

DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

Interim Final 2/5/99

Revised 11/8/00

RCRA Corrective Action
Environmental Indicator (EI) RCRIS Code (CA725)

Current Human Exposures Under Control

Facility Name: **Harcros Chemicals Inc.**
Facility Address: **5200 Speaker Road, Kansas City, KS 66106**
Facility EPA ID #: **KST 210010062**

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 Harcros Chemicals, Inc. (Harcros), facility is at 5200 Speaker Road in Kansas City, Kansas (see Figure 1), along the Kansas River. In the documentation produced since the Administrative Order on Consent (AOC), the facility is divided into four zones, based on distinctions in normal business operations and contamination types: the Mid-Area (MA), the Restricted Zone (RZ), the Area North of the Levee (NOL), and the Surface Drainages (SD) Area (see Figure 2). The following list of solid waste management units (SWMU), areas of interest (AOI), and regulated units (RU) is organized by zone. Except where noted, the descriptions below are derived from the draft Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) (Burns and McDonnell [BMD] 1996).

Mid-Area

SWMU D, Acid Drainage Area (or Acid Wash-Down Area). In this area, acids were brought in by, and unloaded from, railcars and drummed for use on site from the mid-1960s until the mid-1980s. Spills or overflows were contained by, and flowed along, a collection trench lined with concrete and crushed limestone and into a neutralization pit filled with limestone. Based on groundwater and soil concentrations, relative to the facility as a whole, this SWMU does not appear to be a major source of contamination at the site.

SWMU F, Sump 2. This sump is one of two that make up SWMU F (Concrete Sumps); the other is in the RZ. This sump receives wash water from the Liquid Blending Complex (LBC) and some storm water runoff from the MA. At times in the past, it also has been the destination for laboratory wastes, including solvents, acids, and bases, and cooling water from Supply Well (SW) 6. Runoff and wash water is conveyed from Sump 2 to an equalization tank that discharges to the Kansas City, Kansas, sanitary sewer system through site sewers or the area NOL through Outfall 2. Based on groundwater and soil

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concentrations, relative to the facility as a whole, this SWMU does not appear to be a major source of contamination at the site.

SWMU G, East Spur. This railroad spur is one of two that make up SWMU G (Tank Car Unloading Area); the other is in the RZ. This currently inactive area was the location in which tank cars containing, for example, acids and solvents were unloaded and loaded with finished products, primarily pesticides. This SWMU was also the site of pesticide formulation from the late-1960s until the late-1970s. The East Spur is the location of some of the highest soil concentrations of volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), and pesticides in the MA (BMD 2000a). There is also limited contamination of soil by herbicides (BMD 1998). Because of high concentrations of contaminants in soil just above the water table, it is one of the primary sources for VOCs, SVOCs, and pesticides in groundwater at the Harcros facility (BMD 1998).

Central Tank Dike Area. This AOI consists of aboveground storage tanks (AST) and five earthen dikes put into use in about 1965. The tanks stored solvents until the early-1970s. During the 1960s, this area also was used to package solvents into drums. As of 1996, the tanks stored solvents and other raw materials for, and finished products from, the Ethyloxylation (EO) Plant. The EO Plant was constructed in about 1965 and was the location in which surfactants and industrial emulsifiers and wetting agents were manufactured. Based on groundwater and soil concentrations, relative to the facility as a whole, this AOI does not appear to be a major source of contamination at the site.

Liquid Blending Complex (LBC). This AOI has been used for blending and drumming of solvents and emulsifiers from the late-1960s to 1996. A building was constructed on the same location for this use in the early-1970s. In the early-1960s, this area also included a tank that stored tetrachloroethene (PCE); the tank subsequently was moved to the northern portion of the LBC in the 1970s and to the tank farm in the RZ (SWMU E) in the mid-1980s. Pesticides also were formulated in the general area of the LBC from 1967 to the late-1970s. This area has some of the highest concentrations of VOCs, SVOCs, and pesticides in the MA in shallow soil and soil just above the water table. Because of high concentrations of contaminants in soil just above the water table, it is one of the primary sources for VOCs, SVOCs, and pesticides in groundwater at the Harcros facility (BMD 1998).

Drum Storage Pad (DSP). This AOI is an uncurbed concrete pad constructed in 1970 that has been used for drum storage. Although it has been used primarily to store empty drums, it also may have stored merchandise, probably primarily pesticides, for short periods of time. Runoff from the DSP drains into Surface Drainage Way (SDW) 3 and is probably the source of soil and groundwater contamination in the northern part of SDW3.

Restricted Zone

SWMU A, Pilot Plant Solvent Recycling Area. The solvent recycling plant was not associated with production activities in the RZ but lies immediately to the southwest of the RZ. From mid-1982 to mid-1983, it was the location of a pilot program to recycle and reclaim 1,1,1-trichloroethane and, to a lesser extent, PCE and methylene chloride. Any spills from this area may have discharged to site sewers. Based on groundwater and soil concentrations, relative to the facility as a whole, this SWMU does not appear to be a major source of contamination at the site.

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SWMU B, Area East of Dike #2. Since 1980, this paved area has been used for short-term (less than 90 days) storage of drums of hazardous waste and solid waste containing hazardous constituents. Based on groundwater and soil concentrations, relative to the facility as a whole, this SWMU does not appear to be a major source of contamination at the site.

SWMU E, Tank Farm Area. The tank farm formerly was used for herbicide formulation and has also been used for solvent (including PCE) and raw material storage. The farm consists of a number of ASTs and four tank dikes located along the edge of the West Spur, three concrete and one earthen. The area around Dikes 1 and 2 was used for herbicide formulation until 1978. The Dike 3 area was used for the storage of PCE from the mid-1980s until 1990. The area within Dike 4, the earthen dike, has contained tanks of iso-octyl alcohol or caustic soda. This area has some of highest concentrations of VOCs, SVOCs, and herbicides in the RZ in shallow soil and soil just above the water table. Because of high concentrations of contaminants in soil just above the water table, it is one of the primary sources for herbicides in groundwater at the Harcros facility (BMD 1998).

SWMU F, Sump 1. This sump is one of two that make up SWMU F (Concrete Sumps); the other is in the MA. This sump receives storm water runoff from the RZ, including from SWMUs E and B. Water is conveyed from Sump 1 to an equalization tank which discharges to the Kansas City, Kansas, sanitary sewer system through site sewers or the area NOL through Outfall 1. The northern portion of the RZ near Sump 1 has some of highest concentrations of SVOCs, herbicides, and dioxins in the RZ in shallow soil and soil just above the water table. Because of high concentrations of contaminants in soil just above the water table, it is one of the primary sources for herbicides in groundwater at the Harcros facility (BMD 1998).

SWMU G, West Spur. This railroad spur is one of two that make up SWMU G (Tank Car Unloading Area); the other is in the MA. This currently inactive area was the location in which tank cars containing, for example, solvents and acids, were unloaded and loaded with finished products, primarily herbicides. The southern portion of this SWMU also was used to package materials, probably herbicides. The West Spur is the location of some of the highest concentrations of VOCs in soil in the RZ.

Area North of the Levee

SWMU H, Empty Drum Disposal. This area includes a former drum disposal area created by the Army Corps of Engineers in 1972 and an area used by Harcros to allow sulfuric acid drums to depressurize. An investigation conducted by Harcros in 1984 also revealed that the area was being used for unregulated solid waste disposal, including empty drums, plastic liners, and household trash. All of these materials, along with two or three drum volumes of discolored soil, were removed at that time. Based on groundwater and soil concentrations, relative to the facility as a whole, this SWMU does not appear to be a major source of contamination at the site.

SWMU I, Ponding Area. This area includes the outfalls for noncontact cooling water from the RZ and the MA. Until the site was regraded in 1997 (BMD 1998), water from these outfalls ponded in the area as it infiltrated the soil. Water from the outfalls now flows toward the Kansas River, usually infiltrating or evaporating before it reaches the river. SWMU I is now also a collection point for storm water runoff (BMD 2000a). Surface water collected after storm events contains VOCs, mostly chlorinated solvents,

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and sediments have had limited detections of pesticides. Based on groundwater and soil concentrations, relative to the facility as a whole, this SWMU does not appear to be a major source of contamination at the site.

Surface Drainages Area

SWMU C, Open Trenches and Sewers. This SWMU consists of a series of unlined open ditches and leaking sewer canals surrounding the closed Surface Impoundment (SI). These ditches and trenches transported wastewater and some runoff to the equalization tank in the northeastern part of the site. Although they currently are lined with concrete, portions of these trenches were unlined in the past. Based on groundwater and soil concentrations, relative to the facility as a whole, this SWMU does not appear to be a major source of contamination at the site.

Surface Drainage Ways (SDW). SDWs were identified as AOIs in the AOC. They conduct storm water runoff from the operational areas of the facility into site or city sewer systems. SDW 1 drains the RZ, SDW 2 receives storm water runoff from northeastern portion of facility, and SDW 3 drains the MA. Water from SDW 1 and 2 collects in the northern part of the facility. During periods of high flow, water in SDWs 1 and 2 may flow east, off of Harcos property, to a culvert through the levee (near the U.S. Postal Service facilities) and then to the Kansas River. SDW 3 flows south to ditches along Speaker Road, where it either infiltrates or runs into Kansas City, Kansas, city sewers. In addition to these three on-site SDWs, drainage ditches also run along Speaker Road. Contaminants in excess of site-specific screening levels (SSSL) have been found in these other drainage ways. The area in SDW 3 next to the DSP has soil contaminated with VOCs and SVOCs in excess of SSSLs. Contamination in these areas is probably the result of runoff from operational areas, rather than releases in the SDWs.

Closed Surface Impoundment (SI). The SI is an RU being monitored by the Kansas Department of Health and the Environment (KDHE). It was constructed in 1965 to serve as an emergency ethylene oxide relief facility. In 1973, it was drained and lined, and the majority of sludge was removed in 1978. From 1978 to 1988, the SI served as an equalization basin for process wastewater being discharged to Kansas City, Kansas, sewers. It was taken out of service in 1988. Based on the results of continued quarterly monitoring, it appears that the SI is not a major source of constituents in groundwater at the facility relative to other contaminated areas on site (BMD 1998).

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.

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Definition of “Current Human Exposures Under Control” EI

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

Relationship of EI to Final Remedies

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

Duration / Applicability of EI Determinations

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

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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)?

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

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

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

_____ If unknown (for any media) - skip to #6 and enter “IN” status code.

Rationale and Reference(s):

The Harcros facility is at 5200 Speaker Road, in the Kansas Avenue industrial corridor of Kansas City, Kansas. Prior to 1960, the area was used largely for farming and gravel quarrying, but subsequently it has been developed extensively for heavy industry. Adjacent properties include other chemical manufacturers and storage facilities. The site lies within 0.5 mile of the Kansas River, about 7 miles upstream of its confluence with the Missouri River.

No other permanent surface water bodies exist on the property, but pools of standing water do develop during periods of heavy precipitation (BMD 2000a). Storm runoff from the property may infiltrate into the ground onsite; discharge to site sewers and then into city sewers, through equalization tanks; or run south to the drainage ditches along Speaker Road and then directly into city sewers.

Groundwater at the site typically is found 35 to 40 feet below ground surface (bgs), flowing through an unconsolidated, unconfined alluvial aquifer. In the past, gradients at the site were at least partially controlled by the pumping of a cooling-water supply well (BMD 2000a). However, since September

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1999 (U.S. Environmental Protection Agency [EPA] 2001a), pumping has been discontinued, and gradients at the site are now controlled entirely by the stage of the Kansas River (Harcros 2001). During periods of high stage, groundwater flows south. During periods of low stage, groundwater flows north, towards the river.

The Harcros facility has been the subject of ongoing monitoring since at least 1983, when Harcros entered into an AOC with KDHE to investigate the nature and extent of herbicide and dioxin contamination in the RZ. On July 27, 1990, Harcros and EPA entered into an AOC requiring an RFI and a Corrective Measures Study at the site. As a result of this investigation, Harcros and their consultants have collected soil, sediment, groundwater, and surface water samples.

As part of these investigations, an Interim RFI Data Report was generated in May 1993 (BMD 1993), including the results of initial field work, a pumping test of SW6, and the first two rounds of groundwater sampling. The Draft RFI Report was presented in April 1996 (BMD 1996), incorporating the data from the 1993 report, along with EPA revisions, the results of additional field work, and data from the next four groundwater sampling events. The Final RFI Report (BMD 1998) was finished in February 1998. This final report summarized the results of previous drafts, presented data from groundwater sampling Rounds 7 and 9, and initiated the process of developing screening levels and corrective action objectives. After the RFI was complete, the CAO Report was generated in February 2000 (BMD 2000a), outlining Harcros's risk assessment plans and summarizing the extent of contamination at the facility. These documents form the basis of this evaluation.

The Harcros facility has been in operation since 1960. It is currently the site of packaging of acids, formulation of surfactants, manufacturing of animal feed supplements, and warehousing and distribution of industrial chemicals and supplies. In addition, activities in the past also have included formulation of pesticides (including chlordane, aldrin, and dieldrin), manufacture of phenoxy herbicides (including dichlorophenoxyacetic acid [2,4-D], 2,4,5-trichlorophenoxyacetic acid [2,4,5-T], and Agent Orange), and wholesale distribution of industrial, dry cleaning, and laundry chemicals and supplies (BMD 1996).

The MA includes most of the central operational areas at Harcros. It is the site of several ongoing processes, including loading and unloading of raw materials and finished products and packaging of solvents and surfactants, and discontinued processes, such as pesticide formulation. Formulation of pesticides began in 1967, at the area on the western side of the LBC, and continued until the late-1970s.

The RZ includes most of the operational areas on the western side of the site. It is the site of several ongoing processes, including loading and unloading of raw materials and finished products, short-term storage of drums, and long-term storage of materials in ASTs, and discontinued processes, such as the manufacture of phenoxy herbicides and solvent recycling. Production of phenoxy herbicides began in 1960 and continued until 1977. A building was constructed to house herbicide manufacture in 1963. The building subsequently was closed in 1983 and demolished in 2000 (URS 2000). The RZ was also the site of the manufacture of Agent Orange from 1967 until 1971 or 1972, when all raw materials and finished products were removed from the site. Agent Orange is a mixture of 2,4-D, 2,4,5-T, and trace amounts of dioxins (in particular 2,3,7,8-tetrachlorodibenzo-p-dioxin).

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The area NOL consists of the unfenced area that lies south of the Kansas River and north of the levee. It is not an operational area of the facility but has been used for unregulated waste disposal and permitted National Pollutant Discharge Elimination System discharges from Harcros property. This permit is currently expired, and Harcros is not known to have obtained a new one.

The SD area consists of several drainage ways and facilities related to the EO plant. With the exception of the EO plant, the SD area is not an operational area, but it does receive runoff from both the RZ and the MA. Soils and sediments in the SD areas contain some of the highest detections of SVOCs, pesticides, and herbicides at Harcros as a result of runoff from the MA and the RZ.

Soil and Sediment

In all, more than 900 soil and 150 sediment samples have been collected in the course of investigations at Harcros (BMD 1993, 1996, 1998). Of this number, 766 were analyzed for VOCs, 568 for SVOCs, 655 for herbicides (almost all collected in the RZ), and 616 for pesticides. In addition, 150 samples were analyzed for dioxins, including samples collected during pre-RFI investigations. Because of the lack of permanent bodies of surface water, collection of sediment has been limited to samples collected in the SDWs and SWMU I (BMD 1996, 1998). Because they generally are grouped together in the available documentation, sediment and soil will be considered together for this evaluation. Soils were sampled in three distinct intervals: shallow (0 to 10 bgs), intermediate (20 to 25 feet bgs), and deep (35 to 40 feet bgs). The deepest samples were collected from just above the water table.

For the purposes of the RFI (BMD 1996, 1998) and Corrective Action Objectives (CAO) report (BMD 2000a), soil was considered to be contaminated with a compound if concentrations exceeded either an ingestion soil-screening level (SSL), a soil-to-groundwater SSL, or the soil saturation limits, whichever was lowest (BMD 1998). Ingestion SSLs were calculated using the EPA Risk Assessment Guidance for Superfund Part B protocols (EPA 1991). Toxicity values used in the calculations were either from EPA's Integrated Risk Information System (IRIS) (EPA 1999a) or EPA Health Effects Assessment Summary Tables (HEAST) (EPA 1997a) if values were not available for a compound in IRIS. For most polycyclic aromatic hydrocarbons, a toxicity equivalency factor approach was used to establish toxicity values (BMD 1998). In all cases, EPA standard default values were used for frequency and duration of contact, body weight, and other toxicity-calculation factors. The soil-to-groundwater SSLs were calculated to protect groundwater from compounds that would leach from soil into groundwater and result in an unacceptable concentration in groundwater. Acceptable concentrations in groundwater were based on the assumption that groundwater would be used as drinking water, using either EPA's Safe Drinking Water Act Regulations and Health Advisories maximum contaminant levels (MCL) (EPA 1999b) or risk-based values. Finally, screening levels were capped at the soil saturation limit for compounds expected to be liquid at ambient temperatures. These concentrations were based on the sorptive properties of the soils on the site.

Chemicals were classified as chemicals of potential concern (COPC) if they (1) exceeded an EPA Region III industrial-worker, ingestion-risk-based concentration (EPA 1999c), (2) were Class-A carcinogens detected at any concentration, or (3) were detected in more than 5 percent of the samples analyzed for that compound. CAOs were developed for all COPCs.

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Although the highest concentrations of contaminants were found in the upper 10 feet of soil, contamination extended through the vadose zone to the water table in both the MA and the RZ, with high concentrations of contaminants at depth. The results of a comparison of screening levels to soil and sediment concentrations are summarized in Table 1.

In the MA, VOCs (mostly acetone and PCE and its degradation products – trichloroethene [TCE], 1,2-dichloroethene [1,2-DCE], and vinyl chloride [VC]), SVOCs (mostly naphthalenes), and pesticides (mostly chlordane and dieldrin) were detected frequently in soil samples in concentrations above their screening levels. Samples with the highest concentrations were collected from along the East Spur (SWMU G) and east of the LBC. The most contaminated soil samples were those from shallow depths and from directly above the water table (BMD 1998).

VOCs (mostly acetone, xylene, and PCE and its degradation products), SVOCs (mostly chlorophenols), and herbicides (mostly 2,4,5-T and 2,4,5-trichlorophenoxypropionic acid [2,4,5-TP] [Silvex]) were detected frequently in soil in the RZ. The highest concentrations of contaminants were found east of the Tank Dikes (SWMU E) and in the northern portion of the RZ. The highest concentrations of VOCs, SVOCs, and herbicides were found in shallow soil. SVOCs and herbicides also had elevated concentrations just above water table. Dioxins also have been detected in soils in the RZ (BMD 1998).

Pesticides, in particular chlordane, were the most significant contaminants found in soils in the SD area. SVOCs and herbicides also were present in concentrations above their screening levels, but to a lesser extent. Dioxins were found in SDW 1, adjacent to the RZ. Unlike the MA and the RZ, contamination in the soils of the SD area generally was restricted to the uppermost 6 feet (BMD 1998).

Soils and sediments of the area NOL were largely uncontaminated. Contaminated media include soils and sediments, but concentrations generally were low when compared with the facility as a whole. A limited number of samples have exceeded screening levels for pesticides and dioxins in this area (BMD 1998).

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Table 1 – Compounds Detected in Soil and Sediment Samples Compared to Screening Levels

Compound	Maximum Concentration Reported (ppb)	Percent Positive Detections	Ingestion SSL (ppb)***	Soil-to-Groundwater SSL (ppb)***	Ingestion or Groundwater Risk?
Volatile Organic Compounds					
Acetone*	70,000	44	7,821,000	5,600	Groundwater
Benzene*	151	<1	22,000	10	Groundwater
Bromodichloromethane	3,100	<1	10,000	190	Groundwater
2-Butanone*	2,800	11	46,929,000	2,300	Groundwater
Carbon Tetrachloride	170	<1	5,000	22	Groundwater
Chlorobenzene	9,000	2	1,564,000	810	Groundwater
Chloroform	1,800	2	105,000	230	Groundwater
Chloromethane	72	<1	49,000	4.5	Groundwater
1,2-Dichloroethene (total)*	380,000	18	704,000	110	Groundwater
Ethylbenzene*	140,000	7	7,821,000	191,000	Other
4-Methyl-2-Pentanone*	8,100	5	6,257,000	4,500	Groundwater
Methylene Chloride	510,000	8	85,000	7.6	Both
1,1,1,2-Tetrachloroethane	34	<1	3,200	1.1	Groundwater
Tetrachloroethene*	7,700,000	40	12,000	38	Both
Toluene*	670,000	8	15,643,000	3,700	Groundwater
1,1,1-Trichloroethane	2,700	1	7,039,000	1,200	Groundwater
Trichloroethene*	3,500,000	17	58,000	20	Both
Vinyl Chloride*	15	<1	340	11	Groundwater
Xylene (total)*	1,100,000	14	156,429,000	73,000	Groundwater
Semi-volatile Organic Compounds					
Acenaphthene	4,000	3	4,693	3,400	Groundwater
Benzo(a)anthracene*	3,600	6	880	3,200	Both
Benzo(a)pyrene*	3,400	6	88	20,000	Ingestion
Benzo(b)fluoroanthene*	3,800	6	880	13,000	Ingestion
Benzo(k)fluoroanthene*	3,700	6	8,800	10,000	Other
bis(2-Chloroisopropyl)ether	60	<1	9,000	0.75	Groundwater
bis(2-Ethylhexyl)phthalate*	9,000	9	46,000	13,000	Other
Chrysene*	4,200	6	88,000	56,000	Other
Dibenzo(a,h)anthracene	570	2	88	380	Both
1,2-Dichlorobenzene	130,000	3	7,039,000	4,900	Groundwater
1,3-Dichlorobenzene	13,000	1	n/a	5,100	Groundwater
2,4-Dichlorophenol*	170,000	11	235,000	460	Groundwater
2,4-Dimethylphenol*	31,000	3	1,564,000	1,100	Groundwater
Fluoranthene*	9,500	8	3,129,000	1,566,000	Other
Fluorene	8,200	4	3,129,000	190,000	Other
2-Methylnaphthalene*	203,000	11	n/a	n/a	Other
2-Methylphenol(o-cresol)	11,000	1	3,911,000	6,600	Groundwater
4-Methylphenol(p-cresol)*	44,000	7	391,000	410	Groundwater
Naphthalene*	130,000	11	3,129,000	34,000	Groundwater
N-Nitroso-di-n-propylamine	27	<1	91	0.017	Groundwater
Pentachlorophenol	3,300	<1	5,000	24	Groundwater

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Table 1 – Compounds Detected in Soil and Sediment Samples Compared to Screening Levels (continued)

Compound	Maximum Concentration Reported (ppb)	Percent Positive Detections	Ingestion SSL (ppb)***	Soil-to-Ground-water SSL (ppb)***	Ingestion or Ground-water Risk?
Phenanthrene*	5,500	8	n/a	n/a	Other
Pyrene*	7,600	8	2,346,000	2,087,000	Other
2,4,5-Trichlorophenol*	2,800,000	21	7,821,000	143,000	Groundwater
Pesticides					
4,4'-DDD*	63,000	18	2,700	310	Both
4,4'-DDE	19,000	31	1,900	7,000	Both
4,4'-DDT	320,000	31	1,900	1,200	Both
Aldrin*	58,000	13	38	240	Both
Chlordane (technical)*	410,000	40	490	2,000	Both
Dieldrin*	99,000	40	40	3.7	Both
Heptachlor	80	2	140	35	Other
Heptachlor Epoxide*	260,000	5	70	1,000	Both
Toxaphene*	340,000	2	580	450	Both
Herbicides					
Dichlorophenoxyacetic acid (2,4-D)*	520,000	9	782,000	270	Other
2,4,5-Trichlorophenoxyacetic acid (2,4,5-T)*	2,400,000	42	782,000	880	Both
2,4,5-Trichlorophenoxypropionic acid (2,4,5-TP) (Silvex)*	280,000	38	626,000	3,300	Other
Atrazine	1,100	<1	2,900	45	Other
Dioxin					
2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD)*	223	74	0.0043**	n/a	Other

Notes:

- * Identified as a chemical of potential concern.
- ** From U.S. Environmental Protection Agency Region III Risk-based Concentration table (1999c), industrial soil.
- *** From Resource Conservation and Recovery Act Facility Investigation (RFI) (Burns and McDonnell [BMD] 1998). See discussion above for derivation of these values.

This table derived from BMD (1998, 2000a).

“Both” indicates risk to human health from ingestion and risk of migration to groundwater.

DDD = 1,1-dichloro-2,2-bis(p-chlorophenyl)ethane

DDE = 1,1-dichloro-2,2-bis(p-chlorophenyl)ethylene

DDT = 1,1,1-trichloro-2,2-bis(p-chlorophenyl)ethane

n/a = not available

ppb = parts per billion

SSL = soil screening level

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Groundwater

Groundwater samples at the Harcros facility generally have been collected from monitoring wells screened in two depths in the aquifer. Monitoring wells are screened in a shallow zone (less than about 50 feet bgs) and a deep zone (more than about 50 feet bgs) (BMD 1996). Prior to the RFI, nine monitoring wells were completed in the shallow part of the aquifer. During the RFI, 32 monitoring wells were installed – 21 wells in the shallow aquifer zone and 11 in the deep aquifer zone. Investigators also sampled supply wells SW6 and SW5 and three monitoring wells on property to the east belonging to TH Agriculture and Nutrition (THAN), the former owners of the Harcros facility (BMD 1996, 1998).

Nine rounds of sampling were associated with the RFI. Samples for Rounds 1 and 2 were collected during January and February 1993, Rounds 3 and 4 during September and November 1994, Round 5 during May 1995, Round 6 during October 1995, Round 7 during May and July 1996, Round 8 during November 1996, and Round 9 in June 1997. Round 3 samples were collected following the summer floods of 1993 and tended to have higher concentrations of contaminants than samples collected during other rounds. A total of 330 samples were collected, with 187 samples analyzed for VOCs, 100 samples for SVOCs, 176 samples for herbicides (only 43 analyzed for atrazine), and 85 samples for pesticides. Samples also were collected during an additional sampling event in August 2001 to determine the effect of shutting down SW6, a cooling-water supply well that previously had been thought to control the movement of groundwater at the site (BMD 2000a, Harcros 2001).

For the purposes of the RFI (BMD 1993, 1996, 1998) and CAO report (BMD 2000a), groundwater was considered to be contaminated with a compound if concentrations exceeded a drinking-water ingestion screening level (BMD 1998). A compound could be classified as a COPC if (1) its concentration exceeded an ingestion-risk screening concentration, (2) it was a Class-A carcinogen detected at any concentration, or (3) it was detected in more than 5 percent of the samples analyzed for that compound. The screening level was based on EPA's MCL (EPA 1999b). If a compound did not have an EPA MCL, the safe level or risk-based concentration (RBC) was taken from the EPA Region III RBC table (1999c). The results of a comparison of screening levels to groundwater concentrations are summarized in Table 2.

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Table 2 – Compounds Detected in Groundwater Samples Compared to Screening Levels

Compound	Maximum Concentration Reported in RFI (ppb) ^{††}	Percent Positive Detections in RFI	Maximum Concentration in August 2001 (ppb) ^{***}	MCL or RBC (ppb) ^{†††}	Exceeded Screening Level?
Volatile Organic Compounds					
Acetone*	3,300	32	23,000	608	Y
Benzene*	120	28	73	5	Y
Chlorobenzene*	40	23	44	100	N
Chloroform*	29	6	0.57	0.15	Y
Chloromethane*	21	10	0.79	2	Y
1,1-Dichloroethane*	210	43	74	800	N
1,2-Dichloroethane*	45	13	ND	5	Y
1,1-Dichloroethene*	38	10	1,000	7	Y
1,2-Dichloroethene (total)*	6,400	82	2,800	100	Y
Ethylbenzene*	1,600	15	1,500	700	Y
Methylene Chloride [†]	180	<5	ND	5	Y
Tetrachloroethene*	300	25	10,000	5	Y
Toluene*	120	11	16	1,000	N
1,1,1-Trichloroethane*	260	6	6.7	200	Y
Trichloroethene*	260	43	7,200	5	Y
Vinyl Chloride*	2,500	63	2,300	2	Y
Xylene (total)*	5,700	14	3,100	10	Y
Semi-volatile Organic Compounds					
bis(2-Ethylhexyl)phthalate*	42	19	13	6	Y
1,2-Dichlorobenzene*	37	29	4.1	600	N
2,4-Dichlorophenol*	13	19	4.5	109	N
2,4-Dimethylphenol*	24	7	ND	730	N
2-Methylnaphthalene*	27	7	ND	none	N
2-Methylphenol(o-cresol)*	4	7	ND	1,800	N
4-Methylphenol(p-cresol)*	52	9	ND	1,800	N
Naphthalene*	16	15	730	none	N
Phenol*	48	10	ND	22,000	N
2,4,5-Trichlorophenol*	10	7	ND	3,700	N
Pesticides					
4,4'-DDD*	0.35	6	NA	0.28	Y
Aldrin*	0.038	7	NA	0.0039	Y
Chlordane (technical)*	4.7	7	NA	2	Y
Heptachlor Epoxide	0.79	<5	NA	0.2	Y
Toxaphene	12	<5	NA	3	Y
Herbicides					
Dichlorophenoxyacetic acid (2,4-D)**	NR	<5	2.9	70	N
2,4,5-Trichlorophenoxyacetic acid (2,4,5-T)**	NR	<5	0.86	370	N

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Table 2 – Compounds Detected in Groundwater Samples Compared to Screening Levels (continued)

Compound	Maximum Concentration Reported in RFI (ppb) ^{††}	Percent Positive Detections in RFI	Maximum Concentration in August 2001 (ppb) ^{***}	MCL or RBC (ppb) ^{†††}	Exceeded Screening Level?
2,4,5-Trichlorophenoxypropionic acid (2,4,5-TP) (Silvex)*	88	59	460	50	Y
Atrazine*	3.1	7	ND	3	Y

Notes:

- * Identified a chemical of potential concern.
 - † Compound was often found in trip or laboratory blanks. However, the 180-ppb result was not from a qualified sample.
 - ** No maximum reported concentrations in the Corrective Action Objectives report (Burns and McDonnell [BMD] 2000a)
 - †† Only samples collected from January 1995 to June 1997 were included in these results.
 - *** Samples collected during this event were not analyzed for pesticides.
 - ††† MCLs from EPA’s Safe Drinking Water Act Regulations and Health Advisories maximum contaminant levels (MCL) (U.S. Environmental Protection Agency [EPA] 1999b) or from EPA Region III Risk-based Concentration (RBC) table (1999b) for compounds with no MCL.
- This table is derived from BMD (2000a) and TH Agriculture and Nutrition (2001).
 DDD = 1,1-dichloro-2,2-bis(p-chlorophenyl)ethane
 N = no
 NA = not analyzed
 ND = not detected
 NR = not reported
 ppb = parts per billion
 RFI = Resource Conservation and Recovery Act Facility Investigation (BMD 1993, 1996, 1998)
 Y = yes

Groundwater at the Harcros facility is contaminated most significantly with VOCs, and the most contaminated groundwater samples were from the shallowest parts of the aquifer (BMD 1998, 2000a). However, SVOCs, pesticides, and herbicides also have been found in concentrations in excess of their MCLs or RBCs.

VOC, SVOC, and pesticide contamination in groundwater was centered around the East Spur in the MA. The most common VOCs detected above their MCL were PCE (and its degradation products), acetone, ethylbenzene, toluene, and xylenes (BMD 1998). During Rounds 1 through 4, SVOCs commonly were not detected. As a result, the number of wells sampled for SVOC analysis was reduced in later rounds. SVOCs, with the exception of 1,2-dichlorobenzene, naphthalene compounds, and chlorinated phenols, commonly were not detected in groundwater at the Harcros facility. Of these, only bis(2-ethylhexyl)phthalate was detected in concentrations above its MCL (BMD 1998). During Rounds 1 through 4, pesticides were not commonly detected. As a result, the set of wells sampled for pesticide analysis was reduced to those in the area of the East Spur during Rounds 5, 6, and 7. The number of

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wells sampled for pesticide analysis was increased for Rounds 8 and 9. Aldrin, 4,4'-DDD*, chlordane (technical), heptachlor epoxide, and toxaphene were all detected above their screening concentrations during the period from 1995 to 1997 (BMD 1998).

Groundwater that is contaminated with herbicides is most commonly found under the RZ and SDW1. Herbicides detected include 2,4-D, 2,4,5-T, 2,4,5-TP (silvex), and atrazine, with 2,4,5-TP the most common. In recent years, 2,4,5-TP and atrazine have been detected in concentrations above their screening levels. Samples collected during Round 3 had much higher concentrations of herbicides, with concentrations of 2,4,5-TP in excess of 3,000 parts per billion (ppb) (BMD 1996). This concentration dropped off sharply in subsequent sampling events.

Between September 1994 and May 1995, groundwater also was collected during direct-push soil sampling in the RZ. Groundwater samples were collected at a depth interval of about 40 to 45 feet bgs. The maximum detections of total VOCs was 10,377 ppb, with acetone and xylenes most commonly detected. Highest total SVOC concentrations were 30,440 ppb, almost entirely chlorophenol compounds related to the degradation of herbicides. Very high concentrations of herbicides also were detected, with total herbicide concentrations as high as 361,000 ppb. In all cases, contemporaneous groundwater samples from surrounding monitoring wells had much lower concentrations of these contaminants (BMD 1998). Direct-push investigations of groundwater in the area NOL in late 1999 revealed no concentrations of VOCs in excess of screening levels (BMD 2000b).

Surface Water

Because no permanent surface water bodies exist at the Harcros facility, only a small number of surface water samples have been collected. A total of eight surface water samples have been collected, six from the area NOL around SWMU I and two from the drainage ditch along the northern side of Speaker Road (BMD 1996, 1998). These samples represent runoff accumulated in ephemeral ponds and streams. In the RFI and CAO report, samples were screened against KDHE's 1994 Kansas Water Quality Standards (KWQS) for aquatic life and chronic exposure (KDHE 1994). These standards currently are being revised by EPA and KDHE (KDHE 2001). The results of a comparison of screening levels to surface water concentrations are summarized in Table 3.

The primary constituents present in surface water NOL and along Speaker Road are chlorinated solvents and other VOCs. Herbicides and SVOCs also are present in limited concentrations. When screened against the KWQS, only pentachlorophenol is present in concentrations above its screening level, although atrazine approaches its screening level. However, when screened against drinking water standards in order to assess risk to human health, chloroform, PCE, TCE, VC, and pentachlorophenol all exceed MCLs.

*DDD = 1,1-dichloro-2,2-bis(*p*-chlorophenyl)ethane

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Table 3 – Compounds detected in surface water samples compared to screening levels*

Compound	Maximum Concentration Reported in RFI (ppb)	Number of Detections in RFI	KWQS (ppb)	MCL or RBC (ppb) ^{††}
Volatile Organic Compounds				
Acetone	42	4	n/a	608
Benzene	4	3	n/a	5
Bromodichloromethane	8	4	n/a	170
Chlorobenzene	3	1	50	100
Chloroform	12	4	1,240	0.15
1,1-Dichloroethane	4	2	2,000	800
1,1-Dichloroethene [†]	3	1	n/a	7
1,2-Dichloroethene (total)	78	8	n/a	100
Ethylbenzene	2	2	n/a	700
Tetrachloroethene	28	7	840	5
Toluene	4	1	n/a	1,000
Trichloroethene	9	7	21,900	5
Vinyl Chloride	25	5	n/a	2
Xylene (total)	2	3	n/a	10
Semi-volatile Organic Compounds				
Benzoic Acid	1	1	n/a	150,000,000
Di-n-butylphthalate	2	1	3	3,700,000
4-Methylphenol(p-cresol)	2	1	n/a	1,800
Pentachlorophenol	7	3	4.2	1
Herbicides**				
2,4,5-Trichlorophenoxypropionic acid (2,4,5-TP) (Silvex)	0.73	2	n/a	50
Atrazine	0.92	1	1	3

Notes:

- * Because of the small number of samples, any compound detected was present in more than 5 percent of samples analyzed. As a result, all compounds were identified as chemicals of potential concern.
 - † Compound was found in associated trip blank.
 - ** Only six samples analyzed for herbicides.
 - †† MCLs from U.S. Environmental Protection Agency’s (EPA) Safe Drinking Water Act Regulations and Health Advisories maximum contaminant levels (MCL) (EPA 1999b) or from EPA’s Region III Risk-based Concentration (RBC) Table (1999c) for compounds with no MCL. Drinking water MCLs and RBCs provided for comparison only.
- This table is derived from Burns and McDonnell (2000a).
Pesticides were not detected in surface water samples during the Resource Conservation and Recovery Act Facility Investigation.
KWQS = Kansas Water Quality Standards
n/a = not available
ppb = parts per billion
RFI = Resource Conservation and Recovery Act Facility Investigation

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Air

Indoor air is likely to be contaminated by the accumulation of vapors derived from VOCs in soils (BMD 2000a). The Johnson-Ettinger (J-E) model (Johnson and Ettinger 1991) can be used to model the migration of soil vapors to buildings on site. It uses the convective and diffusive transport of vapors from the source of contamination to indoor spaces located directly above or nearby to calculate potential indoor concentrations (EPA 1997b). J-E model calculations are included as Appendix 1. Unit risk factors for carcinogens and reference concentrations for noncarcinogens are derived from IRIS and HEAST. The results of J-E modeling are included as Table 4.

Based on J-E model calculations, the vapors of primary concern are 1,2-DCE, methylene chloride, PCE, and TCE. The hazard quotient for 1,2-DCE is significantly greater than 1, indicating a substantially increased risk of toxic effects. The incremental cancer risks for methylene chloride and TCE are greater than the generally accepted value of 10^{-4} , indicating an increased cancer risk for one out of 10,000 people. The incremental risk for PCE approaches the 10^{-4} value. Because cancer risks are additive, the incremental risks of all compounds can be summed to calculate a total increased cancer risk for exposure to indoor air at Harcros. By adding the risks from TCE, PCE, methylene chloride, and benzene, the increased cancer risk rises to about 10^{-3} .

Table 4 - Estimated Risks from Indoor Air*

Compound	Maximum Soil Concentration (ppb)	Finite Source Bldg. Concentration ($\mu\text{g}/\text{m}^3$)	Incremental Risk, Carcinogen (unitless)	Hazard Quotient, Noncarcinogen (unitless)
Acetone	70,000	4.67		9.13×10^{-3}
Benzene	151	0.432	8.77×10^{-7}	
1,2-Dichloroethene	380,000	1900		1.86×10
Ethylbenzene	140,000	120		8.24×10^{-2}
Methylene Chloride	510,000	1340	1.54×10^{-4}	3.05×10^{-1}
Tetrachloroethene	7,700,000	552	7.83×10^{-5}	
Toluene	670,000	563		9.65×10^{-1}
Trichloroethene	3,500,000	1890	7.86×10^{-4}	
Xylene	1,100,000	186		1.82×10^{-2}
TOTAL			1.02×10^{-3}	2.00×10

Notes:

Total line is the cumulative incremental carcinogenic risk.
 $\mu\text{g}/\text{m}^3$ = micrograms per cubic meter
ppb = parts per billion

Using a recent draft guidance provided by EPA (EPA 2001b), it also was possible to estimate the contribution to risk from vapors derived from contaminated groundwater. The new guidance is based on soil gas or groundwater concentrations. This approach bypasses problems with underestimating the concentration of VOCs in soils because of volatilization during sampling. The concentration in groundwater is compared to a target concentration to determine if there is substantial risk from volatilizing compounds. The new approach also requires that there be inhabited buildings near the

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contamination plume, a condition which Harcross meets. Appendix 2 provides a list of compounds evaluated, their reference concentrations, and the concentration suspected under buildings.

Based on the EPA guidance, there are 12 compounds in groundwater at Harcross that are volatile enough to create a potential hazard. Six of these compounds - 1,1-DCE, 1,2-DCE, chloroform, PCE, TCE, and VC - are found in excess of target concentrations. These compounds create an additional risk to indoor air at Harcross.

Because of the lack of confining features, it is less likely that outdoor air might be contaminated with vapors. The possibility exists that vapors could accumulate in Sumps 1 and 2 from volatilization of compounds in groundwater, VC vapors in particular (BMD 2000a). However, sumps currently are inactive, because neither supply well is pumping (Harcross 2001). In addition, should Harcross initiate any significant excavations, such as for new construction, the potential exists for contamination to develop from vapors derived from soil contamination.

Footnotes:

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

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

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3. Are there **complete pathways** between “contamination” and human receptors such that exposures can be reasonably expected under the current (land- and groundwater-use) conditions?
Summary Exposure Pathway Evaluation Table

Potential **Human Receptors** (Under Current Conditions)

“Contaminated” Media	Residents	Workers	Day-Care	Construction	Trespassers	Recreation	Food³
Groundwater	--	yes	--	yes	no	--	--
Air (indoors)	--	yes	--	no	no	--	--
Soil (surface, e.g., <2 ft)	--	yes	--	yes	yes	--	--
Surface Water	--	no	--	no	no	--	--
Sediment	--	yes	--	yes	yes	--	--
Soil (subsurface e.g., >2 ft)	--	no	--	yes	no	--	--
Air (outdoors)	--	--	--	--	--	--	--

Instructions for Summary Exposure Pathway Evaluation Table:

Strike-out specific Media including Human Receptors’ spaces for Media which are not “contaminated”) as identified in #2 above.

Enter “yes” or “no” for potential “completeness” under each “Contaminated” Media – Human Receptor combination (Pathway).

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

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

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

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

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Rationale and Reference(s):

For the purposes of this evaluation, potential risk to off-site receptors will not be evaluated. Pathways between Harcros contamination and off-site receptors might include consumption of fish from the Kansas River, contact with water from the Kansas River during recreational use such as boating, or a potential downstream water intake for city water supply. In addition to off-site receptors, four categories of potential on-site receptors also can be excluded. The area currently is zoned for heavy industry (KM3), a designation that is unlikely to change in the near future. Therefore, because of the industrial setting, both residential and daycare receptors can be excluded. The closest residential area is just over 0.5 mile south of the facility (BMD 1998). Moreover, surrounding residential areas are provided with drinking water by the City of Kansas City, Kansas, and no private wells are located within 0.5 mile of the facility (BMD 1998). Because the facility is industrial and more than 50 percent paved, all food pathways also were excluded. Finally, the lack of on-site facilities makes exposure through recreational use improbable.

Three kinds of receptors must be evaluated for potential exposure: trespassers, facility workers, and contract construction and utility workers. The area NOL is unfenced and can be accessed from the river side of the levee. In several instances, trespassers have been observed operating four-wheel drive and all-terrain vehicles (ATV) in this area (BMD 2000a). Access to the rest of the facility, including all operational areas, is restricted by a security fence and a guard. Trespassers in operational areas are unlikely. Workers at the Harcros facility can be divided into three categories: general industrial workers, maintenance workers, and nonoperation workers (office and part-time workers) (BMD 2000a). Contract construction and utility workers also are employed at the Harcros facility. Contract workers with Occupational Health and Safety Administration (OSHA) training are responsible for maintenance of supply wells and any activities that require entering the sumps. Any substantial excavation tasks, including utility repair and installation, also are performed by contract workers (BMD 2000a).

Trespassers, Harcros employees, and contract workers might be exposed to contaminated soils and sediments. Trespassers in the area NOL reasonably can be expected to come into contact with contaminated surface soil and sediment. Use of ATVs would disturb surface soil and sediment, and trespassers would then be exposed dermally and through ingestion and inhalation. It is unlikely, however, that they would come into contact with subsurface soils. On-site facility maintenance workers directly contact contaminated soils and sediments in the MA and RZ, which might lead to incidental ingestion, inhalation, or absorption through dermal contact. However, because extended excavation work (any work expected to take more than 2 hours) is contracted out (BMD 2000a), Harcros employees typically would not be exposed to subsurface soils. Contract utility and construction workers are employed for most excavation work. As a result, they may be exposed to contaminated sediments, surface soils, and subsurface soils, either through ingestion, inhalation, or dermal contact.

Harcros employees and contract maintenance workers could potentially be exposed to contaminated groundwater. Unattended monitoring wells in the area NOL provide a pathway through which trespassers could be exposed to contaminated groundwater. However, the standard practice of padlocking wellheads and the average depth to groundwater at the facility (more than 35 feet bgs) make completion of this pathway unlikely. The only historical use of groundwater in the operational areas of the Harcros facility is as noncontact cooling water. Because cooling water from SW6 would be isolated from other operational processes and pump maintenance activities are contracted out, it is unlikely that Harcros

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employees would be exposed to contaminated groundwater through this pathway. However, it is theoretically possible that groundwater could be used as a source of potable water for the facility. Although SW6 is not currently in use, any maintenance work on the pump or in the sumps could expose contract workers to contaminated groundwater.

Trespassers, Harcros employees, and contract workers might be exposed to contaminated surface waters. However, because surface water on site is usually ephemeral, it does not provide an opportunity for regular exposure (BMD 2000a). Moreover, concentrations of contaminants generally are low and would require ingestion for any substantial risk. From a risk assessment perspective, human exposure through this pathway is unlikely.

Only Harcros employees are likely to be exposed to contaminated indoor air. Although contract construction and utility workers may spend time indoors at the Harcros facility, their exposure to organic vapors typically would be limited in duration. Trespassers in the area NOL would not be expected to spend any time indoors at Harcros and therefore would not be exposed.

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

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.”

 X 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

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Rationale and Reference(s):

Exposures can be considered significant if the duration or intensity of exposure to contaminated materials is greater than was expected when calculating screening levels or if the level of contamination is substantially above screening levels. Completed exposure pathways at Harcros include:

1. Harcros employees - indoor air
2. contract workers - surface soil
3. subsurface soil, and sediment
4. Harcros employees - surface soil and sediment
5. contract workers - groundwater
6. Harcros employees-groundwater
7. trespassers - surface soil and sediment

Three pathways should be considered significant: Harcros employees - indoor air; contract workers - surface soil, subsurface soil, and sediment; and Harcros employees - surface soil and sediment.

Estimates of the incremental cancer risk from exposure to organic vapors in indoor air at Harcros exceed, by a factor of 10, the acceptable 10^{-4} level established by EPA. Although industrial and maintenance employees may use respirators and other OSHA-required protective equipment (BMD 2000a), thereby mitigating the effects of exposure, office workers would not. As a result, this exposure can be considered significant because of the level of contamination.

In the course of repairing or installing utilities or other excavation work, contract construction and utility workers would be exposed to contaminated surface soil, subsurface soil, and sediment. Because they are not full-time employees on site, their exposure is limited in duration. Utility repair jobs generally range from 1 to 4 days in duration, but may last as long as 10 days, with about two repair jobs a year (BMD 2000a). However, concentrations of multiple contaminants exceed their SSLs by several orders of magnitude. Because of these high concentrations, this exposure may be significant.

Harcros maintenance employees may come into contact with surface soil and sediment during the course of their regular activities. Although the amount of soil disturbed during any particular excavation would be less than that stirred up by contract utility workers, exposure would be more frequent. The frequency of exposure, combined with the high concentrations, makes this exposure significant.

Although contract workers may come into contact with contaminated groundwater through maintenance of SW6 and the sumps, two factors mitigate their exposure. Currently, SW6 is not operational, potentially eliminating this pathway. Moreover, these contractors are required to complete OSHA hazardous materials and confined space training and use respiratory equipment when entering the sump. As a result, their risk from exposure to contaminated groundwater is minimal.

Although it is theoretically possible for Harcros employees to be exposed to contaminated groundwater through potable water supplies, there currently are no such supplies on the site. Implementation of institutional controls, such as deed restrictions, would be sufficient to prevent completion of this pathway. As a result, significant exposure is not likely through this route.

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Trespassers in the area NOL may ingest or inhale contaminated surface soil or sediment. However, concentrations of COPCs in soil and sediment NOL generally are low. Only one sample exceeded SSL concentrations (610 ppb of chlordane, as compared with an SSL of 490 ppb). Because concentrations are low and duration of exposure would be limited, the risk from exposure along this pathway is minimal.

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

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).

 X 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):

Because of the excessive cancer risk from indoor air (1.02×10^{-3}) and the significant exposures that potentially could result from contact with contaminated soils and sediments, current exposures cannot be shown to be within acceptable limits.

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6. Check the appropriate RCRIS 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 _____ facility, EPA ID # _____, located at _____ 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.

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Completed by (signature) Original signed by _____ Date 1/11/02
(print) Patricia Murrow
(title) Project Manager

Supervisor (signature) Original signed by _____ Date 1/11/02
(print) John Smith
(title) Chief, RCAP Branch
(EPA Region or State) USEPA Region 7

Locations where References may be found:

EPA Region 7 Headquarters, RCRA Files, 901 North 5th Street, Kansas City, Kansas

Contact telephone and e-mail numbers

(name) Patricia Murrow
(phone #) 913-551-7627
(e-mail) murrow.patricia@epa.gov

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

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APPENDIX 1
JOHNSON-ETTINGER MODELS

APPENDIX 2
INDOOR AIR RISK FROM CONTAMINATED GROUNDWATER