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

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

Facility Name: Bayer Cropscience
Facility Address: 8400 Hawthorne Road, Kansas City, MO
Facility EPA ID #: MOD056389828

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?

   __X__ 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.

Bayer Cropscience (Bayer) has owned and operated the agricultural chemical manufacturing facility at 8400 Hawthorne Road in Kansas City, Missouri (See Figures in Appendix 1), since operations began there in 1956. The property was farmland prior to facility construction. Facility operations began under the name Chemagro. Chemagro became a wholly owned subsidiary of Bayer A.G. in 1967. In 1971, Bayer A.G. merged with Mobay Chemical Corporation, who took control of the facility. The facility name changed to Miles, Inc. in 1992, Bayer Corporation in 1995, and Bayer Cropscience in 2002. These name changes were not accompanied by changes in ownership or operating responsibility (Burns & McDonnell Waste Consultants, Inc. [BMcD] 2000).

The Bayer facility covers about 216 acres, 150 of which are protected by the U.S. Army Corps of Engineers East Bottom Levee (See Figures in Appendix 1). The facility is bounded by the Blue River on the east and south, by the Missouri River on the north, by the Kansas City Power and Light (KCPL) Hawthorn electrical generating station on the northwest, and by the Conservation Chemical Company (CCC) Superfund site on the northeast. The CCC Superfund site operates a pump-and-treat remediation and containment system. A steel production facility owned by AK Steel and Compass Big Blue L.L.C. is located across the Blue River to the south. The nearest residential area is about 0.5 mile southeast of the Bayer facility (Tetra Tech EM Inc. [Tetra Tech] 2003).

Since operations began in 1956, the Bayer facility has manufactured and formulated insecticides, herbicides, and fungicides–including Guithion (azinphos-methyl), disulfoton (Disyston), fenthion (Baytex), demeton (Systox), and Coumaphos Metasystox. (BMcD 2000).

The Bayer facility is a large quantity generator of hazardous waste and a permitted hazardous waste treatment and storage facility. In 1987, Bayer received Missouri Hazardous Waste Permit Number MOD056389828 for storage and treatment of hazardous waste and for operation of a thermal oxidizer, four thermal oxidizer storage tanks, and two container storage areas (all constructed in 1979). Bayer reapplied for the permit in 1996, and EPA approved their application in 1998. As a condition of the initial Hazardous Waste Permit, Bayer conducted a Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) and a RCRA Facility Investigation (RFI). During the RFA, three solid waste management units (SWMU) and one area of concern (AOC) were identified, based on investigation results and historical land use at the Bayer facility (BMcD 2000). Following submittal of the RFI report, three additional AOCs were identified (Bayer 2000, 2001, 2002a, 2002b). These SWMUs and AOCs are depicted in Appendix 1 and described as follows:

SWMUs-1, 2, 3: Areas A, B, C. From 1959 to 1973, Bayer disposed of waste in three SWMUs at the facility, referred to as Areas A, B, and C. Trenches were dug in these areas and filled with about 7,500 tons of waste. About 6,900 tons of this waste was filter aid, a diatomaceous earth paste that remains after recovery of pesticide intermediates and products. The remainder of the waste included triesters, toluene, napthol spirits, and DEF (tribufos) treatment residue. After the waste was placed in the trenches, the areas were covered with loess (BMcD 2000).

The horizontal and vertical extent of buried waste in Areas A, B, and C has been delineated. The extent of buried waste at each area is estimated as follows:

Area A:
The extent of buried waste in this area is between 380 square yards (yd^2) and 580 yd^2 horizontally and between 12 and 13 feet deep. The total volume is between 1,520 cubic yards (yd^3) and 2,510 yd^3.

Area B:
The extent of buried waste is between 3,900 yd^2 and 7,780 yd^2 horizontally, and between 7 and 8 feet deep. The total volume is between 9,100 yd^3 and 20,750 yd^3.

Area C:
The extent of buried waste in this area is between 3,260 yd^2 and 8,530 yd^2 horizontally and between 12 and 15 feet deep. The total volume is between 13,000 yd^3 and 42,650 yd^3 (BMcD 2000).

Contaminants detected in soil were similar in each area and include volatile organic compounds (VOC), semivolatile organic compounds (SVOC), and pesticides. VOCs detected included methylene chloride, acetone, 2-butanone, ethylbenzene, 1,2-dichloroethane, benzene, 4-methyl-2-pentanone, 1,1,1-trichloroethane, trichloroethene, tetrachloroethene, total xylenes and toluene. SVOCs detected included napthalene, 2-methylnaphthalene, bis(2-ethylhexyl) phthalate, diethyl phthalate, fluorene, and dibenzofuran. The pesticides detected were DEF, coumaphos, demeton, fenthion, disulfoton, and o,o,o-triethylphosphorothioate (o,o,o-triester). Area B typically had the highest concentrations of these compounds in surface and subsurface soil (BMcD 2000). A soil boring conducted in 2001 beneath the OP Plant (in between Areas A and B) detected

tetrachloroethene in the soil 2 orders of magnitude higher than in either disposal area as well as trichloroethene, toluene, and disulfoton.

The RFI report identifies Areas A, B, and C as the sources of groundwater contamination at the Bayer facility. Groundwater samples collected during the RFI revealed VOCs, SVOCs, and organophosphate pesticides as the primary constituents of concern (BMcD 2000). Groundwater samples collected during a site-wide groundwater sampling event in December 2001 detected VOCs, dissolved arsenic, demeton, disulfoton, azinphos-methyl and o,o,o-triester in monitoring wells in the vicinity of Areas A, B, and C (BMcD 2002).

AOC-1: Drainage Ditch. The drainage ditch trends northwest to southeast across the center of the property, just west of the administrative building. The ditch directs stormwater runoff from the Bayer facility and from the KCPL Hawthorn electrical generating station to the Blue River using a Corps of Engineers lift station. The northwest half of the ditch is grass lined and flanked by buildings and parking lots. The southeast half is lined with rip-rap boulders. The ditch receives stormwater runoff from the aboveground storage tanks, maintenance facilities, open gravel-covered areas that flank the ditch, and the open coal pile on the KCPL property to the north (BMcD 2000).

Surface soil samples were collected from the drainage ditch in 1988 and 1990, in 1997 for the RFI, and in 2000 as part of a culvert renovation project in the drainage ditch. Between 1988 and 1997, soil samples were collected from 6-inch intervals between ground surface and 2 feet below ground surface (bgs). VOCs, SVOCs, and pesticides were detected at concentrations exceeding Missouri Department of Natural Resources (MDNR) Cleanup Levels for Missouri (CALM) values for residential and industrial soil and EPA Region 9 preliminary remediation goals (PRG) for residential and industrial soil (EPA 2002b) at depths between ground surface and 1 foot bgs. No contaminant levels exceeded regulatory criteria in soil samples collected between 1 and 2 feet bgs (BMcD 2000). As part of a culvert renovation project in 2000, stained soil was encountered 1 to 2 feet below the bottom of the drainage ditch. A grab sample of the stained soil was analyzed for VOCs, SVOCs, RCRA metals, and pesticides. Disulfoton and merphos were detected at concentrations exceeding CALM values and EPA Region 9 PRGs for residential and industrial soil. No oily sheen was noted on water in the ditch. Bayer removed all stained soil uncovered by the culvert renovation project and sealed the area with a clay cap. The excavated soil was disposed of in a Subtitle C landfill as nonhazardous waste. Bayer attributed the black coloration of the soil to coal fines in runoff from the KCPL coal pile to the north (Bayer 2000). Stained soil outside of the culvert renovation project was left in place and could act as a continuing source of contamination.

AOC-2: Partial Metal Container. The partial container was discovered during an excavation to install an underground electrical connection box at the facility entrance. No groundwater was detected in the excavation. The container was about a quarter of a metal drum filled with about a cubic foot of a white granular substance identified by Bayer's laboratory as Dyrene. Analytes detected in the granular substance included pesticides (disulfoton and merphos), VOCs (1,2-dichloroethane [DCA], benzene, tetrachloroethene [PCE]), and metals (arsenic, barium, chromium, selenium, and lead). Disulfoton was detected at a concentration above the MDNR CALM A value (residential) and the EPA Region 9 PRG for residential and industrial soil.

Merphos was detected at a concentration above EPA Region 9 PRGs for residential and industrial soil. Bayer responded to the discovery of AOC-2 by excavating an area 5 feet deep and 8 feet across at the location where the container was discovered (Bayer 2001).

AOC-3: Carbon Disulfide Wastewater Release Area. Bayer identified AOC-3 in 2002. The area is related to the historic release of small quantities of wastewater containing trace amounts of carbon disulfide. The last release of wastewater is believed to have occurred in 1999. Bayer stated that the release posed no current threat to human health or the environment. Bayer responded to the discovery of AOC-3 by investigating the historical details related to the area (Bayer 2002a).

AOC-4: Wastewater Discharge Effluent Pipe. Bayer identified a leak in the wastewater discharge effluent pipe between the U.S. Army Corps of Engineers East Bottom Levee and the Missouri and Blue rivers. The leak, which allowed an unknown quantity of treated effluent to be released to the environment, was stopped upon discovery, and the pipe was repaired the following day. Bayer stated that their conservative calculations indicated no reportable quantities were exceeded, and no threat to human health or the environment existed. Bayer responded to the discovery of AOC-4 by investigating/repairing the leak (Bayer 2002b).

In 1999, MDNR performed a survey to identify water wells within 1 mile of the Bayer facility. The water well survey identified two potentially active water wells within 0.5 mile of the facility boundary. The two wells are owned by Heckett Division of Harsco. The well survey also identified numerous monitoring wells on properties adjacent to or near the Bayer facility, including AK Steel, Amoco, KCPL, and the City of Kansas City, Missouri (BMcD 2000).

BACKGROUND

Definition of Environmental Indicators (for 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 EIs developed to date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Current Human Exposures Under Control" EI

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

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program

the EIs 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 is 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 the RCRA Info national database ONLY as long as they remain true (i.e., RCRA Info status codes must be changed when the regulatory authorities become aware of contrary information).

2. Are groundwater, soil, surface water, sediments or air **media** known or reasonably suspected to be **"contaminated"**[1] above appropriately protective risk-based "levels" (applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action (from SWMUs, RUs or AOCs)?

Media	Yes	No	?	Rationale/Key Contaminants
Groundwater	X			Please see description below.
Air (indoors) [2]	X			Please see description below.
Surface Soil (e.g., <2 ft)	X			Please see description below.
Surface Water		X		Please see description below.
Sediment	X			Please see description below.
Subsurf. Soil (e.g., >2 ft)	X			Please see description below.
Air (outdoors)		X		Please see description below.

[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.

_____ 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): RCRA Facility Investigation, January 2000

The Bayer facility is underlain by alluvium from the Missouri River and Blue River, typically consisting of silty clay that grades to fine and medium sand and then coarse sand and gravel with depth. The alluvium is deposited on shale bedrock encountered between 65 and 125 feet bgs. The water table is located in the alluvium and fluctuates with river stage, precipitation, and other recharge factors. Although groundwater is present in the underlying shale, its movement is restricted by the low conductivity of the bedrock. Groundwater typically flows from the Bayer facility toward the Blue River and Missouri River; however, groundwater flow direction may change during high river stages or as a result of groundwater extraction from production or other wells (see Attachment 1). Similarly, without other controls, surface water typically runs from the Bayer facility toward the Blue River and Missouri River. However, an U.S. Army Corps of Engineers East Bottom Levee separates about three-quarters of the Bayer facility from these rivers. The Blue River is about 250 feet south of the Levee along the south side of the Bayer facility. The Missouri River follows the northern edge of the Bayer facility and is about 2,200 feet from the SWMUs described above. Both rivers generally flow toward the east (BMcD 2000). For each medium at the Bayer facility, the following rationale and contaminants were considered:

Soil (surface and subsurface).

Areas A, B, and C:
Subsurface soil samples were collected from Areas A, B, and C of the Bayer facility in 1987 and 1989. In 1999, an additional subsurface soil sample was collected from Area A during installation of a monitoring well. In 2001 samples were collected beneath the OP Plant (in between Areas A and B) as part of a broken drain investigation. Soil samples were analyzed for pesticides, VOCs, and SVOCs. Results were compared to Missouri CALM Scenario A and C C_{LEACH} or EPA Region 9 PRGs for residential and industrial soil and DAF 20 (EPA 2002). The highest detections of these sample analyses are summarized in Table 1. Three borings were conducted to characterize the soil in Area A. Bayer detected the VOCs 1,2-DCA and toluene; the SVOC naphthalene; and the pesticides demeton and disulfoton at concentrations exceeding CALM and/or Region IX PRG values for residential and industrial soil. Compounds without existing regulatory criteria that were detected at elevated concentrations include 2-methylnaphthalene and the pesticides coumaphos, DEF, and o,o,o-triester. In Area B, Bayer detected the VOCs 1,2-DCA, ethylbenzene, xylenes, and toluene; the SVOC naphthalene; and the pesticide disulfoton at concentrations exceeding CALM and/or EPA Region 9 PRGs for residential and industrial soil. It should be noted that demeton was not included in the analysis.

Compounds without existing regulatory criteria that were detected at elevated concentrations include 2-methylnaphthalene and the pesticides disulfoton, fenthion, DEF, and o,o,o-triester. Bis(2-ethylhexyl)phthalate, was detected at concentrations exceeding leaching criteria. In a sample collected beneath the OP Plant (between Areas A and B) PCE, TCE, toluene and disulfoton exceeded CALM criteria. One boring was conducted to characterize the soils in Area C. Disulfoton was the only compound that exceeded CALM and/or EPA Region 9 PRGs for residential and industrial soil. Compounds without existing regulatory criteria that were detected at elevated concentrations and/or exceeded leaching criteria include PCE, TCE, toluene, DEF and o,o,o-triester. No surface soil samples were collected in Areas A, B, and C, because the buried waste in these areas was covered with several feet of loess. A geophysical study conducted in 1997 defined the extent of buried waste in Areas B and C, but was not feasible in Area A because metal structures surrounded the area. A direct-push investigation in 1997 better defined the extent of buried waste in the three areas (BMcD 2000).

Table 1 Compounds Detected in Subsurface Soil (>2' bgs) at Elevated Concentrations

Analyte	Result (mg/kg)	Area	Boring	Depth (bgs)	CALM A (mg/kg)	CALM C (mg/kg)	C_{LEACH} (mg/kg)
Volatile Organic Compounds							
methylene chloride	6.2	B	SB-26	6-8	51	150	0.02
xylenes	570	B	SB-32	23-25	418	418	16
1,2-DCA	830	A	SB-30	6-8	2	6	0.02
tetrachloroethene	3700	OP Plant	P-1	14	40	120	.1
trichloroethene	31	OP Plant	P-1	14	40	89	.1
toluene	9000	B	SB-33	18-20	650	650	3.7
ethylbenzene	46	B	SB-32	8-10	400	400	32
Semivolatile Organic Compounds							
naphthalene	1300	B	SB-26	6-8	120	240	24
2-methylnaphthalene	2100	B	SB-26	6-8	-	-	-
Pesticides							
disulfoton	1200	B	SB-30	6-8	2	2	0.0006
coumaphos	560	A	SB-30	6-8	-	-	-
demeton[1]	27	A	SB-30	6-8	2.4	25	-
DEF	3900	B	SB-26	6-8	-	-	-
fenthion	760	B	SB-32	23-25	-	-	-
ooo-triester	1900	A	SBR-24	6-8	-	-	-

[1] EPA Region 9 PRG for residential and industrial soils (EPA 2002)

Multipurpose Plant:

Bayer also collected surface (1 to 2 feet bgs) and subsurface (5 to 6 feet bgs) soil samples from the Multipurpose Plant to evaluate potential for expanding operations at this location. Shallow samples were analyzed for pesticides, VOCs, SVOCs, and metals. Subsurface soil samples were also analyzed for metals. The results are summarized in Table 2. Results were compared to CALM and/or EPA Region 9 PRGs for residential and industrial soil (EPA 2002). Bayer detected benzene and chlorobenzene at a concentration exceeding leaching criteria. Bayer also detected arsenic in subsurface soil samples at concentrations exceeding CALM for residential and industrial soil (Tetra Tech 2003).

Table 2 Compounds Detected in Multi Purpose Plant Investigation

Analyte	Result (mg/kg)	Boring	Depth (bgs)	CALM A (mg/kg)	CALM C (mg/kg)	C_{LEACH} (mg/kg)
Volatile Organic Compounds						
benzene	.99	SB-1	1-2	6	13	.05
chlorobenzene	33	SB-2	5-6	66	180	2.8
Metals						
arsenic	86.1	SB-2	5-6	11	14	-

East of the Levee:

In 2002, MDNR collected additional soil samples from the open field extending east of the Levee to the Blue River (See Figure in Appendix 1). The soil samples were analyzed for volatiles, semivolatiles, and pesticides. Results were compared to CALM and/or EPA Region 9 PRGs for residential and industrial soil (EPA 2002). The exceedances are summarized in Table 3. Sample locations are illustrated in Appendix 1.

Table 3 Compounds Detected in MDNR Investigation of Area B

Analyte	Result (mg/kg)	Boring	Depth (bgs)	CALM A (mg/kg)	CALM C (mg/kg)	C_{LEACH} (mg/kg)
Pesticides						
merphos oxide[1]	9.6	BYR-1	14-16	1.8	18	-
o,o,o-triester	29	BYR-1	14-16	-	-	-
disulfoton	12	BYR-1	14-16	2	2	.0006
merphos oxide[1]	10	BYR-5	14-16	1.8	18	-
o,o,o-triester	140	BYR-5	14-16	-	-	-
disulfoton	59	BYR-5	14-16	2	2	.0006

[1] EPA Region IX PRG for residential and industrial soils (EPA 2002)

AOC-1:

In 1988, two soil borings were conducted in the drainage ditch, one from the south end and one from the north end and samples were collected from 0-.5 feet bgs. In the sample collected from the south end of the ditch, vinyl chloride and disulfoton were detected at concentrations that exceeded CALM and/or EPA Region 9 PRGs for residential and industrial soil. 1,2-DCA, trichloroethene, methylene chloride, and toluene were detected at concentrations that exceeded leaching criteria. Compounds without existing regulatory criteria that were detected at elevated concentrations include DEF, and o,o,o-triester. In 1990, four additional samples were collected from one location at the south end of the ditch. Samples were collected at 0.5-foot intervals from ground surface to 2 feet bgs. All samples were analyzed for VOCs, SVOCs, and pesticides. Contaminants exceeding EPA Region 9 PRGs for industrial soil included vinyl chloride and disulfoton. Compounds without existing regulatory criteria that were detected at elevated concentrations include DEF, fenthion, and o,o,o-triester. All exceedances were from samples less than 1 foot deep.

During the RFI sampling activities in 1997, surface soil samples were collected from 15 locations in the drainage ditch. Samples were collected from the 0- to 0.5-foot bgs interval at all locations and from the 1.5- to 2-foot bgs interval at seven locations. All samples were analyzed for VOCs, SVOCs, and pesticides. There were no exceedances in samples collected in the deeper interval (1.5-2 feet bgs.). In the shallow soil samples (.5-1 feet bgs.) PAHs were detected at concentrations exceeding CALM and/or EPA Region 9 PRGs for residential and industrial soil. However, PAHs are not thought to have been produced or handled at the Bayer facility and are attributed to KCPL (Tetra Tech 2003). Merphos also exceeded CALM and/or EPA Region 9 PRGs for residential and industrial soil and coumaphos was detected above background concentrations. Some VOCs were detected above leaching criteria. The vertical extent of contamination in the drainage was characterized as 2 feet bgs, with most detections within 6 inches bgs (BMcD 2000). See the figures in Appendix 1 for sampling locations.

During an October 2000 upgrade of the culvert near the Administration building, Bayer identified very dark soil 1 to 2 feet below the bottom of the 9-foot deep drainage ditch. Groundwater was encountered at the same depth as soil staining. Bayer collected a sample of the stained soil for analysis, which is assumed to be at the same depth as the stained soil was encountered. The soil sample contained pesticides, VOCs, and metals. Disulfoton and merphos were detected at a concentration above CALM and EPA Region 9 PRG for residential and industrial soil. Bayer removed all stained soil uncovered in the initial excavation activities and sealed the area with a clay cap. Bayer also removed all visibly stained soil encountered during subsequent excavation and construction, and disposed of the soil in a Subtitle C landfill as nonhazardous waste (Bayer 2000). However, stained soil outside of the renovation project was left in place. It should be noted that demeton was not analyzed in many of the samples taken in the drainage ditch. The results of the Drainage Ditch Investigations are summarized in Table 4. See the figures in Appendix 1 for the location of the stained soil and soil sample locations.

Table 4 Compounds Detected in Drainage Ditch at Elevated Concentrations

Analyte	Result (mg/kg)	Boring	Depth ('bgs)	CALM A (mg/kg)	CALM C (mg/kg)	C_{LEACH} (mg/kg)
Volatile Organic Compounds						
benzene	.4	S.End	0-.5	6	13	0.05
1,2-dichloroethane	.64	S.End	0-.5	2	6	0.02
methylene chloride	1.3	S.End	0-.5	51	150	0.02
toluene	.011	DS-4	0-.5	650	650	3.7
vinyl chloride	8.5	S.End	0-.5	.3	.6	0.02
Pesticides						
disulfoton	44	S.End	0-.5	2	2	0.0006
DEF	16	S.End	0-.5	-	-	-
fenthion	5.5	S.End	0-.5	-	-	-
merphos oxide	42	Stained Soil	1-2	1.8	18	-
coumaphos	2.1	DS-11	0-.5	-	-	-
ooo-triester	2.3	S.End	0-.5	-	-	-

[1] EPA Region IX PRG for residential and industrial soils (EPA 2002)

Surface Water

In 2002, MDNR collected nine surface water samples and a field duplicate (sample numbers 1, 1-FD, 2 through 6, and 21 through 23) from the Missouri and Blue Rivers. Low levels of toluene, 1,2,4-trimethylbenzene, xylenes, and bis(2-ethylhexyl)phthalate were detected in the surface water. Samples 21 through 23 were also analyzed for metals (EPA 2003). Metal concentrations detected were compared to CALM GTARC, EPA MCLs or EPA Region 9 PRGs for tap water (EPA 2002a, EPA 2002b). The Missouri River is protected as a drinking water source and the Blue River adjacent to the Bayer facility is a no discharge stream. Chromium and lead exceeded the CALM GTARC in one sample and manganese exceeded it in two surface water samples. Lead was detected at one order of magnitude higher than the action level, however, this action level is not entirely risk based. Given the results of the surface water analysis and the absence of a drinking water uptake in the vicinity of the Bayer facility, surface water does not appear to pose a risk to potential human receptors at this time (Tetra Tech 2003). Additionally, bioaccumulation of these metals in vertebrates likely is not significant (Hoffman, et al. 1995). Surface water sampling results are summarized in Table 5. See Figures in Appendix 1 for sampling locations.

Table 5 Compounds Detected in Surface Water

Analyte	Result (μg/L)	Station	CALM GTARC (μg/L)
Volatile Organic Compounds			
toluene	7.34	5	150
1,2,4-trimethylbenzene	2.65	5	-
xylenes	1.04	2	320
Metals			
chromium	468	2	100
manganese	220	3	50

lead	150	2	15

Sediment

In 2002, MDNR collected eight sediment samples (102 through 108 and 118) along the Blue and Missouri Rivers. All samples were analyzed for VOCs, SVOCs, and pesticides (EPA 2003). Results are summarized in Table 6. To determine the potential risk to human health, results were compared to CALM and/or EPA Region 9 PRGs for residential and industrial soil (EPA 2002). Concentrations of these compounds detected in each sample are at least one order of magnitude lower than the PRG values.

Blue and Missouri River sediment samples were evaluated further to determine the potential for contaminants from the Bayer facility to impact the food pathway through bioaccumulation in fish in the rivers. Chlordane was eliminated from the evaluation, because this compound was historically detected in samples from the entire length of the Blue River. At one time there was a health advisory for this river due to high chlordane levels. In addition, chlordane was not produced or handled at the Bayer facility. Similarly, PAHs were eliminated from the evaluation, because these compounds were not produced or handled at the Bayer facility. PAHs were attributed to KCPL, AK Steel, and other industrial facilities in the area (Tetra Tech 2003). Of the pesticides remaining in the evaluation, coumaphos and disulfoton have low potential for bioaccumulation in aquatic organisms (National Library of Medicine 2003). Merphos oxide and phorate have moderate to high bioaccumulation potential; however, these compounds have half-lives on the order of hours and days, respectively, allowing little time for bioaccumulation to occur (National Library of Medicine 2003). Diazinon and atrazine were also detected in sediment at low levels, but the bioaccumulative properties of these compounds is unclear No bioaccumulation or partitioning coefficient data was available for o,o,o-triester; however, o,o,o-triester was detected at concentrations below the threshold effect level for protection of aquatic life, as calculated in the risk assessment (Tetra Tech 2003). It should be noted that detection limits were elevated in many samples due to matrix interferences. See Figures in Appendix 1 for sampling locations.

Table 6 Compounds Detected in Sediment at Elevated Concentrations

Analyte	Units	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7	Station 8	Station 9
atrazine	µg/kg	<56	<51	**5.7**	<45	<45	<47	**3.8**	<47
coumaphos	µg/kg	<56	<51	<50	**700**	<52	<47	<54	**25**
diazinon	µg/kg	**9.6**	<51	<50	**10**	<52	<47	<54	<47
disulfoton	µg/kg	**13**	<51	<50	**350**	**6.4**	<47	<54	**18**
merphos Oxide	µg/kg	<56	<51	<50	**300**	**14**	**3.3**	**23**	**9.3**
phorate	µg/kg	<56	<51	<50	**9.8**	<52	<47	<54	<47
tributylphosphine oxide	µg/kg	<56	**27**	**90**	<45	<52	<47	**48**	**3.9**
o,o,o-triester	µg/kg	<56	<51	<50	**9.7**	**4**	<47	**3.8**	**3.9**
1,2,4-trimethylbenzene	µg/kg	**24.1**	<5	<5	<5	<5	NA	<5	<5
1,3,5-trimethylbenzene	µg/kg	**15.2**	<5	<5	<5	<5	NA	<5	<5
toluene	µg/kg	<5	<5	<10	**155**	<5	NA	**15.5**	**38.3**

Table 7 Human Health Criteria For Sediment Detections

Analyte	CALM A (µg/kg)	CALM C (µg/kg)	C_{LEACH} (µg/kg)
atrazine[1]	2200	7800	-
coumaphos	-	-	-
diazinon	59,000	59,000	20
disulfoton	2000	2000	.6
merphos Oxide[1]	1800	18000	-
phorate	14,000	46,000	-
tributylphosphine oxide	-	-	-
o,o,o-triester	-	-	-
1,2,4-trimethylbenzene	100,000	180,000	-
1,3,5-trimethylbenzene	42,000	76,000	-
toluene	650,000	650,000	3700

[1] EPA Region IX PRG for residential and industrial soils (EPA 2002)

Groundwater

Prior to the RFI, groundwater monitoring wells were installed and sampled at the Bayer facility in various stages. Monitoring wells MW-1, MW-2, MW-3, and MW-4 were installed in 1987 and sampled in 1988. Monitoring well MW-5 was installed in 1989. Between 1989 and 1994, three rounds of groundwater samples were collected from these five monitoring wells. During the early 1980s, six monitoring wells (MW-14A, -14B, -14C, -17A, -17B, -17C) were installed as part of the remedial investigation at the CCC site east of the levee. Monitoring wells MW-14A and MW-17A were sampled in 1990. All six wells were sampled in 1991 and 1994. Production well PW-2 was sampled four times between 1983 and 1994, and production well PW-3 was sampled in 1994. Groundwater samples were analyzed for VOCs, SVOCs, or pesticides (BMcD 2000). A summary of the monitoring wells located at the Bayer facilities and their screened intervals is outlined in Table 8.

As part of the RFI, groundwater samples were collected from 16 direct-push borings installed in Areas A, B, and C. Based on the analytical results for these groundwater samples, 10 additional groundwater monitoring wells were installed around Areas A, B, and C. Groundwater samples were collected from the new and existing wells in July and August 1997, and were analyzed for the 40 Code of Federal Regulations (CFR) 264 Appendix IX constituents and organophosphate pesticides. Following this sampling event, groundwater samples were collected and analyzed primarily for VOCs, SVOCs, and demeton. In 2000, an additional well was installed near Area A and sampled for VOCs (BMcD 2000). Bayer conducted additional groundwater monitoring at the facility in 2001 (BMcD 2002). In 2002, MDNR collected groundwater samples from three deep boreholes in the open field extending east from the Levee to the Blue River (EPA 2003). The results of the 1997-98 groundwater investigation in the vicinity of Areas A, B, and C are summarized in Table 9 and 2001 results for the same wells are summarized in Table 10. Miscellaneous well results are summarized in Table 11. In 2002 MDNR collected three groundwater samples in the beanfield in between the current monitoring well network. These results are summarized in Table 12. See the figures in Appendix 1 for sampling locations. The results are compared to CALM GTARC and/or EPA maximum contaminant levels (MCL) or

action levels, or to EPA Region 9 PRGs for tap water where MCLs or action levels are not available (EPA 2002a, EPA 2002b). In Areas A, B, and C, maximum detections of VOCs, SVOCs, and pesticides exceeded EPA standards; no metals were detected at concentrations exceeding EPA standards except for arsenic in Areas B and C. In the miscellaneous wells, maximum detections of VOCs and SVOCs exceeded EPA standards; no pesticides or metals were detected at concentrations exceeding EPA standards except for chromium in MW-5 in 1998.

Table 8 Summary of Monitoring Wells

Shallow Wells	**Intermediate Wells**	**Deep Wells**
MW-1 (16-31 feet bgs)	MW-4A (45-55 feet bgs)	MW-6 (114-124 feet bgs)
MW-2 (16-31 feet bgs)	MW-8A (45-55 feet bgs)	MW-7A (80-90 feet bgs)
MW-3 (16-31 feet bgs)	MW-12B (45-65 feet bgs)	MW-10C (72.5-82.5 feet bgs)
MW-4 (16-31 feet bgs)	MW-13B (45-65 feet bgs)	MW-12C (75.7-85.7 feet bgs)
MW-5 (13-34 feet bgs)	MW-14B (45-65 feet bgs)	MW-14C (58-78 feet bgs)
MW-7B (15-30 feet bgs)	MW-16B (45.7-65.7 feet bgs)	MW-17C (72-92 feet bgs)
MW-8B (15-30 feet bgs)	MW-17B (45-65 feet bgs)	MW-18C (67.5-87.5 feet bgs)
MW-9 (15-30 feet bgs)	PW-1 (52-72 ft bgs) Bedrock 133 ft bgs	
MW-10 (15-30 feet bgs)		
MW-11 (14.5-29.5 feet bgs)	PW-2 (53-73 ft bgs) Bedrock 124 ft bgs	
MW-12 (15-30 feet bgs)		
MW-13A (15-35 feet bgs)	PW-3 (62-74 ft bgs) Bedrock 93 ft bgs	
MW-14A (15-35 feet bgs)		
MW-16A (15-35 feet bgs)		
MW-17A (15-35 feet bgs)		

Table 9 Source Area Groundwater Impacts 1997-98 Sampling Events

Analyte	Highest Conc. (mg/l)	Well	EPA MCL (mg/l)	EPA TAP (mg/l)	CALM GTARC (mg/l)
acetone	31	MW-10	-	.61	-
aldrin	NA/4.8	MW-11/FP	-	4E-6	2E-6
aniline	.43	MW-10	-	.012	-
arsenic	.16	MW-7B	.05	4.5E-5	.05
benzene	3.8	MW-10	.005	3.4E-4	.005
chloroform	11	MW-10	-	.0062	.08
demeton	4.1	MW-10	-	.0015	-
1,2-dichloroethane	380	MW-10	.005	1.2E-4	.005
cis-1,2-dichloroethene	31	MW-11	.07	.061	.07
1,4-dioxane	26	MW-7A	-	.0061	.003
disulfoton	2.2/690	MW-11/FP	-	.0015	3E-4
ethylbenzene	1.6	MW-10	.7	.0029	.7
2-methylnaphthalene	3.4/910	MW-11FP	-	-	-
4-methylphenol	.85	MW-11	-	.18	-
methylene chloride	35	MW-11	-	.0043	.005
MIBK	13	MW-10	-	.16	-
naphthalene	2.7/630	MW-11/FP	-	.0062	.1
o,o,o-triester	13/4900	MW-11/FP	-	-	-
tetrachloroethene	3.6	MW-10	.005	.00066	.005
trichloroethene	2	MW-10	.005	.000028	.005
toluene	760/390	MW-11/FP	1	.72	.15
vinyl chloride	16	MW-7B	.002	2E-5	.002
xylenes	10	MW-10	10	.21	.32

Table 10 Source Area Groundwater Impacts 2001 Sampling Event

Analyte	Concentration (mg/L)	Well	EPA MCL (mg/l)	EPA TAP (mg/l)	CALM GTARC (mg/l)
acetone	<80	MW-10	-	.61	-
aldrin	NA	MW-11	-	4E-6	2E-6
aniline	NA	MW-10	-	.012	-
arsenic	.425	MW-7B	.05	4.5E-5	.05
benzene	2	MW-10	.005	3.4E-4	.005
chloroform	8.9	MW-10	-	.0062	.08
demeton	.16	MW-10	-	.0015	-
1,2-dichloroethane	210	MW-10	.005	1.2E-4	.005
cis-1,2-dichloroethene	28	MW-11	.07	.061	.07
1,4-dioxane	<27	MW-7A	-	.0061	.003
disulfoton	.055	MW-11	-	.0015	3E-4
ethylbenzene	<8	MW-10	.7	.0029	.7
2-methylnaphthalene	.052	MW-11	-	-	-
4-methylphenol	.18	MW-11	-	.18	-
methylene chloride	NA	MW-11	-	.0043	.005
MIBK	8	MW-10	-	.16	-
naphthalene	.17	MW-11	-	.0062	.1
o,o,o-triester	.82	MW-11	-	-	-
tetrachloroethene	<8	MW-10	.005	.00066	.005
trichloroethene	3.2	MW-10	.005	.000028	.005
toluene	260	MW-11	1	.72	.15
vinyl chloride	6	MW-7B	.002	2E-5	.002
xylenes	10	MW-10	10	.21	.32

Table 11 Perimeter Well Detections

Analyte	MW	1997	1999	2001
1,2-DCE (ug/l)	MW-13A	NA	0.12	<1 J
	MW-13B	NA	114	11
	MW-14A	<1	0.44	2.2
	MW-14B	<1	0.68	3.2
	MW-14C	<1	7.7	2.9
	MW-16A	NA	0.28	<1 J
	MW-16B	NA	27.64	<1 J
	MW-17A	<1	<.5	<1 J
	MW-17B	<1	<.5	2.8
	MW-17C	<1	<.5	<1
	MW-18C	NA	<.5	6.7
toluene (ug/l)	MW-13A	NA	<1	<1
	MW-13B	NA	2.2 J	66 J
	MW-14A	<1	<1	<1
	MW-14B	<1	<1	<1
	MW-14C	<1	<1	<1
	MW-16A	NA	<1	1.3
	MW-16B	NA	<1	6.1
	MW-17A	<1	<1	<1
	MW-17B	<1	<1	0.82
	MW-17C	<1	<.5	0.73
	MW-18C	NA	<1	2.7
o,o,o-triester (ug/l)	MW-13A	NA	50 J	<50
	MW-13B	NA	5.2 J	3.1 J
	MW-14A	<50	50 J	<50
	MW-14B	<48	30 J	4.7 J
	MW-14C	<48	46 J	13 J
	MW-16A	NA	50 J	<50
	MW-16B	NA	2.1 J	<50
	MW-17A	<48	<50	<50
	MW-17B	<48	<50	<50
	MW-17C	<48	<50	<50
	MW-18C	NA	<50	3.8 J

Table 12 Geoprobe Groundwater Samples

Analyte	Units	GW-1S 50' bgs	GW-2D 91' bgs	GW-3D 70' bgs
coumaphos	ug/L	**2.3**	<1	<1
disulfoton	ug/L	<1	<1	<1
merphos oOxide	ug/L	**1.4**	<1	<1
o,o,o-triester	ug/L	**3.7**	<1	**1.9**
chlordane	ug/L	<.2	<.2	<.2
arsenic	ug/L	NA	**17.2**	<1
1,1-Dichloroethane	ug/L	<1	**8.57**	**13.2**
1,1-Dichloroethene	ug/L	<1	**3.11**	<1
benzene	ug/L	**4.12**	**10.7**	**28**
chloromethane	ug/L	<25	**39.9**	<25
cis-1,2-dichloroethene	ug/L	**50.1**	**200**	**1.07**
tetrahydrofuran	ug/L	<5	**7.56**	<5
toluene	ug/L	**1.52**	<1	<1
trans-1,2-Dichloroethene	ug/L	<1	**1.17**	<1
trichloroethene	ug/L	<1	**4.98**	<1
vinyl chloride	ug/L	**7.06**	**198**	**86.2**

Air (indoor and outdoor)

Bayer currently monitors all manufacturing buildings for organic constituents in air to meet Occupational Safety and Health Administration regulations. Additionally, as part of the human health risk assessment for the Bayer facility, air modeling was conducted to estimate concentrations of VOCs due to volatilization from groundwater to air in buildings or in construction and utility trenches. Potential risks and hazards from inhalation of indoor air are summarized in Table 13 and are described further under Question 3 of this CA725. The potential risks and hazards from inhalation of outdoor air are anticipated to be less than those of indoor air due to dispersion and unconfined space.

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	Food[3]
Groundwater	NO	YES	NO	YES	NO	NO	NO
Air (indoors)	NO	YES	NO	NO	NO	NO	NO
Soil (surface, e.g., <2 ft)	NO	YES	NO	YES	NO	NO	NO
~~Surface Water~~							
Sediment	NO	YES	NO	YES	NO	NO	NO
Soil (subsurface e.g., >2 ft)	NO	NO	NO	YES	NO	NO	NO
~~Air (outdoors)~~							

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

Instructions for Summary Exposure Pathway Evaluation Table:

1. Strike-out specific Media including Human Receptors' spaces for Media which are not "contaminated") as identified in #2 above.

2. Enter "yes" or "no" for potential "completeness" under each "Contaminated" Media - Human Receptor combination (Pathway).

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

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

__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

Rationale and Reference(s):

Residents

The Bayer facility is in an industrial area, and land use within a 0.5-mile radius of the facility is dominated by industrial operations. The nearest residential property is located over 0.5 mile southeast of the Bayer facility. Potential soil, sediment, and indoor air contamination are limited to the confines of the Bayer facility, and the nearest residential property is beyond the extent of known groundwater contamination from the Bayer facility. The City of Kansas City, Missouri, and the City of Independence, Missouri, provide potable water to residential properties in the area. Although the Missouri River is protected as a drinking water source, no drinking water intake is located on the Missouri and Blue Rivers adjacent to the Bayer facility. Additionally, contamination is not expected to significantly impact fish as a residential food source, given the limited concentration and area of contamination, the volume of the river, the migratory patterns of fish within the river, and the rates of bioaccumulation or degradation of the compounds of concern (BMcD 2000, National Library of Medicine 2003, Tetra Tech 2003).

Workers

On-site workers at the Bayer facility may be exposed to chemicals of potential concern 1) volatilized to indoor air from contaminated soil and groundwater at and in the vicinity of Areas A, B, and C, 2) in surface soil and sediment from the drainage ditch and/or 3) contact with groundwater during monitoring well sampling and/or maintenance of the production wells supplying groundwater to Bayer's operating processes.

According to a human health risk assessment conducted at the Bayer facility, on-site workers have cumulative risks of $2x10^{-4}$ in Area A, $2x10^{-5}$ in Area B, $1x10^{-6}$ in Area C, and $2x10^{-6}$ in the drainage ditch. Except for Area A, these cumulative risks fall within or below EPA's risk range ($1x10^{-6}$ to $1x10^{-4}$) for carcinogenic compounds. These cancer risks are driven by the indoor air and soil (including sediment) exposure pathways (Tetra Tech 2003). On-site workers have cumulative hazard indices of less than one in Areas A, B, and C, and in the drainage ditch. These hazard indices are driven by the indoor air and sediment exposure pathways (Tetra Tech 2003).

Day Care

The Bayer facility is located in an industrial area, and land use within a 0.5-mile radius of the facility is dominated by industrial operations. The nearest school or daycare is located about 1 mile from the Bayer facility (Superpages 2003). Soil, sediment, and potential indoor air contamination are limited to the confines of the Bayer facility, and the nearest school or daycare is beyond the extent of known groundwater contamination from the Bayer facility. The City of Kansas City, Missouri, and the City of Independence, Missouri, provide potable water to properties in the area. Although the Missouri River is protected as a drinking water source, no drinking water intake is located on the Missouri and Blue Rivers adjacent to the Bayer facility (BMcD 2000, Tetra Tech 2003).

Construction Worker

Construction and utility workers at the Bayer facility may be exposed to chemicals of potential concern in (1) groundwater and subsurface soil in Areas A, B, and C; (2) subsurface soil near the multipurpose plant; and (3) surface soil and sediment from the drainage ditch (Tetra Tech 2003).

According to a human health risk assessment conducted at the Bayer facility, construction and utility workers have cumulative risks of $6x10^{-4}$ in Area A, $2x10^{-5}$ in Area B, $4x10^{-5}$ in Area C, $2x10^{-6}$ near the Multipurpose Plant, and $5x10^{-6}$ in the drainage ditch. Except for Area A, these cumulative risks fall within EPA's risk range ($1x10^{-6}$ to $1x10^{-4}$) for carcinogenic compounds. These cancer risks are driven by the groundwater and subsurface soil exposure pathways (Tetra Tech 2003). Construction workers have cumulative hazards of 1,600 in Area A, 1,400 in Area B, 45 in Area C, 1.4 near the Multipurpose Plant, and less than 1 in the drainage ditch. Except for the drainage ditch, all of these areas have cumulative hazard indices exceeding 1 for noncarcinogenic compounds. These hazard indices are driven by the groundwater and subsurface soil exposure pathways (Tetra Tech 2003).

Trespasser

Access to the manufacturing portion of the Bayer facility is controlled by a 6-foot high chain link fence topped with three strands of barbed wire. All entrances to the manufacturing portion of the Bayer facility are monitored by a security guard or locked 24 hours a day. Access is limited to Bayer employees and contractors. The portion of the Bayer facility east of the levee is not fenced; however, the Blue and Missouri Rivers provide natural barriers that discourage entry to the facility. Access to the levee road is controlled by gates maintained by the U.S. Army Corps of Engineers (BMcD 2000). Trespassers able to access the portion of the Bayer facility east of the levee are not likely to contact groundwater. This would require unlocking and pumping secured groundwater wells. Trespassers are not likely to contact potentially contaminated soil, sediment, or indoor air, because the areas of the Bayer facility with these types of contamination are restricted by a fence and guardhouse or locked gate (BMcD 2000).

Recreation

No recreational use of the Bayer facility is anticipated. If recreational use occurs on the portion of the Bayer facility east of the Levee, groundwater wells are secured with locks and metal protective casings. Additionally, the areas of the Bayer facility with potentially contaminated soil, sediment, or indoor air are restricted by a fence and guardhouse or locked gate (BMcD 2000).

Food

Contamination is not expected to significantly impact fish as a food source, given the limited concentration and area of contamination, the volume of the river, the migratory patterns of fish within the river, and the rates of bioaccumulation or degradation of the compounds of concern (BMcD 2000, National Library of Medicine 2003, Tetra Tech 2003).
No crops are grown in contact with groundwater, soil, or sediment contaminated by the Bayer

facility. No crops are grown on site, and no off-site area where crops are grown has been identified as contaminated by facility activities. Surrounding properties are primarily industrial (BMcD 2000).

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)?

__X__ If no (exposures cannot be reasonably expected to be significant (i.e., potentially "unacceptable") for any complete exposure pathway) - skip to #6 and enter "YE" status code after explaining and/or referencing documentation justifying why the exposures (from each of the complete pathways) to "contamination" (identified in #3) are not expected to be "significant."

_____ If yes (exposures could be reasonably expected to be "significant" (i.e., potentially "unacceptable") for any complete exposure pathway) - continue after providing a description (of each potentially "unacceptable" exposure pathway) and explaining and/or referencing documentation justifying why the exposures (from each of the remaining complete pathways) to "contamination" (identified in #3) are not expected to be "significant."

_____ If unknown (for any complete pathway) - skip to #6 and enter "IN" status code

[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.

Rationale and Reference(s):

The complete exposure pathways identified above include worker to indoor air, worker to surface soil, worker to sediment, worker to groundwater ,construction worker to surface and subsurface soil, construction worker to sediment and construction worker to groundwater. Indoor air potentially provides a complete pathway to on-site workers at the Bayer facility. However, all manufacturing buildings currently are monitored for organic constituents in air to meet Occupational Safety and Health Administration regulations. Further, all process buildings at the Bayer facility are designed for a minimum of eight air exchanges per hour (EPA's Johnson & Ettinger model assumes only one air exchange per hour). Therefore, potential exposure of on-site workers through inhalation of indoor air under current conditions is considered a de minimus pathway (Tetra Tech 2003).

Surface soil, subsurface soil and sediment potentially provide a complete pathway to construction or utility workers at the Bayer facility, and sediment, surface soil and groundwater

potentially provides a complete pathway to on-site workers. However, the Bayer health and safety program seeks to eliminate potential exposure by requiring employees to wear proper personal protective equipment (PPE) for any job that involves subsurface digging, including work in the drainage ditch. Proper PPE creates an incomplete exposure pathway to subsurface soils. Additionally, the potential exposure of construction or on-site workers is limited. Industrial PRGs for soil were developed for workers with direct exposure up to 250 days per year for 25 years; residential PRGs for soil were developed for residents with direct exposure up to 350 days per year for 30 years (EPA 2002b). Given the limited duration of construction or on-site worker exposure to subsurface soil or drainage ditch surface soil and sediment, exposures of the construction or on-site worker to subsurface soil or sediment pathway reasonably cannot be expected to be significant.

Similarly, groundwater potentially provides a complete pathway to on-site workers and construction/utility workers at the Bayer facility. The Bayer health and safety program seeks to eliminate the potential exposure pathway by requiring employees to wear proper PPE for any job that involves potential exposure to groundwater. Additionally, potential exposure of on-site and construction/utility workers to groundwater is limited. Applicable groundwater standards, specifically EPA MCLs and tap water PRGs, were developed for residential adults as opposed to on-site workers and construction/utility workers whose exposure would be of limited duration. The exposure duration for residential adults is up to 350 days per year for 30 years (EPA 2002b). Given the limited duration of potential on-site and construction/utility worker exposure to groundwater, those exposures cannot be expected to be significant.

5. Can the "significant" **exposures** (identified in #4) be shown to be within **acceptable** limits?

   ____ If yes (all "significant" exposures have been shown to be within acceptable limits) - continue and enter "YE" after summarizing and referencing documentation justifying why all "significant" exposures to "contamination" are within acceptable limits (e.g., a site-specific Human Health Risk Assessment).

   ____ If no (there are current exposures that can be reasonably expected to be "unacceptable") - continue and enter "NO" status code after providing a description of each potentially "unacceptable" exposure.

   ____ If unknown (for any potentially "unacceptable" exposure) - continue and enter "IN" status code

Rationale and Reference(s):

6. Check the appropriate RCRA Info status codes for the Current Human Exposures Under Control EI event code (CA725), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (and attach appropriate supporting documentation as well as a map of the facility):

__X__ 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 Bayer Cropscience facility, EPA ID #MOD056389828 located at 8400 Hawthorne Road, Kansas City, MO under current and reasonably expected conditions. This determination will be re-evaluated when the Agency/State becomes aware of significant changes at the facility.

____ NO - "Current Human Exposures" are NOT "Under Control."

___ IN - More information is needed to make a determination.

Completed by_____Date ____9/30/03_
Patrick Quinn
Project Manager, Corrective Action Unit
Hazardous Waste Program
Missouri Department of Natural Resources

Supervisor_____Date ____9/30/03_
Richard A. Nussbaum, P.E., R.G.
Chief, Corrective Action Unit
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Locations where References may be found:

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1738 E. Elm Street
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Contact telephone and e-mail numbers

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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

FIGURES