

**DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION**  
**In accordance with EPA Interim Final Guidance of 2/5/99**

**RCRA Corrective Action**  
**Environmental Indicator (EI) RCRA Info Code (CA750)**

**Migration of Contaminated Groundwater Under Control**

**Facility Name:** Quality Analytical Services (QAS)  
**Facility Address:** 1633 South Marsh Avenue, Kansas City, Missouri  
**Facility EPA ID #:** MOD073027609

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.

The Quality Analytical Services (QAS) 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). The name was changed again in 2000 to QAS. For purposes of this report the facility will be referred to QAS. In 1998, the facility was closed when all tanks were decontaminated, dismantled, and disposed of (Missouri Department of Natural Resources [DNR] 2000). The extent of soil contamination was determined, and the most contaminated soil was excavated and disposed of appropriately. The facility is unoccupied and used to store empty roll-away containers (Tetra Tech EMI Inc. [Tetra Tech] 2003).

The area around QAS is zoned for industrial use, but residences and businesses border the facility (Deffenbaugh 1996). The facility is bordered on the west by I-435. 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; DNR 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). Deffenbaugh currently owns this property.

Before its closure, QAS 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). A tank farm at the facility was comprised of tanks, a water treatment building, process heater, flash heater, and stormwater containment pit (Deffenbaugh 1996). The facility offices

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were housed on the first floor of a two-story building (Deffenbaugh 1996). Quality Analytical Services, Inc., a laboratory and affiliate company of QAS, occupied the second floor of the building. Figure 2 shows the site layout before closure.

The QAS facility has been monitored and investigated since at least 1981, when the U.S. Environmental Protection Agency (EPA) conducted a site inspection that 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. Groundwater samples collected during the RFA were found contaminated with metals, VOCs, and free floating product (E&E 1987). Soil was collected and analyzed in 1995, 1997, and 1998 (Deffenbaugh 2000a). Soil samples that confirmed closure were collected in 2000 (Deffenbaugh 2001b). Currently, groundwater for analysis is collected annually from all 24 active monitoring wells and semiannually from 15 wells (see Figure 3).

The RFA defined the following units as solid waste management units—19 bulk storage tanks (14 still in use in 1987), four cooker units (converted railroad tank cars), two oil heater units (out of service), one shaker filter unit (out of service), one flash/heater tower, one vapor recovery system, one water containment pit, and one septic tank (E&E 1987). However, the RFA did not provide complete descriptions of these units, and the current conditions report concluded that investigations would best proceed on a sitewide basis (Deffenbaugh 1996).

Before closure activities, QAS operated primarily as a used oil recycling facility (E&E 1987). Lesser amounts of diesel, hydraulic, and other miscellaneous oils also were recycled at the site. Used oil accepted by QAS was received in the unloading area, where it was pumped into daily deposit tanks. The materials then were sampled, analyzed for halogens and PCBs, and transferred to storage tanks. Oil was dewatered, filtered, and processed. Before a vapor recovery system was installed in 1987, water and organic vapors from processing were vented to the atmosphere from the flash heater/tower, presumably falling out on the facility. This final fuel oil product was stored on-site.

The facility also operated a wastewater treatment system for stormwater runoff, oil-water separation, and vapor recovery (E&E 1987). At some time, wastewater may have been discharged by surface water routes, but later it was transported to the Kansas Water Pollution Control Department location in Kansas City, Kansas. Waste sludge collected from cookers and oil storage tanks and spent filters were transported off-site for proper disposal.

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

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 practical and disposed of at the Johnson County Landfill in Shawnee, Kansas. A lined trench installed parallel to Marsh Road extended north approximately 120 feet from the two-story building with an

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approximately fifteen-foot leg extending east from the trench's north end. A cap subsequently added over the excavation area consisted of crushed shale, compacted soil liner, geomembrane, geocomposite, and vegetative cover (Deffenbaugh 2000b). The entire excavated area was enclosed by a six-foot high chain link fence topped by barbed wire. DNR 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)**

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 "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).

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2. Is groundwater known or reasonably suspected to be “contaminated”<sup>1</sup> 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?

  X   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):**

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 eastern portion of the facility is covered with colluvium and fill from the bluff wall (DNR 2000). Shallow unconsolidated materials on the western part of the property consist of silt and clay to a depth of about 20 to 30 feet below ground surface (bgs), underlain by intermediate water-bearing sands, underlain by deep coarse sand and gravel to a depth of 40 to 50 feet bgs (DNR 2000). Wells on the western part of the property are screened in one of three zones (Deffenbaugh 2005b):

- A. Shallow wells, screened in silt and clay.
- B. Deep, screened in gravel.
- C. Intermediate, screened in fine-grained, semi-consolidated sand (Note: intermediate C-zone wells were installed after most of the A- and B-zone wells).

The Pennsylvanian-age bedrock is predominantly limestone, mixed with clay and sand (DNR 2000). The uppermost limestone bedrock is jointed and fractured, but limestones are separated by relatively impermeable shales (DNR 2000).

Depth to groundwater in monitoring wells can range between 9 and 50 feet bgs (Deffenbaugh 2004). Shallow groundwater flows west and northwest across the property, toward the Blue River. Intermediate depth groundwater and deeper groundwater flow toward four extraction wells installed west of the property (Deffenbaugh 2004, 2005b). However, water level measurements taken in November 2004 suggest that the extraction system may be decreasing in efficiency (see Attachment 1), perhaps as a result of siltation (Deffenbaugh 2005b).

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<sup>1</sup> “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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Groundwater samples at the QAS 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). As of May 2005, 24 monitoring wells remain active at the site (see Figure 3) (Deffenbaugh 2005a, 2005c). For the December 2003 sampling event, an additional six temporary monitoring wells were installed in the area around well nest GW-12 for a one-time sampling event (Deffenbaugh 2004). The facility also installed two extraction wells and an interception trench in 2002, and two additional extraction wells in 2003. These wells are shown on Figure 3, designated with a PW prefix (Deffenbaugh 2005b).

All active monitoring wells are sampled annually, and 15 of these wells are also sampled semiannually (Deffenbaugh 2005b). Samples are analyzed for metals and volatile organic analysis (VOAs). Seven wells are sampled biennially for VOAs, SVOCs, PCBs, metals, and other inorganics. 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, 2002c).

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 cluster GW-11.

Table 1 shows the maximum concentrations of VOCs, SVOCs, metals, pesticides, and PCBs since 2000, including the most recent sampling event (May 2005). From the May 2005 sampling, 10 VOCs—benzene, chloroethane, 1,1 dichloroethene (DCE), *cis*-1,2-DCE, 1,4-dioxane, methyl tert-butyl ether (MTBE), trichloroethene, 1,2,4 trimethylbenzene, 1,3,5-trimethylbenzene, and vinyl chloride—were present in concentrations that exceeded their relevant EPA maximum contaminant level (MCL), preliminary remediation goal (PRG), or DNR groundwater target concentration (GTARC). Only one SVOC, naphthalene, was detected at a concentration that exceeded its MCL. Total metal concentrations exceeded MCLs for arsenic, barium, cadmium, chromium, and lead, but some component of these concentrations probably derived from suspended sediment in the sample. Dissolved metals samples were collected in May 2002, 2003, and 2005. No dissolved metals exceeded their MCLs in any of these samples (Deffenbaugh 2002c, 2003d, 2005c). Finally, no pesticides or PCBs exceeded their MCLs or GTARCs in May 2005.

**TABLE 1**

**MAXIMUM CONCENTRATIONS OF CONSTITUENTS IN GROUNDWATER SINCE 2000**

Constituent	Concentration (µg/L)	Well	Date	EPA MCL (µg/L)	Other Locations Exceeding MCL, GTARC, or PRG
<b>Volatile Organic Compounds</b>					
Acetone	52	EPA-R3	9/2004	610*	
<b>Benzene</b>	<b>350</b>	EPA-R1	9/2000	5	GW-1, GW-2, GW-2R, GW-3, GW-4, GW-11C, TRENCH
n-Butylbenzene	5.9	GW-2R	5/2001	240*	
sec-Butylbenzene	2.8	GW-2R	5/2003	240*	

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TABLE 1

MAXIMUM CONCENTRATIONS OF CONSTITUENTS IN GROUNDWATER SINCE 2000

Constituent	Concentration (µg/L)	Well	Date	EPA MCL (µg/L)	Other Locations Exceeding MCL, GTARC, or PRG
Carbon disulfide	2.7	03-B2-C	12/2003	1,000*	
Carbon tetrachloride	1.4	EPA-R1	9/2004	5	
Chlorobenzene	7.8	EPA-R1	3/2001	100	
<i>Chloroethane</i>	140	GW-3	9/2000	4.6*	EPA-R1, GW-2, GW-2R, GW-4, TRENCH
1,2-Dichlorobenzene	11	GW-2R	3/2001	600	
1,3-Dichlorobenzene	2.3	GW-3	9/2004	5.5*	
1,4-Dichlorobenzene	20	GW-3	11/2001	75	GW-2R
1,1-Dichloroethane	50	GW-11C	9/2004	810*	
<b>1,2-Dichloroethane</b>	5.1	GW-3	11/2001	5	
<i>1,1-Dichloroethene</i>	26	PW-3	9/2004	7	
<i>cis-1,2-Dichloroethene</i>	200	GW-12C	12/2003	70	GW-11C
1,2-Dichloropropane	1.8	GW-9B	12/2003	5	
<i>1,4-Dioxane</i>	3,300	GW-11C	12/2003	3**	EPA-R1, GW-1, GW-2R, GW-3, GW-4, GW-5, GW-6B, GW-7, GW-8A, GW-8B, GW-8C, GW-9A, GW-9B, GW-10B, GW-11A, GW-11B, GW-12A, GW-12B, GW-12C, PW-1, PW-2, PW-3, 03-B2-A, 03-B2-C, 03-B4-A, 03-B4-C, TRENCH
Ethylbenzene	210	GW-4	12/2000	700	
Isopropylbenzene	9.8	GW-2R	3/2001	660*	
<i>Methyl tert-butyl ether</i>	140	EPA-R1	11/2001	20**	GW-3, GW-11B, GW-11C, PW-2, PW-3, TRENCH
n-Propylbenzene	15	EPA-R1	5/2001	240*	
Styrene	6.2	GW-4	11/2001	100	
Tetrachloroethene	2.3	EPA-R1	12/2003	5	
Toluene	170	EPA-R1	9/2004	1,000	
1,2,4-Trichlorobenzene	6.7	GW-3	9/2000	70	
1,1,1-Trichloroethane	13	EPA-R1	3/2001	200	
<i>Trichloroethene</i>	57	PW-3	12/2003	5	GW-6B, GW-7, GW-8C, GW-9B, GW-10C, GW-11C, PW-2, PW-4, TRENCH
Trichlorofluoromethane	4.6	EPA-R1	9/2004	1,300*	
<i>1,2,4-Trimethylbenzene</i>	120	EPA-R1	5/2001	12*	GW-2R, GW-3, GW-4
<i>1,3,5-Trimethylbenzene</i>	29	EPA-R1	5/2001	12*	GW-3
Xylene, total	530	EPA-R1	9/2004	10,000	GW-4

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TABLE 1

MAXIMUM CONCENTRATIONS OF CONSTITUENTS IN GROUNDWATER SINCE 2000

Constituent	Concentration (µg/L)	Well	Date	EPA MCL (µg/L)	Other Locations Exceeding MCL, GTARC, or PRG
<i>Vinyl chloride</i>	130	GW-11C	9/2004	2	EPA-R1, EPA-R3, GW-2, GW-4, GW-6B, GW-8B, GW-8C, GW-9B, GW-10B, GW-10C, GW-11B, PW-3, PW-4
<b>Semivolatile Organic Compounds</b>					
Acenaphthene	25	EPA-R1	11/2001	1,200*	
Benzo(g,h,i)perylene	14	GW-11C	11/2001	NA	
Dibenz(a,h)anthracene	12	GW-11C	11/2001	0.0044**	
Dibenzofuran	12	GW-4	3/2001	24*	
Diethylphthalate	12	EPA-R1	5/2001	23,000**	
2,4-Dimethylphenol	27	GW-4	9/2000	540**	
bis(2-Ethylhexyl)phthalate	28	GW-10B	2/2000	6	GW-1, GW-6A, GW-11B
Fluorene	12	GW-4	9/2000	1,300**	
Indeno(1,2,3-cd)pyrene	11	GW-11C	11/2001	0.0044**	
2-Methylnaphthalene	140	GW-4	9/2000	NA	
<i>Naphthalene</i>	760	GW-4	9/2000	100**	EPA-R1
Phenanthrene	14	GW-4	3/2001	NA	
Phenol	27	EPA-R1	9/2000	4,000**	
<b>Total Metals†</b>					
Arsenic	290	GW-3	11/2001	50	
Barium	4,600	GW-12A	9/2004	2,000	
Cadmium	48	GW-12A	9/2004	5	
Chromium	700	GW-12A	9/2004	100	
Lead	560	GW-12A	9/2004	15**	
Mercury	0.94	GW-12A	9/2004	2	
<b>Pesticides and Polychlorinated Biphenyls</b>					
Aldrin	0.073	GW-6A	3/2001	0.002**	
Chlordane (technical)	1.3	GW-10A	3/2001	2	
alpha-Chlordane	0.078	GW-6B	3/2001	2	
gamma-Chlordane	0.11	GW-6B	3/2001	2	
4,4'-DDD	0.22	GW-10A	3/2001	NA	
4,4'-DDT	1.8	GW-10A	3/2001	2**	
Dieldrin	0.07	GW-2	9/2000	0.002**	GW-3, GW-4
Endosulfan II	0.53	GW-2	9/2000	NA	
Endrin	0.13	GW-2	9/2000	2	
Endrin aldehyde	0.39	GW-2	9/2000	NA	
Heptachlor	0.32	GW-10B	11/2001	0.4	
PCB-1260	8.7	GW-2	9/2000	0.5	EPA-R1, GW-3, GW-5

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Concentrations in bold exceed the MCL, GTARC, or PRG (DNR 2001; EPA 2002a, 2002b). Constituents that exceed the MCL, GTARC, or PRG for September 2004 or May 2005 sampling are shown in bold italics. Table derived from a number of groundwater reports (Deffenbaugh 2001a, 2002a, 2003b, 2004, 2005b, 2005c). The spring 2004 sampling was not included in this table.

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

\*\* EPA does not specify a MCL for this constituent. DNR GTARC is used here (DNR 2001).

† Because MCLs are not specified for dissolved metals, total metals concentrations are not compared to MCLs.

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

EPA U.S. Environmental Protection Agency

GTARC Groundwater target concentration

MCL Maximum contaminant level

DNR 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

DDD 1,1-(2,2-dichloroethylidene)bis[4-chlorobenzene]

DDT Dichlorodiphenyltrichloroethane

PCB Polychlorinated biphenyl

Free product has been found in four wells at the facility. In September 2004, thickness of free product ranged from 1.77 feet (GW-4) to 2.5 feet (GW-3); free product also was found in GW-4 (Deffenbaugh 2005b). In the past, GW-2R also has had free product (Deffenbaugh 2005b). The free product is analyzed annually from the well with the thickest product depth for PCBs, volatile petroleum hydrocarbons (OA-1), viscosity, halogens, flash point, cadmium, arsenic, chromium, and lead. In September 2004, it contained metals (arsenic and chromium), gasoline-range organics, VOCs, and PCBs (Deffenbaugh 2005b).

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3. Has the migration of contaminated groundwater stabilized (such that contaminated groundwater is expected to remain within “existing area of contaminated groundwater”<sup>2</sup> 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”<sup>2</sup>.

       If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the “existing area of groundwater contamination”<sup>2</sup>) - 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):

The groundwater extraction and treatment system at QAS began operating on June 6, 2002. Six, bi-monthly sampling events were conducted to evaluate the effectiveness of the system (Deffenbaugh 2003a, 2003c, 2003d). The most recent sampling of the four extraction wells, the interceptor trench, and the effluent, as well as the active monitoring wells, occurred in May 2005 (Deffenbaugh 2005c). Water level measurements taken in November 2004 suggest that the extraction system may be decreasing in efficiency (see Attachment 1), perhaps as a result of siltation (Deffenbaugh 2005b). However, the data over time show that the extraction system is providing a positive influence on the groundwater contaminant plume at the facility (Deffenbaugh 2004, 2005b). Moreover, the downgradient extent of contamination does not seem to be increasing. Attachment 2 shows isoconcentration maps for 1,4-dioxane, a common contaminant in downgradient wells. Concentrations can be seen decreasing over time.

Downgradient wells have been installed at the facility—well clusters GW-9, GW-10, and GW-12. In addition, well cluster GW-11 is the location of the highest concentrations of *cis*-1,2-DCE, vinyl chloride, and 1,4-dioxane. Table 2 shows concentrations of *cis*-1,2-DCE, 1,4-dioxane, and MTBE, the three compounds detected in three or more downgradient locations in 2004. Between 2003 and 2005, three wells showed net upward trends in concentrations of one or more contaminants (see Table 2).

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<sup>2</sup> “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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- In well GW-11C, concentrations of *cis*-1,2-DCE increased between 2003 and 2004 and between 2004 and 2005. However, this well is within the main body of the plume.
- In well GW-12A, *cis*-1,2-DCE and 1,4-dioxane were not detected in either well in 2003 or 2004 but were detected in the May 2005 sampling. However, the concentration of *cis*-1,2-DCE was below the MCL. The concentration of 1,4-dioxane in May 2005 did exceed the DNR GTARC, but was below the EPA Region 9 PRG for tap water (6.1 µg/L).
- In well GW-12B, concentrations of 1,4-dioxane increased from 2003 to 2005 but decreased between 2004 and 2005.

Neither 1,4-dioxane nor *cis*-1,2-DCE was detected in sediment or surface water samples collected from an oxbow lake immediately downgradient of the facility (see Figure 4) (Deffenbaugh 2005b).

**TABLE 2**

**TRENDS IN CONCENTRATIONS OF HAZARDOUS CONSTITUENTS IN DOWNGRADIENT WELLS**

Well	<i>cis</i> -1,2-Dichloroethene				1,4-Dioxane				Methyl tert-butyl ether			
	12/2003 (µg/L)	9/2004 (µg/L)	5/2005 (µg/L)	Net Trend	12/2003 (µg/L)	9/2004 (µg/L)	5/2005 (µg/L)	Net Trend	12/2003 (µg/L)	9/2004 (µg/L)	5/2005 (µg/L)	Net Trend
GW-8A	ND	ND	NS	--	3.6	2.5	NS	Down	ND	ND	NS	--
GW-8C	NA	NA	6	--	NA	NA	100	--	NA	NA	1.1	--
GW-8B	ND	1.1	ND	--	33	26	8.3	Down	ND	ND	ND	--
GW-9A	ND	2.6	NS	--	7.6	4.3	NS	Down	ND	ND	NS	--
GW-9B	30	ND	ND	Down	85	32	38	Down	2.5	ND	ND	Down
GW-10A	ND	ND	NS	--	2.3	ND	NS	Down	ND	ND	NS	--
GW-10C	NA	NA	ND	--	NA	NA	230	--	NA	NA	ND	--
GW-10B	1.7	2.4	ND	Down	52	43	38	Down	1.2	1.2	ND	Down
GW-11A	ND	ND	ND	--	6.1	4.7	ND	Down	ND	ND	ND	--
GW-11C	87	190	110	Up	3200	1200	1300	Down	8.2	11	6.8	Down
GW-11B	ND	ND	ND	--	15	36	26	Down	ND	2.6	ND	--
GW-12A	ND	ND	2.6	Up	ND	ND	5.7	Up	ND	ND	ND	--
GW-12C	200	7.2	1.9	Down	150	34	63	Down	3.6	ND	ND	Down
GW-12B	ND	1.3	ND	--	ND	13	3.7	Up	ND	ND	ND	--
<b>MCL</b>	70	70	70		3*	3*	3*		20*	20*	20*	

**Notes:**

Table derived from a number of groundwater reports (Deffenbaugh 2004, 2005b, 2005c).

\* U.S. Environmental Protection Agency does not specify a MCL for this constituent. Department of Natural Resources Groundwater Target Concentration is used here (DNR 2001).

A Shallow

B Deep

C Intermediate

MCL U.S. Environmental Protection Agency Maximum Contaminant Level (EPA 2002a)

µg/L Micrograms per liter

NA Not available. This well was not installed for this sampling date.

ND Not detected

NS Not sampled

-- No discernable trend

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Contaminated groundwater may be migrating vertically at the QAS facility, but vertical migration likely is controlled by intermediate or underlying aquitards. Groundwater gradients at the facility are downward, as measured at well cluster GW-8 (Deffenbaugh 2001a, 2002a, 2003b, 2004, 2005b). However, in general, the highest concentrations of contaminants are found in the intermediate (C-zone) wells (see Table 2). The fine-grained and semi-consolidated sand in the intermediate zone is likely acting as an aquitard. In addition, regardless of gradient, relatively impermeable shales underlie the entire facility (DNR 2000), likely slowing any groundwater migration.

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):**

The QAS facility is near the Blue River, which is west 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). Springs in the rock outcrop east of site can generate surface runoff at the facility (E&E 1987). Runoff 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). The Blue River was rechannelized in 1997, and the former channel forms an oxbow lake between the facility and the Blue River (see Figure 3 and Figure 4) (Deffenbaugh 2005b).

Relatively low concentrations of contaminants in groundwater from the GW-12 well cluster suggest that contaminated groundwater is not discharging to surface water (see Table 2), a conclusion supported by recent sampling of surface water and sediment from the oxbow lake and the Blue River. In September 2004, sediment and surface water samples were collected from 10 locations in the oxbow (pre-1997 channel of the Blue River), and surface water samples were collected from the Blue River upstream and downstream of the facility (see Figure 4) (Deffenbaugh 2005b). Samples were analyzed for VOCs and total and dissolved metals (Deffenbaugh 2005b). No VOCs were detected in surface water or sediment collected from the oxbow or the Blue River (Deffenbaugh 2005b). Metals were detected in surface water and sediment (see Table 3 and Table 4), but none at concentrations above their MCLs (Deffenbaugh 2005b). Total lead concentrations did exceed the action level in surface water; however, the dissolved lead concentration was below the action level. This is probably due to suspended sediment in the sample. Samples collected upstream and downstream of the facility had detectable concentrations of only total and dissolved barium and total manganese (Deffenbaugh 2005b).

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**TABLE 3**

**METALS DETECTED IN SURFACE WATER**

Constituent	Maximum Concentration (µg/L)	Sample	EPA MCL (µg/L)	DNR GTARC (µg/L)
Barium, total	370	OX9	2,000	2,000
Barium, dissolved	270	OX9	2,000	2,000
Chromium, total	12	OX10	100	100
Lead, total	39	OX10	15 <sup>†</sup>	15

**Notes:**

Table derived from the 2004 Annual Groundwater Report (Deffenbaugh 2005b).

† EPA has not specified a maximum contaminant level for lead. The action level is used here.

EPA U.S. Environmental Protection Agency

MCL EPA maximum contaminant level (EPA 2002a)

DNR Department of Natural Resources

GTARC DNR groundwater target concentration (DNR 2001)

µg/L Micrograms per liter

**TABLE 4**

**METALS DETECTED IN SEDIMENT**

Constituent	Maximum Concentration (mg/kg)	Sample	Industrial STARC (mg/kg)	Residential STARC (mg/kg)
Arsenic	5.5	OX3	11	14
Barium	130	OX9	14,000	51,000
Cadmium	0.46	OX6	110	380
Chromium	15	OX3	2,100	4,500
Lead	51	OX9	260	660
Mercury	0.11	OX4	0.6	1

**Notes:**

Table derived from the 2004 Annual Groundwater Report (Deffenbaugh 2005b).

STARC Department of Natural Resources soil target concentration (DNR 2001)

Mg/kg Milligrams per kilogram

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5. Is the discharge of "contaminated" groundwater into surface water likely to be "insignificant" (i.e., the maximum concentration<sup>3</sup> 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 concentration<sup>3</sup> 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 concentration<sup>3</sup> 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 concentrations<sup>3</sup> 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):

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<sup>3</sup> 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 implemented<sup>4</sup>)?

\_\_\_\_\_ 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-assessment,<sup>5</sup> 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):

\_\_\_\_\_ <sup>4</sup> 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.

<sup>5</sup> The 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):

A routine groundwater monitoring program has been implemented at the QAS facility as required by the facility post-closure plan. All active monitoring wells are sampled annually, and 15 of these wells are also sampled semiannually (Deffenbaugh 2005b). Additionally, the post-closure plan requires post-closure care for 30 years from completion of closure activities, which took place in 2002 (Deffenbaugh 2002b).

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 the Quality Analytical Services facility, EPA ID MOD073027609, located in Kansas City, Missouri. 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.

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OCT 21 2005

Hazardous Waste Program  
MO Dept. of Natural Resources

Completed by: (Signature) *Darleen Groner* Date 9/29/05  
(Print) Darleen Groner, P.E.  
(Title) Environmental Engineer III  
(State) Missouri Department of Natural Resources  
Hazardous Waste Program

Supervisor: (Signature) *Richard A. Nussbaum* Date 9/29/05  
(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) *David Garrett* Date 9/30/05  
(Print) David Garrett  
(Title) Project Manager, RCRA Corrective Action & Permits Branch  
EPA Region VII

Completed by: (Signature) *Don Toensing* Date 9/30/05  
(Print) Don Toensing  
(Title) Chief, RCRA Corrective Action & Permits Branch  
EPA Region VII

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. 5<sup>th</sup> Street  
Kansas City, KS 66101

Contact telephone number and e-mail address:

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