FINAL

PROPOSED PLAN
FOR THE
OPEN BURNING/OPEN DETONATION GROUND (RANGE 16)
OPERABLE UNIT 006
AT
FORT RILEY, KANSAS

June 9, 2014

Prepared for

U.S. ARMY CORPS OF ENGINEERS
KANSAS CITY DISTRICT

Prepared by

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Proposed Plan
Open Burning/Open Detonation Ground Range 16, Operable Unit 006, Fort Riley, Kansas

This Proposed Plan, part of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process (see Figure 1), identifies the proposed remedial alternative for the contaminated soil, groundwater, and surface water associated with the Open Burning/Open Detonation Ground (OB/OD), Range 16, Operable Unit 006 at Fort Riley, Kansas. In addition, this Plan includes summaries of other cleanup alternatives evaluated for use at the OB/OD and provides the rationale for choosing the preferred alternative. This document is issued by the United States Department of the Army (Army), the lead agency for site activities, in consultation with the United States Environmental Protection Agency, Region VII (EPA), and the Kansas Department of Health and Environment (KDHE), the support agencies. A final remedy will be selected for the OB/OD after reviewing and considering all information submitted during the 30-day public comment period on the Proposed Plan. The Army, in conjunction with the EPA and the KDHE, may modify the preferred alternative or select other response actions presented in this Plan based on new information or public comments. Therefore, the public is encouraged to review and comment on all of the alternatives presented in this Proposed Plan

Dates to Remember:

Public Comment Period: *September 11 through October 10, 2014. The Army will accept written comments on this Proposed Plan during the public comment period by letter or email. See page 14 of this Plan for addresses.*

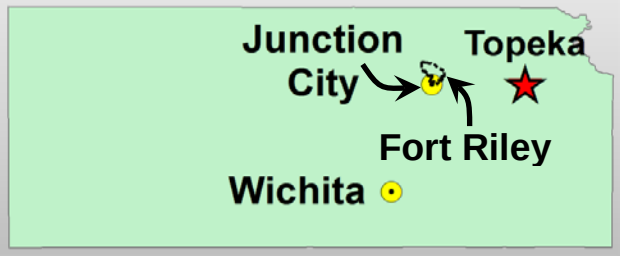
Public Meeting: *October 6, 2014. Fort Riley will hold a public meeting to explain this Proposed Plan and all of the alternatives presented in the Feasibility Study. Oral and written comments on the Proposed Plan will be accepted at the meeting. The meeting will be held at 407 Pershing Court, Fort Riley, Kansas at 7 pm in conjunction with the Restoration Advisory Board.*

The Army is issuing this Proposed Plan as part of its public participation responsibilities under Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and CERCLA Section 117(a). This Proposed Plan summarizes information that can be found in greater detail in the Remedial Investigation (RI) and Feasibility Study (FS) Reports, and other documents contained in the Administrative Record for the OB/OD. The Army encourages the public to review these documents to gain a more comprehensive understanding of the OB/OD and the investigation activities that have been conducted at the OB/OD.

Administrative Record – A public repository of information pertinent to the OB/OD that is stored at the Directorate of Public Works, 407 Pershing Court, Fort Riley, Kansas.

Figure 1 - The CERCLA Process

Figure 2 - Location of Fort Riley



Site Setting

Fort Riley is located in north-central Kansas (see Figure 2) along the Republican and Kansas Rivers in Geary and Riley Counties. The OB/OD is located in the south central portion of Fort Riley (see Figure 3) and north of the developed areas of Fort Riley including the Main Post, Custer Hill, Camp Whitside, and Camp Funston. The OB/OD is located within Range 16 in the southern portion of the Impact Area. The active portion of the site consists of an inverted "L"-shaped area approximately 700 feet by 550 feet (see Figure 4). The OB/OD is a sparsely vegetated area underlain by rocky soil 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. A wet-weather spring is also present within the active portion.

Ephemeral Stream – A stream that typically has flowing water only during, and, for a short time after, precipitation.

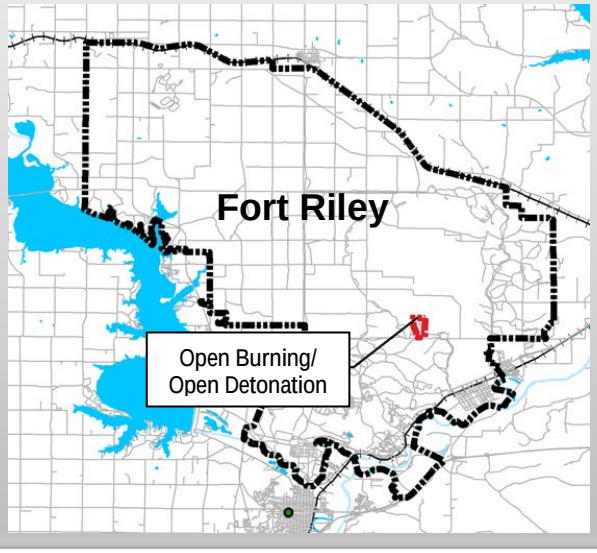
Bedrock at the OB/OD consists of alternating limestone and shale units of the Permian Chase and Council Grove Groups. Bedrock dips gently to the southwest. Two sets of joints, one set orientated east-northeast and one set orientated north-northwest, are present; the joints are more prominent in the limestone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

Joints – Regularly spaced vertical fractures in the bedrock due to natural processes.

Groundwater is present at the OB/OD 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 for public consumption. As the OB/OD is located within an isolated portion of Fort Riley and access is severely restricted by the Army, there is no plan for groundwater use in the near future.

Regolith – A mixture of rock and soil that makes up the uppermost layer of material at the OB/OD.

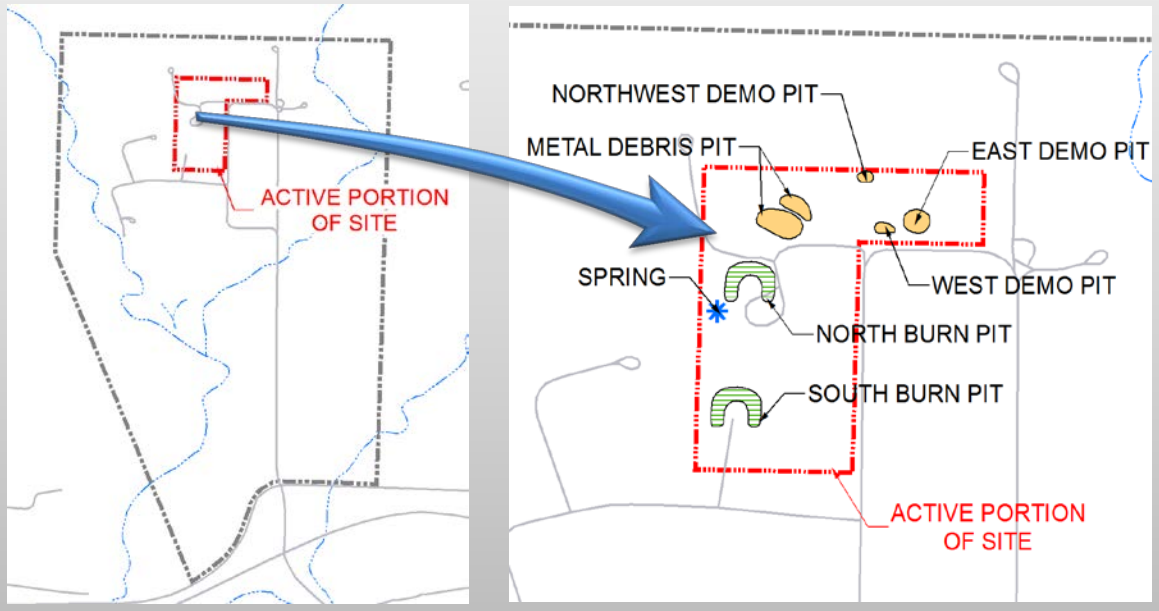
Figure 3 - Location of OB/OD



Site History and Use

The land currently occupied by the OB/OD was obtained by the Army in 1942 and has been used for ordnance detonation activities since that time. Prior to the Army's ownership, the land was used for farming and ranching. Ordnance was and is deactivated at the facility by open burning and open detonation. Open burning was conducted within a small pit surrounded by nine-foot high embankments (see South Burn Pit on Figure 4). The open

Figure 4 - Features of the OB/OD



burn pit was primarily used to dispose of black powder and phosphorus-based munitions. Open burning is no longer performed at the OB/OD. Open detonation occurs on open ground and typically results in crater-like pits. Pits can reach sizes of 25 feet in diameter and 15 feet in depth. Pits are periodically backfilled after clearance for munitions. Currently, there are three active detonation pits (Northwest, East and West Demo Pits), two metal debris pits, and two non-active burn pits at the OB/OD (North and South Burn Pits). The Army plans to continue use of this site for open detonation to deactivate munitions. Any change in mission for this area would require an extensive clearance effort for munitions prior to reuse.

Environmental Investigations

The OB/OD was first investigated as part of the Impact Zone in 1993. The Site Investigation was conducted to determine if contamination was present due to the Army's use of the site. Four monitoring wells, OB-93-01 through OB-93-04, were installed and groundwater, surface water, sediment, and soil samples were collected. During this investigation, it was determined that chlorinated solvents including trichloroethene (TCE) and 1,1,2,2-tetrachloroethane (PCA) were present in the groundwater. The source of the chlorinated solvents was unknown. Between 1994 and 2011, groundwater and surface water were monitored for volatile organic compounds (VOCs), perchlorate, metals, and natural attenuation parameters. Monitoring Wells OB-97-05 through OB-97-08 and OBHD-97-14 and five sets of nested piezometers (OB-97-09PZ through OB-97-13PZ) were installed in 1997. Monitoring Well OB-05-15 was installed in 2005. During that time, three VOCs, including TCE, tetrachloroethene (PCE), and cis-1,2-dichloroethene (cis-1,2-DCE) were detected at levels above the EPA Safe Drinking Water Act Maximum Contaminant Levels (MCLs) for public water supplies. The VOC, PCA, was also detected at levels above the current EPA

Impact Zone – Large area in the central portion of Fort Riley where munitions are used during military exercises.

VOCs – Organic chemical compounds that easily vaporize or evaporate into the air. TCE, PCE, cis-1,2-DCE, and PCA are VOCs.

Perchlorate – A chemical compound often found in munitions.

Natural Attenuation Parameters – Chemical compounds that are used to determine if biodegradation of a contaminant is occurring.

Screening Levels Used for the OB/OD Analytical Data:
(in descending order)

Soil and Sediment
- KDHE RSK for nonresidential soil
- EPA RSL industrial soil

Groundwater and Surface Water
- EPA MCL
- KDHE RSK for groundwater
- EPA RSL for tapwater

Notes:
RSK – Risk-Based Screening Level (KDHE, 2010)
RSL – Regional Screening Level (USEPA, 2012)
MCL – Maximum Contaminant Level for public drinking water supplies (National Primary Drinking Water Regulations)

Regional Screening Level (RSL) (see yellow information box to the right). Of the metals, lead was detected above the KDHE Risk-Based Screening Level (RSK) in one sample; all other detected metals were below MCLs or RSLs. Perchlorate was also detected above the current RSL in a single sample.

In 2011, the Army began the RI/FS process at the OB/OD to define the source of the chlorinated solvents in the groundwater and to determine if risk to human health or the environment was present due to contaminants present at the site. The field activities for the RI were conducted from November 2011 through January 2013 and included sampling and analysis of soil, groundwater, surface water, and sediment. As part of the RI, six monitoring wells were installed, OB-12-15D, OB-12-16, OB-12-17, OB-12-18, OB-12-19D, and OB-12-20D. The five sets of piezometers, OB-97-09PZ through OB-97-13PZ, were removed. Monitoring wells as currently present at the site are shown on Figure 5. Results from the field activities were used to calculate potential risk to human health and the environment, and were published in the RI Report. The EPA and KDHE approved of the RI Report in December, 2013. A FS Report was prepared detailing the proposed cleanup goals and evaluating alternates for remediation. The FS Report was approved by KDHE in March, 2014. Final EPA approval of the FS Report is pending. For information purposes, the responses to EPA comments on the FS Report have been provided in Appendix A.

SVOCs - Organic chemical compounds that evaporate slowly at normal temperatures.

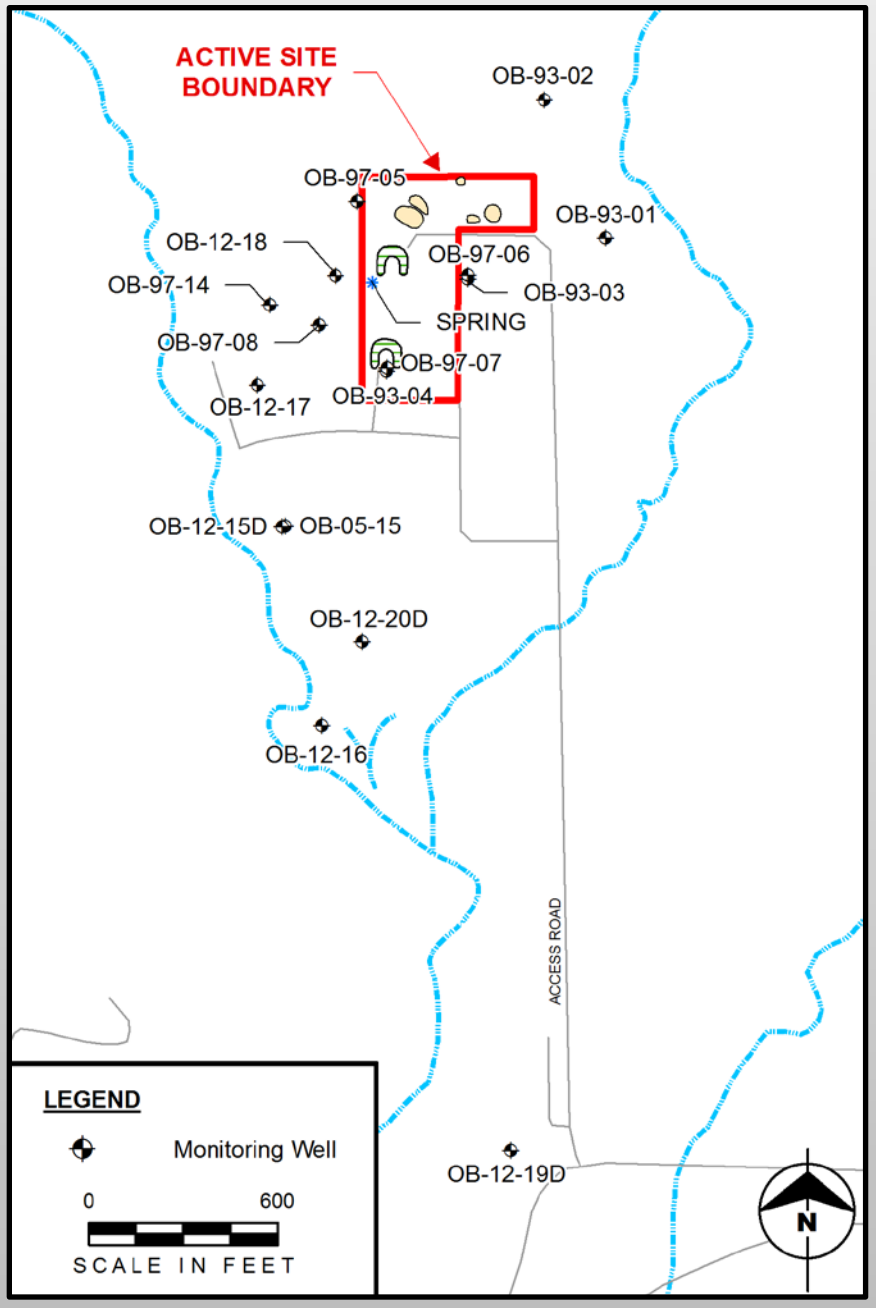
Screening Level - The concentration of a contaminant in soil or water below which no additional regulatory attention is needed.

Site Findings

Surface and subsurface soil, sediment, surface water, and groundwater samples were collected from the OB/OD during RI field activities and analyzed for VOCs, semivolatile organics (SVOCs), perchlorate, explosives, and metals. The results of the analyses were compared to screening levels (see above) that were determined to be appropriate based on current and future planned site usage. Findings of the investigation were:

- **VOCs** – TCE and 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. Within the area of the metal debris pits and directly upgradient 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.
- **Perchlorate** – There were no exceedances of perchlorate.
- **Metals** – There were no exceedances of metals.

Figure 5 – Monitoring Well Map



Soil

Based on RI data, the primary source for VOCs in soil appears to be within the metal debris pits (see Figure 4) located in the north central portion of the site. Within this area, VOCs in soil are the highest in the eastern portion of the metal debris pits near the area of a metallic signature. The metallic signature indicates that metal is present within the subsurface; it is not known at this time what the source of the metal signature is (i.e., munitions, metal debris such as nails or wire, or some other metallic item). VOCs above screening levels are present

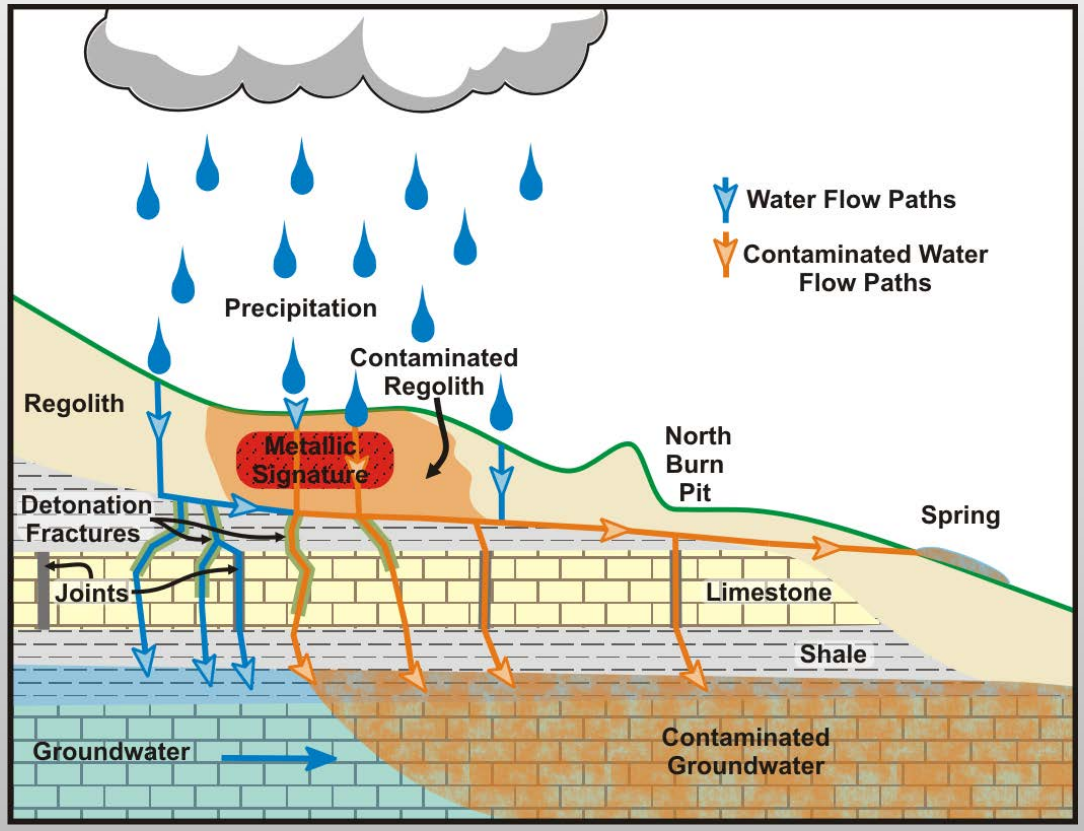
within both the surface and subsurface soil near the metal debris pits and within the deeper soils near the bedrock interface directly down gradient of this area.

Groundwater

Groundwater at the OB/OD is primarily recharged through precipitation. Water from precipitation is transported along the ground surface via overland flow and also migrates downward through the soil. The water then moves downward into the weathered bedrock through fractures and joints. As the precipitation moves through the VOC-contaminated soil, the water collects and transports the VOCs. The VOC-impacted water then migrates downward into the groundwater located within the regolith and weathered bedrock. Results from groundwater samples indicate that the VOCs are migrating down gradient within the regolith/weathered bedrock aquifer and also downward into the lower bedrock aquifer in some locations.

During periods of heavier precipitation, the fracture and joint network within the soil and weathered bedrock will reach maximum capacity for downward movement. The excess water then moves horizontally resulting in wet weather features like ephemeral streams, springs, and seeps. Samples collected from the seeps, spring, and the western ephemeral stream located down gradient of the soil source also contain chlorinated VOCs. A contaminant release and transport model of the OB/OD is shown on Figure 6.

Figure 6 - Contaminant Release and Transport Model



As part of the RI, the characteristics of the chemicals that exceeded the screening levels were evaluated for the mechanisms (see yellow information box to the right) that could affect the fate and transport of the chemicals. The physical and chemical characteristics of the contaminants and the soil, groundwater, and bedrock at the OB/OD were evaluated. Based on these characteristics, it was determined that sorption and volatilization are the primary fate and transport mechanisms. Advection and dispersion appear to be active at the site; however, they are affecting fate and transport of the contaminants at a lesser rate. Biodegradation appears to be minimal at the OB/OD within the regolith and weathered bedrock; however, conditions more favorable for biodegradation are present in the lower bedrock aquifer.

Fate and Transport Mechanisms
Five mechanisms affect contaminant fate and transportation:

- **Sorption** is when a contaminant attaches to soil thereby reducing its ability to be transported.
- **Volatilization** is when a contaminant changes from a liquid to a gas.
- **Advection** is where a contaminant advances with the flow of groundwater.
- **Dispersion** is the mixing of a contaminant within groundwater resulting in an increase in plume size and a decrease in concentration.
- **Biodegradation** is the breakdown of contaminants by microbes into other chemicals or elements.

Summary of Potential Site Risk

As part of the RI, the Army conducted a risk assessment to determine the current and future effects of contaminants on human health and the environment based upon the contaminants that are currently present at the OB/OD. The risk assessment was comprised of two parts: a baseline human health risk assessment and a screening-level ecological risk assessment. The OB/OD is currently used for open detonation to deactivate munitions with only very restricted access to the site. The Army plans to continue use of this site for open detonation; therefore, this scenario was used for both the current and future human health and ecological risk assessments.

Human Health Summary

The human health baseline risk assessment focused on health effects for current and future site workers and current and future demolition workers. The workers were assumed to be exposed to:

- **Current Site Workers** - vapors in outdoor air and surface water in the wet weather spring and ephemeral streams.
- **Future Site Workers** - vapors in outdoor air, surface water in the wet weather spring and ephemeral streams, and groundwater from a future on-site well.
- **Current and Future Demolition Workers** - vapors in outdoor air, surface water in the wet weather spring and ephemeral streams, and groundwater.

Hazard and total excess cancer risks for the workers were calculated (see yellow information box on next page) and are summarized below on Table 1.

Site Worker – An individual who would work at the site doing maintenance activities and ordnance disposal.

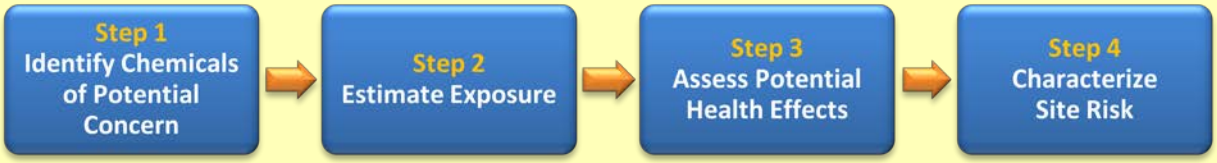
Demolition Worker – An individual involved in training and/or unexploded ordnance disposal activities that could bring them into contact with surface and subsurface soils.

Table 1 – Worker Hazard and Cancer Risk

Potentially Exposed Populations	Calculated Hazard Index	Calculated Excess Lifetime Cancer Risk
Current Site Workers	**1.3**	**6E-04 (6 in 10,000)**
Future Site Workers	**16**	**1E-03 (1 in 1000)**
Current and Future Demolition Workers	**30**	2E-05 (2 in 100,000)

What is Risk and How is it Calculated?

A CERCLA human health risk assessment estimates the "baseline risk." This is an estimate of the likelihood of health problems occurring if no cleanup action were taken at a site. To estimate the baseline risk at a CERCLA site, EPA identifies a four-step process:



In **Step 1**, the risk assessor compiles all the chemical data for a site to identify what chemicals were detected in each medium (i.e. soil and groundwater). Chemicals that are detected high concentrations, or are considered toxic, are considered "chemicals of potential concern" and are evaluated in the risk assessment

In **Step 2**, the risk assessor considers the different ways that people might be exposed to the contaminants identified in Step 1, the concentrations that people might be exposed to, and the potential frequency and duration of exposure. Using this information, the risk assessor calculates a "reasonable maximum exposure" (RME) scenario, which portrays the highest level of human exposure that could reasonably be expected to occur.

In **Step 3**, the risk assessor compiles toxicity information on each chemical, including numeric values for assessing cancer and noncancer adverse health effects. The EPA identifies two types of risk: cancer risk and noncancer risk. The likelihood of any kind of cancer resulting from a CERCLA site is generally expressed as an upper bound probability; for example, a "1 in 10,000 chance." In other words, for every 10,000 people that could be exposed, one extra cancer may occur as a result of exposure to site contaminants. An extra cancer case means that one more person could get cancer than would normally be expected to from all other causes. For non-cancer health effects, the risk assessor calculates a "hazard index." The key concept here is that a "threshold level" (measured usually as a hazard index of less than 1) exists below which non-cancer health effects are no longer predicted.

In **Step 4**, the risk assessor uses the exposure information from Step 2 and toxicity information from Step 3 to calculate potential cancer and noncancer health risks. The results are compared to EPA acceptable levels of risk to determine whether site risks are great enough to potentially cause health problems for populations at or near the CERCLA site.

The EPA level of concern for noncancer risk is a hazard index greater than one. As shown in Table 1, the hazard index is greater than one for all of the potentially exposed populations (see **bolded** numbers). The EPA risk management range for excess cancer risk is 1E-04 to 1E-06 (one in 10,000 to one in 1,000,000). As shown in Table 1, the excess lifetime cancer risk for current and future site workers is greater than 1E-04 (see **bolded** numbers).

In the unlikely event that chemical concentrations and/or land use at the OB/OD changes in a manner that could result in a greater exposure potential than that evaluated in the RI Report, the Army will conduct a comprehensive review of all factors related to the potential risk to ensure adequate protection of human receptors at the OB/OD into the future. This review would occur after completion of the Record of Decision.

Ecological Summary

The OB/OD is currently being used as an ordnance disposal area with plans for continued use as an ordnance disposal area into the near future. Wildlife species that are tolerant of humans and disturbances are present at the OB/OD. The disturbed nature of the OB/OD is unlikely to attract new populations of rare or protected species. For the screening-level ecological risk assessment, it was assumed that the existing wildlife species would continue to occupy the OB/OD

and continue to come into contact with contaminants through various daily activities. The OB/OD was evaluated qualitatively and semi-quantitatively to assess risk to ecological receptors. The semi-quantitative evaluation was based on chemical results of the RI and very conservative assumptions about the ecological receptors present at the site. Based on the results of the semi-quantitative evaluations, ecological receptors exposed to soils experience the most *potential* risk and ecological receptors exposed to surface water experience the least amount of *potential* risk. An ecological survey was conducted by a biologist to identify plants and wildlife potentially affected by site-related contaminants and the presence of completed ecological exposure pathways. No significant effects were observed during the site survey. Based upon the the evaluations, ecological risk is not thought to be present at the OB/OD.

Ecological Receptors – Any living organism including plants, animals, and organisms that are likely present at the OB/OD.

Site Risk Summary

Based upon the human health and ecological risk assessments, it was determined that chemicals present at the OB/OD in soils, groundwater, and surface water could pose risks to human health but are not thought to pose risk to ecological receptors. Therefore, it is appropriate to calculate clean up goals for lessening risk to site workers and to determine the most appropriate methods of remediation to reach those goals.

Remedial Action Objectives

The Remedial Action Objectives (RAOs) describe what the proposed remediation efforts are expected to accomplish. Based upon the human health risk assessment, RAOs were developed for soil, groundwater, and surface water. The RAOs for the OB/OD are:

Soil

- Prevent/minimize migration of contaminants of concern (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 EPA 1E-04 to 1E-06 risk management range or a hazard index greater than one for the current and future site worker and current and future demolition worker.

COCs – Contaminants that pose potential risk to human health and the environment.

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 EPA 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 hazard index 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 EPA 1E-04 to 1E-06 risk management range or a hazard index 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 EPA 1E-04 to 1E-06 risk management range for the current and future site worker and current and future demolition worker.

Identification of Contaminants of Concern (COCs)

Based on the results of the RI and human health baseline risk assessment, the following contaminants are considered COCs for the OB/OD:

Groundwater

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

Surface Water

- PCA
- TCE
- Benzo(a)pyrene

Soil

- TCE

A description of the COCs can be found in the yellow information box on the next page.

Preliminary Remediation Goals

Preliminary remediation goals (PRGs) or cleanup levels are based upon existing federal and state action levels for soil and groundwater 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. PRGs for OB/OD are as follows:

Reasonable Use Scenario – The type and duration of activities expected to be done at the OB/OD now and in the future.

Soil

Due to the unique nature of the OB/OD, a risk-based remediation goal 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. Additional details on the calculation of the risk-based remediation goal for TCE can be found in the FS Report. The PRG for TCE in soil is:

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

Groundwater

ARARs – Federal and state environmental laws that a selected remedy should meet.

Although groundwater at the OB/OD 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 Applicable or Relevant and Appropriate Requirements (ARARs) for those COCs in groundwater that have MCLs. For

those COCs for which there are no MCLs, risk-based concentrations were calculated. PRGs for the groundwater COCs are:

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

Surface Water

For surface water, risk-based remediation goals were calculated based on the dermal contact of surface water by a future demolition worker.

- PCA – 63.6 µg/L (risk-based calculated concentration)
- TCE - 401 µg/L (risk-based calculated concentration)
- Benzo(a)pyrene – 1.07 µg/L (risk-based calculated concentration)

What are the Contaminants of Concern?

Fort Riley has identified five contaminants that pose the greatest potential risk to human health the OB/OD.

1,1,2,2-Tetrachloroethane (PCA): PCA was detected at the OB/OD at concentrations ranging up to 45 µg/L in groundwater and 16 µg/L in surface water. PCA detections were located down gradient of the metal debris pits. PCA is a manufactured, colorless, dense liquid that does not burn easily. It is volatile and has a sweet odor. In the past, it was used in large amounts to produce other chemicals, as an industrial solvent to clean and degrease metals, and as an ingredient in paints and pesticides. Breathing, drinking, or touching large amounts of PCA for a long period of time can cause liver damage, stomach aches, or dizziness. It is not known whether PCA causes cancer in humans.

Trichloroethylene (TCE): TCE was detected at the OB/OD at concentrations ranging up to 260 µg/L in groundwater, 91 J µg/L in surface water, and 181,000 µg/kg in soil. TCE detections were located near or down gradient of the metal debris pits. TCE is a nonflammable, colorless liquid with a somewhat sweet odor and a sweet, burning taste. It is used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers. Drinking small amounts of TCE in water for long periods may cause liver and kidney damage, impaired immune system function, and impaired fetal development. TCE is considered a probable human carcinogen.

Naphthalene: Naphthalene was only detected at a level that exceeded the screening level in groundwater once. Naphthalene is a white solid that evaporates easily. Fuels such as petroleum and coal contain naphthalene. It is also called white tar and tar camphor, and has been used in mothballs and moth flakes. It has a strong, but not unpleasant smell. The major commercial use of naphthalene is in the manufacture of polyvinyl chloride (PVC) plastics. Its major consumer use is in moth repellents and toilet deodorant blocks. Exposure to large amounts of naphthalene may damage or destroy red blood cells. Naphthalene has caused cancer in animals.

Benzo(a)pyrene: Benzo(a)pyrene was detected at the OB/OD at 0.76 J µg/L in one groundwater sample and at 1.1 J µg/L in one surface water sample. Benzo(a)pyrene is a polycyclic aromatic hydrocarbon that is formed during the incomplete burning of coal, oil, gas, wood, garbage, or other organic substances, such as tobacco and charbroiled meat. Benzo(a)pyrene is a known animal carcinogens and is probably carcinogenic to humans.

bis(2-Ethylhexyl)phthalate: bis(2-Ethylhexyl)phthalate was detected in groundwater at concentrations ranging up to 24 µg/L in groundwater. It was detected sporadically at low levels in most monitoring wells but was only detected twice at levels that exceeded the screening level. bis(2-Ethylhexyl)phthalate is a manufactured chemical that is commonly added to plastics to make them flexible. bis(2-Ethylhexyl)phthalate may be a human carcinogen.

Fact sheets with additional information on PCA, TCE, naphthalene, benzo(a)pyrene and bis(2-ethylhexyl)phthalate can be found at the Agency for Toxic Substances and Disease Registry's (ATSDR) Toxicological Profiles on the ATSDR website at www.atsdr.cdc.gov.

Institutional Controls – Land use controls set in place by Fort Riley to prevent specific site-related activities that may result in exposure to COCs.

Real Property Master Plan – The plan by which Fort Riley develops and maintains the installation property to best meet the needs and objectives of the units and organizations assigned to Fort Riley.

Monitoring – Periodic collection of samples to determine contaminant concentrations.

Land farm Treatment Cell – A lined, bermed area in which contaminated soil is spread, allowing for the volatilization and biodegradation of VOCs.

Summary of Remedial Alternatives

As part of the RI/FS process, Fort Riley developed a list of potential remedial alternatives for the soil, groundwater, and surface water at the OB/OD. Remedial alternatives developed include several technologies within each alternative to address the different media and the interactions between the media at the OB/OD. The Army is required by law to consider a No Action Alternative. Alternatives developed by the Army include:

Alternative 1 - No Action (NA): Under this alternative, no institutional controls would be implemented, remediation would not be performed, and monitoring would not be conducted.

Alternative 2 - Institutional Controls through the Fort Riley Real Property Master Plan (RPMP); Groundwater/Surface Water Monitoring; and Soil Removal with Disposal or Treatment (IC/GSM/SR): Under Alternative 2, contaminated soil would be removed by excavation and the area restored by backfilling, grading, and reseeding. The contaminated soil could then be treated or disposed by several different methods; however, on-site land farming in which the contaminated soil would be treated on site in a land farm treatment cell then after remediation is complete either spread on site or transported off site for disposal, has proven to be effective at other Fort Riley sites. Groundwater and surface water monitoring would be used to evaluate contaminant concentration and migration. The Army would control and limit development and other activities at the OB/OD through the RPMP. Institutional controls including restricted access to the site through fencing and security and restricted use of groundwater are currently in place at the OB/OD.

Alternative 3 - Institutional Controls through the Fort Riley RPMP; Groundwater/Surface Water Monitoring; and In-Situ Treatment by Soil Vapor Extraction (SVE) (IC/GSM/SVE): Under Alternative 3, soil contamination would be treated in situ (in place) by soil vapor extraction. For this treatment technology, the Army would induce a vacuum within the contaminated soil to remove VOCs and SVOCs from the soil. The gas would then be treated to destroy or recover the VOCs and SVOCs. Groundwater and surface water monitoring would be used to evaluate contaminant concentration and migration. The Army would control and limit development and other activities at the OB/OD through the RPMP. Institutional controls including restricted access to the site through fencing and security and restricted use of groundwater are currently in place at the OB/OD.

Alternative 4 - Institutional Controls through the Fort Riley RPMP; In-situ Groundwater Treatment, Surface Water Monitoring; and Soil Removal with Treatment and Disposal (IC/IGT/SM/SR): Under Alternative 4, groundwater would be treated in situ by injecting reactive chemicals into the contaminated groundwater. The chemicals would react with the contaminants, breaking down both the chemicals and the contaminants into harmless substances. Surface water monitoring would be used to evaluate contaminant concentration and migration. Contaminated soil would be removed by excavation and the area restored by backfilling, grading, and reseeding. The contaminated soil could then be treated by on-site land farming and the remediated soil either

spread on site or transported off site for disposal. The Army would control and limit development and other activities at the OB/OD through the RPMP. Institutional controls including restricted access to the site through fencing and security and restricted use of groundwater are currently in place at the OB/OD.

Evaluation of Alternatives

Nine criteria (see yellow information box below) are used to evaluate the different remediation alternatives both individually and against each other to select a remedy for the OB/OD. Within the FS, the relative performance of each alternative was evaluated against the first seven criteria, noting how each compares to the other alternatives for that medium. Two of the criteria (Overall Protection of Human Health and the Environment, and Compliance with ARARs) are threshold criteria and as such are rated as "pass" or "fail". These two criteria must be met (ie "pass") for an alternative to be considered acceptable as a stand-alone alternative. If an alternative fails one or both of these criteria, it is not further evaluated against the remaining criteria. The next five criteria evaluated in the FS - Long-term Effectiveness and Permanence; Reduction of Toxicity, Mobility or Volume; Short-term Effectiveness; Implementability; and Cost - are used to identify the best alternative. Each alternative is ranked for each of these criteria. The last two criteria - State/Support Agency Acceptance and Community Acceptance – are not fully assessed until comments are received on this Proposed Plan. These criteria will be addressed more fully in the Record of Decision.

Evaluation Criteria for CERCLA Remedial Alternatives

Overall Protection of Human Health and the Environment determines whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.

Compliance with Applicable or Relevant and Appropriate Requirements evaluates whether the alternative meets Federal and State environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver is justified.

Long-term Effectiveness and Permanence considers the ability of an alternative to maintain protection of human health and the environment over time.

Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.

Short-Term Effectiveness considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.

Implementability considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.

Cost includes estimated capital, periodic, and annual operations and maintenance (O&M) costs, as well as present worth cost. Present worth 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 percent.

State/Support Agency Acceptance considers whether the State agrees with the Army's analyses and recommendations, as described in the RI/FS and Proposed Plan.

Community Acceptance considers whether the local community agrees with Army's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

Each of the previously listed alternatives was compared to each other and assigned a qualitative ranking to determine the alternative that best addresses the environmental problems at OB/OD. The ranking is scored using a numeric range of 1 – 10 where one is the highest rank and 10 is the lowest rank. Table 2 summarizes the evaluation of alternatives for the OB/OD site.

Table 2 – Evaluation of Remedial Alternatives

Evaluation Criteria	Remedial Alternatives			
	1 - No Action	2 - IC/GSM/SR	3 - IC/GSM/SVE	4 - IC/IGT/ MNA/SM/SR
Protection of Human Health and the Environment	Fail	Pass	Pass	Pass
Compliance with ARARs	Fail	Pass	Pass	Pass
Long Term Effectiveness and Permanence		3	3	2
Reduction of Toxicity, Mobility, of Volume Through Treatment		3	5	2
Short Term Effectiveness		3	6	3
Implementability		3	9	6
Cost ($Million)		5 (14.1)	7 (17.7)	10 (25.1)
Total of Rankings		**17**	**30**	**23**
Overall Rank		**1**	**3**	**2**

IC – Institutional Controls **SR** – Soil Removal **MNA** – Monitored Natural Attenuation
SM – Surface Water Monitoring **SVE** – Soil Vapor Extraction
GT – In-Situ Groundwater Treatment **GSM** – Groundwater and Surface Water Monitoring

Alternative 1 failed the first two criteria because this alternative does not protect human health and the environment and does not comply with ARARs. Alternatives 2, 3, and 4 would all provide good long-term effectiveness with permanent reductions of contaminants; however, Alternative 3, which would treat the soil in place, would only provide a fair reduction in the volume of contaminants when compared to Alternatives 2 and 4 which would remove the soil thereby providing reduction in the volume of contaminants. As groundwater concentrations have reduced over time, treatment of the groundwater as proposed in Alternative 4 will not be required. Additionally, Alternatives 2 and 4 would effectively remove the contaminated regolith and prevent future leaching of contaminants to groundwater from the source area.

Alternatives 2 and 4 provide good short-term effectiveness as the contaminated soil would be immediately removed by excavation while Alternative 3 would require a longer time frame to remove contamination from the soil. Alternative

3 was scored poorly for implementability. An SVE system would require both above and a below ground supporting infrastructure that could be damaged during the remediation timeframe as the OB/OD is an active range. Additionally, regular required maintenance would require UXO support and could only be conducted when the area is not in use. Alternative 4 scored only fair for implementability because tight soils at the OB/OD would require more oxidant, tight spacing, and multiple injection events. UXO support would also be required for each injection event. The cost for the Alternative 2 is lower than the costs for Alternatives 3 and 4. Based on the numeric scoring, **Alternative 2 - Institutional Controls through the Fort Riley RPMP; Groundwater/Surface Water Monitoring; and Soil Removal with Disposal or Treatment** is the most effective alternative for the OB/OD site. The preferred alternative may change in response to public comment or new information.

Summary of the Preferred Alternative for Remediation

The proposed **Alternative 2 - Institutional Controls through the Fort Riley RPMP; Groundwater/Surface Water Monitoring; and Soil Removal with Disposal or Treatment** would provide overall protectiveness while being compliant with state and federal requirements. While none of the remediation methods within this alternative could individually properly or adequately address the contamination issues present at the OB/OD, the combined set of remediation techniques would provide an means to achieve the RAOs. The Army is proposing the following combination of remedial activities for the contaminated media at the OB/OD.

Removal and Treatment of Soil: Soil exceeding proposed remediation goals within the area of the metal debris pits would be excavated and treated on site by land farming to below actionable levels. This could require an additional investigation to confirm extent and possible removal of the source of the metallic signature within this area. Upon completion of the excavation, the area would be backfilled with clean, high-clay content soil to lessen infiltration by precipitation, then graded and reseeded. The treated soil could be used on site as general fill or transported to the Fort Riley construction and demolition landfill for use as landfill cover. By removing the soil, the remedy would be effective in the long-term and the result would be permanent. Excavation is easily implementable using standard excavation equipment and land farming has been conducted successfully at Fort Riley previously. Additionally, there is ample space at the OB/OD to conduct land farming. Due to the remoteness of the site, excavation and on-site treatment should have limited short term impacts. The removal and treatment of the soil would significantly reduce the toxicity, mobility, and volume of contamination in the soil.

Monitoring of Groundwater with Institutional Controls: Groundwater monitoring combined with institutional controls would be used to ensure that the contamination present in the groundwater is not increasing in concentration or size and that groundwater is not used for drinking water or other purposes during the remediation process. This remedial alternative for the groundwater could require that additional groundwater monitoring wells be installed within the upper regolith/weathered bedrock aquifer and the lower bedrock aquifer.

Institutional controls to restrict use of groundwater at the OB/OD are currently in place through the Fort Riley RPMP and would require no additional cost for this remedial combination.

Monitoring of Surface Water with Institutional Controls: Surface water monitoring combined with institutional controls would be used to ensure that the contamination present in the surface water is not increasing in concentration. Institutional controls including fencing and security that restrict access to the OB/OD are currently in place and would require no additional cost for this remedial combination.

Community Participation

The Army will provide information regarding the cleanup of the OB/OD to the public through public meetings; presentations and discussions at the Restoration Advisory Board meetings; the Administrative Record for the OB/OD; and announcements published in the Junction City Daily Union and Manhattan Mercury newspapers. The Army encourages the public to gain a more comprehensive understanding of the OB/OD through the RI and FS Reports and reports on other investigations and activities that have occurred at the site. A public meeting will be held during the public comment period on October 6, 2014 to present the conclusions of the RI and FS Reports, to further elaborate on the selection of the preferred alternative, and to receive public comments.

A final decision on remedial actions will not be made until review of the comments received during the comment period has been undertaken. The public comment period begins on September 11, 2014, and ends on October 10, 2014. Comments must be postmarked or emailed no later than October 10, 2014. The Army will respond to comments received during the public comment period. These responses will be documented in the Responsiveness Summary in the Record of Decision.

It is important to comment on the Proposed Plan and the alternative proposed for the remediation. Based upon public comments or new information, the Army may decide to modify the preferred alternative or to select another remedial alternative. The EPA and KDHE will also assess their positions on the preferred alternative after review of the received public comments. Comments on the proposed remedial actions may be sent to:

Richard Shields, Ph.D., P.G.
Public Works - Environmental Division
Installation Restoration Program
407 Pershing Court
Fort Riley, KS 66442
Email: richard.h.shields6.civ@mail.mil
Please add "OB/OD Proposed Plan" to the subject line of emails.

The dates for the public comment period and the date, location, and time of the public meeting are on page one of this Proposed Plan. Copies of the ***RI and FS Reports*** and ***Proposed Plan*** are available for viewing at the following locations:

Hale Library, Kansas State University
1100 MidCampus Drive
Manhattan, Kansas
(785) 532-0551 (Ms. Connie Kissee)
Hours:
Mon – Fri 8 am – 10 pm
Sat 10 am – 5 pm
Sun 1 pm – 5 pm
(Hours vary, please check ahead.)

Manhattan Public Library
629 Poyntz Ave
Manhattan, Kansas
(785) 776-4741
Hours:
Mon – Thurs 9 am – 9 pm
Fri 9 am – 8 pm
Sat 9 am – 6 pm
Sun 1 pm – 6 pm

The ***Administrative Record*** can be viewed at:

Directorate of Public Works
Environmental Division
407 Pershing Court
Fort Riley, Kansas 66442-6016
(785) 239-3194
Hours: Mon – Fri 7 am – 4 pm

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APPENDIX A –
Army's Responses to EPA Comments on the Feasibility Study

Response to Comments on the *Draft Final Remedial Investigation Report for the Open Burn/Open-Detonation Ground (Range 16) Operable Unit 06 at Fort Riley, Kansas*, dated December 12, 2013. Comments provided by Amer Safadi, Remedial Project Manager, Missouri/Kansas Remedial Branch, Superfund Division, United States Environmental Protection Agency, dated January 22, 2014

General Comments

1. This site poses unacceptable risk to ecological receptors but there is not a Remedial Action Objective (RAO) that addresses surface soil contamination to ecological receptors. This FS Report, including but not limited to RAOs, the area/volume calculations and remedial alternatives, needs to be revised accordingly. In addition, a new Preliminary Remediation Goal (PRG) needs to be developed.

   There is not a Remedial Action Objective (RAO) that addresses surface soil contamination to ecological receptors. *See response to comments #21 and 25.*

   This FS Report, including but not limited to RAOs needs to be revised. *See response to comments #16, 17, 18, 19, 20, 21, 22, and 23.*

   The area/volume calculations and remedial alternatives, needs to be revised accordingly. *See response to comments #2, 3, 32, 39, and 40.*

   A new Preliminary Remediation Goal (PRG) needs to be developed. *See response to comment #25.*

2. This FS Report seems to be missing a discussion of the identification or area and volumes of impacted media exceeding PRGs. Please include such detailed discussion and associated figures (if needed) in the report, preferably in Section 3.0.

   Concur. *Discussion of areas and volumes of impacted media exceeding PRGs will be added to Section 3.0.*

3. Institutional controls are not a viable alternative as a stand-alone option for soil and groundwater at this site and never should have been selected as a remedial alternative as it does not even meet the technological screening criterion of effectiveness for achieving RAOs, and further, had no chance to meet the threshold criteria. Institutional Controls could possibly be paired with a containment response action like capping (for soil) or a treatment response action like monitored natural attenuation (for groundwater and surface water) to be considered a remedial alternative worthy of evaluation. Please re-evaluate the remedial options for the project and revise the selected alternatives and subsequently the document accordingly.

   Noted. *We acknowledge that institutional controls are not a viable stand-alone remedial option. However, as discussed in the conclusion portion of Section 6.4 "As no single alternative developed in this FS Report adequately addresses the issues and concerns encountered within the OB/OD site area, the following steps will be undertaken in the PP.*

   1. *Combinations of the various remedial alternatives that are presented in this FS Report will be produced.*
   2. *Those combinations of remedial alternatives will be evaluated as to their ability to meet the threshold screening criteria.*
   3. *A final selection of an appropriate combination of remedial alternatives that best satisfies the protectiveness of human health and the environment will be put forth as the plan to be implemented by the PP.*
   4. *State and community acceptance were not considered in this evaluation but will be evaluated after the publication of the PP as part of the development of the ROD."*

The following sentence will be added to the discussion of institutional controls for soil, groundwater, and surface water in Sections 4.3.1.2, 4.3.2.2, and 4.3.3.2: "Institutional controls, through the Fort Riley RPMP, although not viable as a stand-alone remedial option, is retained for inclusion as a potential component of a more robust remedial package, since this option may be used in combination with other remedial technologies.

4. The presence of UXO at the site seems to be treated as a minor inconvenience to invasive activities as opposed to a significant safety issue – it's not even addressed by an RAO. It would seem that much more attention needs to be given to the presence of UXO in the subsurface and how it will be addressed by each of the proposed remedial alternatives for soil.

   Noted. *UXOs are not being remediated at this site; therefore, a RAO addressing them would not be appropriate. UXOs are addressed in the descriptions of each alternative as well as the cost estimates.*

   The potential presence of UXO at the site is not taken lightly and the safety of site workers during site investigations and construction is of significant concern to the team. However, the presence or absence of UXO is a variable that cannot be specifically addressed during the feasibility study phase.

   Because the site is actively used by the Post for OB/OD activities and will be for the foreseeable future, the presence/location of UXOs at the site today may be very different than the presence/location of UXO at the site during the remedial design phase. In addition, the presence/location of UXO at the site during the design phase may be different than the presence/location at the time of construction of potential remedies. The presence of UXO in the area is a function of Post operations. However, there are standard procedures used by the Post to address work in areas where UXO may be present, as well as industry standards and technical specialists trained to work in areas where UXO is potentially present.

   Short of avoiding all active remediation on the property itself, site workers will be potentially exposed to UXO at the site. To minimize the risk to workers, costs have been included in each of the alternatives for addressing UXO at the site during each phase of work. For example, additional geophysical testing will be performed during the predesign investigation phase to locate UXO; prior to any workers entering the site, work areas will be "cleared" by trained UXO specialists; a UXO specialist will be on-site at all times that workers are on the site to address conditions encountered in the field; site workers will be trained in the identification of UXO and procedures in case UXO is encountered at the site; invasive activities will be conducted in accordance with a number of UXO avoidance procedures designed to minimize the risk (e.g., borings will be advanced one to two feet at a time and the borehole checked between intervals for UXO; this will continue to a borehole depth of between 5 and 10 feet below the ground surface; similar procedures will be used with excavations).

5. Broad assumptions were made with respect to the time it would take for the selected remedial alternatives to achieve regulatory limits. Some basic modeling data would be very helpful in estimating contaminant concentrations over time and help streamline the high O&M costs that have been included in the SVE and groundwater remedial alternatives in particular. Consideration should be given to perform this modeling to better predict the effectiveness of the proposed alternatives, resulting in a refinement of the cost estimates.

   Noted. *If SVE or chemical reagent injection were to be selected as a remedy, modeling would be appropriate during the remedial design phase, to determine O&M requirements (and thus resulting costs) would be streamlined as a result.*

Specific Comments

6. Section 1.1, Page 1-1: In addition to CERCLA, this FS Report should conform to the National Oil and Hazardous Substance Pollution Contingency Plan, or NCP. Please revise the text accordingly.

   Concur. *Text will be changed to add the NCP as well as CERCLA.*

7. Section 1.2, Page 1-1: The remedial alternatives identified should be technically feasible, reasonable and cost effective. Please note this in the objectives.

   Concur. *Text will be added that states the remedial alternatives should be technically feasible, reasonable and cost effective***.**

8. Section 1.4: Open burning activities were performed at the site but it doesn't appear that the impacted media have ever been analyzed for dioxins and furans, even though dioxins and furans are common contaminants associated with these types of sites. Please explain why this analysis was omitted.

   Noted. *The OB/OD, as well as the entire Impact Range, regularly undergoes controlled burns to prevent uncontrolled grass fires that have occurred in the past, both before and after ownership of the property by the US Army. These controlled and uncontrolled burns are known potential sources of dioxins and furans. Sampling of the OB/OD for dioxins and furans could result in positive detections that are not a result of the OB/OD activities but are instead a result of naturally-occurring grassfires. Additionally, please note that groundwater and the spring samples were analyzed in 2004 for dioxins. All samples were nondetect.*

9. Section 1.4.3, Page 1-7: The last entry in Table 1-1 is the collection of soil, sediment, and surface water samples, the installation of monitoring wells, and four rounds of quarterly sampling from 2011-2013. However, these activities are not referenced in this section. It concludes with the second to last entry on the table, the collection of groundwater samples from 2007 through 2010. Please update this section to include the 2011-2013 activities.

   Concur. *The RI activities performed from 2011-2013 will be added to the text in this section.*

10. Section 1.4.3, Page 1-7, Line 22: As noted Table 1-1, the reference for the Data Summary Reports should be 2007-2011, not 2010. Please revise.

    Concur. *The text and references for the Data Summary Reports will be changed to 2007-2011.*

11. Section 2.2.3: To Be Considered (TBCs) are advisories or guidance typically considered along with ARARs in determining the level of cleanup required to protect human health and the environment. The list of TBCs seems above and beyond what is necessary, including, but not limited to, "Guidance for Quality for Assurance Project Plans, Guidance on Systematic Planning Using the Data Quality Objectives Process," and Groundwater Sampling Guidelines for Superfund and RCRA Project Managers." Consider limiting the list to just document that provide screening or cleanup criteria.

    Noted. *The list of TBCs were developed using the KDHE BER Policy# BER-RS-015 document. The KDHE has historically insisted on the use of this policy for determining ARARs and TBC for sites at Fort Riley.*

12. Section 2.2.3, Page 2-7: Since there are no chemical-specific ARARs for contaminated soils identified, the risk assessment calculations have been used to evaluate each alternative for its ability to achieve a basic level of protectiveness in soil. Therefore, please identify the baseline risk assessment as a TBC.

    Nonconcur. *The baseline risk assessment is not an official advisory or guidance. Please note that the applicable risk assessment guidance documents, which the baseline risk assessment was based on, are listed as TBCs. However, the results and conclusion of the baseline risk assessment are included in the FS.*

13. Section 3.2.3, Page 3-1: This section discusses the receptors exposed to surface water, including the current and future worker and the future demolition worker. However, it fails to mention the risk for the current demolition worker, even though the current demolition worker was evaluated in the Human Health Baseline Risk Assessment. Please revise this section to address the current demolition worker.

    Concur. *Section 3.2.3 will be revised to include the current demolition worker population.*

14. Section 3.3, Page 3-2: This section, Chemicals of Concern, states the following: "Based on the results of the HHBLRA, ecological risk assessment, the ARAR analysis, and the COCs currently present at concentrations above screening levels, the following are considered COCs for the OB/OD." Exceedances of a screening value or the ARAR analysis should not impact the chemicals identified as COCs. The COCs should be based on those chemicals that pose a CR greater than 1E-06 and an HQ greater than 1.0. Please revise accordingly.

    Concur. *Section 3.3 will be revised to state that COCs are based on those chemicals that pose a CR greater than 1E-06 and an HQ greater than 1.0. It should be noted that an exceedance of a screening level was not used to determine the COC list for the calculation of PRGs.*

15. Section 3.4, Line 22 (Page 3-2) and Line 1 (Page 3-3): The text refers to the chemical-specific standards. Please revise the text to include TBCs with the reference to ARARs as many of the PRGs are based on risk-based valued (i.e., TBCs).

    Concur. *Section 3.4 will be revised to say "Chemical-specific standards, including ARARs and/or TBCs that define acceptable levels are exceeded and exposure to contaminants above these levels is predicted for the reasonable maximum exposure (RME) identified in the risk assessment."*

16. Section 3.4.3, Page 3-5: Per "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA" (USEPA, 1988), RAOs must specify the COCs identified for the site, the exposure routes and receptors, and acceptable COCs for each exposure route. At a minimum, it is recommended that the RAOs be revised to note the specific receptor(s).

    Concur. *RAOs will be revised to note the specific receptor(s).*

17. Section 3.4.3, Page 3-5: For RAOs, in addition to referring to "having a total excess cancer risk greater than the USEPA 1E-04 to 1E-06 risk management range" and "having a HI greater than one," please reference "risk-based cleanup goals." For example, "Prevent ingestion of groundwater with COCs that exceed the risk based cleanup levels."

    Concur. *Section 3.4.3 will be revised to include references to risk-based cleanup goals.*

18. Section 3.4.3, Page 3-5: Please revise the RAOs by adding "with COCs" or "containing COCs" after the listed medium. For example, "Prevent ingestion of groundwater *with COCs* having a HI greater than one."

    Concur. *RAOs will be revised to include "with COCs" or "containing COCs".*

19. Section 3.4.3, Page 3-5: Please revise the RAOs by replacing "contaminants" with "COCs".

    Concur. *"Contaminants" will be replaced with "COCs".*

20. Section 3.4.3, Page 3-5, Lines 8-9: Revise the RAO accordingly: "Prevent the migration of COCs that would result in groundwater with concentrations of chemicals in excess of MCLs or risk-based cleanup goals."

    Concur. *This RAO will be revised as suggested above.*

21. Section 3.4.3, Page 3-5: An RAO that addresses excess risk to the ecological receptors from surface soil needs to be added to this section. The following is recommended: "Prevent direct contact with, inhalation of, and/or ingestion of contaminated soil with COCs that exceed risk-based screening goals.

    Noted. *Based upon the response to comment #25, the development of ecological RAOs is not appropriate for the site at this time.*

22. Section 3.4.3, Page 3-5, Lines 18-23: Air is not a medium of concern – thus, RAOs should not have been developed for air. RAOs for the inhalation of vapors for soil and groundwater should be incorporated into the RAOs for soil and groundwater, respectively. Please combine the two air RAOs into one (see comment below) and include it with the soil RAO and the groundwater RAOs.

    Concur. *The two air RAOs will be combined into one and included with the soil RAO and groundwater RAOs.*

23. Section 3.4.3, Page 3-5, Lines 18-23: These two RAOs should be combined into one RAO that references both excess cancer risk and non-cancer risk. Please use the revised verbiage below for an additional soil RAO (first bullet) and groundwater RAO (second bullet):

    a. "Prevent inhalation of vapors from soil with COCs having a total excess risk greater than the USEPA 1E-04 to 1E-06 risk management range or a HI greater than one."

    b. "Prevent inhalation of vapors from groundwater with COCs having a total excess cancer risk greater than the USEPA 1E-04 to 1E-06 risk management range or a HI greater than one."

    Concur. *These two RAOs will be combined into one RAO as suggested above.*

24. Section 3.5, Page 3-6, Lines 3-4: The text states the following: "PRGs are usually quantitative chemical-specific concentration targets for each individual COC for each reasonable exposure scenario." Consequently, it is confusing that only one PRG is presented for each medium. Please revise this section to clarify that PRGs were calculated for each potentially exposed receptor and that these sections provide the most conservative PRG of the receptors.

    Concur. *The PRG calculations and subsequent selection process will be clarified.*

25. Section 3.5.1, Page 3-6: A PRG needs to be developed to address elevated risk to ecological receptors from exposure to surface soil. It is unlikely that the PRG listed here for the Current/Future Worker will be sufficiently protective of the environment.

    Noted. *Ecological PRGs were not developed at this time because the screening level ecological risk assessment completed in the RI Report is conservative in nature. Ecological PRGs are typically calculated after the completion of a baseline ecological risk assessment, which involves a much more in-depth level of effort (i.e. animal tissue sampling, plant specimen collection, site-specific considerations, etc.).*

    More significantly, as summarized in Section 1.8.2 "The results of the qualitative assessment of the OB/OD concluded that no significant effects were observed during the December 15, 2011, site visit. The OB/OD was occupied by a variety of common plant and animal species tolerant of human disturbances. Fish and crayfish were observed in a pool along an ephemeral stream located downstream of the OB/OD. Areas devoid of vegetation or stressed vegetation were not observed during the site visit.

    Currently, the OB/OD site is being used as an ordnance disposal area with plans to continue to use the site as an ordnance disposal area. The OB/OD 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. The lands surrounding OB/OD consist of undeveloped wooded and grassy lands. The current disturbed nature of the OB/OD site 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. It was assumed that, regardless of the future of the OB/OD site, the existing representative wildlife species would continue to enter the OB/OD site when human disturbances are minimal and continue to come into contact with chemicals of ecological concern (COECs) through various daily activities. However, a wildlife species actual risk would be less than predicted if it spends less time on the OB/OD because of regular human disturbances or the lack of prey or forage due to regular human disturbances."

26. Section 3.5.1, Page 3-6, Lines 13-20. Delete these lines. This section discusses the PRG for soil but these lines discuss the exposure frequency for the demolition worker, and the PRG for soil wasn't even based on the demolition worker but on the current/future worker.

    Nonconcur. *Lines 13-20 discuss the rationale for the demolition worker exposure variable values. This information is provided for transparency in the calculations. As shown on Table 3-13, both the demolition worker and the site worker were considered when choosing the soil PRG. The most conservative calculated PRG was chosen to be carried forward in the FS (see also response to comment #24).*

27. Section 3.5.3, Pages 3-7 and 3-8: Provide a rationale as to why the MCL has been used as a PRG for surface water even though the MCL is based on the investigation of groundwater, whereas the risk-based PRGs are on the dermal component.

    Concur. *The MCL was used (where available) to remain consistent with the screening process conducted in the RI Report. PRG calculations for surface water will be revised based on dermal contact.*

28. Section 4.1, Page 4-1 and Table 4-1: Removal is a general response action (GRA), as is Discharge/Disposal, and not a technology under physical treatment. Please revise this section and table to list removal and disposal as stand-alone GRAs with their own technologies and process options. In addition, revise any other portions of Section 4.0 accordingly.

    Concur. *The GRA in the text and Table 4-1 will be changed to Removal and Disposal or Treatment.*

29. Section 4.1, Page 4-1 and Table 4-1: Containment is a viable GRA for soil and should be evaluated for this site. A technology option for containment is a cap, which will address exposure to the ecological receptors as well as contaminant migration. Please revise the text and tables accordingly. In addition, revise any other portions of Section 4.0 accordingly.

    Nonconcur. *Based upon the current and future use of the site as well as the physical location of the OB/OD, capping is not a viable remedial option. The site is currently used for emergency disposal of ordnance and ordnance disposal training and the future land use plans are not projected to change at the site. These activities are likely to damage or destroy any cap that is put in place. The site also resides within the impact fan of the adjacent artillery range, which would also damage or destroy the cap.*

30. Section 4.1, Page 4-1 and Table 4-1: Biological treatment involves the use of natural or enhanced biological degradation processes to reduce the concentration and extent of groundwater contamination. Monitored Natural Attenuation is not a GRA but a natural biological degradation process option that involves periodic groundwater monitoring for contaminant concentrations, as well as water quality field parameters. It is entirely an in-situ process, so please remove MNA as GRA and move it as a process option under In-Situ Treatment. In addition, revise any other portions of Section 4.0 accordingly.

    Concur. *The text and Table 4-2 will be changed as suggested.*

31. Section 4.2 "green" considerations are not one of the three criteria for screening the technologies (effectiveness, implementability, and cost), "green" implementation strategies should be considered as remedial alternatives are developed. Some of these potential implementation strategies and considerations may include:

    - Minimizing material usage (well material, extensive piping, etc.) through selection or reusable or multi-purpose materials and designs, as opposed to disposable components;
    - Minimizing energy consumption (required to operate the pumps and external equipment);
    - Optimizing equipment operation (maintaining equipment, selecting appropriate pump capacities, optimizing extraction well spacing, etc.);
    - Minimizing waste generation and landfill usage when other in-situ treatment options are feasible;
    - Offset energy consumption costs and energy transmission by installing on-site alternative power sources at or near the point of consumption (solar panels or wind turbines);
    - Select biodegradable components where possible, such as using locally-sourced bio matter as a filter material instead of carbon or using food grade surfactant solution.

    Noted. *"Green" considerations will be considered during the remedial design and implementation phases of the remedial action.*

32. Section 4.3.2.4, Page 4-9, Lines 22-23: The text states that "For MNA to be considered a stand-alone remedial alternative for the OB/OD, the criteria outlined in the following guidance documents must be met…" The text provides the two guidance documents but does not list the criteria or indicate if the criteria were met. Please provide the criteria and state if the criteria were met. If, not please remove MNA as an alternative.

    Concur. *The text stating "sole remedy" and "stand-alone remedial alternative" will be removed. We acknowledge that MNA is not a viable stand-alone remedial option. However, used in conjunction as portion of a remedial package MNA would be viable. As discussed in the conclusion portion of Section 6.4 "As no single alternative developed in this FS Report adequately addresses the issues and concerns encountered within the OB/OD site area, the following steps will be undertaken in the PP.*

    1. *Combinations of the various remedial alternatives that are presented in this FS Report will be produced.*
    2. *Those combinations of remedial alternatives will be evaluated as to their ability to meet the threshold screening criteria.*
    3. *A final selection of an appropriate combination of remedial alternatives that best satisfies the protectiveness of human health and the environment will be put forth as the plan to be implemented by the PP.*
    4. *State and community acceptance were not considered in this evaluation but will be evaluated after the publication of the PP as part of the development of the ROD."*

    The following text will be added: "Although MNA is not a viable stand-alone remedial alternative for the OB/OD because MNA alone does not address the source area, MNA is; however, retained for inclusion as a potential component of a more robust remedial package, since this option may be used in combination with other remedial technologies.

33. Section 4.4, Page 4-11: Alternative S3 needs to be broken out into separate alternatives. Instead of S3a, S3b, and S3c, which gives the impression that these alternatives are linked somehow, they should be labeled S3, S4, and S5. Please re-label the alternatives accordingly.

    Nonconcur. *All three alternatives are linked to soil excavation activities and as such, the only difference is the disposal/treatment method of the soil.*

34. Section 4.4, Page 4-11: Per an earlier comment regarding removal/excavation as a GRA, the Soil remedial alternatives should be revised accordingly:

    a. Alternative S3 – Excavation and Off-Site Disposal
    b. Alternative S4 – Excavation and On-Site Land Farming
    c. Alternative S5 – Excavation and Off-Site Thermal Incineration and Disposal
    d. Alternative S6 – Soil Vapor Extraction

    Noted. *The GRA will be changed as per comment #28. However, Alternatives S3a, S3b, and S3c will remain the same as per comment #33.*

35. Table 4-4: Oxidation/Reduction was screened out as a result of being ineffective for VOCs. On the contrary, oxidation/reduction is very effective for organics such as VOC and SVOCs. However, low soil permeability in the surface and subsurface soil is a reason to screen it out. Please revise the table accordingly.

    Concur. *Oxidation/Reduction will be screened out due to soil permeability.*

36. In Section 5.3.1, Page 5-6, Line 17: The words "fewer VOCs" is unclear. It is not clear whether the subsurface soil samples contain a smaller number of different volatile organic compounds or a lower concentration of these compounds. Please modify the text to clarify the situation.

    Concur. *The sentence will be changed to read as follows: "Subsurface soil samples contained a smaller suite of constituents (VOCs) in most samples as compared to surface soil samples and no SVOCs".*

37. Section 5.3.1.4, Page 5-26, Line 31: The text states that the system would be required to operate for 10 years or more to achieve regulatory limits. Yet, the cost includes $11M annually for an operation for 30 years. Why was 30 years operation assumed?

    Noted. *Based on existing data, it is not possible to know how long the SVE system will need to operate. If SVE were the selected remedy, pilot testing may be necessary to obtain the information necessary to establish design parameters. Accordingly, based on EPA guidance [USEPA, 2000. A Guide to Developing and Documenting Cost Estimates During the Feasibility Study. EPA 54-R-00-002. OSWER 9355.0-75. July 2000), a 30-year operating period was assumed for cost-comparison purposes.*

38. Section 5.3.2.1, Page 5-32, Lines 23-25: It would seem that the No Action Alternative essentially means that no additional action will be taken and that current conditions will remain the same) i.e., the institutional controls currently in place would remain in place). It is the reviewer's opinion that GW 1 should acknowledge these controls.

    Concur. *The following text will be added to the No Action Alternative "Although under the "No Action" Alternative institutional controls are generally not enacted, it should be acknowledged that access restrictions via range controls are already in place due to the location of the OB/OD on a military base within the limits of the impact area. Range controls will remain in effect as long as Fort Riley remains active."*

39. Section 5.3.3, Page 5-50, Lines 9-10: The text states that "Soil erosion and runoff may be carrying contaminants into the ephemeral stream." If this is the case, then there should be a surface water alternative proposed that addresses soil erosion and runoff. Consider adding a fourth remedial alternative to evaluate cleanup options for surface water.

    Noted. *The text stating that "Soil erosion and runoff may be carrying contaminants into the ephemeral stream." will be removed. It is unlikely that soil erosion and runoff are responsible for the benzo(a)pyrene detection in the eastern ephemeral stream for the following reasons:*

    - *There are no soil detections of benzo(a)pyrene in the vicinity of the eastern ephemeral stream;*
    - *There are also no surface water detections of benzo(a)pyrene either upstream or downstream of sample point Stream-11/SW01;*
    - *The benzo(a)pyrene detection in sample point Stream-11/SW01 was only observed one time, and was not able to be replicated during any previous or subsequent sampling events, due to the lack of water in the eastern ephemeral stream;*
    - *Surface drainage at the site is not in the direction of the eastern ephemeral stream, and;*
    - *The eastern ephemeral stream shares a border with the range adjacent to the site.*

    Therefore, a fourth remedial alternative to evaluate cleanup options for surface water is not required.

40. Section 6.0: A remedial alternative that combines the components of SW2 and SW3 should have been presented as SW4 in Sections 4.0 and 5.0 to be evaluated in Section 6.0. Please add this alternative to these sections or remove it from Section 6.0.

    Nonconcur. *As discussed in the conclusion portion of Section 6.4 "As no single alternative developed in this FS Report adequately addresses the issues and concerns encountered within the OB/OD site area, the following steps will be undertaken in the PP.*

    1. *Combinations of the various remedial alternatives that are presented in this FS Report will be produced.*
    2. *Those combinations of remedial alternatives will be evaluated as to their ability to meet the threshold screening criteria.*
    3. *A final selection of an appropriate combination of remedial alternatives that best satisfies the protectiveness of human health and the environment will be put forth as the plan to be implemented by the PP.*
    4. *State and community acceptance were not considered in this evaluation but will be evaluated after the publication of the PP as part of the development of the ROD."*

41. Section 7.0: Add QCSR April 2004 Sampling Event, OB/OD Site, Fort Riley, Kansas, which appears in table 1-1, to the list of references.

    Concur. *Reference will be added.*

Administrative Comments

42. Section 1.3, Page 1-2, Line 14: The text indicates what is provided in each section. Therefore, please change "and ranks the most feasible and effective alternative" to "and a ranking of the most feasible and effective alternatives".

    Concur. *Text will be changed as suggested.*

43. Table 1-1: Please revise the following:

    a. For April 2003, change the reference from BMcD, 2003b to BMcD, 2003.
    b. For March 2004, change the reference from MP-BMcD, 2004f to MP-BMcD, 2004a.
    c. For April 2004, change the reference from MP-BMcD, 2004g to MP-BMcD, 2004b.
    d. Add LBG to the Notes portion below the table.

    Concur. *Table will be changed as suggested.*

44. Table 1-2: What does NAp mean? Please define.

    Concur. *NAp will be defined in Table 1-2.*

45. Section 3.0: Be consistent in the reference to the ecological risk assessment. Sometimes "Ecological Risk Assessment" is used and other times "ECORA" is used. Please reconcile.

    Concur. *Text will be revised to be consistent.*

46. Section 3.0 tables: For consistency with the text, use PCA instead of 1,1,2,2-Tetrachlorethane.

    Concur. *Table will be revised to be consistent.*

Fort Riley Proposes Cleanup Plan for Contaminated Soil, Groundwater, and Surface Water

Proposed Plan
Fort Riley, Kansas
July 18, 2014

The United States Department of the Army (Army), the lead agency for site activities, with support from the Kansas Department of Health and Environment (KDHE) and the United States Environmental Protection Agency (EPA), will hold a Public Meeting to discuss the Remedial Investigation and Feasibility Study (RI/FS) Reports and Proposed Plan for the cleanup of contaminated soil, groundwater, and surface water associated with the Open Burning/Open Detonation Range 16, Fort Riley, Kansas (OB/OD). The RI and FS Reports discuss the risks posed by the OB/OD and present an evaluation of cleanup options for soil, groundwater, and surface water. The Proposed Plan identifies the preferred remedial alternative for the contaminated soil, groundwater, and surface water associated with the OB/OD. The Army, KDHE, and EPA evaluated the following alternatives for addressing the contaminated soil, groundwater, and surface water for this site:

- **Alternative 1** – No Action
- **Alternative 2** - Institutional Controls through the Fort Riley Real Property Master Plan; Groundwater/Surface Water Monitoring; and Soil Removal with Disposal or Treatment
- **Alternative 3** - Institutional Controls through the Fort Riley Real Property Master Plan; Groundwater/Surface Water Monitoring; and In-Situ Treatment by Soil Vapor Extraction
- **Alternative 4** - Institutional Controls through the Fort Riley Real Property Master Plan; In-situ Groundwater Treatment, Surface Water Monitoring; and Soil Removal with Treatment and Disposal

Based on available information, the preferred alternative for public comment at this time is **Alternative 2**. Proposed activities to be conducted under Alternative 2 include:

- **Removal and Treatment of Soil:** Soil exceeding proposed remediation goals within the area of the metal debris pits would be excavated and treated on site by land farming to below actionable levels. Upon completion of the excavation, the area would be backfilled with clean, high-clay content soil to lessen infiltration by precipitation, then graded and reseeded. The treated soil could be used on site as general fill or transported to the Fort Riley construction and demolition landfill for use as landfill cover.
- **Monitoring of Groundwater and Surface Water with Institutional Controls**: Monitoring combined with institutional controls would be used to ensure that the contamination present in the groundwater and surface water is not increasing in concentration or size and neither groundwater nor surface water is used for drinking water or other purposes during the remediation process. Institutional controls to restrict use of groundwater at the OB/OD are currently in place through the Fort Riley RPMP and would continue under this alternative.

The Army, KDHE, and EPA welcome the public's comments on all of the alternatives listed above. The formal comment period ends on October 10, 2014. The Army, KDHE, and EPA will choose the final remedy after the comment period ends and may select any one of the options after taking public comments into account.

Public Comment Period:
September 11 – October 10, 2014
The Army will accept written comments on the Proposed Plan during the public comment period by letter or email.

Public Meeting:
October 6, 2014 at 7:00 pm
The Army will hold a public meeting to explain the Proposed Plan and the alternatives presented in the FS Report. Oral and written comments will also be accepted at the meeting. The meeting will be held at 407 Pershing Court at 7:00 pm

Copies of the RI/FS Reports and Proposed Plan are available for viewing at the following locations:

Hale Library, Kansas State University
1100 MidCampus Drive
Manhattan Kansas 66506
(785) 532-0551 (Ms. Connie Kissee)
Hours: Mon – Fri 8 am – 10 pm
Sat 10 am – 5 pm
Sun 1 pm – 5 pm
(Hours vary, please check ahead.)

Manhattan Public Library
629 Poyntz Ave
Manhattan Kansas 66502
(785) 776-4741
Hours: Mon – Thurs 9 am – 9 pm
Fri 9 am – 8 pm
Sat 9 am – 6 pm
Sun 1 pm – 6 pm

The Administrative Record can be viewed at:

Directorate of Public Works
Environmental Division
IMNW-RLY-PWE
407 Pershing Court
Fort Riley, Kansas 66442-6016
(785) 239-3194
Hours: Mon – Fri 7 am – 4 pm

For further information or to submit written or emailed comments, please contact:

Richard Shields, PhD, PG, Project Manager
Public Works - Environmental Division
Installation Restoration Program
407 Pershing Court
Fort Riley, KS 66442
785-239-3194
Email: richard.h.shields6.civ@mail.mil

Please add "OB/OD Proposed Plan" to the subject line of emails.