DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

Interim Final 2/5/99
Revised 9/20/02

RCRA Corrective Action
Environmental Indicator (EI) RCRA Info code (CA725)
Current Human Exposures Under Control

Facility Name: Kansas Army Ammunition Plant
Facility Address: 23018 Rooks Road, Parsons, Kansas 67357
Facility EPA ID #: KS0213820467

DETERMINATION RESULT: YE

1. Has **all** available relevant/significant information on known and reasonably suspected releases to soil, groundwater, surface water/sediments, and air, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

__X__ If yes - check here and continue with #2 below.

_____ If no - re-evaluate existing data, or

_____ if data are not available skip to #6 and enter"IN" (more information needed) status code.

The Kansas Army Ammunition Plant (KSAAP) is a Government-Owned, Contractor-Operated (GOCO) installation under the jurisdiction of the US Army Operations Support Command (OSC). The installation is designated as inactive. The operating contractor, Day and Zimmerman Government Munitions Services (DZGMS), has a Facility Use Contract for use in third party contracting of both DOD and Non-DOD munition items. The operating contractor has a production contract with DOD for the Load/Assemble and Pack (LAP) of the Sensor Fused Weapon (SFW) on the 1100 line (KSAAP 2003).

The property on which KSAAP was built was acquired in 1940 under authorization of the Secretary of War. Prior to construction of the plant, the land was agricultural and generally used for livestock grazing and farming. Construction of the facility, known as Kansas Ordnance Works, began in August 1941. Production of artillery ammunition, bombs, and artillery shell components began in July 1942 and continued through World War II. At that time the operating contractor was J-M Service Corporation (Radian 1994a).

After World War II, KSAAP's mission changed to encompass receipt, storage, and issuance of ammunition and explosives; equipment and site maintenance; and renovation and demilitarization of selected items. During this time, the plant was operated by the government. From 1950 through 1957, the plant produced bombs, ammunition, artillery components, and reworked 105-millimeter (mm) cartridge cases for the Korean conflict. The operating contractor was National Gypsum Company. In July 1957, the lines were shut down and the plant was placed on standby status that extended to December 1966, during which time responsibility for the plant lay with the government. Facilities not in use by the government became available for outleasing. Two cabinet manufacturers and a sheet metal company leased warehouse space, the Census Bureau occupied the Administrative Area, and land was leased for agricultural purposes (Radian 1994a).

In 1966, demand for ammunition for the Southeast Asian conflict prompted reactivation of the plant. All production lines except the 105-mm cartridge case rework area were reactivated. The plant produced cluster bombs, 105-mm shells, 81-mm mortars, detonators, fuses, primers, and lead cup assemblies. The lead azide area was constructed, and in September 1968 production began in this area for primary explosives used in primer mixtures, detonators, and fuses. In March 1970, DZGMS took over as the operating contractor. After the Southeast Asian conflict, production lines were reduced as ammunition demand fell. By 1975, only three of the eight production lines remained active (Radian 1994a).

During the 1980s and 1990s, ammunition production at KSAAP was limited to the 300, 700, and 1100 Areas. The 300 Area produced the M864/155-mm Improved Convention Munition (ICM) round using composition A5 explosives (which contain hexahydro-1,3,5-trinitro-1,3,5-triazine [RDX] and stearic acid); the M219 lead assembly; and both inert and loaded expulsion charge assemblies for the M864/155-mm round. The 700 Area produced the M55 detonator using explosives such as lead axide and RDX. Combined effect munitions are produced at the 1100 Area by third-party contract to Aerojet-Honeywell (Radian 1994a).

Areas now leased at KSAAP are used for crops, grazing, hay, and hayseed. KSAAP-operated facilities include a water filtration plant on the Neosho River; a sewage treatment plant; steam generation plants; and water, electrical, and steam distribution systems. The current mission at KSAAP is to LAP ammunition items and maintain active and laidaway facilities. The installation surveys, renovates, demilitarizes, salvages, stores, inventories, and issues field service stocks; it also is involved with procuring, receiving, storing, and issuing necessary items for ammunition manufacturing (Radian 1994a; KSAAP 2003).

KSAAP encompasses about 13,727 acres in Labette County in southeast Kansas (Figure 1). The Missouri and Oklahoma state lines are approximately 30 miles east and 20 miles south of the installation, respectively. The area surrounding the production plant is primarily privately owned agricultural or residential land (LAW, 1998).

The installation is comprised of 416 acres of improved land, 1,630 acres of semi-improved land, and 11,681 acres of unimproved land. Active and standby production facilities occupy the improved land. The semi-improved land consists of railroads, storage areas, roads, and parking lots. The unimproved land consists of woodlands and agricultural land (see Figure 2). The installation contains 123 miles of roadways and 33 miles of Union Pacific Railroad. KSAAP has over 2.5 million square feet of building and storage area (Radian 1994a).

Agricultural land comprises approximately 92 percent of the unimproved land and approximately 78 percent of the total installation area. Areas outleased at the time of the RFI were used for crops, grazing, hay, and hayseed. Some farm crops currently in surrounding areas include milo, soybeans, sunflowers, winter wheat, oats, and fescue (grass and hay for livestock) (Radian 1994a).

A number of investigations were conducted between 1978 and 1989 at KSAAP that included a RCRA Facility Assessment (RFA) for USEPA Region 7 by A.T. Kearney. In 1989, a RCRA Part B permit was issued. In 1994, Radian conducted a Phase I RFI. Subsequently, USEPA Region 7 entered into a compliance agreement with KSAAP for corrective action at selected solid waste management unit (SWMU) groups in accordance with Section 3004(u) of RCRA (Radian 1998). At EPA's request, a background metals study was completed in June 1994 to compare to Phase I investigation data. EPA also requested an Interim Measures Fish/Pond Study (completed in May 1995) to assess potential risk to people catching and eating fish at KSAAP. As a result of this study, one pond was closed to fishing voluntarily pending information to be gathered in the Phase II investigations. Phase II field investigations were completed in September 1996. Final investigation reports were completed in May 1998 (LAW 1998).

During these previous investigations a number of sites were identified as having possible soil, surface water, and groundwater contamination resulting from past activities at KSAAP. The 1989 RCRA permit identified 25 SWMU groups requiring investigation of surface water, groundwater, and surface and subsurface soils. Table 1 identified and describes these SWMU groups and they are shown on Figure 3.

Table 1

Solid Waste Management Unit Group Descriptions

SWMU Name	Status	Description
SWMU Group No. 1: Building 112 Sump, Ditch, and Oxidation Pond	Inactive	Group No. 1 is in the northwest portion of the facility in the 100 Area. It consists of the Building 112 laundry washwater sump, an underground drainage pipeline (which generally has been referred to as a "ditch"), and an oxidation pond (Pond 30). Operations at this group began in 1942. The laundry washwater sump—constructed of poured concrete with a steel cover—is on the north side of Building 112. It was used as a settling tank for laundry process wastewaters generated during washing of miscellaneous powder-contaminated uniforms and rags used on the production lines. The wastewaters were conveyed to the sump via a concrete gutter system. Discharge from the sump flowed via gravity through an underground pipeline that leads to the oxidation pond. The solids that accumulated in the sump periodically were removed and transferred in drums which then were stored in the hazardous waste storage igloos. The solids were last removed in August 1994. Pond 30 is an unlined manmade impoundment measuring approximately 700 feet long and 400 feet wide. It is approximately 2,000 feet south of Building 112. The pond was to provide natural degradation and dilution of laundry wastewater. Waster from this pond discharges to an unnamed south-flowing stream that discharged to Labette Creek, located approximately 3 miles downstream. Wastewaters flowing through the sump to the oxidation pond system may have been contaminated with explosives and metals during the time the system was in operation.
SWMU Group No. 2: Oil and Water Separator (OWS) at 200 Area	Active	Group No. 2 is in the northwestern portion of KSAAP on the south side of the 200 Area, approximately 450 feet west of Road D and 600 feet north of Road 2. The OWS consists of a 10-foot wide concrete dike constructed across an open unlined ditch. This ditch receives wastewater from the 200 Area, which includes the vehicle washrack located in Building 202. The washrack is approximately 12 feet by 20 feet. The OWS is approximately 150 feet downgradient and southeast of Building 202. The OWS operates on the assumption that oil collects on the surface of the water in the ditch behind the dike, while water discharges to the ditch downstream through four underdrains. This waster in the ditch then flows southward towards Pond 28 and is monitored as NPDES outfall 002.

Table 1

Solid Waste Management Unit Group Descriptions

SWMU Name	Status	Description
SWMU Group No. 3: Oil Land Farm at 200 Area	Inactive	Group No. 3 is in the northwestern portion of the facility just south of the 200 Area and SWMU Group 2, approximately 700 feet west of Road D on the north side of Road 2. Operations in this former landfarm began in 1984. The landfarm consists of three cells. The largest (Cell 1) measures approximately 200 feet on each side and is surrounded by a 12-inch high earth berm. Cells 2 and 3 also are surrounded by berms and measure approximately 100 feet by 70 feet each. The cells are lined with compacted clay. The landfarm was used to treat oil-contaminated soil from spill cleanup activities at the facility, and operated on the principle that naturally occurring soil microbes would degrade the oily wastes. The landfarm reportedly was tilled regularly as needed to maintain proper aeration of the oily soil. The landfarm has not been tilled in several years. Use of Cells 2 and 3 ceased in 1985; Cell 1 was last used in April 1993. A regular program of soil monitoring occurred at this unit during its period of operation, with testing between the months of April and October each year. According to KSAAP personnel, this program consisted of routine soil testing for total petroleum hydrocarbons and periodic testing for barium, lead, and iron. Perimeter drainage ditches directed runoff water around and away from the landfarm cells.
SWMU Group No. 4: Building 314 Waste Oil-Toluene Storage Tank	Inactive	The waste oil-toluene underground storage tank (UST) was immediately south of Building 325 and east of Building 314. The tank contained a mixture of No. 5 fuel oil, waste oil, and toluene. This mixture was burned in the waste oil boilers. Wastes were transferred to the tank manually through a fill pipe at the ground surface. Tracer Research Corporation tested the UST "tightness" in January 1992, and it showed no indication of leakage. The installation date and history of the UST are not known. In September 1993, the UST was removed, and tank closure was performed per RCRA Subtitle I.

Table 1

Solid Waste Management Unit Group Descriptions

SWMU Name	Status	Description
SWMU Group No. 5: 300 Area Sumps, Ditches, Pink-Water Ditches, and Oxidation Ponds	Active/ Inactive	The 300 Area trough and sump systems are outside Buildings 302, 305, 306, 315, and inside Building 327. The trough and sump systems, constructed of concrete, were used to collect wastewater containing explosive particle contaminants. Wastewater flowed from the production area by gravity into the trough system, then to the sumps, and finally to a wastewater treatment plant. The sumps were covered, but no secondary containment structures existed for either the troughs or sumps. Explosive residues were collected within the trough system on a cheesecloth filter, and additional sludge was retained in the sumps. After settling, wastewater was discharged from the sumps to the 300 Area wastewater treatment system. Prior to construction of the trough and sump systems, wastewater generated at the 300 Area discharged to an unlined ditch and three unlined ponds in the 300 Area ditch-oxidation pond system. This system was constructed in 1942. Two oxidation ponds have been combined into a single pond, while a third is an evaporation pond. Because the ditch and ponds convey and collect wastewater generated within the 300 Area, wastewater containing hazardous constituents was allowed to infiltrate underlying soil or to discharge to the Neosho River without additional treatment. The Neosho River is approximately 4.5 miles downstream from the pond. The inactive oxidation pond, approximately 300 feet in diameter, is approximately 800 feet northeast of the 300 Area fence. Wastewater received by the oxidation pond was treated by natural oxidation before discharge to the Neosho River through an unnamed drainage ditch. Currently, treated wastewater from the 300 Area wastewater treatment system discharges to the pond. The pond also receives rainfall runoff. The evaporation pond is roughly circular in shape, with a diameter of approximately 200 feet, and has no outfall. It appears to have been significantly larger in the past when it was active. Wastewater received by the evaporation pond evaporated or infiltrated into the soil. The wastewater that flows through the trough and sump system is potentially contaminated with explosive constituents from Composition A-5, which is 98.5% RDX. The sludge in the sumps is classified as a characteristic and listed hazardous waste. Therefore, the sludge is treated at the explosive-waste incinerator, burning pad, or detonation grounds. The oxidation ponds formerly received untreated wastewater containing TNT from the 300 Area, Composition B, tetryl, and black powder.

Table 1

Solid Waste Management Unit Group Descriptions

SWMU Name	Status	Description
SWMU Group No. 6: 500 Area Sumps and Ditches	Inactive	This group includes of three sets of sumps and unlined ditches constructed in 1942 but not operating since the area was taken out of service in the 1970s. The 500 Ara sumps—located adjacent to Buildings 503, 505, and 513—are open-topped, concrete, and designed to overflow to unlined ditches. No secondary containment structures are associated with the sumps. Explosives-contaminated wastewater and solid explosive constituents were collected and settled in the sumps. Solids that accumulated in the sumps were removed and burned at the burning pad. Wastewater containing hazardous constituents was allowed to enter the unlined ditch and infiltrate into the ground or to discharge, without additional treatment, to the Neosho River via the 300 Area pond system. The 500 Area sumps received wastewater (possibly containing tetryl) and explosive mixtures used to manufacture boosters.
SWMU Group No. 7: 800 Area Sumps, Ditches, and Oxidation Pond	Inactive	The trough and sump systems adjacent to Building 804 and 816 conveyed and settled wastewater containing explosives constituents. Solids that settled to the bottom of the sumps were removed and burned at the burning pad, flashing pad, or detonation grounds. Both the sumps and the troughs are open-topped, concrete, and covered with metal grating. The troughs are approximately 8 inches wide, while the sumps measure approximately 12 feet long by 2 feet wide by 6 feet deep. The trough and sump systems received wastewater containing explosives constituents—including composition A-5, black powder, and cyclonite (which contains RDX). Wastewater containing explosives constituents discharged to the ground surface near the 800 Area sumps.

Table 1

Solid Waste Management Unit Group Descriptions

SWMU Name	Status	Description
SWMU Group No. 8: 900 Area Sumps, Ditches, Pink-Water Ditches, and Oxidation Ponds	Active	The 900 Area sump-and-trough systems are adjacent to buildings 905, 907, 927, 946, and 952. One sump is also located inside Building 907. The sump-and-trough systems convey wastewater containing explosives constituents to the 900 Area wastewater treatment system. The sumps, which have concrete sides and bottoms and are open-topped, are intended to separate the particulate matter from the wastewater. Prior to construction of the 900 Area wastewater treatment system, wastewater was discharged from the sump-and-trough systems directly to the 900 Area ditch-oxidation pond system put into service in 1942 that consisted of three unlined ponds and associated drainage ditches. The oxidation pond on the east side of the 900 Area (SWMU No. 130) treated process wastewater until 1970. A ditch conveyed wastewater in an eastward direction from the 900 Area approximately 1,500 feet to this pond. The eastern pond encompasses approximately 1.5 to 2.0 acres and discharges to the Neosho River, approximately 5 miles east of the pond. SWMU No. 130 currently receives only rainfall runoff. Another ditch conveys water in a southwest direction from the 900 Area wastewater treatment system to the other two oxidation ponds. The upstream pond is approximately 1,000 feet southwest of the 900 area. The second pond, approximately 3,000 feet downstream of SWMU No. 131, receives wastewater from the SWMU No. 131, as well as wastewater from Pond E in the 700 Area ditch-oxidation pond system. Until 1976, when the 900 Area wastewater treatment system was installed, the ponds received untreated wastewater. Water contained in the southernmost pond ultimately is discharged to Labette Creek. The ditches and oxidation ponds are unlined, allowing treated wastewater and formerly untreated wastewater to infiltrate the soil or to drain to the Neosho River and Labette Creek. Untreated wastewater upstream of the wastewater treatment plant is classified as hazardous and includes Composition A-5, black powder, TNT, and cyclonite. The principal explosives constituents of the treated wastewater stream are TNT, RDX, and tetryl. Untreated wastewater, formerly received by the eastern pond, contained constituents of explosives including Composition B, tetryl, TNT, and smokeless powder. The 700 Area wastewater contained lead, lead azide, mercury fulminate, and RDX.

Table 1

Solid Waste Management Unit Group Descriptions

SWMU Name	Status	Description
SWMU Group No. 9: 1000 Area Sumps, Ditches, Pink-Water Ditches, and Oxidation Ponds	Active	Most 1000 Area sump and trough systems are adjacent to Buildings 1106 and 1017, while one sump is located inside the wastewater treatment building. The sump-and-trough systems used to convey wastewater containing explosives contaminants to the 1000 Area pink-red wastewater treatment system. The sumps filtered and settled explosives particulate matter from the wastewater stream. Sludge accumulated in the sumps was burned at the burning pad. The sumps and troughs have concrete sides and bottoms, and are open-topped. Prior to construction of the 1000 Area sump-and trough systems, wastewater containing explosives constituents was discharged directly to the 1000 Area ditch-oxidation pond system. This ditch and pond system, put into service in 1942, consisted of three unlined ponds and interconnecting drainage ditches. Prior to construction of the wastewater treatment system in 1976, the ponds and ditches received untreated wastewater generated in the 1000 Area. After construction of the wastewater treatment system in 1976, the ditch and pond system received treated wastewater from the 1000 Area. Wastewater from the 1000 Area flowed in a ditch to the upstream oxidation Pond No. 39 located immediately outside on the southwest side of the production area fenced boundary. The wastewater then flowed from this pond through another ditch to the 1500 Area pond (Pond No. 31) approximately 5,000 feet southwest of the 1000 Area. Discharge from Pond No. 31 subsequently flowed to Labette Creek. The ditches and oxidation ponds are unlined and, when in use, allowed wastewater to infiltrate into the soil. Also, wastewater ultimately flowed to Labette Creek via the third pond. The most recent wastewater stream contained explosives constituents, including Composition B, Composition A-5, RDX, TNT, and smokeless powder. Before construction of the treatment plant, wastewater flowing through the system contained TNT and RDX.

Table 1

Solid Waste Management Unit Group Descriptions

SWMU Name	Status	Description
SWMU Group No. 10: 1100 Area Sumps, Ditches, and Oxidation Pond	Active	The 1100 Area sump-and trough systems are outside of buildings 1109, 1123, 1126, and 1127, and inside Building 1127. Wastewater containing explosives contaminants flows by gravity from the 1100 Area production lines through the sump-and-trough systems to the 1100 Area wastewater treatment system. The sumps provide the retention time needed to settle explosives particles from the wastewater. Wastewater flowing through the sumps is further clarified by an anthracite-coal filter. Solids that accumulate in the sumps are removed periodically and taken to the burning pads for treatment. The sumps and troughs are concrete and open-topped. Extending from the troughs are three distinct drainageways: (1) a south-flowing ditch system in the central part of the 1100 Area with branches leading from Buildings 1109 and 1113—currently conveying treated wastewater from the treatment system in Building 1127; (2) a west-flowing ditch system in the west part of the 1100 Area with branches leading from Buildings 1123 and 1126; (3) a south-flowing discharge ditch extending from the oxidation pond to Labette Creek. Before construction of the sump-and-trough systems, wastewater containing explosives constituents discharged from the first pair of basins for each sump to either the 1100 Area ditch-oxidation pond system or to a second oxidation pond west of Building 1123. The ditch-oxidation pond that constitutes SWMU 138 is northeast of Building 1135, near the southern border of the 1100 Area. This ditch-pond was put into service in 1942 and received untreated wastewater generated in the 1100 Area. During this period, treatment of wastewater in the pond consisted of only "natural oxidation" of explosives constituents prior to discharge to the ditch that flowed to Labette Creek. In 1975, the 1100 Area wastewater treatment system was constructed and began discharging treated wastewater to the ditch extending south of Buildings 1109/1127.

Table 1

Solid Waste Management Unit Group Descriptions

SWMU Name	Status	Description
SWMU Group No. 11: Open Burning Pads Numbered 1, 2, 3, and 4	Inactive	These burning pads are in the eastern portion of the 2700 Area, and were used for remote ignition of explosive wastes. It is not known when the pads were constructed; however, the pads were used during World War II. The pads were closed in 1985. The size, construction, and design of the former pads was essentially the same as that of the currently active pads at SWMU Group No 24. However, the SWMU Group No 24 pads are bermed on three sides, whereas nothing indicates that such berms existed at SWMU Group No. 11. Presently, a berm measuring approximately 270 feet long and 10 feet high exists between the former burning Pads 1 and 2. However, whether this berm was in place while the pads were in use is not known. Burning Pad 1 is no longer visible, as the CWP building stands over the area. Burning Pads 2, 3, and 4 are obscured by tall grass and weeds. The Phase I RFI report describes these three pads as rectangular, slightly elevated surfaces. The boundaries of Pads 2 and 3 were barely discernible during the Phase II RFI, located by the field sampling team's careful reconnaissance. Identification of Pads 2 and 3 was aided by the presence of large metal rings and a relative abundance of small metal fragments at the pads. In addition, a slight change in vegetation type appeared at the surface of the pads. Pad 4 was identifiable by its slight elevation and a change in vegetation. Metallic debris was observed beyond the pad boundaries, especially east of Pads 2 and 3. Waste materials burned on these pads are unknown, but likely were similar to the USEPA hazardous wastes treated at the current burning pads, SWMU Group 24. The types of engineering and/or operational controls that may have been in place for environmental protection are also unknown. Assumedly, the former pads operated in a manner similar to that of the current burning pads—where the wastes are burned directly on the native soil, and the air emissions are discharged uncontrolled to the atmosphere. Disposal practices for residues from the former pads are unknown.

Table 1

Solid Waste Management Unit Group Descriptions

SWMU Name	Status	Description
SWMU Group No. 12: Classification Area at 100 Area by Gate 3	Inactive	Group No 12, the 100 Area Classification Area, is near the north boundary of KSAAP approximately 0.25 mile southeast of Gate 3. In 1942, this area was used as a solid waste landfill for disposal of construction debris generated from KSAAP construction. Comprised of approximately 4 acres of relatively flat, moderately vegetated grasslands, the old landfill area is bounded partially on the north by Pond 50, and on the west and south by an east-southeast flowing stream. Vegetation along the stream consists of dense shrubs and trees. During the Phase I RFI, a 10,000-square-foot scrap metal pile was moved from within the landfill to outside the fence to facilitate sampling. Neither the quantity of waste nor the disposal method is known. No record exists of release controls. Leachate seepage was not observed during the Phase I RFI.
SWMU Group No. 13: Closed Landfill Near the Quarry	Inactive	The landfill is roughly circular, with a diameter of approximately 150 feet. Wastes were placed on the ground to a height of about 6 feet and covered with 4 feet of soil. The landfill is a small mound with an area of approximately 0.2 acre. The landfill received construction-demolition debris, including scrap metal parts, rubble, trash, and other inert material. No written documentation or visual evidence indicates that hazardous constituents were disposed of in this landfill.
SWMU Group No. 14: Closed Landfill and Refuse Burn Pits Near 200 Area	Inactive	The landfill consists of 23 pits and covers an area of 2.5 acres. Approximately 6 feet of waste was placed in 10-foot deep pits and covered with 4 feet of earthen fill. Materials disposed of in the pits consisted of construction-demolition wastes, maintenance-operation wastes, and wastes generated by office and lunchroom facilities. It is not known whether hazardous constituents were disposed of in the landfills. This area is currently pasture. Two groundwater monitoring wells were installed near the 200 Area in 1978. No other release-control or environmental monitoring features have been documented for this site.

Table 1

Solid Waste Management Unit Group Descriptions

SWMU Name	Status	Description
SWMU Group No. 15: Current Landfill, Including Asbestos and Grenade Disposal Areas	Active	The current landfill occupies approximately 13 acres. Wastes disposed of in the landfill include inert grenade bodies, asbestos, contaminated waste processor ash, maintenance operation wastes, sludge from the anaerobic digester, and trash. Wastes are disposed of in unlined trenches of various sizes, and are covered with earthen fill. No chemical analysis to determine the hazardous constituents of the wastes has been performed. Rainfall that accumulates in the open trenches is pumped out periodically. This water is allowed to flow onto the ground surface and downhill from the landfill. No release control features are documented for this unit. DZGMS constructed two groundwater monitoring wells near the current landfill in 1987. Based on visual observations during the Phase II RFI, the landfill is a combination trench and above-grade landfill. A north-south-trending open trench—approximately 800 feet long, 75 feet wide, and 15 to 20 feet deep—was in use during the Phase II RFI site visit. Soil excavated from this trench was used as cover material. Wastes were not placed above grade level (LAW 1998).
SWMU Group No. 16: Closed Landfill Near the Open Detonation Area	Inactive	The former demolition landfill area consists of 12 landfill units of the open detonation area in the 2700 Area. Each of the 12 landfill units occupies approximately 1 acre. Approximately 6 feet of waste was placed in 10-foot deep, unlined pits and covered with 4 feet of earthfill cover material. The pits were opened and covered individually. The landfill area now is covered with grass and used for pasture. Wastes disposed of in the landfill pits included ashes from burning operations and non-sellable scrap metal. An analysis to determine the concentration of hazardous constituents in the waste has not been conducted. Other than use of earthfill cover material, no release controls have been documented for this unit. Three groundwater monitoring wells exist in the area of the landfill, two north of road 3 and the other 200 feet south of the landfill along the access road. No exposed waste was observed during the Phase I RFI; however, field personnel during the Phase I investigation observed depressional areas in the southern portion of the site, possibly caused by consolidation settlement of the waste-filled trenches. Open sinkholes or cavities in the ground were observed in the southeast section of the landfill (Radian 1994). During the Phase I RFI, possible leachate seepage was observed and sampled in the ditch in the south central part of the landfill. The "leachate" evaporated or infiltrated into the ditch within approximately 75 feet downstream of the seep.

Table 1

Solid Waste Management Unit Group Descriptions

SWMU Name	Status	Description
SWMU Group No. 17: Open Detonation Field	Active	The detonation area is a RCRA-regulated unit encompassing approximately 25 acres. Explosive wastes are brought to the demolition grounds, placed in excavated pits, covered with earthen fill, and detonated from a remote location. Detonation operations have been conducted in at least 20 pits within the demolition grounds. Explosives constituents possibly present in the environment at the demolition grounds include Composition B, Composition A-5, lead azide, lead styphnate, tetryl, black powder, M-10 propellant, mercury fulminate, PBX, tetracene, RDX, TNT, smokeless powder, ammonium nitrate, and cyclotol.
SWMU Group No. 18: Sewage Treatment Plant Wastewater Sludge Drying Beds	Active	Group No. 18 in the southwest portion of the facility consists of two sludge drying beds at the 2200 Area Sewage Treatment System. The beds and the sewage treatment system were constructed in 1941 and 1942, respectively, rehabilitation of the beds occurred in 1985. The sewage treatment system with a capacity of 1 million gallons per day receives the wastewater from KSAAP. Sludge and solids from the primary settling tanks are transferred to an anaerobic sludge digester. The sludge from the digester is transferred mechanically to the sludge drying beds, where it is allowed to dry. The sludge historically was transferred approximately once every five years, but as production decreased, the frequency of transfer also decreased. Wastewater from the drying beds is transferred to the secondary settling tanks and treated prior to discharge through NPDES 004. The outfall discharges to a tributary to Labette Creek. As required, the treated sludge is taken off plant to a sanitary landfill. The sewage treatment units include both aboveground and in-ground units, which are surrounded by native soil or fill material. With the exception of the sludge drying beds, the units have concrete sides and bottoms. The sludge drying beds are bound by wooden containment boards and are not lined.
SWMU Group No. 19: Coal Pile Runoff Catchment Device and Associated Ditches	Active	This unit, located in the 200 Area near the coal-fired boiler plant, is a runoff control and discharge point for the coal pile associated with the plant. It consists of a concrete pad approximately 200 feet by 75 feet. Runoff from the coal pile leaves the control device through the discharge point and enters a ditch adjacent to the railroad line. The runoff may be slightly acidic depending on the coal type and quality due to leaching of sulfur from the coal. Available records indicate no evidence of uncontrolled release of wastes during recent facility inspections. KSAAP personnel monitor the discharge from the site as specified in the National Pollutant Discharge Elimination System (NPDES) Permit.

Table 1

Solid Waste Management Unit Group Descriptions

SWMU Name	Status	Description
SWMU Group No. 20: Explosive Waste Incinerator (EWI)	Active	The EWI started operation in 1981 and was closed for modifications in 1989. Regulated by RCRA, it was installed for the purpose of incinerating residual raw explosives and loaded components that result from production activities. The major component of the EWI is the destruction furnace which consists of feed and discharge assemblies and a cast steel revolving retort. The retort section of the furnace is 20 feet long and is fired by a No. 2 fuel oil burner at the discharge end of the furnace. Materials to be incinerated are fed into the cool end to the retort and propelled toward the flame end by means of spiral flights inside the kiln. As the wastes approach the flame, they detonate or burn freely. High-order detonations are contained by the retort walls which are 2.5 inches thick at the end and 3.25 inches thick in the center. Items are fed into the rotary kiln by a conveyor and feed chute, or on a conveyor in open-topped metal boxes. Wastes treated at the EWI are generated throughout KSAAP and are stored in the hazardous waste storage facilities. The EWI is a partially enclosed, aboveground metal unit surrounded by a concrete wall and underlain with a concrete pad. Emissions from the unit are treated in the EWI gas cooler, cyclone separator, and baghouse before discharge to the atmosphere. Modifications include shrouding for retort, an afterburner, and a high-temperature gas cooler. The EWI received residual raw explosives and loaded components generated during the production activities. Hazardous wastes incinerated include D003 and D008. Burn residue from the EWI is classified as D003 and D008 and is stored at the Building 1813 hazardous waste storage area. Residues remaining after the detonation process are analyzed to determine appropriate disposal measures.

Table 1

Solid Waste Management Unit Group Descriptions

SWMU Name	Status	Description
SWMU Group No. 21: Container Storage Units	Active	Hazardous wastes generated at the installation are stored in these RCRA-permitted on-site storage areas for treatment on site or disposal off site at a permitted hazardous waste treatment/storage/disposal facility. The permitted storage facilities consist of 18 igloo structures in the 1700, 1900, and 2700 Areas and one explosives storage magazine in the 1800 Area. The combined storage capacity is 207,720 gallons in the igloos and 118,800 gallons in the aboveground magazine. Wastes must be compatible with their respective containers, and incompatible wastes cannot be placed in the same container. Wastes permitted for storage at these units include the following EPA hazardous waste code numbers: F001, F002, F003, F005, D001, D002, D003, D005, D006, D007, D008, D009, D011, K044, K046, K047, U036, U122, and U132. Two classes of storage units include the 18 igloo structures and one storage magazine. The igloo structures are of three types: (1) an earth covered, concrete structure with an arched semi-cylindrical ceiling with inside dimension of 61 feet by 26.5 feet; (2) an earth-covered, concrete structure with two separate compartments; and (3) an earth-covered, concrete structure with inside dimensions of 6 feet by 6 feet and a 7-foot ceiling. The magazine is a brick open-bay structure—approximately 50 feet wide and 200 feet long—with four equally spaced roll-up doors, 8 feet wide, along one of the long sides. The concrete floor has three expansion joints that divide it into four equal 50- by 50-foot sections, each serviced by one of the doors.

Table 1

Solid Waste Management Unit Group Descriptions

SWMU Name	Status	Description
SWMU Group No. 22: Contaminated Waste Processor (CWP)	Active	The CWP furnace is housed inside Building 2712 and is not a RCRA-regulated unit. It burns trash that may have contacted explosive contaminants. Ash generated by the unit is stored in Building 1813 until tested. The ash has never been found to exhibit hazardous characteristics and is disposed of in the current landfill Area No. 4. Emissions from the CWP are treated in the CWP gas cooler, cyclone separator, and baghouse before discharge to the atmosphere. The CWP cyclone separator unit is the second of three air-pollution control units that remove particulate matter from the CWP furnace emissions. The cyclone separator is adjacent to the northwest corner of Building 2712. It is a completely enclosed metal unit approximately 15 feet high and 1 to 2 feet in diameter. The unit is entirely above ground and is underlain with a concrete pad. The particulate matter it removes may contain hazardous concentrations of cadmium and lead, and is disposed of off site. The CWP baghouse is the third of three air-pollution control units associated with the CWP furnace. The baghouse is an aboveground unit that receives treated emissions from the CWP cyclone unit. Air pollution control units are outside the southeast corner of the building. Particles removed from the baghouse are contained in an aboveground metal container located directly below the baghouse. Treated emissions are discharged into the atmosphere under an air quality permit from KDHE. Dust removed by the CWP baghouse is considered a characteristic hazardous waste due to presence of cadmium and lead. The fly ash from both the cyclone and baghouse is stored in Building 1813 before transport off site for disposal.
SWMU Group No. 23: Burning Cages No. 14, 17, and 22	Active	Group No 23 consists of Burning Cages 014, 017, and 022; they are in the 2700 Area between SWMU Group No. 24 and the CWP. The burning cages include large metal cages approximately 60 feet long by 40 feet wide by 15 feet high. Earthen berms over 10 feet high surround the cages on three sides, with the fourth side open to allow access. The burning cages have a natural soil bottom upon which nonhazardous, explosives-contaminated trash is burned when the CWP is not operating. It is not known exactly when the burning cages were constructed or when burning activities started. Aerial photographs indicate that Burning Cages 14 and 17 were constructed between 1950 and 1956, and that Burning Cage 22 was constructed between 1963 and 1970 (LAW 1998). Special permission has been received from KDHE to operate the burning cages. KDHE has granted a permit exemption for the air emissions from the burning cages. Burned residue from the operation of the cages is collected in drums and transported to the hazardous waste storage area in Building 1813. Residue determined to be hazardous is transferred for off-site disposal, whereas nonhazardous residue is disposed of on site in the current landfill.

Table 1

Solid Waste Management Unit Group Descriptions

SWMU Name	Status	Description
SWMU Group No. 24: Open Burning Pads No. 5 and 6	Active	This site consists of two areas where contaminated wastes are burned: one area is called the burning pad, and the second area is called the flashing pad. These pads are west of SWMU Group No. 23 and are known to have operated since 1967. Pad 5 was first identified on aerial photographs as a "burn area" in 1956. Pad 5, the burning pad, measures approximately 150 feet long by 100 feet wide. It is used for remote burning of explosive hazardous waste and is surrounded on the east, north, and west sides by a 5-foot high earthen berm. The south side is open to allow access to the pad. The surface of the pad is native soil. Wastes are contained in elevated metal pans during burning operations. No regulated air emission controls are used at this pad. Pad 6, the flashing pad, is 500 feet west of the burning pad and is used for explosive decontamination of items too large for the CWP to process. Construction of the flashing pad is similar to that of the burning pad. However, at the flashing pad, explosive contaminated items are placed directly onto the unlined soil surface of the pad and burned to flash the explosive constituents. The residue from the process either is salvaged or disposed of on site at the current landfill. This unit does not manage hazardous waste. KDHE also has granted an exemption for air emissions from this unit.
Pistol Range	Active	The Pistol Range, which began operation in 1968, is approximately 800 feet west of Road D and 800 feet south of Road 2. The site consists of a berm used for gunnery target backstop and contains projectiles from the ammunition used at the range. A potential exists for lead contamination of soils at the Pistol Range. The Pistol Range is not a designated SWMU Group.

Table 1

Solid Waste Management Unit Group Descriptions

SWMU Name	Status	Description
Sludge Lagoons	Active	The Sludge Lagoons are south of Road 2 in the northeastern portion of the facility. The site consists of two unlined rectangular impoundments, each measuring approximately 200 feet wide by 500 feet long by 4 to 6 feet deep. The lagoons were built in 1978 and are used to collect sludge generated by the River Water Treatment Plant, which treats river water for drinking purposes. Each lagoon has a capacity of approximately 122,000 gallons. During the treatment process, water passes through a lime/alum/polymer coagulation basin and rapid sand filters. The sludge generated is sent to a sludge settling basin. The sludge from the settling basin then is transferred via tank truck to the lagoons, where it is dewatered. Approximately 60,000 gallons of sludge per year is pumped into the unlined evaporation lagoons as required—generally once per year. Records indicate no environmental investigations at the lagoons before the Phase II RFI investigation to evaluate presence or absence of potential contamination. Six sludge samples were collected at the Sludge Lagoons and analyzed for herbicides, semivolatile organic compounds (SVOC), total metals, pesticides and polychlorinated biphenyls (PCBs), nitrate and nitrite, ammonia nitrogen, total nitrogen, total phosphorous, and sulfate. Herbicides and PCBs were not detected in the sludge. Pesticides were not detected at concentrations exceeding the screening values. Only beryllium and manganese were detected at concentrations exceeding the Kansas Interim Remedial Guidelines (IRG). Because beryllium and manganese were detected at concentrations above the IRG and/or background in soil samples collected facility-wide during the Phase I and Phase II RFI, these analytes are considered to occur naturally at KSAAP; thus, they are not contaminants of concern at the Sludge Lagoons.

Table 1

Solid Waste Management Unit Group Descriptions

SWMU Name	Status	Description
Water Towers	Active	Four Water Towers are at the KSAAP facility, each enclosed with a secured fence. The ground surface at the base of each tower is covered with a 1 to 2 inch layer of gravel placed beneath the towers at the time of construction. Water Tower 1 is on the south side of Road 1, approximately 3,500 feet east of Gate 1 and 1,000 feet west of the intersection of Road 1 and Road D. SWMU Group No. 1 is approximately 3,500 feet west of the tower, and SWMU Group No. 12 is 3,400 feet northeast of the tower. Water Tower 2 is on the south side of Road 1.5, approximately 250 feet west of Road E. SWMU Group No. 12 is approximately 5,500 feet northwest of the tower, and SWMU Group No. 19 is approximately 5,200 feet west of the tower. Water Tower 3 is along the southeast corner of the intersection of roads 4 and D. SWMU Group 13 is approximately 5,700 feet southeast of the tower. SWMU Group 18 is approximately 5,200 feet southwest of the tower. Water Tower 4 is along the west side of Road E between the 1,000 and 1,100 Areas. SWMU Group No. 13 is approximately 7,700 feet south of the Water Tower. SWMU Group No. 16 is approximately 4,500 feet northeast of the tower. The towers were built in 1941; they store water at the facility. As part of routine maintenance, the towers periodically were sandblasted and repainted. The towers reportedly were sandblasted in 1968 and 1982, with each sandblasting episode lasting approximately four weeks. As a result of the sandblasting operations, lead-based paint residue may have accumulated at the base of the towers. No records were available to indicate that any previous environmental investigations have been conducted at these towers.

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Current Human Exposures Under Control" EI

A positive "Current Human Exposures Under Control" EI determination ("YE" status code) indicates that there are no "unacceptable" human exposures to "contamination" (i.e., contaminants in concentrations in excess of appropriate risk-based levels) that can be reasonably expected under current land- and groundwater-use conditions (for all "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Current Human Exposures Under Control" EI are for reasonably expected human exposures under current land- and groundwater-use conditions ONLY, and do not consider potential future land- or groundwater-use conditions or ecological receptors. The RCRA Corrective Action program's overall mission to protect human health and the environment requires that Final remedies address these issues (i.e., potential future human exposure scenarios, future land and groundwater uses, and ecological receptors).

Duration / Applicability of EI Determinations

EI Determinations status codes should remain in RCRA Info national database ONLY as long as they remain true (i.e., RCRA Info status codes must be changed when the regulatory authorities become aware of contrary information).

2. Are groundwater, soil, surface water, sediments, or air **media** known or reasonably suspected to be **"contaminated"**[1] above appropriately protective risk-based "levels" (applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria [e.g., Maximum Contaminant Levels (MCLs), the maximum permissible level of a contaminant in water delivered to any user of a public water system under the Safe Drinking Water Act] from releases subject to RCRA Corrective Action (from SWMUs, RUs, or AOCs)?

Media	Yes	No	?	Rationale/Key Contaminants
Groundwater	X			
Air (indoors)[2]		X		
Surface Soil (e.g., <2 ft)	X			See comments below.
Surface Water	X			
Sediment	X			
Subsurf. Soil (e.g., >2 ft)	X			
Air (outdoors)		X		

_____ If no (for all media) - skip to #6, and enter "YE," status code after providing or citing appropriate "levels," and referencing sufficient supporting documentation demonstrating that these "levels" are not exceeded.

__X__ If yes (for any media) - continue after identifying key contaminants in each "contaminated" medium, citing appropriate "levels" (or provide an explanation for the determination that the medium could pose an unacceptable risk), and referencing supporting documentation.

______ If unknown (for any media) - skip to #6 and enter "IN" status code.

Rationale and Reference(s):

KSAAP is bisected by a drainage divide that trends from northwest to southeast through the installation. This divide extends from the Administration Area near the northern boundary to the east of the 1900 Area near the southeast

[1] "Contamination" and "contaminated" describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriately protective risk-based "levels" (for the media, that identify risks within the acceptable risk range).

[2] Recent evidence (from the Colorado Dept. of Public Health and Environment, and others) suggest that unacceptable indoor air concentrations are more common in structures above groundwater with volatile contaminants than previously believed. This is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration necessary to be reasonably certain that indoor air (in structures located above (and adjacent to) groundwater with volatile contaminants) does not present unacceptable risks.

boundary. In the northeast portion of the installation, surface water drains to the east towards the Neosho River, approximately 2 to 3 miles east of the installation. Surface water drains southwest toward Labette Creek in the southwest portion of the installation. Labette Creek is immediately west of the installation and coincides with the installation boundary near the sewage treatment plant. The Neosho River and Labette Creek both flow in a southerly direction and join at the town of Chetopa, 15 miles south of KSAAP (Radian 1998).

KSAAP has three quarry ponds covering 10 acres, and 15 oxidation ponds. Total pond area at the installation is approximately 45 acres. Most of the oxidation ponds are within natural surface runoff drainages. The intent of this design was to dissipate contamination by natural flushing of the ponds. Three lagoons at the installation are not part of the natural drainage pattern—two water treatment plant sludge lagoons south of the 1700 Area and the evaporation pond for the 300 Area (Radian 1998).

KSAAP lies in the Osage Plains of the Central Lowlands physiographic province, which generally comprises the typical rolling prairie of eastern Kansas. The surficial geology generally consists of terrace and floodplain alluvial deposits in the lowlands and residual soils, weathered from bedrock, in the uplands. Surface soils at KSAAP consist mostly of silty clays and silt loams. Groundwater resources at the installation and surrounding areas are present both in unconsolidated surficial materials and in the bedrock. The water table depth is generally shallow, less than 20 feet. The surficial materials are generally the best potential sources of groundwater in Labette County (Radian 1998).

Local aquifer use is limited. Farms and residences in the area near KSAAP generally receive potable water from rural water districts or from KSAAP. The rural water districts obtain their water from surface water reservoirs located at least 7 miles north and west of KSAAP and from the Neosho River (approximately 5 miles east of the 100 Area of KSAAP). KSAAP obtains potable water from the Neosho River (Radian 1998).

The Phase II RFI was conducted, in part, to fill data gaps identified following the Phase I RFI. Additionally, the Phase II RFI was to determine the nature, extent, and migration potential for chemical constituents suspected of releases to the environment. In evaluating the analytical data from the RFI, Radian and LAW used EPA Maximum Contaminant Levels (MCLs), Kansas Department of Health and Environment (KDHE) Interim Remedial Guidelines (IRGs), and calculated risk-based screening levels (RSK) for five explosives compounds (1,3-dinitrobenzene, 1,3,5-trinitrobenzene, 2,4,6-trinitrotoluene, HMX, and RDX) using the KDHE IRG equations (Radian 1998) as screening values. The Phase II RFI was conducted at 21 of the SWMU groups identified during the Phase I RFI plus three additional areas that had not been designated SWMUs—the Pistol Range, the Sludge Lagoons, and Water Towers. SWMU Groups 4, 20, 21, and 22 were eliminated after the Phase I RFI.

To define the background concentrations of target analytes at KSAAP, background investigations were initiated in conjunction with Phase I and Phase II RFI efforts. The term “background” refers to naturally-occurring concentrations of chemicals, particularly metals, in the soils, sediments, surface water, and groundwater at KSAAP. Background conditions were determined by measuring the naturally-occurring concentrations of selected analytes within the different environmental media at the facility. The purpose of the background investigations was to produce representative background concentration values for target analytes in surface soil, subsurface soil, sediment, surface water, and groundwater. These data were needed to provide a facility-specific screening “tool” for reducing the final analytical data set and to focus the discussion of contamination at each SWMU group.

Table 2 presents a summary of SWMU groups with constituents detected above screening values. The table identifies which constituents exceeded the screening values and which media were impacted. The tables in Appendix A summarize analytical results from the Phase II RFI. The tables include a screening of maximum detected concentrations of constituents to screening values (MCLs, RSKs, or PRGs) for each constituent of potential concern (COPC) for each media.

Groundwater - Groundwater samples across the facility were found to be contaminated at concentrations exceeding the screening values identified above. Constituents above screening values include inorganics (antimony, lead, manganese, nickel, and thallium), semivolatile organic compounds, volatile organic compounds, and explosives. Table A-1 in Appendix A summarizes these exceedances. Trichloroethylene was detected in only one sample at SWMU Group 14 at 7 micrograms per liter (µg/L), just slightly above the MCL of 5 µg/L. The explosive RDX was detected at 750 µg/L, well above the Kansas RSK of 30 µg/L in SWMU Group 9. The only SVOC detected above its screening value (150 µg/L for Kansas RSK and 3 µg/L for MCL) was bis(2-Ethylhexyl)phthalate at 855 µg/L. This SWMU group is a former production area at KSAAP.

Surface Water - Constituents detected in surface water samples from across the KSAAP facility exceeded screening values for inorganics (metals), explosives, VOCs, and dioxins-furans. Table A-2 in Appendix A indicates the maximum detections above screening values and where those maximum detections were found. Two of the maximum detections were in surface water samples collected from sumps at SWMU Group 6 (lead at 152 µg/L) and SWMU Group 10 (manganese at 6,110 µg/L). The screening values for lead and manganese were 15 µg/L and 880 µg/L, respectively. Vanadium was detected in SWMU Group 1 at 315,000 µg/L, which exceeded the screening value of 110 µg/L. Note that vanadium has an elevated background value at KSAAP of 5,860 µg/L (Radian 1994).

Sediment - Constituents exceeding screening values in sediment samples include explosives, inorganic metals, and SVOCs. Table A-3 summarizes constituents exceeding screening values in sediment samples across the facility. Six of the maximum detections were from sump sediment samples in SWMU groups 6, 7, 8, and 9 (all former production areas). Explosives exceeding screening values were at the SWMU Group 6 sump (tetryl), the SWMU Group 8 sump (nitrobenzene), and the SWMU Group 9 sump (TNT).

Surface Soil - Constituents exceeding screening values in surface soil include explosives, metals, and SVOCs. The maximum detected concentration of lead for the site was at SWMU Group 11 at a concentration of 120,000 mg/kg, well above the Kansas RSK value of 1,000 mg/kg for nonresidential soil. SWMU Group 11 includes the former open burning pads 1, 2, 3, and 4. The sample with this maximum concentration was believed to contain lead scrap. Table A-4 summarizes the maximum detected concentrations for each constituent that exceeded the screening values for surface soil.

Subsurface Soil - During the Phase II RFI, subsurface soil samples often were collected from the same location as surface soil samples. Frequently, one sample was collected for surface and subsurface investigation (at a depth of 1 to 3 feet below ground surface) (LAW 1998). Table A-5 summarizes the maximum detected exceedances for contaminants in subsurface soil at KSAAP. Constituents include explosives, inorganics (metals), and SVOCs.

Table 2
Summary of SWMU Groups with Constituents Exceeding Screening Values

SWMU Group	Constituent Exceeding Screening Value	Media Impacted
1	Antimony	SW
	Arsenic	SS
	Cadmium	SW
	Manganese	GW
	Vanadium	SW
	bis(2-Ethylhexyl)phthalate	GW
2	None	
3	Arsenic	SSS
	Lead	SSS
	Benzo(a)pyrene	SSS
5	Arsenic	Sed/SSS
	Lead	GW
	Manganese	SS/Sed/SSS/SW/GW
	Thallium	GW
	TNT	SS/SSS
	RDX	SS/SSS
	HMX	SS/SSS
6	Arsenic	SSS
	Lead	SSS/SS/Sed/SW
	Manganese	SW/GW
	Mercury	SS/SSS
	Thallium	GW
	Zinc	SS
	TNT	Sed/SS/SSS
	Tetryl	Sed/SS/SSS

Table 2
Summary of SWMU Groups with Constituents Exceeding Screening Values

SWMU Group	Constituent Exceeding Screening Value	Media Impacted
	2-Nitrotoluene	SS
	Benzo(a)pyrene	SS/SSS
	Benzo(b)fluoranthene	SS/SSS
7	Arsenic	SS/SSS
	Lead	Sed
	Manganese	SW/GW
	bis(2-Ethylhexyl)phthalate	GW
	RDX	SS/SSS
8	Arsenic	Sed/SS/SSS
	Cadmium	Sed (sump)/SS/SSS
	Lead	Sed (sump)/SS/SSS
	Manganese	Sed/SW/GW/SS/SSS
	Thallium	GW
	Zinc	SS/SSS
	TNT	Sed (sump)/SS/SSS
	RDX	Sed (sump)/SS/SSS
	Nitrobenzene	Sed (sump)
	HMX	Sed (sump)/SS/SSS
	bis(2-Ethylhexyl)phthalate	GW
	DNT	SS/SSS
	Benzo(b)fluoranthene	SS/SSS
9	Antimony	GW
	Arsenic	Sed/SSS
	Chromium, Total	Sed
	Lead	Sed

Table 2
Summary of SWMU Groups with Constituents Exceeding Screening Values

SWMU Group	Constituent Exceeding Screening Value	Media Impacted
	Manganese	Sed/GW/SS/SSS
	TNT	Sed/SS/SSS
	RDX	Sed/GW/SS/SSS
	HMX	Sed/SS/SSS
	Benzo(b)fluoranthene	Sed
	DNT	SS/SSS
	Methylene Chloride	SW
10	Antimony	SS/SSS
	Arsenic	Sed/SS/SSS
	Cadmium	SSS
	Lead	SW
	Manganese	SW/GW/SS/SSS
	Zinc	SS
	TNT	SS/SSS
	RDX	GW/SS/SSS
	HMX	SS/SSS
	bis(2-Ethylhexyl)phthalate	GW
11	Antimony	SS/SSS
	Arsenic	SS/SSS
	Lead	SS/SSS
	Manganese	GW/SS/SSS
	Thallium	GW
	TNT	SSS
	DNT	SS/SSS
	RDX	SS/SSS

Table 2
Summary of SWMU Groups with Constituents Exceeding Screening Values

SWMU Group	Constituent Exceeding Screening Value	Media Impacted
	HMX	SS/SSS
12	Antimony	SS/SSS
	Arsenic	SS/SSS
	Manganese	SS
13	Arsenic	SS/SSS
	Lead	SS/SSS
	Manganese	GW/SS/SSS
	Thallium	GW
	bis(2-Ethylhexyl)phthalate	GW
14	Manganese	SW/GW/SS
	Trichloroethylene	GW
15	Arsenic	SS/SSS
	Manganese	GW
	Thallium	GW
16	Antimony	SS/SSS
	Arsenic	SS/SSS
	Manganese	SW/GW
17	Antimony	SS/SSS
	Arsenic	SS/SSS
	Copper	SS/SSS
	Lead	SS/SSS
	Manganese	GW/SS/SSS
	Nickel	GW
18	Arsenic	SS/SSS
	Lead	SS/SSS

Table 2
Summary of SWMU Groups with Constituents Exceeding Screening Values

SWMU Group	Constituent Exceeding Screening Value	Media Impacted
	Manganese	SSS
19	Arsenic	SS
	Manganese	GW/SS
23	Antimony	GW
	Arsenic	SS
	Copper	SS
	Lead	SS
	Manganese	GW
	bis(2-Ethylhexyl)phthalate	GW
	TNT	SS
	RDX	SS
	Dioxins-furans (Total 2,3,7,8-TCDD Equivalents)	SS
24	Antimony	SS
	Arsenic	SS
	Lead	SS/SSS
	Manganese	SS/SSS/GW
	Thallium	GW
	TNT	SS/SSS
	RDX	SS/SSS
	HMX	SS/SSS
Sludge Lagoons	Manganese	SS
Water Towers	Lead	SS

Notes

2,3,7,8-TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
HMX	Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine
GW	Groundwater
RDX	Hexahydro-1,3,5-Trinitro-1,3,5-Triazine
SS	Surface Soil
SSS	Subsurface Soil
SW	Surface Water
SWMU	Solid Waste Management Unit
TNT	2,4,6-Trinitrotoluene

Source: USACE 2001.

3. Are there **complete pathways** between "contamination" and human receptors such that exposures can be reasonably expected under the current (land- and groundwater-use) conditions?

Summary Exposure Pathway Evaluation Table Potential Human Receptors (Under Current Conditions)							
"Contaminated" Media	~~Residents~~	Workers	~~Day-Care~~	Construction	~~Trespassers~~	Recreation	Food[3]
Groundwater	---	Yes	---	Yes	---	No	No
Air (indoors)	---	No	---	No	---	No	No
Soil (surface, e.g., <2 ft)	---	Yes	---	Yes	---	Yes	Yes
Surface Water	---	Yes	---	Yes	---	Yes	Yes
Sediment	---	Yes	---	Yes	---	Yes	Yes
Soil (subsurface e.g., >2 ft)	---	No	---	Yes	---	No	No
Air (outdoors)	---	No	---	No	---	No	No

Instructions for Summary Exposure Pathway Evaluation Table:

1. Strike-out specific Media including Human Receptors' spaces for Media which are not "contaminated") as identified in #2 above.

2. enter "yes" or "no" for potential "completeness" under each "Contaminated" Media -- Human Receptor combination (Pathway).

Note: In order to focus the evaluation to the most probable combinations some potential "Contaminated" Media - Human Receptor combinations (Pathways) do not have check spaces ("___"). While these combinations may not be probable in most situations they may be possible in some settings and should be added as necessary.

_____ If no (pathways are not complete for any contaminated media-receptor combination) - skip to #6, and enter "YE" status code, after explaining and/or referencing condition(s) in-place, whether natural or man-made, preventing a complete exposure pathway from each contaminated medium (e.g., use optional Pathway Evaluation Work Sheet to analyze major pathways).

__X__ If yes (pathways are complete for any "Contaminated" Media - Human Receptor combination) - continue after providing supporting explanation.

_____ If unknown (for any "Contaminated" Media - Human Receptor combination) - skip to #6 and enter "IN" status code

[3] Indirect Pathway/Receptor (e.g., vegetables, fruits, crops, meat and dairy products, fish, shellfish, etc.)

Rationale and Reference(s):

KSAAP is a limited-restricted access installation not open to the general public. Direct contact with contaminants is limited to on-site personnel. This includes occupational exposure to Army personnel, DZGMS employees, agricultural lessees, subcontractors, and visitors to the facility (Radian, 1998).

Air Pathway (indoor and outdoor) - The exposure to on-site receptors through air pathways is limited. Many of the constituents exceeding screening values are non-volatile. The soils at KSAAP are clayey and tend to remain moist due to moderate levels of annual rainfall and extensive vegetation. Both of these factors lower the risk of inhalation of vapor-phase contaminants or fugitive dust by receptors (Radian, 1998). Though the Open Burning-Open Detonation operations (permitted operations) may cause releases to the air, these releases will be minimal. Therefore, the air pathway is considered insignificant.

Surface Water Pathway - Potential exists for exposure of on- and off-site receptors to contaminants through surface water pathways. Transport of dissolved- and solid-phase contaminants can occur through runoff of surface water. Ditches and streams at KSAAP drain surface runoff to the Neosho River to the northeast and to Labette Creek to the southwest. The Neosho River is approximately 2 miles east of KSAAP, and Labette Creek forms a portion of the western boundary of KSAAP. No SWMUs are located within 1,000 feet of these streams or within the 100-year floodplain (Radian 1998).

Though the oxidation ponds at the facility occur along natural surface drainages, many of them are man-made and not considered natural surface water bodies. Releases from these ponds go either to the Neosho River or to Labette Creek. Livestock in the facility have access to some of these oxidation ponds. No site surface waters are used for human consumption. Several ponds on the installation serve employees and agricultural land lessees for recreational activities including fishing. In addition to potential for direct contamination of the fish, bioaccumulation can occur, with possible adverse health effects in humans and predators that ingest the fish. Incidental contact and ingestion of the surface water may cause exposure to contaminants of concern (Radian 1998).

Groundwater Pathway - Potential exists for exposure of on-site receptors to contaminants through groundwater pathways. Potential pathways associated with the shallow groundwater are skin contact with the water, ingestion of the groundwater, and root uptake of groundwater by plants subsequently consumed by animals or humans. The shallow groundwater does not appear to be a serious concern as an exposure pathway at the KSAAP sites, because it is not used directly at these sites or nearby. In general, the shallow aquifer does not produce sufficient quantities of water for domestic purposes. No groundwater production wells are on the installation (Radian 1998).

Exposure via the root uptake pathway could occur through ingestion of flora by livestock and birds, resulting in bioaccumulation and subsequent human exposure through consumption of the animals. Another potential exposure scenario via root uptake exists with the human consumption of crops irrigated with contaminated groundwater or human consumption of livestock that are fed crops irrigated with contaminated groundwater. However, groundwater is not used for irrigation at KSAAP (Radian 1998).

Surface Soil and Sediment Pathways - Potential exists for exposure of on-site receptors to contaminants through surface soil and sediment pathways. Incidental dermal exposure or ingestion of contaminated soil may occur as an occupational exposure to Army personnel, contractor employees (DZGMS), agricultural lessees (all included in the “worker” category in the table above), or contract construction workers. Potential exists for transport of dissolved- or solid-phase contaminants in surface water runoff. These contaminants ultimately may accumulate in the ponds within the installation or migrate to streams that flow through or from the KSAAP installation. Ingestion of contaminated sediment by fish or other wildlife may result in bioaccumulation of contaminants, ultimately resulting in exposure to humans and predators that consume the contaminated prey (Radian 1998).

Incidental ingestion and dermal contact of sediments may also result in exposure to on- site human receptors. Since some agricultural lessees use a portion of the KSAAP land for production of crops and livestock feed, human ingestion of grains or vegetables contaminated by soil or sediments or consumption of grasses and hay by livestock may also be relevant pathways (Radian 1998).

Subsurface Soil Pathway - Only contract construction (excavation) workers likely would be exposed to contaminated subsurface soils. Facility workers (including Army personnel, contractor employees (DZGMS), agricultural lessees) are not likely to contact soils deeper than 2 feet below ground surface (bgs) during normal facility operations.

4. Can the **exposures** from any of the complete pathways identified in #3 be reasonably expected to be **"significant"**[4] (i.e., potentially "unacceptable" because exposures can be reasonably expected to be: 1) greater in magnitude (intensity, frequency and/or duration) than assumed in the derivation of the acceptable "levels" (used to identify the "contamination"); or 2) the combination of exposure magnitude (perhaps even though low) and contaminant concentrations (which may be substantially above the acceptable "levels") could result in greater than acceptable risks)?

___X___ If no (exposures can not be reasonably expected to be significant (i.e., potentially "unacceptable") for any complete exposure pathway) - skip to #6 and enter "YE" status code after explaining and/or referencing documentation justifying why the exposures (from each of the complete pathways) to "contamination" (identified in #3) are not expected to be "significant."

_____ If yes (exposures could be reasonably expected to be "significant" (i.e., potentially "unacceptable") for any complete exposure pathway) - continue after providing a description (of each potentially "unacceptable" exposure pathway) and explaining and/or referencing documentation justifying why the exposures (from each of the remaining complete pathways) to "contamination" (identified in #3) are not expected to be "significant."

______ If unknown (for any complete pathway) - skip to #6 and enter "IN" status code

Rationale and Reference(s):

Because most surface soil at KSAAP is covered with pavement, crushed rock, or vegetation (LAW, 1998), facility workers (including agricultural lessees) are less likely to be exposed to contaminated surface soil. However, any excavation workers might be exposed to contaminated soils.

While repairing or installing utilities or other excavation work, contract construction workers and utility workers could be exposed to contaminated groundwater, surface soil, and subsurface soil with concentrations of contaminants that exceed Kansas risk-based standards. However, because they are not full-time employees on site, their exposure is limited in duration. Because of the limited period of contact, exposure of contract construction workers to hazardous constituents in soil likely will not be significant. Groundwater target concentrations are based on ingestion of water and are not applicable to dermal contact. Given the average depth to groundwater (10 to 20 feet bgs) the level of exposure of contract construction and utility workers to hazardous constituents in groundwater likely would not be significant.

A Human Health Risk Assessment (HHRA) was performed on 20 SWMU groups and two areas of concern at KSAAP. Objectives of the HHRA were to identify constituents of potential concern (COPCs); identify potential exposure pathways and human receptors; evaluate toxicities of the COPCs; and characterize current and future potential health risks associated with the site. Risk information was developed for each SWMU group. The risk values were compared to threshold values set by the National Contingency Plan (NCP) (ARCADIS, 2003). Risks did not exceed NCP threshold levels for any of the 22 areas assessed, and only seven of the 22 areas were recommended for some type of further action. Therefore, exposures from the complete pathways identified in the previous question likely would not be significant.

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[4]If there is any question on whether the identified exposures are "significant" (i.e., potentially "unacceptable") consult a human health Risk Assessment specialist with appropriate education, training and experience.

Future exposure pathway and receptor scenarios are not expected to change greatly. If KSAAP is closed, the town of Parsons possibly would take over the area. This has the potential of increasing public exposure by placing people in closer proximity to the sites. If KSAAP is closed, domestic use of groundwater is possible in portions of the installation where geologic units have high enough yields of potable water. Any future construction or remedial activity occurring on the sites also could lead to increased exposure through excavation of contaminated material (Radian 1998).

5. Can the “significant” **exposures** (identified in #4) be shown to be within **acceptable** limits?

_____ If yes (all “significant” exposures have been shown to be within acceptable limits) - continue and enter “YE” after summarizing and referencing documentation justifying why all “significant” exposures to “contamination” are within acceptable limits (e.g., a site-specific Human Health Risk Assessment).

_____ If no (there are current exposures that can be reasonably expected to be “unacceptable”)- continue and enter “NO” status code after providing a description of each potentially “unacceptable” exposure.

_____ If unknown (for any potentially “unacceptable” exposure) - continue and enter “IN” status code

Rationale and Reference(s):

6. Check the appropriate RCRA Info status codes for the Current Human Exposures Under Control EI event code (CA725), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (and attach appropriate supporting documentation as well as a map of the facility):

__X__ YE - Yes, "Current Human Exposures Under Control" has been verified. Based on a review of the information contained in this EI Determination, "Current Human Exposures" are expected to be "Under Control" at the Kansas Army Ammunition Plant facility, EPA ID #KS0213820467, located at 23018 Rooks Road, Parsons, Kansas 67357, under current and reasonably expected conditions. This determination will be re-evaluated when the Agency/State becomes aware of significant changes at the facility.

____ NO - "Current Human Exposures" are NOT "Under Control."

____ IN - More information is needed to make a determination.

Completed by ______ Date 9/30/03
(signature)
Ken Herstowski
Project Manager, RCRA Corrective Action & Permits Branch
EPA Region 7

Supervisor ______ Date 9/30/03
(signature)
John Smith
Branch Chief, RCRA Corrective Action & Permits Branch
EPA Region 7

Locations where References may be found:

EPA Region 7
RCRA Files - Region 7 Records Center
901 North 5th Street
Kansas City, Kansas 66101

Contact telephone and e-mail numbers

Ken Herstowski
(913) 551-7631
herstowski.ken@epa.gov

FINAL NOTE: THE HUMAN EXPOSURES EI IS A QUALITATIVE SCREENING OF EXPOSURES AND THE DETERMINATIONS WITHIN THIS DOCUMENT SHOULD NOT BE USED AS THE SOLE BASIS FOR RESTRICTING THE SCOPE OF MORE DETAILED (E.G., SITE-SPECIFIC) ASSESSMENTS OF RISK.

REFERENCES

ARCADIS Geraghty and Miller, Inc. (ARCADIS). 2003. "Kansas Army Ammunition Plant Human Health Risk Assessment Report Draft." May.

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LAW Engineering and Environmental Services, Inc. (LAW). 1998. "Final Phase II RFI Report Kansas Army Ammunition Plant (KSAAP) Parsons, Kansas." June.

Radian Corporation. (Radian). 1994. "Background Metals Study, Kansas Army Ammunition Plant, Parsons, Kansas." June.

Radian. 1994a. "RCRA Facility Investigation, Kansas Army Ammunition Plant, Parsons, Kansas." August.

Radian. 1998. "Final Report Phase II RCRA Facility Investigation, Kansas Army Ammunition Plant, Parsons, Kansas." May.

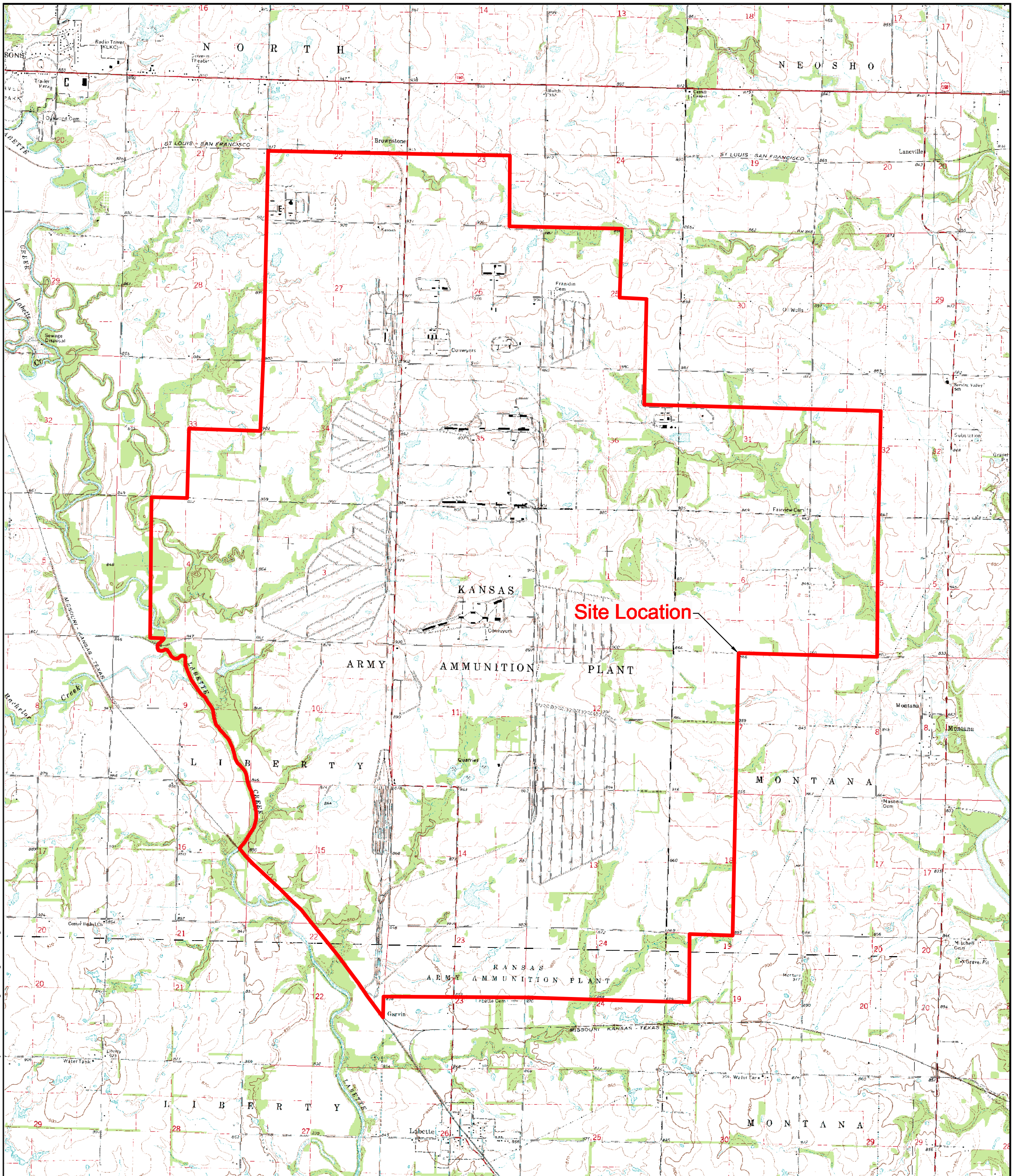
United States Army Corps of Engineers (USACE) Kansas City District. 2001. "Final Corrective Measures Study for the Kansas Army Ammunition Plant, Parsons, Kansas." February.

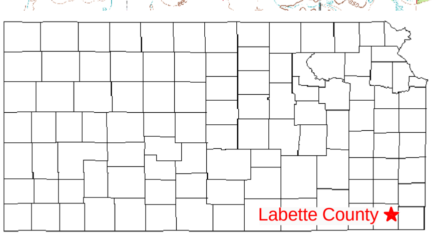
United States Environmental Protection Agency (EPA). 2002a. "List of Contaminants and their MCLs." EPA 816-F-02-013. July.

EPA. 2002b. "Region 9 Preliminary Remediation Goals 2002 Update." October.

FIGURES

(Three Pages)





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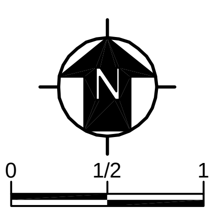
USGS Oswego, KS 7.5 Minute Topo Quad, 1974
USGS Parsons East, KS 7.5 Minute Topo Quad, 1973



Scale in Miles

Kansas Army Ammunition Plant
23018 Rooks Road
Parsons, Kansas 67357

Figure 1
Site Location Map

Tetra Tech EM Inc.

Date: 09/30/03 Drawn By: Roger Stull Project No: G9017.0.R07.1.19.05.DN

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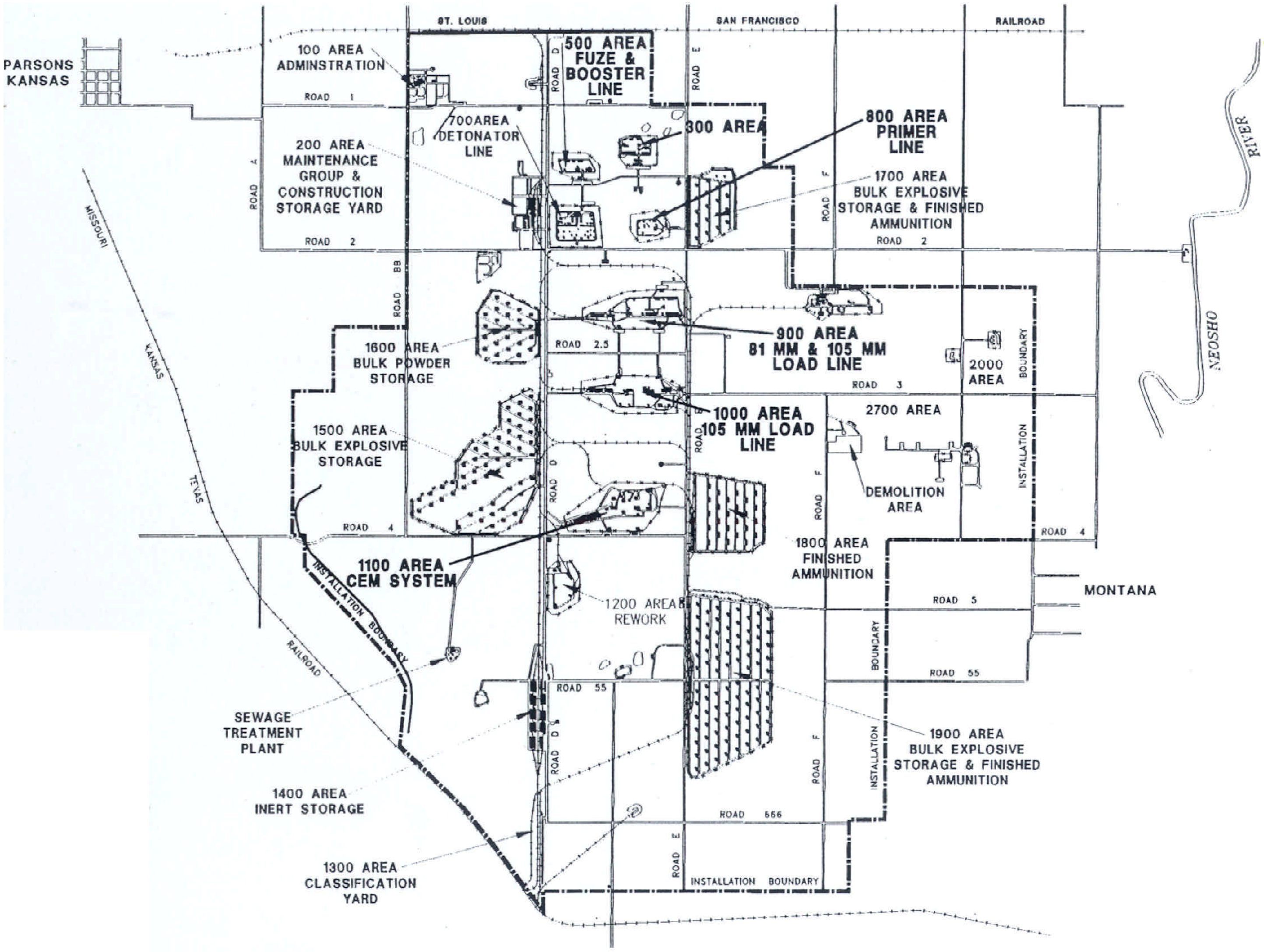

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Scale in Feet

Kansas Army Ammunition Plant
23018 Rooks Road
Parsons, Kansas 67357

Figure 2
KSAAP Installation Map

Tetra Tech EM Inc.

Date: 09/30/03 Drawn By: Roger Stull Project No: G9017.0.R07.1.19.05.DN

Source: Modified from KSAAP, 1998

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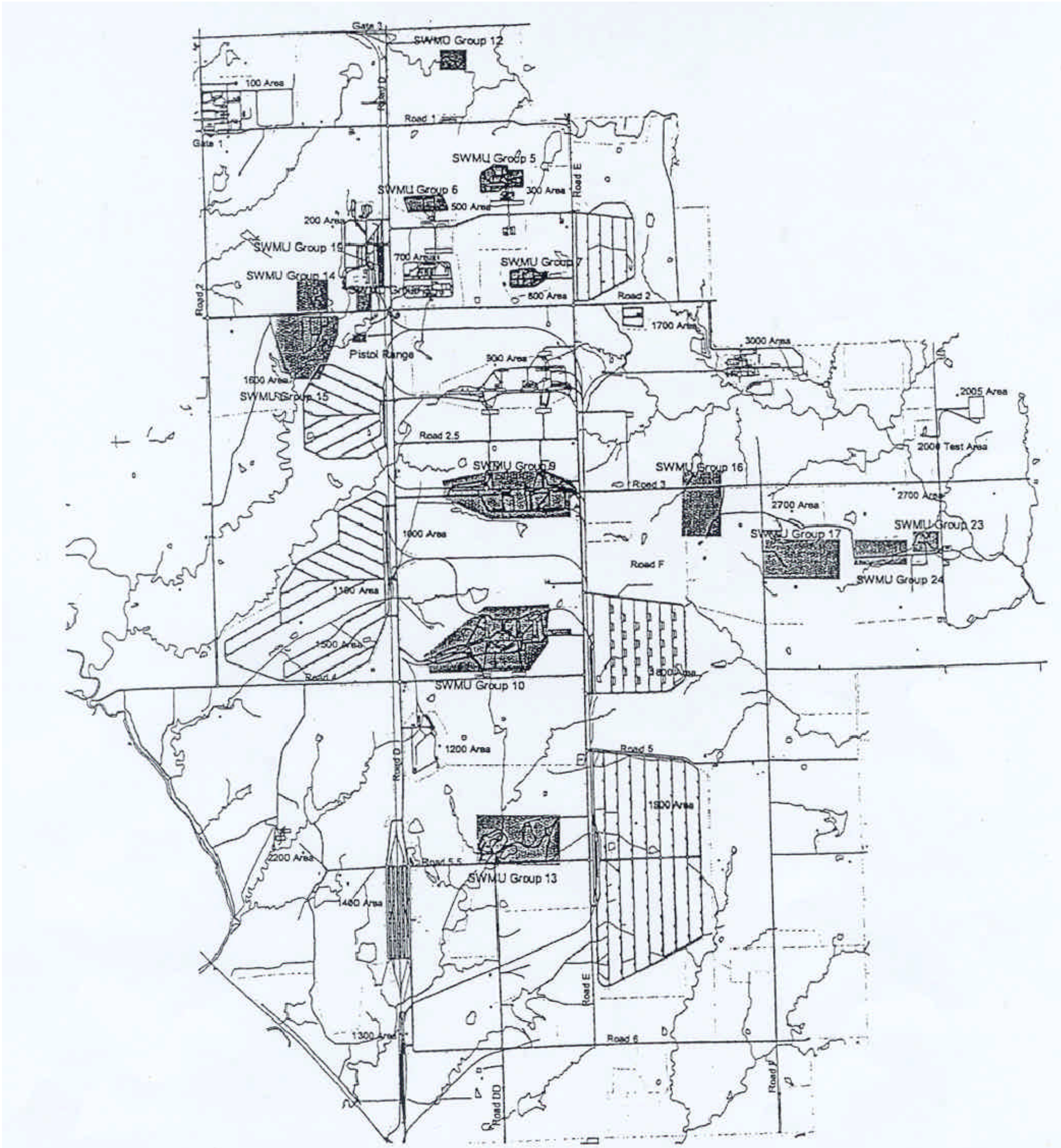

Legend

- SWMU Group Boundary
- Buildings
- Fences
- Railroad
- Roads
- Streams

Source: Modified from Arcadis, 2003

0 2000 4000

Scale in Feet

Kansas Army Ammunition Plant
23018 Rooks Road
Parsons, Kansas 67357

Figure 3
SWMU Location Map

Tetra Tech EM Inc.

Date: 09/30/03 | Drawn By: Roger Stull | Project No: G9017.0.R07.1.19.05.DN

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APPENDIX A

TABLES

TABLE A-1. CHEMICALS ABOVE COMPARISON VALUES IN SURFACE WATER

Contaminant	Maximum Detected Concentration	Location of Maximum Detection	Comparison Value	Comparison Value Type
Dioxins/Furans (ng/L)				
Total 2,3,7,8-TCDD Equivalents[a]	0.133	SWMU Group 14	0.03	RSK/MCL
Explosives (µg/L)				
RDX	610	SWMU Group 9	30 110	RSK PRG
Inorganics (µg/L)				
Antimony	143	SWMU Group 1	6	MCL
Cadmium	12.2	SWMU Group 1	5	MCL
Lead	152	SWMU Group 6 (sump)	15	MCL RSK
Manganese	6,110	SWMU Group 10 (sump)	50 880	RSK PRG
Vanadium	315,000	SWMU Group 1	71 260	RSK PRG
Volatile Organic Compounds (µg/L)				
Methylene Chloride	8.0	SWMU Group 9	5	MCL RSK

Notes:

a Dioxins/furans are each assigned a toxicity equivalency factor which is used to convert that chemical to its "toxic equivalent" of 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). The equivalents are then added and compared to the RSK for 2,3,7,8-TCDD (USACE 2001).

MCL Maximum Contaminant Level (EPA "List of Contaminants and their MCLs." EPA 816-F-02-013. July 2002.)

ng/L Nanograms per liter

PRG Preliminary Remediation Goal (EPA "Region 9 Preliminary Remediation Goals 2002 Update." October 2002.)

RDX Hexahydro-1,3,5-Trinitro-1,3,5-Triazine

RSK Risk-based Standards for Kansas (Kansas Department of Health and Environment. 2003. "Risk Based Standards for Kansas." RSK Manual-3rd Version. March 1.)

SWMU Solid Waste Management Unit

µg/L Micrograms per liter

Source: USACE. 2001. "Final Corrective Measures Study for Kansas Army Ammunition Plant, Parsons, KS." February.

TABLE A-2. CHEMICALS ABOVE COMPARISON VALUES IN GROUNDWATER

Contaminant	Maximum Detected Concentration	Location of Maximum Detection	Comparison Value	Comparison Value Type
Explosives (µg/L)				
RDX	750	SMWU Group 9	30 110	RSK PRG
Inorganics (µg/L)				
Antimony	6.71	SMWU Group 9	6	RSK MCL
Lead	15.2	SWMU Group 5	15	RSK MCL
Manganese	2,880	SWMU Group 5	50 880	RSK PRG
Nickel	5.3	SWMU Group 17	2	RSK MCL
Thallium	23	SWMU Group 6	2	MCL
Semivolatile Organic Compounds (µg/L)				
bis(2-Ethylhexyl)phthalate	855	SWMU Group 7	150 3	RSK MCL
Volatile Organic Compounds (µg/L)				
Trichloroethylene	7	SWMU Group 14	5	MCL

Notes:

MCL Maximum Contaminant Level (EPA "List of Contaminants and their MCLs." EPA 816-F-02-013. July 2002.)
PRG Preliminary Remediation Goal (EPA "Region 9 Preliminary Remediation Goals 2002 Update." October 2002.)
RDX Hexahydro-1,3,5-trinitro-1,3,5-triazine
RSK Risk-based Standards for Kansas (Kansas Department of Health and Environment. 2003. "Risk Based Standards for Kansas." RSK Manual-3rd Version. March 1.)
SWMU Solid Waste Management Unit
µg/L Micrograms per liter

Source: USACE. 2001. "Final Corrective Measures Study for Kansas Army Ammunition Plant, Parsons, KS." February.

TABLE A-3. CHEMICALS ABOVE COMPARISON VALUES IN SEDIMENT

Contaminant	Maximum Detected Concentration	Location of Maximum Detection	Comparison Value	Type of Comparison Value
Explosives (mg/kg)				
Nitrobenzene	4.26	SWMU Group 8	0.09	RSK
TNT	19,000	SWMU Group 9	5.1/3.3	PRG RSK
RDX	4.700	SWMU Group 9	1,800/0.43	PRG RSK
Tetryl	9.25	SWMU Group 6	2.2	RSK
HMX	6,240	SWMU Group 9	3,300/3,100	RSK PRG
Inorganics (mg/kg)				
Arsenic	19.9	SWMU Group 9	11/1.6	RSK PRG
Cadmium	41.9	SWMU Group 8	39	RSK
Chromium, Total	458	SWMU Group 9	390/450	RSK PRG
Lead	8,770	SWMU Group 7	400/450	RSK PRG
Manganese	5,760	SWMU Group 5	3,600/1,800	RSK PRG
SVOCs (mg/kg)				
Benzo(b)fluoranthene	1.5	SWMU Group 9	1.2	RSK

Notes:

HMX Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
mg/kg Milligrams per kilogram
PRG Preliminary Remediation Goal (EPA "Region 9 Preliminary Remediation Goals 2002 Update." October 2002.)
RDX Hexahydro-1,3,5-trinitro-1,3,5-triazine
RSK Risk-based Standards for Kansas (Kansas Department of Health and Environment. 2003. "Risk Based Standards for Kansas." RSK Manual-3rd Version. March 1.)
SWMU Solid Waste Management Unit
TNT 2,4,6-Trinitrotoluene

Source: USACE. 2001. "Final Corrective Measures Study for Kansas Army Ammunition Plant, Parsons, KS." February.

TABLE A-4. CHEMICALS ABOVE COMPARISON VALUES IN SURFACE SOIL

Contaminant	Maximum Detected Concentration	Location of Maximum Detection	Comparison Value	Type of Comparison Value
Explosives (mg/kg)				
TNT	174,000	SWMU Group 8	310/340	PRG RSK
2-Nitrotoluene	2.5	SWMU Group 6	0.03	RSK
RDX	332,000	SWMU Group 8	170/1,800	RSK PRG
HMX	6,000	SWMU Group 8	3,300/3,100	RSK PRG
Tetryl	156	SWMU Group 6	2.2	RSK
Inorganics (mg/kg)				
Antimony	126	SWMU Group 12	31	RSK PRG
Arsenic	82.6	SWMU Group 12	11/22	RSK PRG
Cadmium	237	SWMU Group 8	39/37	RSK PRG
Copper	3,290	SWMU Group 17	2,900	RSK
Lead	120,000	SWMU Group 11	400/1,000	RSK
Manganese	18,800	SWMU Group 5	3,600	RSK
Mercury	2.62	SWMU Group 6	2	RSK
Zinc	91,200	SWMU Group 10	23,000	RSK
SVOCs (mg/kg)				
Benzo(a)pyrene	10.0	SWMU Group 6	1.2	RSK
Benzo(b)fluoranthene	5.74	SWMU Group 8	1.2	RSK

Notes:
HMX Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
mg/kg Milligrams per kilogram
PRG Preliminary Remediation Goal (EPA "Region 9 Preliminary Remediation Goals 2002 Update." October 2002.)
RDX Hexahydro-1,3,5-trinitro-1,3,5-triazine
RSK Risk-based Standards for Kansas (Kansas Department of Health and Environment. 2003. "Risk Based Standards for Kansas." RSK Manual-3rd Version. March 1.)
SWMU Solid Waste Management Unit
TNT 2,4,6-Trinitrotoluene

Source: USACE. 2001. "Final Corrective Measures Study for Kansas Army Ammunition Plant, Parsons, KS." February.

TABLE A-5. CHEMICALS ABOVE COMPARISON VALUES IN SUBSURFACE SOIL

Contaminant	Maximum Detected Concentration	Location of Maximum Detection	Comparison Value	Type of Comparison Value
Explosives (mg/kg)				
TNT	174,000	SWMU Group 8	310/340	PRG RSK
DNT	18.6	SWMU Group 11	13	RSK
RDX	1,700	SWMU Group 10	170	RSK
HMX	6,000	SWMU Group 8	3,300/3,100	RSK PRG
Tetryl	1,400	SWMU Group 6	2.2	RSK
Inorganics (mg/kg)				
Antimony	126	SWMU Group 12	31	RSK PRG
Arsenic	142	SWMU Group 18	11/22	RSK PRG
Cadmium	596	SWMU Group 10	39/37	RSK PRG
Copper	3,290	SWMU Group 17	2,900	RSK
Lead	120,000	SWMU Group 11	400/1,000	RSK
Manganese	18,800	SWMU Group 5	3,600	RSK
Mercury	2.62	SWMU Group 6	2	RSK
Zinc	30,720	SWMU Group 8	23,000	RSK
SVOCs (mg/kg)				
Benzo(a)pyrene	10.0	SWMU Group 6	1.2	RSK
Benzo(b)fluoranthene	5.74	SWMU Group 8	1.2	RSK

Notes:

DNT 2,4-Dinitrotoluene
HMX Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
mg/kg Milligrams per kilogram
PRG Preliminary Remediation Goal (EPA "Region 9 Preliminary Remediation Goals 2002 Update." October 2002.)
RDX Hexahydro-1,3,5-trinitro-1,3,5-triazine
RSK Risk-based Standards for Kansas (Kansas Department of Health and Environment. 2003. "Risk Based Standards for Kansas." RSK Manual-3rd Version. March 1.)
SWMU Solid Waste Management Unit
TNT 2,4,6-Trinitrotoluene

Source: USACE. 2001. "Final Corrective Measures Study for Kansas Army Ammunition Plant, Parsons, KS." February.