

DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

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

RCRA Corrective Action
Environmental Indicator (EI) RCRA Info code (CA750)
Migration of Contaminated Groundwater Under Control

Facility Name: US Army Combined Arms Center and Fort Leavenworth
Facility Address: Fort Leavenworth, KS 66027
Facility EPA ID #: KS4213720499

DETERMINATION RESULT: YE

1. Has **all** available relevant/significant information on known and reasonably suspected releases to the groundwater media, 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?
- If yes - check here and continue with #2 below.
- If no - re-evaluate existing data, or
- if data are not available, skip to #8 and enter "IN" (more information needed) status code.

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 "Migration of Contaminated Groundwater Under Control" EI

A positive "Migration of Contaminated Groundwater Under Control" EI determination ("YE" status code) indicates that the migration of "contaminated" groundwater has stabilized, and that monitoring will be conducted to confirm that contaminated groundwater remains within the original "area of contaminated groundwater" (for all groundwater "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 “Migration of Contaminated Groundwater Under Control” EI pertains ONLY to the physical migration (i.e., further spread) of contaminated ground water and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

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).

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2. Is **groundwater** known or reasonably suspected to be “**contaminated**”¹ above appropriately protective “levels” (i.e., 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, anywhere at, or from, the facility?

If yes - continue after identifying key contaminants, citing appropriate “levels,” and referencing supporting documentation.

If no - skip to #8 and enter “YE” status code, after citing appropriate “levels,” and referencing supporting documentation to demonstrate that groundwater is not “contaminated.”

If unknown - skip to #8 and enter “IN” status code.

Rationale and Reference(s):

Fort Leavenworth contains 71 SWMUs. These SWMUs have been investigated singly and in groups since the early 1980s. Many of the individual SWMUs are not known or suspected to have groundwater contamination above appropriately protective levels based on past investigations. These SWMUs are as follows:

<u>SWMU Name</u>	<u>Rationale</u>	<u>Reference</u>
FTL-01, Inactive Sanitary Landfill	Not part of Fort Leavenworth	7, 11
FTL-12, Used Oil Tank at Building 305	Tank removed and closed clean	12
FTL-13, Used Oil Tank at Building 689	Tank removed and closed clean	3, 11
FTL-14, Used Oil Tank at Building 86	Tank removed and closed clean	1, 2, 10, 11
FTL-19, USDB Farm Sewage Lagoons	No suspicion of contamination	1, 2, 8, 11
FTL-20, Septic Tank, USDB Greenhouse	No contamination found above current risk-based levels	16
FTL-21, Septic Tank at Building 428	No suspicion of contamination	2, 11
FTL-22, Septic Tank at Building 425	No suspicion of contamination	2, 11
FTL-23, Mineral Settling Lagoons	No suspicion of contamination	4, 11
FTL-25, Past Pesticide Building 234	No suspicion of contamination	1, 2
FTL-26, Past Pesticide Building 234A	Building demolished and removed	1, 2, 11
FTL-27, Past Pesticide Building 237	No suspicion of contamination	2
FTL-28, Past Pesticide Building 93	Building demolished and removed	1, 2, 11
FTL-29, Past Pesticide Building 412	Building demolished, rubble and soil removed	1, 2, 11
FTL-30, Past Pesticide Area at Building 413	No contamination found above current risk-based levels	6, 11
FTL-31, USDB Greenhouse Building 398	Building demolished and removed	1, 2, 11
FTL-32, Past Pesticide Building 84	No suspicion of contamination	1, 2
FTL-33, Wash Rack at Building 262	No suspicion of contamination	1, 2, 10, 11
FTL-34, Wash Rack at Building 431	No suspicion of contamination	1, 2, 11
FTL-35, Wash Rack at Building 571	No suspicion of contamination	1, 2, 10, 11

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 appropriate “levels” (appropriate for the protection of the groundwater resource and its beneficial uses).

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FTL-36, Wash Rack at Building 132	No suspicion of contamination	1, 2, 10, 11
FTL-37, Wash Rack at Building 86	No suspicion of contamination	1, 2, 11
FTL-38, Wash Rack at Building 305	No suspicion of contamination	1, 2, 11
FTL-39, Wash Rack at Building 496	No suspicion of contamination	1, 2, 11
FTL-40, Wash Rack at Building 237	No suspicion of contamination	1, 2, 11
FTL-41, Medical Incinerator in Building 344	Incinerator removed and disposed of	1, 2, 10, 11
FTL-42, Document Incinerator in Building 111	Incinerator cleaned and shut down	1, 2, 10, 11
FTL-43, Document Incinerator in Building 111	Incinerator cleaned and shut down	1, 2, 10, 11
FTL-44, Commissary Incinerator at Building 632	Incinerator and building demolished and removed	1, 2, 10, 11
FTL-45, Document Incinerator at Building 136	Incinerator removed and disposed of	1, 2, 10, 11
FTL-46, Building 279 Hazwaste Storage	Clean closed in compliance with RCRA Part 1 permit	1, 2, 10, 11
FTL-47, Media Support Area Building 77	No suspicion of contamination	1, 2
FTL-48, Building 138 Sewage Treatment System	No suspicion of contamination	2, 10, 11
FTL-49, Building 829 Hazwaste Storage	Clean closed in compliance with RCRA Part 1 permit	2, 10, 11
FTL-52, Used Oil Tank at Building 109	Tank removed and closed clean	1, 2, 10, 11
FTL-53, Used Oil Tank at Building 471	Tank removed and closed clean	1, 2, 10, 11
FTL-54, Used Oil Storage at Building 132	No suspicion of contamination	1, 2, 11
FTL-55, Used Oil Storage, City Airport Ops	No suspicion of contamination	1, 2, 11
FTL-56, Used Oil and Contaminated Fuel Storage	No suspicion of contamination	1, 2, 11
FTL-58, Active Skeet Range	No suspicion of contamination	14
FTL-59, Kinder Firing Range	No suspicion of contamination	1, 2, 14
FTL-60, Stripped Paint Area	No contamination found above current risk-based levels	16
FTL-61, Tank at Building 431	Tank closed in place	9, 11
FTL-62, Propane Tank at Building 424	Tank removed and closed clean	11
FTL-64, Tank at Building 264	Tank removed and closed clean	11
FTL-65, Pond in Family Housing	No contamination found above current risk-based levels	13
FTL-66, 5 th Artillery Road Firing Range	No suspicion of contamination	14
FTL-67, Tanks at Old Service Station	Tanks removed and closed clean	11
FTL-68, Weed Control Area	No contamination found above current risk-based levels	5, 11
FTL-69, Diesel Tank Leak at Building 139	No contamination found above current risk-based levels	15
FTL-70, Fuel Tank Leak at USDB	No contamination found above current risk-based levels	17

References:

- 1) Environmental Science and Engineering Inc, March 1983: Installation Assessment of Combined Arms Center, Report No. 327.
- 2) United States Army Environmental Hygiene Agency, February 1987: Interim Final Report, Hazardous Waste Consultation No. 37-26-1386-88: Evaluation of Solid Waste Management Units.
- 3) Ecology and Environment, December 2003: Final RCRA Facility Investigation for FTL-13.
- 4) O'Brien & Gere Engineers Inc, January 1994: Contamination Evaluation of Specific Solid Waste Management Units, Final Report.
- 5) Ecology and Environment, June 2004: Final Confirmation Sampling Report for FTL-68.
- 6) Arcadis G&M, February 2003: Final (Revision 1) Closure Report for FTL-30.
- 7) Geosystems Engineering, Inc. and George Butler Associates Inc, August 1991: Volume I Task 1 Report – Preliminary Site Investigation, Hazardous Waste Site Remedial Investigation at US Penitentiary
- 8) United States Army Environmental Hygiene Agency, March 1986: Groundwater Potential Contamination Survey No. 38-26-0916-86.
- 9) HDB Construction Inc, May 1995: Closure Report, Building 431, USACE Underground Storage Tank Removal, USACE Contract DACW41-93-D-0037 Delivery Order No. 0010.
- 10) US Environmental Protection Agency, July 1989: RCRA Facilities Assessment for Fort Leavenworth.
- 11) US Army Combined Arms Center and Fort Leavenworth, December 2005: Installation Action Plan.

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- 12) Ecology and Environment, July 2005: Final Confirmation Sampling Report for FTL-12.
- 13) Arcadis G&M, October 2003: Final RFI Addendum Report for FTL-65.
- 14) Ecology and Environment, April 2003: Firing Ranges and Associated Facilities at Fort Leavenworth
- 15) Ecology and Environment, October 2001: Final Initial RFI for FTL-69, Diesel Tank Leak at Building 139
- 16) Arcadis G&M, June 2006: Final RFI Report for FTL-20 (includes FTL-60 Final Closure Report)
- 17) Arcadis G&M, September 2006: Draft Final RFI Report for FTL-70, USDB Fuel Tank Leak

Note that SWMUs FTL-15, FTL-16, FTL-17, FTL-18, FTL-50 and FTL-51 are individual underground storage tanks which were co-located adjacent to Building 487, the former Dry Cleaning shop. For clarity, all six of these tanks are now tracked as SWMU FTL-15, and the remaining SWMUs are no longer considered active.

The remaining SWMUs at Fort Leavenworth, at which groundwater contamination has been found and delineated, are discussed in Question 3 below.

3. Has the **migration** of contaminated groundwater **stabilized** (such that contaminated groundwater is expected to remain within “existing area of contaminated groundwater”² as defined by the monitoring locations designated at the time of this determination)?

X If yes - continue, after presenting or referencing the physical evidence (e.g., groundwater sampling/measurement/migration barrier data) and rationale why contaminated groundwater is expected to remain within the (horizontal or vertical) dimensions of the “existing area of groundwater contamination”²).

If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the “existing area of groundwater contamination”²) - skip to #8 and enter “NO” status code, after providing an explanation.

If unknown - skip to #8 and enter “IN” status code.

Rationale and Reference(s):

Much of the developed area of Fort Leavenworth, and most of the SWMUs at the Fort are located in the uplands on the bluffs overlooking the Missouri River. The unconsolidated soil materials making up the surface soil and subsoil in the uplands consists of silts and clays derived from loess (wind-blown dust deposits). These materials have a very low permeability and thus groundwater flow velocities are generally low. Contaminated groundwater plumes at uplands SWMUs are generally small in extent.

² “existing area of contaminated groundwater” is an area (with horizontal and vertical dimensions) that has been verifiably demonstrated to contain all relevant groundwater contamination for this determination, and is defined by designated (monitoring) locations proximate to the outer perimeter of “contamination” that can and will be sampled/tested in the future to physically verify that all “contaminated” groundwater remains within this area, and that the further migration of “contaminated” groundwater is not occurring. Reasonable allowances in the proximity of the monitoring locations are permissible to incorporate formal remedy decisions (i.e., including public participation) allowing a limited area for natural attenuation.

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Uplands SWMUs with evidence of stabilized groundwater contamination include the following:

- FTL-02, Inactive Demolition Landfill: FTL-02 is an inactive demolition landfill located on Bundel Road in the southeast quadrant of the installation. The landfill received construction and demolition debris between 1982 and 1987, although earlier dumping may have occurred. The waste at FTL-02 consists of debris generated by installation construction and demolition activities. Groundwater at the FTL-02 landfill is present in a very low conductivity silt and clay layer within the Missouri River alluvium at depths ranging from 9 to 25 feet below ground surface. This groundwater is not used for any purpose at or near the landfill. The groundwater flow direction is to the east-southeast towards the Missouri River, approximately 500 feet away. Sampling performed during the Corrective Measures Study (Arcadis G&M, August 2004: Final CMS for FTL-02 and FTL-03, Inactive Demolition Landfills) and previous studies demonstrated that contaminant trends with time are not increasing, and thus the plume appears to have stabilized. Contaminants found in groundwater include bis(2-ethylhexyl)phthalate at 82 parts per billion (ppb), manganese at 6,410 ppb, and arsenic at 65 ppb as well as lower levels of other metals.

- FTL-03, Inactive Demolition Landfill: FTL-03 is an inactive demolition landfill located south of Wint and Stimson Avenues, in the southeast quadrant of the installation. The landfill was originally used as a borrow area for construction of the adjacent railroad and streets. The site was filled in with clean fill material from 1975 to 1980. Following the fill activities, the site was an unpermitted landfill and reportedly received construction and demolition debris from 1983 through 1984. Groundwater at the FTL-03 landfill is present within a very low conductivity silt and clay layer within the Missouri River alluvium at depths ranging from 18 to 19 feet below ground surface. This groundwater is not used for any purpose at the facility. Groundwater flow direction is to the east or southeast towards the Missouri River, approximately 500 feet away. Sampling performed during the CMS (Arcadis G&M, August 2004: Final CMS for FTL-02 and FTL-03, Inactive Demolition Landfills) and previous studies demonstrated that contaminant trends with time are not increasing, and thus the plume appears to have stabilized. Contaminants found in groundwater include bis(2-ethylhexyl)phthalate at 82 ppb, manganese at 6,410 ppb, and arsenic at 65 ppb as well as lower levels of other metals.

- FTL-04, Inactive Sanitary Landfill: FTL-04 is an inactive sanitary landfill located on Hancock Avenue in the southwest quadrant of the installation. The landfill received sanitary waste during the late 1940s and early 1950s generated by educational, administrative, health care, and confinement activities at the Fort. Groundwater at the FTL-04 landfill is present within the shallow loess deposits of the upland areas at Fort Leavenworth at depths ranging from 8 to 9 feet below ground surface. This groundwater is not used for any purpose at or near the landfill. Groundwater flow direction is to the southeast, roughly in accordance with the surface topography. Two small intermittent drainage ditches intersect the FTL-04 landfill and merge into a single drainage feature east of the site. Sampling performed during the RCRA Facilities Investigation (Arcadis G&M, October 2003: Final RFI Addendum Report for FTL-04 Inactive Sanitary Landfill) and previous studies demonstrated that contaminant trends with time are not increasing, and thus the plume appears to have stabilized. Contaminants in groundwater include arsenic at 5.6 ppb, thallium at 3 ppb, manganese at 908 ppb, and di-n-octyl phthalate at 3.2 ppb.

- FTL-05, Inactive Sanitary Landfill: FTL-05 is an unpermitted, inactive sanitary landfill located in the center of Fort Leavenworth. The size of the FTL-05 landfill is about eight acres. An unnamed tributary to Quarry Creek flows along the eastern edge of the landfill. The landfill received sanitary waste from Fort Leavenworth from the late 1960s until 1977. Groundwater at the FTL-05 landfill occurs within the shallow silty clay or weathered Douglas Shale and is not utilized as a drinking water source. The depth to groundwater at the FTL-05 landfill is approximately 16 to 17 ft below ground surface (bgs) along the western boundary and approximately 4 to 5 ft bgs along the eastern boundary of the site. The general direction of groundwater flow is east towards Quarry Creek and the Missouri River. Sampling performed during the CMS (Arcadis G&M, October 2003: Final Corrective Measures Study for FTL-05, Inactive Sanitary Landfill) and previous studies demonstrated that contaminant trends

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with time are not increasing, and thus the plume appears to have stabilized. Contaminants in groundwater include vinyl chloride at 0.18 ppb, p-nitroaniline at 9.3 ppb, 1,2-dichloropropane at 0.22 ppb, manganese at 16,900 ppb, and barium at 415 ppb.

- FTL-06, Inactive Incinerator Landfill: FTL-06 is an inactive incinerator landfill located at Girl Scout Camp Conestoga, about one mile west of the Missouri River in the center of the Fort. A large refuse incinerator was active at the site in the 1940s and 1950s, and the ash from the incinerator was deposited in the area now known as FTL-06. Incinerated materials included household refuse, office wastes, and maintenance shop wastes. An unnamed intermittent tributary to Quarry Creek previously flowed through a culvert that runs from the northwest to the southeast through the FTL-06 landfill; this culvert was plugged in 2003 and the tributary rerouted around the landfill. Groundwater at the FTL-06 landfill ranges from 19 ft below ground surface (bgs) to 26 ft bgs and occurs in clay and silty clay material. The groundwater flow direction follows the topography and is southeast toward the unnamed, intermittent stream. Sampling performed during the CMS (Arcadis G&M, October 2003: Final Corrective Measures Study for FTL-06, Inactive Incinerator Landfill) found no contamination in groundwater around the landfill perimeter. Surface water from the intermittent stream (which previously flowed through the landfill) had occasional detections of lead in excess of groundwater and surface water standards, so although groundwater directly beneath this culvert is likely contaminated, it has not migrated from beneath the landfill and thus the contamination is stable.

- FTL-07, Inactive Sanitary Landfill: FTL-07 consists of a closed landfill located in the vicinity of the Hunt Kennels and the Girl Scout camping area in the west-central portion of the Fort. The landfill encompasses approximately 4 acres, and is situated on an access road north of McPherson Avenue. The landfill was reportedly used from 1967 to 1970 for the disposal of wood, ash from incinerated trash, and solid waste. Groundwater at FTL-07 is present within the shallow loess and underlying weathered shale. Groundwater at the site was encountered at depths ranging from approximately 35 to 40 feet bgs during this investigation. Groundwater flow during the quarterly sampling events was to the east-southeast. Sampling performed during the CMS (Arcadis G&M, August 2006: Final CMS Report for FTL-07, Inactive Sanitary Landfill) demonstrated the limited extent of the groundwater plume, which is believed to be stable due to the very low hydraulic conductivity of the loess and weathered shale aquifer. Contaminants in groundwater include vinyl chloride at 7.3 ppb, cis-1,2-dichloroethylene at 200 ppb, trichloroethylene at 1.9 ppb, lead at 136 ppb, as well as several other metals and volatile organic compounds.

- FTL-09, Closed Sanitary Landfill: FTL-09 is an inactive landfill located 1,500 feet west of the Sherman Army Airfield on a modest slope leading to the uplands portion of the Fort. The landfill began operation in 1977 and was used for disposal of general refuse and incinerator ash, and possibly construction debris. The 11-acre landfill was closed in 1993 under a permit from the State of Kansas and was properly capped. Groundwater at the site is present at a depth of approximately 18 feet in clay and silty clay material. Groundwater flow direction is to the south and east following surface topography. Sampling for pesticides and herbicides performed during as part of postclosure monitoring (Ecology and Environment, November 2004: Final Groundwater and Surface Water Monitoring Report for FTL-09, July 2004 Sampling Event) found no pesticides or herbicides in groundwater. However, earlier sampling (Burns & McDonnell, 2001: Groundwater and Surface water Monitoring Report, November/December 2000 Sampling Event) found the volatile organic compounds acetone, toluene, and vinyl acetate at levels below 1 ppb, as well as manganese at 9,200 ppb. This report also defined the limited extent of the plume. Multiple rounds of sampling demonstrated that contaminant trends are not increasing, and thus the plume appears to have stabilized.

- FTL-15, Solvent USTs at Building 487: FTL-15 is located within the former USDB in the northeastern portion of Fort Leavenworth. It is situated on the bluffs west of the Missouri River, just south of the Weston Bend Meander, in the southwest corner of the USDB between Buildings 468 (machine shop) and 487 (dry cleaning shop). Site geology consists of unconsolidated silty clay soil overlying shale and sandstone bedrock. Groundwater at the site is located in the unconsolidated materials above bedrock and flows to the north-northwest and northeast. The depth to groundwater ranges from approximately 8 to 18 feet. Sampling performed during the CMS (Arcadis G&M, July

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2005: Final CMS for FTL-15, Stoddard Solvent Tanks Area) and previous studies demonstrated the extent of the groundwater plume, which flows westward from the site and then turns northward along the valley west of FTL-15. Multiple rounds of sampling demonstrated that contaminant trends are not increasing, and thus the plume appears to have stabilized. Contaminants in the groundwater include tetrachloroethylene (PCE) at 130 ppb, trichloroethylene at 95 ppb, cis-1,2-dichloroethylene at 240 ppb, vinyl chloride at 77 ppb, and several other volatile organic compounds.

- FTL-24, Building 227 Entomology Shop: FTL-24 consists of Building 227 and a fenced concrete area west of the building where pesticides and herbicides are mixed before application, and is located near the central portion of the Fort. Building 227 was constructed in 1903 as a warehouse, and has been used as the Entomology Shop since 1976. The building was renovated in 1989 by sealing the concrete floors and installing a drain system to collect rinsewater into tanks for reuse. The soil at FTL-24 is a silty clay formed in loess approximately 40-50 feet thick overlying shale and limestone bedrock. The depth to groundwater is approximately 37 feet, and the groundwater flow direction is approximately radially away from the site due to local topography. Sampling performed during the RCRA Facilities Investigation (Arcadis G&M, December 2005: Draft RFI Report Addendum for FTL-24, Building 227 Entomology Shop) and previous studies demonstrated the limited extent of groundwater contamination. Multiple rounds of sampling demonstrated that contaminant trends are not increasing, and thus the plume appears to have stabilized. The herbicide Mecoprop was detected at 154 ppb in one well, but this compound has not been detected in subsequent sampling events.

- FTL-63, DRMO Scrap Yard: FTL-63 is the former Defense Reutilization and Marketing Office (DRMO) scrap yard, comprising approximately 0.6 acres on the north side of Building 280, at the north end of West Warehouse Road. This area began receiving scrap materials in the 1940s and ceased operation in 1998. The site is now covered with gravel fill up to 7 feet thick. Soil at the site consists of silty clays overlying shale bedrock. The depth to groundwater ranges from 15-21 feet. Groundwater flow direction is generally southeast, towards a drainage feature on the east side of the site. Sampling performed during the RCRA Facility Investigation (Ecology and Environment, January 2004: Draft RFI Report for FTL-63, Defense Reutilization and Marketing Office Scrap Yard) demonstrated the limited extent of groundwater contamination, which is believed to be stable due to the very low hydraulic conductivity of the silty clay and weathered shale aquifer. Contaminants exceeding regulatory standards in groundwater included benzo(a)pyrene at 0.0245 ppb and polychlorinated biphenyls (PCBs, Aroclor 1260) at 0.143 ppb.

- FTL-71, McClellan Avenue Site: FTL-71 is an old solvent spill site along and east of McClellan Avenue, from its intersection with McPherson Avenue northward to Building 194. The spill is believed to have originated at Building 89 in the 1950s, when a typewriter repair facility which included a solvent dip tank was located there. The size of the current groundwater plume is less than 2 acres. Soil at the site consists of clayey silt and silty clay up to 65 feet deep overlying limestone and shale bedrock. Groundwater is present in the interface between bedrock and the unconsolidated overburden, and flows generally north-northeast following surface topography. Sampling performed during the RCRA Facility Investigation (Arcadis G&M, 2006: Draft RFI Report for FTL-71, McClellan Avenue Site) demonstrated the extent of the plume. Because of the age of the plume, the lack of soil contamination in the presumed source area, and the low hydraulic conductivity of the aquifer, the plume is believed to be stable. The RFI found carbon tetrachloride at up to 14 ppb and chloroform at up to 35 ppb in groundwater.

A few SWMUs including FTL-08, FTL-10, FTL-11, and FTL-57 at Fort Leavenworth are located in the floodplain area near the Missouri River. Unconsolidated materials in the floodplain consist of silts and clays near the surface which overlie more permeable sands and gravels extending down to bedrock. Groundwater flow velocities can be substantially higher than in the uplands area, so groundwater contaminant plumes in the floodplain have the potential to migrate significant distances.

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Floodplain SWMUs with evidence of stabilized groundwater contamination include the following:

- FTL-08, Inactive Sanitary Landfill: FTL-08 is an inactive landfill on the Missouri River floodplain, outside the levee and northwest of the Sherman Army Airfield. The landfill is approximately 5 acres in size. From approximately 1950 to 1967, FTL-08 received tree trimmings and other wood debris, construction and demolition waste, residential waste, and bulky wastes. Burning of wood debris may have also occurred at FTL-08. The soil consists mainly of silty clay loam overlying a sequence of silty sand, sand, and sand and gravel deposits which coarsen downward. The Missouri River provides recharge to the alluvial aquifer from the north in the vicinity of FTL-08 and groundwater discharges to the river on the south side of the Weston Bend Meander, to the southeast of FTL-08. The depth to groundwater is approximately 15 feet. Sampling performed during the RCRA Facility Investigation (Ecology and Environment, October 2001: Final Initial RFI for FTL-08, Inactive Sanitary Landfill) found cis-1,2-dichloroethylene at 2.4 ppb, arsenic at 39 ppb, and manganese at 2,090 ppb in groundwater. Multiple rounds of groundwater sampling before and after this RFI demonstrated that contaminant trends are not increasing, and thus the plume appears to have stabilized.

- FTL-10, Old Fire Training Area: FTL-10 is located on the Missouri River floodplain, and is situated within the Weston Bend Meander inside the north portion of the Sherman Army Airfield levee. The FTL-10 area was used to store drummed flammable and hazardous waste materials from about 1940 to 1984. The site was also used for firefighting training activities between the 1950s and 1980s. During this time, flammable materials were dumped on the ground, ignited, and then extinguished. In the FTL-10 area, the soil consists mainly of silty clay loam overlying a sequence of silty sand, sand, and sand and gravel deposits which coarsen downward. A clay layer exists at approximately 50 feet below ground surface (bgs) throughout most of FTL-10 and may extend to the south and southeast of the site. The Missouri River provides recharge to the alluvial aquifer from the north in the vicinity of FTL-10 and groundwater discharges to the river on the south side of the Weston Bend Meander, to the southeast of FTL-10. The depth to groundwater is approximately 15 feet. Sampling performed during the CMS (Arcadis G&M, November 2005: Final CMS Report for FTL-10, Old Fire Training Area) demonstrated the extent of the plume, which extends several hundred feet to the southeast across the meander bend. Multiple rounds of sampling demonstrated that contaminant trends are not increasing, and thus the plume appears to have stabilized. Contaminants in the groundwater include trichloroethylene at 6.3 ppb, cis-1,2-dichloroethylene at 96 ppb, vinyl chloride at 24 ppb, benzene at 55 ppb, 1,4-dioxane at 270 ppb, 1,1,1-trichloroethane at 1,100 ppb, as well as several other volatile organic compounds.

- FTL-11, Closed Fire Training Area: FTL-11 is located on the Weston Bend meander loop on the Missouri River floodplain at the southeast end of an abandoned runway. The site was used two to three times per year from the mid 1970s until the late 1980s by the Fort Leavenworth Fire Department to conduct firefighting training exercises. The site encompasses approximately 1.4 acres and consists of 16 adjoining concrete slabs. An 8-inch concrete retaining berm, measuring 120 feet by 160 feet, was constructed in the late 1980s on top of the concrete slabs to serve as containment around the perimeter of the burn area. The site had a simulated airplane fuselage that was used for training purposes. Approximately 100 gallons of jet fuel was piped from the tank to the simulator and ignited during each training exercise. Soils at FTL-11 consist of nearly level, poorly drained silty clay overlying approximately 100 feet of sandy river sediments, which is underlain by shale and limestone bedrock. The depth to groundwater ranges from about 4 to 11 feet below ground surface (bgs). The groundwater flow is to the south. Sampling was performed during the RCRA Facility Investigation (Arcadis G&M, November 2005: Final RFI Report for FTL-11, Closed Fire Training Area) to confirm detections of benzene in groundwater during an earlier investigation in the late 1990s. The RFI did not find benzene or any other contaminants in groundwater, and based on multiple rounds of sampling it is thought that the previously detected benzene plume has fully attenuated.

- FTL-57, Inactive Skeet Range: FTL-57 is located just northwest of the Sherman Army Airfield and is approximately 23 acres in size. The site was used as a skeet range for shotgun use from the late 1940s until approximately 1989. Soils at FTL-57 consist of nearly level, poorly drained silty clay overlying approximately 100

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feet of sandy river sediments, which is underlain by shale and limestone bedrock. The depth to groundwater is approximately 7 feet below ground surface (bgs). The groundwater flow is generally to the east but varies slightly with seasons and the stage of the Missouri River. Sampling performed during the Engineering Evaluation / Cost Analysis (Burns & McDonnell, March 2002: Final EE/CA for FTL-57, Former Skeet Range) and related groundwater monitoring events defined the limited area of contamination. These events found a single detection of trichloroethylene at 3 ppb, as well as numerous detections of arsenic up to 305 ppb, manganese up to 831 ppb, and lead up to 3.7 ppb. Multiple rounds of sampling demonstrated that contaminant trends are not increasing, and thus the plume appears to have stabilized.

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4. Does “contaminated” groundwater **discharge** into **surface water** bodies?

_____ If yes - continue after identifying potentially affected surface water bodies.

 X If no - skip to #7 (and enter a “YE” status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater “contamination” does not enter surface water bodies.

_____ If unknown - skip to #8 and enter “IN” status code.

Rationale and Reference(s):

None of the SWMUs discussed in Question 3 with stabilized groundwater plumes are known or suspected to have contaminated groundwater discharging to surface water bodies, as summarized below and in discussed in the references cited for these SWMUs in Question 3.

FTL-02: No elevated levels of contaminants related to this SWMU were detected in samples of surface water from the adjacent drainage (One Mile Creek).

FTL-03: No elevated levels of contaminants related to this SWMU were detected in samples of surface water from the adjacent drainage (One Mile Creek).

FTL-04: No elevated levels of contaminants related to this SWMU were detected in samples of surface water from the creek bisecting the landfill.

FTL-05: No elevated levels of contaminants related to this SWMU were detected in samples of surface water from the adjacent drainage (Quarry Creek).

FTL-06: The intermittent stream running through the landfill was rerouted around the landfill in late 2004 in part to alleviate previous occasional elevated lead levels in surface water. No elevated levels of contaminants related to this SWMU are expected in future sampling events of the intermittent stream.

FTL-07: This SWMU is more than one-quarter mile upgradient of the nearest intermittent drainage channel. Groundwater gradient and recharge is very low due to the low-permeability unconsolidated materials (loess) beneath the SWMU.

FTL-08: No site-related contaminants exceed MCLs in groundwater. Although this SWMU is less than one-quarter mile from the Missouri River, the SWMU is actually cross-gradient or downgradient from this closest river segment due to the geometry of the meander loop at the Fort.

FTL-09: No elevated levels of contaminants related to this SWMU were detected in samples of surface water from the adjacent intermittent drainage and water retention structure.

FTL-10: The groundwater plume for this SWMU has been delineated and does not come within one-half mile of the Missouri River or the Fort’s water supply wells.

FTL-11: High concentrations of contaminants historically detected beneath the concrete slab at this SWMU have not migrated to downgradient monitoring wells.

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FTL-15: The groundwater plume for this SWMU has been delineated and does not come within one-quarter mile of any perennial or intermittent drainage channels.

FTL-24: This SWMU is approximately 350 feet upgradient of the nearest intermittent drainage channel. Groundwater gradient and recharge is low due to the low-permeability unconsolidated materials (loess) beneath the SWMU.

FTL-57: This SWMU is more than a mile upgradient of the Missouri River and the groundwater gradient is very low. No elevated levels of contaminants have been detected in the Fort's water supply wells, which are between FTL-57 and the Missouri River.

FTL-63: No elevated levels of contaminants related to this SWMU were detected in samples of surface water from the adjacent intermittent drainage channel.

FTL-71: The groundwater plume for this SWMU has been delineated and does not approach any perennial or intermittent drainage channels.

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5. Is the **discharge** of “contaminated” groundwater into surface water likely to be “**insignificant**” (i.e., the maximum concentration³ of each contaminant discharging into surface water is less than 10 times their appropriate groundwater “level,” and there are no other conditions (e.g., the nature, and number, of discharging contaminants, or environmental setting), which significantly increase the potential for unacceptable impacts to surface water, sediments, or eco-systems at these concentrations)?

_____ If yes - skip to #7 (and enter “YE” status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentration³ of key contaminants discharged above their groundwater “level,” the value of the appropriate “level(s),” and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgement/explanation (or reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments, or eco-system.

_____ If no - (the discharge of “contaminated” groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration³ of each contaminant discharged above its groundwater “level,” the value of the appropriate “level(s),” and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations³ greater than 100 times their appropriate groundwater “levels,” the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.

_____ If unknown - enter “IN” status code in #8.

Rationale and Reference(s):

Not applicable – see discussion in Question 4.

³ As measured in groundwater prior to entry to the groundwater-surface water/sediment interaction (e.g., hyporheic) zone.

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6. Can the **discharge** of “contaminated” groundwater into surface water be shown to be “**currently acceptable**” (i.e., not cause impacts to surface water, sediments or eco-systems that should not be allowed to continue until a final remedy decision can be made and implemented⁴)?

_____ If yes - continue after either: 1) identifying the Final Remedy decision incorporating these conditions, or other site-specific criteria (developed for the protection of the site’s surface water, sediments, and eco-systems), and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater; OR 2) providing or referencing an interim-assessment⁵, appropriate to the potential for impact, that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialists, including ecologist) adequately protective of receiving surface water, sediments, and eco-systems, until such time when a full assessment and final remedy decision can be made. Factors which should be considered in the interim-assessment (where appropriate to help identify the impact associated with discharging groundwater) include: surface water body size, flow, use/classification/habitats and contaminant loading limits, other sources of surface water/sediment contamination, surface water and sediment sample results and comparisons to available and appropriate surface water and sediment “levels,” as well as any other factors, such as effects on ecological receptors (e.g., via bio-assays/benthic surveys or site-specific ecological Risk Assessments), that the overseeing regulatory agency would deem appropriate for making the EI determination.

_____ If no - (the discharge of “contaminated” groundwater can not be shown to be “**currently acceptable**”) - skip to #8 and enter “NO” status code, after documenting the currently unacceptable impacts to the surface water body, sediments, and/or eco-systems.

_____ If unknown - skip to 8 and enter “IN” status code.

Rationale and Reference(s):

Not applicable – see discussion in Question 4.

⁴ Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, appropriate specialist (e.g., ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies.

⁵The understanding of the impacts of contaminated groundwater discharges into surface water bodies is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration to be reasonably certain that discharges are not causing currently unacceptable impacts to the surface waters, sediments or eco-systems.

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7. Will groundwater **monitoring** / measurement data (and surface water/sediment/ecological data, as necessary) be collected in the future to verify that contaminated groundwater has remained within the horizontal (or vertical, as necessary) dimensions of the “existing area of contaminated groundwater?”

If yes - continue after providing or citing documentation for planned activities or future sampling/measurement events. Specifically identify the well/measurement locations which will be tested in the future to verify the expectation (identified in #3) that groundwater contamination will not be migrating horizontally (or vertically, as necessary) beyond the “existing area of groundwater contamination.”

If no - enter “NO” status code in #8.

If unknown - enter “IN” status code in #8.

Rationale and Reference(s):

The sites with evidence of groundwater contamination discussed in Questions 3 and 4 above are subject to long-term monitoring requirements under the authority of Fort Leavenworth’s RCRA Part II (HSWA) permit. Statements of basis have been completed for several of these sites (FTL-02, -03, -04, -05, -06, -07, -10, -11, -15), and a permit modification will be completed which will require implementation of the selected remedies. Fort Leavenworth is already implementing the selected remedies in anticipation of the upcoming permit modification. A State landfill permit is in effect for FTL-09, requiring groundwater monitoring for that site. Other sites (FTL-08, -24, -57 and -71) are currently being sampled to support preparation of corrective measures studies and selection of remedies, which will then be incorporated into the permit to require long-term monitoring requirements as appropriate. Additional groundwater sampling is planned at FTL-63 but this work has not yet been funded.

The statements of basis for sites with groundwater contamination specify a minimum of five years of annual or biannual sampling for the contaminants of concern, after which the need for further monitoring will be reevaluated. A site-wide post-closure groundwater monitoring plan is being created (Arcadis G&M, 2006) to define the scope of the long-term monitoring required at these sites. This plan will ensure that all required monitoring follows a common methodology, is performed on schedule, includes the appropriate monitoring wells and analytes, and is subject to appropriate quality assurance and quality control measures.

<u>SWMU Name</u>	<u>Reference</u>
FTL-02, Inactive Demolition Landfill	EPA, June 2005: Final Statement of Basis for FTL-02
FTL-03, Inactive Demolition Landfill	EPA, June 2005: Final Statement of Basis for FTL-03
FTL-04, Inactive Sanitary Landfill	EPA, June 2005: Final Statement of Basis for FTL-04
FTL-05, Inactive Sanitary Landfill	EPA, June 2005: Final Statement of Basis for FTL-05
FTL-06, Inactive Incinerator Landfill	EPA, June 2005: Final Statement of Basis for FTL-06
FTL-07, Inactive Sanitary Landfill	EPA, December 2006: Final Statement of Basis for FTL-07
FTL-08, Inactive Sanitary Landfill	Arcadis G&M, April 2006: Final Corrective Measures Study Workplan for FTL-08, Inactive Sanitary Landfill
FTL-09, Closed Sanitary Landfill	KDHE, November 2003: Letter specifying future groundwater sampling and analytical requirements
FTL-10, Old Fire Training Area	EPA, December 2006: Final Statement of Basis for FTL-10
FTL-11, Closed Firefighting Training Area	EPA, December 2006: Final Statement of Basis for FTL-11
FTL-15, Solvent USTs at Bldg. 487	EPA, December 2006: Final Statement of Basis for FTL-15
FTL-24, Bldg. 227 Entomology Shop	Arcadis G&M, July 2006: Final Supplemental Groundwater Investigation Workplan for FTL-24, Building 227 Entomology Shop

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FTL-57, Inactive Skeet Range

Arcadis G&M, May 2006: Final Groundwater Sampling Workplan for
FTL-57, Old Skeet Range

FTL-63, DRMO Scrap Yard

Ecology and Environment, January 2004: Draft RFI Report for FTL-
63, Defense Reutilization and Marketing Office Scrap Yard

FTL-71, McClellan Avenue Site

Arcadis G&M, December 2006: Draft RFI Report for FTL-71,
McClellan Avenue Site

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8. Check the appropriate RCRA Info status codes for the Migration of Contaminated Groundwater Under Control EI (event code CA750), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (attach appropriate supporting documentation as well as a map of the facility).

YE - Yes, "Migration of Contaminated Groundwater Under Control" has been verified. Based on a review of the information contained in this EI determination, it has been determined that the "Migration of Contaminated Groundwater" is "Under Control" at Fort Leavenworth, EPA ID # KS4213720499, located at Leavenworth, KS. Specifically, this determination indicates that the migration of "contaminated" groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the "existing area of contaminated groundwater" This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.

NO - Unacceptable migration of contaminated groundwater is observed or expected.

IN - More information is needed to make a determination.

Completed by _____ Date _____
(signature)
Daniel R. Gravatt
Project Manager, RCRA Corrective Action & Permits Branch
EPA Region 7

Supervisor _____ Date _____
(signature)
Lynn Slugantz
Chief, RCRA Corrective Action & Permits Branch
EPA Region 7

Locations where References may be found:

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FIGURES

(X pages)