

**Documentation of Environmental Indicator Determination
in accordance with EPA Interim Final Guidance 2/5/99**

**RCRA Corrective Action
Environmental Indicator (EI) RCRA Info code (CA725)**

Current Human Exposures Under Control

Facility Name: Industrial Service Corporation
Facility Address: 1633 S. Marsh Avenue, Kansas City, Missouri
Facility EPA ID #: MOD073027609

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?

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 Industrial Service Corporation (ISC) facility is on about 6 acres in Kansas City, Missouri (Ecology and Environment [E&E] 1987) (see Figure 1). In 1958, the facility began operation under the name Radium Petroleum as a used oil collection and recycling business (Deffenbaugh Industries, Inc. [Deffenbaugh] 1996). The current owner purchased the facility from Radium Petroleum in 1974, and the name was changed to ISC in 1988 (Deffenbaugh 1996). In 1998, the facility was closed when all tanks were decontaminated, dismantled, and disposed of (Missouri Department of Natural Resources [MDNR] 2000). The extent of soil contamination was determined, and the most contaminated soil was excavated and disposed of accordingly. Currently, the facility is unoccupied and is used to store empty roll-away containers (Tetra Tech 2003).

Before its closure, ISC accepted waste oils, removed associated water, and blended the wastes for sale as a fuel. Before 1983, Radium Petroleum also used waste solvents to increase the heat capacity of the refined oil (E&E 1987). The facility offices were housed on the first floor of a two-story building (Deffenbaugh 1996). Quality Analytical Services, Inc., a laboratory and affiliate company of ISC, occupied the second floor of the building. A tank farm immediately north of this building was comprised of tanks, a water treatment building, process heater, flash heater, and stormwater containment pit (Deffenbaugh 1996). Figure 2 shows the site layout.

The ISC facility has been monitored and investigated since at least 1981, when EPA conducted a site inspection which found semivolatile organic compounds (SVOC) in soil (E&E 1987). This inspection was followed by an EPA site investigation in 1984, which found volatile organic compounds (VOC), polychlorinated biphenyls (PCB) and metals in soil (E&E 1987). The Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) was completed in 1987. During the RFA, monitoring wells were installed and groundwater samples were collected and were found to be contaminated with metals, VOCs, and free floating product (E&E 1987). The RFA defined the following units as solid waste management units – 19 bulk storage tanks (14 still in use in 1987), 4 cooker units (converted railroad tank cars), 2 oil heater units (out of service), 1 shaker filter unit (out of service), 1 flash/heater tower, 1 vapor recovery system, 1 water containment pit, and 1 septic tank (E&E 1987). However, the RFA did not

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

Page 2

provide complete descriptions of these units, and the current conditions report (CCR) concluded that investigations would best proceed on a site-wide basis (Deffenbaugh 1996).

Additional soil samples were collected and analyzed in 1995, 1997, and 1998 as part of closure and RCRA Facility Investigation (RFI) activities (Deffenbaugh 2000a). Soil samples that confirmed closure were collected in 2000 (Deffenbaugh 2001b). Currently, groundwater samples are collected and analyzed semiannually in accordance with the post-closure plan (Deffenbaugh 2003c).

The tank farm was located immediately north of the two-story building. Before closure activities, ISC operated primarily as a used oil recycling facility. Lesser amounts of diesel, hydraulic, and other miscellaneous oils also were recycled at the site. Used oil accepted by ISC was received in the unloading area, where it was pumped into daily deposit tanks. The materials were then sampled, analyzed for halogens and PCBs, and transferred to storage tanks. Water removed from the tanks flowed to another tank for storage before its treatment in the carbon-clay filtration system (Deffenbaugh 1996). The processed oil was transferred to a flash heater and flash tower unit where the temperature was raised to 265°F to evaporate water and other light ends from the oil. These vapors were collected and condensed in the vapor recovery system. Before 1987, water and organic vapors were vented to the atmosphere from the flash heater/tower, presumably falling out on the facility (E&E 1987). The recovered light ends were blended with diesel fuel into the processed oil to produce a marketable fuel oil. This final product was stored in a separate tank (Tank 28). Waste sludge collected from cookers and oil storage tanks was documented and transported to an approved off-site treatment, storage, or disposal facility. Wastewater from stormwater runoff, oil-water separation, and vapor recovery was transferred to the wastewater treatment building. At some point in the past, wastewater from the facility probably was discharged by surface water routes (E&E 1987). The water was pumped through granular clay absorbent media to remove emulsified oil and grease. It was then processed through two granular activated carbon filtration units to remove dissolved organic contaminants. The treated water was stored in a separate tank before transport to the Kansas Water Pollution Control Department location in Kansas City, Kansas. Spent clay and carbon filters were treated as hazardous waste – they were documented and properly transported to authorized locations. Prior to shipment, however, these units were stored temporarily near the garage door on the lower floor of the two-story building (see Figure 2) (Deffenbaugh 1996).

Closure activities at the facility began in April 1998 (MDNR 2000). On June 22, 2000, MDNR approved Closure Plan Modifications for the Final Cap Design and Construction Quality Assurance. On July 26, 2000, a Soil Excavation Plan Modification Request by ISC was approved pending final confirmation results. In August 2000, the MDNR approved a 120-day Extension Request for Completion of Closure Activities at ISC.

Closure activities included decontaminating, dismantling, and disposing of all tanks. The extent of soil contamination around the tanks was determined, and contaminated soil was excavated to the extent practicable and disposed of at the Johnson County Landfill in Shawnee, Kansas. A lined trench was installed parallel to Marsh Road, extending north approximately 120 feet from the two-story building with an approximate 15-foot leg extending east from the trench's north end. A cap consisting of crushed shale, compacted soil liner, geomembrane, geocomposite, and vegetative cover was subsequently added over the excavation area (Deffenbaugh 2000b). The entire excavated area was enclosed by a 6-foot high chain link fence topped by barbed wire. MDNR accepted the closure certification on January 25, 2002. The post-closure plan required a deed restriction associated with the cap to prevent excavation (Deffenbaugh 2002b). The post-closure plan also specifies that buildings, ground cover, security systems, and recovery systems will be inspected quarterly during the post-closure period (30 years) (Deffenbaugh 2002b).

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

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

Page 3

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, GPRAs). 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	✓			
Air (indoors) ²	✓			

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).

²Recent 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

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

Page 4

Media	Yes	No	?	Rationale/Key Contaminants
Surface Soil (e.g., <2 ft)	✓			
Surface Water		✓		See below for all media
Sediment		✓		
Subsurf. Soil (e.g., >2 ft)	✓			
Air (outdoors)		✓		

_____ 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.

_____ ✓ 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):

The ISC facility is on about 6 acres in Kansas City, Missouri, adjacent to I-435 (see Figure 1). The area is zoned for industrial use, but residences and businesses border the facility (Deffenbaugh 1996). The facility is bordered on the west by I-435, and on the north, south, and east by a bluff. The eastern boundary of the facility is a cliff excavated into the bluff (Deffenbaugh 1996). An abandoned landfill located on the bluffs east of the facility reportedly received waste from industrial facilities along the Blue River and from the Amoco refinery in Sugar Creek (Deffenbaugh 1996; MDNR 2000). Other nearby businesses include a scrap metal and battery recycler, a foundry, a metal fabricator, and gas stations (Deffenbaugh 1996; Tetra Tech 2003). The nearest residence is adjacent to the southern property boundary (Tetra Tech 2003). The property downgradient and across the street, formerly occupied by Livers Bronze Company, is abandoned – presumably since Livers Bronze moved in 1999 (Tetra Tech 2003; Livers Bronze Company 2003).

The ISC facility is near the Blue River, which is east of I-435 (see Figure 1). The facility is situated on a terrace above the river, out of the 500-year floodplain (Deffenbaugh 1996; Center for Agricultural, Resource, and Environmental Systems 2003). Surface water in the area drains west to the Blue River. Runoff at the facility is directed to a drainage ditch on the east side of I-435, which flows north into a culvert, then under I-435, and into the Blue River (E&E 1987). Springs in the rock outcrop east of the site can generate surface runoff at the facility (E&E 1987).

The surficial geology of the site consists of varying thicknesses of unconsolidated material overlying limestone bedrock. A substantial portion of the facility is built on excavated bedrock, although the western portion of the facility is covered with colluvium and fill from the bluff wall (MDNR 2000). The Pennsylvanian-age bedrock is predominantly limestone, with admixed clay and sand (MDNR 2000). When the original monitoring wells were installed in 1986, static water levels were about 20 to 25 feet below ground surface (bgs) (E&E 1987). In 2002,

indoor air (in structures located above (and adjacent to) groundwater with volatile contaminants) does not present unacceptable risks.

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

Page 5

depth to groundwater in monitoring wells ranged between 12 and 43 feet bgs (Deffenbaugh 2003c). Groundwater may be perched on interbedded shales or lower-permeability limestone units, and numerous contact springs and seeps flow from the bluff during periods of heavy rain (Deffenbaugh 1996; MDNR 2000). Groundwater under most of the site flows west and northwest across the property, toward the Blue River (Deffenbaugh 1996, 2002a). The facility does not include any surface water bodies. See the attached water table contour map.

Groundwater

Groundwater samples at the ISC facility have been collected since at least 1986, when the first two monitoring wells were installed at the facility during the RFA (E&E 1987). Since 1986, 75 wells have been installed at the site. Of these, 56 wells have been abandoned. As of February 2003, 19 monitoring wells remain active at the site and are used for semiannual groundwater sampling (see Figure 2a) (Deffenbaugh 2003c). The facility also installed two extraction wells and an interception trench in 2002, and MDNR approved two additional extraction wells in 2003 (Deffenbaugh 2002c, MDNR 2003). The post-closure plan specified semiannual monitoring and analysis for metals, VOCs, SVOCs, PCBs, dioxins, herbicides, and other inorganics (Deffenbaugh 2002b). In addition, the facility monitors free product – which has been found in four wells (GW-2R, GW-3, GW-4, EPA-R1) – measuring its thickness and composition (Deffenbaugh 2001a, 2002d).

The most contaminated groundwater samples were collected from two areas at the facility. The highest concentrations of PCBs and petroleum-derived VOCs were found in the eastern half of the facility, in an area around well EPA-R1. This is also the area in which free product was found. The highest concentrations of chlorinated VOCs were found in the western half of the facility, around well GW-11.

Table 1 shows the maximum concentrations of VOCs, SVOCs, metals, pesticides, and PCBs from the most recent sampling events. Nine VOCs – benzene, chloroethane, 1,4-dioxane, methyl tert-butyl ether (MTBE), 1,2,4-trichlorobenzene, trichloroethene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and vinyl chloride (VC) – had concentrations that exceeded their relevant EPA maximum contaminant level (MCL) or preliminary remediation goal (PRG) or MDNR groundwater target concentration (GTARC). Although SVOCs were detected in groundwater, only one SVOC, naphthalene, exceeded its MCL. Total metal concentrations exceeded MCLs for arsenic, cadmium, chromium, and lead, but some component of these concentrations probably derived from suspended sediment in the sample. Finally, two pesticides and one PCB exceeded MCL or GTARCs – aldrin, dieldrin, and PCB-1260.

Free product has been found in four wells at the facility, although its thickness is decreasing. In 2002, thickness of free product ranged from 0.16 feet (GW-3) to 2.01 feet (EPA-R1); free product also was found in GW-4 (Deffenbaugh 2003c). In the past, GW-2R also has had free product (Deffenbaugh 2001a). The free product is regularly analyzed and contains metals (arsenic, cadmium, chromium, lead), gasoline-range organics, and PCBs (Deffenbaugh 2001a, 2002d).

Table 1 – Maximum Concentrations of Constituents in Groundwater

Constituent	Concentration (µg/l)	Well	Date	EPA MCL (µg/l)	Other Locations Exceeding MCL, GTARC, or PRG
Volatile Organic Compounds					
Benzene	350	EPA-R1	3Q 2000	5	GW-1, GW-2, GW-2R, GW-3, GW-4
n-Butylbenzene	5.9	GW-2R	2Q 2001	240*	
Chlorobenzene	7.8	EPA-R1	1Q 2001	100	
Chloroethane	140	GW-3	4Q 2002	4.6*	EPA-R1, GW-2, GW-2R, GW-4

Current Human Exposures Under Control
Environmental Indicator (EI) RCRA Info code (CA725)
Page 6

Table 1 – Maximum Concentrations of Constituents in Groundwater

Constituent	Concentration (µg/l)	Well	Date	EPA MCL (µg/l)	Other Locations Exceeding MCL, GTARC, or PRG
1,2-Dichlorobenzene	11	GW-2	3Q 2000	600	
1,4-Dichlorobenzene	15	GW-3	4Q 2002	75	
1,1-Dichloroethane	37	GW-11C	4Q 2002	810*	
cis-1,2-Dichloroethene	56	GW-11C	4Q 2002	70	
1,4-Dioxane	3,300	GW-4	3Q 2002	3**	EPA-R1, GW-2R, GW-3, GW-6B, GW-9B, GW-10B, GW-11C
Ethylbenzene	170	GW-4	2Q 2002	700	
Isopropyl benzene	10	GW-2	3Q 2000	660*	
Methyl tert-butyl ether	130	EPA-R1	3Q 2002	20**	GW-4
n-Propylbenzene	15	EPA-R1	1Q 2001	240*	
Toluene	190	EPA-R1	3Q 2002	1,000	
1,2,4-Trichlorobenzene	100	EPA-R1	4Q 2002	70	none
1,1,1-Trichloroethane	13	EPA-R1	1Q 2001	200	
Trichloroethene	91.9	GW-6B	1998	5	GW-7, GW-9B
1,2,4-Trimethylbenzene	120	EPA-R1	2Q 2001	12*	GW-3, GW-4
1,3,5-Trimethylbenzene	30	EPA-R1	1Q 2001	12*	GW-3, GW-4
Xylene, total	420	EPA-R1	4Q 2002	10,000	
Vinyl chloride	150	GW-11C	4Q 2002	2	EPA-R1, GW-2, GW-4, GW-6B, GW-8B, GW-9B, GW-10B, GW-11B
Semivolatile Organic Compounds					
Acenaphthene	17	GW-4	1Q 2001	1,200*	
Dibenzofuran	12	GW-4	1Q 2001	24*	
Diethylphthalate	12	EPA-R1	2Q 2001	23,000**	
2,4-Dimethylphenol	27	GW-4	3Q 2000	540**	
Fluorene	12	GW-4	3Q 2000	1,300**	
2-Methylnaphthalene	140	GW-4	3Q 2000	NA	
Naphthalene	760	GW-4	3Q 2000	100**	EPA-R1
Phenanthrene	14	GW-4	1Q 2001	NA	
Phenol	27	EPA-R1	3Q 2000	4,000**	
Dissolved Metals[†]					
Barium	520	GW-11C	2Q 2002	2,000	
Total Metals^{††}					
Arsenic	289	EPA-R1	1Q 2001	50	GW-3, GW-4, GW-8B
Barium	1,380	GW-2	3Q 2000	2,000	

Current Human Exposures Under Control
Environmental Indicator (EI) RCRA Info code (CA725)
Page 7

Table 1 – Maximum Concentrations of Constituents in Groundwater

Constituent	Concentration (µg/l)	Well	Date	EPA MCL (µg/l)	Other Locations Exceeding MCL, GTARC, or PRG
Cadmium	22.5	GW-5	1998	5	EPA-R1, GW-1, GW-2, GW-3, GW-4, GW-6B, GW-7, GW-8A, GW-10A, GW-10B
Chromium	129	GW-5	3Q 2000	100	GW-11A
Lead	327	GW-5	2Q 2000	15 ^{†††}	GW-9B, GW-10A
Mercury	0.768	GW-5	3Q 2000	2	
Pesticides and Polychlorinated Biphenyls					
Aldrin	0.073	GW-6A	1Q 2001	0.002 ^{**}	none
Chlordane (technical)	1.3	GW-6A	1Q 2001	2	
alpha-Chlordane	0.078	GW-6B	1Q 2001	2	
gamma-Chlordane	0.11	GW-6B	1Q 2001	2	
4,4'-DD	0.12	GW-3	3Q 2000	NA	
4,4'-DDT	1.8	GW-10A	1Q 2001	2 ^{**}	
Dieldrin	0.07	GW-2	3Q 2000	0.002 ^{**}	GW-3, GW-4
Endosulfan II	0.53	GW-2	3Q 2000	NA	
Endrin	0.13	GW-2	3Q 2000	2	
Endrin aldehyde	0.39	GW-2	3Q 2000	NA	
Heptachlor	0.26	GW-9A	1Q 2001	0.4	
PCB-1260	8.7	GW-2	3Q 2000	0.5	EPA-R1, GW-3, GW-5

Notes:

Concentrations in bold exceed the MCL, GTARC, or PRG (MDNR 2001; EPA 2002a, 2002b). Table derived from a number of groundwater reports (Deffenbaugh 2000a, 2001a, 2002a, 2002d, 2002e, 2003a, 2003b, 2003c).

* EPA does not specify a MCL for this constituent, and MDNR does not specify a GTARC (EPA 2002a). EPA Region 9 PRG is used here (EPA 2002b).

** EPA does not specify an MCL for this constituent. MDNR GTARC is used here (MDNR 2001).

† Dissolved metals were reported only or the second quarter of 2002.

†† Because MCLs are specified for dissolved metals, total metals concentrations exceeding MCL are not in bold type.

††† EPA has not specified an MCL for lead. The EPA action level is used here.

EPA = U.S. Environmental Protection Agency

GTARC = Groundwater target concentration

MCL = Maximum contaminant level

MDNR = Missouri Department of Natural Resources

µg/l = Micrograms per liter

NA = Not applicable. No MCL, PRG, or GTARC is established for this compound.

PRG = Preliminary remediation goal

Q = Quarter

Surface and Subsurface Soil

Surface and subsurface soils at the ISC facility are contaminated with metals and VOCs. Surface (collected from a depth of less than 2 feet) and subsurface (collected from a depth of more than 2 feet) soil samples were collected at ISC during the RFI in 1998 and closure activities in 2000 (Deffenbaugh 2000a, 2001b). Soil sampling locations are shown in Figures 3 and 4.

Current Human Exposures Under Control
Environmental Indicator (EI) RCRA Info code (CA725)
Page 8

Appendix A shows the results of surface soil sampling conducted before the 2000 closure activities. Soil was analyzed for VOCs, SVOCs, herbicides, pesticides, and PCBs. The RFI discovered soils that contained VOCs (chloromethane, methylene chloride, 1,1,2,2-tetrachloroethane [1,1,2,2-PCA]) and one metal (arsenic) at concentrations in excess of MDNR soil target concentrations (STARC).

In 2000, contaminated soil was excavated over an area 90 by 115 feet to an average depth of 15 feet. MDNR accepted the closure certification report in January 25, 2002. Samples were collected from the walls of the excavation at several depths and from the floor of the excavation. Samples were analyzed for VOCs, SVOCs, herbicides, pesticides, PCBs, and metals.

Surface soils are contaminated with VOCs and metals. In the area of the excavation, closure confirmation sampling showed that surface soil was still contaminated with arsenic. Outside the excavated area, surface soil is contaminated with methylene chloride and 1,1,2,2-PCA. Table 2 shows the maximum concentrations of a range of constituents found in surface soil in the excavated area, and Table A1 shows the maximum concentrations in areas that were not excavated. The highest levels of contamination in surface soil around the excavation were from the sample collected from the southwest corner of the excavation. In sample EX6, collected from a depth of 6 inches, arsenic exceeded its industrial STARC, and lead exceeded the more conservative residential STARC. Presumably, this contaminated soil was left in place because of its proximity to the foundation of the building (see Figure 3).

Subsurface soils also are contaminated with VOCs and metals. In the area of the excavation, closure confirmation sampling showed that subsurface soil was still contaminated with arsenic. Outside the excavated area, subsurface soil is contaminated with chloromethane, methylene chloride, and 1,1,2,2-PCA. Table 3 shows the maximum concentrations of a range of constituents found in subsurface soil in the excavated area, and Table A2 shows the maximum concentrations in areas that were not excavated. The highest levels of contamination in subsurface soil around the excavation were from the sample collected from the floor of the excavation, nearest the center. In sample EX5, arsenic exceeded its industrial STARC. In addition, soil samples were collected as part of the RFI in the south parking lot area, beneath the garage floor of the building and in a drainage ditch along Marsh Avenue. Samples were analyzed for VOCs, BNAs, herbicides, pesticides and PCBs. Methylene chloride remains in the drainage ditch at concentrations that exceed residential STARCs, and chloromethane and 1,1,2,2-PCA remain in the south parking lot area at concentrations that exceed industrial STARCs.

Current Human Exposures Under Control
Environmental Indicator (EI) RCRA Info code (CA725)
Page 9

Table 2 – Maximum Concentrations of Constituents Detected in Surface Soil during 2000 Confirmation Sampling

Constituent	Concentration (mg/kg)	Location	Depth (ft bgs)	MDNR STARC, Unrestricted Use (mg/kg)	MDNR STARC, Industrial Use (mg/kg)
Volatile Organic Compounds					
Acetone	0.28	EX13	0 - 0.5	2,700	8,700
Methylene chloride	0.15	EX14	0 - 0.5	51	150
Tetrachloroethene	0.015	EX14	0 - 0.5	40	120
Toluene	0.011	EX6	0 - 0.5	650	650
Xylenes (total)	0.02	EX14	0 - 0.5	418	418
Semivolatile Organic Compounds					
Acenaphthene	0.88	EX13	0 - 0.5	1,700	5,400
Butyl benzyl phthalate	3.2	EX6	0 - 0.5	930	930
Chrysene	0.49	EX6	0 - 0.5	36	140
Di-n-butylphthalate	0.75	EX6	0 - 0.5	NA	NA
bis(2-Ethylhexyl)phthalate	1.9	EX14	0 - 0.5	410	1,800
Fluoranthene	0.47	EX6	0 - 0.5	1,600	5,200
Fluorene	1.7	EX13	0 - 0.5	1,100	3,600
Naphthalene	0.95	EX14	0 - 0.5	120	240
2-Methylnaphthalene	4.2	EX14	0 - 0.5	NA	NA
Phenanthrene	4.1	EX13	0 - 0.5	NA	NA
Pyrene	1.4	EX14	0 - 0.5	2,100	6,900
Metals					
Arsenic	14.7	EX6	0 - 0.5	11	14
Cadmium	1.55	EX6	0 - 0.5	110	380
Chromium	36.9	EX6	0 - 0.5	2,100	4,500
Lead	462	EX6	0 - 0.5	260	660
Pesticides and Polychlorinated Biphenyls					
gamma-BHC	0.013	EX14	0 - 0.5	1	5
PCB 1260	0.46	EX6	0 - 0.5	0.6	2.5

Notes:

Concentrations in bold exceed industrial soil target concentrations. Concentrations in bold and italics exceed residential soil target concentrations. Table derived from the 2000 confirmation sampling (Deffenbaugh 2001b).

ft bgs = Feet below ground surface

MDNR = Missouri Department of Natural Resources

mg/kg = Milligrams per kilogram

NA = Not available. MDNR has not established STARC's for these constituents.

STARC = Soil target concentrations (MDNR 2001)

Current Human Exposures Under Control
Environmental Indicator (EI) RCRA Info code (CA725)
Page 10

Table 3 – Maximum Concentrations of Constituents Detected in Subsurface Soil during 2000 Confirmation Sampling

Constituent	Concentration (mg/kg)	Location	Depth (ft bgs)	MDNR STARC, Unrestricted Use (mg/kg)	MDNR STARC, Industrial Use (mg/kg)
Volatile Organic Compounds					
Acetone	5	EX12	11 - 12	2,700	8,700
Benzene	0.19	EX10	floor	6	13
Ethylbenzene	0.93	EX10	floor	400	400
Methylene chloride	0.58	EX2	floor	51	150
Methyl ethyl ketone	18	EX12	11 - 12	7,400	16,000
Toluene	0.75	EX13	5 - 6	650	650
Trichloroethene	0.011	EX9	floor	40	89
Xylenes (total)	7	EX13	5 - 6	418	418
Semivolatile Organic Compounds					
Acenaphthene	1.5	EX12	11 - 12	1,700	5,400
Anthracene	0.98	EX12	11 - 12	85,000	27,000
Benzo(a)anthracene	0.66	EX12	11 - 12	1	4
Chrysene	0.57	EX12	11 - 12	36	140
Dibenzofuran	1.1	EX12	11 - 12	110	360
Di-n-butylphthalate	0.36	EX10	floor	NA	NA
bis(2-Ethylhexyl)phthalate	1.9	EX13	5 - 6	410	1,800
Fluoranthene	3.1	EX12	11 - 12	1,600	5,200
Naphthalene	7.8	EX13	5 - 6	120	240
2-Methylnaphthalene	22	EX13	5 - 6	NA	NA
Phenanthrene	5.9	EX12	11 - 12	NA	NA
Pyrene	2.6	EX12	11 - 12	2,100	6,900
Metals					
Arsenic	22	EX5	floor	11	14
Cadmium	2.59	EX3	floor	110	380
Chromium	81.6	EX5	floor	2,100	4,500
Lead	50.3	EX5	floor	260	660

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

Page 11

Table 3 – Maximum Concentrations of Constituents Detected in Subsurface Soil during 2000 Confirmation Sampling

Constituent	Concentration (mg/kg)	Location	Depth (ft bgs)	MDNR STARC, Unrestricted Use (mg/kg)	MDNR STARC, Industrial Use (mg/kg)
Pesticides and Polychlorinated Biphenyls					
beta-BHC	0.0078	EX14	5 - 6	0.9	3
PCB 1260	0.15	EX9	floor	0.6	2.5

Notes:

Concentrations in bold exceed industrial soil target concentrations. Table derived from the 2000 confirmation sampling (Deffenbaugh 2001b).

floor = Sample collected from floor of excavation, depth unspecified. The average depth of excavation was 15 feet.

ft bgs = Feet below ground surface

MDNR = Missouri Department of Natural Resources

mg/kg = Milligrams per kilogram

NA = Not available. MDNR has not established STARCs for these constituents.

STARC = Soil target concentrations (MDNR 2001)

Surface Water and Sediment

No surface water or sediment samples have been collected at the ISC facility, and additional sampling and groundwater modeling would be necessary to establish levels of contamination and identify hazardous constituents. However, the available geological and hydrogeological data has been used to estimate the facility's contribution to surface water and sediment in the Blue River. Estimates of exchange between groundwater and surface water at the facility suggest that surface water and sediment have not been contaminated by activities at the ISC facility. The approach for estimating the facility's contribution is outlined in the following paragraphs. Calculations, parameters, and assumptions are included in Appendix B.

- 1. Estimate the concentration of contaminants at the edge of the Blue River.** Concentrations of contaminants in groundwater at the edge of the Blue River were extrapolated from the concentrations in groundwater at the western edge of the facility (wells GW-9B and GW-10B). In the most recent sampling event (January 2003), the compounds *cis*-1,2-dichloroethene (*cis*-1,2-DCE) (maximum concentration of 19 µg/l), 1,4-dioxane (maximum 380 µg/l), MTBE (maximum 5.1 µg/l), and VC (maximum 2.6 µg/l) were detected in these two wells. Transport of these compounds was estimated using EPA's BIOCHLOR model, the groundwater gradient, and the estimated porosity and permeability for the aquifer at the site. Although the BIOCHLOR software is designed for chlorinated VOCs such as *cis*-1,2-DCE and VC, it may also be used for non-chlorinated VOCs if retardation and biodegradation are ignored. The resulting concentrations at the edge of the Blue River were estimated at 16 µg/l (*cis*-1,2-DCE), 320 µg/l (1,4-dioxane), 4.3 µg/l (MTBE), and 2.2 µg/l (VC).
- 2. Estimate the discharge of contaminated groundwater at the edge of the Blue River.** Darcy's Law can then be used to estimate the discharge of contaminated groundwater at the edge of the Blue River. Width of the plume was based on the distance between wells GW-10B and GW-9B, the perimeter wells that have detectable concentrations of contaminants. Depth was based on the total depth of wells GW-9B and GW-10B. Using the resulting cross-sectional area, the discharge of contaminated groundwater can be estimated at 173 cubic feet per day (cfs/day).
- 3. Estimate the dilution factor.** A dilution factor was calculated by dividing the discharge of the plume (Step 2) by the discharge of the Blue River. To provide a conservative estimate, the dilution factor was

Current Human Exposures Under Control
Environmental Indicator (EI) RCRA Info code (CA725)
Page 12

calculated using one-quarter of the lowest instantaneous discharge of the Blue River near the facility – 4.25×10^5 cfs/day (U.S. Geological Survey 2003). The resulting dilution-attenuation factor was 4.1×10^{-4} .

4. **Estimate the concentration of contaminants in surface water in the Blue River.** Concentrations of contaminants in surface water derived from the ISC facility were calculated by multiplying concentration of contaminants at the river's edge (Step 1) by the dilution factor (Step 3). The resulting concentrations in surface water – 6.5×10^{-3} µg/l (*cis*-1,2-DCE), 0.13 µg/l (1,4-dioxane), 1.8×10^{-3} µg/l (MTBE), and 9.0×10^{-4} µg/l (VC) – are below the EPA MCLs or MDNR GTARCs.
5. **Estimate the concentration of contaminants in sediment.** Concentrations of these contaminants in sediment can be estimated by multiplying the concentrations of contaminants in groundwater at the edge of the river (Step 1), the estimated percentage of organic matter in sediment, and the partition coefficient of contaminants. The resulting estimated concentrations – 1.1×10^{-2} mg/kg (*cis*-1,2-DCE), 7.9×10^{-3} mg/kg (1,4-dioxane), 5.2×10^{-4} mg/kg (MTBE), and 8.4×10^{-4} mg/kg (VC) – are all well below the relevant residential STARCs. Standards for sediments have not been promulgated.
6. **Worst case scenario evaluation given maximum detections at monitoring well GW-11C.** To further evaluate the facility's potential for contribution to surface water contamination at the Blue River, the BIOCHLOR software was used to estimate the concentrations at the Blue River based on the maximum concentrations of constituents detected during the May 2003 sampling event. Contaminant concentrations are consistently significantly higher at monitoring well GW-11C in the intermediate zone compared to the two most downgradient bedrock wells GW-10B and GW-9B (as previously evaluated). In the May 2003 sampling event, the compounds *cis*-1,2-dichloroethene (*cis*-1,2-DCE) (maximum concentration of 62 mg/l), 1,4-dioxane (maximum 1800 mg/l), MTBE (maximum 64 mg/l), and VC (maximum 83 mg/l) were detected at well GW-11C. Based on this, BIOCHLOR was used to estimate the resulting concentrations at the edge of the Blue River to be at 53 µg/l (*cis*-1,2-DCE), 1531 µg/l (1,4-dioxane), 54 µg/l (MTBE), and 71 µg/l (VC). Assuming the same cross sectional area and dilution attenuation factor as used in calculation number 2, the resulting concentrations in surface water [0.022 µg/l (*cis*-1,2-DCE), 0.627 µg/l (1,4-dioxane), 0.022 µg/l (MTBE), and 0.029 µg/l (VC)] are still below the EPA MCLs or MDNR GTARCs.

Additionally, ISC initiated implementation of a groundwater extraction and treatment system in June 2002, including two pumping wells, PW-1 and PW-2. Two additional pumping wells, PW-3 and PW-4, were installed in May 2003 and put into service in June 2003 (see Figure 2a). More recently, ISC conducted additional investigation to further evaluate the extent of groundwater contamination west of interstate I-435. Two boring logs were completed from the surface to total depth and two temporary piezometers were installed to evaluate the lithology and to propose locations for permanent monitoring well installation. Groundwater samples were also collected and analyzed for volatile organic compounds using Method 8260 and for 1,4-Dioxane using Method 1625. At this point, it appears the extraction system is effective in influencing the groundwater contaminant plume, and the levels of contamination at the furthest downgradient temporary piezometers indicate significant decreasing levels of contamination. However, some levels do remain in exceedance of the EPA MCLs or MDNR GTARCs.

Indoor Air

Indoor air at the facility two-story building likely is contaminated. Groundwater at the facility contains elevated concentrations of VOCs and SVOCs that are sufficiently volatile and toxic to pose potentially unacceptable indoor air inhalation risks. Moreover, the highest concentrations of VOCs in groundwater are found within 100 feet of the unoccupied two-story building, suggesting that indoor air is probably contaminated with organic vapors (EPA 2002c).

Outdoor Air

Current Human Exposures Under Control
Environmental Indicator (EI) RCRA Info code (CA725)
Page 13

Outdoor air at the facility likely is not contaminated. Because surface soil is not significantly contaminated and the vegetative cover is well maintained (Tetra Tech 2003), contamination of indoor or outdoor air with soil particulate likely is minimal. Because groundwater at the site contains volatile chemicals, outdoor air may contain organic vapors. However, lack of confining features makes accumulation of organic vapors outside unlikely.

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							
“Contaminated” Media	Residents	Workers	Day Care	Construction	Trespassers	Recreation	Food ³
Groundwater		YES	–	YES	NO	–	–
Air (indoors)	–	YES	–	YES	–	–	–
Soil (surface, e.g., <2 ft)		YES	–	YES	YES	–	–
Surface Water	–	–	–	–	–	–	–
Sediment	–	–	–	–	–	–	–
Soil (subsurface e.g., >2 ft)		YES	–	YES	NO	–	–
Air (outdoors)	–	–	–	–	–	–	–

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).
- _____ ✓ If yes (pathways are complete for any “Contaminated” Media - Human Receptor combination) - continue after providing supporting explanation.

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

Current Human Exposures Under Control
Environmental Indicator (EI) RCRA Info code (CA725)
Page 14

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

Rationale and Reference(s)

Several media and potential receptors can be excluded from further consideration. Three media – surface water, sediment and outdoor air – can be excluded from further consideration. No evidence indicates that outdoor air is contaminated at the ISC facility or that offsite surface water or sediment has been contaminated by groundwater from the ISC facility. In addition, the remaining building at ISC is abandoned, as is the former Livers Bronze facility, the nearest downgradient building. The nearest occupied buildings – the residence south of the ISC facility and the nearby auto repair and sales lots – are not over contaminated groundwater (see Figure 2) (Deffenbaugh 2002d, 2002e, 2003b). The only potential exposure to contaminated indoor air is due to volatilization of contaminated groundwater beneath the two story building. Groundwater at the facility contains elevated concentrations of VOCs and SVOCs that are sufficiently volatile and toxic to pose potentially unacceptable indoor air inhalation risks. Facility workers or consultants may be exposed while conducting sampling or maintenance of the pump and treat system. However, because the exposure is limited in duration and frequency, the potential for exposure is not likely to be significant. In addition, during the sampling and maintenance activities, the double garage doors remain open. Given the distance to the nearest occupied building, the likelihood is small that any other receptors are exposed to contaminated indoor air (EPA 2002c). Three types of receptors – day care students, recreational users, and food consumers – also can be excluded. The nearest school or day care center is more than one mile from the facility (Switchboard.com 2003). Because of the distance to the facility, day care receptors likely will not be exposed to contamination at the facility. The only potential food receptors would be linked to the Blue River, and, absent any recreational facilities such as parks near the facility (see Figure 1), the only potential recreational receptors also are linked to the river. However, initial estimates suggest that neither surface water nor sediment has been significantly contaminated by groundwater from the ISC facility.

All other receptors must be evaluated for potential exposure. The nearest occupied residence is adjacent to ISC property, and the area on top of the bluffs is residential (see Figures 1 and 2) (Tetra Tech 2003). Because of this relative proximity of residential neighborhoods, residential receptors must be considered. A chain-link fence topped with barbed wire surrounds the area formerly occupied by the tanks (Tetra Tech 2003). However, the facility does not have full-time security. Thus, trespassers on the property are possible. The post closure plan for the facility specifies that Deffenbaugh will employ “qualified environmental personnel and/or contractors” to monitor and maintain the facility and to collect environmental samples. Therefore, contract workers and Deffenbaugh employees (facility workers) must be considered.

Groundwater - residents, incomplete. Nearby residents do not use groundwater for drinking water, and they are unlikely to use significant amounts of groundwater for other domestic uses. All residences in the area are served by public water supplies, which collect drinking water from intakes in the Missouri River (Deffenbaugh 1996). As a result, residents do not ingest contaminated groundwater from ISC. A few wells may be used for domestic irrigation, but in 1996, only eight registered wells were within one mile of the facility. Moreover, MDNR code regulates the construction of wells near waste landfills, limiting the possibility of any new wells near the ISC facility (10 CSR 23-3).

Groundwater - facility workers, complete. The only wells at the facility are monitoring wells periodically sampled by Deffenbaugh’s environmental staff. Any Deffenbaugh employees collecting samples at ISC must have Occupational Health and Safety Administration (OSHA) training and take reasonable precautions to avoid contact with hazardous constituents (Deffenbaugh 2002b). Any exposure to contaminated groundwater would be minimal.

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

Page 15

Groundwater - construction workers, complete. The only wells at the facility are monitoring wells periodically sampled by ISC's contractors. Any contractors collecting samples at ISC must have OSHA training and take reasonable precautions to avoid contact with hazardous constituents (Deffenbaugh 2002b). In addition, the post-closure plan includes restrictions that require MDNR to approve any excavations in areas where contamination is present on the site (Deffenbaugh 2002b). However, because plumes extend off ISC property, it is possible that excavation workers may be exposed to contaminated groundwater.

Groundwater - trespassers, incomplete. Unattended monitoring wells provide a pathway through which trespassers could be exposed to contaminated groundwater. However, the practice of padlocking well covers makes completion of this pathway unlikely (MDNR 2000; Tetra Tech 2003).

Surface soil - residents, incomplete. The fence that surrounds most of the facility, the well-maintained cover and cap, the industrial setting of the facility, and the limited extent of surface soil contamination discourage or minimize casual or accidental contact by nearby residents.

Surface soil - facility workers, complete. The well-maintained cover and cap and the limited extent of surface soil contamination minimize facility workers' exposure to contaminated surface soil. In addition, the post-closure plan includes restrictions that require MDNR to approve any excavations where contamination is present on the site (Deffenbaugh 2002b). Any Deffenbaugh employees collecting soil samples at ISC must have OSHA training and take reasonable precautions to avoid contact with hazardous constituents (Deffenbaugh 2002b). Therefore, any exposure to contaminated surface soil would be minimal.

Surface soil - construction workers, complete. The well-maintained cover and cap and the limited extent of surface soil contamination minimize construction workers' exposure to contaminated surface soil. In addition, the post-closure plan includes restrictions that require MDNR to approve any excavations where contamination is present on the site (Deffenbaugh 2002b). Moreover, any contractors collecting soil samples at ISC must have OSHA training and take reasonable precautions to avoid contact with hazardous constituents (Deffenbaugh 2002b). However, because contaminated surface soil is found along the drainage ditch, it is possible that construction or utility workers may be exposed to contaminated surface soil.

Surface soil - trespassers, complete. Although the fence prevents exposure of nearby residents, and the deed restrictions minimize exposure of contract and construction workers, these measures cannot guarantee that trespassers will not disturb the cap, thereby exposing themselves to contaminated surface soil near the two-story building. In addition, trespassers may disturb contaminated surface soil in the area of the south parking lot.

Subsurface soil - residents, incomplete. The fence that surrounds most of the facility, the well-maintained cover and cap, the industrial setting of the facility, and the limited extent of surface soil contamination discourage or minimize casual or accidental contact by nearby residents. Moreover, residents are not likely to contact soils deeper than 2 feet bgs.

Subsurface soil - facility workers, complete. Facility workers may be exposed to contaminated subsurface soil during maintenance of the extraction system or during sample collection, but the potential for exposure is minimal. Any Deffenbaugh employees working with the extraction system at ISC must have OSHA training and take reasonable precautions to avoid contact with hazardous constituents (Deffenbaugh 2002b). In addition, the post-closure plan includes restrictions that require MDNR to approve any excavations in areas where contamination is present on the site (Deffenbaugh 2002b).

Subsurface soil - construction workers, complete. Construction workers may be exposed to contaminated subsurface soil during maintenance of the extraction system or during excavation, but the potential for exposure is minimal. Any contractors working with the extraction system at ISC must have OSHA training and take reasonable

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

Page 16

precautions to avoid contact with hazardous constituents (Deffenbaugh 2002b). In addition, the post-closure plan includes restrictions that require MDNR to approve any excavations in areas where contamination is present on the site (Deffenbaugh 2002b). However, because surface soil is found along the drainage ditch, it is possible that construction or utility workers may be exposed to contaminated subsurface soil.

Subsurface soil - trespassers, incomplete. Though trespassers may enter the fenced area and disturb surface soil, they are not likely to contact soils deeper than 2 feet bgs.

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)?

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): Exposures can be considered significant if the duration or intensity of exposure to contaminated materials exceeds calculated screening levels or if the level of contamination substantially exceeds screening levels. Completed exposure pathways at ISC include:

1. workers – groundwater, air (indoors), surface soil and subsurface soil
2. trespassers – surface soil
3. construction – groundwater, air (indoors), surface soil and subsurface soil

While repairing or installing utilities or other excavation work, facility, contract and/or utility workers could be exposed to groundwater, surface soil, and subsurface soil with concentrations of contaminants that exceed MDNR target concentrations for industrial exposure. However, because they are not full-time employees on site, their exposure is limited in duration. MDNR industrial target concentrations for soil are calculated based on assumptions of 25 years, 250 days per year, of exposure (MDNR 2001). Because of the limited period of contact, exposure of facility or contract construction workers to hazardous constituents in soil is not likely to be significant.

Groundwater target concentrations are based on ingestion of water and are not applicable to dermal contact. Given

⁴If 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.

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

Page 17

the average depth to groundwater (12 to 43 feet bgs), the limited duration of exposure, and existing institutional controls to limit excavation at the facility, the level of exposure of facility, contract and/or utility workers to hazardous constituents is not likely to be significant.

The only potential exposure to contaminated indoor air is due to volatilization of contaminated groundwater beneath the two story building. Groundwater at the facility contains elevated concentrations of VOCs and SVOCs that are sufficiently volatile and toxic to pose potentially unacceptable indoor air inhalation risks. Facility workers or consultants may be exposed while conducting sampling or maintenance of the pump and treat system. However, because the exposure is limited in duration and frequency, the potential for exposure is not likely to be significant.

Trespassers may be exposed to contaminated surface soil. However, the fence around the former tank farm area is well maintained and topped by barbed wire, discouraging most trespassers. In addition, areas in the south parking lot with contaminated surface soil are covered with empty rollaway containers, further limiting exposure. Finally, trespassers are unlikely to spend significant amounts of time in this area, and their exposure would be much less than the 25 years, 250 days per year, used to calculate industrial PRGs. As a result, the exposure of trespassers to hazardous constituents in surface soil likely is not significant.

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):

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

Page 18

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):

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 Industrial Service Corporation facility, EPA ID # MOD073027609, located at 1633 Marsh Avenue, Kansas City, Missouri, 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: (Signature) Original signed by Natalie Roark Date 9/29/03
(Print) Natalie Roark, P.E.
(Title) Environmental Engineer III
(State) Missouri Department of Natural Resources
Hazardous Waste Program

Supervisor: (Signature) Original signed by Richard A. Nussbaum Date 9/30/03
(Print) Richard A. Nussbaum, P.E., R.G.
(Title) Chief, Corrective Action Unit
(State) Missouri Department of Natural Resources
Hazardous Waste Program

Completed by: (Signature) Original signed by David Garrett Date 9/30/03
(Print) David Garrett
(Title) Project Manager, RCRA Corrective Action & Permits Branch
EPA Region VII

Completed by: (Signature) Original signed by John Smith Date 9/30/03
(Print) John Smith
(Title) Chief, RCRA Corrective Action & Permits Branch
EPA Region VII

Current Human Exposures Under Control
Environmental Indicator (EI) RCRA Info code (CA725)
Page 19

Locations where References may be found:

EPA and the Missouri Department of Natural Resources have received copies of all reports and correspondence in reference to this facility. The Industrial Service Corporation facility files are located at:

Missouri Department of Natural Resources
Hazardous Waste Program
1738 East Elm Street
Jefferson City, MO 65101
and
U.S. Environmental Protection Agency, Region VII
RCRA Corrective Action and Permits Branch
Air, RCRA, and Toxics Division
901 N. 5th Street
Kansas City, KS 66101

Contact telephone number and e-mail address:

(Name): Richard Nussbaum
(Phone #): (573) 751-3553
(E-mail): richard.nussbaum@dnr.mo.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.

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

Page 20

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Current Human Exposures Under Control
Environmental Indicator (EI) RCRA Info code (CA725)
Page 21

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FIGURES

APPENDIX A

**POSITIVE DETECTIONS IN SOIL FROM THE RESOURCE CONSERVATION AND RECOVERY ACT
FACILITY INVESTIGATION**

Table A1 - Maximum Concentrations of Constituents Detected in Surface Soil

Constituent	Concentration (mg/kg)	Location	Depth (ft bgs)	MDNR STARC, Unrestricted Use (mg/kg)	MDNR STARC, Industrial Use (mg/kg)
Volatile Organic Compounds					
Methylene chloride	<i>74.4</i>	B16	0 - 0.5	51	150
1,1,2,2-Tetrachloroethane	15.3	B1	0 - 0.5	2	5
Toluene	96.0	B13	0 - 0.5	650	650
Metals					
Arsenic	9.08	B15	0 - 0.5	11	14
Cadmium	2.91	B15	0 - 0.5	110	380
Chromium	13.5	B17	0 - 0.5	2,100	4,500
Lead	43.4	B5	0 - 0.5	260	660
Mercury	0.078	B17	0 - 0.5	0.6	1
Pesticides and Polychlorinated Biphenyls					
beta-BHC	0.00881	B16	0 - 0.5	0.9	3
Heptachlor	0.0549	B4	0 - 0.5	0.3	0.9
PCB 1260	0.0987	B5	0 - 0.5	0.6	2.5

Notes:

Concentrations in bold exceed industrial soil target concentrations. Concentrations in bold and italics exceed residential soil target concentrations. Table derived from the 2000 facility investigation work plan addendum closure activities (Deffenbaugh 2000a). Samples were collected in 1997 and 1998,

ft bgs = Feet below ground surface
 MDNR = Missouri Department of Natural Resources
 mg/kg = Milligrams per kilogram
 STARC = Soil target concentrations (MDNR 2001)

Table A2- Maximum Concentrations of Constituents Detected in Subsurface Soil

Constituent	Concentration (mg/kg)	Location	Depth (ft bgs)	MDNR STARC, Unrestricted Use (mg/kg)	MDNR STARC, Industrial Use (mg/kg)
Volatile Organic Compounds					
Acetone	1,070	B16	5	2,700	8,700
Chloromethane	66.9	B6	10	1.2*	2.6*
Methylene chloride	<i>111</i>	B15	10	51	150
1,1,2,2-Tetrachloroethane	17.9	B8	29	2	5
Xylenes (total)	0.126	B18	7.5	418	418
Metals					
Arsenic	18	B16	15	11	14
Cadmium	5.23	B6	10	110	380
Chromium	68.3	B6	10	2,100	4,500
Lead	136	B11	30	260	660
Mercury	0.178	B6	10	0.6	1
Pesticides and Polychlorinated Biphenyls					
beta-BHC	0.004	B18	7.5	0.9	3
Heptachlor	0.015 J	B14	10	0.3	0.9
PCB 1260	0.445	B18	7.5	0.6	2.5

Notes:

Concentrations in bold exceed industrial soil target concentrations. Concentrations in bold and italics exceed residential soil target concentrations. Table derived from the 2000 facility investigation work plan addendum closure activities (Deffenbaugh 2000a). Samples were collected in 1997 and 1998.

* MDNR does not specify a STARC for this compound. EPA Region 9 PRG used here (EPA 2002b).

ft bgs = Feet below ground surface

J = Estimated

MDNR = Missouri Department of Natural Resources

mg/kg = Milligrams per kilogram

STARC = Soil target concentrations (MDNR 2001)

APPENDIX B

SURFACE WATER EXCHANGE CALCULATIONS AND PARAMETERS

Table B-1 - Parameters Used in Calculations

Parameter	Symbol	Value	Reference or Assumption
Hydraulic conductivity	K	0.425 feet per day	Deffenbaugh 2002d
Hydraulic gradient	I	5.43×10^{-2} feet per foot	Deffenbaugh 2002d
Effective porosity	N	5 percent	Deffenbaugh 2002d
Dispersivity	D	10 feet	Conservative value to maximize transport
Retardation	R	1	Conservative value to maximize transport
Simulation time	t	50 years	Facility began operations in 1958 (Deffenbaugh 1996)
Modeled area width	W	300 feet	Estimated width of operational areas, based on maps of facility
Modeled area length	L	600 feet	Distance to Blue River (Deffenbaugh 1996)
Source thickness in saturated zone	z	75 feet	Total depth of wells GW-9B and GW-10B, conservative value to maximize flux (Deffenbaugh 2002d)
Width of source	x	100 feet	Distance between GW-9B and GW-10B (Deffenbaugh 2002d)
Cross-sectional area of plume	A	7,500 square feet	Estimated in question 2
Discharge of plume	Q_{plume}	173 cubic feet per day	Estimated in question 2
Discharge of Blue River	Q_{river}	4.25×10^5 cubic feet per day	One-quarter of the lowest discharge at the 12 th Street gauging station, recorded June 9, 2000 (U.S. Geological Survey 2003)
Dilution factor	DF	4.1×10^{-4}	Estimated in question 3
Fraction of organic carbon	f_{oc}	2 percent	Estimate based on professional judgment

Concentrations in surface water will be estimated by estimating the concentration of contaminants at the edge of the river, the amount of contaminated groundwater discharging into the river, and the dilution of groundwater by surface water. Concentrations of contaminants in sediment will be estimated by approximating the amount of contamination that will sorb to organic carbon in sediment.

1. Estimate the concentration of contaminants at the edge of the river.

Table B-2 - Concentrations at Edge of River

Constituent	Concentration at Western Edge of Facility ($\mu\text{g/l}$)	Well	Estimated Concentration in Groundwater at the edge of the Blue River ($\mu\text{g/l}$)
<i>cis</i> -1,2-Dichloroethene	19	GW-9B	16
1,4-Dioxane	380	GW-10B	320
Methyl tert butyl ether	5.1	GW-10B	4.3
Vinyl chloride	2.6	GW-10B	2.2

Notes:

$\mu\text{g/l}$ = micrograms per liter

The following spreadsheets show the input and calculations to the BIOCHLOR software. For the purposes of this estimation, PCE was used as the proxy for 1,4-dioxane, and TCE was used for methyl tert butyl ether (MTBE). To understand the results, *disregard concentrations derived from biotransformation*. Estimated concentration in groundwater at the edge of the Blue River is derived using *no degradation*.

2. Estimate the discharge of contaminated groundwater at the edge of the river.

$$A = z \cdot x$$

$$A = 7,500 \text{ square feet}$$

$$Q_{\text{plume}} = -K \cdot I \cdot A$$

$$Q_{\text{plume}} = 173 \text{ cubic feet per day}$$

3. Estimate the dilution factor.

$$DF = Q_{\text{plume}} / Q_{\text{river}}$$

$$DF = 4.1 \times 10^{-4}$$

4. Estimate the concentration of contaminants in surface water in the Blue River.

Table B-3 - Concentrations in Surface Water, derived from the ISC Facility

Constituent	Estimated Concentration in Groundwater at the edge of the Blue River (µg/l)	Estimated Concentration in Surface Water, derived from the ISC facility (µg/l)	EPA MCL for Drinking Water (µg/l)
<i>cis</i> -1,2-Dichloroethene	16	6.5×10^{-3}	70
1,4-Dioxane	320	0.13	3*
Methyl tert butyl ether	4.3	1.8×10^{-3}	20*
Vinyl chloride	2.2	9.0×10^{-4}	2

Notes:

* EPA has not established an MCL for this compound. The Missouri Groundwater Target Concentration has been used instead.

EPA = U.S. Environmental Protection Agency

MCL = maximum contaminant level

µg/l = micrograms per liter

5. Estimate the concentration of contaminants in sediment.

$$\text{Concentration in sediment} = \text{Concentration in Solution} * f_{oc} * K_{oc} / 1000$$

Table B-4 - Concentrations in Sediment, derived from the ISC Facility

Constituent	Estimated Concentration in Groundwater at the edge of the Blue River (µg/l)	Partition Coefficient (K _{oc})	Estimated Concentration in Sediment, derived from the ISC facility (mg/kg)	MDNR Residential STARC (mg/kg)
<i>cis</i> -1,2-Dichloroethene	16	36	1.1x10 ⁻²	1,200
1,4-Dioxane	320	1.23	7.9x10 ⁻³	150
Methyl tert butyl ether	4.3	6.0	5.2x10 ⁻⁴	8,760
Vinyl chloride	2.2	19	8.4x10 ⁻⁴	0.3

Notes:

Partition coefficients are from EPA Region 9 Preliminary Remediation Goals tables (EPA2002b) and from EPA chemical fact sheets (EPA 1995).

- EPA = U.S. Environmental Protection Agency
- MCL = maximum contaminant level
- MDNR = Missouri Department of Natural Resources
- µg/l = micrograms per liter
- mg/kg = milligrams per kilogram
- STARC = soil target concentrations