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Subject: Technical Memorandum
CAP-18 Injection Project
Dry Cleaning Facility Area
Fort Riley, Kansas

This Technical Memorandum summarizes the CAP 18[®] injection field activities performed conducted by CTI & Associates, Inc. (CTI) at the former Dry Cleaning Facility Area (DCFA), Fort Riley, Kansas. CTI and Associates, Inc. was contracted by the United States Army Corps of Engineers – Kansas City District (USACE - KCD) to enhance anaerobic bioremediation of chlorinated volatile organic compounds (CVOCs) in soil and groundwater by injection of liquid CAP 18[®] into the vadose zone and groundwater. The on-site field activities were performed on February 25, 2010 in accordance with the Draft Letter Work Plan – CAP-18[®] Injection Project, Environmental Remediation Services (CTI and Associates, Inc., October 14, 2009). The CTI field representative present during the field effort was Phil Riley.

Fort Riley completed the remedial investigation of detectable soil and groundwater contamination above regulatory levels for CVOCs and associated breakdown products at the DCFA in 2004 and the feasibility study addendum in 2005. The Pilot Study Report, completed in January 2008, details extensive field activities to support the pilot study including utility clearance, groundwater monitoring well installation and/or abandonment, and extensive pre- and post-performance monitoring. Pilot Study treatment activities included vadose zone assessment, treatability bench studies, soil excavation and transportation, revitalization of landfarm treatment cells for treatment, vadose zone chemical oxidation treatment, saturated zone chemical oxidation treatment, and enhanced



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anaerobic bioremediation by CAP 18[®] injection. The location of the DCFA is presented on Figure 1.

The goal of the reinjection effort was to ensure injection of CAP 18[®] into the deepest and possibly untreated portions of the bedrock channel to further enhance the natural degradation of CVOCs and their associated breakdown products in groundwater to below Kansas Department of Health and Environment Risk-based Standards for Kansas (KDHE RSKs) and USEPA maximum Contaminant Levels (MCLs). The Pilot Study injection method was "top down" and did not necessarily inject Cap 18[®] at bedrock. Prior to field mobilization, CTI submitted and received approval of a KDHE Class V Injection Permit for enhanced anaerobic bioremediation injection under the KDHE UIC program's 2005 authorization letter.

The ten CAP 18[®] vadose zone and groundwater injection points, completed along an approximate 130-foot line aligned with the deepest part of the erosional bedrock channel, are presented in Figure 2. The CAP 18[®] injections were performed by Environmental Priority Service (EPS) of Salina, Kansas. An average depth to the local water table of approximately 35 feet bgs was determined based on measurement of the groundwater level in surrounding monitoring wells (DCF92-03, DCF93-13, and DCF06-40).

The injection program included approximately 2,500 pounds (330 gallons) of CAP 18[®], a proprietary blend of food-grade, long-chain fatty acids refined from natural vegetable oils. A high pressure pump was used to transfer the CAP 18[®] from a graduated tank into the direct push rods and through injection tip. The target dose of 32 to 33 gallons for each location was distributed across the injection interval using the "bottom up" direct-push injection method. Upon completion of each injection point, the probe rods and tooling were extracted from the ground and the boreholes were backfilled with bentonite pellets. The CAP 18[®] injection point depth interval, injection pressure, injected volume, estimated injection flow rate, and approximate location is summarized in Table 1.

The original work plan required the use of the "top down" injection method. However, upon recommendations from CTI and EPS, Mr. John Shimp of Fort Riley modified the injection strategy to "bottom up" injection. This change was approved to ensure CAP 18[®] was injected into the granular soils directly above the bedrock formation. Additionally, minor changes to the injection locations were made during the injection effort based on field conditions.

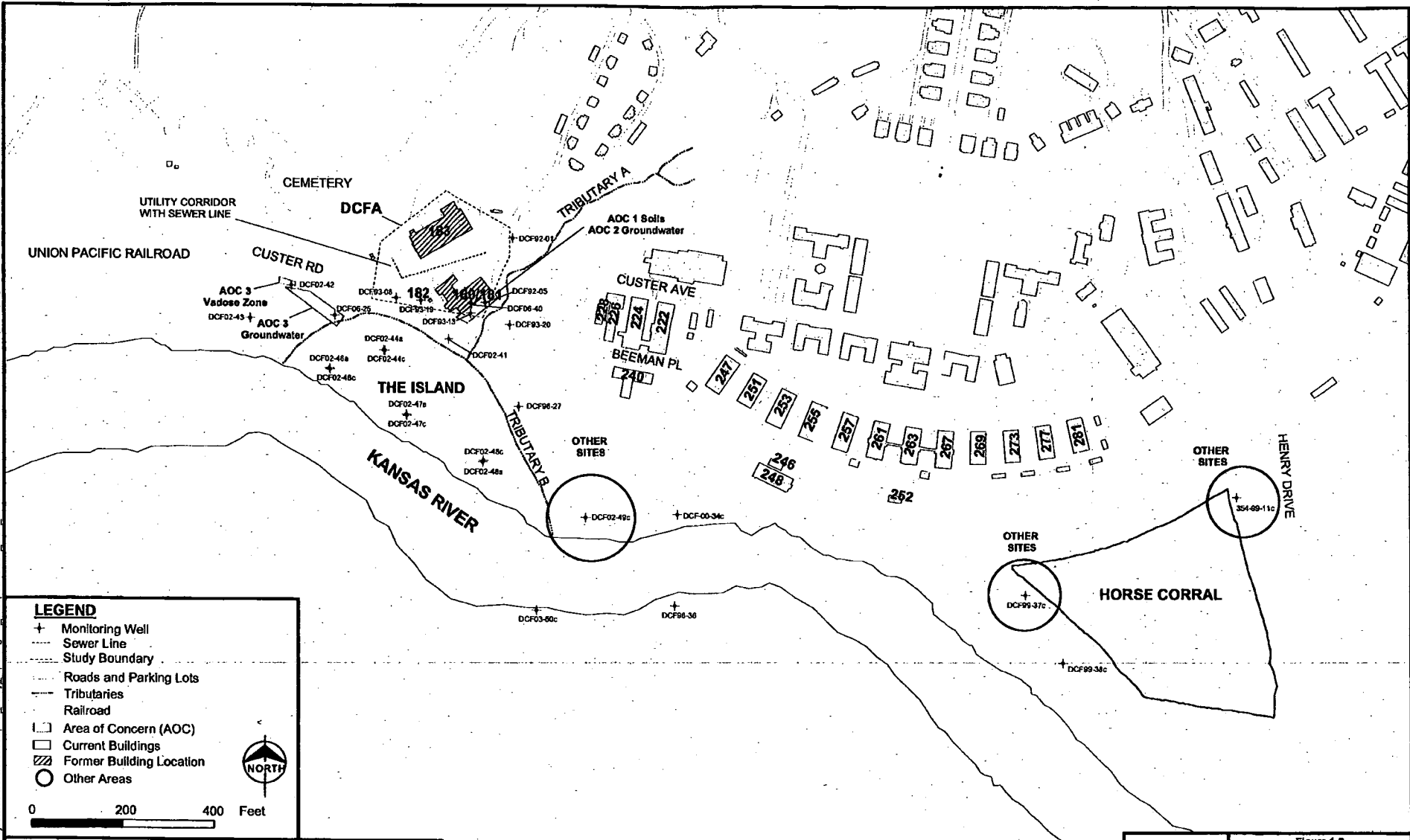
Table
CAP-18 Injection Summary
DCFA Study Area
Fort Riley, Kansas

Date	Injection Location	Injection Interval (ft bgs)	Injection Pressure (gal)	Total Amount Injected (gal)	Injection Time		Estimated Flow Rate (gpm)	Injection Point Location (in feet from Monitoring Wells)			Comments
					Start	Finish		DCF93-13	DCF92-05	DCF06-40	
2/25/10	IP-1	35 - 44.2	100	33	0925	0935	3.5	22	61		Injection initiated at bedrock refusal
2/25/10	IP-2	35 - 41.4	150	32	1031	1039	4.5	41	46		Injection initiated at bedrock refusal
2/25/10	IP-3	35 - 46	100	33	1117	1122	6.5	61	37		Injection initiated at bedrock refusal
2/25/10	IP-4	35 - 39	100	33	1203	1210	4.5	78	36		Injection initiated at bedrock refusal
2/25/10	IP-5	35 - 41	100	33	1323	1328	6.5	102	46		Injection initiated at bedrock refusal
2/25/10	IP-6	35 - 38	80	34	1400	1408	4.5	122	62		Injection initiated at bedrock refusal, Stopped flow during injection/restarted
2/25/10	IP-7	35 - 37	80	32	1445	1550	6.4	143	80	80	Injection initiated at bedrock refusal
2/25/10	IP-8	35 - 44	100	32	1524	1529	6.4	164	99		Injection initiated at bedrock refusal
2/25/10	IP-9	35 - 42	100	36	1507	1512	6.4	183	118		Injection initiated at bedrock refusal
2/25/10	IP-10	35 - 42	80	32	1418	1423	6.4	203	137	140	Injection initiated at bedrock refusal


330 Total Gallons

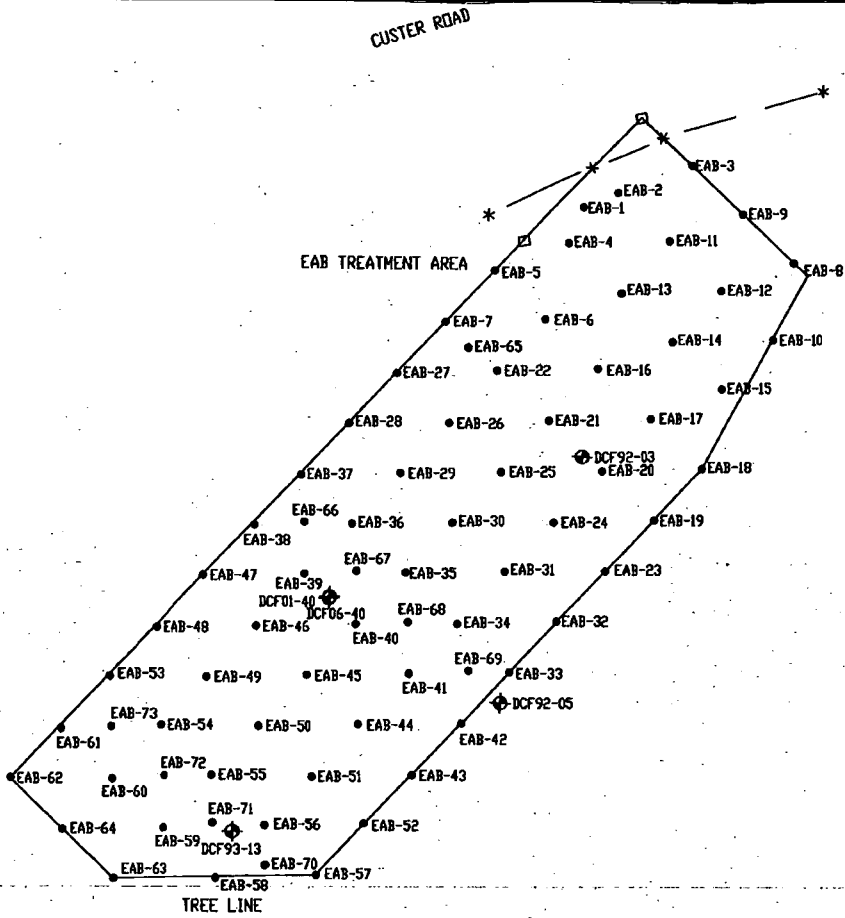
Notes: EAB - Enhanced Anaerobic Bioremediation using liquid Cap-18 injection
gpm - Gallons per minute ft - Feet
bgs - Below ground surface gal - Gallon

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NOTES:
 1. River bank based on aerial photography collected on February 8, 1998.


Figure 1-2
SITE SPECIFIC AREAS OF CONCERN
 Pilot Study Report
 DCF Study Area
 Fort Riley, Kansas



LEGEND

- X - X - GAS LINE
- PROPOSED INJECTION POINT
- ◆ MONITORING WELL
DCF93-13

NOTES

- 73 TOTAL INJ. POINTS (15 GAL CAP. 18 PER POINT)



Figure 3-12
AOC 2 EAB Injection
Locations
DCF Study Area
Pilot Study Report
Fort. Riley, Kansas