8 U	6.4 U	6.3 U	30 U	6.3 U J
cis-1,2-Dichloroethene	µg/kg	194,000	6.4 U	6.9 U	6.5 U J	***160 J***	6.7 U	6.1 U	6.3 U	6.3 U	5.8 U	6.4 U	6.3 U	***9 J***	6.3 U J
Isopropylbenzene	µg/kg	5,680,000	6.4 U	6.9 U	6.5 U J	6.3 U J	6.7 U	6.1 U	6.3 U	6.3 U	5.8 U	6.4 U	6.3 U	30 U	6.3 U J
p-Isopropyltoluene	µg/kg	NA	6.4 U	6.9 U	6.5 U J	6.3 U J	6.7 U	6.1 U	6.3 U	6.3 U	5.8 U	6.4 U	6.3 U	30 U	6.3 U J
sec-Butylbenzene	µg/kg	654,000	6.4 U	6.9 U	6.5 U J	6.3 U J	6.7 U	6.1 U	6.3 U	6.3 U	5.8 U	6.4 U	6.3 U	30 U	6.3 U J
tert-Butylbenzene	µg/kg	NA	6.4 U	6.9 U	6.5 U J	6.3 U J	6.7 U	6.1 U	6.3 U	6.3 U	5.8 U	6.4 U	6.3 U	30 U	6.3 U J
Tetrachloroethene	µg/kg	210,000	***1.6 J***	6.9 U	6.5 U J	***140 J***	6.7 U	6.1 U	6.3 U	6.3 U	5.8 U	***1.7 J***	***1.2 J***	***10 J***	6.3 U J
Toluene	µg/kg	29,800,000	6.4 U	6.9 U	6.5 U J	6.3 U J	6.7 U	6.1 U	6.3 U	6.3 U	5.8 U	6.4 U	6.3 U	5.9 J U	5 J U
trans-1,2-Dichloroethene	µg/kg	333,000	6.4 U	6.9 U	6.5 U J	***35 J***	6.7 U	6.1 U	6.3 U	6.3 U	5.8 U	6.4 U	6.3 U	30 U	6.3 U J
Trichloroethene	µg/kg	9,910	***21***	6.9 U	6.5 U J	***1,700 J***	6.7 U	6.1 U	6.3 U	6.3 U	5.8 U	6.4 U	6.3 U	***93***	***30 J***
Semivolatile Organic Compounds															
2,4-Dinitrotoluene	µg/kg	79,600	420 U	460 U	***3,600 J***	***2,200***	440 U	400 U	410 U	***670***	380 U	410 U	410 U	NS	NS
2,6-Dinitrotoluene	µg/kg	881,000	420 U	460 U	430 U	410 U	440 U	400 U	410 U	420 U	380 U	410 U	410 U	NS	NS
Di-n-butyl phthalate	µg/kg	62,000,000	420 U	460 U	***4,000 J***	***10,000***	440 U	400 U	410 U	***1,900***	380 U	410 U	410 U	NS	NS
N-Nitrosodiphenylamine	µg/kg	350,000	420 U	460 U	***480***	***1,300 J***	440 U	400 U	410 U	***480***	380 U	410 U	410 U	NS	NS
Perchlorate															
Perchlorate	µg/kg	1,430,000	6.3 U	6.6 U	6.3 U	***0.39 J***	6.5 U	***0.71 J***	***5.3 J***	***1.5 J***	***0.69 J***	***25***	***1.2 J***	NS	NS
Explosives															
2,4,6-Trinitrotoluene	mg/kg	440	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	***0.072 J***	0.25 U	0.25 U	0.25 U	NS	NS
2,4-Dinitrotoluene	mg/kg	79.6	0.25 U	0.25 U	***0.03 J***	***0.24 J***	***0.093 J***	0.25 U	0.25 U	***1.1***	0.25 U	0.25 U	0.25 U	NS	NS
4-Amino-2,6-dinitrotoluene	mg/kg	1,900	0.25 U	0.25 U	0.25 U	***0.032 J***	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	NS	NS
HMX	mg/kg	44,000	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	***0.069 J***	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	NS	NS
Nitroglycerin	mg/kg	62	0.5 U	0.5 U	***0.57***	0.5 U	0.5 U	0.5 U	0.5 U	***4.1***	0.5 U	0.5 U	0.5 U	NS	NS
RDX	mg/kg	224	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	NS	NS
Metals															
Antimony	mg/kg	817	0.77 U	***0.64 J***	***0.66 J***	***0.55 J***	***0.47 J***	***0.64 J***	***0.4 J***	***0.72 J***	***0.3 J***	0.76 U	***0.68 J***	NS	NS
Arsenic	mg/kg	38	***3.8***	***9.2***	***5.5 J***	***3.6***	***5.3***	***6.5***	***6.3***	***5.4***	***5.1***	***4.8***	***6***	NS	NS
Beryllium	mg/kg	3,650	***1.1***	***1.7***	***1.2***	***0.96***	***1.6***	***1.1***	***1.1***	***0.97***	***0.93***	***1***	***1***	NS	NS
Cadmium	mg/kg	965	***0.45***	***1***	***1.1***	***1.1***	***1***	***1***	***0.91***	***1***	***1.2***	***0.57***	***0.89***	NS	NS
Chromium	mg/kg	111	***25***	***51.1***	***29.3 J***	***27.1***	***45.9***	***30.8***	***24.1***	***20.7***	***21.1***	***19.2***	***22.1***	NS	NS
Copper	mg/kg	81,700	***11.9***	***17.7***	***37.2***	***23.7***	***39.7***	***17.8***	***14.7***	***52.6***	***10.7***	***11.2***	***32.1***	NS	NS
Lead	mg/kg	1,000	***12.1***	***17.9***	***26.6***	***15.2***	***17.4***	***15.9***	***18.3***	***29.6***	***13.6***	***14.4***	***40.4***	NS	NS
Mercury	mg/kg	20	***0.019 J***	***0.029 J***	***0.03 J***	***0.023 J***	***0.02 J***	***0.027 J***	***0.014 J***	***0.025 J***	***0.015 J***	***0.021 J***	***0.018 J***	NS	NS
Nickel	mg/kg	32,400	***18.3***	***36.7***	***22.9***	***21.8***	***55.6***	***28.4***	***18.5***	***18.4***	***20.5***	***18.4***	***20***	NS	NS
Selenium	mg/kg	10,200	***0.5***	***1.1***	***0.55***	***0.53***	***0.77***	***0.77***	***1.1***	***0.68***	***0.53***	***0.62***	***0.76***	NS	NS
Silver	mg/kg	10,200	***0.11 J***	***0.23***	***0.17***	***0.14***	***0.17***	***0.16***	***0.19***	***0.18***	***0.2***	***0.15***	***0.18***	NS	NS
Thallium	mg/kg	10	***0.25***	***0.42***	***0.27***	***0.17 J***	***0.28***	***0.35***	***0.33***	***0.32***	***0.34***	***0.31***	***0.33***	NS	NS
Zinc	mg/kg	613,000	***35.3***	***81***	***82.7***	***60.3***	***116***	***52.6***	***46.7***	***59.7***	***31.1***	***33.2***	***220***	NS	NS

Notes:
Bold / Italics = compound was detected
Highlighted = Concentration exceeds screening level
bgs = below ground surface
ID = Identification
J = estimated value
mg/kg = milligrams per kilogram
NA = Not analyzed
NS = Not sampled
U = compound was not detected (or qualified as not detected during QA/QC review)
µg/kg = micrograms per kilogram
[1] For source of screening level, see Table 2-3.

Table 2-5
RI Surface Soil Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	RISS-01/SS01	RISS-02/SS01	RISS-03/SS01	RISS-04/SS01	RISS-05/SS01	RISS-06/SS01	RISS-07/SS01	RISS-08/SS01	RISS-09/SS01	RISS-10/SS01	RISS-11/SS01	RISS-12/SS01	RISS-13/SS01
		Lab Number(s):	G1L160529-007	G1L160513-010	G1L160518-001	G1L210484-007	G1L210484-004	G1L210484-001	G1L210482-009	G1L160527-010	G1L160527-009	G1L160527-008	G1L160527-014	G1L190420-005	G1L190420-004
		Date(s) Sampled:	12/15/2011	12/12/2011	12/12/2011	12/19/2011	12/19/2011	12/19/2011	12/19/2011	12/14/2011	12/14/2011	12/14/2011	12/14/2011	12/15/2011	12/15/2011
		Depth (feet bgs):	1.5 - 2.5	1.0 -2.0	1.5 - 2.5	1.0 -2.0	1.0 -2.0	1.0 -2.0	1.0 -2.0	0.5 - 1.5	0.5 - 1.5	1.0-2.5	1.0 -2.0	1.0 -2.0	1.0 -2.0
Parameter	**Units**	**Screening Level[1]**													
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	µg/kg	48,800	6.4 U	6.3 U J	6.5 U J	6.4 U J	6.4 U	6.2 U	6.1 U J	6.5 U J	6.9 U	6.3 U J	6.1 U	6.3 U	6.4 U
1,1,2,2-Tetrachloroethane	µg/kg	15,200	6.4 U	6.3 U J	6.5 U J	6.4 U J	6.4 U	6.2 U	6.1 U J	6.5 U J	6.9 U	6.3 U J	6.1 U	6.3 U	6.4 U
1,1,2-Trichloroethane	µg/kg	27,600	6.4 U	6.3 U J	6.5 U J	6.4 U J	6.4 U	6.2 U	6.1 U J	6.5 U J	6.9 U	6.3 U J	6.1 U	6.3 U	6.4 U
1,2,4-Trimethylbenzene	µg/kg	126,000	6.4 U	6.3 U J	6.5 U J	***0.83 J***	6.4 U	6.2 U	6.1 U J	6.5 U J	6.9 U	6.3 U J	6.1 U	6.3 U	6.4 U
1,3-Dichlorobenzene	µg/kg	NA	6.4 U	6.3 U J	6.5 U J	6.4 U J	6.4 U	6.2 U	6.1 U J	6.5 U J	6.9 U	6.3 U J	6.1 U	6.3 U	6.4 U
Acetone	µg/kg	406,000,000	26 U	***5.6 J***	26 U J	25 U J	25 U	25 U	24 U J	26 U J	27 U	25 U J	24 U	25 U	26 U
Bromochloromethane	µg/kg	680,000	6.4 U	6.3 U J	6.5 U J	6.4 U J	6.4 U	6.2 U	6.1 U J	6.5 U J	6.9 U	6.3 U J	6.1 U	6.3 U	6.4 U
Chlorobenzene	µg/kg	740,000	6.4 U	6.3 U J	6.5 U J	6.4 U J	6.4 U	6.2 U	6.1 U J	6.5 U J	6.9 U	6.3 U J	6.1 U	6.3 U	6.4 U
cis-1,2-Dichloroethene	µg/kg	194,000	6.4 U	6.3 U J	6.5 U J	6.4 U J	6.4 U	6.2 U	6.1 U J	6.5 U J	6.9 U	6.3 U J	6.1 U	6.3 U	6.4 U
Isopropylbenzene	µg/kg	5,680,000	6.4 U	6.3 U J	6.5 U J	6.4 U J	6.4 U	6.2 U	6.1 U J	6.5 U J	6.9 U	6.3 U J	6.1 U	6.3 U	6.4 U
p-Isopropyltoluene	µg/kg	NA	6.4 U	6.3 U J	6.5 U J	6.4 U J	6.4 U	6.2 U	6.1 U J	6.5 U J	6.9 U	6.3 U J	6.1 U	6.3 U	6.4 U
sec-Butylbenzene	µg/kg	654,000	6.4 U	6.3 U J	6.5 U J	6.4 U J	6.4 U	6.2 U	6.1 U J	6.5 U J	6.9 U	6.3 U J	6.1 U	6.3 U	6.4 U
tert-Butylbenzene	µg/kg	NA	6.4 U	6.3 U J	6.5 U J	6.4 U J	6.4 U	6.2 U	6.1 U J	6.5 U J	6.9 U	6.3 U J	6.1 U	6.3 U	6.4 U
Tetrachloroethene	µg/kg	210,000	6.4 U	6.3 U J	6.5 U J	6.4 U J	6.4 U	6.2 U	6.1 U J	6.5 U J	6.9 U	6.3 U J	6.1 U	6.3 U	6.4 U
Toluene	µg/kg	29,800,000	6.4 U	6.3 U J	6.5 U J	***0.78 J***	6.4 U	6.2 U	6.1 U J	6.5 U J	6.9 U	6.3 U J	6.1 U	6.3 U	6.4 U
trans-1,2-Dichloroethene	µg/kg	333,000	6.4 U	6.3 U J	6.5 U J	6.4 U J	6.4 U	6.2 U	6.1 U J	6.5 U J	6.9 U	6.3 U J	6.1 U	6.3 U	6.4 U
Trichloroethene	µg/kg	9,910	6.4 U	6.3 U J	6.5 U J	6.4 U J	6.4 U	6.2 U	6.1 U J	6.5 U J	6.9 U	6.3 U J	6.1 U	6.3 U	6.4 U
Semivolatile Organic Compounds															
2,4-Dinitrotoluene	µg/kg	79,600	420 U	420 U	420 U	410 U	420 U	410 U	400 U	420 U	450 U	410 U	400 U	410 U	420 U
2,6-Dinitrotoluene	µg/kg	881,000	420 U	420 U	420 U	410 U	420 U	410 U	400 U	420 U	450 U	410 U	400 U	410 U	420 U
Di-n-butyl phthalate	µg/kg	62,000,000	420 U	420 U	420 U	410 U	420 U	410 U	400 U	420 U	450 U	410 U	***390 J***	410 U	420 U
N-Nitrosodiphenylamine	µg/kg	350,000	420 U	420 U	420 U	410 U	420 U	410 U	400 U	420 U	450 U	410 U	400 U	410 U	420 U
Perchlorate															
Perchlorate	µg/kg	1,430,000	6.4 U	6.3 U	6.4 U	6.2 U	6.4 U	6 U	6 U	***0.56 J***	6.9 U	6.2 U	5.9 U	6.3 U	0.7 J U
Explosives															
2,4,6-Trinitrotoluene	mg/kg	440	0.25 U	0.25 U	0.25 U	0.24 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2,4-Dinitrotoluene	mg/kg	79.6	0.25 U	0.25 U	0.25 U	0.24 U	0.25 U	0.25 U	0.25 U	0.25 U	***0.033 J***	0.25 U	0.25 U	0.25 U	0.25 U
4-Amino-2,6-dinitrotoluene	mg/kg	1,900	0.25 U	0.25 U	0.25 U	0.24 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
HMX	mg/kg	44,000	0.25 U	0.25 U	0.25 U	0.24 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Nitroglycerin	mg/kg	62	0.5 U	0.5 U	0.5 U	0.48 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
RDX	mg/kg	224	0.25 U	0.25 U	0.25 U	0.24 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Metals															
Antimony	mg/kg	817	***0.28 J***	***0.32 J***	***0.3 J***	0.76 U	0.76 U	0.74 U	***0.36 J***	0.78 U	***0.34 J***	***0.25 J***	***0.41 J***	***0.47 J***	***0.29 J***
Arsenic	mg/kg	38	***6.8***	***5.1***	***3.6***	***1.2***	***3.5***	***4.7***	***5.3***	***5.5***	***9.1***	***5.7***	***4.1***	***7.4***	***6.2***
Beryllium	mg/kg	3,650	***1.3***	***0.96***	***0.59***	***0.76***	***0.8***	***0.89***	***0.92***	***0.97***	***1.3***	***1.1***	***0.63***	***1***	***1.3***
Cadmium	mg/kg	965	***1.1***	***0.85***	***0.6***	***0.52***	***0.54***	***0.44***	***0.73***	***0.74***	***1.1***	***0.76***	***0.84***	***0.72***	***0.59***
Chromium	mg/kg	111	***35.6***	***23.4***	***15.7***	***19.7***	***18.8***	***15.2***	***21.7***	***23.8***	***34***	***31.9***	***20.5***	***30.1***	***37***
Copper	mg/kg	81,700	***12.7***	***9.9***	***11.5***	***9.4***	***9.5***	***10.6***	***11***	***13.4***	***21.3***	***13.1***	***18.8***	***18***	***20.6***
Lead	mg/kg	1,000	***14***	***12***	***14.8***	***10.4***	***10.5***	***11.4***	***15.9***	***14.3***	***21.6***	***14***	***14.9***	***32.4***	***15.5***
Mercury	mg/kg	20	0.051 U	0.051 U	***0.014 J***	0.051 U	0.051 U	***0.015 J***	***0.015 J***	***0.011 J***	***0.036 J***	***0.016 J***	***0.024 J***	***0.034 J***	***0.018 J***
Nickel	mg/kg	32,400	***24.8***	***18.2***	***11.4***	***12***	***13.3***	***11.9***	***16.8***	***21.7***	***35.6***	***21.4***	***13.5***	***28.4***	***32.7***
Selenium	mg/kg	10,200	***0.78***	***0.7***	***0.61***	***0.44***	***0.47***	***0.74***	***0.55***	***0.75***	***1.1***	***0.6***	***0.71***	***0.92***	***0.95***
Silver	mg/kg	10,200	***0.22***	***0.13***	***0.096 J***	***0.1 J***	***0.066 J***	***0.13***	***0.15***	***0.13***	***0.17***	***0.15***	***0.11 J***	***0.13***	***0.19***
Thallium	mg/kg	10	***0.31***	***0.25***	***0.21***	***0.2***	***0.22***	***0.25***	***0.27***	***0.25***	***0.5***	***0.32***	***0.2***	***0.25***	***0.28***
Zinc	mg/kg	613,000	***63.3***	***50.8***	***40.1***	***37.7***	***34.9***	***29.8***	***34.2***	***42.5***	***60.6***	***49.1***	***47.8***	***49.2***	***47.1***

Notes:
Bold / Italics = compound was detected
Highlighted = Concentration exceeds screening level
bgs = below ground surface
ID = Identification
J = estimated value
mg/kg = milligrams per kilogram
NA = Not analyzed
NS = Not sampled
U = compound was not detected (or qualified as not detected during QA/QC review)
µg/kg = micrograms per kilogram
[1] For source of screening level, see Table 2-3.

Table 2-5
RI Surface Soil Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	RISS-14/SS01	RISS-15/SS01	RISS-16/SS01	RISS-17/SS01	RISS-18/SS01	RISS-19/SS01	RISS-20/SS01	RISS-21/SS01	RISS-22/SS01	RISS-23/SS01	RISS-24/SS01	RISS-25/SS01	RISS-26/SS01
		Lab Number(s):	G1L190420-003	G1L190420-002	G1L190420-012	G1L160505-004	G1L160522-003	G1L160522-008	G1L160518-009	G1L190420-006	G1L160513-002	G1L160529-012	G1L190420-001	G1L190420-013	G1L160529-006
		Date(s) Sampled:	12/15/2011	12/15/2011	12/16/2011	12/13/2011	12/13/2011	12/13/2011	12/12/2011	12/15/2011	12/12/2011	12/15/2011	12/15/2011	12/16/2011	12/15/2011
		Depth (feet bgs):	1.0 -2.0	0.0-1.0	1.0 -2.0	1.0 -2.0	1.0 -2.0	1.0 -2.0	1.0 -2.0	1.0 -2.0	1.0 -2.0	1.0 -2.5	0.5 - 1.5	1.0 -2.0	1.0 -2.0
Parameter	**Units**	**Screening Level[1]**													
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	µg/kg	48,800	6.5 U	6.6 U	6.4 U	6.2 U J	6.2 U	6.4 U	6.3 U J	6.3 U	6.4 U J	5.9 U	6.6 U	6.3 U	6.5 U
1,1,2,2-Tetrachloroethane	µg/kg	15,200	6.5 U	6.6 U	6.4 U	6.2 U J	6.2 U	6.4 U	6.3 U J	6.3 U	6.4 U J	5.9 U	6.6 U	6.3 U	6.5 U
1,1,2-Trichloroethane	µg/kg	27,600	6.5 U	6.6 U	6.4 U	6.2 U J	6.2 U	6.4 U	6.3 U J	6.3 U	6.4 U J	5.9 U	6.6 U	6.3 U	6.5 U
1,2,4-Trimethylbenzene	µg/kg	126,000	6.5 U	6.6 U	6.4 U	6.2 U J	6.2 U	6.4 U	6.3 U J	6.3 U	6.4 U J	5.9 U	6.6 U	6.3 U	6.5 U
1,3-Dichlorobenzene	µg/kg	NA	6.5 U	6.6 U	6.4 U	6.2 U J	6.2 U	6.4 U	6.3 U J	6.3 U	6.4 U J	5.9 U	6.6 U	6.3 U	6.5 U
Acetone	µg/kg	406,000,000	26 U	26 U	26 U	25 U J	25 U	25 U	25 U J	25 U	***7.3 J***	24 U	26 U	25 U	26 U
Bromochloromethane	µg/kg	680,000	6.5 U	6.6 U	6.4 U	6.2 U J	6.2 U	6.4 U	6.3 U J	6.3 U	6.4 U J	5.9 U	6.6 U	6.3 U	6.5 U
Chlorobenzene	µg/kg	740,000	6.5 U	6.6 U	6.4 U	6.2 U J	6.2 U	6.4 U	6.3 U J	6.3 U	6.4 U J	5.9 U	6.6 U	6.3 U	6.5 U
cis-1,2-Dichloroethene	µg/kg	194,000	6.5 U	6.6 U	6.4 U	6.2 U J	6.2 U	6.4 U	6.3 U J	6.3 U	6.4 U J	5.9 U	6.6 U	6.3 U	6.5 U
Isopropylbenzene	µg/kg	5,680,000	6.5 U	6.6 U	6.4 U	6.2 U J	6.2 U	6.4 U	6.3 U J	6.3 U	6.4 U J	5.9 U	6.6 U	6.3 U	6.5 U
p-Isopropyltoluene	µg/kg	NA	6.5 U	6.6 U	6.4 U	6.2 U J	6.2 U	6.4 U	***1.2 J***	6.3 U	6.4 U J	5.9 U	6.6 U	6.3 U	6.5 U
sec-Butylbenzene	µg/kg	654,000	6.5 U	6.6 U	6.4 U	6.2 U J	6.2 U	6.4 U	6.3 U J	6.3 U	6.4 U J	5.9 U	6.6 U	6.3 U	6.5 U
tert-Butylbenzene	µg/kg	NA	6.5 U	6.6 U	6.4 U	6.2 U J	6.2 U	6.4 U	6.3 U J	6.3 U	6.4 U J	5.9 U	6.6 U	6.3 U	6.5 U
Tetrachloroethene	µg/kg	210,000	6.5 U	6.6 U	6.4 U	6.2 U J	6.2 U	6.4 U	6.3 U J	6.3 U	6.4 U J	5.9 U	6.6 U	6.3 U	6.5 U
Toluene	µg/kg	29,800,000	6.5 U	6.6 U	6.4 U	6.2 U J	6.2 U	6.4 U	6.3 U J	6.3 U	6.4 U J	5.9 U	6.6 U	6.3 U	6.5 U
trans-1,2-Dichloroethene	µg/kg	333,000	6.5 U	6.6 U	6.4 U	6.2 U J	6.2 U	6.4 U	6.3 U J	6.3 U	6.4 U J	5.9 U	6.6 U	6.3 U	6.5 U
Trichloroethene	µg/kg	9,910	6.5 U	6.6 U	6.4 U	6.2 U J	6.2 U	6.4 U	6.3 U J	6.3 U	6.4 U J	5.9 U	6.6 U	6.3 U	6.5 U
Semivolatile Organic Compounds															
2,4-Dinitrotoluene	µg/kg	79,600	420 U	430 U	420 U	400 U	400 U	420 U	410 U	410 U	410 U	380 U	420 U	410 U	420 U
2,6-Dinitrotoluene	µg/kg	881,000	420 U	430 U	420 U	400 U	400 U	420 U	410 U	410 U	410 U	380 U	420 U	410 U	420 U
Di-n-butyl phthalate	µg/kg	62,000,000	420 U	430 U	420 U	400 U	400 U	420 U	410 U	410 U	410 U	380 U	420 U	***200 J***	420 U
N-Nitrosodiphenylamine	µg/kg	350,000	420 U	430 U	420 U	400 U	400 U	420 U	410 U	410 U	410 U	380 U	420 U	***140 J***	420 U
Perchlorate															
Perchlorate	µg/kg	1,430,000	6.4 U	6.5 U	6.2 U	***2.5 J***	6.3 U	***2.4 J***	6.1 U	0.35 J U	6 U	5.9 U	0.35 J U	***1.2 J***	6.5 U
Explosives															
2,4,6-Trinitrotoluene	mg/kg	440	0.25 U	0.25 U	0.25 U J	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2,4-Dinitrotoluene	mg/kg	79.6	0.25 U	0.25 U	0.25 U J	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
4-Amino-2,6-dinitrotoluene	mg/kg	1,900	0.25 U	0.25 U	0.25 U J	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
HMX	mg/kg	44,000	0.25 U	0.25 U	0.25 U J	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Nitroglycerin	mg/kg	62	0.5 U	0.5 U	0.5 U J	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
RDX	mg/kg	224	0.25 U	0.25 U	0.25 U J	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Metals															
Antimony	mg/kg	817	***0.54 J***	***0.41 J***	***0.46 J***	***0.47 J***	***0.28 J***	0.76 U	0.75 U	***0.46 J***	***0.38 J***	***0.42 J***	***0.45 J***	***0.54 J***	0.78 U
Arsenic	mg/kg	38	***3.1***	***3.9***	***7.4***	***5.7 J***	***6.8***	***5.2***	***6***	***5.9***	***4.7***	***5***	***6.5 J***	***3.9***	***6.1***
Beryllium	mg/kg	3,650	***0.67***	***0.76***	***1.3***	***1***	***0.98***	***0.94***	***0.86***	***1***	***0.87***	***0.87***	***1.4***	***1.2***	***1.3***
Cadmium	mg/kg	965	***1.3***	***1.1***	***0.77***	***1.4***	***1.1***	***0.6***	***0.64***	***0.63***	***0.61***	***2.2***	***0.82 J***	***0.86***	***0.69***
Chromium	mg/kg	111	***19.8***	***24.4***	***36.6***	***23.9***	***19.4***	***20.6***	***18***	***25.7***	***18.7***	***22.6***	***36.9***	***38.9***	***29.2***
Copper	mg/kg	81,700	***28.4***	***16.5***	***13.8***	***18.8 J***	***12.6***	***11.5***	***12.9***	***12.8***	***10.8***	***27.9***	***13.4 J***	***14.6***	***15***
Lead	mg/kg	1,000	***31.3***	***21.7***	***16.7***	***21.2 J***	***13.5***	***13.6***	***15***	***14.9***	***13.6***	***24.8***	***15.6 J***	***12.2***	***14.4***
Mercury	mg/kg	20	***0.032 J***	***0.024 J***	***0.02 J***	***0.013 J***	***0.02 J***	***0.017 J***	***0.017 J***	***0.018 J***	***0.015 J***	***0.021 J***	***0.018 J***	0.051 U	***0.014 J***
Nickel	mg/kg	32,400	***16.7***	***19***	***27.7***	***22.6 J***	***30.4***	***16.1***	***16.1***	***18***	***14.9***	***18.5***	***29 J***	***31.8***	***23.2***
Selenium	mg/kg	10,200	***0.34 J***	***0.55***	***0.83***	***0.58***	***0.64***	***0.52***	***0.63***	***0.75***	***0.69***	***0.71***	***0.46 J***	***0.68***	***0.76***
Silver	mg/kg	10,200	***0.16***	***0.31***	***0.17***	***0.18***	***0.16***	***0.16***	***0.12 J***	***0.14***	***0.12 J***	***0.22***	***0.14***	***0.19***	***0.17***
Thallium	mg/kg	10	***0.13 J***	***0.17 J***	***0.32***	***0.41***	***0.36***	***0.33***	***0.33***	***0.28***	***0.25***	***0.2***	***0.28***	***0.21***	***0.32***
Zinc	mg/kg	613,000	***72.7***	***69.7***	***52.8***	***83.2 J***	***16.5***	***33.4***	***33.3***	***41***	***29***	***69.7***	***50.3***	***55.6***	***41.7***

Notes:
Bold / Italics = compound was detected
Highlighted = Concentration exceeds screening level
bgs = below ground surface
ID = Identification
J = estimated value
mg/kg = milligrams per kilogram
NA = Not analyzed
NS = Not sampled
U = compound was not detected (or qualified as not detected during QA/QC review)
µg/kg = micrograms per kilogram
[1] For source of screening level, see Table 2-3.

Table 2-5
RI Surface Soil Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	RISS-27/SS01	RISS-28/SS01	RISS-29/SS01	RISS-30/SS01	RISS-31/SS01	RISS-32/SS01	RISS-33/SS01	RISS-34/SS01	RISS-35/SS01	RISS-36/SS01	RISS-37/SS01	RISS-38/SS01	RISS-39/SS01
		Lab Number(s):	G1L160529-005	G1L160527-012	G1L160513-007	G1L160513-006	G1L160513-005	G1L160513-004	G1L160513-001	G1L160529-011	G1L160518-004	G1L160518-007	G1L160518-005	G1L160518-008	G1L160527-005
		Date(s) Sampled:	12/15/2011	12/14/2011	12/12/2011	12/12/2011	12/12/2011	12/12/2011	12/12/2011	12/15/2011	12/12/2011	12/12/2011	12/12/2011	12/12/2011	12/14/2011
		Depth (feet bgs):	1.0 -2.0	1.0 -2.0	1.0 -2.0	1.0 -2.0	1.0 -2.0	1.0 -2.0	1.0 -2.0	1.0 -2.0	1.0 -2.0	1.0 -2.0	1.0 -2.0	1.0 -2.0	1.0 -2.0
Parameter	**Units**	**Screening Level[1]**													
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	µg/kg	48,800	6.5 U	6.2 U	6.3 U J	6.2 U J	6.3 U J	6.3 U J	6.7 U J	7.4 U J	6.2 U	6.3 U	6.4 U	6.6 U	6.2 U
1,1,2,2-Tetrachloroethane	µg/kg	15,200	6.5 U	6.2 U	6.3 U J	6.2 U J	6.3 U J	6.3 U J	6.7 U J	7.4 U J	6.2 U	6.3 U	6.4 U	6.6 U	6.2 U
1,1,2-Trichloroethane	µg/kg	27,600	6.5 U	6.2 U	6.3 U J	6.2 U J	6.3 U J	6.3 U J	6.7 U J	7.4 U J	6.2 U	6.3 U	6.4 U	6.6 U	6.2 U
1,2,4-Trimethylbenzene	µg/kg	126,000	6.5 U	6.2 U	6.3 U J	6.2 U J	6.3 U J	6.3 U J	6.7 U J	7.4 U J	6.2 U	6.3 U	6.4 U	6.6 U	6.2 U
1,3-Dichlorobenzene	µg/kg	NA	6.5 U	6.2 U	6.3 U J	6.2 U J	0.39 J J	6.3 U J	***0.42 J***	7.4 U J	6.2 U	6.3 U	6.4 U	6.6 U	6.2 U
Acetone	µg/kg	406,000,000	26 U	25 U	25 U J	***6.4 J***	25 U J	***6.1 J***	***5.5 J***	30 U J	25 U	25 U	25 U	26 U	25 U
Bromochloromethane	µg/kg	680,000	6.5 U	6.2 U	6.3 U J	6.2 U J	6.3 U J	6.3 U J	6.7 U J	7.4 U J	6.2 U	6.3 U	6.4 U	6.6 U	6.2 U
Chlorobenzene	µg/kg	740,000	6.5 U	6.2 U	6.3 U J	6.2 U J	6.3 U J	6.3 U J	6.7 U J	7.4 U J	6.2 U	6.3 U	6.4 U	6.6 U	6.2 U
cis-1,2-Dichloroethene	µg/kg	194,000	6.5 U	6.2 U	6.3 U J	6.2 U J	6.3 U J	6.3 U J	6.7 U J	7.4 U J	6.2 U	6.3 U	6.4 U	6.6 U	6.2 U
Isopropylbenzene	µg/kg	5,680,000	6.5 U	6.2 U	6.3 U J	6.2 U J	6.3 U J	6.3 U J	6.7 U J	7.4 U J	6.2 U	6.3 U	6.4 U	***1.4 J***	6.2 U
p-Isopropyltoluene	µg/kg	NA	6.5 U	6.2 U	6.3 U J	6.2 U J	6.3 U J	6.3 U J	6.7 U J	7.4 U J	6.2 U	6.3 U	6.4 U	***16***	***2 J***
sec-Butylbenzene	µg/kg	654,000	6.5 U	6.2 U	6.3 U J	6.2 U J	6.3 U J	6.3 U J	6.7 U J	7.4 U J	6.2 U	6.3 U	6.4 U	***2.7 J***	6.2 U
tert-Butylbenzene	µg/kg	NA	6.5 U	6.2 U	6.3 U J	6.2 U J	6.3 U J	6.3 U J	6.7 U J	7.4 U J	6.2 U	6.3 U	6.4 U	***1.1 J***	6.2 U
Tetrachloroethene	µg/kg	210,000	6.5 U	6.2 U	6.3 U J	6.2 U J	6.3 U J	6.3 U J	6.7 U J	7.4 U J	6.2 U	6.3 U	6.4 U	6.6 U	6.2 U
Toluene	µg/kg	29,800,000	6.5 U	6.2 U	6.3 U J	6.2 U J	6.3 U J	6.3 U J	***2.4 J***	7.4 U J	6.2 U	6.3 U	6.4 U	6.6 U	6.2 U
trans-1,2-Dichloroethene	µg/kg	333,000	6.5 U	6.2 U	6.3 U J	6.2 U J	6.3 U J	6.3 U J	6.7 U J	7.4 U J	6.2 U	6.3 U	6.4 U	6.6 U	6.2 U
Trichloroethene	µg/kg	9,910	6.5 U	6.2 U	6.3 U J	6.2 U J	6.3 U J	6.3 U J	6.7 U J	7.4 U J	6.2 U	6.3 U	6.4 U	6.6 U	6.2 U
Semivolatile Organic Compounds															
2,4-Dinitrotoluene	µg/kg	79,600	420 U	400 U	410 U	410 U	420 U	400 U	450 U	490 U	400 U	410 U	420 U	420 U	400 U
2,6-Dinitrotoluene	µg/kg	881,000	420 U	400 U	410 U	410 U	420 U	400 U	450 U	490 U	400 U	410 U	420 U	420 U	400 U
Di-n-butyl phthalate	µg/kg	62,000,000	420 U	400 U	410 U	410 U	420 U	400 U	450 U	490 U	400 U	410 U	420 U	420 U	400 U
N-Nitrosodiphenylamine	µg/kg	350,000	420 U	400 U	410 U	410 U	420 U	400 U	450 U	490 U	400 U	410 U	420 U	420 U	400 U
Perchlorate															
Perchlorate	µg/kg	1,430,000	6.3 U	***0.6 J***	***0.51 J***	6.2 U	6 U	6.3 U	6.6 U	7.4 U	6.2 U	6.3 U	***0.86 J***	***0.47 J***	***0.64 J***
Explosives															
2,4,6-Trinitrotoluene	mg/kg	440	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
2,4-Dinitrotoluene	mg/kg	79.6	0.25 U	***0.14 J***	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
4-Amino-2,6-dinitrotoluene	mg/kg	1,900	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
HMX	mg/kg	44,000	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Nitroglycerin	mg/kg	62	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
RDX	mg/kg	224	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Metals															
Antimony	mg/kg	817	0.78 U	***0.35 J***	0.76 U	***0.35 J***	***0.4 J***	***0.33 J***	***0.55 J***	0.89 U	***0.35 J***	***0.38 J***	0.76 U	***0.26 J***	***0.25 J***
Arsenic	mg/kg	38	***6.4***	***5.3***	***2***	***5.3***	***5.4***	***5.8***	***8.2***	***6.4***	***5.9***	***5.2***	***3.3***	***6.9***	***5.2***
Beryllium	mg/kg	3,650	***1.3***	***1***	***0.72***	***0.92***	***0.91***	***1.1***	***1.3***	***1.1***	***1.1***	***0.9***	***1.6***	***1.1***	***1***
Cadmium	mg/kg	965	***0.74***	***0.67***	***0.58***	***0.67***	***0.63***	***0.6***	***0.72***	***1***	***0.72***	***0.62***	***0.67***	***0.6***	***0.74***
Chromium	mg/kg	111	***35.2***	***25***	***19.1***	***21.1***	***20.2***	***21.7***	***31.1***	***29***	***22.3***	***21.1***	***24***	***21.7***	***23***
Copper	mg/kg	81,700	***17.9***	***12.6***	***10***	***11.1***	***12.1***	***12.1***	***15.2***	***13.3***	***12.9***	***9.7***	***14.4***	***14.3***	***15.2***
Lead	mg/kg	1,000	***16.8***	***13.8***	***11.5***	***13.3***	***12.2***	***16.7***	***22.1***	***13.9***	***13.9***	***13.5***	***14.1***	***13.2***	***14.7***
Mercury	mg/kg	20	***0.015 J***	***0.02 J***	***0.014 J***	***0.018 J***	***0.011 J***	***0.014 J***	***0.026 J***	0.059 U	***0.018 J***	0.051 U	0.051 U	***0.014 J***	***0.016 J***
Nickel	mg/kg	32,400	***30***	***18.6***	***14.2***	***16.6***	***15.1***	***17***	***25.7***	***22.3***	***19.5***	***15.7***	***21.6***	***19.5***	***20.7***
Selenium	mg/kg	10,200	***0.77***	***0.74***	***0.43***	***0.73***	***0.6***	***0.75***	***0.55***	***0.98***	***0.73***	***0.96***	***0.47***	***0.96***	***0.8***
Silver	mg/kg	10,200	***0.17***	***0.15***	***0.097 J***	***0.12***	***0.13***	***0.17***	***0.16***	***0.16***	***0.19***	***0.13***	***0.15***	***0.19***	***0.15***
Thallium	mg/kg	10	***0.3***	***0.29***	***0.22***	***0.27***	***0.29***	***0.34***	***0.35***	***0.26***	***0.32***	***0.29***	***0.48***	***0.33***	***0.32***
Zinc	mg/kg	613,000	***40.7***	***46.6***	***37***	***43.8***	***38.9***	***32.9***	***27.7***	***67.6***	***23.4***	***29.9***	***47.9***	***37.9***	***55.1***

Notes:
Bold / Italics = compound was detected
Highlighted = Concentration exceeds screening level
bgs = below ground surface
ID = Identification
J = estimated value
mg/kg = milligrams per kilogram
NA = Not analyzed
NS = Not sampled
U = compound was not detected (or qualified as not detected during QA/QC review)
µg/kg = micrograms per kilogram
[1] For source of screening level, see Table 2-3.

Table 2-5
RI Surface Soil Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	RISS-40/SS01	RISS-41/SS01	RISS-42/SS01
		Lab Number(s):	G1L160527-001	G1L160518-006	G1L160522-009
		Date(s) Sampled:	12/14/2011	12/12/2011	12/13/2011
		Depth (feet bgs):	1.0 -2.0	1.0 -2.0	1.0 -2.0
Parameter	**Units**	**Screening Level[1]**			
Volatile Organic Compounds					
1,1,1,2-Tetrachloroethane	µg/kg	48,800	6.3 U	6.3 U J	6.2 U
1,1,2,2-Tetrachloroethane	µg/kg	15,200	6.3 U	6.3 U J	6.2 U
1,1,2-Trichloroethane	µg/kg	27,600	6.3 U	6.3 U J	6.2 U
1,2,4-Trimethylbenzene	µg/kg	126,000	6.3 U	6.3 U J	6.2 U
1,3-Dichlorobenzene	µg/kg	NA	***0.39 J***	6.3 U J	6.2 U
Acetone	µg/kg	406,000,000	25 U	25 U J	25 U
Bromochloromethane	µg/kg	680,000	6.3 U	6.3 U J	6.2 U
Chlorobenzene	µg/kg	740,000	6.3 U	6.3 U J	6.2 U
cis-1,2-Dichloroethene	µg/kg	194,000	6.3 U	6.3 U J	6.2 U
Isopropylbenzene	µg/kg	5,680,000	6.3 U	6.3 U J	6.2 U
p-Isopropyltoluene	µg/kg	NA	6.3 U	6.3 U J	6.2 U
sec-Butylbenzene	µg/kg	654,000	6.3 U	6.3 U J	6.2 U
tert-Butylbenzene	µg/kg	NA	6.3 U	6.3 U J	6.2 U
Tetrachloroethene	µg/kg	210,000	6.3 U	6.3 U J	6.2 U
Toluene	µg/kg	29,800,000	6.3 U	6.3 U J	6.2 U
trans-1,2-Dichloroethene	µg/kg	333,000	6.3 U	6.3 U J	6.2 U
Trichloroethene	µg/kg	9,910	6.3 U	6.3 U J	6.2 U
Semivolatile Organic Compounds					
2,4-Dinitrotoluene	µg/kg	79,600	410 U	420 U	***690***
2,6-Dinitrotoluene	µg/kg	881,000	410 U	420 U	410 U
Di-n-butyl phthalate	µg/kg	62,000,000	***130 J***	420 U	***820***
N-Nitrosodiphenylamine	µg/kg	350,000	410 U	420 U	410 U
Perchlorate					
Perchlorate	µg/kg	1,430,000	***0.5 J***	6.2 U	***6.8***
Explosives					
2,4,6-Trinitrotoluene	mg/kg	440	0.25 U	0.25 U	0.25 U
2,4-Dinitrotoluene	mg/kg	79.6	0.25 U	0.25 U	0.25 U
4-Amino-2,6-dinitrotoluene	mg/kg	1,900	0.25 U	0.25 U	0.25 U
HMX	mg/kg	44,000	0.25 U	0.25 U	0.25 U
Nitroglycerin	mg/kg	62	0.5 U	0.5 U	***0.23 J***
RDX	mg/kg	224	0.25 U	0.25 U	0.25 U
Metals					
Antimony	mg/kg	817	***0.39 J***	***0.29 J***	***0.93***
Arsenic	mg/kg	38	***6.2***	***4.7 J***	***6.4***
Beryllium	mg/kg	3,650	***1***	***0.92***	***1.1***
Cadmium	mg/kg	965	***1.1***	***0.54***	***0.76***
Chromium	mg/kg	111	***28.4***	***20.4***	***24.9***
Copper	mg/kg	81,700	***23***	***11.5 J***	***32.7***
Lead	mg/kg	1,000	***15***	***10.7 J***	***37.8***
Mercury	mg/kg	20	***0.018 J***	***0.017 J***	***0.022 J***
Nickel	mg/kg	32,400	***25.7***	***13.2 J***	***19.4***
Selenium	mg/kg	10,200	***0.84***	***0.86***	***0.76***
Silver	mg/kg	10,200	***0.16***	***0.15***	***0.18***
Thallium	mg/kg	10	***0.3***	***0.29***	***0.35***
Zinc	mg/kg	613,000	***52.5***	***29.5 J***	***56.8 J***

Notes:
Bold / Italics = compound was detected
Highlighted = Concentration exceeds screening level
bgs = below ground surface
ID = Identification
J = estimated value
mg/kg = milligrams per kilogram
NA = Not analyzed
NS = Not sampled
U = compound was not detected (or qualified as not detected during QA/QC review)
µg/kg = micrograms per kilogram
[1] For source of screening level, see Table 2-3.

Table 2-6
RI Multi-Increment Soil Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	MIS-01/SS01	MIS-02/SS01	MIS-03/SS01	MIS-04/SS01
		Lab Number(s):	G2B030499-001	G2B030499-002	G2B030499-003	G2B030499-004
		Date(s) Sampled:	2/1/2012	2/1/2012	2/1/2012	2/1/2012
		Depth (feet bgs):	0.00 - 0.25	0.00 - 0.25	0.00 - 0.25	0.00 - 0.25
Parameter	**Units**	**Screening Level[1]**				
Explosives						
2,4,6-Trinitrotoluene	mg/kg	440	0.25 U	***0.08 J***	***0.34 J***	***1.1 J***
2,4-Dinitrotoluene	mg/kg	79.6	***10***	***9.4***	***15***	***32***
2,6-Dinitrotoluene	mg/kg	881	***0.27***	***0.38 J***	***0.1 J***	***0.71 J***
4-Nitrotoluene	mg/kg	110	0.25 U	0.25 U	***0.024 J***	0.25 U
HMX	mg/kg	44,000	0.25 U	***0.27***	0.24 U	***0.59***
Nitroglycerin	mg/kg	62	***11 J***	***2.8 J***	***1.1 J***	***26 J***
RDX	mg/kg	224	0.25 U	***0.044 J***	0.24 U J	***1.9 J***

Notes:
Bold / Italics = compound was detected
Highlighted = Concentration exceeds screening level
bgs = below ground surface
ID = Identification
J = estimated value
mg/kg = milligrams per kilogram
U = compound was not detected (or qualified as not detected during QA/QC review)
[1] For source of screening level, see Table 2-3.

Table 2-7
RI Subsurface Soil Samples, Detected Analytes
Record of Decision
Open Burning / Opened Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	BDSS-03/SB01	BDSS-03/SB02	BDSS-13/SB01	BDSS-20/SB01	BDSS-20/SB02	BDSS-22/SB01	BDSS-22/SB02	MD-16/SB02	MD-25/SB03	MD-26/SB03	MD-31/SB03	MD-33/SB03
		Lab Number(s):	G1L210482-006	G1L210482-007	G1L190422-007	G1L160505-008	G1L160505-009	G1L160505-002	G1L160505-003	13012083	13011890	13011891	13011887	13012082
		Date(s) Sampled:	12/19/2011	12/19/2011	12/16/2011	12/13/2011	12/13/2011	12/13/2011	12/13/2011	1/30/2013	1/28/2013	1/28/2013	1/28/2013	1/30/2013
		Depth (feet bgs):	5.0 - 6.0	9.0 - 10.0	3.0 - 4.0	5.5 - 6.5	9.0 - 10.0	5.5 - 6.5	8.5 - 9.5	6.0	10.0	11.5	10.0	3.0
Parameter	**Units**	**Screening Level[1]**												
Volatile Organic Compounds														
1,1,2,2-Tetrachloroethane	µg/kg	15,200	6.1 U	6.2 U	6.2 U	6 U	6 U J	5.8 U	6.1 U J	6.0 U	***3,200 J***	***200 J***	***250***	***1,060***
1,1,2-Trichloroethane	µg/kg	27,600	6.1 U	6.2 U	6.2 U	6 U	6 U J	5.8 U	6.1 U J	6.0 U	***270 J***	***78 J***	***7.9 J***	40 U
Acetone	µg/kg	406,000,000	25 U	25 U	25 U	24 U	24 U J	23 U	24 U J	***6 J***	8,000 U	8,000 U	800 U	700 U
Bromochloromethane	µg/kg	680,000	6.1 U	6.2 U	6.2 U	6 U	6 U J	5.8 U	6.1 U J	***10 J***	***100 J***	***100 J***	***10 J***	***7 J***
Chloroform	µg/kg	7,140	6.1 U	6.2 U	6.2 U	6 U	6 U J	5.8 U	6.1 U J	6.0 U	***300 J***	***300 J***	10 J U	10 J U
cis-1,2-Dichloroethene	µg/kg	194,000	6.1 U	6.2 U	6.2 U	6 U	6 U J	5.8 U	6.1 U J	***0.4 J***	***2,600***	***300 J***	***60***	40 U
Methylene chloride	µg/kg	267,000	6.1 U	6.2 U	6.2 U	6 U	6 U J	5.8 U	6.1 U J	6.0 U	***110 J***	***100 J***	10 J U	8.6 J U
Styrene	µg/kg	20,400,000	6.1 U	6.2 U	6.2 U	6 U	6 U J	5.8 U	6.1 U J	6.0 U	***72 J***	***70 J***	40 U	40 U
Tetrachloroethene	µg/kg	210,000	6.1 U	6.2 U	6.2 U	6 U	6 U J	5.8 U	6.1 U J	6.0 U	***600***	***500***	***30 J***	40 U
Toluene	µg/kg	29,800,000	6.1 U	6.2 U	6.2 U	6 U	6 U J	5.8 U	6.1 U J	6.0 U	***190 J***	***190 J***	8.6 J U	7.3 J U
trans-1,2-Dichloroethene	µg/kg	333,000	6.1 U	6.2 U	6.2 U	6 U	6 U J	5.8 U	6.1 U J	6.0 U	***700 J***	***100 J***	***20 J***	40 U
Trichloroethene	µg/kg	9,910	6.1 U	***1.1 J***	6.2 U	6 U	6 U J	5.8 U	6.1 U J	***40***	***181,000***	***84,500***	***4,550***	***1,450***
Semivolatile Organic Compounds														
	µg/kg		ND	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS	ND
Perchlorate														
Perchlorate	µg/kg	1,430,000	6 U	***0.87 J***	***1.3 J***	***8.7***	***14***	***1.8 J***	***5.4 J***	NS	NS	NS	NS	NS
Explosives														
HMX	mg/kg	44,000	0.25 U	0.25 U	***0.035 J***	0.25 U	0.25 U	0.25 U	0.25 U	NS	NS	NS	NS	NS
Metals														
Antimony	mg/kg	817	***0.34 J***	***0.26 J***	***1.2***	***0.33 J***	***0.24 J***	***0.25 J***	***0.32 J***	NS	NS	NS	NS	NS
Arsenic	mg/kg	38	***5.9***	***4.7***	***6.3***	***4.9***	***3.8***	***2.9***	***3.6***	NS	NS	NS	NS	NS
Beryllium	mg/kg	3,650	***1***	***0.97***	***1.5***	***0.95***	***0.88***	***0.68***	***0.79***	NS	NS	NS	NS	NS
Cadmium	mg/kg	965	***1***	***0.56***	***2.4***	***0.97***	***0.71***	***0.58***	***0.57***	NS	NS	NS	NS	NS
Chromium	mg/kg	111	***23.9***	***25.7***	***40.3***	***19.7***	***20.7***	***15***	***18.3***	NS	NS	NS	NS	NS
Copper	mg/kg	81,700	***13.9***	***11.6***	***61.1 J***	***10.1***	***10***	***7.1***	***7.5***	NS	NS	NS	NS	NS
Lead	mg/kg	1,000	***13.8***	***11.3***	***44.2***	***12.9***	***11.1***	***9.4***	***9.9***	NS	NS	NS	NS	NS
Mercury	mg/kg	20	***0.02 J***	***0.012 J***	***0.054 J***	***0.02 J***	0.048 U	***0.011 J***	0.048 U	NS	NS	NS	NS	NS
Nickel	mg/kg	32,400	***18.8***	***16.9***	***41.1***	***18***	***13.2***	***8.7***	***14.6***	NS	NS	NS	NS	NS
Selenium	mg/kg	10,200	***0.52***	***0.45***	***0.76***	***0.77***	***0.84***	***0.42***	***0.61***	NS	NS	NS	NS	NS
Silver	mg/kg	10,200	***0.16***	***0.1 J***	***0.25***	***0.18***	***0.13***	***0.12***	***0.12***	NS	NS	NS	NS	NS
Thallium	mg/kg	10	***0.31***	***0.2***	***0.37***	***0.23***	***0.24***	***0.15 J***	***0.23***	NS	NS	NS	NS	NS
Zinc	mg/kg	613,000	***43.1***	***38.8***	***113***	***22.9***	***27.7***	***23.9***	***32.5***	NS	NS	NS	NS	NS

Notes:
Bold / Italics = compound was detected
Highlighted = Concentration exceeds screening level
bgs = below ground surface
ID = Identification
J = estimated value
mg/kg = milligrams per kilogram
NA = Not analyzed
ND = Not Detected
NS = Not sampled
U = compound was not detected (or qualified as not detected during QA/QC review)
µg/kg = micrograms per kilogram
[1] For source of screening level, see Table 2-3.

Table 2-7
RI Subsurface Soil Samples, Detected Analytes
Record of Decision
Open Burning / Opened Detonation Ground (Range 16)
Fort Riley, Kansas

			Sample ID:	RISB-01/SB01	RISB-01/SB02	RISB-02/SB01	RISB-02/SB02	RISB-03/SB01	RISB-03/SB02	RISB-04/SB01	RISB-04/SB02	RISB-05/SB01	RISB-05/SB02	RISB-06/SB01
			Lab Number(s):	G1L160529-008	G1L160529-010	G1L160513-008	G1L160513-009	G1L160518-002	G1L160518-003	G1L210484-008	G1L210484-010	G1L210484-005	G1L210484-006	G1L210484-002
			Date(s) Sampled:	12/15/2011	12/15/2011	12/12/2011	12/12/2011	12/12/2011	12/12/2011	12/19/2011	12/19/2011	12/19/2011	12/19/2011	12/19/2011
			Depth (feet bgs):	4.5 - 5.5	8.0 - 9.0	5.0 - 6.0	8.0 - 9.0	6.0 - 8.0	9.0 - 10.0	5.0 - 6.0	9.0 - 10.0	5.0 - 6.0	9.0 - 10.0	5.0 - 6.0
Parameter	**Units**	**Screening Level[1]**												
Volatile Organic Compounds														
1,1,2,2-Tetrachloroethane	µg/kg	15,200	5.8 U	6 U	6 U J	6.2 U J	6.1 U	6.4 U	5.9 U	6.3 U	6 U	6.5 U	6.2 U
1,1,2-Trichloroethane	µg/kg	27,600	5.8 U	6 U	6 U J	6.2 U J	6.1 U	6.4 U	5.9 U	6.3 U	6 U	6.5 U	6.2 U
Acetone	µg/kg	406,000,000	2.5 J U	24 U	24 U J	***5.6 J***	24 U	26 U	24 U	***3.8 J***	24 U	26 U	25 U
Bromochloromethane	µg/kg	680,000	5.8 U	6 U	6 U J	6.2 U J	6.1 U	6.4 U	5.9 U	6.3 U	6 U	6.5 U	6.2 U
Chloroform	µg/kg	7,140	5.8 U	6 U	6 U J	6.2 U J	6.1 U	6.4 U	5.9 U	6.3 U	6 U	6.5 U	6.2 U
cis-1,2-Dichloroethene	µg/kg	194,000	5.8 U	6 U	6 U J	6.2 U J	6.1 U	6.4 U	5.9 U	6.3 U	6 U	6.5 U	6.2 U
Methylene chloride	µg/kg	267,000	5.8 U	6 U	6 U J	6.2 U J	6.1 U	6.4 U	5.9 U	6.3 U	6 U	6.5 U	6.2 U
Styrene	µg/kg	20,400,000	5.8 U	6 U	6 U J	6.2 U J	6.1 U	6.4 U	5.9 U	6.3 U	6 U	6.5 U	6.2 U
Tetrachloroethene	µg/kg	210,000	5.8 U	6 U	6 U J	6.2 U J	6.1 U	6.4 U	5.9 U	6.3 U	6 U	6.5 U	6.2 U
Toluene	µg/kg	29,800,000	5.8 U	6 U	6 U J	6.2 U J	6.1 U	6.4 U	5.9 U	6.3 U	6 U	6.5 U	6.2 U
trans-1,2-Dichloroethene	µg/kg	333,000	5.8 U	6 U	6 U J	6.2 U J	6.1 U	6.4 U	5.9 U	6.3 U	6 U	6.5 U	6.2 U
Trichloroethene	µg/kg	9,910	5.8 U	6 U	6 U J	6.2 U J	6.1 U	6.4 U	5.9 U	6.3 U	6 U	***1.3 J***	6.2 U
Semivolatile Organic Compounds														
	µg/kg		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perchlorate														
Perchlorate	µg/kg	1,430,000	5.7 U	5.9 U	6 U	6 U	***0.32 J***	***1.6 J***	5.9 U	6.3 U	5.9 U	***1.1 J***	***1.4 J***
Explosives														
HMX	mg/kg	44,000	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.24 U	0.24 U	0.25 U	0.25 U	0.25 U
Metals														
Antimony	mg/kg	817	0.7 U	0.72 U	0.72 U	0.74 U	***0.24 J***	0.77 U	***0.32 J***	***0.34 J***	***0.32 J***	0.78 U	***0.37 J***
Arsenic	mg/kg	38	***6.6***	***4.7***	***3.7***	***3.6***	***4.3***	***4.3***	***7.6***	***5.6***	***5.3***	***6.1***	***5.5***
Beryllium	mg/kg	3,650	***1.1***	***1.1***	***0.78***	***0.7***	***0.71***	***0.79***	***0.91***	***0.97***	***1***	***1.1***	***1.1***
Cadmium	mg/kg	965	***1.3***	***1.1***	***0.69***	***0.65***	***0.78***	***0.78***	***1.5***	***0.92***	***0.66***	***0.58***	***1.1***
Chromium	mg/kg	111	***26.5***	***23.9***	***16.2***	***14.5***	***15.7***	***14.7***	***20.6***	***20.7***	***26.6***	***28.1***	***25.4***
Copper	mg/kg	81,700	***15***	***15.4***	***9.8***	***10.1***	***10.2***	***12.2***	***12***	***13.1***	***13.6***	***13.3***	***14.9***
Lead	mg/kg	1,000	***16.5***	***14.4***	***10.6***	***11.3***	***12.6***	***15.7***	***17.4***	***12.7***	***13.8***	***14.5***	***13.4***
Mercury	mg/kg	20	***0.014 J***	***0.017 J***	0.048 U	0.049 U	0.049 U	0.051 U	***0.012 J***	***0.02 J***	***0.022 J***	***0.013 J***	***0.021 J***
Nickel	mg/kg	32,400	***23.6***	***26.1***	***13.5***	***12.8***	***12.3***	***13.1***	***32.6***	***18.9***	***21.2***	***29***	***19.8***
Selenium	mg/kg	10,200	***0.55***	***0.59***	***0.47***	***0.48***	***0.44***	***0.49***	***0.37***	***0.51***	***0.49***	***0.46***	***0.58***
Silver	mg/kg	10,200	***0.21***	***0.19***	***0.12***	***0.11 J***	***0.14***	***0.12 J***	***0.17***	***0.16***	***0.12***	***0.093 J***	***0.22***
Thallium	mg/kg	10	***0.33***	***0.37***	***0.25***	***0.26***	***0.28***	***0.31***	***0.36***	***0.27***	***0.26***	***0.21***	***0.34***
Zinc	mg/kg	613,000	***46.8***	***45.4***	***28.8***	***31.6***	***34.7***	***38***	***34.8***	***42.9***	***38.9***	***36.2***	***42.8***

Notes:
Bold / Italics = compound was detected
Highlighted = Concentration exceeds screening level
bgs = below ground surface
ID = Identification
J = estimated value
mg/kg = milligrams per kilogram
NA = Not analyzed
ND = Not Detected
NS = Not sampled
U = compound was not detected (or qualified as not detected during QA/QC review)
µg/kg = micrograms per kilogram
[1] For source of screening level, see Table 2-3.

Table 2-7
RI Subsurface Soil Samples, Detected Analytes
Record of Decision
Open Burning / Opened Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	RISB-06/SB02	RISB-07/SB01	RISB-07/SB02	RISB-08/SB01	RISS-17/SB01	RISS-17/SB02	RISB-18/SB01	RISB-18/SB02	RISB-19/SB01	RISB-19/SB02	RISB-20/SB01
		Lab Number(s):	G1L210484-003	G1L210482-010	G1L210482-011	G1L160527-011	G1L160505-005	G1L160505-006	G1L160522-004	G1L160522-005	G1L160522-006	G1L160522-007	G1L160513-011
		Date(s) Sampled:	12/19/2011	12/19/2011	12/19/2011	12/14/2011	12/13/2011	12/13/2011	12/13/2011	12/13/2011	12/13/2011	12/13/2011	12/12/2011
		Depth (feet bgs):	8.0 - 9.5	5.0 - 6.0	9.0 - 10.0	4.0 - 5.0	5.0 - 6.0	8.5 - 9.0	4.0 - 5.0	8.0 - 9.0	4.0 - 5.0	8.5 - 9.0	5.0 - 6.0
Parameter	**Units**	**Screening Level[1]**											
Volatile Organic Compounds													
1,1,2,2-Tetrachloroethane	µg/kg	15,200	6.4 U J	6 U	6.3 U	***3.4 J***	5.9 U J	6.2 U	6 U	6 U	5.9 U	5.9 U	6.1 U J
1,1,2-Trichloroethane	µg/kg	27,600	6.4 U J	6 U	6.3 U	6 U J	5.9 U J	6.2 U	6 U	6 U	5.9 U	5.9 U	6.1 U J
Acetone	µg/kg	406,000,000	26 U J	24 U	25 U	24 U J	24 U J	25 U	24 U	24 U	***3.3 J***	24 U	***7.9 J***
Bromochloromethane	µg/kg	680,000	6.4 U J	6 U	6.3 U	6 U J	5.9 U J	6.2 U	6 U	6 U	5.9 U	5.9 U	6.1 U J
Chloroform	µg/kg	7,140	6.4 U J	6 U	6.3 U	6 U J	5.9 U J	6.2 U	6 U	6 U	5.9 U	5.9 U	6.1 U J
cis-1,2-Dichloroethene	µg/kg	194,000	6.4 U J	6 U	6.3 U	6 U J	5.9 U J	6.2 U	6 U	6 U	5.9 U	5.9 U	6.1 U J
Methylene chloride	µg/kg	267,000	6.4 U J	6 U	6.3 U	6 U J	5.9 U J	6.2 U	6 U	6 U	5.9 U	5.9 U	6.1 U J
Styrene	µg/kg	20,400,000	6.4 U J	6 U	6.3 U	6 U J	5.9 U J	6.2 U	6 U	6 U	5.9 U	5.9 U	6.1 U J
Tetrachloroethene	µg/kg	210,000	6.4 U J	6 U	6.3 U	6 U J	5.9 U J	6.2 U	6 U	6 U	5.9 U	5.9 U	6.1 U J
Toluene	µg/kg	29,800,000	6.4 U J	6 U	6.3 U	6 U J	5.9 U J	6.2 U	6 U	6 U	5.9 U	5.9 U	6.1 U J
trans-1,2-Dichloroethene	µg/kg	333,000	6.4 U J	6 U	6.3 U	6 U J	5.9 U J	6.2 U	6 U	6 U	5.9 U	5.9 U	6.1 U J
Trichloroethene	µg/kg	9,910	6.4 U J	6 U	6.3 U	***3.4 J***	5.9 U J	***10***	6 U	6 U	5.9 U	5.9 U	6.1 U J
Semivolatile Organic Compounds													
	µg/kg		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perchlorate													
Perchlorate	µg/kg	1,430,000	***3 J***	6 U	***0.53 J***	***0.7 J***	***75***	***450***	***1.5 J***	***0.7 J***	***340***	***800***	6.1 U
Explosives													
HMX	mg/kg	44,000	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Metals													
Antimony	mg/kg	817	***0.42 J***	***0.26 J***	***0.29 J***	0.72 U	***0.31 J***	***0.29 J***	***0.29 J***	***0.27 J***	0.71 U	0.71 U	***0.32 J***
Arsenic	mg/kg	38	***5.9 J***	***5.7***	***4.3***	***8.7***	***4.1***	***4***	***3.7***	***3.3***	***4.8***	***3.3***	***7.2***
Beryllium	mg/kg	3,650	***1.1***	***0.94***	***1.2***	***1***	***0.98***	***0.85***	***0.75***	***0.68***	***0.94***	***0.67***	***1.2***
Cadmium	mg/kg	965	***0.72 J***	***0.91***	***0.61***	***0.98***	***0.8***	***0.64***	***0.7***	***0.58***	***0.56***	***0.56***	***0.82***
Chromium	mg/kg	111	***22.3***	***19.5***	***31.1***	***23.6***	***23.2***	***20***	***17***	***14.9***	***18.2***	***14.2***	***19.3***
Copper	mg/kg	81,700	***13.2 J***	***13.2***	***13.5***	***22.1***	***10.7***	***7.7***	***10.1***	***8***	***9.7***	***7.9***	***11.5***
Lead	mg/kg	1,000	***11.9 J***	***16***	***12.5***	***16.7***	***12***	***10.1***	***10.7***	***11.6***	***18***	***9.6***	***14***
Mercury	mg/kg	20	***0.015 J***	***0.019 J***	***0.019 J***	***0.022 J***	0.048 U	0.05 U	***0.016 J***	0.048 U	***0.021 J***	***0.011 J***	***0.018 J***
Nickel	mg/kg	32,400	***19.4 J***	***26.8***	***20.2***	***21.8***	***16.2***	***16.9***	***14.1***	***15.1***	***15.7***	***10.3***	***13.8***
Selenium	mg/kg	10,200	***0.38 J***	***0.45***	***0.54***	***0.54***	***0.82***	***0.65***	***0.39***	***0.34 J***	***0.67***	***0.45***	***0.57***
Silver	mg/kg	10,200	***0.13***	***0.12***	***0.11 J***	***0.21***	***0.15***	***0.12***	***0.14***	***0.1 J***	***0.12***	***0.11 J***	***0.16***
Thallium	mg/kg	10	***0.26 J***	***0.35***	***0.25***	***0.36***	***0.25***	***0.23***	***0.21***	***0.23***	***0.29***	***0.17 J***	***0.28***
Zinc	mg/kg	613,000	***37.7 J***	***32.1***	***42***	***56.8***	***26.8***	***35.5***	***29.2***	***24.3***	***25.3***	***23.9***	***32.6***

Notes:
Bold / Italics = compound was detected
Highlighted = Concentration exceeds screening level
bgs = below ground surface
ID = Identification
J = estimated value
mg/kg = milligrams per kilogram
NA = Not analyzed
ND = Not Detected
NS = Not sampled
U = compound was not detected (or qualified as not detected during QA/QC review)
µg/kg = micrograms per kilogram
[1] For source of screening level, see Table 2-3.

Table 2-7
RI Subsurface Soil Samples, Detected Analytes
Record of Decision
Open Burning / Opened Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	RISB-20/SB02	RISB-21/SB01	RISB-22/SB01	RISB-23/SB01	RISB-23/SB02	RISB-24/SB01	RISB-24/SB02	RISB-39/SB01	RISB-39/SB02	RISB-40/SB01	RISB-40/SB02
		Lab Number(s):	G1L160518-010	G1L190420-007	G1L160513-003	G1L160529-013	G1L160529-014	G1L160522-001	G1L160522-002	G1L160527-006	G1L160527-007	G1L160527-003	G1L160527-004
		Date(s) Sampled:	12/12/2011	12/15/2011	12/12/2011	12/15/2011	12/15/2011	12/13/2011	12/13/2011	12/14/2011	12/14/2011	12/14/2011	12/14/2011
		Depth (feet bgs):	9.0 - 10.0	5.0 - 6.0	3.0 - 4.0	4.5 - 5.0	8.0 - 9.0	4.6 - 5.4	8.0 - 9.0	4.0 - 5.0	8.0 -9.0	4.0 - 5.0	8.0 -9.0
Parameter	**Units**	**Screening Level[1]**											
Volatile Organic Compounds													
1,1,2,2-Tetrachloroethane	µg/kg	15,200	6 U J	6.3 U	5.8 U J	5.9 U	6 U	6.3 U J	6.3 U	5.8 U	6.4 U J	5.9 U	5.8 U
1,1,2-Trichloroethane	µg/kg	27,600	6 U J	6.3 U	5.8 U J	5.9 U	6 U	6.3 U J	6.3 U	5.8 U	6.4 U J	5.9 U	5.8 U
Acetone	µg/kg	406,000,000	24 U J	25 U	***2.7 J***	24 U	24 U	***12 J***	25 U	23 U	25 U J	24 U	23 U
Bromochloromethane	µg/kg	680,000	6 U J	6.3 U	5.8 U J	5.9 U	6 U	6.3 U J	6.3 U	5.8 U	6.4 U J	5.9 U	5.8 U
Chloroform	µg/kg	7,140	6 U J	6.3 U	5.8 U J	5.9 U	6 U	6.3 U J	6.3 U	5.8 U	6.4 U J	5.9 U	5.8 U
cis-1,2-Dichloroethene	µg/kg	194,000	6 U J	6.3 U	5.8 U J	5.9 U	6 U	6.3 U J	6.3 U	5.8 U	6.4 U J	5.9 U	5.8 U
Methylene chloride	µg/kg	267,000	6 U J	6.3 U	5.8 U J	5.9 U	6 U	6.3 U J	6.3 U	5.8 U	6.4 U J	5.9 U	5.8 U
Styrene	µg/kg	20,400,000	6 U J	6.3 U	5.8 U J	5.9 U J	6 U	6.3 U J	6.3 U	5.8 U	6.4 U J	5.9 U	5.8 U
Tetrachloroethene	µg/kg	210,000	6 U J	6.3 U	5.8 U J	5.9 U	6 U	6.3 U J	6.3 U	5.8 U	6.4 U J	5.9 U	5.8 U
Toluene	µg/kg	29,800,000	6 U J	6.3 U	5.8 U J	5.9 U	6 U	6.3 U J	6.3 U	5.8 U	6.4 U J	5.9 U	5.8 U
trans-1,2-Dichloroethene	µg/kg	333,000	6 U J	6.3 U	5.8 U J	5.9 U	6 U	6.3 U J	6.3 U	5.8 U	6.4 U J	5.9 U	5.8 U
Trichloroethene	µg/kg	9,910	6 U J	6.3 U	5.8 U J	5.9 U	6 U	6.3 U J	6.3 U	5.8 U	6.4 U J	5.9 U	5.8 U
Semivolatile Organic Compounds													
	µg/kg		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perchlorate													
Perchlorate	µg/kg	1,430,000	5.8 U	***160***	5.7 U	5.8 U	***0.43 J***	6.1 U	6.3 U	***1.3 J***	***9.8***	5.9 U	***240***
Explosives													
HMX	mg/kg	44,000	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U
Metals													
Antimony	mg/kg	817	0.72 U	***0.34 J***	***0.33 J***	0.71 U J	0.72 U	0.76 U J	0.75 U	***0.36 J***	0.76 U	***0.29 J***	***0.32 J***
Arsenic	mg/kg	38	***3.1***	***3.1***	***4.1***	***5***	***4.6***	***2.4***	***2.1***	***4.6***	***2.2***	***5.1***	***3.5***
Beryllium	mg/kg	3,650	***0.71***	***1***	***0.61***	***1***	***1.1***	***0.8***	***0.7***	***0.94***	***1***	***0.94***	***0.69***
Cadmium	mg/kg	965	***0.37***	***1.1***	***0.56***	***0.7***	***0.46***	***0.28***	***0.46***	***0.81***	***0.62***	***0.92***	***0.56***
Chromium	mg/kg	111	***15.4***	***26.9***	***16.7***	***27 J***	***23.1***	***15.8***	***16.6***	***21.7***	***29.3***	***21.4***	***18.2***
Copper	mg/kg	81,700	***7.7***	***12.1***	***8.6***	***14.1***	***14***	***7.3 J***	***5.6***	***12.8***	***10.9***	***13.4***	***8.9***
Lead	mg/kg	1,000	***8.8***	***13.2***	***10.5***	***13.5***	***11.6***	***10.1***	***8.5***	***12.6***	***10.9***	***12.9***	***10.5***
Mercury	mg/kg	20	0.048 U	***0.024 J***	***0.012 J***	0.047 U	***0.01 J***	0.051 U	0.05 U	***0.015 J***	0.051 U	***0.014 J***	0.046 U
Nickel	mg/kg	32,400	***11.4***	***31.6***	***13.5***	***24.5***	***19.1***	***13 J***	***11.5***	***18.8***	***23.7***	***16.6***	***12.6***
Selenium	mg/kg	10,200	***0.49***	***0.6***	***0.43***	***0.48***	***0.36***	***0.33 J***	***0.28 J***	***0.57***	***0.44***	***0.67***	***0.52***
Silver	mg/kg	10,200	***0.079 J***	***0.16***	***0.096 J***	***0.11 J***	***0.094 J***	***0.056 J***	***0.083 J***	***0.15***	***0.099 J***	***0.18***	***0.11 J***
Thallium	mg/kg	10	***0.19***	***0.39***	***0.21***	***0.22***	***0.18***	***0.22***	***0.19***	***0.25***	***0.32***	***0.27***	***0.19***
Zinc	mg/kg	613,000	***24.1***	***63.4***	***24.9***	***42.3***	***39.5***	***17.9***	***19.7***	***38.7***	***40.5***	***33.5***	***29.8***

Notes:
Bold / Italics = compound was detected
Highlighted = Concentration exceeds screening level
bgs = below ground surface
ID = Identification
J = estimated value
mg/kg = milligrams per kilogram
NA = Not analyzed
ND = Not Detected
NS = Not sampled
U = compound was not detected (or qualified as not detected during QA/QC review)
µg/kg = micrograms per kilogram
[1] For source of screening level, see Table 2-3.

Table 2-8
RI Sediment Samples, Detected Analytes
Record of Decision
Open Burning / Opened Detonation Ground (Range 16
Fort Riley, Kansas

		Sample ID:	SD-01/SS01	SD-02/SS01	SD-03/SS01	SD-04/SS01	SD-05/SS01	SD-06/SS01
		Date(s) Sampled:	12/7/2011	12/7/2011	12/7/2011	12/7/2011	12/7/2011	12/7/2011
Parameter	**Units**	**Screening Level[1]**						
Volatile Organic Compounds								
Tetrachloroethene	µg/kg	210,000	6.3 U	7 U J	***0.9 J***	6.3 U	6.5 U J	7.5 U J
Toluene	µg/kg	29,800,000	6.3 U	7 U J	6.6 U	6.3 U	***1.1 J***	7.5 U J
Semivolatile Organic Compounds								
	µg/kg		ND	ND	ND	ND	ND	ND
Perchlorate								
	µg/kg		ND	ND	ND	ND	ND	ND
Explosives								
	mg/kg		ND	ND	ND	ND	ND	ND
Metals								
Antimony	mg/kg	817	0.76 U	0.84 U	0.79 U	0.76 U	0.78 U	0.9 U
Arsenic	mg/kg	38	***6.8***	***6.7***	***6.9***	***5.2***	***6.8***	***7.7***
Beryllium	mg/kg	3,650	***1.5***	***1***	***1.1***	***0.91***	***1.1***	***0.96***
Cadmium	mg/kg	965	***0.65***	***1.1***	***1***	***0.65***	***0.9***	***0.92***
Chromium	mg/kg	111	***40***	***23.4***	***25.7***	***21.9***	***27.3***	***23.5***
Copper	mg/kg	81,700	***21.8***	***14***	***13.5***	***12.5***	***12.5***	***13***
Lead	mg/kg	1,000	***13.7***	***19.3***	***21***	***13.1***	***17.4***	***20.3***
Mercury	mg/kg	20	***0.017 J***	***0.017 J***	***0.012 J***	***0.016 J***	***0.011 J***	***0.013 J***
Nickel	mg/kg	32,400	***42.3***	***23.7***	***26.8***	***20.2***	***22.1***	***23***
Selenium	mg/kg	10,200	***0.68***	***0.65***	***0.69***	***0.56***	***0.78***	***0.82***
Silver	mg/kg	10,200	***0.1 J***	***0.15***	***0.14***	***0.1 J***	***0.14***	***0.12 J***
Thallium	mg/kg	10	***0.2***	***0.31***	***0.32***	***0.27***	***0.27***	***0.27***
Zinc	mg/kg	613,000	***51.1***	***50.5***	***49.3***	***44.7***	***55.2***	***39.3***

Notes:

[1] For source of screening levels, see Table 2-3.

Bold / Italics = compound was detected

Highlighted = Detection is equal to or exceeds screening level

ID = identification

J = estimated value

mg/kg = milligrams per kilogram

U = compound was not detected
(or qualified as not detected during QA/QC review)

µg/kg = micrograms per kilogram

ND = not detected

Table 2-8
RI Sediment Samples, Detected Analytes
Record of Decision
Open Burning / Opened Detonation Ground (Range 16
Fort Riley, Kansas

		Sample ID:	SD-07/SS01	SD-08/SS01	SD-09/SS01	SD-10/SS01	SD-11/SS01	SD-12/SS01
		Date(s) Sampled:	12/7/2011	12/7/2011	12/7/2011	12/7/2011	12/7/2011	12/7/2011
Parameter	**Units**	**Screening Level[1]**						
Volatile Organic Compounds								
Tetrachloroethene	µg/kg	210,000	6.2 U J	7 U	6.9 U J	6.3 U	6.3 U J	6.5 U J
Toluene	µg/kg	29,800,000	6.2 U J	7 U	6.9 U J	6.3 U	***1.6 J***	6.5 U J
Semivolatile Organic Compounds								
	µg/kg		ND	ND	ND	ND	ND	ND
Perchlorate								
	µg/kg		ND	ND	ND	ND	ND	ND
Explosives								
	mg/kg		ND	ND	ND	ND	ND	ND
Metals								
Antimony	mg/kg	817	0.74 U	0.84 U	0.83 U	***0.25 J***	0.76 U J	0.78 U
Arsenic	mg/kg	38	***7.3***	***4.1***	***4.3***	***6.9***	***4.5***	***5.1***
Beryllium	mg/kg	3,650	***0.92***	***0.92***	***0.84***	***0.97***	***0.85***	***0.89***
Cadmium	mg/kg	965	***1.3***	***0.7***	***0.8***	***0.81***	***0.63***	***0.84***
Chromium	mg/kg	111	***21.5***	***23.7***	***20.5***	***21.2***	***18.7***	***20.5***
Copper	mg/kg	81,700	***12.1***	***12.3***	***35.4***	***11.4***	***9.2 J***	***12***
Lead	mg/kg	1,000	***20.8***	***12.2***	***19.5***	***19.1***	***11.8***	***17.7***
Mercury	mg/kg	20	0.049 U	***0.012 J***	***0.032 J***	***0.021 J***	***0.014 J***	***0.018 J***
Nickel	mg/kg	32,400	***25.3***	***18.3***	***16.4***	***20.2***	***13.6***	***18.1***
Selenium	mg/kg	10,200	***0.82***	***0.59***	***0.87***	***0.64***	***0.54***	***0.66***
Silver	mg/kg	10,200	***0.12 J***	***0.12 J***	***0.12 J***	***0.13***	***0.11 J***	***0.13***
Thallium	mg/kg	10	***0.27***	***0.26***	***0.25***	***0.29***	***0.25***	***0.26***
Zinc	mg/kg	613,000	***33***	***49.7***	***66.4***	***43.2***	***45.5***	***59***

Notes:

[1] For source of screening levels, see Table 2-3.

Bold / Italics = compound was detected

Highlighted = Detection is equal to or exceeds screening level

ID = identification

J = estimated value

mg/kg = milligrams per kilogram

U = compound was not detected
(or qualified as not detected during QA/QC review)

µg/kg = micrograms per kilogram

ND = not detected

Table 2-8
RI Sediment Samples, Detected Analytes
Record of Decision
Open Burning / Opened Detonation Ground (Range 16
Fort Riley, Kansas

		Sample ID:	SD-13/SS01	SD-14/SS01
		Date(s) Sampled:	12/7/2011	12/7/2011
Parameter	**Units**	**Screening Level[1]**		
Volatile Organic Compounds				
Tetrachloroethene	µg/kg	210,000	6.1 U J	6.6 U J
Toluene	µg/kg	29,800,000	6.1 U J	6.6 U J
Semivolatile Organic Compounds				
	µg/kg		ND	ND
Perchlorate				
	µg/kg		ND	ND
Explosives				
	mg/kg		ND	ND
Metals				
Antimony	mg/kg	817	0.74 U	***0.31 J***
Arsenic	mg/kg	38	***4.6***	***7.4***
Beryllium	mg/kg	3,650	***0.61***	***0.98***
Cadmium	mg/kg	965	***0.73***	***1.5***
Chromium	mg/kg	111	***12.7***	***21.4***
Copper	mg/kg	81,700	***7.5***	***11.8***
Lead	mg/kg	1,000	***14.8***	***28.1***
Mercury	mg/kg	20	0.049 U	***0.015 J***
Nickel	mg/kg	32,400	***16.4***	***33.6***
Selenium	mg/kg	10,200	***0.53***	***0.63***
Silver	mg/kg	10,200	***0.072 J***	***0.12 J***
Thallium	mg/kg	10	***0.18***	***0.33***
Zinc	mg/kg	613,000	***26.6***	***36.3***

Notes:

[1] For source of screening levels, see Table 2-3.

Bold / Italics = compound was detected

Highlighted = Detection is equal to or exceeds screening level

ID = identification

J = estimated value

mg/kg = milligrams per kilogram

U = compound was not detected
(or qualified as not detected during QA/QC review)

µg/kg = micrograms per kilogram

ND = not detected

Table 2-9
RI Surface Water Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

			Sample ID:	Stream-01/SW01	Stream-07/SW01	Stream-08/SW01	Stream-09/SW01	Stream-10/SW01
			Lab Number:	G1L090461-001 G1L090463-001 G1L120448-002	G1L090463-002 G1L120448-003	G1L090461-002 G1L090463-004 G1L120448-005	G1L090463-003 G1L120448-001	G1L090462-001 G1L090463-005 G1L120448-006
			Date Sampled:	12/8/2011	12/8/2011	12/8/2011	12/8/2011	12/8/2011
Parameter	**Units**	**Screening Level[1]**						
Volatile Organic Compounds								
1,1,2,2-Tetrachloroethane	µg/L	1.28		1 U	1 U	1 U	1 U	1 U
2-Butanone (MEK)	µg/L	11,800		2 U	2 U	2 U	2 U	2 U
Acetone	µg/L	45,500		10 U	10 U	***3.1 J***	10 U	10 U
cis-1,2-Dichloroethene	µg/L	70		1 U	1 U	1 U	1 U	1 U
m-Xylene & p-Xylene	µg/L	190		1 U	1 U	1 U	***0.2 J***	1 U
Tetrachloroethene	µg/L	5		1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	µg/L	100		1 U	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	5		1 U	***0.18 J***	1 U	1 U	1 U
Semivolatile Organic Compounds								
Benzo(a)pyrene	µg/L	0.2		9.9 U	9.6 U	9.7 U	9.6 U	9.9 U
bis(2-Ethylhexyl)phthalate	µg/L	6		***1.2 J***	9.6 U	***1.3 J***	9.6 U	***1.1 J***
Perchlorate								
Perchlorate	µg/L	70.9		***0.44 J***	***0.23 J***	0.5 U	***0.22 J***	***0.54***
Explosives								
4-Amino-2,6-dinitrotoluene	µg/L	30		0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Metals								
Beryllium	µg/L	4		1 U	1 U	***0.2 J***	1 U	1 U
Copper	µg/L	1,300		***2.2 J***	3 U	***5.4***	3 U	***1.3 J***
Lead	µg/L	15		2.5 U	2.5 U	***3.1***	2.5 U	2.5 U
Mercury	µg/L	2		0.2 U	***0.18 J***	0.2 U	***0.32***	0.2 U
Nickel	µg/L	2,040		3 U	3 U	***2.1 J***	3 U	3 U
Selenium	µg/L	50		***2.2 J***	3 U	3 U	3 U	3 U
Zinc	µg/L	30,500		12 U	12 U J	***4.9 J***	12 U	12 U

Notes:
[1] For source of screening levels, see Table 2-3.
Bold / Italics = compound was detected
Highlighted = Concentration exceeds screening level
ID = Identification
J = estimated value
mg/L = milligrams per liter
NA = Not analyzed
U = compound was not detected
µg/L = micrograms per liter

Table 2-9
RI Surface Water Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	Stream-11/SW01	Stream-12/SW01	Stream-13/SW01	Seep-03/SW01	Spring/SW02
		Lab Number:	G1L090463-007 G1L120448-008	G1L090463-008 G1L120448-009	G1L090463-009 G1L120448-010	G1L120448-011	G2C100418-005
		Date Sampled:	12/8/2011	12/8/2011	12/8/2011	12/9/2011	3/9/2012
Parameter	**Units**	**Screening Level[1]**					
Volatile Organic Compounds							
1,1,2,2-Tetrachloroethane	µg/L	1.28	1 U	1 U	1 U	1 U	***16***
2-Butanone (MEK)	µg/L	11,800	2 U	2 U	2 U	2 U	2 U
Acetone	µg/L	45,500	10 U	10 U	10 U	10 U	10 U
cis-1,2-Dichloroethene	µg/L	70	1 U	1 U	1 U	1 U	***1.4***
m-Xylene & p-Xylene	µg/L	190	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene	µg/L	5	1 U	1 U	1 U	1 U	***1.8 J***
trans-1,2-Dichloroethene	µg/L	100	1 U	1 U	1 U	1 U	***0.19 J***
Trichloroethene	µg/L	5	1 U	1 U	1 U	1 U	***91 J***
Semivolatile Organic Compounds							
Benzo(a)pyrene	µg/L	0.2	***1.1 J***	9.9 U	10 U	9.4 U	9.4 U
bis(2-Ethylhexyl)phthalate	µg/L	6	***1.2 J***	***1.2 J***	***1.1 J***	9.4 U	9.4 U
Perchlorate							
Perchlorate	µg/L	70.9	***0.4 J***	***0.33 J***	***0.43 J***	***0.38 J***	***0.55***
Explosives							
4-Amino-2,6-dinitrotoluene	µg/L	30	0.2 U	0.2 U	0.2 U	0.2 U	***0.75 J***
Metals							
Beryllium	µg/L	4	1 U	***0.1 J***	1 U	1 U	1 U
Copper	µg/L	1,300	3 U	***1.8 J***	***1.2 J***	3 U	3 U
Lead	µg/L	15	2.5 U	***2.4 J***	2.5 U	2.5 U	2.5 U
Mercury	µg/L	2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Nickel	µg/L	2,040	3 U	3 U	3 U	3 U	***1.1 J***
Selenium	µg/L	50	3 U	3 U	***2.9 J***	3 U	3 U
Zinc	µg/L	30,500	12 U	12 U	12 U	12 U	12 U

Notes:
[1] For source of screening levels, see Table 2-3.
Bold / Italics = compound was detected
Highlighted = Concentration exceeds screening level
ID = Identification
J = estimated value
mg/L = milligrams per liter
NA = Not analyzed
U = compound was not detected
µg/L = micrograms per liter

Table 2-9
RI Surface Water Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	Stream-01/SW02	Stream-02/SW02
		Lab Number:	G2C100418-004	G2C100418-002
		Date Sampled:	3/9/2012	3/9/2012
Parameter	**Units**	**Screening Level[1]**		
Volatile Organic Compounds				
1,1,2,2-Tetrachloroethane	µg/L	1.28	1 U	***0.74 J***
2-Butanone (MEK)	µg/L	11,800	2 U	***0.38 J***
Acetone	µg/L	45,500	10 U	***2.8 J***
cis-1,2-Dichloroethene	µg/L	70	1 U	***0.61 J***
m-Xylene & p-Xylene	µg/L	190	1 U	1 U
Tetrachloroethene	µg/L	5	1 U	***0.13 J***
trans-1,2-Dichloroethene	µg/L	100	1 U	1 U
Trichloroethene	µg/L	5	1 U	***7.2***
Semivolatile Organic Compounds				
Benzo(a)pyrene	µg/L	0.2	9.4 U	9.4 U
bis(2-Ethylhexyl)phthalate	µg/L	6	9.4 U	9.4 U
Perchlorate				
Perchlorate	µg/L	70.9	***0.84***	***29***
Explosives				
4-Amino-2,6-dinitrotoluene	µg/L	30	0.1 U	0.1 U
Metals				
Beryllium	µg/L	4	1 U	1 U
Copper	µg/L	1,300	***1.4 J***	***1.3 J***
Lead	µg/L	15	2.5 U	2.5 U
Mercury	µg/L	2	***0.11 J***	0.2 U
Nickel	µg/L	2,040	3 U	3 U
Selenium	µg/L	50	***1.2 J***	***1.1 J***
Zinc	µg/L	30,500	12 U	12 U

Notes:
[1] For source of screening levels, see Table 2-3.
Bold / Italics = compound was detected
Highlighted = Concentration exceeds screening level
ID = Identification
J = estimated value
mg/L = milligrams per liter
NA = Not analyzed
U = compound was not detected
µg/L = micrograms per liter

Table 2-10
RI Direct-Push Groundwater Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	GW-07/GW01	GW-08/GW01	GW-09/GW01	GW-10/GW01	GW-11/GW01	GW-12/GW01
		Laboratory Number(s):	G1L080501-002	G1L080501-003	G1L070484-004	G1L020426-003	G1L070484-005	G1L070488-003
		Date(s) Sampled:	12/6/2011	12/6/2011	12/5/2011	11/30/2011	12/5/2011	12/5/2011
Parameter	**Units**	**Screening Level[1]**						
Volatile Organic Compounds								
1,1,2,2-Tetrachloroethane	µg/L	1.28	***0.22 J***	***0.76 J***	***0.59 J***	***2.5***	***2.9***	***2.7***
1,2,3-Trichlorobenzene	µg/L	5.2	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	µg/L	70	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trimethylbenzene	µg/L	17.4	1 U	***0.13 J***	1 U	1 U	1 U	1 U
2-Butanone (MEK)	µg/L	11,800	***0.59 J***	2 U	2 U	2 U	2 U	2 U
Acetone	µg/L	45,500	10 U	10 U	10 U	***2.9 J***	10 U	10 U
Benzene	µg/L	5	***0.2 J***	***0.16 J***	1 U	***0.17 J***	***0.35 J***	***0.17 J***
Bromoform	µg/L	80	1 U	1 U	1 U	***1.6***	1 U	1 U
Carbon disulfide	µg/L	1,660	***0.2 J***	2 U	2 U	0.21 J U	2 U	2 U
cis-1,2-Dichloroethene	µg/L	70	1 U	***0.55 J***	***0.42 J***	***0.97 J***	***1.4***	***0.52 J***
Dibromochloromethane	µg/L	80	1 U	1 U	1 U	***1.2***	1 U	1 U
Ethylbenzene	µg/L	700	***0.17 J***	***0.18 J***	***0.13 J***	***0.19 J***	***0.29 J***	***0.23 J***
m-Xylene & p-Xylene	µg/L	190	***0.28 J***	***0.39 J***	1 U	***0.27 J***	***0.27 J***	1 U
Naphthalene	µg/L	2.11	1 U	1 U	1 U	0.66 J U	1 U	1 U
n-Propylbenzene	µg/L	1,910	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	µg/L	190	***0.12 J***	***0.16 J***	1 U	***0.1 J***	***0.13 J***	1 U
Tetrachloroethene	µg/L	5	***0.18 J***	***0.14 J***	***0.36 J***	1 U	***0.33 J***	***0.42 J***
Toluene	µg/L	1,000	***0.46 J***	***0.72 J***	1 U	***0.88 J***	***0.78 J***	***0.41 J***
trans-1,2-Dichloroethene	µg/L	100	1 U	***0.52 J***	***0.44 J***	***0.27 J***	***0.18 J***	1 U
Trichloroethene	µg/L	5	***6.2***	***8.4***	***11***	***12***	***23***	***26 J***
Perchlorate								
Perchlorate	µg/L	70.9	***3.1***	***4***	***1.2***	***7.3***	***9***	***6.1***
Explosives								
2,4-Dinitrotoluene	µg/L	8.98	0.1 U	0.1 U	0.12 U	0.097 U	0.12 U	0.1 U
HMX	µg/L	5,110	0.1 U	0.1 U	0.12 U	***0.11 J***	0.12 U	0.1 U J
Nitroglycerin	µg/L	1.5	0.65 U	0.65 U	0.78 U	0.63 U	0.79 U	0.65 U J
RDX	µg/L	25.9	***0.12***	0.1 U	0.12 U	***0.13 J***	0.12 U	0.1 U
Tetryl	µg/L	407	0.1 U	0.1 U	0.12 U	0.097 U	0.12 U	0.1 U

Notes:

Bold / Italics = compound was detected

Highlighted = Detection is equal to or exceeds screening level

E = Estimated value; result outside of calibration range (lab qualifier)

ID = identification NS = not sampled

J = estimated value µg/L = micrograms per liter

U = compound was not detected
(or qualified as not detected during QA/QC review)

[1] For source of screening levels, see Table 2-3.

* Samples were collected over two days due to low recovery.

Table 2-10
RI Direct-Push Groundwater Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	GW-13/GW01	GW-14/GW01	GW-18/GW01	GW-19/GW01	GW-20/GW01	GW-21/GW01
		Laboratory Number(s):	G1L070483-002	G1L070483-004	G1L030414-002	G1L030414-003	G1L030434-002	G1L020426-002
		Date(s) Sampled:	12/5/2011	12/5/2011	12/1/2011	12/1/2011	12/1/2011	11/29/2011
Parameter	**Units**	**Screening Level[1]**						
Volatile Organic Compounds								
1,1,2,2-Tetrachloroethane	µg/L	1.28	***0.78 J***	0.37 J U	***0.75 J***	***0.16 J***	1 U	***0.097 J***
1,2,3-Trichlorobenzene	µg/L	5.2	***0.41 J***	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	µg/L	70	***0.28 J***	1 U	1 U	1 U	1 U	1 U
1,2,4-Trimethylbenzene	µg/L	17.4	1 U	***0.18 J***	1 U	1 U	1 U	1 U
2-Butanone (MEK)	µg/L	11,800	***1.1 J***	2 U	2 U	***0.68 J***	2 U	2 U
Acetone	µg/L	45,500	10 U	10 U	10 U	10 U	10 U	***2.4 J***
Benzene	µg/L	5	***0.16 J***	***0.15 J***	1 U	***0.14 J***	1 U	1 U
Bromoform	µg/L	80	1 U	1 U	1 U J	1 U	1 U	1 U
Carbon disulfide	µg/L	1,660	2 U	2 U	2 U	2 U	0.25 J U	2 U
cis-1,2-Dichloroethene	µg/L	70	1 U	1 U	***0.24 J***	1 U	***0.24 J***	1 U
Dibromochloromethane	µg/L	80	1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	µg/L	700	***0.27 J***	***0.41 J***	1 U	***0.17 J***	1 U	1 U
m-Xylene & p-Xylene	µg/L	190	1 U	***0.35 J***	1 U	***0.2 J***	1 U	1 U
Naphthalene	µg/L	2.11	***0.7 J***	1 U	1 U J	1 U	1 U	0.65 J U
n-Propylbenzene	µg/L	1,910	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	µg/L	190	1 U	***0.16 J***	1 U	1 U	1 U	1 U
Tetrachloroethene	µg/L	5	***0.25 J***	***0.21 J***	***0.4 J***	1 U	***0.15 J***	***0.16 J***
Toluene	µg/L	1,000	***0.42 J***	***0.87 J***	1 U	***0.58 J***	1 U	***0.31 J***
trans-1,2-Dichloroethene	µg/L	100	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	5	***11***	***7.4***	***22 J***	***5.2***	***6.3***	***7.3***
Perchlorate								
Perchlorate	µg/L	70.9	***1.3***	***2.2***	***6.4***	***5***	***0.64***	***3.7***
Explosives								
2,4-Dinitrotoluene	µg/L	8.98	0.12 U	0.16 U	0.11 U	0.1 U	0.13 U	0.11 U
HMX	µg/L	5,110	0.12 U	0.16 U	0.11 U	0.1 U	0.13 U	0.11 U
Nitroglycerin	µg/L	1.5	0.75 U	1 U	0.69 U	0.65 U	0.87 U	0.69 U
RDX	µg/L	25.9	0.12 U	0.16 U	0.11 U	0.1 U	0.13 U	0.11 U
Tetryl	µg/L	407	0.12 U	0.16 U	0.11 U	0.1 U	0.13 U	***0.069 J***

Notes:

Bold / Italics = compound was detected

Highlighted = Detection is equal to or exceeds screening level

E = Estimated value; result outside of calibration range (lab qualifier)

ID = identification NS = not sampled

J = estimated value µg/L = micrograms per liter

U = compound was not detected
(or qualified as not detected during QA/QC review)

[1] For source of screening levels, see Table 2-3.

* Samples were collected over two days due to low recovery.

Table 2-10
RI Direct-Push Groundwater Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

			Sample ID:	GW-22/GW01	GW-23/GW01	GW-24/GW01	GW-26/GW01	GW-28/GW01	GW-29/GW01
			Laboratory Number(s):	G1L070488-002 G1L080501-006	G1L070488-004	G1L080501-005	G1L050446-002	G1L020427-002	G1L050446-004
			Date(s) Sampled:	12/5/2011 12/6/2011*	12/5/2011	12/6/2011	12/2/2011	11/30/2011	12/2/2011
Parameter	**Units**	**Screening Level[1]**							
Volatile Organic Compounds									
1,1,2,2-Tetrachloroethane	µg/L	1.28		1 U	1 U	1 U	***29***	***0.87 J***	***0.12 J***
1,2,3-Trichlorobenzene	µg/L	5.2		1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	µg/L	70		1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trimethylbenzene	µg/L	17.4		***0.46 J***	1 U	1 U	***0.23 J***	1 U	1 U
2-Butanone (MEK)	µg/L	11,800		***1.6 J***	2 U	2 U	2 U	2 U	2 U
Acetone	µg/L	45,500		10 U	10 U	10 U	10 U	10 U	10 U
Benzene	µg/L	5		***0.3 J***	1 U	1 U	1 U	***0.18 J***	1 U
Bromoform	µg/L	80		1 U	1 U	1 U	1 U	1 U	1 U
Carbon disulfide	µg/L	1,660		2 U	2 U	2 U	2 U	2 U	***1.3 J***
cis-1,2-Dichloroethene	µg/L	70		1 U	***0.13 J***	***0.2 J***	***15***	***0.74 J***	1 U
Dibromochloromethane	µg/L	80		1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	µg/L	700		***0.77 J***	1 U	1 U	***0.15 J***	***0.2 J***	***0.11 J***
m-Xylene & p-Xylene	µg/L	190		***0.61 J***	1 U	1 U	***0.36 J***	1 U	***0.19 J***
Naphthalene	µg/L	2.11		1 U	1 U	1 U	1 U	***0.63 J***	1 U
n-Propylbenzene	µg/L	1,910		***0.16 J***	1 U	1 U	1 U	1 U	1 U
o-Xylene	µg/L	190		***0.25 J***	1 U	1 U	***0.18 J***	1 U	1 U
Tetrachloroethene	µg/L	5		***0.21 J***	1 U	1 U	***2.1***	***0.65 J***	***0.16 J***
Toluene	µg/L	1,000		***1.9***	1 U	1 U	***0.42 J***	***0.48 J***	***0.54 J***
trans-1,2-Dichloroethene	µg/L	100		1 U	1 U	1 U	***0.54 J***	1 U	1 U
Trichloroethene	µg/L	5		***5.7***	***1.4***	***3.8***	***130***	***31***	***6***
Perchlorate									
Perchlorate	µg/L	70.9		***1.5***	0.5 U	NS	***63***	***6.4***	***7.5***
Explosives									
2,4-Dinitrotoluene	µg/L	8.98		0.1 U	0.1 U	NS	0.1 U	0.1 U	0.11 U
HMX	µg/L	5,110		0.1 U	0.1 U	NS	0.1 U	0.1 U	0.11 U
Nitroglycerin	µg/L	1.5		0.65 U	0.65 U	NS	0.68 U	0.65 U	0.7 U
RDX	µg/L	25.9		0.1 U	0.1 U	NS	***0.21***	0.1 U	0.11 U
Tetryl	µg/L	407		0.1 U	0.1 U	NS	0.1 U	0.1 U	0.11 U

Notes:

Bold / Italics = compound was detected

Highlighted = Detection is equal to or exceeds screening level

E = Estimated value; result outside of calibration range (lab qualifier)

ID = identification NS = not sampled

J = estimated value µg/L = micrograms per liter

U = compound was not detected
(or qualified as not detected during QA/QC review)

[1] For source of screening levels, see Table 2-3.

* Samples were collected over two days due to low recovery.

Table 2-10
RI Direct-Push Groundwater Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

			Sample ID:	GW-30/GW01	GW-31/GW01	GW-32/GW01	GW-33/GW01	GW-34/GW01	GW-41/GW01
			Laboratory Number(s):	G1L050446-005 G1L070483-005	G1L050444-002	G1L050444-003	G1L030434-003	G1L050444-004 G1L070484-003	G1L020426-004
			Date(s) Sampled:	12/2/2011 12/5/2011*	12/2/2011	12/2/2011	12/1/2011	12/2/2011 12/5/2011*	11/30/2011
Parameter	**Units**	**Screening Level[1]**							
Volatile Organic Compounds									
1,1,2,2-Tetrachloroethane	µg/L	1.28		1 U	1 U	1 U	1 U	1 U	1 U
1,2,3-Trichlorobenzene	µg/L	5.2		1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	µg/L	70		1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trimethylbenzene	µg/L	17.4		1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone (MEK)	µg/L	11,800		***0.41 J***	2 U	2 U	***0.84 J***	2 U	***0.4 J***
Acetone	µg/L	45,500		***3.5 J***	10 U	10 U	10 U	10 U	***5.3 J***
Benzene	µg/L	5		1 U	1 U	***0.3 J***	1 U	1 U	1 U
Bromoform	µg/L	80		1 U	1 U	1 U	1 U	1 U	1 U
Carbon disulfide	µg/L	1,660		2 U	0.2 J U	0.2 J U	2 U	2 U	0.22 J U
cis-1,2-Dichloroethene	µg/L	70		1 U	***0.12 J***	1 U	1 U	1 U	1 U
Dibromochloromethane	µg/L	80		1 U	1 U	1 U	1 U	1 U	***1.1***
Ethylbenzene	µg/L	700		***0.13 J***	1 U	***0.33 J***	***0.12 J***	***0.12 J***	1 U
m-Xylene & p-Xylene	µg/L	190		***0.27 J***	***0.2 J***	1 U	1 U	***0.23 J***	1 U
Naphthalene	µg/L	2.11		1 U	1 U	1 U	1 U	***0.63 J***	0.64 J U
n-Propylbenzene	µg/L	1,910		1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	µg/L	190		***0.12 J***	1 U	1 U	1 U	***0.1 J***	1 U
Tetrachloroethene	µg/L	5		***0.1 J***	1 U	1 U	1 U	1 U	1 U
Toluene	µg/L	1,000		***0.69 J***	***0.41 J***	***0.68 J***	***0.26 J***	***0.4 J***	***0.46 J***
trans-1,2-Dichloroethene	µg/L	100		1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	5		***3.3***	***0.67 J***	***0.27 J***	1 U	1 U	1 U
Perchlorate									
Perchlorate	µg/L	70.9		***7.1***	0.5 U	***0.48 J***	***1.4***	***2.1***	0.5 U
Explosives									
2,4-Dinitrotoluene	µg/L	8.98		0.16 U	0.11 U	0.1 U	0.14 U	0.12 U	0.12 U J
HMX	µg/L	5,110		0.16 U	0.11 U	0.1 U	0.14 U	0.12 U	0.12 U J
Nitroglycerin	µg/L	1.5		1 U	0.69 U	0.68 U	0.91 U	0.79 U	0.78 U J
RDX	µg/L	25.9		0.16 U	0.11 U	0.1 U	0.14 U	0.12 U	0.12 U J
Tetryl	µg/L	407		0.16 U	0.11 U	0.1 U	0.14 U	0.12 U	***0.56 J***

Notes:

Bold / Italics = compound was detected

Highlighted = Detection is equal to or exceeds screening level

E = Estimated value; result outside of calibration range (lab qualifier)

ID = identification NS = not sampled

J = estimated value µg/L = micrograms per liter

U = compound was not detected
(or qualified as not detected during QA/QC review)

[1] For source of screening levels, see Table 2-3.

* Samples were collected over two days due to low recovery.

Table 2-10
RI Direct-Push Groundwater Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	GW-42/GW01	GW-45/GW01
		Laboratory Number(s):	G1L050446-003 G1L070484-002	G1L080501-008
		Date(s) Sampled:	12/2/2011 12/5/2011*	12/7/2011
Parameter	**Units**	**Screening Level[1]**		
Volatile Organic Compounds				
1,1,2,2-Tetrachloroethane	µg/L	1.28	***0.78 J***	***30***
1,2,3-Trichlorobenzene	µg/L	5.2	1 U	1 U
1,2,4-Trichlorobenzene	µg/L	70	1 U	1 U
1,2,4-Trimethylbenzene	µg/L	17.4	1 U	1 U
2-Butanone (MEK)	µg/L	11,800	2 U	***0.65 J***
Acetone	µg/L	45,500	10 U	10 U
Benzene	µg/L	5	1 U	1 U
Bromoform	µg/L	80	1 U	1 U
Carbon disulfide	µg/L	1,660	2 U	2 U
cis-1,2-Dichloroethene	µg/L	70	***15***	***1.8***
Dibromochloromethane	µg/L	80	1 U	1 U
Ethylbenzene	µg/L	700	1 U	***0.3 J***
m-Xylene & p-Xylene	µg/L	190	***0.19 J***	***0.37 J***
Naphthalene	µg/L	2.11	1 U	1 U
n-Propylbenzene	µg/L	1,910	1 U	1 U
o-Xylene	µg/L	190	***0.12 J***	***0.13 J***
Tetrachloroethene	µg/L	5	***0.63 J***	***0.31 J***
Toluene	µg/L	1,000	***0.49 J***	***0.56 J***
trans-1,2-Dichloroethene	µg/L	100	***0.34 J***	***0.38 J***
Trichloroethene	µg/L	5	***38***	***110 E J***
Perchlorate				
Perchlorate	µg/L	70.9	***3.9***	NS
Explosives				
2,4-Dinitrotoluene	µg/L	8.98	***0.055 J***	NS
HMX	µg/L	5,110	0.1 U	NS
Nitroglycerin	µg/L	1.5	***0.34 J***	NS
RDX	µg/L	25.9	0.1 U	NS
Tetryl	µg/L	407	0.1 U	NS

Notes:

Bold / Italics = compound was detected

Highlighted = Detection is equal to or exceeds screening level

E = Estimated value; result outside of calibration range (lab qualifier)

ID = identification NS = not sampled

J = estimated value µg/L = micrograms per liter

U = compound was not detected
(or qualified as not detected during QA/QC review)

[1] For source of screening levels, see Table 2-3.

* Samples were collected over two days due to low recovery.

Table 2-11
RI Core-Hole Groundwater Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	CH-1/GW01	CH-2/GW01	CH-3/GW01
		Date Sampled:	2/19/2012	2/18/2012	2/22/2012
		Comments:			
Parameter	**Units**	**Screening Level[1]**			
Volatile Organic Compounds					
2-Butanone (MEK)	µg/L	11,800	***0.41 J***	2 U	***2***
2-Hexanone	µg/L	34	2 U	2 U	***0.3 J***
4-Methyl-2-pentanone (MIBK)	µg/L	4,170	2 U	2 U	***0.4 J***
Acetone	µg/L	45,500	***2.8 J***	10 U	***11***
Benzene	µg/L	5	***0.14 J***	1 U	***0.25 J***
Carbon disulfide	µg/L	1,660	2 U	2 U	***0.29 J***
Ethylbenzene	µg/L	700	1 U	1 U	***0.23 J***
m-Xylene & p-Xylene	µg/L	190	1 U	1 U	***0.38 J***
Naphthalene	µg/L	2.11	1 U	1 U	***0.2 J***
o-Xylene	µg/L	190	1 U	1 U	***0.13 J***
Toluene	µg/L	1,000	1 U	1 U	***0.45 J***
Explosives					
Nitroglycerin	µg/L	1.5	0.67 U J	0.72 U	***1.3***

Notes:
Bold / Italics = compound was detected
Highlighted = Concentration exceeds screening level
ID = identification
J = estimated value
U = compound was not detected (or qualified as not detected during QA/QC review)
µg/L = micrograms per liter
[1] The source of screening levels (EPA MCL, KDHE RSK, or EPA RSL) is noted on Table 2-3.

Table 2-12
RI Monitoring Well Groundwater Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	OB-93-01/GW01	OB-93-01/GW02	OB-93-01/GW03	OB-93-01/GW04
		Date Sampled:	3/5/2012	6/19/2012	9/25/2012	12/17/2012
		Comment(s):	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Parameter	**Units**	**Screening Level[1]**				
Volatile Organic Compounds						
1,1,1,2-Tetrachloroethane	µg/L	9.91	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	1.28	1 U	1 U	1 U	1 U
1,2,3-Trichlorobenzene	µg/L	5.2	1 U	1 U	1 U	1 U
2-Butanone (MEK)	µg/L	11,800	2 U	2 U	6 U	6 U
Acetone	µg/L	45,500	10 U	10 U	10 U	10 U J
cis-1,2-Dichloroethene	µg/L	70	1 U	1 U	1 U	1 U
Naphthalene	µg/L	2.11	1 U	1 U	1 U	1 U
Tetrachloroethene	µg/L	5	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	µg/L	100	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	5	1 U	1 U	1 U	1 U
Semivolatile Organic Compounds						
Benzo(a)pyrene	µg/L	0.2	9.5 U	9.9 U	9.5 U	9.7 U
Benzo(ghi)perylene	µg/L	NA	9.5 U	9.9 U	9.5 U	9.7 U
bis(2-Ethylhexyl)phthalate	µg/L	6	9.5 U	9.9 U	***1.1 J***	9.7 U
Perchlorate						
Perchlorate	µg/L	70.9	***0.22 J***	***0.25 J***	***0.31 J***	***0.31 J***
Explosives						
HMX	µg/L	5,110	0.099 U	0.1 U	0.1 U	0.1 U
RDX	µg/L	25.9	0.099 U	0.1 U	0.1 U	0.1 U
Metals						
Antimony	µg/L	6	6 U	6 U	6 U	6 U
Arsenic	µg/L	10	3 U	3 U	3 U	3 U
Beryllium	µg/L	4	1 U	1 U	1 U	1 U
Cadmium	µg/L	5	1.5 U	1.5 U	1.5 U	1.5 U
Chromium	µg/L	100	5 U	5 U	***1.5 J***	5 U
Copper	µg/L	1,300	***2.2 J***	3 U	3 U	3 U
Lead	µg/L	15	2.5 U	2.5 U	2.5 U	2.5 U
Mercury	µg/L	2	0.2 U	0.2 U	0.14 U	0.2 U
Nickel	µg/L	2,040	***2.6 J***	3 U	3 U	3 U
Selenium	µg/L	50	3 U	***1.1 J***	***1.1 J***	***1 J***
Silver	µg/L	508	1 U	1 U	1 U	1 U
Zinc	µg/L	30,500	12 U	12 U J	***21***	***17***
Groundwater Quality Package						
Ammonia	mg/L	NA	***0.28 J***	***0.073 J***	0.1 U	0.1 U
Chloride	mg/L	NA	***5***	***5***	***5.2***	***5.1***
Nitrate as N	mg/L	10	0.05 U	***0.12***	***0.045 J***	0.05 U J
Orthophosphate as P	mg/L	NA	0.2 U	0.2 U	0.2 U	0.2 U
Sulfate	mg/L	NA	***30.1***	***26.4***	***42***	***38***
Sulfide	mg/L	NA	4 U	4 U	4 U	***1.4 J***
Monitored Natural Attenuation Package						
Methane	µg/L	NA	5 U	5 U	***0.25 J***	5 U
Ethane	µg/L	NA	5 U	5 U J	5 U J	5 U J
Total Organic Carbon	mg/L	NA	***0.76 J***	***1.1 J***	***0.98 J***	***0.7 J***

Notes:
Bold / Italics = compound was detected
Highlighted = Concentration exceeds screening level
ID = Identification
J = estimated value
mg/L = milligrams per liter
NA = Not available / Not analyzed
NS = Not sampled
U = compound was not detected (or qualified as not detected during QA/QC review)
µg/L = micrograms per liter
[1] For source of screening levels, see Table 2-3.

Table 2-12
RI Monitoring Well Groundwater Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	OB-93-02/GW01	OB-93-02/GW02	OB-93-02/GW03	OB-93-02/GW04
		Date Sampled:	3/7/2012	6/18/2012	9/25/2012	12/17/2012
		Comment(s):	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Parameter	**Units**	**Screening Level[1]**				
Volatile Organic Compounds						
1,1,1,2-Tetrachloroethane	µg/L	9.91	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	1.28	1 U	1 U	1 U	1 U
1,2,3-Trichlorobenzene	µg/L	5.2	1 U	1 U	1 U	1 U
2-Butanone (MEK)	µg/L	11,800	2 U	2 U	6 U	6 U
Acetone	µg/L	45,500	10 U	10 U	10 U	10 U J
cis-1,2-Dichloroethene	µg/L	70	1 U	1 U	1 U	1 U
Naphthalene	µg/L	2.11	1 U	1 U	1 U	1 U
Tetrachloroethene	µg/L	5	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	µg/L	100	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	5	1 U	1 U	1 U	1 U
Semivolatile Organic Compounds						
Benzo(a)pyrene	µg/L	0.2	9.4 U	9.5 U	9.5 U	10 U
Benzo(ghi)perylene	µg/L	NA	9.4 U	9.5 U	9.5 U	10 U
bis(2-Ethylhexyl)phthalate	µg/L	6	***1.7 J***	1.8 J U	***1.7 J***	10 U
Perchlorate						
Perchlorate	µg/L	70.9	***0.34 J***	***0.32 J***	***0.36 J***	***0.24 J***
Explosives						
HMX	µg/L	5,110	0.099 U	0.1 U	0.1 U	0.1 U
RDX	µg/L	25.9	0.099 U	0.1 U	0.1 U	0.1 U
Metals						
Antimony	µg/L	6	6 U	6 U	6 U	6 U
Arsenic	µg/L	10	***1.2 J***	3 U	3 U	***1.2 J***
Beryllium	µg/L	4	1 U	1 U	1 U	1 U
Cadmium	µg/L	5	1.5 U	1.5 U	1.5 U	1.5 U
Chromium	µg/L	100	5 U	5 U	***1.5 J***	5 U
Copper	µg/L	1,300	3 U	3 U	3 U	1.1 J U
Lead	µg/L	15	2.5 U	2.5 U	***1.3 J***	2.5 U
Mercury	µg/L	2	***0.12 J***	0.2 U	0.14 U	0.2 U
Nickel	µg/L	2,040	3 U	3 U	3 U	3 U
Selenium	µg/L	50	***1 J***	3 U	3 U	3 U
Silver	µg/L	508	1 U	1 U	1 U	1 U
Zinc	µg/L	30,500	12 U	12 U	12 U	12 U
Groundwater Quality Package						
Ammonia	mg/L	NA	1 U	***0.079 J***	***0.044 J***	0.1 U
Chloride	mg/L	NA	***2.9***	***2.9***	***2.9***	***2.8***
Nitrate as N	mg/L	10	***0.88***	***1.1 J***	***0.92***	***0.62***
Orthophosphate as P	mg/L	NA	0.2 U	0.2 U	0.2 U	0.2 U
Sulfate	mg/L	NA	***34.6***	***35.2***	***37***	***46***
Sulfide	mg/L	NA	***1.3 J***	4 U	4 U	4 U
Monitored Natural Attenuation Package						
Methane	µg/L	NA	5 U	5 U	5 U	5 U
Ethane	µg/L	NA	***0.62 J***	5 U	5 U	5 U
Total Organic Carbon	mg/L	NA	***0.26 J***	***0.72 J***	***0.63 J***	***0.51 J***

Notes:
Bold / Italics = compound was detected
Highlighted = Concentration exceeds screening level
ID = Identification
J = estimated value
mg/L = milligrams per liter
NA = Not available / Not analyzed
NS = Not sampled
U = compound was not detected (or qualified as not detected during QA/QC review)
µg/L = micrograms per liter
[1] For source of screening levels, see Table 2-3.

Table 2-12
RI Monitoring Well Groundwater Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	OB-93-03/GW01	OB-93-03/GW02	OB-93-03/GW03	OB-93-03/GW04
		Date Sampled:	3/5/2012	6/19/2012	9/24/2012	12/18/2012
		Comment(s):	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Parameter	**Units**	**Screening Level[1]**				
Volatile Organic Compounds						
1,1,1,2-Tetrachloroethane	µg/L	9.91	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	1.28	1 U	1 U	1 U	1 U
1,2,3-Trichlorobenzene	µg/L	5.2	1 U	1 U	1 U	1 U
2-Butanone (MEK)	µg/L	11,800	2 U	2 U	6 U	6 U
Acetone	µg/L	45,500	10 U	10 U	10 U	10 U
cis-1,2-Dichloroethene	µg/L	70	1 U	***0.24 J***	1 U	1 U
Naphthalene	µg/L	2.11	1 U	1 U	1 U	1 U
Tetrachloroethene	µg/L	5	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	µg/L	100	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	5	1 U	***0.9 J***	***0.92 J***	***0.79 J***
Semivolatile Organic Compounds						
Benzo(a)pyrene	µg/L	0.2	9.4 U	9.5 U	9.5 U	***0.76 J***
Benzo(ghi)perylene	µg/L	NA	9.4 U	9.5 U	9.5 U	***1.3 J***
bis(2-Ethylhexyl)phthalate	µg/L	6	9.4 U	1.3 J U	9.5 U	***1.2 J***
Perchlorate						
Perchlorate	µg/L	70.9	0.5 U	0.5 U	0.5 U	0.5 U
Explosives						
HMX	µg/L	5,110	0.099 U	0.1 U	0.1 U	0.1 U
RDX	µg/L	25.9	0.099 U	0.1 U	0.1 U	0.1 U
Metals						
Antimony	µg/L	6	6 U	6 U	6 U	6 U
Arsenic	µg/L	10	3 U	3 U	3 U	***1.2 J***
Beryllium	µg/L	4	1 U	1 U	1 U	1 U
Cadmium	µg/L	5	1.5 U	1.5 U	1.5 U	1.5 U
Chromium	µg/L	100	5 U	5 U	5 U	5 U
Copper	µg/L	1,300	3 U	***1.6 J***	3 U	3 U
Lead	µg/L	15	2.5 U	2.5 U	2.5 U	2.5 U
Mercury	µg/L	2	***0.14 J***	***0.15 J***	0.14 U	0.2 U
Nickel	µg/L	2,040	3 U	3 U	3 U	3 U
Selenium	µg/L	50	3 U	3 U	3 U	3 U
Silver	µg/L	508	1 U	1 U	1 U	1 U
Zinc	µg/L	30,500	12 U	12 U	12 U	12 U
Groundwater Quality Package						
Ammonia	mg/L	NA	***0.49 J***	***0.34 J***	***0.16 J***	***0.17***
Chloride	mg/L	NA	***49***	***20.3***	***15***	***12***
Nitrate as N	mg/L	10	0.25 U	0.25 U	***0.14***	0.05 U
Orthophosphate as P	mg/L	NA	1 U	1 U	0.2 U	0.2 U
Sulfate	mg/L	NA	***1,020***	***356***	***260***	***180***
Sulfide	mg/L	NA	4 U	4 U	4 U J	4 U
Monitored Natural Attenuation Package						
Methane	µg/L	NA	***0.22 J***	***1.8 J***	***3 J***	***2.6 J***
Ethane	µg/L	NA	5 U	5 U	5 U	5 U
Total Organic Carbon	mg/L	NA	***0.56 J***	***0.86 J***	***0.75 J***	***0.52 J***

Notes:
Bold / Italics = compound was detected
Highlighted = Concentration exceeds screening level
ID = Identification
J = estimated value
mg/L = milligrams per liter
NA = Not available / Not analyzed
NS = Not sampled
U = compound was not detected (or qualified as not detected during QA/QC review)
µg/L = micrograms per liter
[1] For source of screening levels, see Table 2-3.

Table 2-12
RI Monitoring Well Groundwater Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	OB-93-04/GW01	OB-93-04/GW02	OB-93-04/GW03	OB-93-04/GW04
		Date Sampled:	3/6/2012	6/20/2012	9/26/2012	12/18/2012
		Comment(s):	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Parameter	**Units**	**Screening Level[1]**				
Volatile Organic Compounds						
1,1,1,2-Tetrachloroethane	µg/L	9.91	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	1.28	1 U	1 U	1 U	1 U
1,2,3-Trichlorobenzene	µg/L	5.2	1 U	1 U	1 U	1 U
2-Butanone (MEK)	µg/L	11,800	2 U	2 U	6 U	6 U
Acetone	µg/L	45,500	10 U	10 U	10 U	10 U
cis-1,2-Dichloroethene	µg/L	70	***0.17 J***	***0.18 J***	1 U	1 U
Naphthalene	µg/L	2.11	1 U	1 U	1 U	1 U
Tetrachloroethene	µg/L	5	***0.13 J***	***0.16 J***	1 U	1 U
trans-1,2-Dichloroethene	µg/L	100	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	5	***5.5***	***5.8***	***6.2***	***5.7***
Semivolatile Organic Compounds						
Benzo(a)pyrene	µg/L	0.2	9.5 U	9.8 U	9.5 U	9.6 U
Benzo(ghi)perylene	µg/L	NA	9.5 U	9.8 U	9.5 U	9.6 U
bis(2-Ethylhexyl)phthalate	µg/L	6	9.5 U	9.8 U	9.5 U	9.6 U
Perchlorate						
Perchlorate	µg/L	70.9	***0.1 J***	***0.12 J***	***0.24 J***	0.5 U
Explosives						
HMX	µg/L	5,110	0.1 U	0.1 U	0.1 U	0.11 U
RDX	µg/L	25.9	0.1 U	0.1 U	0.1 U	0.11 U
Metals						
Antimony	µg/L	6	6 U	6 U	6 U	6 U
Arsenic	µg/L	10	3 U	15 U	3 U	3 U
Beryllium	µg/L	4	1 U	1 U	1 U	1 U
Cadmium	µg/L	5	1.5 U	1.5 U	1.5 U	1.5 U
Chromium	µg/L	100	5 U	***4.1 J***	5 U	5 U
Copper	µg/L	1,300	3 U	***2.8 J***	3 U	3 U
Lead	µg/L	15	2.5 U	2.5 U	2.5 U	2.5 U
Mercury	µg/L	2	0.2 U	0.2 U	0.14 U	0.2 U
Nickel	µg/L	2,040	3 U	***1.8 J***	3 U	3 U
Selenium	µg/L	50	3 U	***1.2 J***	3 U	3 U
Silver	µg/L	508	1 U	1 U	1 U	1 U
Zinc	µg/L	30,500	12 U	12 U J	12 U	12 U
Groundwater Quality Package						
Ammonia	mg/L	NA	***0.14 J***	***0.15 J***	0.1 U	***0.028 J***
Chloride	mg/L	NA	***9.3***	***8.3***	***6.7***	***6.8***
Nitrate as N	mg/L	10	0.1 U	0.25 U	0.05 U	0.05 U
Orthophosphate as P	mg/L	NA	0.4 U	1 U	0.2 U	0.2 U
Sulfate	mg/L	NA	***314***	***347 J***	***180***	***210***
Sulfide	mg/L	NA	4 U	4 U	4 U	4 U
Monitored Natural Attenuation Package						
Methane	µg/L	NA	5 U	5 U	***0.78 J***	***1.2 J***
Ethane	µg/L	NA	5 U	5 U	5 U	5 U
Total Organic Carbon	mg/L	NA	***0.57 J***	***0.65 J***	***0.86 J***	***0.65 J***

Notes:
Bold / Italics = compound was detected
Highlighted = Concentration exceeds screening level
ID = Identification
J = estimated value
mg/L = milligrams per liter
NA = Not available / Not analyzed
NS = Not sampled
U = compound was not detected (or qualified as not detected during QA/QC review)
µg/L = micrograms per liter
[1] For source of screening levels, see Table 2-3.

Table 2-12
RI Monitoring Well Groundwater Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	OB-97-05/GW01	OB-97-05/GW02	OB-97-05/GW03	OB-97-05/GW04
		Date Sampled:	3/6/2012	6/19/2012	9/26/2012	12/18/2012
		Comment(s):	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Parameter	**Units**	**Screening Level[1]**				
Volatile Organic Compounds						
1,1,1,2-Tetrachloroethane	µg/L	9.91	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	1.28	1 U	1 U	1 U	1 U
1,2,3-Trichlorobenzene	µg/L	5.2	1 U	1 U	1 U	1 U
2-Butanone (MEK)	µg/L	11,800	2 U	2 U	6 U	6 U
Acetone	µg/L	45,500	10 U	10 U	10 U	10 U
cis-1,2-Dichloroethene	µg/L	70	1 U	1 U	1 U	1 U
Naphthalene	µg/L	2.11	1 U	1 U	1 U	1 U
Tetrachloroethene	µg/L	5	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	µg/L	100	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	5	***0.3 J***	***0.23 J***	***0.22 J***	1 U
Semivolatile Organic Compounds						
Benzo(a)pyrene	µg/L	0.2	9.4 U	9.6 U	9.9 U	9.7 U
Benzo(ghi)perylene	µg/L	NA	9.4 U	9.6 U	9.9 U	9.7 U
bis(2-Ethylhexyl)phthalate	µg/L	6	9.4 U	9.6 U	9.9 U	***1.7 J***
Perchlorate						
Perchlorate	µg/L	70.9	0.5 U	0.5 U	***0.13 J***	0.5 U
Explosives						
HMX	µg/L	5,110	0.099 U	0.1 U	0.1 U	0.1 U
RDX	µg/L	25.9	0.099 U	0.1 U	0.1 U	0.1 U
Metals						
Antimony	µg/L	6	6 U	6 U	6 U	6 U
Arsenic	µg/L	10	3 U	3 U	3 U	***1.9 J***
Beryllium	µg/L	4	1 U	1 U	1 U	1 U
Cadmium	µg/L	5	1.5 U	1.5 U	1.5 U	1.5 U
Chromium	µg/L	100	5 U	5 U	5 U	5 U
Copper	µg/L	1,300	3 U	3 U	3 U	***2.2 J***
Lead	µg/L	15	2.5 U	2.5 U	2.5 U	2.5 U
Mercury	µg/L	2	0.2 U	0.2 U	0.14 U	0.2 U
Nickel	µg/L	2,040	3 U	***1.5 J***	3 U	3 U
Selenium	µg/L	50	3 U	3 U	3 U	3 U
Silver	µg/L	508	1 U	1 U	1 U	1 U
Zinc	µg/L	30,500	12 U	***5.4 J***	12 U	***6.5 J***
Groundwater Quality Package						
Ammonia	mg/L	NA	***0.11 J***	***0.15 J***	***0.044 J***	***0.067 J***
Chloride	mg/L	NA	***6.6***	***6.6***	***6.7***	***6.8***
Nitrate as N	mg/L	10	0.05 U	0.05 U	0.05 U	0.05 U J
Orthophosphate as P	mg/L	NA	0.2 U	0.2 U	0.2 U	0.2 U
Sulfate	mg/L	NA	***98.6***	***110***	***110***	***98 J***
Sulfide	mg/L	NA	4 U	4 U	4 U	4 U
Monitored Natural Attenuation Package						
Methane	µg/L	NA	***1.1 J***	***1.3 J***	***2.5 J***	***2.1 J***
Ethane	µg/L	NA	5 U	5 U	5 U	5 U
Total Organic Carbon	mg/L	NA	***0.57 J***	***0.69 J***	***0.73 J***	***0.63 J***

Notes:
Bold / Italics = compound was detected
Highlighted = Concentration exceeds screening level
ID = Identification
J = estimated value
mg/L = milligrams per liter
NA = Not available / Not analyzed
NS = Not sampled
U = compound was not detected (or qualified as not detected during QA/QC review)
µg/L = micrograms per liter
[1] For source of screening levels, see Table 2-3.

Table 2-12
RI Monitoring Well Groundwater Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	OB-97-06/GW01	OB-97-06/GW02	OB-97-06/GW03	OB-97-06/GW04
		Date Sampled:	3/5/2012	6/19/2012	9/24/2012	12/17/2012
		Comment(s):	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Parameter	**Units**	**Screening Level[1]**				
Volatile Organic Compounds						
1,1,1,2-Tetrachloroethane	µg/L	9.91	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	1.28	1 U	1 U	1 U	1 U
1,2,3-Trichlorobenzene	µg/L	5.2	1 U	1 U	1 U	0.25 J U
2-Butanone (MEK)	µg/L	11,800	2 U	2 U	6 U	6 U
Acetone	µg/L	45,500	10 U	10 U	10 U	10 U J
cis-1,2-Dichloroethene	µg/L	70	1 U	1 U	1 U	1 U
Naphthalene	µg/L	2.11	1 U	1 U	1 U	0.26 J U
Tetrachloroethene	µg/L	5	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	µg/L	100	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	5	***0.57 J***	***0.24 J***	***0.31 J***	***0.22 J***
Semivolatile Organic Compounds						
Benzo(a)pyrene	µg/L	0.2	9.4 U	9.6 U	9.5 U	11 U
Benzo(ghi)perylene	µg/L	NA	9.4 U	9.6 U	9.5 U	11 U
bis(2-Ethylhexyl)phthalate	µg/L	6	9.4 U	1.7 J U	***2.2 J***	1.1 J U
Perchlorate						
Perchlorate	µg/L	70.9	***2.4***	***2.2***	***2.4***	***0.96***
Explosives						
HMX	µg/L	5,110	0.1 U	0.1 U	0.1 U	0.1 U
RDX	µg/L	25.9	0.1 U	0.1 U	0.1 U	0.1 U
Metals						
Antimony	µg/L	6	6 U	6 U	6 U	6 U
Arsenic	µg/L	10	3 U	3 U	3 U	3 U
Beryllium	µg/L	4	1 U	1 U	1 U	1 U
Cadmium	µg/L	5	1.5 U	1.5 U	1.5 U	1.5 U
Chromium	µg/L	100	5 U	5 U	5 U	5 U
Copper	µg/L	1,300	***1.2 J***	3 U	3 U	3 U
Lead	µg/L	15	2.5 U	2.5 U	2.5 U	2.5 U
Mercury	µg/L	2	0.2 U	0.2 U	0.14 U	0.2 U
Nickel	µg/L	2,040	3 U	3 U	3 U	3 U
Selenium	µg/L	50	3 U	3 U	3 U	***1.4 J***
Silver	µg/L	508	1 U	1 U	1 U	1 U
Zinc	µg/L	30,500	12 U	12 U	12 U	12 U
Groundwater Quality Package						
Ammonia	mg/L	NA	1 U	***0.071 J***	***0.064 J***	0.1 U
Chloride	mg/L	NA	***3.9***	***3.9***	***4***	***4.8***
Nitrate as N	mg/L	10	***0.29***	***0.48***	***0.37***	***0.094***
Orthophosphate as P	mg/L	NA	0.2 U	0.2 U	0.2 U	0.2 U
Sulfate	mg/L	NA	***18.1***	***20.4***	***23***	***25***
Sulfide	mg/L	NA	4 U	4 U	4 U J	4 U
Monitored Natural Attenuation Package						
Methane	µg/L	NA	5 U	5 U	5 U	5 U
Ethane	µg/L	NA	5 U	5 U	5 U	5 U
Total Organic Carbon	mg/L	NA	***0.57 J***	***0.69 J***	***0.78 J***	***0.52 J***

Notes:
Bold / Italics = compound was detected
Highlighted = Concentration exceeds screening level
ID = Identification
J = estimated value
mg/L = milligrams per liter
NA = Not available / Not analyzed
NS = Not sampled
U = compound was not detected (or qualified as not detected during QA/QC review)
µg/L = micrograms per liter
[1] For source of screening levels, see Table 2-3.

Table 2-12
RI Monitoring Well Groundwater Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	OB-97-07/GW01	OB-97-07/GW02	OB-97-07/GW03	OB-97-07/GW04
		Date Sampled:	3/6/2012	6/20/2012	9/26/2012	12/18/2012
		Comment(s):	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Parameter	**Units**	**Screening Level[1]**				
Volatile Organic Compounds						
1,1,1,2-Tetrachloroethane	µg/L	9.91	5 U	1 U	2 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	1.28	***3.4 J***	***1***	***1.6 J***	***5.1***
1,2,3-Trichlorobenzene	µg/L	5.2	5 U	1 U	2 U	1 U
2-Butanone (MEK)	µg/L	11,800	10 U	2 U	12 U	6 U
Acetone	µg/L	45,500	50 U	10 U	20 U	10 U
cis-1,2-Dichloroethene	µg/L	70	***11***	***2.8***	***2.7***	***5.3***
Naphthalene	µg/L	2.11	5 U	***0.22 J***	2 U	1 U
Tetrachloroethene	µg/L	5	***3.1 J***	***0.94 J***	***1 J***	***2***
trans-1,2-Dichloroethene	µg/L	100	***0.6 J***	***0.21 J***	***0.39 J***	***0.45 J***
Trichloroethene	µg/L	5	***140***	***41***	***73***	***130***
Semivolatile Organic Compounds						
Benzo(a)pyrene	µg/L	0.2	9.4 U	9.6 U	9.6 U	10 U
Benzo(ghi)perylene	µg/L	NA	9.4 U	9.6 U	9.6 U	10 U
bis(2-Ethylhexyl)phthalate	µg/L	6	9.4 U	9.6 U	9.6 U	***1.1 J***
Perchlorate						
Perchlorate	µg/L	70.9	***16***	***7.3***	***9.5***	***15***
Explosives						
HMX	µg/L	5,110	0.1 U	0.1 U	0.1 U	0.1 U
RDX	µg/L	25.9	***0.068 J***	0.1 U	0.1 U	0.1 U
Metals						
Antimony	µg/L	6	6 U	6 U	6 U	6 U
Arsenic	µg/L	10	3 U	15 U	3 U	3 U
Beryllium	µg/L	4	1 U	1 U	***0.11 J***	1 U
Cadmium	µg/L	5	1.5 U	1.5 U	1.5 U	1.5 U
Chromium	µg/L	100	5 U	***4.2 J***	5 U	5 U
Copper	µg/L	1,300	3 U	***1.2 J***	3 U	3 U
Lead	µg/L	15	2.5 U	2.5 U	2.5 U	2.5 U
Mercury	µg/L	2	0.2 U	***0.17 J***	0.14 U	0.2 U
Nickel	µg/L	2,040	3 U	3 U	3 U	3 U
Selenium	µg/L	50	3 U	3 U	3 U	3 U
Silver	µg/L	508	1 U	1 U	1 U	1 U
Zinc	µg/L	30,500	12 U	12 U	***5.3 J***	12 U
Groundwater Quality Package						
Ammonia	mg/L	NA	1 U	***0.065 J***	0.1 U	0.1 U
Chloride	mg/L	NA	***4.9***	***4.5***	***4.4***	***5.4***
Nitrate as N	mg/L	10	***0.3***	***0.43***	***0.46***	***0.11***
Orthophosphate as P	mg/L	NA	0.2 U	0.2 U	0.2 U	0.2 U
Sulfate	mg/L	NA	***27.2***	***25.6***	***34***	***31***
Sulfide	mg/L	NA	***1.1 J***	***0.96 J***	4 U	4 U
Monitored Natural Attenuation Package						
Methane	µg/L	NA	***0.90 J***	***0.49 J***	***2.3 J***	***2.5 J***
Ethane	µg/L	NA	5 U	5 U	5 U	5 U
Total Organic Carbon	mg/L	NA	***0.52 J***	***0.78 J***	***0.88 J***	***0.62 J***

Notes:
Bold / Italics = compound was detected
Highlighted = Concentration exceeds screening level
ID = Identification
J = estimated value
mg/L = milligrams per liter
NA = Not available / Not analyzed
NS = Not sampled
U = compound was not detected (or qualified as not detected during QA/QC review)
µg/L = micrograms per liter
[1] For source of screening levels, see Table 2-3.

Table 2-12
RI Monitoring Well Groundwater Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	OB-97-08/GW01	OB-97-08/GW02	OB-97-08/GW03	OB-97-08/GW04
		Date Sampled:	3/6/2012	6/20/2012	9/27/2012	12/19/2012
		Comment(s):	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Parameter	**Units**	**Screening Level[1]**				
Volatile Organic Compounds						
1,1,1,2-Tetrachloroethane	µg/L	9.91	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	1.28	***6.6***	***4.5***	***1.5***	***1.1 J***
1,2,3-Trichlorobenzene	µg/L	5.2	1 U	1 U	1 U	1 U
2-Butanone (MEK)	µg/L	11,800	2 U	2 U	6 U	6 U
Acetone	µg/L	45,500	10 U	10 U	10 U	10 U
cis-1,2-Dichloroethene	µg/L	70	***1.5***	***2.4***	***5.4***	***4.2***
Naphthalene	µg/L	2.11	1 U	1 U	1 U	1 U
Tetrachloroethene	µg/L	5	***0.84 J***	***0.82 J***	***0.46 J***	***0.6 J***
trans-1,2-Dichloroethene	µg/L	100	***0.11 J***	***0.17 J***	1 U	1 U
Trichloroethene	µg/L	5	***40***	***45***	***28***	***26***
Semivolatile Organic Compounds						
Benzo(a)pyrene	µg/L	0.2	9.4 U	17 U	NS	NS
Benzo(ghi)perylene	µg/L	NA	9.4 U	17 U	NS	NS
bis(2-Ethylhexyl)phthalate	µg/L	6	9.4 U	***24***	NS	NS
Perchlorate						
Perchlorate	µg/L	70.9	***19***	***8.1***	***5.6***	***5.3***
Explosives						
HMX	µg/L	5,110	0.1 U	0.1 U	NS	NS
RDX	µg/L	25.9	0.1 U	0.1 U	NS	NS
Metals						
Antimony	µg/L	6	6 U	6 U	6 U	6 U
Arsenic	µg/L	10	3 U	3 U	3 U	***2.1 J***
Beryllium	µg/L	4	1 U	1 U	***0.29 J***	***0.19 J***
Cadmium	µg/L	5	1.5 U	1.5 U	1.5 U	1.5 U
Chromium	µg/L	100	5 U	***2.9 J***	***11***	***6.8***
Copper	µg/L	1,300	3 U	***2.2 J***	***5.1***	***4.2***
Lead	µg/L	15	2.5 U	***0.7 J***	***2.8***	***1.9 J***
Mercury	µg/L	2	0.2 U	0.2 U	0.14 U	0.2 U
Nickel	µg/L	2,040	3 U	***1.4 J***	***5.2***	***4.7***
Selenium	µg/L	50	***1.3 J***	3 U	3 U	***1.7 J***
Silver	µg/L	508	1 U	***0.83 J***	***1.1***	***0.53 J***
Zinc	µg/L	30,500	12 U	12 U	***19***	***17***
Groundwater Quality Package						
Ammonia	mg/L	NA	***0.36 J***	***0.099 J***	NS	NS
Chloride	mg/L	NA	***6.5***	***6***	NS	***5.5***
Nitrate as N	mg/L	10	***0.11***	***0.12***	NS	***0.049 J***
Orthophosphate as P	mg/L	NA	0.2 U	0.2 U	NS	0.2 U
Sulfate	mg/L	NA	***29.2***	***25.4***	NS	***26***
Sulfide	mg/L	NA	4 U	4 U	NS	NS
Monitored Natural Attenuation Package						
Methane	µg/L	NA	***0.31 J***	***4.9 J***	NS	NS
Ethane	µg/L	NA	5 U	5 U	NS	NS
Total Organic Carbon	mg/L	NA	***0.88 J***	***1.4 J***	NS	NS

Notes:
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mg/L = milligrams per liter
NA = Not available / Not analyzed
NS = Not sampled
U = compound was not detected (or qualified as not detected during QA/QC review)
µg/L = micrograms per liter
[1] For source of screening levels, see Table 2-3.

Table 2-12
RI Monitoring Well Groundwater Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	OBHD-97-14/GW01	OBHD-97-14/GW02	OBHD-97-14/GW03	OBHD-97-14/GW04
		Date Sampled:	3/6/2012	6/21/2012	9/27/2012	12/18/2012
		Comment(s):	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Parameter	**Units**	**Screening Level[1]**				
Volatile Organic Compounds						
1,1,1,2-Tetrachloroethane	µg/L	9.91	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	1.28	***9.7***	***8.6***	***4.6***	***5.8***
1,2,3-Trichlorobenzene	µg/L	5.2	1 U	1 U	1 U	1 U
2-Butanone (MEK)	µg/L	11,800	2 U	2 U	6 U	6 U
Acetone	µg/L	45,500	10 U	10 U	10 U	10 U
cis-1,2-Dichloroethene	µg/L	70	***19***	***21***	***6.1***	***9.4***
Naphthalene	µg/L	2.11	1 U	1 U	1 U	1 U
Tetrachloroethene	µg/L	5	***0.96 J***	***0.78 J***	***0.75 J***	***1.1***
trans-1,2-Dichloroethene	µg/L	100	***0.48 J***	***0.49 J***	1 U	1 U
Trichloroethene	µg/L	5	***45***	***45***	***41***	***57***
Semivolatile Organic Compounds						
Benzo(a)pyrene	µg/L	0.2	9.7 U	10 U	9.5 U	10 U
Benzo(ghi)perylene	µg/L	NA	9.7 U	10 U	9.5 U	10 U
bis(2-Ethylhexyl)phthalate	µg/L	6	9.7 U	10 U	***3.6 J***	***3.3 J***
Perchlorate						
Perchlorate	µg/L	70.9	***19***	***7.9***	***11***	***13***
Explosives						
HMX	µg/L	5,110	0.1 U	0.1 U	0.1 U	0.11 U
RDX	µg/L	25.9	***0.072 J***	0.1 U	0.1 U	0.11 U
Metals						
Antimony	µg/L	6	6 U	6 U	6 U	6 U
Arsenic	µg/L	10	3 U	3 U	3 U	3 U
Beryllium	µg/L	4	1 U	1 U	1 U	1 U
Cadmium	µg/L	5	1.5 U	1.5 U	1.5 U	1.5 U
Chromium	µg/L	100	5 U	5 U	5 U	5 U
Copper	µg/L	1,300	***1.2 J***	3 U	***1.1 J***	3 U
Lead	µg/L	15	2.5 U	2.5 U	2.5 U	2.5 U
Mercury	µg/L	2	0.2 U	0.2 U	0.14 U	0.2 U
Nickel	µg/L	2,040	3 U	3 U	3 U	3 U
Selenium	µg/L	50	3 U	3 U	3 U	***1.1 J***
Silver	µg/L	508	1 U	1 U	1 U	1 U
Zinc	µg/L	30,500	12 U	12 U	12 U	12 U
Groundwater Quality Package						
Ammonia	mg/L	NA	***0.41 J***	***0.47 J***	0.1 U	0.1 U
Chloride	mg/L	NA	***7.5***	***6.5***	***5.4***	***5.4***
Nitrate as N	mg/L	10	0.05 U	0.05 U J	***0.14***	***0.072***
Orthophosphate as P	mg/L	NA	0.2 U	0.2 U J	0.2 U	0.2 U
Sulfate	mg/L	NA	***32.8***	***24***	***27***	***27***
Sulfide	mg/L	NA	***1.1 J***	4 U	4 U	4 U
Monitored Natural Attenuation Package						
Methane	µg/L	NA	***980***	***2,400***	***440***	***840***
Ethane	µg/L	NA	***0.59 J***	5 U	5 U	5 U
Total Organic Carbon	mg/L	NA	***1.1***	***1.1 J***	***1***	***0.69 J***

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U = compound was not detected (or qualified as not detected during QA/QC review)
µg/L = micrograms per liter
[1] For source of screening levels, see Table 2-3.

Table 2-12
RI Monitoring Well Groundwater Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	OB-05-15/GW01	OB-05-15/GW02	OB-05-15/GW03	OB-05-15/GW04
		Date Sampled:	3/7/2012	6/21/2012	9/25/2012	12/19/2012
		Comment(s):	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Parameter	**Units**	**Screening Level[1]**				
Volatile Organic Compounds						
1,1,1,2-Tetrachloroethane	µg/L	9.91	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	1.28	***1***	***0.58 J***	1 U	***0.38 J***
1,2,3-Trichlorobenzene	µg/L	5.2	1 U	1 U	1 U	1 U
2-Butanone (MEK)	µg/L	11,800	2 U	2 U	6 U	6 U
Acetone	µg/L	45,500	10 U	10 U	10 U	10 U
cis-1,2-Dichloroethene	µg/L	70	***0.73 J***	***0.34 J***	***0.22 J***	***0.43 J***
Naphthalene	µg/L	2.11	1 U	1 U	1 U	1 U
Tetrachloroethene	µg/L	5	***0.32 J***	***0.25 J***	***0.21 J***	***0.26 J***
trans-1,2-Dichloroethene	µg/L	100	***0.46 J***	***0.2 J***	1 U	***0.22 J***
Trichloroethene	µg/L	5	***18***	***8.7***	***7.3***	***9.3***
Semivolatile Organic Compounds						
Benzo(a)pyrene	µg/L	0.2	9.4 U	9.5 U	10 U	9.5 U
Benzo(ghi)perylene	µg/L	NA	9.4 U	9.5 U	10 U	9.5 U
bis(2-Ethylhexyl)phthalate	µg/L	6	***1.2 J***	9.5 U	***1.9 J***	9.5 U
Perchlorate						
Perchlorate	µg/L	70.9	***3.7***	***1.5***	***1.9***	***1.3***
Explosives						
HMX	µg/L	5,110	0.099 U	0.1 U	0.1 U	0.1 U
RDX	µg/L	25.9	0.099 U	0.1 U	0.1 U	0.1 U
Metals						
Antimony	µg/L	6	6 U	6 U	6 U	6 U
Arsenic	µg/L	10	3 U	3 U	3 U	3 U
Beryllium	µg/L	4	1 U	1 U	1 U	1 U
Cadmium	µg/L	5	1.5 U	1.5 U	1.5 U	1.5 U
Chromium	µg/L	100	5 U	5 U	***1.6 J***	5 U
Copper	µg/L	1,300	3 U	3 U	3 U	***4.2***
Lead	µg/L	15	2.5 U	2.5 U	2.5 U	2.5 U
Mercury	µg/L	2	0.2 U	0.2 U	0.14 U	0.2 U
Nickel	µg/L	2,040	3 U	3 U	3 U	3 U
Selenium	µg/L	50	***1.5 J***	***1 J***	***1.5 J***	***1.8 J***
Silver	µg/L	508	1 U	1 U	1 U	1 U
Zinc	µg/L	30,500	12 U	12 U	***8.4 J***	***4.3 J***
Groundwater Quality Package						
Ammonia	mg/L	NA	1 U	***0.082 J***	***0.054 J***	0.1 U
Chloride	mg/L	NA	***5.5***	***6.4***	***62***	***6.2***
Nitrate as N	mg/L	10	***0.082***	***0.084***	***0.68***	***0.055***
Orthophosphate as P	mg/L	NA	0.2 U	***0.13 J***	2 U	0.2 U
Sulfate	mg/L	NA	***45.9***	***33.3***	***360***	***41***
Sulfide	mg/L	NA	***0.80 J***	4 U	4 U	4 U
Monitored Natural Attenuation Package						
Methane	µg/L	NA	5 U	5 U	5 U	5 U
Ethane	µg/L	NA	5 U	5 U	5 U	5 U
Total Organic Carbon	mg/L	NA	***0.53 J***	***0.96 J***	***0.99 J***	***0.81 J***

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U = compound was not detected (or qualified as not detected during QA/QC review)
µg/L = micrograms per liter
[1] For source of screening levels, see Table 2-3.

Table 2-12
RI Monitoring Well Groundwater Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	OB-12-15D/GW01	OB-12-15D/GW02	OB-12-15D/GW03	OB-12-15D/GW04
		Date Sampled:	3/9/2012	6/21/2012	9/27/2012	12/20/2012
		Comment(s):	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Parameter	**Units**	**Screening Level[1]**				
Volatile Organic Compounds						
1,1,1,2-Tetrachloroethane	µg/L	9.91	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	1.28	1 U	1 U	1 U	1 U
1,2,3-Trichlorobenzene	µg/L	5.2	1 U	1 U	1 U	1 U
2-Butanone (MEK)	µg/L	11,800	2 U	2 U	6 U	6 U
Acetone	µg/L	45,500	10 U	10 U	10 U	10 U J
cis-1,2-Dichloroethene	µg/L	70	1 U	1 U	1 U	1 U
Naphthalene	µg/L	2.11	***0.17 J***	1 U	1 U	1 U
Tetrachloroethene	µg/L	5	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	µg/L	100	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	5	1 U	1 U	1 U	1 U
Semivolatile Organic Compounds						
Benzo(a)pyrene	µg/L	0.2	9.4 U	9.6 U	9.5 U	11 U
Benzo(ghi)perylene	µg/L	NA	9.4 U	9.6 U	9.5 U	11 U
bis(2-Ethylhexyl)phthalate	µg/L	6	9.4 U	***1.3 J***	9.5 U	11 U
Perchlorate						
Perchlorate	µg/L	70.9	0.5 U	0.5 U	0.5 U	0.5 U
Explosives						
HMX	µg/L	5,110	0.099 U	0.1 U	0.1 U	0.1 U
RDX	µg/L	25.9	0.099 U	0.1 U	0.1 U	0.1 U
Metals						
Antimony	µg/L	6	***2.4 J***	6 U	6 U	6 U
Arsenic	µg/L	10	***2.7 J***	***1.4 J***	3 U	***1.1 J***
Beryllium	µg/L	4	1 U	1 U	1 U	1 U J
Cadmium	µg/L	5	1.5 U	1.5 U	***0.5 J***	1.5 U
Chromium	µg/L	100	5 U	5 U	5 U	5 U
Copper	µg/L	1,300	3 U	3 U	3 U	3 U
Lead	µg/L	15	2.5 U	2.5 U	2.5 U	2.5 U
Mercury	µg/L	2	0.2 U	0.2 U	0.14 U	0.2 U
Nickel	µg/L	2,040	***5.4***	***1 J***	3 U	3 U
Selenium	µg/L	50	***1.5 J***	3 U	3 U	***1.6 J***
Silver	µg/L	508	1 U	1 U	1 U	1 U
Zinc	µg/L	30,500	12 U	12 U	12 U	12 U
Groundwater Quality Package						
Ammonia	mg/L	NA	***0.10 J***	***0.19 J***	***0.074 J***	***0.14***
Chloride	mg/L	NA	***4.1***	***3.7***	***3.9***	***3.9***
Nitrate as N	mg/L	10	0.05 U J	0.05 U	0.05 U	0.05 U J
Orthophosphate as P	mg/L	NA	0.2 U	0.2 U	0.2 U	0.2 U
Sulfate	mg/L	NA	***33.3***	***25.6***	***27***	***25***
Sulfide	mg/L	NA	4 U	4 U	4 U	4 U
Monitored Natural Attenuation Package						
Methane	µg/L	NA	***0.39 J***	***1.1 J***	***1.9 J***	***2.7 J***
Ethane	µg/L	NA	5 U	5 U	5 U	5 U
Total Organic Carbon	mg/L	NA	***1.3 J***	***0.46 J***	***0.55 J***	***0.5 J***

Notes:
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Highlighted = Concentration exceeds screening level
ID = Identification
J = estimated value
mg/L = milligrams per liter
NA = Not available / Not analyzed
NS = Not sampled
U = compound was not detected (or qualified as not detected during QA/QC review)
µg/L = micrograms per liter
[1] For source of screening levels, see Table 2-3.

Table 2-12
RI Monitoring Well Groundwater Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	OB-12-16/GW01	OB-12-16/GW02	OB-12-16/GW03	OB-12-16/GW04
		Date Sampled:	3/7/2012	6/20/2012	9/27/2012	12/19/2012
		Comment(s):	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Parameter	**Units**	**Screening Level[1]**				
Volatile Organic Compounds						
1,1,1,2-Tetrachloroethane	µg/L	9.91	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	1.28	***0.6 J***	***0.91 J***	1 U	1 U
1,2,3-Trichlorobenzene	µg/L	5.2	1 U	1 U	1 U	1 U
2-Butanone (MEK)	µg/L	11,800	2 U	2 U	6 U	6 U
Acetone	µg/L	45,500	10 U	10 U	10 U	10 U
cis-1,2-Dichloroethene	µg/L	70	1 U	1 U	1 U	1 U
Naphthalene	µg/L	2.11	1 U	1 U	1 U	1 U
Tetrachloroethene	µg/L	5	1 U	***0.36 J***	***0.2 J***	***0.2 J***
trans-1,2-Dichloroethene	µg/L	100	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	5	***6.3***	***12***	***7.2***	***5.5***
Semivolatile Organic Compounds						
Benzo(a)pyrene	µg/L	0.2	9.4 U	9.5 U	9.4 U	11 U
Benzo(ghi)perylene	µg/L	NA	9.4 U	9.5 U	9.4 U	11 U
bis(2-Ethylhexyl)phthalate	µg/L	6	***2.2 J***	9.5 U	9.4 U	***1.1 J***
Perchlorate						
Perchlorate	µg/L	70.9	***3.2***	***2.2***	***3.3***	***3.4***
Explosives						
HMX	µg/L	5,110	0.099 U	0.1 U	0.1 U	0.1 U
RDX	µg/L	25.9	0.099 U	0.1 U	0.1 U	0.1 U
Metals						
Antimony	µg/L	6	6 U	6 U	6 U	6 U
Arsenic	µg/L	10	3 U	3 U	3 U	3 U
Beryllium	µg/L	4	***0.13 J***	1 U	1 U	1 U
Cadmium	µg/L	5	1.5 U	1.5 U	1.5 U	1.5 U
Chromium	µg/L	100	***2.5 J***	5 U	5 U	5 U
Copper	µg/L	1,300	***2.2 J***	3 U	3 U	3 U
Lead	µg/L	15	***1.5 J***	2.5 U	2.5 U	2.5 U
Mercury	µg/L	2	0.2 U	0.2 U	0.14 U	0.2 U
Nickel	µg/L	2,040	***1.9 J***	3 U	3 U	3 U
Selenium	µg/L	50	***1.6 J***	3 U	3 U	***1.5 J***
Silver	µg/L	508	1 U	1 U	1 U	1 U
Zinc	µg/L	30,500	12 U	12 U	12 U	12 U
Groundwater Quality Package						
Ammonia	mg/L	NA	1 U	***0.066 J***	0.1 U	0.1 U
Chloride	mg/L	NA	***5.9***	***5.9***	***6.8***	***6.7***
Nitrate as N	mg/L	10	0.05 U	***0.081***	0.05 U	***0.1***
Orthophosphate as P	mg/L	NA	0.2 U	0.2 U	0.2 U	0.2 U
Sulfate	mg/L	NA	***39.1***	***34***	***29***	***26***
Sulfide	mg/L	NA	4 U	4 U	4 U	4 U
Monitored Natural Attenuation Package						
Methane	µg/L	NA	5 U	5 U	***0.29 J***	***1.6 J***
Ethane	µg/L	NA	5 U	5 U	5 U	5 U
Total Organic Carbon	mg/L	NA	***1.2 J***	***0.97 J***	***1***	***0.84 J***

Notes:
Bold / Italics = compound was detected
Highlighted = Concentration exceeds screening level
ID = Identification
J = estimated value
mg/L = milligrams per liter
NA = Not available / Not analyzed
NS = Not sampled
U = compound was not detected (or qualified as not detected during QA/QC review)
µg/L = micrograms per liter
[1] For source of screening levels, see Table 2-3.

Table 2-12
RI Monitoring Well Groundwater Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	OB-12-17/GW01	OB-12-17/GW02	OB-12-17/GW03	OB-12-17/GW04
		Date Sampled:	3/8/2012	6/21/2012	9/26/2012	12/19/2012
		Comment(s):	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Parameter	**Units**	**Screening Level[1]**				
Volatile Organic Compounds						
1,1,1,2-Tetrachloroethane	µg/L	9.91	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	1.28	***0.19 J***	***0.15 J***	***0.47 J***	***0.52 J***
1,2,3-Trichlorobenzene	µg/L	5.2	1 U	1 U	1 U	1 U
2-Butanone (MEK)	µg/L	11,800	2 U	2 U	6 U	6 U
Acetone	µg/L	45,500	10 U	10 U	10 U	10 U
cis-1,2-Dichloroethene	µg/L	70	1 U	1 U	1 U	1 U
Naphthalene	µg/L	2.11	1 U	1 U	1 U	1 U
Tetrachloroethene	µg/L	5	***0.16 J***	***0.22 J***	***0.21 J***	***0.22 J***
trans-1,2-Dichloroethene	µg/L	100	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	5	***6.7***	***5.9***	***9.5***	***9.8***
Semivolatile Organic Compounds						
Benzo(a)pyrene	µg/L	0.2	9.5 U	9.5 U	10 U	10 U
Benzo(ghi)perylene	µg/L	NA	9.5 U	9.5 U	10 U	10 U
bis(2-Ethylhexyl)phthalate	µg/L	6	***1.4 J***	9.5 U	***7.3 J***	***2.1 J***
Perchlorate						
Perchlorate	µg/L	70.9	***3.6***	***4.8***	***6.2***	***6.7***
Explosives						
HMX	µg/L	5,110	0.1 U	0.1 U	0.1 U	0.1 U
RDX	µg/L	25.9	0.1 U	0.1 U	0.1 U	0.1 U
Metals						
Antimony	µg/L	6	6 U	6 U	6 U	6 U
Arsenic	µg/L	10	3 U	3 U	3 U	3 U
Beryllium	µg/L	4	1 U	1 U	***0.18 J***	1 U J
Cadmium	µg/L	5	1.5 U	1.5 U	1.5 U	1.5 U
Chromium	µg/L	100	5 U	5 U	***2.5 J***	5 U
Copper	µg/L	1,300	3 U	3 U	***2.2 J***	***1 J***
Lead	µg/L	15	2.5 U	2.5 U	***1.4 J***	2.5 U
Mercury	µg/L	2	0.2 U	0.2 U	0.14 U	***0.11 J***
Nickel	µg/L	2,040	3 U	3 U	3 U	3 U
Selenium	µg/L	50	3 U	***1 J***	3 U	3 U
Silver	µg/L	508	1 U	1 U	1 U	1 U
Zinc	µg/L	30,500	12 U	12 U	***9.7 J***	***4 J***
Groundwater Quality Package						
Ammonia	mg/L	NA	1 U	***0.068 J***	0.1 U	0.1 U
Chloride	mg/L	NA	***7.6***	***6.9***	***7.1***	***7***
Nitrate as N	mg/L	10	0.05 U	0.05 U J	***0.084***	***0.05***
Orthophosphate as P	mg/L	NA	0.2 U	0.2 U J	0.2 U	0.2 U
Sulfate	mg/L	NA	***23.7***	***22.7***	***26***	***26***
Sulfide	mg/L	NA	4 U	4 U	4 U	4 U
Monitored Natural Attenuation Package						
Methane	µg/L	NA	5 U	5 U	5 U	5 U
Ethane	µg/L	NA	5 U	5 U	5 U	5 U
Total Organic Carbon	mg/L	NA	***0.79 J***	***0.98 J***	***0.96 J***	***0.87 J***

Notes:
Bold / Italics = compound was detected
Highlighted = Concentration exceeds screening level
ID = Identification
J = estimated value
mg/L = milligrams per liter
NA = Not available / Not analyzed
NS = Not sampled
U = compound was not detected (or qualified as not detected during QA/QC review)
µg/L = micrograms per liter
[1] For source of screening levels, see Table 2-3.

Table 2-12
RI Monitoring Well Groundwater Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	OB-12-18/GW01	OB-12-18/GW02	OB-12-18/GW03	OB-12-18/GW04
		Date Sampled:	3/8/2012	6/19/2012	9/26/2012	12/18/2012
		Comment(s):	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Parameter	**Units**	**Screening Level[1]**				
Volatile Organic Compounds						
1,1,1,2-Tetrachloroethane	µg/L	9.91	1 U	***0.13 J***	10 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	1.28	***11***	***45***	***43***	***45***
1,2,3-Trichlorobenzene	µg/L	5.2	1 U	1 U	10 U	***2.3 J***
2-Butanone (MEK)	µg/L	11,800	2 U	2 U	60 U	6 U
Acetone	µg/L	45,500	10 U	10 U	***40 J***	10 U
cis-1,2-Dichloroethene	µg/L	70	***4.8***	***5.1***	***5 J***	***4.4 J***
Naphthalene	µg/L	2.11	1 U	***2.1 J***	10 U	***2.5 J***
Tetrachloroethene	µg/L	5	***0.87 J***	***4.7***	***3.2 J***	***3.8 J***
trans-1,2-Dichloroethene	µg/L	100	***0.29 J***	***0.48 J***	10 U	***0.3 J***
Trichloroethene	µg/L	5	***60***	***260***	***250***	***230***
Semivolatile Organic Compounds						
Benzo(a)pyrene	µg/L	0.2	9.4 U	9.9 U	9.6 U	10 U
Benzo(ghi)perylene	µg/L	NA	9.4 U	9.9 U	9.6 U	10 U
bis(2-Ethylhexyl)phthalate	µg/L	6	***1.9 J***	1 J U	***1.2 J***	10 U
Perchlorate						
Perchlorate	µg/L	70.9	***24***	***36***	***52***	***54***
Explosives						
HMX	µg/L	5,110	0.099 U	***0.097 J***	***0.1***	***0.14***
RDX	µg/L	25.9	***0.069 J***	***0.4***	***0.46***	***0.51***
Metals						
Antimony	µg/L	6	6 U	6 U	6 U	6 U
Arsenic	µg/L	10	3 U	3 U	3 U	3 U
Beryllium	µg/L	4	1 U	1 U	1 U	1 U
Cadmium	µg/L	5	1.5 U	1.5 U	1.5 U	1.5 U
Chromium	µg/L	100	***2.2 J***	***3.2 J***	***2.2 J***	5 U
Copper	µg/L	1,300	***3.6***	***1.6 J***	3 U	3 U
Lead	µg/L	15	2.5 U	2.5 U	2.5 U	2.5 U
Mercury	µg/L	2	0.2 U	0.2 U	0.14 U	0.2 U
Nickel	µg/L	2,040	***1.7 J***	***1.7 J***	3 U	3 U
Selenium	µg/L	50	***1.1 J***	3 U	3 U	***1.4 J***
Silver	µg/L	508	1 U	1 U	1 U	1 U
Zinc	µg/L	30,500	12 U	12 U	12 U	12 U
Groundwater Quality Package						
Ammonia	mg/L	NA	1 U	***0.068 J***	0.1 U	0.1 U
Chloride	mg/L	NA	***7.6***	***6.6***	***6.6***	***6.9***
Nitrate as N	mg/L	10	0.05 U	***0.15***	***0.23***	***0.09***
Orthophosphate as P	mg/L	NA	0.2 U	0.2 U	0.2 U	0.2 U
Sulfate	mg/L	NA	***34.5***	***26.9***	***27***	***27***
Sulfide	mg/L	NA	4 U	4 U	4 U	4 U
Monitored Natural Attenuation Package						
Methane	µg/L	NA	***0.29 J***	***1.9 J***	***2.2 J***	5 U
Ethane	µg/L	NA	5 U	5 U	5 U	5 U
Total Organic Carbon	mg/L	NA	***0.99 J***	***0.86 J***	***1.1***	***0.79 J***

Notes:
Bold / Italics = compound was detected
Highlighted = Concentration exceeds screening level
ID = Identification
J = estimated value
mg/L = milligrams per liter
NA = Not available / Not analyzed
NS = Not sampled
U = compound was not detected (or qualified as not detected during QA/QC review)
µg/L = micrograms per liter
[1] For source of screening levels, see Table 2-3.

Table 2-12
RI Monitoring Well Groundwater Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	OB-12-19D/GW01	OB-12-19D/GW02	OB-12-19D/GW03	OB-12-19D/GW04
		Date Sampled:	3/7/2012	6/21/2012	9/24/2012	12/20/2012
		Comment(s):	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Parameter	**Units**	**Screening Level[1]**				
Volatile Organic Compounds						
1,1,1,2-Tetrachloroethane	µg/L	9.91	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	1.28	1 U	1 U	1 U	1 U
1,2,3-Trichlorobenzene	µg/L	5.2	1 U	1 U	1 U	1 U
2-Butanone (MEK)	µg/L	11,800	2 U	2 U	6 U	6 U
Acetone	µg/L	45,500	10 U	10 U	10 U	10 U J
cis-1,2-Dichloroethene	µg/L	70	1 U	1 U	1 U	1 U
Naphthalene	µg/L	2.11	1 U	1 U	1 U	1 U
Tetrachloroethene	µg/L	5	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	µg/L	100	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	5	***1.1***	***1.7***	***1.1***	***1.1***
Semivolatile Organic Compounds						
Benzo(a)pyrene	µg/L	0.2	9.8 U	9.5 U	9.7 U	9.5 U
Benzo(ghi)perylene	µg/L	NA	9.8 U	9.5 U	9.7 U	9.5 U
bis(2-Ethylhexyl)phthalate	µg/L	6	***2.1 J***	9.5 U	***1.8 J***	9.5 U
Perchlorate						
Perchlorate	µg/L	70.9	***0.31 J***	***0.81***	***0.73***	***0.63***
Explosives						
HMX	µg/L	5,110	0.1 U	0.1 U	0.1 U	0.1 U
RDX	µg/L	25.9	0.1 U	0.1 U	0.1 U	0.1 U
Metals						
Antimony	µg/L	6	6 U	6 U	6 U	6 U
Arsenic	µg/L	10	***1.9 J***	3 U	3 U	3 U
Beryllium	µg/L	4	***0.29 J***	1 U	1 U	1 U J
Cadmium	µg/L	5	1.5 U	1.5 U	1.5 U	1.5 U
Chromium	µg/L	100	5 U	5 U	5 U	5 U
Copper	µg/L	1,300	***1.4 J***	3 U	3 U	***1.2 J***
Lead	µg/L	15	2.5 U	2.5 U	2.5 U	2.5 U
Mercury	µg/L	2	0.2 U	0.2 U	0.14 U	***0.1 J***
Nickel	µg/L	2,040	***12.6***	***11.1***	***3.5***	***1.5 J***
Selenium	µg/L	50	3 U	***1.6 J***	3 U	***2 J***
Silver	µg/L	508	1 U	1 U	1 U	1 U
Zinc	µg/L	30,500	12 U	12 U	12 U	12 U
Groundwater Quality Package						
Ammonia	mg/L	NA	1 U	***0.093 J***	***0.09 J***	0.1 U
Chloride	mg/L	NA	***4.9***	***5.5***	***4.5***	***4.2***
Nitrate as N	mg/L	10	0.05 U	***0.18***	***0.38***	***0.34***
Orthophosphate as P	mg/L	NA	0.2 U	0.2 U	0.2 U	0.2 U
Sulfate	mg/L	NA	***48.3***	***81.6***	***57***	***49***
Sulfide	mg/L	NA	4 U	4 U	4 U J	4 U
Monitored Natural Attenuation Package						
Methane	µg/L	NA	5 U	***0.29 J***	5 U	5 U
Ethane	µg/L	NA	5 U	5 U	5 U	5 U
Total Organic Carbon	mg/L	NA	***2.6***	***0.69 J***	***0.9 J***	***0.67 J***

Notes:
Bold / Italics = compound was detected
Highlighted = Concentration exceeds screening level
ID = Identification
J = estimated value
mg/L = milligrams per liter
NA = Not available / Not analyzed
NS = Not sampled
U = compound was not detected (or qualified as not detected during QA/QC review)
µg/L = micrograms per liter
[1] For source of screening levels, see Table 2-3.

Table 2-12
RI Monitoring Well Groundwater Samples, Detected Analytes
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

		Sample ID:	OB-12-20D/GW01	OB-12-20D/GW02	OB-12-20D/GW03	OB-12-20D/GW04
		Date Sampled:	3/8/2012	6/20/2012	9/27/2012	12/19/2012
		Comment(s):	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Parameter	**Units**	**Screening Level[1]**				
Volatile Organic Compounds						
1,1,1,2-Tetrachloroethane	µg/L	9.91	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	µg/L	1.28	1 U	1 U	1 U	1 U J
1,2,3-Trichlorobenzene	µg/L	5.2	1 U	1 U	1 U	1 U
2-Butanone (MEK)	µg/L	11,800	***0.95 J***	2 U	6 U	6 U
Acetone	µg/L	45,500	10 U	10 U	10 U	10 U
cis-1,2-Dichloroethene	µg/L	70	1 U	1 U	1 U	1 U
Naphthalene	µg/L	2.11	1 U	***0.2 J***	1 U	1 U
Tetrachloroethene	µg/L	5	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	µg/L	100	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	5	***1.1***	***2.2***	***2.1***	***1.7***
Semivolatile Organic Compounds						
Benzo(a)pyrene	µg/L	0.2	9.4 U J	9.5 U	10 U	10 U
Benzo(ghi)perylene	µg/L	NA	9.4 U J	9.5 U	10 U	10 U
bis(2-Ethylhexyl)phthalate	µg/L	6	***1.6 J***	9.5 U	10 U	***1.3 J***
Perchlorate						
Perchlorate	µg/L	70.9	***0.65***	***1.1***	***0.94***	***0.71***
Explosives						
HMX	µg/L	5,110	0.099 U	0.1 U	0.1 U	0.1 U
RDX	µg/L	25.9	0.099 U	0.1 U	0.1 U	0.1 U
Metals						
Antimony	µg/L	6	6 U	6 U	6 U	6 U
Arsenic	µg/L	10	***1 J***	3 U	3 U	3 U
Beryllium	µg/L	4	1 U	1 U	1 U	1 U
Cadmium	µg/L	5	1.5 U	1.5 U	1.5 U	1.5 U
Chromium	µg/L	100	5 U	5 U	5 U	5 U
Copper	µg/L	1,300	***1.5 J***	3 U	3 U	3 U
Lead	µg/L	15	2.5 U	2.5 U	2.5 U	2.5 U
Mercury	µg/L	2	0.2 U J	0.2 U	0.14 U	0.2 U
Nickel	µg/L	2,040	***6.2***	***1.5 J***	3 U	3 U
Selenium	µg/L	50	***23.5***	***1.5 J***	***1.6 J***	***1.4 J***
Silver	µg/L	508	1 U	1 U	1 U	1 U
Zinc	µg/L	30,500	12 U	12 U	12 U	12 U
Groundwater Quality Package						
Ammonia	mg/L	NA	1 U	***0.095 J***	0.1 U	0.1 U
Chloride	mg/L	NA	***4.8***	***5.3***	***5.3***	***5.2***
Nitrate as N	mg/L	10	0.57 U J	***0.072***	***0.62***	***0.059***
Orthophosphate as P	mg/L	NA	0.2 U	0.2 U	0.2 U	0.2 U
Sulfate	mg/L	NA	***23.8***	***27.1***	***38***	***41***
Sulfide	mg/L	NA	4 U	***0.8 J***	4 U	4 U
Monitored Natural Attenuation Package						
Methane	µg/L	NA	5 U	5 U	5 U J	***0.23 J***
Ethane	µg/L	NA	5 U	5 U	5 U J	5 U
Total Organic Carbon	mg/L	NA	***1.4 J***	***0.82 J***	***0.94 J***	***0.74 J***

Notes:
Bold / Italics = compound was detected
Highlighted = Concentration exceeds screening level
ID = Identification
J = estimated value
mg/L = milligrams per liter
NA = Not available / Not analyzed
NS = Not sampled
U = compound was not detected (or qualified as not detected during QA/QC review)
µg/L = micrograms per liter
[1] For source of screening levels, see Table 2-3.

Table 2-13
Exposure Point Concentrations
Demolition Soil
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Chemical	Maximum Detected Concentration (mg/kg)	Upper Confidence Limit (mg/kg)	Exposure Point Concentration (mg/kg)
Volatile Organic Compounds			
Trichloroethene	181	41.7	41.7

Notes:

mg/kg - milligrams per kilogram

UCL values calculated using ProUCL Version 4.1.

Exposure point concentration is lower of maximum detected concentration or upper confidence limit.

Table 2-14
Exposure Point Concentrations
Comprehensive Soil
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Chemical	Maximum Detected Concentration (mg/kg)	Upper Confidence Limit (mg/kg)	Exposure Point Concentration (mg/kg)
Volatile Organic Compounds			
Trichloroethene	181	13.7	13.7

Notes:

mg/kg - milligrams per kilogram

UCL values calculated using ProUCL Version 4.1.

Exposure point concentration is lower of maximum detected concentration or upper confidence limit.

Table 2-15
Exposure Point Concentrations
Surface Water
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Chemical	Maximum Detected Concentration (mg/L)	Upper Confidence Limit (mg/L)	Exposure Point Concentration (mg/L)
Volatile Organic Compounds			
1,1,2,2-Tetrachloroethane	0.016	NC	0.016
Trichloroethene	0.091	NAp	0.091
Semivolatile Organic Compounds			
Benzo(a)pyrene	0.0011	NC	0.0011

Notes:

mg/L - milligrams per Liter

NAp - Not applicable due to less than four distinct detected data.

NC - Not calculated due to an insufficient number of samples.

UCL values calculated using ProUCL Version 4.1.

Exposure point concentration is lower of maximum detected concentration or upper confidence limit.

Table 2-16
Exposure Point Concentrations
Groundwater
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Chemical	Maximum Detected Concentration (mg/L)	Exposure Point Concentration (mg/L)
Volatile Organic Compounds		
Naphthalene	0.0025	0.0025
1,1,2,2-Tetrachloroethane	0.045	0.045
Trichloroethene	0.26	0.26
Semivolatile Organic Compounds		
Benzo(a)pyrene	0.00076	0.00076
bis(2-ethylhexyl)phthalate	0.024	0.024

Notes:

mg/L - milligrams per Liter

No UCL was calculated for groundwater samples, due to exposure being a point-source.

Table 2-17
Hazard Index Estimates for
Current Worker Scenario
Record of Decision
OpenBurning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Chemical	Daily Intake	RfD/RfC	Hazard Quotient	Pathway Hazard Index	Total Hazard Index
Exposure Pathway: Inhalation of Outdoor Vapors					
Volatile Organic Compounds					
Naphthalene	2.17E-009	3E-003	0.000001		
1,1,2,2-Tetrachloroethane	9.06E-006	NAv	NAp		
Trichloroethene	2.51E-003	2E-003	1		
Semivolatile Organic Compounds					
Benzo(a)pyrene	0.00E+000	NAv	NAp		
bis(2-ethylhexyl)phthalate	0.00E+000	NAv	NAp		
				1	
Exposure Pathway: Dermal Contact with Surface Water					
Volatile Organic Compounds					
1,1,2,2-Tetrachloroethane	1.79E-005	2E-002	0.001		
Trichloroethene	1.58E-004	5E-004	0.3		
Semivolatile Organic Compounds					
Benzo(a)pyrene	2.13E-004	NAv	NAp		
				0.3	
Exposure Pathway: Inhalation of Vapors from Surface Water					
Volatile Organic Compounds					
1,1,2,2-Tetrachloroethane	5.84E-007	NAv	NAp		
Trichloroethene	6.16E-006	2E-003	0.0007		
Semivolatile Organic Compounds					
Benzo(a)pyrene	1.00E-010	NAv	NAp		
				0.0007	
					1

Notes:
NAp - Not Applicable
NAv - Not Available
RfC - Reference Concentration
RfD - Reference Dose
Daily intakes and RfDs applicable to ingestion and dermal contact pathways are expressed in units of mg/kg/day.
Daily intakes and RfDs applicable to inhalation pathways are expressed in units of mg/m^3.

Table 2-18
Hazard Index Estimates for
Future Worker Scenario
Record of Decision
OpenBurning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Chemical	Daily Intake	RfD/RfC	Hazard Quotient	Pathway Hazard Index	Total Hazard Index
Exposure Pathway: Inhalation of Outdoor Vapors					
Volatile Organic Compounds					
Naphthalene	2.17E-009	3E-003	0.000001		
1,1,2,2-Tetrachloroethane	9.06E-006	NAv	NAp		
Trichloroethene	2.51E-003	2E-003	1		
Semivolatile Organic Compounds					
Benzo(a)pyrene	0.00E+000	NAv	NAp		
bis(2-ethylhexyl)phthalate	0.00E+000	NAv	NAp		
				1	
Exposure Pathway: Dermal Contact with Surface Water					
Volatile Organic Compounds					
1,1,2,2-Tetrachloroethane	1.79E-005	2E-002	0.001		
Trichloroethene	1.58E-004	5E-004	0.3		
Semivolatile Organic Compounds					
Benzo(a)pyrene	2.13E-004	NAv	NAp		
				0.3	
Exposure Pathway: Inhalation of Vapors from Surface Water					
Volatile Organic Compounds					
1,1,2,2-Tetrachloroethane	5.84E-007	NAv	NAp		
Trichloroethene	6.16E-006	2E-003	0.0007		
Semivolatile Organic Compounds					
Benzo(a)pyrene	1.00E-010	NAv	NAp		
				0.0007	
Exposure Pathway: Ingestion of Groundwater					
Volatile Organic Compounds					
Naphthalene	4.89E-005	2E-002	0.002		
1,1,2,2-Tetrachloroethane	8.81E-004	2E-002	0.04		
Trichloroethene	5.09E-003	5E-004	10		
Semivolatile Organic Compounds					
Benzo(a)pyrene	1.49E-005	NAv	NAp		
bis(2-ethylhexyl)phthalate	4.70E-004	2E-002	0.02		
				10	
Exposure Pathway: Dermal Contact with Groundwater					
Volatile Organic Compounds					
Naphthalene	1.4E-005	2E-002	0.0007		
1,1,2,2-Tetrachloroethane	3.8E-005	2E-002	0.002		
Trichloroethene	3.4E-004	5E-004	0.7		
Semivolatile Organic Compounds					
Benzo(a)pyrene	1.1E-004	NAv	NAp		
bis(2-ethylhexyl)phthalate	0.0E+000	2E-002	NAp		
				0.7	
Exposure Pathway: Inhalation of Vapors from Groundwater Use					
Volatile Organic Compounds					
Naphthalene	7.1E-007	3E-003	0.0002		
1,1,2,2-Tetrachloroethane	2.3E-004	NAv	NAp		
Trichloroethene	7.7E-003	2E-003	4		
Semivolatile Organic Compounds					
Benzo(a)pyrene	6.6E-008	NAv	NAp		
bis(2-ethylhexyl)phthalate	6.6E-005	NAv	NAp		
				4	
					16

Notes:
NAp - Not Applicable
NAv - Not Available
RfC - Reference Concentration
RfD - Reference Dose
Daily intakes and RfDs applicable to ingestion and dermal contact pathways are expressed in units of mg/kg/day.
Daily intakes and RfDs applicable to inhalation pathways are expressed in units of mg/m^3.

Table 2-19
Hazard Index Estimates for
Current/Future Demolition Worker Scenario
Record of Decision
OpenBurning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Chemical	Daily Intake	RfD/RfC	Hazard Quotient	Pathway Hazard Index	Total Hazard Index
Exposure Pathway: Incidental Ingestion of Soil					
Volatile Organic Compounds					
Trichloroethene	1.4E-004	5E-004	0.3		
				0.3	
Exposure Pathway: Dermal Contact with Soil					
Volatile Organic Compounds					
Trichloroethene	0.0E+000	5E-004	NAp		
				NAp	
Exposure Pathway: Inhalation of Fugitive Dust					
Volatile Organic Compounds					
Trichloroethene	7.5E-009	2E-003	0.000004		
				0.000004	
Exposure Pathway: Inhalation of Outdoor Vapors					
Volatile Organic Compounds					
Naphthalene	2.3E-009	3E-003	0.000001		
1,1,2,2-Tetrachloroethane	5.9E-005	NAv	NAp		
Trichloroethene	3.5E-002	2E-003	17		
Semivolatile Organic Compounds					
Benzo(a)pyrene	0.0E+000	NAv	NAp		
bis(2-ethylhexyl)phthalate	0.0E+000	NAv	NAp		
				17	
Exposure Pathway: Dermal Contact with Surface Water					
Volatile Organic Compounds					
1,1,2,2-Tetrachloroethane	1.9E-005	2E-002	0.001		
Trichloroethene	1.7E-004	5E-004	0.3		
Semivolatile Organic Compounds					
Benzo(a)pyrene	2.2E-004	NAv	NAp		
				0.3	
Exposure Pathway: Inhalation of Vapors from Surface Water					
Volatile Organic Compounds					
1,1,2,2-Tetrachloroethane	1.4E-007	NAv	NAp		
Trichloroethene	1.5E-006	2E-003	0.0007		
Semivolatile Organic Compounds					
Benzo(a)pyrene	2.4E-011	NAv	NAp		
				0.0007	
Exposure Pathway: Ingestion of Groundwater					
Volatile Organic Compounds					
Naphthalene	5.1E-005	2E-002	0.003		
1,1,2,2-Tetrachloroethane	9.2E-004	2E-002	0.05		
Trichloroethene	5.3E-003	5E-004	11		
Semivolatile Organic Compounds					
Benzo(a)pyrene	1.6E-005	NAv	NAp		
bis(2-ethylhexyl)phthalate	4.9E-004	2E-002	0.02		
				11	
Exposure Pathway: Dermal Contact with Groundwater					
Volatile Organic Compounds					
Naphthalene	1.4E-005	2E-002	0.001		
1,1,2,2-Tetrachloroethane	3.9E-005	2E-002	0.002		
Trichloroethene	3.5E-004	5E-004	0.7		
Semivolatile Organic Compounds					
Benzo(a)pyrene	1.2E-004	NAv	NAp		
bis(2-ethylhexyl)phthalate	0.0E+000	2E-002	NAp		
				0.7	
					29

Notes:
NAp - Not Applicable
NAv - Not Available
RfC - Reference Concentration
RfD - Reference Dose
Daily intakes and RfDs applicable to ingestion and dermal contact pathways are expressed in units of mg/kg/day.
Daily intakes and RfDs applicable to inhalation pathways are expressed in units of mg/m^3.

Table 2-20
Excess Lifetime Cancer Risk Estimate for
Current Worker Scenario
Record of Decision
OpenBurning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Chemical	Daily Intake	Slope Factor/ IUR	Excess Cancer Risk	Pathway Cancer Risk	Total Cancer Risk
Exposure Pathway: Inhalation of Outdoor Vapors					
Volatile Organic Compounds					
Naphthalene	8E-010	3E-002	3E-011		
1,1,2,2-Tetrachloroethane	3E-006	6E-002	2E-007		
Trichloroethene	9E-004	4E-003	4E-006		
Semivolatile Organic Compounds					
Benzo(a)pyrene	0E+000	1E+000	0E+000		
bis(2-ethylhexyl)phthalate	0E+000	2E-003	0E+000		
				4E-006	
Exposure Pathway: Dermal Contact with Surface Water					
Volatile Organic Compounds					
1,1,2,2-Tetrachloroethane	6E-006	2E-001	1E-006		
Trichloroethene	6E-005	5E-002	3E-006		
Semivolatile Organic Compounds					
Benzo(a)pyrene	8E-005	7E+000	6E-004		
				6E-004	
Exposure Pathway: Inhalation of Vapors from Surface Water					
Volatile Organic Compounds					
1,1,2,2-Tetrachloroethane	5E-008	6E-002	3E-009		
Trichloroethene	5E-007	4E-003	2E-009		
Semivolatile Organic Compounds					
Benzo(a)pyrene	8E-012	1E+000	9E-012		
				5E-009	
					6E-004

Notes:
IUR - Inhalation Unit Risk
NAp - Not Applicable
NAv - Not Available
Daily intakes and Slope Factors applicable to ingestion and dermal contact pathways are expressed in units of mg/kg/day.
Daily intakes and IURs applicable to inhalation pathways are expressed in units of mg/m^3.

Table 2-21
Excess Lifetime Cancer Risk Estimate for Future Worker Scenario
Record of Decision
OpenBurning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Chemical	Daily Intake	Slope Factor/ IUR	Excess Cancer Risk	Pathway Cancer Risk	Total Cancer Risk
Exposure Pathway: Inhalation of Outdoor Vapors					
Volatile Organic Compounds					
Naphthalene	8E-010	3E-002	3E-011		
1,1,2,2-Tetrachloroethane	3E-006	6E-002	2E-007		
Trichloroethene	9E-004	4E-003	4E-006		
Semivolatile Organic Compounds					
Benzo(a)pyrene	0E+000	1E+000	0E+000		
bis(2-ethylhexyl)phthalate	0E+000	2E-003	0E+000		
				4E-006	
Exposure Pathway: Dermal Contact with Surface Water					
Volatile Organic Compounds					
1,1,2,2-Tetrachloroethane	6E-006	2E-001	1E-006		
Trichloroethene	6E-005	5E-002	3E-006		
Semivolatile Organic Compounds					
Benzo(a)pyrene	8E-005	7E+000	6E-004		
				6E-004	
Exposure Pathway: Inhalation of Vapors from Surface Water					
Volatile Organic Compounds					
1,1,2,2-Tetrachloroethane	5E-008	6E-002	3E-009		
Trichloroethene	5E-007	4E-003	2E-009		
Semivolatile Organic Compounds					
Benzo(a)pyrene	8E-012	1E+000	9E-012		
				5E-009	
Exposure Pathway: Ingestion of Groundwater					
Volatile Organic Compounds					
Naphthalene	1.7E-005	NAv	NAp		
1,1,2,2-Tetrachloroethane	3.1E-004	2E-001	6E-005		
Trichloroethene	1.8E-003	5E-002	8E-005		
Semivolatile Organic Compounds					
Benzo(a)pyrene	5.3E-006	7E+000	4E-005		
bis(2-ethylhexyl)phthalate	1.7E-004	1E-002	2E-006		
				2E-004	
Exposure Pathway: Dermal Contact with Groundwater					
Volatile Organic Compounds					
Naphthalene	4.8E-006	NAv	NAp		
1,1,2,2-Tetrachloroethane	1.4E-005	2E-001	3E-006		
Trichloroethene	1.2E-004	5E-002	6E-006		
Semivolatile Organic Compounds					
Benzo(a)pyrene	3.9E-005	7E+000	3E-004		
bis(2-ethylhexyl)phthalate	0.0E+000	1E-002	0E+000		
				3E-004	
Exposure Pathway: Inhalation of Vapors from Groundwater Use					
Volatile Organic Compounds					
Naphthalene	2.5E-007	3E-002	9E-009		
1,1,2,2-Tetrachloroethane	8.3E-005	6E-002	5E-006		
Trichloroethene	2.8E-003	4E-003	1E-005		
Semivolatile Organic Compounds					
Benzo(a)pyrene	2.4E-008	1E+000	3E-008		
bis(2-ethylhexyl)phthalate	2.3E-005	2E-003	6E-008		
				2E-005	
					1E-003

Notes:
IUR - Inhalation Unit Risk
NAp - Not Applicable
NAv - Not Available
Daily intakes and Slope Factors applicable to ingestion and dermal contact pathways are expressed in units of mg/kg/day.
Daily intakes and IURs applicable to inhalation pathways are expressed in units of mg/m^3.

Table 2-22
Excess Lifetime Cancer Risk Estimate for Current/Future Demolition Worker Scenario
Record of Decision
OpenBurning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Chemical	Daily Intake	Slope Factor/ IUR	Excess Cancer Risk	Pathway Cancer Risk	Total Cancer Risk
Exposure Pathway: Incidental Ingestion of Soil					
Volatile Organic Compounds					
Trichloroethene	9.2E-007	5E-002	4E-008		
				4E-008	
Exposure Pathway: Dermal Contact with Soil					
Volatile Organic Compounds					
Trichloroethene	0.0E+000	5E-002	NAp		
				NAp	
Exposure Pathway: Inhalation of Fugitive Dust					
Volatile Organic Compounds					
Trichloroethene	5.0E-011	4E-003	2E-013		
				2E-013	
Exposure Pathway: Inhalation of Outdoor Vapors					
Volatile Organic Compounds					
Naphthalene	1.5E-011	3E-002	5E-013		
1,1,2,2-Tetrachloroethane	3.9E-007	6E-002	2E-008		
Trichloroethene	2.3E-004	4E-003	9E-007		
Semivolatile Organic Compounds					
Benzo(a)pyrene	0.0E+000	1E+000	0E+000		
bis(2-ethylhexyl)phthalate	0.0E+000	2E-003	0E+000		
				1E-006	
Exposure Pathway: Dermal Contact with Surface Water					
Volatile Organic Compounds					
1,1,2,2-Tetrachloroethane	1.2E-007	2E-001	2E-008		
Trichloroethene	1.1E-006	5E-002	5E-008		
Semivolatile Organic Compounds					
Benzo(a)pyrene	1.5E-006	7E+000	1E-005		
				1E-005	
Exposure Pathway: Inhalation of Vapors from Surface Water					
Volatile Organic Compounds					
1,1,2,2-Tetrachloroethane	9.1E-010	6E-002	5E-011		
Trichloroethene	9.6E-009	4E-003	4E-011		
Semivolatile Organic Compounds					
Benzo(a)pyrene	1.6E-013	1E+000	2E-013		
				9E-011	
Exposure Pathway: Ingestion of Groundwater					
Volatile Organic Compounds					
Naphthalene	3.4E-007	NAv	NAp		
1,1,2,2-Tetrachloroethane	6.0E-006	2E-001	1E-006		
Trichloroethene	3.5E-005	5E-002	2E-006		
Semivolatile Organic Compounds					
Benzo(a)pyrene	1.0E-007	7E+000	7E-007		
bis(2-ethylhexyl)phthalate	3.2E-006	1E-002	5E-008		
				4E-006	
Exposure Pathway: Dermal Contact with Groundwater					
Inorganic Compounds					
Naphthalene	9.3E-008	NAv	NAp		
1,1,2,2-Tetrachloroethane	2.6E-007	2E-001	5E-008		
Trichloroethene	2.3E-006	5E-002	1E-007		
Semivolatile Organic Compounds					
Benzo(a)pyrene	7.6E-007	7E+000	6E-006		
bis(2-ethylhexyl)phthalate	0.0E+000	1E-002	0E+000		
				6E-006	
					2E-005

Notes:
IUR - Inhalation Unit Risk
NAp - Not Applicable
NAv - Not Available
Daily intakes and Slope Factors applicable to ingestion and dermal contact pathways are expressed in units of mg/kg/day.
Daily intakes and IURs applicable to inhalation pathways are expressed in units of mg/m^3.

Table 2-23
Summary of Human Health Risk Results
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Population	Noncancer	Cancer
Current Site Worker		
Inhalation of Outdoor Vapors	1	**4E-06**
Dermal Contact with Surface Water	0.3	**6E-04**
Inhalation of Vapors from Surface Water	0.0007	5E-09
Total	1	**6E-04**
Future Site Worker		
Inhalation of Outdoor Vapors	1	**4E-06**
Dermal Contact with Surface Water	0.3	**6E-04**
Inhalation of Vapors from Surface Water	0.0007	5E-09
Ingestion of Groundwater	**10**	**2E-04**
Dermal Contact with Groundwater	0.7	**3E-04**
Inhalation of Vapors from Groundwater Use	**4**	**2E-05**
Total	**16**	**1E-03**
Current/Future Demolition Worker		
Incidental Ingestion of Shallow and Subsurface Soil	0.3	4E-08
Dermal Contact with Shallow and Subsurface Soil	NAp	NAp
Inhalation of Fugitive Dust	0.000004	2E-13
Inhalation of Outdoor Vapors	**17**	**1E-06**
Dermal Contact with Surface Water	0.3	**1E-05**
Inhalation of Vapors from Surface Water	0.0007	9E-11
Ingestion of Groundwater	**11**	**4E-06**
Dermal Contact with Groundwater	0.7	**6E-06**
Total	**29**	**2E-05**

Notes:
Bold indicates a hazard index greater than one and/or a cancer risk greater than 1E-06.
NAp = Not Applicable

Table 2-24
Body Mass and Food, Water, and Soil or Sediment Consumption Rates for Representative Wildlife Species

Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Representative Wildlife Species	Body Mass (kg)[a]	Food Intake (kg/day)[a]	Water Intake (L/day)[a]	Estimated Soil or Sediment Intake (kg/day)[b]
Short-tailed Shrew	1.50E-02	9.00E-03	3.30E-03	1.17E-03
White-footed Mouse	2.20E-02	3.40E-03	6.60E-03	6.80E-05
Meadow Vole	4.40E-02	5.00E-03	6.00E-03	1.20E-04[c]
Eastern Cottontail Rabbit	1.20E+00	2.37E-01	1.16E-01	1.49E-02[c]
Red Fox	4.50E+00	4.50E-01	3.80E-01	1.26E-02
Raccoon	5.20E+00[d]	2.37E-01[e]	3.83E-01[f]	2.22E-02[g]
White-tailed Deer	5.65E+01	1.74E+00	3.70E+00	3.50E-02
American Robin	7.70E-02	9.30E-02	1.06E-02	8.74E-03[h]
Red-tailed Hawk	1.13E+00	1.09E-01	6.40E-02	3.05E-03[i]

Notes:

[a]Based on reported body weights and food and water consumption rates for selected avian and mammalian wildlife species from ORNL (1996) unless noted otherwise

[b]Based on reported soil ingestion rates from Efroymson et al. (1997) unless noted otherwise

[c]Estimated fraction of soil or sediment in diet as reported in USEPA (1993) -- The fraction of soil in diet for the jackrabbit was substituted for the cottontail rabbit

[d] Minimum adult body mass reported in Mammals of Kansas (http://kufs.ku.edu/libres/Mammals_of_Kansas/list.html#procy; accessed May 3, 2013)

[e] Based on Food Intake (Kg/day) = 0.0687(Body Mass in Kilograms)$^{0.822}$ (ORNL 1996 and USEPA 1993)

[f] Based on Water Intake (L/day) = 0.099(Body Mass in Kilograms)$^{0.90}$ (ORNL 1996 and USEPA 1993)

[g] Assumes 9.4% of diet is sediment or soil as reported in USEPA (1993).

[h] Food Ingestion Rate x Percent of Soil in Diet (9.4) as reported in Beyer et al. (1994)

[i] Percent of soils comprising diet (2.8%) is assumed to be the same as for the Red Fox.

kg - kilograms

kg/day - kilograms per day

L/day - liters per day

Table 2-25

Assumed Percent Composition of Diet for Representative Wildlife Species

Record of Decision

Open Burning / Opend Detonation Ground (Range 16)

Fort Riley, Kansas

Representative Wildlife Species	Benthic Invertebrates	Aquatic Invertebrates	Soil Invertebrates (Earthworms)	Aquatic Plants	Terrestrial Plants	Fish	Small Mammal	Representing Cast
Short-tailed Shrew	0%	0%	100%	0%	0%	0%	0%	Insectivore
White-footed Mouse	0%	0%	0%	0%	100%	0%	0%	Herbivore
Meadow Vole	0%	0%	50%	0%	50%	0%	0%	Omnivore
Eastern Cottontail Rabbit	0%	0%	0%	0%	100%	0%	0%	Herbivore
Red Fox	0%	0%	0%	0%	0%	0%	100%	Carnivore
Raccoon	20%	0%	20%	0%	20%	20%	20%	Omnivore
White-tailed Deer	0%	0%	0%	0%	100%	0%	0%	Herbivore
American Robin	0%	0%	80%	0%	20%	0%	0%	Omnivore
Red-tailed Hawk	0%	0%	0%	0%	0%	0%	100%	Carnivore

Table 2-26
Home Range and Percent of Home Range Within Areas Evaluated for Representative Wildlife Species
Record of Decision
Open Burning / Opend Detonation Ground (Range 16)
Fort Riley, Kansas

Representative Wildlife Species	Home Range (acres)[a]	Percent of Home Range Within the 70-Acre OB/OD Site
Short-tailed Shrew	0.05	100
White-footed Mouse	0.05	100
Meadow Vole	0.05	100
Eastern Cottontail Rabbit	1	100
Red Fox	150	46.7
Raccoon	480	14.6
White-tailed Deer	320	21.9
American Robin	2	100
Red-tailed Hawk	940	7.4

Notes:

[a]Based on most conservative estimates of home range sizes as reported in Schwartz and Schwartz (1981) and USEPA (1993).

Table 2-27

Ecological Hazard Index for Representative Wildlife Species

Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Representative Wildlife Species	Ecological Hazard Index (EHI)
Terrestrial Invertebrate (i.e., Earthworm)	4.6E+00
Benthic Invertebrate	7.6E+00
Terrestrial Plant (Surface Soil Exposure)	3.2E+02
Terrestrial Plant (Subsurface Soil Exposure)	2.8E+02
Aquatic Plant	9.2E+00
Aquatic Invertebrate	2.8E+01
Fish	3.2E+00
Short-tailed Shrew	4.6E+01
White-footed Mouse	4.9E+01
Meadow Vole	2.5E+01
Eastern Cottontail Rabbit	1.7E+02
Red Fox	1.2E+01
Raccoon	3.4E+00
White-tailed Deer	1.5E+01
American Robin	1.0E+05
Red-tailed Hawk	6.9E+00

Table 2-28
Allowable Chemical Concentrations in Soil for Noncancer Effects
Current/Future Demolition Worker Scenario
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Equation:

$$SLing = \frac{THI \times BW \times AT}{ED \times EF \times CF_1 \times IRs \times FI \times 1/RfDo}$$

$$SLinh = \frac{THI \times AT}{ED \times EF \times ET \times CF_2 \times (1/PEF + 1/VFout) \times 1/RfC}$$

$$SLder = \frac{THI \times BW \times AT}{ED \times EF \times SA \times AF \times ABS \times CF_1 \times 1/RfDd}$$

$$C = \frac{1}{(1/SLing) + (1/SLinh) + (1/SLder)}$$

Variables:		Variable Values	Reference
C =	Allowable concentration in soil [milligrams per kilogram (mg/kg)]	Chemical-specific	Calculated
THI =	Target hazard index (unitless)	1	USEPA, 1991b
BW =	Body weight (kg)	70	USEPA, 1989c
AT =	Averaging time (days)	180	30 days/month x 6 months
ED =	Exposure duration (years)	1	Standard
EF =	Exposure frequency (days/year)	37	Assumed 6 months of utility work
CF_1 =	Conversion factor (kg/mg)	1E-06	Standard
CF_2 =	Conversion factor (day/hours)	4E-02	Standard
IRs =	Ingestion rate of soil (mg/day)	330	USEPA, 2002
FI =	Fraction ingested from contaminated source (unitless)	1	Assumed worst case value
RfDo =	Oral reference dose (mg/kg/day)	Chemical-specific	USEPA, 2013a
ET =	Exposure time (hours/day)	1.5	Standard working day
PEF =	Particle emission factor (m^3/kg)	1.32E+09	USEPA, 2002
VFout =	Volatilization factor for outdoor air (m^3/kg)	Chemical-specific	Calculated
RfC =	Reference concentration (mg/m^3)	Chemical-specific	USEPA, 2013a
SA =	Surface area of exposed skin [square centimeters per day (cm^2/day)]	3,300	USEPA, 1997b
AF =	Soil-to-skin adherence factor (mg/cm^2)	0.3	USEPA, 2002
ABS =	Absorption factor (unitless) - VOCs	0	USEPA, 2004
RfDd =	Adjusted oral reference dose for dermal exposure (mg/kg/day)	Chemical-specific	USEPA, 2013a
SLing =	Allowable concentration for ingestion of soil (mg/kg)	Chemical-specific	Calculated
SLinh =	Allowable concentration for inhalation of particulates and vapors (mg/kg)	Chemical-specific	Calculated
SLder =	Allowable concentration for dermal contact with soil (mg/kg)	Chemical-specific	Calculated

Chemicals Detected Above Screening Levels	VFout (m^3/kg)	Toxicity Information RfDo (mg/kg/day)	RfC (mg/m^3)	RfDd (mg/kg/day)	SLing (mg/kg)	SLinh (mg/kg)	SLder (mg/kg)	Allowable Chemical Concentration in Soil (mg/kg)
Trichloroethene (TCE)	2.86E+02	5E-04	2E-03	5E-04	5.16E+02	4.45E+01	0	4.10E+01

Notes:
NAv - Not available
NC - Not calculated

Table 2-29
Allowable Chemical Concentrations in Soil for Cancer Effects
Current/Future Demolition Worker Scenario
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Equation:

$$SLing = \frac{TR \times BW \times AT}{ED \times EF \times CF_1 \times IRs \times FI \times SFo}$$

$$SLinh = \frac{TR \times AT}{ED \times EF \times ET \times CF_2 \times (1/PEF + 1/VFout) \times IUR}$$

$$SLder = \frac{TR \times BW \times AT}{ED \times EF \times SA \times AF \times ABS \times CF_1 \times SFd}$$

$$C = \frac{1}{(1/SLing) + (1/SLinh) + (1/SLder)}$$

Variables:		Variable Values	Reference
C =	Allowable concentration in soil [milligrams per kilogram (mg/kg)]	Chemical-specific	Calculated
TR =	Target risk level (unitless)	1E-05	USEPA, 1991b
BW =	Body weight (kg)	70	USEPA, 1989c
AT =	Averaging time (days)	25,550	70 years
ED =	Exposure duration (years)	1	Standard
EF =	Exposure frequency (days/year)	37	Assumed 6 months of utility wo
CF_1 =	Conversion factor (kg/mg)	1E-06	Standard
CF_2 =	Conversion factor (day/hours)	4E-02	Standard
IRs =	Ingestion rate of soil (mg/day)	330	USEPA, 2002
FI =	Fraction ingested from contaminated source (unitless)	1	Assumed worst case value
SFo =	Oral slope factor 1/(mg/kg/day)	Chemical-specific	USEPA, 2013a
ET =	Exposure time (hours/day)	1.5	Standard working day
PEF =	Particle emission factor (m^3/kg)	1.32E+09	USEPA, 2002
VFout =	Volatilization factor for outdoor air (m^3/kg)	Chemical-specific	Calculated
IUR =	Inhalation unit risk 1/(mg/m^3)	Chemical-specific	USEPA, 2013a
SA =	Surface area of exposed skin [square centimeters per day (cm^2/day)]	3,300	USEPA, 1997b
AF =	Soil-to-skin adherence factor (mg/cm^2)	0.3	USEPA, 2002
ABS =	Absorption factor (unitless) - VOCs	0	USEPA, 2004
SFd =	Adjusted oral slope factor for dermal exposure 1/(mg/kg/day)	Chemical-specific	USEPA, 2013a
SLing =	Allowable concentration for ingestion of soil (mg/kg)	Chemical-specific	Calculated
SLinh =	Allowable concentration for inhalation of particulates and vapors (mg/kg)	Chemical-specific	Calculated
SLder =	Allowable concentration for dermal contact with soil (mg/kg)	Chemical-specific	Calculated

Chemicals Detected Above Screening Levels	VFout (m^3/kg)	Toxicity Information: SFo 1/(mg/kg/day)	Toxicity Information: IUR 1/(mg/m^3)	Toxicity Information: SFd 1/(mg/kg/day)	SLing (mg/kg)	SLinh (mg/kg)	SLder (mg/kg)	Allowable Chemical Concentration in Soil (mg/kg)
Trichloroethene (TCE)	2.86E+02	4.6E-02	4.1E-03	4.6E-02	3.2E+04	7.7E+03	0	6.21E+03

Notes:
NAp - Not applicable
NAv - Not available
NC - Not calculated

Table 2-30
Allowable Chemical Concentrations in Groundwater for Noncancer Effects
Current/Future Demolition Worker Scenario
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Equation:

$$SLing = \frac{THI \times BW \times AT \times CF_1}{ED \times EF \times IRw \times 1/RfDo}$$

$$SLinh = \frac{THI \times AT \times CF_1}{ED \times EF \times ET \times CF_2 \times 1/RfC \times K}$$

$$SLder = \frac{DAevent \times CF_3}{FA \times Kp \times [(ETd/1+B)+(2 \times Tevent \times (1+3B+3B^2)/(1+B)^2)]} \quad \text{Or} \quad SLder = \frac{DAevent \times CF_3}{2 \times FA \times Kp \times ((6 \times Tevent \times ETd)/\pi)^{1/2}}$$

$$C = \frac{1}{(1/SLing) + (1/SLinh) + (1/SLder)}$$

Variables:		Variable Values	Reference
C =	Allowable concentration in groundwater [micrograms per liter (ug/L)]	Chemical-specific	Calculated
THI =	Target hazard index (unitless)	1	USEPA, 1991b
BW =	Body weight (kg)	70	USEPA, 1989c
AT =	Averaging time (days)	180	30 days/month x 6 months
CF_1 =	Conversion factor (ug/mg)	1E+03	Standard
ED =	Exposure duration (years)	1	Standard
EF =	Exposure frequency (days/year)	37	Assumed 6 months of utility work
IRw =	Ingestion rate of tapwater (L/day)	2	USEPA, 1991b
RfDo =	Oral reference dose (mg/kg/day)	Chemical-specific	USEPA, 2013a
ET =	Exposure time (hours/day)	1.5	Standard working day
CF_2 =	Conversion factor (day/hours)	4E-02	Standard
ETd =	Exposure time (hours/event)	1	USEPA, 2004
RfC =	Reference concentration (mg/m^3)	Chemical-specific	USEPA, 2013a
K =	Volatilization factor (L/m^3)	0.5	Standard
DAevent =	Absorbed dose per event (ug/cm^2-event)	Chemical-specific	Calculated
CF_3 =	Conversion factor (cm^3/L)	1E+03	Standard
FA =	Fraction absorbed water (unitless)	Chemical-specific	USEPA, 2004
Kp =	Dermal permeability coefficient in water (cm/hour)	Chemical-specific	USEPA, 2004
B =	Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (ve) (unitless)	Chemical-specific	USEPA, 2004
Tevent =	Lag time per event (hours/event)	Chemical-specific	USEPA, 2004
SLing =	Allowable concentration for ingestion of soil (mg/kg)	Chemical-specific	Calculated
SLinh =	Allowable concentration for inhalation of particulates and vapors (mg/kg)	Chemical-specific	Calculated
SLder =	Allowable concentration for dermal contact with soil (mg/kg)	Chemical-specific	Calculated

Table 2-30
Allowable Chemical Concentrations in Groundwater for Noncancer Effects
Current/Future Demolition Worker Scenario
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Chemicals Detected Above Screening Levels	Toxicity Information		DAevent	FA	Kp	B	Tevent	SLing	SLinh	SLder	Allowable Chemical Concentration in Groundwater
	RfDo (mg/kg/day)	RfC (mg/m^3)	(ug/cm^2-event)	(unitless)	(cm/hour)	(unitless)	(hours/event)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
Naphthalene	2E-02	3E-03	4.17E-04	1.0	4.70E-02	2.00E-01	5.60E-01	3.41E+03	4.67E+02	4.09E+00	4.05E+00
1,1,2,2-Tetrachloroethane (PCA)	2E-02	NAv	1.17E-03	1.0	6.90E-03	0.00E+00	9.30E-01	3.41E+03	NC	6.36E+01	6.24E+01
bis(2-ethylhexyl)phthalate	2E-02	NAv	NAv	NAv	NAv	NAv	NAv	3.41E+03	NC	NC	3.41E+03

Notes:
NAv - Not available
NC - Not calculated

Table 2-31
Allowable Chemical Concentrations in Groundwater for Cancer Effects
Current/Future Demolition Worker Scenario
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Equation:

$$SLing = \frac{TR \times BW \times AT \times CF_1}{ED \times EF \times IRw \times SFo}$$

$$SLinh = \frac{TR \times AT}{ED \times EF \times ET \times CF_2 \times IUR \times K}$$

$$SLder = \frac{DAevent \times CF_3}{FA \times Kp \times [(ETd/1+B)+(2 \times Tevent \times (1+3B+3B^2)/(1+B)^2)]}$$ Or $$SLder = \frac{DAevent \times CF_3}{2 \times FA \times Kp \times ((6 \times Tevent \times ETd)/\pi)^{1/2}}$$

$$C = \frac{1}{(1/SLing) + (1/SLinh) + (1/SLder)}$$

Variables:		Variable Values	Reference
C =	Allowable concentration in groundwater [micrograms per liter (ug/L)]	Chemical-specific	Calculated
TR =	Target risk level (unitless)	1E-05	USEPA, 1991b
BW =	Body weight (kg)	70	USEPA, 1989c
AT =	Averaging time (days)	25,550	70 years
CF_1 =	Conversion factor (ug/mg)	1E+03	Standard
ED =	Exposure duration (years)	1	Standard
EF =	Exposure frequency (days/year)	37	Assumed 6 months of utility work
IRw =	Ingestion rate of tapwater (L/day)	2	USEPA, 1991b
SFo =	Oral slope factor 1/(mg/kg/day)	Chemical-specific	USEPA, 2013a
ET =	Exposure time (hours/day)	1.5	Standard working day
CF_2 =	Conversion factor (day/hours)	4.2E-02	Standard
ETd =	Exposure time (hours/event)	1	USEPA, 2004
IUR =	Inhalation unit risk 1/(ug/m^3)	Chemical-specific	USEPA, 2013a
K =	Volatilization factor (L/m^3)	0.5	Standard
DAevent =	Absorbed dose per event (ug/cm^2-event)	Chemical-specific	Standard
CF_3 =	Conversion factor (cm^3/L)	1E+03	Standard
FA =	Fraction absorbed water (unitless)	Chemical-specific	USEPA, 2004
Kp =	Dermal permeability coefficient in water (cm/hour)	Chemical-specific	USEPA, 2004
B =	Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (ve) (unitless)	Chemical-specific	USEPA, 2004
Tevent =	Lag time per event (hours/event)	Chemical-specific	USEPA, 2004
SLing =	Allowable concentration for ingestion of soil (ug/L)	Chemical-specific	Calculated
SLinh =	Allowable concentration for inhalation of particulates and vapors (ug/L)	Chemical-specific	Calculated
SLder =	Allowable concentration for dermal contact with soil (ug/L)	Chemical-specific	Calculated

Table 2-31
Allowable Chemical Concentrations in Groundwater for Cancer Effects
Current/Future Demolition Worker Scenario
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Chemicals Detected Above Screening Levels	Toxicity Information		DAevent	FA	Kp	B	Tevent	SLing	SLinh	SLder	Allowable Chemical Concentration in Groundwater
	SFo	IUR									
	1/(mg/kg/day)	1/(ug/m^3)	(ug/cm^2-event)	(unitless)	(cm/hour)	(unitless)	(hours/event)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
Naphthalene	NAv	3.4E-05	4.17E-04	1.0	4.70E-02	2.00E-01	5.60E-01	NC	6.50E+03	4.09E+00	4.08E+00
1,1,2,2-Tetrachloroethane (PCA)	2.0E-01	5.8E-05	1.17E-03	1.0	6.90E-03	0.00E+00	9.30E-01	1.21E+03	3.81E+03	6.36E+01	5.95E+01
bis(2-ethylhexyl)phthalate	1.4E-02	2.4E-06	NAv	NAv	NAv	NAv	NAv	1.73E+04	9.21E+04	NC	1.45E+04

Notes:
NAv - Not available
NC - Not calculated

Table 2-32
Allowable Chemical Concentrations in Surface Water for Noncancer Effects
Current/Future Demolition Worker Scenario
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Equation:

$$C = \frac{DAevent \times CF}{FA \times Kp \times [(ETd/1+B)+(2 \times Tevent \times (1+3B+3B^2)/(1+B)^2)]} \quad \text{Or} \quad C = \frac{DAevent \times CF}{2 \times FA \times Kp \times ((6 \times Tevent \times ET)/\pi)^{1/2}}$$

Where

$$DAevent = \frac{DAD \times AT \times BW}{EV \times ED \times EF \times SA} \quad \text{and} \quad DAD = THI \times RfDo$$

Variables:		Variable Values	Reference
C =	Allowable concentration in surface water [micrograms per liter (ug/L)]	Chemical-specific	Calculated
DAevent =	Absorbed dose per event (ug/cm^2-event)	Chemical-specific	Calculated
CF =	Conversion factor (ug/L)	1E+06	Standard
FA =	Fraction absorbed water (unitless)	Chemical-specific	USEPA, 2004
Kp =	Dermal permeability coefficient in water (cm/hour)	Chemical-specific	USEPA, 2004
ETd =	Exposure time (hours/event)	1	USEPA, 2004
B =	Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (ve) (unitless)	Chemical-specific	USEPA, 2004
Tevent =	Lag time per event (hours/event)	Chemical-specific	USEPA, 2004
DAD =	Dermal absorbed dose (mg/kg-day)	Chemical-specific	Calculated
AT =	Averaging time (days)	180	70 years
BW =	Body weight (kg)	70	USEPA, 1989c
EV =	Event frequency (events/day)	1	Standard
ED =	Exposure duration (years)	1	Standard
EF =	Exposure frequency (days/year)	37	Assumed 6 months of utility worl
SA =	Surface area of exposed skin [square centimeters per day (cm²/day)]	3,300	USEPA, 1997b
THI =	Target hazard index (unitless)	1	USEPA, 1991b
RfDo =	Oral reference dose (mg/kg/day)	Chemical-specific	USEPA, 2013a

Chemicals Detected Above Screening Levels	Toxicity Information: RfDo (mg/kg/day)	Toxicity Information: DAD (mg/kg/day)	DAevent (mg/cm^2-event)	FA (unitless)	Kp (cm/hour)	B (unitless)	Tevent (hours/event)	Allowable Chemical Concentration in Surface Water (ug/L)
1,1,2,2-Tetrachloroethane (PCA)	2E-02	2E-02	2.06E-03	1.0	6.90E-03	0.00E+00	9.30E-01	1.12E+05
Trichloroethene (TCE)	5E-04	5E-04	5.16E-05	1.0	1.20E-02	1.00E-01	5.80E-01	2.04E+03
Benzo(a)pyrene	NAv	NC	NC	1.0	7.00E-01	4.30E+00	2.69E+00	NC

Notes:
NAv - Not available
NC - Not calculated

Table 2-33
Allowable Chemical Concentrations in Surface Water for Cancer Effects
Current/Future Demolition Worker Scenario
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Equation:

$$C = \frac{DAevent \times CF}{FA \times Kp \times [(ETd/1+B)+(2 \times Tevent \times (1+3B+3B^2)/(1+B)^2)]}$$ Or $$C = \frac{DAevent \times CF}{2 \times FA \times Kp \times ((6 \times Tevent \times ET)/\pi)^{1/2}}$$

Where

$$DAevent = \frac{DAD \times AT \times BW}{EV \times ED \times EF \times SA}$$ and $$DAD = \frac{TR}{SFo}$$

Variables:		Variable Values	Reference
C =	Allowable concentration in surface water [micrograms per liter (ug/L)]	Chemical-specific	Calculated
DAevent =	Absorbed dose per event (ug/cm^2-event)	Chemical-specific	Standard
CF =	Conversion factor (ug/L)	1E+06	Standard
FA =	Fraction absorbed water (unitless)	Chemical-specific	USEPA, 2004
Kp =	Dermal permeability coefficient in water (cm/hour)	Chemical-specific	USEPA, 2004
ETd =	Exposure time (hours/event)	1	USEPA, 2004
B =	Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (ve) (unitless)	Chemical-specific	USEPA, 2004
Tevent =	Lag time per event (hours/event)	Chemical-specific	USEPA, 2004
DAD =	Dermal absorbed dose (mg/kg-day)	Chemical-specific	Calculated
AT =	Averaging time (days)	25,550	70 years
BW =	Body weight (kg)	70	USEPA, 1989c
EV =	Event frequency (events/day)	1	Standard
ED =	Exposure duration (years)	1	Standard
EF =	Exposure frequency (days/year)	37	Assumed 6 months of utility worl
SA =	Surface area of exposed skin [square centimeters per day (cm²/day)]	3,300	USEPA, 1997b
TR =	Target risk (unitless)	1E-05	USEPA, 1991b
SFo =	Oral slope factor 1/(mg/kg/day)	Chemical-specific	USEPA, 2013a

Chemicals Detected Above Screening Levels	Toxicity Information: SFo 1/(mg/kg/day)	Toxicity Information: DAD (mg/kg/day)	DAevent (mg/cm^2-event)	FA (unitless)	Kp (cm/hour)	B (unitless)	Tevent (hours/event)	Allowable Chemical Concentration in Surface Water (ug/L)
1,1,2,2-Tetrachloroethane (PCA)	2.0E-01	5.0E-05	7.32E-04	1.0	6.90E-03	0.00E+00	9.30E-01	3.98E+04
Trichloroethene (TCE)	4.6E-02	2.2E-04	3.18E-03	1.0	1.20E-02	1.00E-01	5.80E-01	1.26E+05
Benzo(a)pyrene	7.3E+00	1.4E-06	2.01E-05	1.0	7.00E-01	4.30E+00	2.69E+00	6.32E+00

Notes:
NAv - Not available
NC - Not calculated

Table 2-34
Allowable Chemical Concentrations in Soil for Noncancer Effects
Current/Future Site Worker Scenario
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Equation:

$$SLing = \frac{THI \times BW \times AT}{ED \times EF \times CF_1 \times IRs \times FI \times 1/RfDo}$$

$$SLinh = \frac{THI \times AT}{ED \times EF \times ET \times CF_2 \times (1/PEF + 1/VFout) \times 1/RfC}$$

$$SLder = \frac{THI \times BW \times AT}{ED \times EF \times SA \times AF \times ABS \times CF_1 \times 1/RfDd}$$

$$C = \frac{1}{(1/SLing) + (1/SLinh) + (1/SLder)}$$

Variables:		Variable Values	Reference
C =	Allowable concentration in soil [milligrams per kilogram (mg/kg)]	Chemical-specific	Calculated
THI =	Target hazard index (unitless)	1	USEPA, 1991b
BW =	Body weight (kg)	70	USEPA, 1989c
AT =	Averaging time (days)	9,125	ED x 365 days/year
ED =	Exposure duration (years)	25	USEPA, 1991b
EF =	Exposure frequency (days/year)	250	USEPA, 1991b
CF_1 =	Conversion factor (kg/mg)	1E-06	Standard
CF_2 =	Conversion factor (day/hours)	4E-02	Standard
IRs =	Ingestion rate of soil (mg/day)	100	USEPA, 2002
FI =	Fraction ingested from contaminated source (unitless)	1	Assumed worst case value
RfDo =	Oral reference dose (mg/kg/day)	Chemical-specific	USEPA, 2013a
ET =	Exposure time (hours/day)	8	Standard working day
PEF =	Particle emission factor (m^3/kg)	1.32E+09	USEPA, 2002
VFout =	Volatilization factor for outdoor air (m^3/kg)	Chemical-specific	Calculated
RfC =	Reference concentration (mg/m^3)	Chemical-specific	USEPA, 2013a
SA =	Surface area of exposed skin [square centimeters per day (cm^2/day)]	3,300	USEPA, 1997b
AF =	Soil-to-skin adherence factor (mg/cm^2)	0.2	USEPA, 2002
ABS =	Absorption factor (unitless) - VOCs	0	USEPA, 2004
RfDd =	Adjusted oral reference dose for dermal exposure (mg/kg/day)	Chemical-specific	USEPA, 2013a
SLing =	Allowable concentration for ingestion of soil (mg/kg)	Chemical-specific	Calculated
SLinh =	Allowable concentration for inhalation of particulates and vapors (mg/kg)	Chemical-specific	Calculated
SLder =	Allowable concentration for dermal contact with soil (mg/kg)	Chemical-specific	Calculated

Chemicals Detected Above Screening Levels	VFout (m^3/kg)	Toxicity Information: RfDo (mg/kg/day)	Toxicity Information: RfC (mg/m^3)	Toxicity Information: RfDd (mg/kg/day)	SLing (mg/kg)	SLinh (mg/kg)	SLder (mg/kg)	Allowable Chemical Concentration in Soil (mg/kg)
Trichloroethene (TCE)	1.25E+03	5E-04	2E-03	5E-04	5.11E+02	1.09E+01	0	1.07E+01

Notes:
NAv - Not available
NC - Not calculated

Table 2-35
Allowable Chemical Concentrations in Soil for Cancer Effects
Current/Future Site Worker Scenario
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Equation:

$$SLing = \frac{TR \times BW \times AT}{ED \times EF \times CF_1 \times IRs \times FI \times SFo}$$

$$SLinh = \frac{TR \times AT}{ED \times EF \times ET \times CF_2 \times (1/PEF + 1/VFout) \times IUR}$$

$$SLder = \frac{TR \times BW \times AT}{ED \times EF \times SA \times AF \times ABS \times CF_1 \times SFd}$$

$$C = \frac{1}{(1/SLing) + (1/SLinh) + (1/SLder)}$$

Variables:		Variable Values	Reference
C =	Allowable concentration in soil [milligrams per kilogram (mg/kg)]	Chemical-specific	Calculated
TR =	Target risk level (unitless)	1E-05	USEPA, 1991b
BW =	Body weight (kg)	70	USEPA, 1989c
AT =	Averaging time (days)	25,550	70 years
ED =	Exposure duration (years)	25	USEPA, 1991b
EF =	Exposure frequency (days/year)	250	USEPA, 1991b
CF_1 =	Conversion factor (kg/mg)	1E-06	Standard
CF_2 =	Conversion factor (day/hours)	4E-02	Standard
IRs =	Ingestion rate of soil (mg/day)	100	USEPA, 2002
FI =	Fraction ingested from contaminated source (unitless)	1	Assumed worst case value
SFo =	Oral slope factor 1/(mg/kg/day)	Chemical-specific	USEPA, 2013a
ET =	Exposure time (hours/day)	8	Standard working day
PEF =	Particle emission factor (m^3/kg)	1.32E+09	USEPA, 2002
VFout =	Volatilization factor for outdoor air (m^3/kg)	Chemical-specific	Calculated
IUR =	Inhalation unit risk 1/(mg/m^3)	Chemical-specific	USEPA, 2013a
SA =	Surface area of exposed skin [square centimeters per day (cm^2/day)]	3,300	USEPA, 1997b
AF =	Soil-to-skin adherence factor (mg/cm^2)	0.2	USEPA, 2002
ABS =	Absorption factor (unitless) - VOCs	0	USEPA, 2004
SFd =	Adjusted oral slope factor for dermal exposure 1/(mg/kg/day)	Chemical-specific	USEPA, 2013a
SLing =	Allowable concentration for ingestion of soil (mg/kg)	Chemical-specific	Calculated
SLinh =	Allowable concentration for inhalation of particulates and vapors (mg/kg)	Chemical-specific	Calculated
SLder =	Allowable concentration for dermal contact with soil (mg/kg)	Chemical-specific	Calculated

Chemicals Detected Above Screening Levels	VFout (m^3/kg)	Toxicity Information: SFo 1/(mg/kg/day)	Toxicity Information: IUR 1/(mg/m^3)	Toxicity Information: SFd 1/(mg/kg/day)	SLing (mg/kg)	SLinh (mg/kg)	SLder (mg/kg)	Allowable Chemical Concentration in Soil (mg/kg)
Trichloroethene (TCE)	1.25E+03	4.6E-02	4.1E-03	4.6E-02	6.2E+02	3.7E+01	0	3.53E+01

Notes:
NAp - Not applicable
NAv - Not available
NC - Not calculated

Table 2-36
Allowable Chemical Concentrations in Groundwater for Noncancer Effects
Current/Future Site Worker Scenario
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Equation:

$$SLing = \frac{THI \times BW \times AT \times CF_1}{ED \times EF \times IRw \times 1/RfDo}$$

$$SLinh = \frac{THI \times AT \times CF_1}{ED \times EF \times ET \times CF_2 \times 1/RfC \times K}$$

$$SLder = \frac{DAevent \times CF_3}{FA \times Kp \times [(ETd/1+B)+(2 \times Tevent \times (1+3B+3B^2)/(1+B)^2)]} \quad \text{Or} \quad SLder = \frac{DAevent \times CF_3}{2 \times FA \times Kp \times ((6 \times Tevent \times ETd)/\pi)^{1/2}}$$

$$C = \frac{1}{(1/SLing) + (1/SLinh) + (1/SLder)}$$

Variables:		Variable Values	Reference
C =	Allowable concentration in groundwater [micrograms per liter (ug/L)]	Chemical-specific	Calculated
THI =	Target hazard index (unitless)	1	USEPA, 1991b
BW =	Body weight (kg)	70	USEPA, 1989c
AT =	Averaging time (days)	9,125	ED x 365 days/year
CF_1 =	Conversion factor (ug/mg)	1E+03	Standard
ED =	Exposure duration (years)	25	USEPA, 1991b
EF =	Exposure frequency (days/year)	250	USEPA, 1991b
IRw =	Ingestion rate of tapwater (L/day)	2	USEPA, 1991b
RfDo =	Oral reference dose (mg/kg/day)	Chemical-specific	USEPA, 2013a
ET =	Exposure time (hours/day)	8	Standard working day
CF_2 =	Conversion factor (day/hours)	4E-02	Standard
ETd =	Exposure time (hours/event)	1	USEPA, 2004
RfC =	Reference concentration (mg/m^3)	Chemical-specific	USEPA, 2013a
K =	Volatilization factor (L/m^3)	0.5	Standard
DAevent =	Absorbed dose per event (ug/cm^2-event)	Chemical-specific	Calculated
CF_3 =	Conversion factor (cm^3/L)	1E+03	Standard
FA =	Fraction absorbed water (unitless)	Chemical-specific	USEPA, 2004
Kp =	Dermal permeability coefficient in water (cm/hour)	Chemical-specific	USEPA, 2004
B =	Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (ve) (unitless)	Chemical-specific	USEPA, 2004
Tevent =	Lag time per event (hours/event)	Chemical-specific	USEPA, 2004
SLing =	Allowable concentration for ingestion of soil (mg/kg)	Chemical-specific	Calculated
SLinh =	Allowable concentration for inhalation of particulates and vapors (mg/kg)	Chemical-specific	Calculated
SLder =	Allowable concentration for dermal contact with soil (mg/kg)	Chemical-specific	Calculated

Table 2-36
Allowable Chemical Concentrations in Groundwater for Noncancer Effects
Current/Future Site Worker Scenario
Record of Decision
Open Burning / Open Detonation Ground (Range 16)

Chemicals Detected Above Screening Levels	Toxicity Information		DAevent	FA	Kp	B	Tevent	SLing	SLinh	SLder	Allowable Chemical Concentration in Groundwater
	RfDo (mg/kg/day)	RfC (mg/m^3)	(ug/cm^2-event)	(unitless)	(cm/hour)	(unitless)	(hours/event)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
Naphthalene	2E-02	3E-03	4.17E-04	1.0	4.70E-02	2.00E-01	5.60E-01	1.02E+03	2.63E+01	4.09E+00	3.52E+00
1,1,2,2-Tetrachloroethane (PCA)	2E-02	NAv	1.17E-03	1.0	6.90E-03	0.00E+00	9.30E-01	1.02E+03	NC	6.36E+01	5.99E+01

Notes:
NAv - Not available
NC - Not calculated

Table 2-37
Allowable Chemical Concentrations in Groundwater for Cancer Effects
Current/Future Site Worker Scenario
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Equation:

$$SLing = \frac{TR \times BW \times AT \times CF_1}{ED \times EF \times IRw \times SFo}$$

$$SLinh = \frac{TR \times AT}{ED \times EF \times ET \times CF_2 \times IUR \times K}$$

$$SLder = \frac{DAevent \times CF_3}{FA \times Kp \times [(ETd/1+B)+(2 \times Tevent \times (1+3B+3B^2)/(1+B)^2)]}$$ Or $$SLder = \frac{DAevent \times CF_3}{2 \times FA \times Kp \times ((6 \times Tevent \times ETd)/\pi)^{1/2}}$$

$$C = \frac{1}{(1/SLing) + (1/SLinh) + (1/SLder)}$$

Variables:		Variable Values	Reference
C =	Allowable concentration in groundwater [micrograms per liter (ug/L)]	Chemical-specific	Calculated
TR =	Target risk level (unitless)	1E-05	USEPA, 1991b
BW =	Body weight (kg)	70	USEPA, 1989c
AT =	Averaging time (days)	25,550	70 years
CF_1 =	Conversion factor (ug/mg)	1E+03	Standard
ED =	Exposure duration (years)	25	USEPA, 1991b
EF =	Exposure frequency (days/year)	250	USEPA, 1991b
IRw =	Ingestion rate of tapwater (L/day)	2	USEPA, 1991b
SFo =	Oral slope factor 1/(mg/kg/day)	Chemical-specific	USEPA, 2013a
ET =	Exposure time (hours/day)	8	Standard working day
CF_2 =	Conversion factor (day/hours)	4.2E-02	Standard
ETd =	Exposure time (hours/event)	1	USEPA, 2004
IUR =	Inhalation unit risk 1/(ug/m^3)	Chemical-specific	USEPA, 2013a
K =	Volatilization factor (L/m^3)	0.5	Standard
DAevent =	Absorbed dose per event (ug/cm^2-event)	Chemical-specific	Standard
CF_3 =	Conversion factor (cm^3/L)	1E+03	Standard
FA =	Fraction absorbed water (unitless)	Chemical-specific	USEPA, 2004
Kp =	Dermal permeability coefficient in water (cm/hour)	Chemical-specific	USEPA, 2004
B =	Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (ve) (unitless)	Chemical-specific	USEPA, 2004
Tevent =	Lag time per event (hours/event)	Chemical-specific	USEPA, 2004
SLing =	Allowable concentration for ingestion of soil (ug/L)	Chemical-specific	Calculated
SLinh =	Allowable concentration for inhalation of particulates and vapors (ug/L)	Chemical-specific	Calculated
SLder =	Allowable concentration for dermal contact with soil (ug/L)	Chemical-specific	Calculated

Table 2-37
Allowable Chemical Concentrations in Groundwater for Cancer Effects
Current/Future Site Worker Scenario
Record of Decision
Open Burning / Open Detonation Ground (Range 16)

Chemicals Detected Above Screening Levels	Toxicity Information SFo 1/(mg/kg/day)	Toxicity Information IUR 1/(ug/m^3)	DAevent (ug/cm^2-event)	FA (unitless)	Kp (cm/hour)	B (unitless)	Tevent (hours/event)	SLing (ug/L)	SLinh (ug/L)	SLder (ug/L)	Allowable Chemical Concentration in Groundwater (ug/L)
Naphthalene	NAv	3.4E-05	4.17E-04	1.0	4.70E-02	2.00E-01	5.60E-01	NC	7.21E+00	4.09E+00	2.61E+00
1,1,2,2-Tetrachloroethane (PCA)	2.0E-01	5.8E-05	1.17E-03	1.0	6.90E-03	0.00E+00	9.30E-01	7.15E+00	4.23E+00	6.36E+01	2.55E+00

Notes:
NAv - Not available
NC - Not calculated

Table 2-38
Allowable Chemical Concentrations in Surface Water for Noncancer Effects
Current/Future Site Worker Scenario
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Equation:

$$C = \frac{DAevent \times CF}{FA \times Kp \times [(ETd/1+B)+(2 \times Tevent \times (1+3B+3B^2)/(1+B)^2)]}$$ Or $$C = \frac{DAevent \times CF}{2 \times FA \times Kp \times ((6 \times Tevent \times ET)/\pi)^{1/2}}$$

Where

$$DAevent = \frac{DAD \times AT \times BW}{EV \times ED \times EF \times SA}$$ and $$DAD = THI \times RfDo$$

Variables:		Variable Values	Reference
C =	Allowable concentration in surface water [micrograms per liter (ug/L)]	Chemical-specific	Calculated
DAevent =	Absorbed dose per event (ug/cm^2-event)	Chemical-specific	Calculated
CF =	Conversion factor (ug/L)	1E+06	Standard
FA =	Fraction absorbed water (unitless)	Chemical-specific	USEPA, 2004
Kp =	Dermal permeability coefficient in water (cm/hour)	Chemical-specific	USEPA, 2004
ETd =	Exposure time (hours/event)	1	USEPA, 2004
B =	Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (ve) (unitless)	Chemical-specific	USEPA, 2004
Tevent =	Lag time per event (hours/event)	Chemical-specific	USEPA, 2004
DAD =	Dermal absorbed dose (mg/kg-day)	Chemical-specific	Calculated
AT =	Averaging time (days)	9,125	70 years
BW =	Body weight (kg)	70	USEPA, 1989c
EV =	Event frequency (events/day)	1	Standard
ED =	Exposure duration (years)	25	Standard
EF =	Exposure frequency (days/year)	250	Assumed 6 months of utility worl
SA =	Surface area of exposed skin [square centimeters per day (cm²/day)]	3,300	USEPA, 1997b
THI =	Target hazard index (unitless)	1	USEPA, 1991b
RfDo =	Oral reference dose (mg/kg/day)	Chemical-specific	USEPA, 2013a

Chemicals Detected Above Screening Levels	Toxicity Information: RfDo (mg/kg/day)	Toxicity Information: DAD (mg/kg/day)	DAevent (mg/cm^2-event)	FA (unitless)	Kp (cm/hour)	B (unitless)	Tevent (hours/event)	Allowable Chemical Concentration in Surface Water (ug/L)
1,1,2,2-Tetrachloroethane (PCA)	2E-02	2E-02	6.19E-04	1.0	6.90E-03	0.00E+00	9.30E-01	3.37E+04
Trichloroethene (TCE)	5E-04	5E-04	1.55E-05	1.0	1.20E-02	1.00E-01	5.80E-01	6.13E+02
Benzo(a)pyrene	NAv	NC	NC	1.0	7.00E-01	4.30E+00	2.69E+00	NC

Notes:
NAv - Not available
NC - Not calculated

Table 2-39
Allowable Chemical Concentrations in Surface Water for Cancer Effects
Current/Future Site Worker Scenario
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Equation:

$$C = \frac{DAevent \times CF}{FA \times Kp \times [(ETd/1+B)+(2 \times Tevent \times (1+3B+3B^2)/(1+B)^2)]} \quad \text{Or} \quad C = \frac{DAevent \times CF}{2 \times FA \times Kp \times ((6 \times Tevent \times ET)/\pi)^{1/2}}$$

Where

$$DAevent = \frac{DAD \times AT \times BW}{EV \times ED \times EF \times SA} \quad \text{and} \quad DAD = \frac{TR}{SFo}$$

Variables:		Variable Values	Reference
C =	Allowable concentration in surface water [micrograms per liter (ug/L)]	Chemical-specific	Calculated
DAevent =	Absorbed dose per event (ug/cm^2-event)	Chemical-specific	Standard
CF =	Conversion factor (ug/L)	1E+06	Standard
FA =	Fraction absorbed water (unitless)	Chemical-specific	USEPA, 2004
Kp =	Dermal permeability coefficient in water (cm/hour)	Chemical-specific	USEPA, 2004
ETd =	Exposure time (hours/event)	1	USEPA, 2004
B =	Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (ve) (unitless)	Chemical-specific	USEPA, 2004
Tevent =	Lag time per event (hours/event)	Chemical-specific	USEPA, 2004
DAD =	Dermal absorbed dose (mg/kg-day)	Chemical-specific	Calculated
AT =	Averaging time (days)	25,550	70 years
BW =	Body weight (kg)	70	USEPA, 1989c
EV =	Event frequency (events/day)	1	Standard
ED =	Exposure duration (years)	25	Standard
EF =	Exposure frequency (days/year)	250	Assumed 6 months of utility worl
SA =	Surface area of exposed skin [square centimeters per day (cm²/day)]	3,300	USEPA, 1997b
TR =	Target risk (unitless)	1E-05	USEPA, 1991b
SFo =	Oral slope factor 1/(mg/kg/day)	Chemical-specific	USEPA, 2013a

Chemicals Detected Above Screening Levels	Toxicity Information: SFo 1/(mg/kg/day)	Toxicity Information: DAD (mg/kg/day)	DAevent (mg/cm^2-event)	FA (unitless)	Kp (cm/hour)	B (unitless)	Tevent (hours/event)	Allowable Chemical Concentration in Surface Water (ug/L)
1,1,2,2-Tetrachloroethane (PCA)	2.0E-01	5.0E-05	4.34E-06	1.0	6.90E-03	0.00E+00	9.30E-01	2.36E+02
Trichloroethene (TCE)	4.6E-02	2.2E-04	1.89E-05	1.0	1.20E-02	1.00E-01	5.80E-01	7.46E+02
Benzo(a)pyrene	7.3E+00	1.4E-06	1.19E-07	1.0	7.00E-01	4.30E+00	2.69E+00	3.74E-02

Notes:
NAv - Not available
NC - Not calculated

Table 2-40
Summary of Allowable Chemical Concentrations in Soil
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Chemical	Future Demolition Worker (mg/kg)		Current/Future Site Worker (mg/kg)		Preliminary Remedial Goal[2] (mg/kg)
	Noncancer	Cancer[1]	Noncancer	Cancer[1]	
Volatile Organic Compounds					
Trichloroethene (TCE)	40.99	6,205	10.72	35.27	10.72

Note:
[1] - Values calculated using a target cancer risk of 1E-05.
[2] - Preliminary Remedial Goal represents the most conservative of the calculated individual allowable concentrations, in order to remain protective of all exposures.

Table 2-41
Summary of Allowable Chemical Concentrations in Groundwater
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Chemical	Future Demolition Worker (ug/L)		Current/Future Site Worker (ug/L)		Preliminary Remedial Goal[2] (ug/L)
	Noncancer	Cancer[1]	Noncancer	Cancer[1]	
Volatile Organic Compounds					
Naphthalene	4.05	4.08	3.52	2.61	2.61
1,1,2,2-Tetrachloroethane (PCA)	62.4	59.5	59.9	2.55	2.55

Note:
[1] - Values calculated using a target cancer risk of 1E-05.
[2] - Preliminary Remedial Goal represents the most conservative of the calculated individual allowable concentrations, in order to remain protective of all exposures.

Table 2-42
Summary of Allowable Chemical Concentrations in Surface Water
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Chemical	Future Demolition Worker (ug/L)		Current/Future Site Worker (ug/L)		Preliminary Remedial Goal[2] (ug/L)
	Noncancer	Cancer[1]	Noncancer	Cancer[1]	
Volatile Organic Compounds					
1,1,2,2-Tetrachloroethane (PCA)	1.12E+05	3.98E+04	3.37E+04	2.36E+02	2.36E+02
Trichloroethene (TCE)	2.04E+03	1.26E+05	6.13E+02	7.46E+02	6.13E+02
Benzo(a)pyrene	NC	6.32E+00	NC	3.74E-02	3.74E-02

Note:
[1] - Values calculated using a target cancer risk of 1E-05.
[2] - Preliminary Remedial Goal represents the most conservative of the calculated individual allowable concentrations, in order to remain protective of all exposures.

Table 2-43
Cost Evaluation for Remedial Alternatives
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Alternative	Description	Estimated Design / Construction Timeframe	Estimated Timeframe to Achieve Soil RAOs	Estimated Timeframe to Achieve Groundwater RAOs	Estimated Timeframe to Achieve Surface Water RAOs	Capital Costs	O&M Costs (per year)	Periodic Costs (per event)	Total Present Value Costs
Alternative 1	No Action	0 months	unknown	unknown	unknown	$0	$0	$0	**$0**
Alternative 2	Soil Removal with Treatment and Disposal, Groundwater/Surface Water Monitoring, and Institutional Controls through the Fort Riley Real Property Master Plan	1 year	1 year	30 years	5 years	$ 5,150,000	$ 700,000	$ 122,000	**$ 14,100,000**
Alternative 3	In-Situ Treatment by SVE, Groundwater/Surface Water Monitoring, and Intitutional Controls through the Fort Real Property Master Plan	2 years	10 years	30 years	5 years	$ 5,963,000	$ 925,000	$ 122,000	**$ 17,700,000**
Alternative 4	Soil Removal with Treatment and Disposal, In-Situ Groundwater Treatment, Surface Water Monitoring, and Intitutional Controls through the Fort Riley Real Property Master Plan	1 year	1 year	30 years	5 years	$ 9,000,000	$ 1,154,000	$ 825,000	**$ 25,100,000**

Notes:

1. The Present Value was calculated based on Discount Rate of 7% per OSWER memorandum 9355.0-75 dated July 2000.
2. For calculating present value, a 30 year operating period was assumed.
3. Capital costs all assumed to be incurred in Year 0 for present worth calculations.

Table 2-44
Comparative Analysis of Remedial Alternatives
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Evaluation Criteria	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Protection of Human Health and the Environment	Fail	Pass	Pass	Pass
Compiance with ARARs	Fail	Pass	Pass	Pass
Long-Term Effectiveness and Permanence	-	3	3	2
Reduction of Toxicity, Mobility, or Volume through Treatment	-	3	3	2
Short-Term Effectiveness	-	3	5	3
Implementability	-	3	6	6
Cost ($Million)	-	5 (14.1)	9 (17.7)	10 (25.1)
Total of Ranking	-	17	30	23
Overall Ranking	-	1	3	2

Notes:

Alternative 1 - No Action
Alternative 2 - Soil Removal with Treatment and Disposal, Groundwater/Surface Water Monitoring, and ICs through the Fort Riley RPMP
Alternative 3 - In-Situ Treatment by SVE, Groundwater/Surface Water Monitoring, and ICs through the Fort Riley RPMP
Alternative 4 - Soil Removal with Treatment and Disposal, In-Situ Groundwater Treatment, Surface Water Monitoring, and ICs through the Fort Riley RPMP

Ranking
1 = Most Favorable
3 = Good, Generally Favorable
5 = Fair, Potentially Favorable/Potentially Unfavorable
7 = Poor, Unfavorable
10 = Least Favorable

Table 2-45
Estimated Capital Costs for Selected Remedy
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Description	Unit	Quantity	Unit Cost	Cost
2.1 Institutional Controls				
- Development of ICs				**$267,700.00**
Soil ICs	LS	1	$2,625.00	$2,600.00
Groundwater ICs	LS	1	$262,500.00	$262,500.00
Surface Water ICs	LS	1	$2,625.00	$2,600.00
-Design (10%)	LS	1	$264,706.00	**$26,770.00**
-Project Management (10%)	LS	1	$264,706.00	**$26,770.00**
-Scope Contingency (15%)	LS	1	$397,060.00	**$40,155.00**
-Bid Contingency (10%)	LS	1	$264,706.00	**$26,770.00**
2.2 Soil Removal with Treatment (Land Farming), and Disposal				
-Pre-Design (Metallic Anomaly) Investigation				**$121,275.00**
Site Clearance	LS	1	$10,500.00	$10,500.00
UXO/MEC Technician	Days	25	$1,575.00	$39,375.00
Geophysical Testing	Days	2	$3,150.00	$6,300.00
Test Pits	Day	1	$2,100.00	$2,100.00
Soil Sampling	Sample	50	$630.00	$31,500.00
Backfill Sampling and Analysis	LS	1	$5,250.00	$5,250.00
Pilot Testing for Removal Rates	LS	1	$26,250.00	$26,250.00
-General Requirements				**$1,039,900.00**
Performance and Payment Bond	LS	1	$15,500.00	$15,500.00
Insurance	LS	1	$30,500.00	$30,500.00
Mobilization	LS	1	$76,100.00	$76,100.00
Program Management/Corporate Oversight/QA	Hour	520	$210.00	$109,200.00
Project Management	Hour	1,040	$158.00	$164,320.00
Administrative Assistant	Hour	520	$79.00	$41,080.00
Job Superintendent	Hour	1,040	$132.00	$137,280.00
UXO/MEC Technician	Hour	1,040	$132.00	$137,280.00
SSHS Officer	Hour	1,040	$132.00	$137,280.00
Foreman	Hour	1,040	$79.00	$82,160.00
General Laborer	Hour	3,120	$27.00	$84,240.00
Water Truck	Hour	260	$96.00	$24,960.00
-Site Work				**$83,275.00**
Silt Fencing	LF	2,500	$1.60	$4,000.00
Temporary Fencing	LF	2,500	$5.25	$13,125.00
Clearing and Grubbing	Acre	2	$1,575.00	$3,150.00
Confirmation Sampling	Sample	30	$1,575.00	$47,250.00
Topographic Surveys	Each	3	$5,250.00	$15,750.00

Table 2-45
Estimated Capital Costs for Selected Remedy
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Description	Unit	Quantity	Unit Cost	Cost
2.2 Soil Removal with Treatment (Land Farming), and Disposal (Continued)				
-Source Area Investigation/Removal				**$143,825.00**
Staging Area Setup (2- 50 by 50 foot areas)	Each	2	$21,000.00	$42,000.00
Contact Water (Delivery, Rental, and Pickup)	Month	3	$1,575.00	$4,725.00
Contact Water Treatment System	Month	3	$10,500.00	$31,500.00
Soil Excavation	CY	500	$16.00	$8,000.00
Backfill Excavation and Hauling	CY	575	$6.00	$3,450.00
Backfill Placement and Compaction	CY	575	$12.00	$6,900.00
Waste Characterization	Sample	10	$2,100.00	$21,000.00
Transfer and Disposal of Waste	Drums	25	$1,050.00	$26,250.00
-Soil Excavation				**$326,100.00**
Excavation 0-15 ft	CY	3,500	$10.50	$36,750.00
Excavation 15-25 ft	CY	3,500	$21.00	$73,500.00
Windrow Construction	Month	1	$10,500.00	$10,500.00
Lined Dump Trucks	Month	1	$103,950.00	$103,950.00
Backfill Excavation and Hauling	CY	4,375	$6.00	$26,250.00
Backfill Placement and Compaction	CY	4,950	$12.00	$59,400.00
Air Quality Monitoring	Month	3	$5,250.00	$15,750.00
-Land Farming				**$932,685.00**
Grading/Berm Construction, Liner,	SF	24,000	$10.50	$252,000.00
SW Piping	CY	475	$105.00	$49,875.00
SW Collection Basin	LS	1	$7,350.00	$7,350.00
Water Treatment Mob/Demob	LS	1	$10,500.00	$10,500.00
Water Treatment	Month	12	$10,500.00	$126,000.00
Transportation and Disposal - Grading	CY	7,460	$6.00	$44,760.00
Turning Equipment	Month	12	$5,250.00	$63,000.00
Labor	Hour	720	$132.00	$95,040.00
Sampling	Month	12	$17,325.00	$207,900.00
Air Quality Monitoring	Month	12	$2,625.00	$31,500.00
-Design (10%)	LS	1	$264,706.00	**$264,706.00**
-Project Management (10%)	LS	1	$264,706.00	**$264,706.00**
-Construction Management (6%)	LS	1	$158,823.60	**$158,823.60**
-Scope Contingency (15%)	LS	1	$397,060.00	**$397,059.00**
-Bid Contingency (10%)	LS	1	$264,706.00	**$264,706.00**

Table 2-45
Estimated Capital Costs for Selected Remedy
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Description	Unit	Quantity	Unit Cost	Cost
2.3 Groundwater and Surface Water Monitoring				
-Pre-Design Investigation (Well Location Selection)	LS	1	$10,500.00	**$10,500.00**
-General Requirements				**$141,350.00**
Work Planning Documents	LS	1	$52,600.00	$52,600.00
Clear Site for Installation of Monitoring Wells	LS	1	$10,000.00	$10,000.00
-Site Work				**$375,700.00**
New Monitoring Well Installation	LS	1	$211,100.00	$211,100.00
New Monitoring Well Development	LS	1	$39,900.00	$39,900.00
Baseline Sampling - 2 Rounds	Event	2	$49,000.00	$98,000.00
Reporting/Documentation	LS	1	$26,700.00	$26,700.00
-Design (10%)	LS	1	$52,755.00	**$52,755.00**
-Project Management (10%)	LS	1	$52,755.00	**$52,755.00**
-Scope Contingency (15%)	LS	1	$79,132.50	**$79,132.50**
-Bid Contingency (10%)	LS	1	$52,755.00	**$52,755.00**

Total Capital Costs **$5,150,173.10**

Notes:

1. Costs used for estimate are 2014 dollars, without adjustments for inflation.
2. Costs represent and order-of-magnitude engineering cost estimate that is expected to be within +50% to -30% of the actual project costs.

Table 2-46
Estimated Annual O&M Costs for Selected Remedy
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Description	Unit	Quantity	Unit Cost	Cost
2.4 Institutional Controls Enforcement				
-Enforcement				**$1,500**
Soil	Year	1	$500	$500
Groundwater	Year	1	$500	$500
Surface Water	Year	1	$500	$500
2.5 Groundwater and Surface Water Monitoring				
-Sampling, Equipment, UXO Avoidance, & Reporting				**$296,323**
Year 1 - Quarterly Sampling	Event	1	$296,323	$296,323

Total Annual O&M Costs **$297,823.00**

Notes:

1. Costs used for estimate are 2015 dollars, without adjustments for inflation.
2. Costs represent tasks to be completed in line with the Army's future mission at this site.
3. Costs intially include quarterly LTM, but will ramp down to semi-annual (Years 3 - 5) to annual (Years 6 - 30).
4. Each sampling event includes sampling, UXO avoidance, a QCSR, and a DSR.

Table 2-47
Estimated Periodic Costs for Selected Remedy
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Description	Unit	Quantity	Unit Cost	Cost
2.6 Five Year Reviews				
-Five Year Review Reports	Event	1	$48,000.00	**48,000.00**
-Project Management, Engineering, and Technical Assistance (10%)	Event	1	$4,800.00	**4,800.00**
-Operational Contingency	LS	1	$80,000.00	**80,000.00**
		Total Periodic Costs		**$132,800.00**

Notes:

1. Costs used for estimate are 2015 dollars, without adjustments for inflation.
2. Costs represent tasks to be completed in line with the Army's future mission at this site.
3. Operational contingency includes well maintenance, pump and well replacement, excavation cap repair.

Table 2-48
Estimated Present Value Costs for Selected Remedy
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Year	Undiscounted Costs			
	Capital Costs	Annual O&M Costs	Periodic Costs	Total Cost (Undiscounted)
0	$5,150,173.10	-	-	$5,150,173.10
1	-	$298,000.00	-	$298,000.00
2	-	$298,000.00	-	$298,000.00
3	-	$148,900.00	-	$148,900.00
4	-	$148,900.00	-	$148,900.00
5	-	$148,900.00	$132,800.00	$281,700.00
6	-	$74,500.00	-	$74,500.00
7	-	$74,500.00	-	$74,500.00
8	-	$74,500.00	-	$74,500.00
9	-	$74,500.00	-	$74,500.00
10	-	$74,500.00	$132,800.00	$207,300.00
11	-	$74,500.00	-	$74,500.00
12	-	$74,500.00	-	$74,500.00
13	-	$74,500.00	-	$74,500.00
14	-	$74,500.00	-	$74,500.00
15	-	$74,500.00	$132,800.00	$207,300.00
16	-	$74,500.00	-	$74,500.00
17	-	$74,500.00	-	$74,500.00
18	-	$74,500.00	-	$74,500.00
19	-	$74,500.00	-	$74,500.00
20	-	$74,500.00	$132,800.00	$207,300.00
21	-	$74,500.00	-	$74,500.00
22	-	$74,500.00	-	$74,500.00
23	-	$74,500.00	-	$74,500.00
24	-	$74,500.00	-	$74,500.00
25	-	$74,500.00	$132,800.00	$207,300.00
26	-	$74,500.00	-	$74,500.00
27	-	$74,500.00	-	$74,500.00
28	-	$74,500.00	-	$74,500.00
29	-	$74,500.00	-	$74,500.00
30	-	$74,500.00	$132,800.00	$207,300.00
Total	**$5,150,173.10**	**$2,905,200.00**	**$796,800.00**	**$8,852,173.10**

Notes:

1. Costs used for estimate are 2015 dollars, without adjustments for inflation.
2. O&M costs represent a ramp down sampling strategy to include quarterly (Year 1-2), Semi-Annual (Year 3-5) and Annual (Year 6-30).

Table 2-48
Estimated Present Value Costs for Selected Remedy
Record of Decision
Open Burning / Open Detonation Ground (Range 16)
Fort Riley, Kansas

Year	Discount Factor at 7%	Discounted Costs			
		Capital Costs	Annual O&M Costs	Periodic Costs	Total Present Value Cost (Discounted)
0	1.000	$5,150,173.10	-	-	$5,150,173.10
1	0.935	-	$278,630.00	-	$278,630.00
2	0.873	-	$260,154.00	-	$260,154.00
3	0.816	-	$121,502.40	-	$121,502.40
4	0.763	-	$113,610.70	-	$113,610.70
5	0.713	-	$106,165.70	$94,686.40	$200,852.10
6	0.666	-	$49,617.00	-	$49,617.00
7	0.623	-	$46,413.50	-	$46,413.50
8	0.582	-	$43,359.00	-	$43,359.00
9	0.544	-	$40,528.00	-	$40,528.00
10	0.508	-	$37,846.00	$67,462.40	$105,308.40
11	0.475	-	$35,387.50	-	$35,387.50
12	0.444	-	$33,078.00	-	$33,078.00
13	0.415	-	$30,917.50	-	$30,917.50
14	0.388	-	$28,906.00	-	$28,906.00
15	0.362	-	$26,969.00	$48,073.60	$75,042.60
16	0.339	-	$25,255.50	-	$25,255.50
17	0.317	-	$23,616.50	-	$23,616.50
18	0.296	-	$22,052.00	-	$22,052.00
19	0.277	-	$20,636.50	-	$20,636.50
20	0.258	-	$19,221.00	$34,262.40	$53,483.40
21	0.242	-	$18,029.00	-	$18,029.00
22	0.226	-	$16,837.00	-	$16,837.00
23	0.211	-	$15,719.50	-	$15,719.50
24	0.197	-	$14,676.50	-	$14,676.50
25	0.184	-	$13,708.00	$24,435.20	$38,143.20
26	0.172	-	$12,814.00	-	$12,814.00
27	0.161	-	$11,994.50	-	$11,994.50
28	0.15	-	$11,175.00	-	$11,175.00
29	0.141	-	$10,504.50	-	$10,504.50
30	0.131	-	$9,759.50	$17,396.80	$27,156.30
Total	**-**	**$5,150,173.10**	**$1,499,083.30**	**$286,316.80**	**$6,935,573.20**

Notes:

1. Costs used for estimate are 2015 dollars, without adjustments for inflation.
2. O&M costs represent a ramp down sampling strategy to include quarterly (Year 1-2), Semi-Annual (Year 3-5) and Annual (Year 6-30).

FIGURES

OB/OD SITE

CUSTER HILL

CAMP FUNSTON

CAMP WHITSIDE

Union Pacific Railroad

Kansas River

114

18

0 3,000 6,000

SCALE IN FEET

N

KANSAS

Fort Riley

Topeka

Salina

Wichita

Not to Scale

Figure 2-1

GENERAL LOCATION MAP
OB/OD

Fort Riley, Kansas

Path: K:\ENV\LOUIS BERGER GROUP INC\site\63598\Deliver\GIS\2014\ROD\Fig2-1_General_Location_Map_OBOD_REV1.mxd 7/24/2014

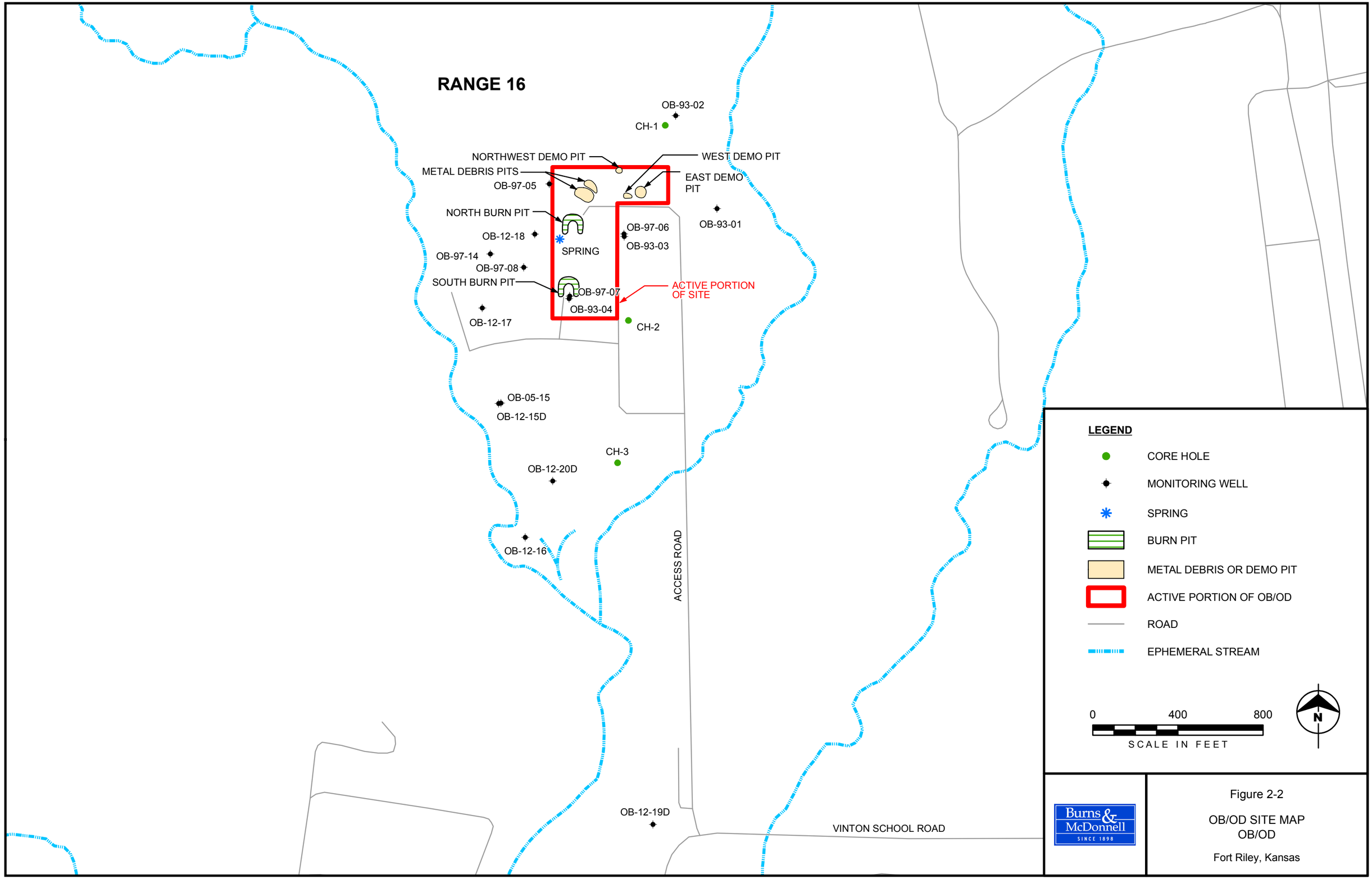
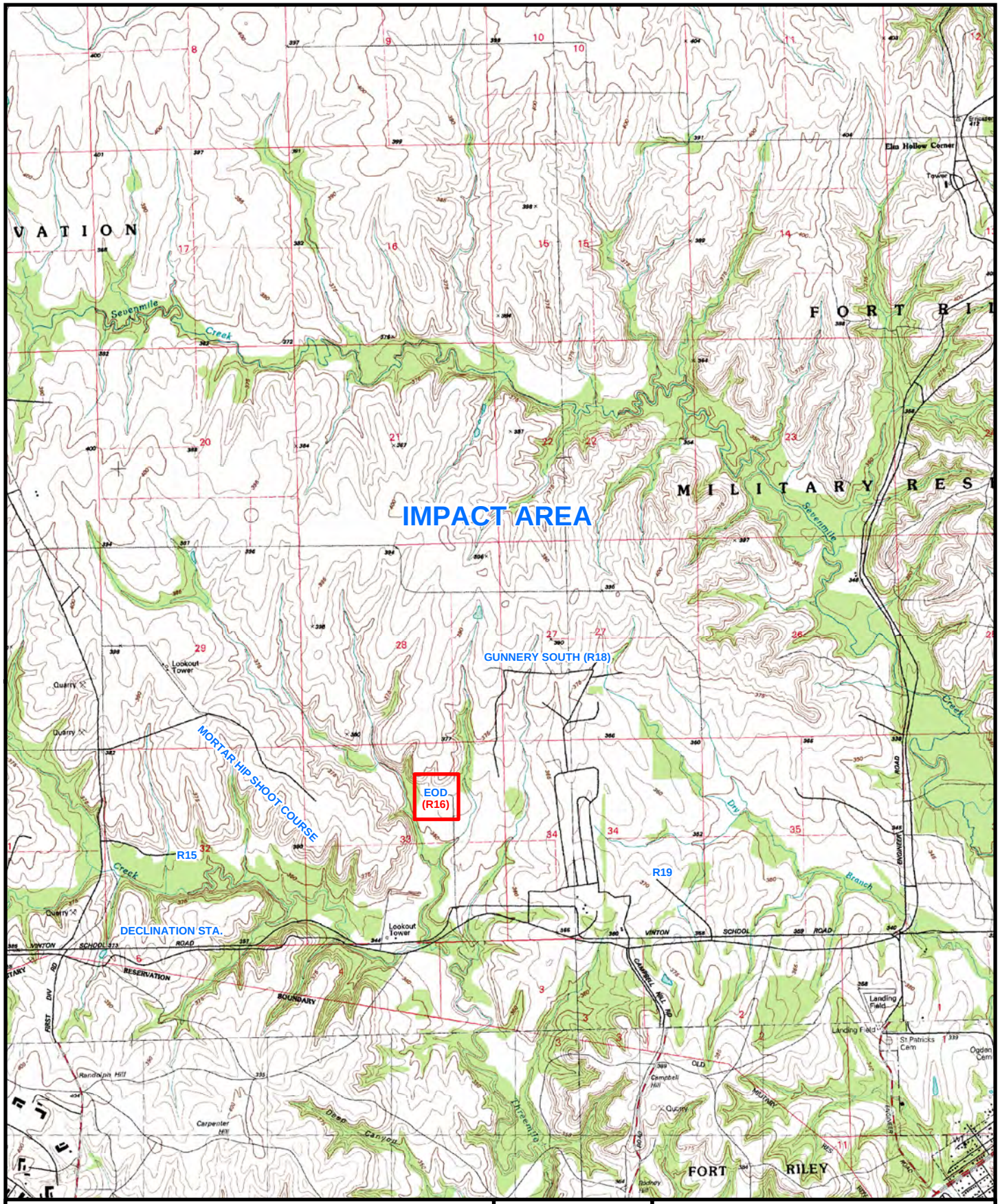


Figure 2-2

OB/OD SITE MAP
OB/OD

Fort Riley, Kansas

Path: K:\ENV\LOUIS BERGER GROUP INC\site\63598\Deliver\GIS\2014\ROD\Fig2-2_OB-OD_Site_Location_OBOD.mxd 8/5/2014



LEGEND

OB/OD SITE BOUNDARY

0 3,500 7,000

SCALE IN FEET

N

Burns & McDonnell SINCE 1898

Figure 2-3

IMPACT AREA
OB/OD

Fort Riley, Kansas

Path: K:\ENV\LOUIS BERGER GROUP INC\site\63598\Deliver\GIS\2014\ROD\Fig2-3_Impact_Area_OBOD.mxd 7/24/2014

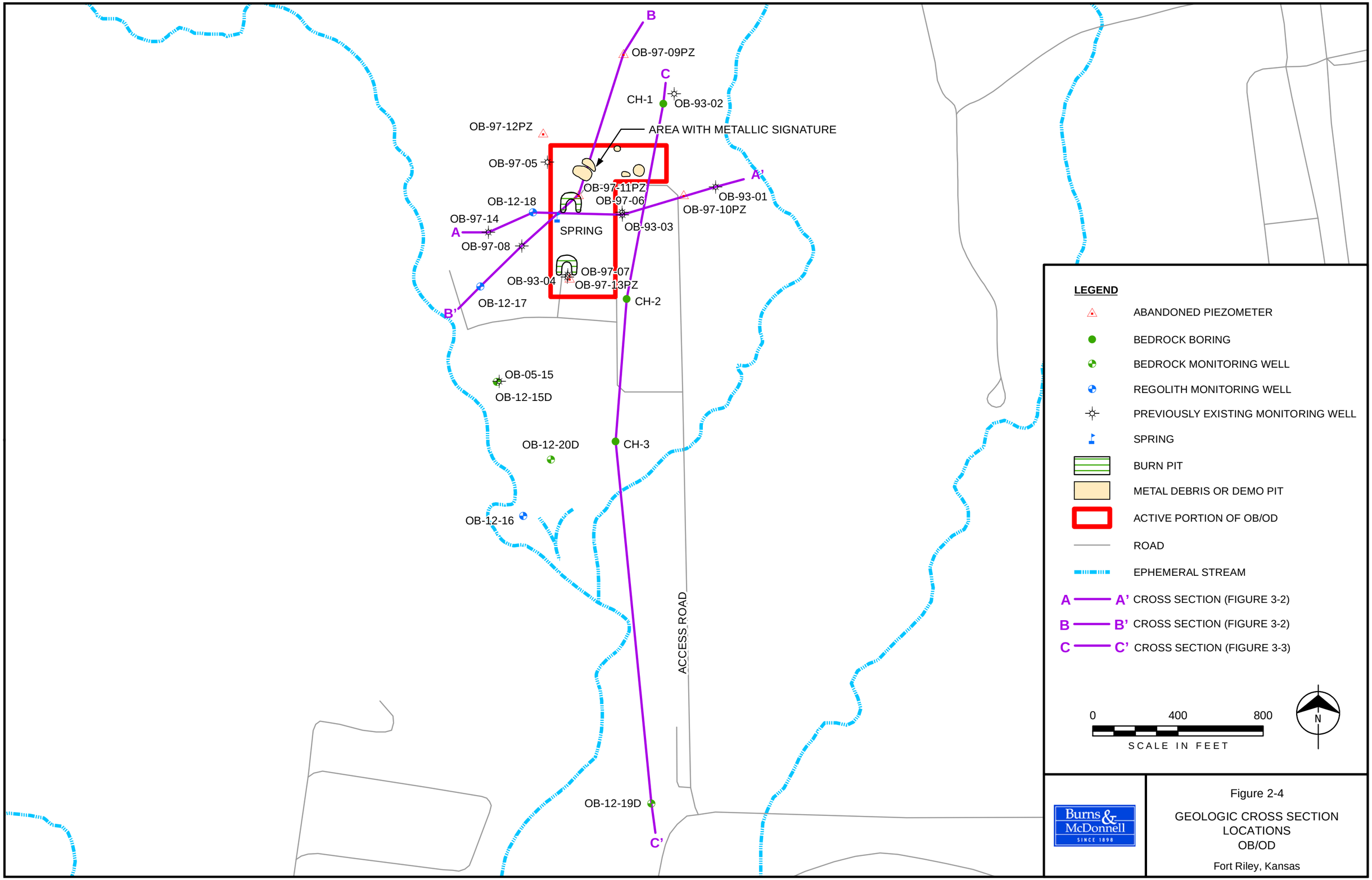
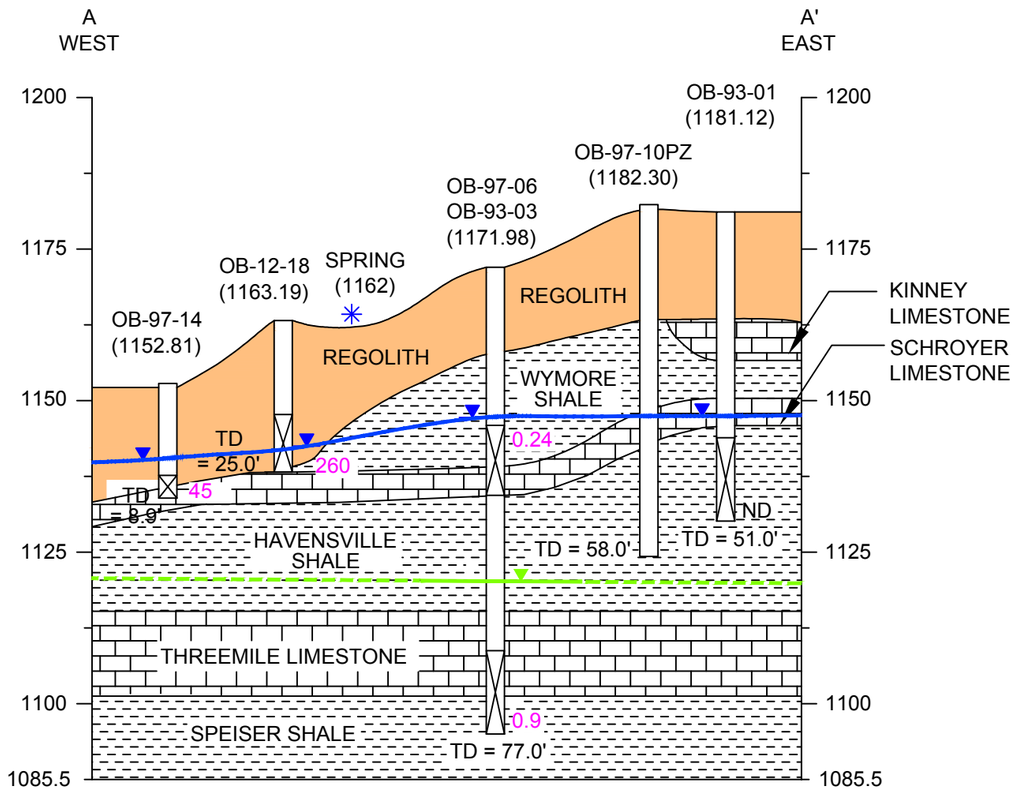


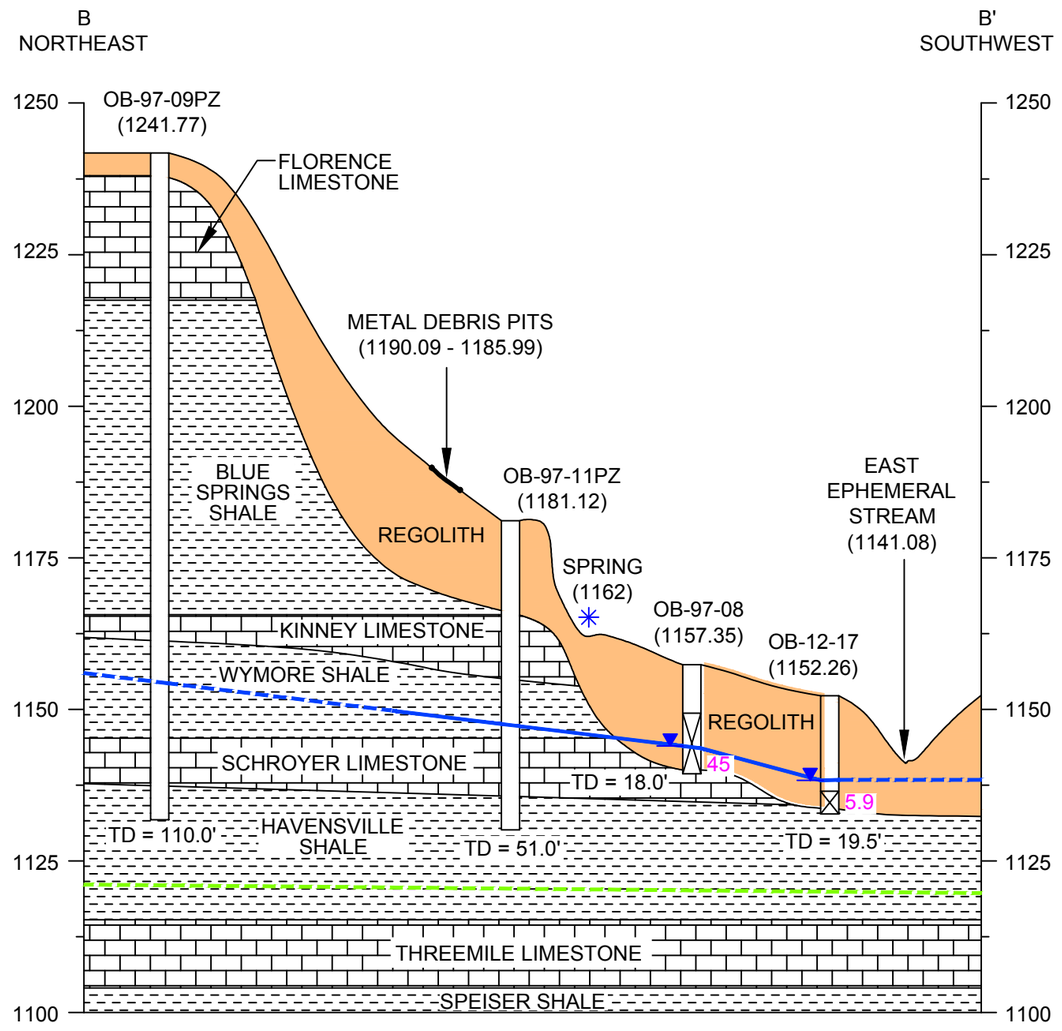
Figure 2-4

GEOLOGIC CROSS SECTION LOCATIONS
OB/OD

Fort Riley, Kansas

Path: K:\ENV\LOUIS BERGER GROUP INC\site\63598\Deliver\GIS\2014\ROD\Fig2-4_Geologic_X_Section_LINES_OBOD.mxd 10/15/2014





LEGEND:

- WELL OR BORING
- SCREEN INTERVAL
- 45 — TCE IN µg/L, JUNE 2012
- REGOLITH
- LIMESTONE
- SHALE
- OB-93-03 (1171.98) — GROUND SURFACE ELEVATION IN FT ABOVE MEAN SEA LEVEL (MSL)
- PIEZOMETRIC SURFACE - REGOLITH/WEATHERED BEDROCK (DASHED WHERE INFERRED)
- PIEZOMETRIC SURFACE - THREEMILE LIMESTONE (DASHED WHERE INFERRED)

NOTE:

1. WATER LEVELS OBSERVED FOR JUNE 2012.

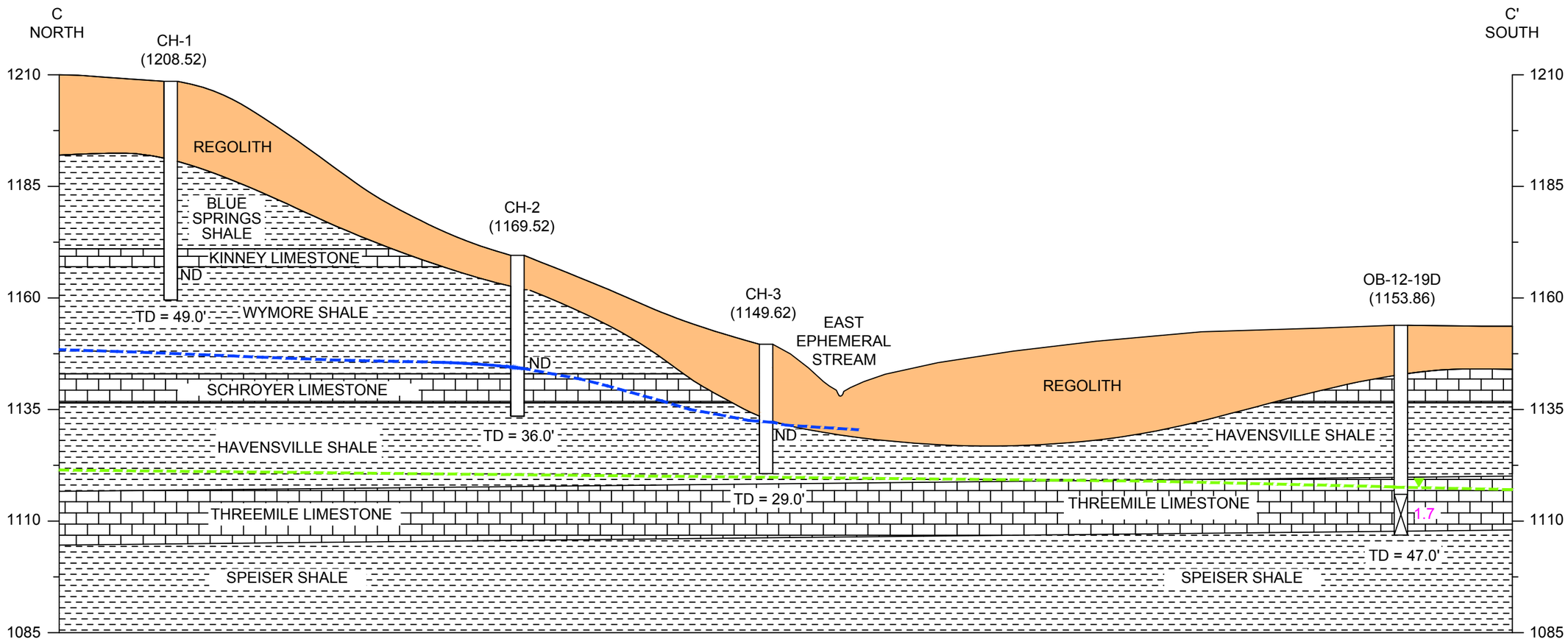
HORIZONTAL 0 300' 600' SCALE IN FEET

VERTICAL 0 25' 50' SCALE IN FEET

Figure 2-5

GEOLOGIC CROSS SECTIONS
A - A' AND B - B'
OB/OD

Fort Riley, Kansas



LEGEND:

- WELL OR BORING
- SCREEN INTERVAL
- 1.7 — TCE IN µg/L, JUNE 2012
- REGOLITH
- LIMESTONE
- SHALE
- CH-1 (1208.52) — GROUND SURFACE ELEVATION IN FT ABOVE MEAN SEA LEVEL (MSL)
- PIEZOMETRIC SURFACE - REGOLITH/WEATHERED BEDROCK (DASHED WHERE INFERRED)
- PIEZOMETRIC SURFACE - THREEMILE LIMESTONE (DASHED WHERE INFERRED)

NOTE:

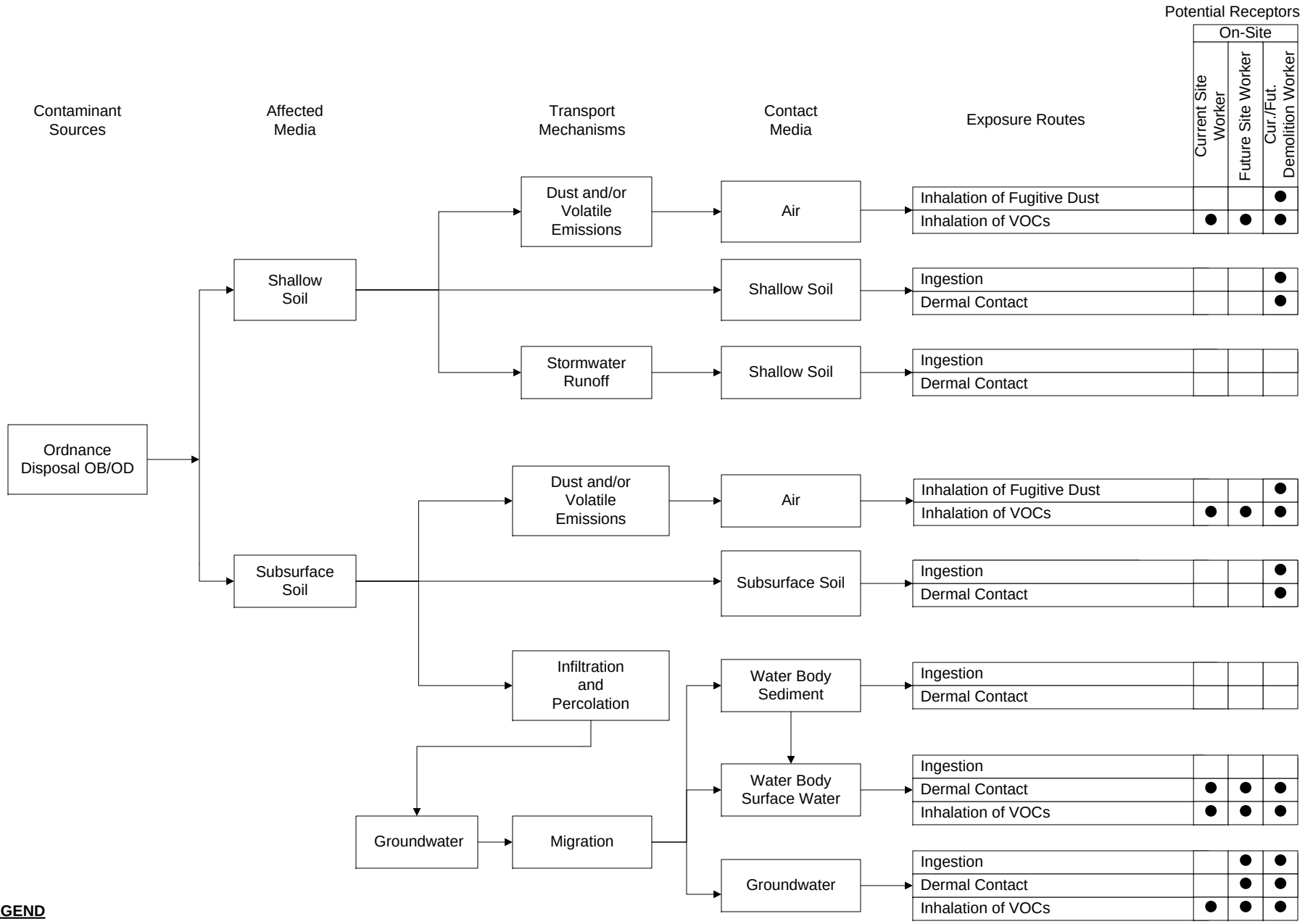
1. WATER LEVLELS OBSERVED FOR JUNE 2012.

HORIZONTAL 0 300' 600' SCALE IN FEET

VERTICAL 0 25' 50' SCALE IN FEET

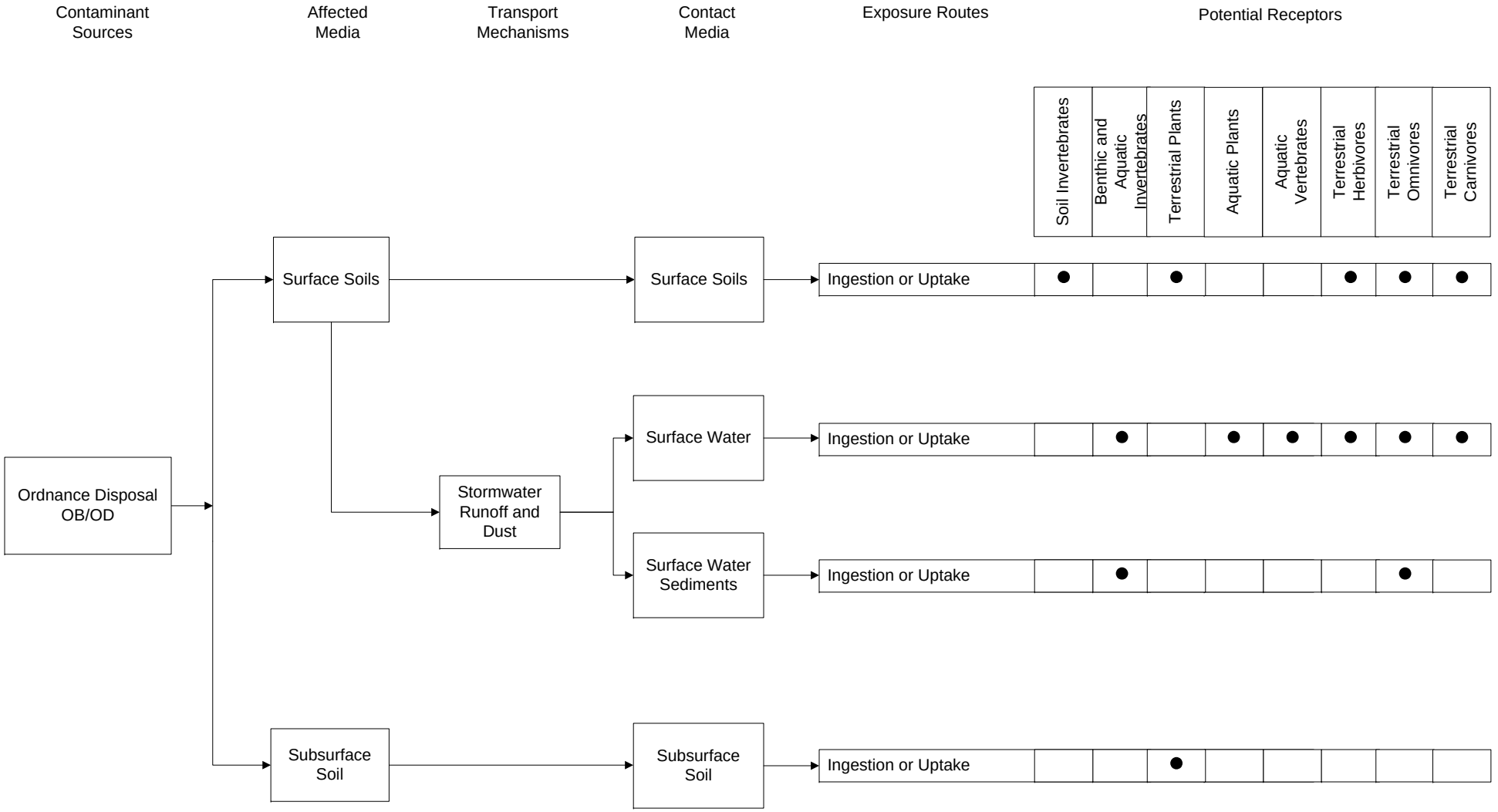
Figure 2-6

GEOLOGIC CROSS SECTION
C - C'
OB/OD
Fort Riley, Kansas



Burns & McDonnell
SINCE 1898

Figure 2-7
Human Health
Conceptual Site Model
OB/OD
Fort Riley, Kansas



Burns & McDonnell
SINCE 1898

Figure 2-8
ECOLOGICAL CONCEPTUAL SITE MODEL
OB/OD
Fort Riley, Kansas

RISS-25

MD-21	
SS01-1.0'	9,700 J
SB01-3.0'	540
SB02-8.0'	4,200 J
SB03-11.0'	11,000 J

MD-20	
SS01-0.9'	430
SB01-3.0'	74
SB02-6.5'	428
SB03-10.0'	144

BD-SS-18

BD-SS-19

MD-35	
SS01-1.0'	10 U
SB01-7.0'	10 U

RISS-14

MD-31	
SS01-0.9'	400
SB01-3.0'	180
SB02-7.5'	2,800 J
SB03-10.0'	4,700 J

MD-15	
SS01-0.5'	302
SB01-2.0'	80
SB02-7.0'	121

RISS-21

MD-27	
SS01-0.5'	10 U
SB01-3.0'	10 U
SB02-6.0'	10 U

SS-13

MD-36	
SS01-1.0'	10 U
SB01-6.0'	10 U

MD-34	
SS01-1.0'	10 U
SB01-12.0'	10 U

MD-35

BD-SS-15

BD-SS-16

MD-20

MD-27

MD-12	
SS01-0.5'	36
SB01-2.0'	10 U
SB02-6.5'	378
SB03-10.5'	38

BD-SS-11

MD-36

MD-15

MD-31

BD-SS-17

MD-28	
SS01-0.5'	78
SB01-3.0'	62
SB02-7.0'	170

MD-29	
SS01-0.9'	51
SB01-3.0'	105
SB02-7.0'	169
SB03-11.9'	6,700 J

MD-21

MD-28

MD-34

MD-29

BD-SS-12

MD-22

MD-29

MD-12

MD-25

MD-25	
SS01-1.0'	9,100 J
SB01-2.0'	640
SB02-7.0'	28,000 J
SB03-10.0'	43,000 J
SB04-13.0'	1,200,000 J

MD-22	
SS01-1.0'	24,000 J
SB01-3.0'	4,300 J
SB02-8.0'	790,000 J
SB03-11.0'	2,000,000 J

BD-SS-13

MD-16

MD-16	
SS01-1.0'	144
SB01-3.0'	620
SB02-6.0'	111

MD-37

MD-26

BD-SS-14

MD-32

MD-32	
SS01-1.0'	1,400 J
SB01-3.0'	79
SB02-6.0'	256
SB03-11.0'	4,600 J

MD-26	
SS01-0.9'	1,400 J
SB01-3.0'	875
SB02-7.0'	27,000 J
SB03-11.5'	200,000 J

RISS-40

MD-37	
SS01-1.0'	10 U
SB01-3.0'	10 U
SB02-7.8'	10 U

MD-38

MD-33

MD-33	
SS01-1.0'	109
SB01-3.0'	201
SB02-7.0'	155
SB03-12.0'	6,200 J

MD-38	
SS01-0.9'	10 U
SB01-3.0'	10 U
SB02-8.0'	86

ACCESS ROAD

MD-39

RISS-39

MD-39	
SS01-0.9'	10 U
SB01-7.0'	10 U
SB02-11.5'	35

LEGEND

- 2011 SOIL SAMPLE LOCATION
- 2013 SOIL SAMPLE LOCATION
- AREA WHERE TCE FIELD GC RESULTS > REMEDIAL CLEANUP LEVEL OF 10,720 ug/kg
- AREA WITH METALLIC SIGNATURE
- METAL DEBRIS OR DEMO PIT
- ROAD

Soil Result	
Sample ID	<Remedial Cleanup Level
	>Remedial Cleanup Level

NOTES:

1. ALL RESULTS IN ug/kg. DETECTIONS ARE BOLDED.
2. THE CALCULATED RISK-BASED REMEDIATION GOAL (RG) FOR TCE IN SOIL IS 10,720 ug/kg.

0 25 50

SCALE IN FEET

N

Figure 2-9

TCE SOIL RESULTS
FIELD GC
METAL DEBRIS PITS
OB/OD

Fort Riley, Kansas

Path: K:\ENV\LOUIS BERGER GROUP INC\site\63598\Deliver\GIS\2014\ROD\Fig2-9_TCE_Soil_Results_FieldGC_Metal_Debris_Pits.mxd 7/31/2014

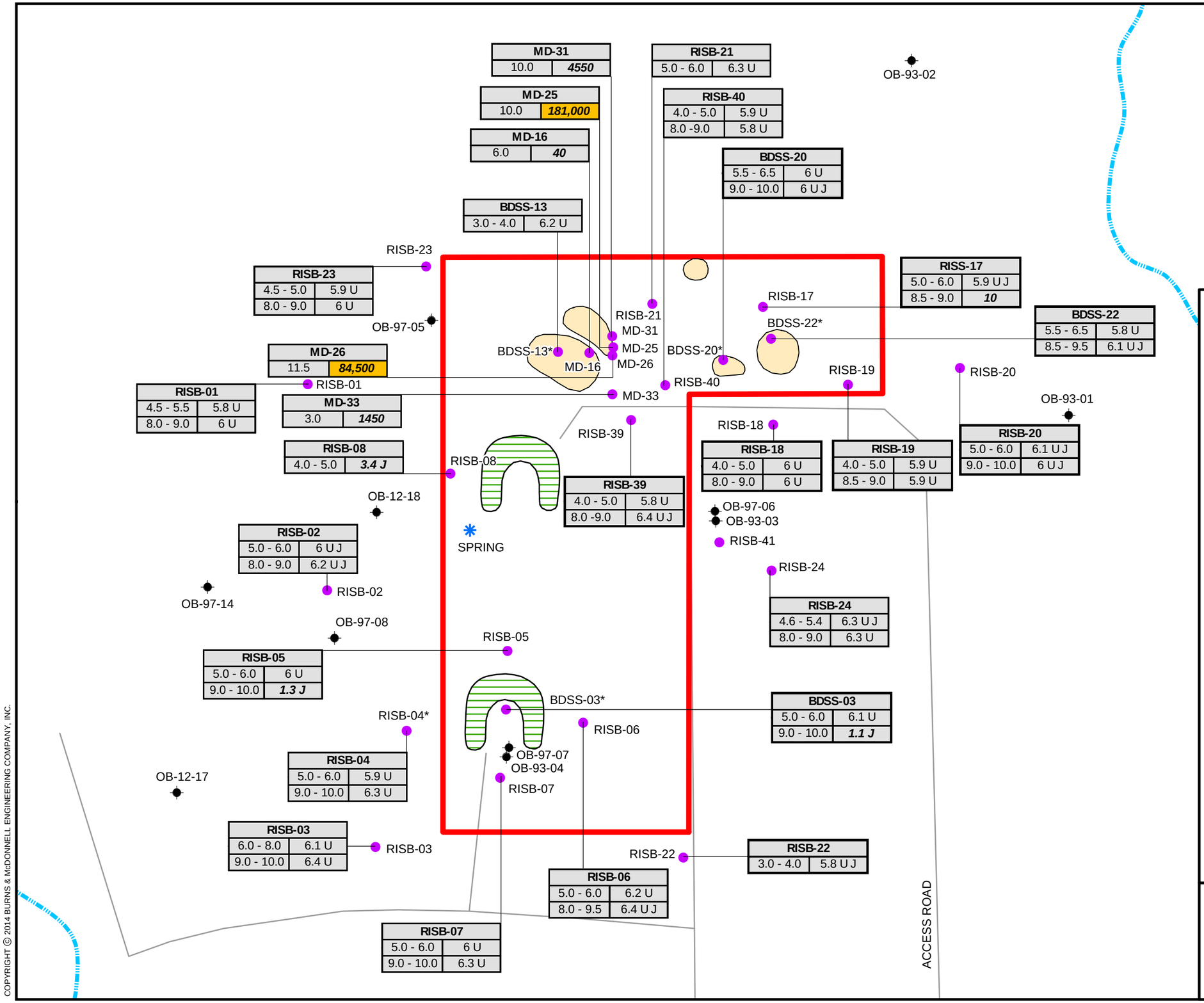
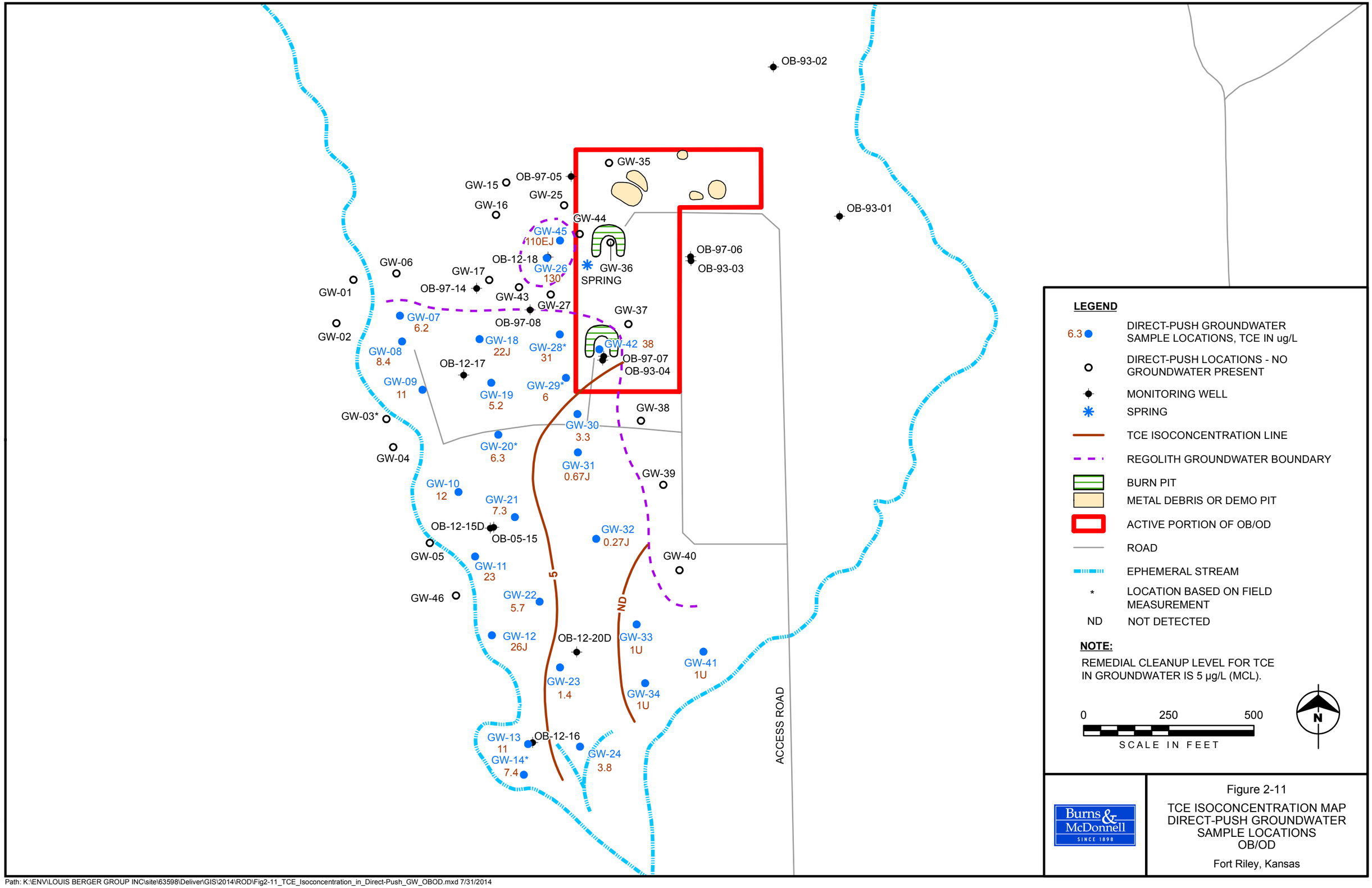


Figure 2-10

TCE
SUBSURFACE SOIL RESULTS
OB/OD

Fort Riley, Kansas

Path: Z:\Clients\ENV\LouisBerger\63598_RifsFtRiley\Studies\Deliverables\GIS\2014\ROD\Fig2-10_TCE_Subsurface_Soil_Results_OBOD.mxd 2/16/2015



LEGEND

- 6.3 ● DIRECT-PUSH GROUNDWATER SAMPLE LOCATIONS, TCE IN ug/L
- ○ DIRECT-PUSH LOCATIONS - NO GROUNDWATER PRESENT
- ✱ MONITORING WELL
- ✱ SPRING
- TCE ISOCONCENTRATION LINE
- REGOLITH GROUNDWATER BOUNDARY
- BURN PIT
- METAL DEBRIS OR DEMO PIT
- ACTIVE PORTION OF OB/OD
- ROAD
- EPHEMERAL STREAM
- * LOCATION BASED ON FIELD MEASUREMENT
- ND NOT DETECTED

NOTE:

REMEDIAL CLEANUP LEVEL FOR TCE IN GROUNDWATER IS 5 µg/L (MCL).

0 250 500

SCALE IN FEET

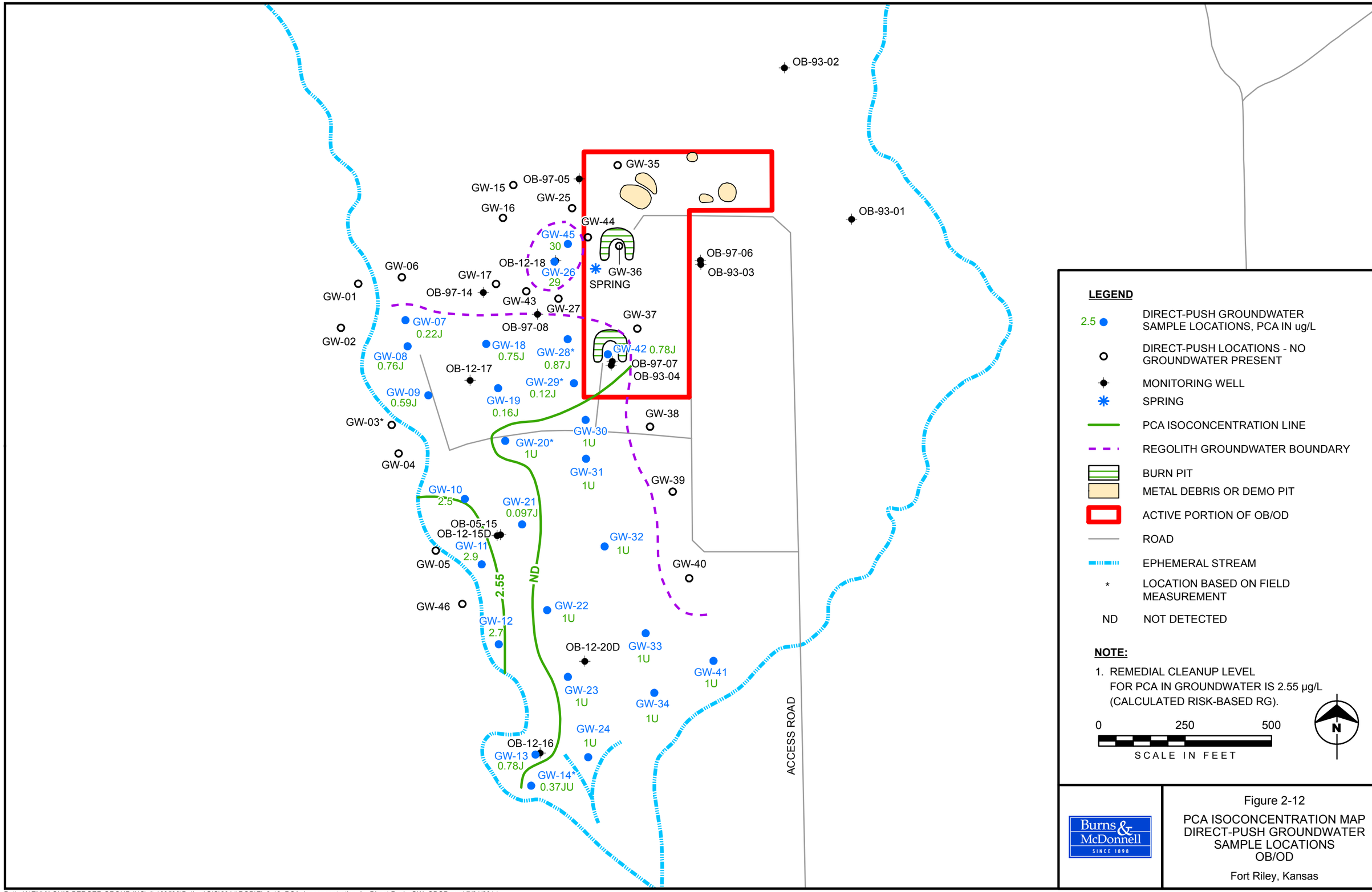
N

Figure 2-11

TCE ISOCONCENTRATION MAP
DIRECT-PUSH GROUNDWATER SAMPLE LOCATIONS
OB/OD

Fort Riley, Kansas

Path: K:\ENV\LOUIS BERGER GROUP INC\site\63598\Deliver\GIS\2014\ROD\Fig2-11_TCE_Isoconcentration_in_Direct-Push_GW_OBOD.mxd 7/31/2014



LEGEND

- 2.5 — DIRECT-PUSH GROUNDWATER SAMPLE LOCATIONS, PCA IN ug/L
- DIRECT-PUSH LOCATIONS - NO GROUNDWATER PRESENT
- MONITORING WELL
- SPRING
- PCA ISOCONCENTRATION LINE
- REGOLITH GROUNDWATER BOUNDARY
- BURN PIT
- METAL DEBRIS OR DEMO PIT
- ACTIVE PORTION OF OB/OD
- ROAD
- EPHEMERAL STREAM
- * LOCATION BASED ON FIELD MEASUREMENT
- ND NOT DETECTED

NOTE:

1. REMEDIAL CLEANUP LEVEL FOR PCA IN GROUNDWATER IS 2.55 µg/L (CALCULATED RISK-BASED RG).

0 250 500

SCALE IN FEET

N

Figure 2-12

PCA ISOCONCENTRATION MAP
DIRECT-PUSH GROUNDWATER SAMPLE LOCATIONS
OB/OD

Fort Riley, Kansas

Path: K:\ENV\LOUIS BERGER GROUP INC\site\63598\Deliver\GIS\2014\ROD\Fig2-12_PCA_Isoconcentration_in_Direct-Push_GW_OBOD.mxd 7/31/2014

OB-97-05	
1Q	*0.3 J*
2Q	*0.23 J*
3Q	*0.22 J*
4Q	1 U

OBHD-97-14	
1Q	*45*
2Q	*45*
3Q	*41*
4Q	*57*

OB-12-18	
1Q	*60*
2Q	*260*
3Q	*250*
4Q	*230*

OB-97-08	
1Q	*40*
2Q	*45*
3Q	*28*
4Q	*26*

OB-97-07	
1Q	*140*
2Q	*41*
3Q	*73*
4Q	*130*

OB-12-17	
1Q	*6.7*
2Q	*5.9*
3Q	*9.5*
4Q	*9.8*

OB-93-04	
1Q	*5.5*
2Q	*5.8*
3Q	*6.2*
4Q	*5.7*

OB-12-15D	
1Q	1 U
2Q	1 U
3Q	1 U
4Q	1 U

OB-05-15	
1Q	*18*
2Q	*8.7*
3Q	*7.3*
4Q	*9.3*

OB-12-16	
1Q	*6.3*
2Q	*12*
3Q	*7.2*
4Q	*5.5*

OB-12-19D	
1Q	*1.1*
2Q	*1.7*
3Q	*1.1*
4Q	*1.1*

OB-12-20D	
1Q	*1.1*
2Q	*2.2*
3Q	*2.1*
4Q	*1.7*

OB-93-02	
1Q	1 U
2Q	1 U
3Q	1 U
4Q	1 U

OB-93-01	
1Q	1 U
2Q	1 U
3Q	1 U
4Q	1 U

OB-93-03	
1Q	1 U
2Q	*0.9 J*
3Q	*0.92 J*
4Q	*0.79 J*

OB-97-06	
1Q	*0.57 J*
2Q	*0.24 J*
3Q	*0.31 J*
4Q	*0.22 J*

OB-97-05
OB-12-18
OB-97-14
OB-97-08
OB-97-07
OB-12-17
OB-93-04
OB-12-15D
OB-05-15
OB-12-16
OB-12-20D
OB-12-19D
OB-93-02
OB-93-01
OB-97-06
OB-93-03
SPRING
100
5
ACCESS ROAD

LEGEND

- BEDROCK MONITORING WELL
- SPRING
- REGOLITH/WEATHERED BEDROCK MONITORING WELL
- TCE ISOCONCENTRATION LINES
- BURN PIT
- METAL DEBRIS OR DEMO PIT
- ACTIVE PORTION OF OB/OD
- ROAD
- EPHEMERAL STREAM

Monitoring Well	
Quarter	<Remedial Cleanup Level
	>Remedial Cleanup Level

NOTES:

1. ALL RESULTS IN ug/L. DETECTIONS ARE BOLD.
2. THE REMEDIAL CLEANUP LEVEL FOR TCE IS 5.0 ug/L (MCL).
3. ISOCONCENTRATION CONTOURS BASED ON AVERAGE RESULT FOR FOUR QUARTERS FOR THE REGOLITH/WEATHERED BEDROCK AQUIFER.

0 400 800

SCALE IN FEET

N

Figure 2-13

QUARTERLY TCE DETECTIONS
GROUNDWATER
OB/OD

Fort Riley, Kansas

Path: Z:\Clients\ENV\LouisBerger\63598_RifsFtRiley\Studies\Deliverables\GIS\2014\ROD\Fig2-13_Quarterly_TCE_Detections_GW_OBOD.mxd 10/15/2014

OB-97-08	
1Q	6.6
2Q	4.5
3Q	1.5
4Q	1.1 J

OB-97-07	
1Q	3.4 J
2Q	1
3Q	1.6 J
4Q	5.1

OBHD-97-14	
1Q	9.7
2Q	8.6
3Q	4.6
4Q	5.8

OB-12-18	
1Q	11
2Q	45
3Q	43
4Q	45

OB-97-05	
1Q	1 U
2Q	1 U
3Q	1 U
4Q	1 U

OB-12-17	
1Q	0.19 J
2Q	0.15 J
3Q	0.47 J
4Q	0.52 J

OB-93-04	
1Q	1 U
2Q	1 U
3Q	1 U
4Q	1 U

OB-12-15D	
1Q	1 U
2Q	1 U
3Q	1 U
4Q	1 U

OB-05-15	
1Q	1
2Q	0.58 J
3Q	1 U
4Q	0.38 J

OB-12-16	
1Q	0.6 J
2Q	0.91 J
3Q	1 U
4Q	1 U

OB-12-19D	
1Q	1 U
2Q	1 U
3Q	1 U
4Q	1 U

OB-12-20D	
1Q	1 U
2Q	1 U
3Q	1 U
4Q	1 U J

OB-93-03	
1Q	1 U
2Q	1 U
3Q	1 U
4Q	1 U

OB-93-02	
1Q	1 U
2Q	1 U
3Q	1 U
4Q	1 U

OB-93-01	
1Q	1 U
2Q	1 U
3Q	1 U
4Q	1 U

OB-97-06	
1Q	1 U
2Q	1 U
3Q	1 U
4Q	1 U

OB-97-05
OB-12-18
OB-97-14
OB-97-08
SPRING
OB-97-07
OB-12-17
OB-93-04
2.55
ND
OB-12-15D
OB-05-15
OB-12-20D
OB-12-16
OB-12-19D
OB-93-02
OB-93-01
OB-97-06
OB-93-03
ACCESS ROAD

LEGEND

- BEDROCK MONITORING WELL
- SPRING
- REGOLITH/WEATHERED BEDROCK MONITORING WELL
- PCA ISOCONCENTRATION LINE
- BURN PIT
- METAL DEBRIS OR DEMO PIT
- ACTIVE PORTION OF OB/OD
- ROAD
- EPHEMERAL STREAM
- ND NOT DETECTED

Monitoring Well	
Quarter	<Remedial Cleanup Level
	>Remedial Cleanup Level

NOTES:

1. ALL RESULTS IN ug/L. DETECTIONS ARE BOLD.
2. THE REMEDIAL CLEANUP LEVEL FOR PCA IS 2.55 ug/L (CALCULATED RISK-BASED REMEDIAL GOAL [RG]).
3. ISOCONCENTRATION CONTOURS BASED ON AVERAGE RESULT FOR FOUR QUARTERS FOR THE REGOLITH/WEATHERED BEDROCK AQUIFER.

0 400 800

SCALE IN FEET

N

Figure 2-14

QUARTERLY PCA DETECTIONS
GROUNDWATER
OB/OD

Fort Riley, Kansas

Path: Z:\Clients\ENV\LouisBerger\63598_RifsFtRiley\Studies\Deliverables\GIS\2014\ROD\Fig2-14_Quarterly_PCA_Detections_GW_OBOD.mxd 10/15/2014

RANGE 16

SEEP 02
STREAM 01
STREAM 02
STREAM 03
SURFACE WATER 01
SURFACE WATER 02
STREAM 04
STREAM 05
SEEP 01
STREAM 14
STREAM 12
SEEP 03
STREAM 13
STREAM 07
STREAM 06
STREAM 08
STREAM 10
STREAM 11
STREAM 09
SPRING
OB-97-05
OB-12-18
OB-97-14
OB-97-08
OB-12-17
OB-97-07
OB-93-04
OB-97-06
OB-93-03
OB-93-02
OB-93-01
OB-05-15
OB-12-15D
OB-12-20D
OB-12-16
OB-12-19D
ACCESS ROAD
VINTON SCHOOL ROAD
VINTON SCHOOL ROAD

Stream-01/SW02	
PCA	1 U
TCE	1 U
BP	9.4 U

Stream-01/SW01	
PCA	1 U
TCE	1 U
BP	9.9 U

Spring-01/SW02	
PCA	**16.0**
TCE	**91 J**
BP	9.4 U

Stream-09/SW01	
PCA	1 U
TCE	1 U
BP	9.6 U

Stream-03/SW02	
PCA	**0.74 J**
TCE	**7.2**
BP	9.4 U

Stream-08/SW01	
PCA	1 U
TCE	1 U
BP	9.7 U

Stream-10/SW01	
PCA	1 U
TCE	1 U
BP	9.9 U

Stream-12/SW01	
PCA	1 U
TCE	1 U
BP	9.9 U

Stream-11/SW01	
PCA	1 U
TCE	1 U
BP	**1.1 J**

Seep-03/SW01	
PCA	1 U
TCE	1 U
BP	9.4 U

Stream-13/SW01	
PCA	1 U
TCE	1 U
BP	10 U

Stream-07/SW01	
PCA	1 U
TCE	**0.18 J**
BP	9.6 U

LEGEND

- SURFACE WATER SAMPLE LOCATION. NOTE STREAM 02 AND SPRING WERE DRY ON DECEMBER 8, 2011
- SURFACE WATER SAMPLE LOCATIONS - SURFACE WATER NOT PRESENT ON DECEMBER 8, 2011
- MONITORING WELL
- BURN PIT
- METAL DEBRIS OR DEMO PIT
- ACTIVE PORTION OF OB/OD
- ROAD
- EPHEMERAL STREAM

Sample Number	
COC	<Remedial Cleanup Goal
COC	**>Remedial Cleanup Goal**

BP Benzo(a)pyrene
PCA 1,1,2,2-Tetrachloroethane
TCE Trichloroethene

NOTES:

1. RESULTS IN ug/L. DETECTIONS ARE BOLDED.
2. THE REMEDIAL CLEANUP LEVEL FOR PCA IS 236 ug/L (CALCULATED RISK-BASED REMEDIAL GOAL).
3. THE REMEDIAL CLEANUP LEVEL FOR TCE IS 613 ug/L (CALCULATED RISK-BASED REMEDIAL GOAL).
4. THE REMEDIAL CLEANUP LEVEL FOR BP IS 0.0374 ug/L (CALCULATED RISK-BASED REMEDIAL GOAL).
5. SW01 SAMPLES COLLECTED DECEMBER 2011.
6. SW02 COLLECTED NOVEMBER 2012.

0 500 1,000
SCALE IN FEET

N

Figure 2-15
SURFACE WATER SAMPLE RESULTS
DECEMBER 2011 AND MARCH 2012
OB/OD
Fort Riley, Kansas

Path: Z:\Clients\ENV\LouisBerger\63598_RifsFtRiley\Studies\Deliverables\GIS\2014\ROD\Fig2-15_Surface_Water_Sample_Exceedances_OBOD.mxd 10/15/2014

APPENDICES

APPENDIX A – MEMORANDUM FOR RECORD

DEPARTMENT OF THE ARMY
INSTALLATION MANAGEMENT AGENCY
HEADQUARTERS, UNITED STATES AREMY GARRISON, FORT RILEY
500 HUEBNER ROAD
FORT RILEY, KANSAS 66442-5000

REPLY TO
ATTENTION OF

Directorate of Public Works
Environmental Division

7 June 2016

MEMORANDUM FOR RECORD

SUBJECT: Record of Decision (ROD) Screening Level Changes

1. Fort Riley, Directorate of Public Works, Environmental Division, is providing a Memorandum for Record (MFR) on the Final ROD for the Open Burning/Open Detonation Ground (Range 16). During Environmental Protection Agency (EPA) review, a comment was provided from the Human Health Risk Assessor that documented the previous version was using screening levels from Kansas' "Risk-Based Standards for Kansas" where EPA's "Regional Screening Levels" produced a more stringent result. For the purposes of addressing EPA's concerns, this led to the recalculation of screening levels in the Record of Decision at the subject site. It is noted that the site is to continue operating as an OB/OD range where explosive materials will continue to have their energy content expended. No explosives or other munitions-related contaminants such as metals are to be remediated at the site.

2. Kansas City District has conducted an assessment on the impact to soil chemicals retained from the change of screening levels and compared the RSK values to the Nov. 2015 industrial use soil RSLs based on a cancer risk of 1×10^{-6}, and a hazard quotient (HQ) of 0.1. Based on these values, 1,1,2,2-Tetrachloroethane (PCA) is carried forward as a COPC for the site. The screening level changed from 15.2 mg as the soil RSK to 2.7 mg/kg on a carcinogenic basis. This assessment will be carried forward in future documents. Maximum detections of metals were compared to the RSLs and background values and this comparison indicated that no site-related metals require further evaluation as part of this site.

3. For groundwater, the RSK values were compared to the Nov. 2015 tap water RSLs based on a cancer risk of 1 x 10-6, and a HQ of 0.1. The reanalysis determined 1,2,3-trichlorobenzene, cis-1,2- Dichloroethene (DCE) and Tetrachloroethene (PCE) exceed the new, lower screening levels, and would have been further evaluated in the risk assessment. The screening levels were:

1,2,3-trichlorobenzene: 0.7 µg/L
cis-1,2-Dichloroethene: 3.6 µg/L
Tetrachloroethene: 4.1 µg/L

4. Based on these screening levels, one detection above screening levels of 1,2,3-trichlorobenzene and PCE occurred in a single well.

cis-1,2-DCE was detected in low concentrations and is related to the degradation of TCE, which was a much higher concentration in these wells. Future documentation at the site will ensure that these compounds are addressed appropriately.

5. No text changes occurred to the ROD based on the EPA comments. This memo serves as an explanation on why the screening values had changed and the effect the change had on the path forward. This memorandum will be included in the Record of Decision as an appendix in order to formalize the evaluation of the updated screening levels.

Alan Hynek
Chief, Conservation Branch

APPENDIX B – RESPONSE TO USEPA COMMENTS ON THE FINAL ROD

REPLY TO
ATTENTION OF:

DEPARTMENT OF THE ARMY
INSTALLATION MANAGEMENT AGENCY
HEADQUARTERS, UNITED STATES ARMY GARRISON, FORT RILEY
500 HUEBNER ROAD
FORT RILEY, KANSAS 66442-5000

June 7, 2016

Directorate of Public Works
Environmental Division

Mr. Amer Safadi, Remedial Project Manager
U.S. Environmental Protection Agency, Region 7
Federal Facilities/Special Emphasis Branch, Superfund
11201 Renner Blvd
Lenexa, Kansas 66217

Dear Mr. Safadi:

Fort Riley, Directorate of Public Works, Environmental Division, is providing the responses to comments for the Final Record of Decision (ROD) for the Open Burning – Open Detonation Ground (Range 16) for your consideration. Upon approval of the responses to comment, the ROD will be staffed through Army channels to obtain the Commander, U.S. Army Environmental Command, COL Robert C. Wittig's signature prior to returning the document for Ms. Peterson's signature. Fort Riley would appreciate receiving a completed signature page for our administrative record.

Comments were received from U.S. EPA on the Final ROD later than prescribed by the Federal Facilities Agreement. Subsequent to receipt of these unexpected comments, the Army conducted an evaluation on those that would have significant impact on the decision for proposed remedial action. The Army review determined that in order to proceed with implementation of the remedy, and reduce the risks that are currently present at the site, a revision to the ROD is not warranted at this time. Detailed responses to the EPA comments are contained in Appendix A. Based on the change in screening criteria from Risk-Based Standards for Kansas (RSKs) to EPA Regional Screening Levels (RSLs), those analytes that were detected above RSLs will be assessed in the Remedial Design and Remedial Action as implementation of the Remedial Action is critical to ensure protectiveness of human health and the environment. It was determined that the only additional compound in the soil was 1,1,2,2-tetrachloroethane, co-located with the trichloroethene (TCE) source, which will be remediated in parallel with the TCE by the selected remedy. Additional groundwater compounds, 1,2,3-trichlorobenzene, cis-1,2-dichloroethene, and tetrachloroethene (PCE), will be added to the monitoring program that is prescribed in the ROD.

Any questions should be directed to Dr. Richard Shields, at 785-239-3194.

Sincerely,

Alan Hynek
Chief, Conservation Branch

CC:

Kelly Peterson, Kansas Department of Health and Environment
Nicholas Smith, U.S. Army Environmental Command
Amanda Chirpich, US Army Corps of Engineers, Kansas City District

Appendix A: EPA comments and response:

1. Section 1.5 – Please change the following sentence as noted in red: A five-year review will be conducted to evaluate the effectiveness of the selected remedy as a matter of law ~~EPA *policy*~~, until cleanup levels are achieved, allowing unlimited use and unrestricted exposure.

   a. Response: Per OSWER 9355.7, the language to be used is "EPA Policy". The Fort Riley FFA also uses this language. No document revision is appropriate.

2. Section 1.2 - Please change the following sentence as noted in red: This remedy was jointly selected by the DA (Fort Riley) ~~in consultation with~~ and the USEPA, Region VII, and) in consultation with the KDHE-BER

   a. Response: Guidance document, OSWER 9200.1, §6.1.1 states the consultation language is correct and the Fort Riley FFA uses this language as well. No document revision is appropriate.

3. Section 2.1 – Please change the following sentence as noted in red: This document is issued by the DA, the lead agency for the activities at Fort Riley, with approval from ~~consultation with~~ the USEPA, Region VII and in consultation with KDHE-BER~~, the support agencies~~.

   a. Response: Guidance document, OSWER 9200.1, §6.1.1 states the consultation language is correct and the Fort Riley FFA uses this language as well. No document revision is appropriate.

4. CL #1 - Please include a map that shows the LUC boundaries

   a. Response: LUC boundaries will be developed as part of the Remedial Design (RD) and will be implemented during Remedial Action (RA) phase at the site.

5. CL #2 – Are there any known prohibited uses that should be listed?

   a. Response: Site uses are currently controlled to only allow OB/OD activities. All other uses are prohibited by the Fort Riley Real Property Master Plan for the foreseeable future.

6. CL #6 – Please include the duration language as worded in the CL.

   a. Response: Duration will be determined in the RD phase.

7. CL#8 – Please include the language as worded in the CL. We understand you think it may not ever apply to the site but it covers both us and the Army in the event that it does. Additionally, we are trying to figure out if the DA is going to be doing the work or if the USACE will be performing the work such that the language in CL 8 applies.

   a. Response: It is unclear as to what the acronym CL stands for. Please provide clarity so that a response can be drafted.

8. CL #9 – Please include both dates for when the RD/RA WP will be done and that it will be submitted to EPA for review and approval.

   a. Response: An estimate is not available at this time since a contract will need to be awarded.

Human Health Risk Assessment Comments

1. Reportedly, the principal COC in soil at the site is TCE. Yet Section 2.5.7 states that there is no known historical or current use of solvents, or knowledge of solvent disposal, at the site. Without some understanding of how solvents came to be present in site soil, it may be difficult to ensure that all potential areas of soil contamination have been identified.

a. Response: From the statistical analysis conducted in the RI, which received EPA concurrence, the site boundaries have been determined accurate.

2. Page 2-7 reports that most of the identified soil contamination from solvents is located in the metal debris pits. According to Table 2-7, metals analysis was not done on soil samples from the metal debris pits. We could find no rationale which would support not analyzing for metals at the metal debris pits.

a. Response: The site will continue being used as a disposal location for explosives, and as such, will continue to be exposed to more metals and energetic compounds until such time that the range is no longer needed. The Army does not remediate active ranges for contaminants that are a result of active range operations unless migration off range is evident and poses a threat to human health and the environment. "Metal debris pits" is a generalized term based on the metallic anomaly identified as part of anomaly avoidance procedures during the RI.

3. The contaminated plume maps reportedly contained in Figures 2-11 and 2-12 are inadequate. No actual plumes are identified. We question whether the well locations and number of data points are sufficient to have fully characterized the extent of groundwater contamination at the site. We also question how the selected groundwater remedy will be implemented, given the uncertainty regarding the nature and extent of the groundwater contamination plume(s).

a. Response: The nature and extent of groundwater contamination was delineated during the RI, which was approved by KDHE and EPA. The majority of the wells are present to ensure that no offsite migration occurs from this site or the impact area to the north. The borings depicted in Figure 2-11 are used to determine lower bounds to the site. Additional figures in the RI show plume boundaries. These boundaries exist on the active range and will be monitored for offsite migration. Additionally, the Army plans to install additional monitoring wells to complete the groundwater monitoring network during the RD/RA phase.

4. Most of the contaminant screening values used in Table 2-3 to identify COPCs are Kansas RSK values, rather than EPA values. Regional policy is to use EPA values or, if State values are to be considered, then the lower (more conservative) of the two screening values should be used, to ensure that all potential COPCs are identified. In most cases, the RSK screening values apparently used in the risk assessment are higher (less conservative) than EPA values. Thus, it is possible that potential contaminants of concern were inappropriately screened out of the risk assessment.

a. Response: Please see attached analysis in Appendix A-1. The lower of RSL and RSK will be carried forward in the RD and beyond.

5. Table 2-6 indicates that multi-increment soil samples were taken. We could find no description of that process in the document, or how those sample results may have been used in the risk assessment.

a. This detail is provided in Section 2.3 of the RI Report. This level of detail is not appropriate for inclusion in the ROD.

6. Tables 2-13 through 2-16 show the exposure point concentrations used in the risk assessment. There is no documentation showing how those concentrations were developed.

a. This detail is provided in the RI Report, which was approved by EPA, and is not appropriate for inclusion in the ROD.

7. Chromium data was not speciated between the trivalent and hexavalent forms. In the absence of speciated data, Regional policy is to assume all chromium concentrations are in the hexavalent form. Apparently that was not done in the risk assessment.

a. Response: Noted. There is no evidence that any historical activity took place at this site which would have been a source of hexavalent chromium. Chromium concentrations are consistent across the site and there is no evidence of an anthropogenic source. Without a reason to expect higher concentrations of Hexavalent Chromium, such as a plating shop, the Army believes that this Chromium detection is in its natural state of fluctuation between species.

8. There appears to be a very large discrepancy between the field GC data, and the analytical data apparently used in the risk assessment. However, it appears that this discrepancy, and its impact on the risk assessment, was not explained.

a. Response: The discrepancy is discussed in Section 6 of the RI Report and inclusion of that level of detail in the ROD would be inappropriate. Section 6 of the RI Report notes that the field GC data was used as screening tool and was not carried forward to the BLRA.

Ecological Risk Assessor Comments

1. The selected remedy for the site includes soil removal from source areas (with treatment and disposal), in conjunction with groundwater and surface water monitoring. Overall, this remedy will be protective of terrestrial wildlife species as removal of contaminated soil should eliminate overall ecological risk.

a. Response: Noted.

2. Potential risk to aquatic receptors will remain a concern in the ephemeral streams and spring. However, the ecological risk assessment performed for the site calculated Hazard Indices based on maximum concentrations and conservative toxicity reference values. The long-term risk to aquatic species exposed to groundwater discharges into the spring and ephemeral streams is likely to be lower, as average exposures would reduce the overall risk. In addition, the spring and

streams are not perennial, therefore, the aquatic community is somewhat limited. Based on average exposures, and the quality of the aquatic habitat, monitoring of surface water is an acceptable remedial alternative.

a. Response: Noted

3. The clean-up levels are protective of ecological risk; however, the ecological screening level and calculated risk-based remedial goal for benzo(a) pyrene in surface water are both less than 1.0 µg/L. Results from previous investigations, as reported in the ROD, are above these limits. In developing the monitoring plan for surface water, we recommend that you ensure reporting limits for benzo (a) pyrene are less than 1.0 µg/L.

a. Response: Noted, a screening level of 0.2 µg/L has been used based on the MCL. Reporting limit will be adjusted appropriately in order to provide resolution at this level.

Hydrogeologist Comments

1. The selected remedy (removal of ~7,500 yd^3 of TCE impacted soil to prevent leaching to groundwater, land-farming of TCE impacted soil, groundwater/surface water monitoring, and ICs) appears appropriate (with noted concerns below) for OU6. The remediation goal for TCE in soil is 10.72 mg/kg which may present a concern. Impacts to groundwater and surface water will apparently be treated through natural processes; however, TCE impacted soil at this RG concentration may leach with surface infiltration or a fluctuating water table and inhibit reduction of TCE to the MCL if soil at this concentration remains. The land-farm treatment will consist of a lined area with berms and a leachate collection system. The treated soil will be spread on site or used as a landfill cover for the Campbell Hill Landfill.

a. Response: Noted, removal of source area will reduce the amount of TCE that can leach into groundwater.

2) The RG calculations for TCE were not provided in the ROD. The RG for TCE in soil is 10,720 mg/kg. This may not restrict/inhibit leaching to groundwater if soil impacts are not successfully removed from the pits to depth. The protection of groundwater soil screening level, based on the MCL for TCE, is 1.8 mg/kg (DAF=1). At other sites in the Region, the TCE RG for protection of groundwater is 60 mg/kg. If the TCE RG is not significantly reduced and if concentrations of up to 10,720 mg/kg remain, impacts to groundwater may continue for a significant period of time. Estimates of the timeframe to reduce TCE concentrations in groundwater to below the MCL were apparently not provided in the ROD.

a. Response: The RG stated on page 1-2 of the ROD is 10.72 mg/kg. This is below the 60 mg/kg stated in the comment above.

3) As 1,4-dioxane can be a stabilizer in TCE and TCA, groundwater should be analyzed for this potential contaminate.

a. Response: 1,4-dioxane will be added as an analyte for consideration in the RD and compared to appropriate promulgated standards for determining if it is present at the site.

4) Based on the figures in the ROD, the regolith thickness in the area of the metals debris pits is about 15 ft to 20 ft. Soil samples from the metal debris pits were collected to a depth of 6 ft to 13 ft at concentrations up to 2,000,000 J mg/kg (field GC). The extent of these impacts were apparently not vertically delineated in this area. TCE impacted soil at concentration above the RG are present in an area of approximately 25 ft X 35 ft.

a. Response: Concentrations from the field GC are in µg/kg. The sample you discuss would be 2,000 mg/kg. The Remedial Design will determine the final excavation limits required in order to reach 10.72 mg/kg RG in soil. During excavation, field sampling pre-excavation samples and post-excavation confirmation samples will confirm remedy achievement of the RG.

5) The horizontal/vertical extent of TCE impacts in groundwater are not apparently delineated at this site. Groundwater appears to migrate along the regolith/bedrock interface. This interface appears to extend under the streams which may transport contaminated groundwater beyond these apparent boundaries. The remedy indicates treatment of contaminated groundwater through natural processes. At other sites, this remedy is called MNA or monitored natural attenuation. Typically for this remedy, the source should be removed and the groundwater adequately delineated to determine if the plume is stable, contracting or expanding. In addition to the COC, geochemical constituents should be included in the groundwater analysis.

a. Response: The Remedial Design will provide analysis of the required monitoring well installations to monitor the plume, as well as the analyte list for the groundwater monitoring program. Note that some areas may be inaccessible due to unexploded ordnance concerns of the active range complex.

6) The Soil EPC table indicates a maximum detected TCE concentration of 181 mg/kg. As indicated in comment #4, TCE was detected at much higher concentration with an on-site GC at 2,000 mg/kg. The 181 mg/kg TCE concentration detected by the lab appears to be a duplicate soil sample (MD-25 @ 10ft) analyzed by the on-site GC at a concentration of 43 mg/kg. If the lab results tend to be higher than the on-site GC results at other soil sample locations, the maximum detected concentration/soil EPC may be much higher as well.

a. Response: The variance is accounted for in the RI. As described in Section 6 of the RI Report, the field GC results were not carried forward to the risk assessment due to high variability between field GC and fixed-laboratory results. Tables included in the ROD have been qualified per the QAPP and the 2,000 mg/kg is J flagged appropriately.

Appendix A-1: Response to comment 4 under Human Health Risk Assessment comments.

Evaluation of EPA screening levels (RSLs) to the Kansas Screening Levels (RSKs) at Ft. Riley OB/OD.

This evaluation was conducted to evaluate the potential impacts to the ROD at Ft. Riley OB/OD if contaminants of potential concern (COPCs) are determined based on RSLs instead of RSKs. The evaluation was completed following HQ EPA's comment to Ft. Riley.

> "Most of the contaminant screening values used in Table 2-3 to identify COPCs are Kansas RSK values, rather than EPA values. Regional policy is to use EPA values or, if State values are to be considered, then the lower (more conservative) of the two screening values should be used, to ensure that all potential COPCs are identified. In most cases, the RSK screening values apparently used in the risk assessment are higher (less conservative) than EPA values. Thus, it is possible that potential contaminants of concern were inappropriately screened out of the risk assessment."

SOIL

The screening levels used during the RI from Table 4-1 were compared to the Nov. 2015 industrial use soil RSLs based on a cancer risk of 1×10^{-6}, and a hazard quotient (HQ) of 0.1. The chemicals detected in soil that had the RSKs identified as the source of screening levels were further evaluated for any potential impact to the ROD. Since the OB/OD range will continue to remain an active range, explosive contaminants were not evaluated as a part of this proposed remedy. This includes the following explosives and explosive related contaminants that were compared to RSKs instead of the RSLs: 2,4,6-Trinitrotoluene, 2,4-Dinitrotoluene, 2,6-Dinitrotoluene, HMX, RDX, Perchlorate, and Tetryl.

The volatile organic contaminants (VOCs) that were determined to have previously been screened against the RSKs in soil include 1,1,1,2-Tetrachloroethane, 1,1,2,2-Tetrachloroethane (PCA), sec-Butylbenzene, tert-Butylbenzene, Chlorobenzene, Chloroform, cis-1,2-Dichloroethene (cis-1,2-DCE), trans-1,2-Dichloroethene, Isopropylbenzene, Methylene Chloride, Styrene, Tetrachloroethene (PCE), Toluene, Trichloroethene (TCE), 1,1,2-Trichloroethane, and 1,2,4-Trimethylbenzene.

To evaluate the potential impact, the maximum detected concentration in surface soil and subsurface soil was compared to the lower of either the EPA RSL or the RSK. TCE was included in Table 1, but no further analysis was necessary since it was previously assessed in the baseline risk assessment. As demonstrated in Table 1, the results of this new evaluation indicate that only PCA exceeds the new screening level, and would have been further evaluated in the risk assessment. However, there were only two locations that exceeded the RSL, BDSS-17 and MD-25/SB01. Both of these sample locations are well within the area planned for remediation. Additionally, PCA is effectively treated with the remedy that has been proposed for the site.

Therefore, the remediation boundaries and the proposed remedy would not need to be altered in any way.

In general, the RSKs for metals in soil are greater than the RSLs. Therefore, the RI had not considered many of the metals detected in soil. To evaluate the potential impact, the November 2015 RSLs were compared to the RSKs. The maximum detected concentration in surface soil, and subsurface soil was compared to background to determine if it is potentially a site related contaminant. If it was greater than background, it was also evaluated against the lower of either the EPA RSL or the RSK. This was done for Antimony, Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Silver, and Zinc. The results of the comparison shown on Table 2 indicate that there were no site related metals that need to be further evaluated as a part of this site.

GROUNDWATER

The groundwater screening levels used during the RI from Table 4-1 were compared to the Nov. 2015 tap water RSLs based on a cancer risk of 1×10^{-6}, and a HQ of 0.1. The chemicals that had the RSKs identified as the source of screening levels were further evaluated for any potential impact to the ROD.

Since the range will continue to remain active, the following explosives and explosive related contaminants were not were not evaluated as a part of this proposed remedy: 2,4,6-Trinitrotoluene, 2,4-Dinitrotoluene, 2,6-Dinitrotoluene, HMX, RDX, Perchlorate, and Tetryl. Similarly, based on the continued use of the site as an active range, any potential contamination from inorganics is not a part of this project assessment.

The groundwater data set used for the baseline risk assessment included the groundwater monitoring well samples collected during the four quarterly groundwater sampling events in 2012. Nine VOCs including 1,1,1,2-Tetrachloroethane, PCA, 1,2,3-trichlorobenzene, 2-butanone (methyl ethyl ketone), cis-1,2-DCE, naphthalene, PCE, trans-1,2-DCE, and TCE were detected during the four groundwater sampling events. The detected VOCs that exceeded the screening levels in the RI and were therefore evaluated quantitatively in the baseline risk assessment included TCE, PCA, and naphthalene. Benzo(a)pyrene was detected in a single monitoring well during one event above its screening level, and thus quantitatively evaluated in the baseline risk assessment. Bis(2-ethylhexyl)phthalate and acetone were sporadically detected but were not further evaluated since they are common laboratory artifacts.

In this reassessment, each of the VOCs that were previously identified as detected, but less than the project screening levels were compared to the lowest of the RSL, MCL, or the previously used screening level. The four contaminants that had already been evaluated in the baseline risk assessment (TCE, PCA, naphthalene, and Benzo(a)pyrene) were included in Table 3 for illustration, but no further analysis was. There were 6 remaining detected VOCs that were re-evaluated in Table 3. They are 1,1,1,2-tetrachloroethane, 1,2,3-trichlorobenzene, 2-butanone (MEK), cis-1,2-DCE, PCE, and trans-1,2-DCE.

As demonstrated in Table 3, the results of this new evaluation indicate that only 1,2,3-trichlorobenzene, cis-1,2-DCE and PCE exceed the new, lower screening levels, and would have been further evaluated in the risk assessment. Further evaluation was conducted for these 3 VOCs and is shown in Table 4. For the contaminant 1,2,3-trichlorobenzene, only one detection exceeds the new screening level. During 4th quarter sampling, 1,2,3-trichlorobenzene was detected at location OB-12-18 at a concentration of 2.3 µg/L. In this same sample, TCE was detected at 230 µg/L. Therefore, the relative risk of 1,2,3-trichlorobenzene compared to TCE is very small. Additionally, the screening value of 1,2,3-trichlorobenzene is based on an HQ of 0.1, therefore the detected concentration is still below an HQ of 1, so the current risk assessment is protective. Similarly, PCE only exceeds the new screening level in one sample during 2nd quarter sampling at the same location (OB-12-18) at a concentration of 4.7 µg/L. In this same sample, TCE was detected at 260 µg/L. Therefore, the relative risk of PCE compared to TCE is very small. Additionally, the screening value of PCE is based on a HQ of 0.1, therefore the detected concentration is still below a HQ of 1, so the current risk assessment is protective. cis-1,2 DCE was detected at several locations; however, at each location that it exceeded the screening values, the TCE concentrations were much higher than cis-1,2-DCE. Since cis-1,2-DCE is less toxic than TCE, and a degradation product, the current risk assessment is protective, and focusing any proposed site related remediation on TCE is the appropriate approach.

The proposed remedial action for groundwater is expected to be effective on treating these additional contaminants.

Appendix A-1 Tables:

Analyte	Carcinogenic SL TR=1E-06 (mg/kg)	Noncarcinogenic SL HQ=0.1 (mg/kg)	RSK (mg/kg)	Max detected surface soil (mg/kg)*	NOW RETAINED?	Max detected subsurface* (mg/kg)	NOW RETAINED?
1,1,1,2-Tetrachloroethane	8.8	3500	48.8	0.002	NO		
1,1,2,2-Tetrachloroethane (PCA)	2.7	2300	15.2	3.1	YES	3.2	YES
1,2,4-Trimethylbenzene		24	126	0.83	NO		
1,1,2-Trichloroethane	5	0.63	27.6	0.0037	NO	0.27	NO
Chlorobenzene		130	740	0.002	NO		
Chloroform	1.4	100	7.14			0.3	NO
1,2-cis-Dichloroethene		230	194	0.016	NO	2.6	NO
Methylene Chloride	1000	320	267			0.11	NO
Isopropylbenzene (Cumene)		990	5680	0.0014	NO		
sec-Butylbenzene		12000	654	0.0027	NO		
Styrene		3500	20.4			0.072	NO
tert-Butylbenzene		12000		0.0011	NO		
Tetrachloroethene (PCE)	100	39	210	0.14	NO	0.6	NO
Toluene		4700	29800	0.0024	NO	0.19	NO
trans-1,2-Dichloroethene		2300		0.035	NO	0.7	NO
Trichloroethene (TCE)	6	1.9	9.91	1.7	already evaluated	181	already evaluated

Table 1: Soil VOC Evaluation

Analyte	Carcinogenic SL TR=1E^{-6} (mg/kg)	Noncarcinogenic SL HQ=0.1 (mg/kg)	RSK (mg/kg)	Lowest Screening Value (mg/kg)	KS literature Max (mg/kg)	KS literature (mean) (mg/kg)	Ft. Leavenworth background Levels UTL*	Max Detected surface soil (mg/kg)	Max detected subsurface soil (mg/kg)	Max detected > Background?	Max detected > Screening?	Now Retained?
Antimony		47	817	47			4	6.2	1.2	Maybe	NO	NO
Arsenic	3	48	38	3			11.6	9.2	8.7	NO		NO
Beryllium	6900	230	3650	230	12	5	1.1	1.7	1.5	NO		NO
Cadmium	9300	98	965	98	168	30	3.6	16.8	2.4	NO		NO
Chromium(III)		180000	111	111	1428	140	20.8	51.1	40.3	NO		NO
Chromium(VI)	6.3	350		6								NO
Copper		4700	81700	4700	140	29	30.6	207	61.1	YES	NO	NO
Lead		800	1000	800	356	28	29	231	44.2	Maybe	NO	NO
Mercury		4.6	20	4.6			0.2	0.036	0.054	NO		NO
Nickel	64000	2200	32400	2200	661	79	31	55.6	41.1	NO		NO
Selenium		580	10200	580			-	1.1	0.84	?	NO	NO
Silver		580	10200	580	46	1	-	0.31	0.25	NO		NO
Zinc		35000	613000	35000	909	207	104	899	113	Maybe	NO	NO

Table 2: Soil Inorganic Evaluation

Analyte	Carcinogenic SL TR=1E-06 (µg/L)	Noncarcinogenic SL Child HQ=0.1 (µg/L)	MCL (ug/L)	Lowest screening value (ug/L)	Basis of lowest level	Previously Used Screening Value (ug/L)	Is "New" # < previous value?	GW max detected MW	Is Max > SL
Trichloroethylene (TCE)	4.9E-01	2.8E-01	5.0E+00	0.28	NC	5	Y	already evaluated	
1,1,2,2-Tetrachloroethane (PCA)	7.6E-02	3.6E+01		0.076	C	1.28	Y	already evaluated	
Naphthalene	1.7E-01	6.1E-01		0.17	C	2	Y	already evaluated	
Benzo[a]pyrene	3.4E-03		2.0E-01	0.0034	C	0.2	Y	already evaluated	
1,1,1,2-Tetrachloroethane	5.7E-01	4.8E+01		0.57	C	9.91	Y	0.13	NO
1,2,3-Trichlorobenzene		7.0E-01		0.7	NC	5.2	Y	2.3	YES
Methyl Ethyl Ketone (2-Butanone)		5.6E+02		560	NC	11800	Y	0.95	NO
cis-1,2-Dichloroethene		3.6E+00	7.0E+01	3.6	C	70	Y	21	YES
Tetrachloroethene (PCE)	1.1E+01	4.1E+00	5.0E+00	4.1	NC	5	Y	4.7	YES
trans-1,2-dichloroethene		3.6E+01	1.0E+02	36	NC	100	Y	0.6	NO

Table 3: Groundwater VOC/SVOC Evaluation

	Previously Used Screening Value (ug/L)	Is "New" value less than Previous value	Maximum detected groundwater result (ug/L)	Is Max > SL	Details of Analysis
1,2,3-Trichlorobenzene	5.2	Y	2.3	YES	Only one detection exceeds the new screening level. OB-12-18/GW02 at a concentration of 2.3 µg/L In this same sample, TCE was detected at 230 (ug/L). Therefore, the current assessment of risk is adequate.
cis-1,2-Dichloroethene	70	Y	21	YES	Further information - 9 well locations exceeded new level. Each location that exceeded also had elevated concentrations of TCE. Therefore, the current assessment of nature and extent and risk is adequate.
Tetrachloroethene (PCE)	5	Y	4.7	YES	Only one detection exceeds the new screening level. OB-12-18/GW02 at a concentration of 4.7 (ug/L). In this same sample, TCE was detected at 260 (ug/L). Therefore, the current assessment risk is adequate.

Table 4: Further Evaluation of Groundwater.

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