DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

Interim Final 2/5/99
Revised 9/20/02

RCRA Corrective Action
Environmental Indicator (EI) RCRA Info code (CA750)
Migration of Contaminated Groundwater Under Control

Facility Name: **Vulcan Materials Company**
Facility Address: **6200 South Ridge Road, Wichita, Kansas 67215**
Facility EPA ID #: **KSD007482029**

DETERMINATION RESULT: YE

1. Has **all** available relevant/significant information on known and reasonably suspected releases to the groundwater media, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

   _X_ If yes - check here and continue with #2 below.

   _____ If no - re-evaluate existing data, or

   _____ if data are not available, skip to #8 and enter"IN" (more information needed) status code.

The Wichita facility of Vulcan Materials Company (Vulcan), formerly Vulcan Chemicals Company, is located about 5 miles southwest of Wichita, Kansas, in the southwest quarter of Section 27, Township 28S, Range 1W, Sedgewick County, Kansas. Figure 1 shows the Wichita facility boundary. Land owned by Vulcan includes the majority of Section 27, most of the eastern half of Section 28, the northern half of Section 34, the northern half of the northeast quarter of Section 33, and other small parcels of land. Vulcan is located in a rural industrial area, surrounded by farms, ranches, and other industrial facilities. Neighboring industries include AtoFina, DeBruce Grain, Builders Incorporated, and the Murray Gill power plant to the northeast, and the Air Products facility, formerly Abbott Laboratories, to the southwest. Abbott Laboratories had produced cyclohexylamine and amine-based intermediates since the 1960s; in 1979, Abbott Laboratories began operating an extraction well to remediate groundwater beneath their facility (Shaw Environmental & Infrastructure, Inc. [Shaw] 2003).

Vulcan acquired the Wichita facility when they purchased Frontier Chemicals in 1957. Frontier Chemicals had begun production of chlorine, sodium hydroxide, hydrochloric acid, and benzene hexachloride (BHC) at the facility in 1952. Chemicals produced when Vulcan purchased the facility in 1957 included chlorine; caustic soda; hydrochloric acid; gamma-BHC (also known as Lindane); 2,4-dichlorophenoxyacetic acid (2,4-D); methylene chloride; chloroform; carbon tetrachloride; pentachlorophenol; chloromethanes. Aqueous wastes from chemical production were discharged to deep injection wells, a practice that continues at the Wichita facility today (see Attachment 1). Solid wastes, such as those generated during production of PCE and BHC, were disposed of in an on-site landfill located directly north of 63rd Street and east of the railroad (see Attachment 1) (Shaw 2003; Eder & Associates 1993).

Since Vulcan acquired the Wichita facility, the following modifications have been made to the facility structure and processes (Shaw 2003):

1958: Vulcan began producing PCE with carbon tetrachloride. Wastes generated in the production process included hexachlorobenzene, hexachlorobutadiene, hexachloroethane, and other chlorinated organic compounds. Vulcan disposed of these wastes in the on-site landfill.

1959: Vulcan ceased 2,4-D production and began producing anhydrous hydrochloric acid.

1960: Vulcan added a sniff gas recovery section to the chlorine plant.

1962: Vulcan ceased operations at the BHC plant. Production of BHC generated "alpha-cake" wastes containing alpha-BHC, with lesser amounts of beta-, delta-, and gamma-BHC isomers. Vulcan disposed of these wastes in the on-site landfill.

Vulcan constructed an ammonia plant.

1965: Vulcan expanded the ammonia plant.

1972: Vulcan constructed the caustic bead plant.

1973: Vulcan constructed the methyl chloride plant

1977: Vulcan opened the chloromethanes II (methanes II) plant to increase production of chloroform, carbon tetrachloride, and methylene chloride. Production at this plant generated chlorosolvent wastes.

Vulcan implemented: pollution control measures, including concrete pads and dikes, to segregate stormwater from waste water; sump pumps in each process area to control wastewater flow; aboveground process wastewater lines for early leak detection; and a rainwater collection system. Vulcan also capped the on-site landfill. Hazardous and non-hazardous solid wastes were then incinerated or shipped to permitted off-site disposal facilities.

Vulcan implemented an interim remedial measure by placing five interceptor wells (IW29, IW30, IW31, IW32, IW35) along the southern boundary of the Wichita facility. These wells provided a hydraulic barrier to prevent migration off-site of contaminated groundwater from on-site solid waste management units (SWMU).

1992: Vulcan constructed the calcium chloride plant.

Vulcan ceased production at the chloromethanes I (methanes I) plant.

1994: Vulcan closed the caustic bead plant.

1995: Vulcan closed the anhydrous hydrochloric acid plant and replaced IW32 with a new interceptor well.

1996: Vulcan put the Vapor Capture and Recovery Unit (VCRU) into service and closed the PCE plant.

1997: Vulcan opened the Vulcan Feed Stock (VFS) plant. The VFS produced chlorinated propane intermediates that were used in manufacturing refrigerant products.

2002: Vulcan idled VFS and calcium chloride plants.

2003: Vulcan installed four additional interceptor wells.

Currently, Vulcan's Wichita facility manufactures chlorine, caustic, hydrogen, sodium chlorite, hydrochloric acid, pentachlorophenol, methylene chloride, methyl chloride, chloroform, and carbon tetrachloride. Additionally, Vulcan has identified 138 SWMUs at its Wichita facility. Attachment 1 contains an inventory of these SWMUs and a map showing their locations. Included among the SWMUs are the deep injection wells where aqueous wastes from chemical production are discharged. Vulcan's Wichita facility also generates 14 Resource Conservation and Recovery Act (RCRA) hazardous waste streams that are disposed of off site (see Table 1) (Shaw 2003).

TABLE 1
RCRA HAZARDOUS WASTE STREAMS

WASTE NAME	EPA WASTE CODE
Circulation Filters	D007, D001
Debris with Chlorinated Solvents	D001, D002, U044, U045, U077, U080, U128, U131, U210, U211, U226, U228, U127, K016, F024
Filter Bags and Miscellaneous Drying Agents	D006, D010, F025
Organic Contaminated Soil	U044, U045, U077, U080, U210, U226, U228, K016, D001, D002
Spent Traps and Debris	F024
VFS Compounds with NBN (*)	D001, F024
VFS Compounds with NBN and Catalysts (*)	D001, D002, F024
VFS Compounds (*)	F024, K016
VFS Heavy Ends (*)	F024, D003
Waste Flammable Liquids	D001, F002, F003, F005
Waste Petroleum Oil	D019, D022, D039
Waste Abbott Carbon	D019, D022, D028, D039
Waste Ventsorb Carbon	D002, U045, U080, U228, F024
Waste Pentachlorophenol	D037, F021, F027

Notes:
EPA U.S. Environmental Protection Agency
RCRA Resource Conservation and Recovery Act
VFS Vulcan Feed Stock
(*) Waste stream not currently generated

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Migration of Contaminated Groundwater Under Control" EI

A positive "Migration of Contaminated Groundwater Under Control" EI determination ("YE" status code) indicates that the migration of "contaminated" groundwater has stabilized, and that monitoring will be conducted to confirm that contaminated groundwater remains within the original "area of contaminated groundwater" (for all groundwater "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993 (GPRA). The "Migration of Contaminated Groundwater Under Control" EI pertains ONLY to the physical migration (i.e., further spread) of contaminated ground water and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

Duration / Applicability of EI Determinations

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

2. Is **groundwater** known or reasonably suspected to be **"contaminated"**[1] above appropriately protective "levels" (i.e., applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria [e.g., Maximum Contaminant Levels (MCLs), the maximum permissible level of a contaminant in water delivered to any user of a public water system under the Safe Drinking Water Act]) from releases subject to RCRA Corrective Action, anywhere at, or from, the facility?

__X__ If yes - continue after identifying key contaminants, citing appropriate "levels," and referencing supporting documentation.

_____ If no - skip to #8 and enter "YE" status code, after citing appropriate "levels," and referencing supporting documentation to demonstrate that groundwater is not "contaminated."

_____ If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s):

Vulcan is underlain by unconsolidated alluvial sediment consisting of continuous and discontinuous layers of coarse to fine sand, silt, and clay. Specifically, the alluvial sediment is divided into four clay and four sand units. A silty sand (S4) is underlain by a clay unit (C4), a sand unit (S3), a discontinuous clay unit (C3), a sand unit (S2), a clay unit (C2), a coarse sand unit (S1), and a thin layer of clay (C1) above bedrock. Groundwater occurs in the uppermost sand layer (S4) under perched conditions. The lower sand layers are groundwater-saturated, creating the primary shallow (S2/S3) and deep (S1) aquifers beneath Vulcan's Wichita facility. The thickness of the alluvium ranges from 60 feet on the northwest side of the site to 125 feet on the southwest side of the site, and it disappears almost entirely as bedrock elevation rises on the eastern side of the site. The S1 sand unit subcrops about 1 to 1.25 miles east-northeast of the site. The alluvium lies unconformably on Wellington Shale bedrock, which varies in thickness from 80 to 550 feet. The Wellington Shale is not a source of potable, industrial, or irrigation water in the Vulcan vicinity; however, groundwater may be present in cracks in the shale surface. Regional groundwater flow in the alluvial aquifers is toward the southeast; however, local groundwater flow is influenced by area irrigation wells and extraction wells at Vulcan, Air Products, and the Westar Murray Gill power plant (Shaw 2002a).

Groundwater quality at Vulcan has been monitored through their monitoring well network since the late 1970s. In 1986 and 1987, the U.S. Environmental Protection Agency (EPA) conducted a RCRA facility assessment (RFA) at the Vulcan facility and determined that releases–potentially including off-site releases–of hazardous materials were impacting soil and groundwater at Vulcan. In response, Vulcan submitted an off-site RCRA facility investigation (RFI) work plan and addendum in 1989 and conducted the off-site RFI from 1989 through 1991. Vulcan also submitted to EPA an on-site RFI work plan in 1991 and a work plan for off-site corrective measures study (CMS) in 1996. As part of the CMS, Vulcan submitted *Groundwater Model Calibration Corrective Measures Study*, *Evaluation of the Interceptor System: Model Simulation Results Corrective Measures Study for Offsite Groundwater*, *Risk Analysis and Media Cleanup Standard Development of Offsite Groundwater*, and *Corrective Measures Study for Offsite Groundwater* in 1997, as well as *Risk Analysis and Media Cleanup Standard Development for Offsite Soils* in 1998. In 2001, Vulcan submitted to EPA *Quality Assurance Project Plan*, *Field*

[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 appropriate "levels" (appropriate for the protection of the groundwater resource and its beneficial uses).

Investigation Work Plan, and *Field Screening Report* that summarized the results of Geoprobe™ boring and groundwater sampling. Vulcan submitted an off-site *Report of Field Investigation Activities and Groundwater Modeling* in 2002, and a revised *Onsite RCRA Facility Investigation Work Plan* in 2003 (Shaw 2003). Throughout much of this time, Vulcan conducted regular groundwater monitoring and semiannual status reporting pursuant to Part II of their hazardous waste permit KSD007482029 and a 1986 Administrative Order from the Kansas Department of Health and Environment (KDHE). Figure 2 shows locations of Vulcan monitoring wells and interceptor wells (MW, IW), Abbott monitoring wells and extraction wells (AMW, AEW), and Air Products monitoring wells (APMW) included in regular groundwater monitoring. Many monitoring wells installed at Vulcan's Wichita facility are located in clusters of wells screened in various sand units. The following monitoring and interceptor wells are screened in the shallow aquifer (S2/S3) and uppermost sand unit (S4) (Vulcan 2004b):

•

MW2S3

- MW2S3SS
- MW4S3
- MW5S3
- MW6S3
- MW7S2
- MW7S3
- MW8S2
- MW8S3
- MW8S4
- MW9S3
- MW10S2
- MW10S3
- MW11S3A
- MW12S3
- MW13S3A
- MW14S3
- MW15S2
- MW15S4
- MW16S2
- MW16S2PVC
- MW16S4
- MW17S3A
- MW17S3B
- MW20S3
- MW21S3
- MW21S4
- MW22S2
- MW24S3
- MW26S3
- MW28S2
- MW28S3
- MW29S2
- MW29S3
- MW30S2
- MW30S3
- MW113S3
- MW130S2
- MW130S3
- MW131S2
- MW131S3
- MW132S2-3
- MW133S2-3
- MW134S2
- MW134S3
- MW135S2-3
- MW136S2-3
- MW137S2
- MW137S3
- MW138S2-3
- MW139S2-3
- IW30
- IW31
- IW32
- IW35E
- IW35W
- IW40
- IW41
- IW42
- AMW1
- AMW3
- AMW4S
- AMW5S
- AMW8S
- AMW16S
- AMW101S
- AMW101I
- AMW102S
- AMW105S
- AMW106S
- AMW107S
- AMW108S
- AEW10 (out of
- APMW302S2
- APMW302S3

The following monitoring and interceptor wells are screened in the deep aquifer (S1) or bedrock (Vulcan 2004b):

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MW2S1

- MW3S1
- MW4S1
- MW6S1
- MW6BR
- MW7S1
- MW8S1
- MW9S1
- MW10S1
- MW11S1
- MW12S1A
- MW13S1
- MW14S1
- MW15S1
- MW16S1
- MW16BR
- MW17S1
- MW20S1
- MW21S1
- MW22S1
- MW23BR
- MW24S1
- MW25S1
- MW26S1
- MW28S1
- MW29S1
- MW30S1
- MW31S1
- MW32S1
- MW130S1
- MW132S1
- MW135S1
- MW137S1
- MW138S1
- IW29
- IW36
- AMW4D
- AMW5D
- AMW8D
- AMW16D
- AMW101D
- AMW102D
- AMW104
- AMW105D
- AMW106D
- AMW107D
- AMW108D
- AEW17 (out of
- APMW302S1

The groundwater samples are monitored for volatile organics, chlorinated hydrocarbons, chlorinated phenols, hardness, and chlorides (Vulcan 2004b, Shaw 2002b). For each of the compounds of concern identified in Vulcan's 2002 *Quality Assurance Project Plan for the RCRA Corrective Action Program*, Table 2 presents the maximum concentration detected in the shallow or deep aquifer during the last 10 years and compares the concentrations to EPA maximum contaminant levels (MCL) (EPA 2002a) or EPA Region 9 preliminary remediation goals (PRG) for tap water (EPA 2002b) where MCLs are not available.

TABLE 2
MAXIMUM CONTAMINANT DETECTIONS IN GROUNDWATER
1993-2004

Analyte	Groundwater Standard (μg/L)	Shallow Aquifer			Deep Aquifer		
		Maximum Concentration Detected (μg/L)	Well ID	Date of Maximum Detection	Maximum Concentration Detected (μg/L)	Well ID	Date of Maximum Concentration
1,1,1-Trichloroethane	200[a]	**7,400**	IW30	9/7/1994	**680**	MW12S1	9/21/1993
1,2-Dichloroethane	5[a]	**44,000**	IW30	3/14/2001	**11000**	MW12S1	7/20/1999
Benzene	5[a]	**3,800**	IW31	9/7/1994	**1100**	MW7S1	8/23/1995

TABLE 2
MAXIMUM CONTAMINANT DETECTIONS IN GROUNDWATER
1993-2004

Analyte	Groundwater Standard (μg/L)	Shallow Aquifer			Deep Aquifer		
		Maximum Concentration Detected (μg/L)	Well ID	Date of Maximum Detection	Maximum Concentration Detected (μg/L)	Well ID	Date of Maximum Concentration
Carbon tetrachloride	5[a]	**200,000**	IW30	8/24/1999	**110000**	MW12S1	7/20/1999
Chloroform	6.2[b]	**400,000**	IW30	8/24/1999	**310000**	MW12S1	7/20/1999
Chloromethane	1.5[b]	**160**	IW35	2/28/1995	**250**	IW29	2/10/2004

TABLE 2
MAXIMUM CONTAMINANT DETECTIONS IN GROUNDWATER
1993-2004

Analyte	Groundwater Standard (μg/L)	Shallow Aquifer			Deep Aquifer		
		Maximum Concentration Detected (μg/L)	Well ID	Date of Maximum Detection	Maximum Concentration Detected (μg/L)	Well ID	Date of Maximum Concentration
Methylene chloride	5[a]	**180,000**	IW30	3/16/1994	**58000**	MW12S1	7/20/1999
Tetrachloroethene	5[a]	**120,000**	IW31	3/16/1994	**20000**	MW12S1	7/20/1999
Trichloroethene	5[a]	**8,400**	IW30	8/6/1996	**1200**	MW12S1	3/18/1996

TABLE 2
MAXIMUM CONTAMINANT DETECTIONS IN GROUNDWATER
1993-2004

Analyte	Groundwater Standard (μg/L)	Shallow Aquifer			Deep Aquifer		
		Maximum Concentration Detected (μg/L)	Well ID	Date of Maximum Detection	Maximum Concentration Detected (μg/L)	Well ID	Date of Maximum Concentration
Vinyl chloride	2[a]	**45**	MW08S3	7/18/2000	**100**	IW29	2/28/2000
alpha-BHC	0.2[a]	**61**	IW31	8/6/1996	**7**	MW12S1	1/26/1995
beta-BHC	0.2[a]	**46**	MW12S3	9/17/2001	**14**	MW12S1	7/20/1999

TABLE 2
MAXIMUM CONTAMINANT DETECTIONS IN GROUNDWATER
1993-2004

Analyte	Groundwater Standard (μg/L)	Shallow Aquifer			Deep Aquifer		
		Maximum Concentration Detected (μg/L)	Well ID	Date of Maximum Detection	Maximum Concentration Detected (μg/L)	Well ID	Date of Maximum Concentration
gamma-BHC	0.2[a]	**150**	IW31	9/27/1995	**17**	IW29	2/8/2001
Hexachlorobenzene	1[a]	**3.10**	MW12S3	1/25/1999	**4.90**	MW12S1A	1/25/1999

TABLE 2
MAXIMUM CONTAMINANT DETECTIONS IN GROUNDWATER
1993-2004

Analyte	Groundwater Standard (μg/L)	Shallow Aquifer			Deep Aquifer		
		Maximum Concentration Detected (μg/L)	Well ID	Date of Maximum Detection	Maximum Concentration Detected (μg/L)	Well ID	Date of Maximum Concentration

TABLE 2
MAXIMUM CONTAMINANT DETECTIONS IN GROUNDWATER
1993-2004

Analyte	Groundwater Standard (µg/L)	Shallow Aquifer			Deep Aquifer		
		Maximum Concentration Detected (µg/L)	Well ID	Date of Maximum Detection	Maximum Concentration Detected (µg/L)	Well ID	Date of Maximum Concentration
					Hexachlorobutadiene	0.86[b]	**59,000**

TABLE 2
MAXIMUM CONTAMINANT DETECTIONS IN GROUNDWATER
1993-2004

Analyte	Groundwater Standard (μg/L)	Shallow Aquifer			Deep Aquifer		
		Maximum Concentration Detected (μg/L)	Well ID	Date of Maximum Detection	Maximum Concentration Detected (μg/L)	Well ID	Date of Maximum Concentration
Hexachloroethane	4.8[b]	**2,300**	IW30	9/27/1995	**190**	IW29	9/7/1994
2,3,4,5-Tetrachlorophenol	NA	240	IW30	9/22/1993	17	IW29	9/22/1993
2,3,4,6-Tetrachlorophenol	1,100[b]	570	IW30	3/10/1999	54	IW29	8/29/2001

TABLE 2
MAXIMUM CONTAMINANT DETECTIONS IN GROUNDWATER
1993-2004

Analyte	Groundwater Standard (μg/L)	Shallow Aquifer			Deep Aquifer		
		Maximum Concentration Detected (μg/L)	Well ID	Date of Maximum Detection	Maximum Concentration Detected (μg/L)	Well ID	Date of Maximum Concentration
2,4,5-Trichlorophenol	3,600[b]	**7,400**	MW16S2	9/21/1993	500	MW12S1A	9/21/1993
2,4,6-Trichlorophenol	3.6[b]	**8,300**	MW16S2	9/6/1994	**530**	MW12S1A	2/11/1997
2,4- & 2,5-Dichlorophenol	110[b]	**6,400**	MW16S2	7/20/2000	**5,400**	M002S1	9/21/1993

TABLE 2
MAXIMUM CONTAMINANT DETECTIONS IN GROUNDWATER
1993-2004

Analyte	Groundwater Standard (µg/L)	Shallow Aquifer			Deep Aquifer		
		Maximum Concentration Detected (µg/L)	Well ID	Date of Maximum Detection	Maximum Concentration Detected (µg/L)	Well ID	Date of Maximum Concentration
2,6-Dichlorophenol	NA	3600	IW31	9/7/1994	1200	MW02S1	2/11/1997
2-Chlorophenol	30[b]	**870**	IW32	9/22/1993	**1,400**	MW02S1	9/21/1993
3- & 4-Chlorophenol	NA	920	IW32	9/22/1993	1000	MW02S1	1/26/1995

TABLE 2
MAXIMUM CONTAMINANT DETECTIONS IN GROUNDWATER
1993-2004

Analyte	Groundwater Standard (μg/L)	Shallow Aquifer			Deep Aquifer		
		Maximum Concentration Detected (μg/L)	Well ID	Date of Maximum Detection	Maximum Concentration Detected (μg/L)	Well ID	Date of Maximum Concentration
Pentachlorophenol	1[a]	**1,300**	IW30	9/4/1997	**130**	MW12S1A	3/18/1996

Notes:
Boldfaced data value indicates that concentration exceeds a groundwater standard.

[a] EPA maximum contaminant level
[b] EPA Region 9 preliminary remediation goal
BHC Benzene hexachloride
EPA U.S. Environmental Protection Agency
ID Identifier
IW Vulcan interceptor well
μg/L Micrograms per liter
MW Vulcan monitoring well

In addition to sampling monitoring wells to determine the nature and extent of contamination, Vulcan routinely collects groundwater samples from neighboring residential and industrial groundwater wells (see Figure 3). During 2001 semiannual groundwater sampling, detections of beta-BHC, carbon tetrachloride, and chloromethane were detected above EPA MCLs or PRGs in groundwater samples collected from five neighboring residential and industrial groundwater wells (see Table 3) (IT Corporation 2002).

TABLE 3
MAXIMUM DETECTIONS OF CONTAMINANTS
EXCEEDING THEIR EPA MCL OR PRG IN NEIGHBORING WELLS

Analyte		**Carbon Tetrachloride (μg/L)**	**Chloromethane (μg/L)**	**beta-BHC (μg/L)**
Groundwater Standard		**5[a]**	**1.5[b]**	**0.2[b]**
Neighbor Well ID	**Date**			
121Builders	4/2001	**11**	ND (2)	ND (0.037)
122Peterson	8/2001	**11**	ND (1.5)	ND (0.037)
212Dugan	8/2001	ND (5)	ND (1.5)	**0.313**
110KGE-10	2/2001	**38**	ND (1.5)	ND (0.037)
111KGE-11	2/2001	**42**	ND (1.5)	ND (0.037)

Notes:
Boldfaced data value indicates that concentration exceeds a groundwater standard.
[a] EPA maximum contaminant level
[b] EPA Region 9 preliminary remediation goal
BHC Benzene hexachloride
EPA U.S. Environmental Protection Agency
ID Identifier
μg/L Micrograms per liter
ND () Denotes analyte not detected at concentration listed

3. Has the **migration** of contaminated groundwater **stabilized** (such that contaminated groundwater is expected to remain within "existing area of contaminated groundwater"[2] as defined by the monitoring locations designated at the time of this determination)?

__X__ If yes - continue, after presenting or referencing the physical evidence (e.g., groundwater sampling/measurement/migration barrier data) and rationale why contaminated groundwater is expected to remain within the (horizontal or vertical) dimensions of the "existing area of groundwater contamination"[2]).

_____ If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the "existing area of groundwater contamination"[2]) - skip to #8 and enter "NO" status code, after providing an explanation.

_____ If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s):

Under natural conditions, groundwater in the alluvial aquifers beneath Vulcan's Wichita facility is expected to flow toward the southeast. However, a series of interceptor wells at Vulcan have altered this groundwater flow pattern, as have extraction and production wells at the Air Products facility. Vulcan has operated the interceptor wells along the southern boundary of its Wichita facility for about 30 years. These interceptor wells include IW-29, screened in the deep alluvial aquifer, and IW-30, IW-31, IW-32, and IW-35, screened in the shallow alluvial aquifer. Additionally, Vulcan installed four new interceptor wells east of the facility between June and September 2003. These wells include IW-36, screened in the deep alluvial aquifer, and IW-40, IW-41, and IW-42, screened in the shallow alluvial aquifer (see Figure 2). Groundwater monitoring in the area of Vulcan's Wichita facility indicates that groundwater elevations within the contamination plume have been influenced by continual pumping of the interceptor wells. These trends are evident in the historical groundwater contour maps provided in Attachment 2 (Vulcan 2003a, 2004b). The October 2003 and April 2004 contours are drawn based on depths to groundwater measured after installation of the interceptor wells east of the facility in 2003.

Vertical migration of contaminated groundwater is also contained by the Wellington Shale aquitard beneath the alluvium. Estimated hydraulic conductivity of the shale aquitard is between 10^{-11} and 10^{-7} centimeters per second, based on published values (Freeze and Cherry 1979). The shale is encountered at depths up to 125 feet bgs and varies in thickness from 80 to 550 feet (Shaw 2002a). Groundwater has been detected in fractures in the upper 10 feet of the shale layer (Shaw 2002b).

Hydraulic control of groundwater flow controls migration of contamination in groundwater. Delineation of the existing area of contaminated groundwater beneath Vulcan's Wichita facility was completed with a Geoprobe™

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[2] "existing area of contaminated groundwater" is an area (with horizontal and vertical dimensions) that has been verifiably demonstrated to contain all relevant groundwater contamination for this determination, and is defined by designated (monitoring) locations proximate to the outer perimeter of "contamination" that can and will be sampled/tested in the future to physically verify that all "contaminated" groundwater remains within this area, and that the further migration of "contaminated" groundwater is not occurring. Reasonable allowances in the proximity of the monitoring locations are permissible to incorporate formal remedy decisions (i.e., including public participation) allowing a limited area for natural attenuation.

groundwater investigation in 2001, monitoring well installation in 2001 and 2002, and subsequent Modflow computer modeling in 2002. Isopleth maps showing the estimated extent of contamination are provided in Attachment 3. Based on this information, Vulcan established the existing area of contaminated groundwater using perimeter monitoring wells (see Table 4) that define the extent of the contamination above an MCL or, in the absence of an MCL, a generic EPA-calculated $1x10^{-6}$ risk concentration value or PRG (Shaw 2002b).

TABLE 4
PERIMETER MONITORING WELLS

Perimeter Monitoring Well	Alluvial Aquifer Designation
MW06BR, MW06S1, MW06S3	Shallow, Deep
MW17S1, MW17S3A, MW173B	Shallow, Deep
MW25S1	Deep
MW130S1, MW130S2, MW130S3	Shallow, Deep
MW131S2, MW131S3	Shallow
MW133S2-3	Shallow
MW134S2, MW134S3	Shallow
MW136S2-3	Shallow
MW137S1, MW137S2, MW137S3	Shallow, Deep
MW138S1, MW138S2-3	Shallow, Deep
MW139S2-3	Shallow
AMW3	Shallow
AMW102D	Deep
AMW105S, AMW105D	Shallow, Deep

Notes:
AMW Abbott monitoring well
MW Vulcan monitoring well

During the Spring 2003, Fall 2003, and Spring 2004 groundwater sampling events, only one contaminant of concern was detected above reporting levels in any of the perimeter monitoring wells. During the Fall 2003 sampling event, beta-BHC was detected in Abbott Monitoring Well AMW3 at 0.04 μg/L, a concentration above the reporting level of 0.037- μg/L, the EPA PRG (Vulcan 2003b, 2004b).

Subsequent investigation of this data point, and other low-level analyte detections, determined that instrument cross contamination in the laboratory may have been responsible. The Spring 2004 sampling event set had no unexpected low-level detections in the perimeter well set. Attachment 4 is a summary of the contamination levels in the shallow and deep aquifers from Spring 1993 through Spring 2004.

Neighboring groundwater wells sampled by Vulcan also define the plume boundary and serve as sentinels at its perimeter. Neighboring industrial wells 105KGE-05, 106KGE-06, 107KGE-07, 108KGE-08, 110KGE-10, and

111KGE-11 are located further from the Vulcan Wichita facility than nearby Vulcan perimeter monitoring wells (see Figure 3). Historically, carbon tetrachloride concentrations in groundwater samples from 110KGE-10 and 111KGE-11 have exceeded the EPA MCL (see Table 3 and Figure 3). Between 2001 and 2003, however, concentrations of carbon tetrachloride in 110KGE-10 decreased from 38 to 9.2 μg/L and concentrations in 111KGE-11 decreased from 42 to 29 μg/L. . In the spring 2004 sampling event, although 110KGE-10 was not in service to sample, the concentration of carbon tetrachloride in 111KGE-11 had decreased to 1.2 μg/L, below the EPA MCL. Additionally, carbon tetrachloride concentrations are below the method reporting limit of 0.5 μg/L in neighboring industrial wells 105KGE-05, 106KGE-06, 107KGE-07, 108KGE-08, which are located further from the Vulcan Wichita facility than wells 110KGE-10 and 111KGE-11 and which extend the perimeter monitored by Vulcan (see Figure 3) (IT Corporation 2002; Vulcan 2004a, 2004c).

4. Does "contaminated" groundwater **discharge** into **surface water** bodies?

_____ If yes - continue after identifying potentially affected surface water bodies.

__X__ If no - skip to #7 (and enter a "YE" status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater "contamination" does not enter surface water bodies.

_____ If unknown - skip to #8 and enter "IN" status code.

Rationale and Reference(s):

The current Vulcan groundwater management system prevents contaminated groundwater from discharging to surface water by using interceptor wells, carbon adsorption treatment systems, and deep injection wells. Semiannual monitoring of perimeter wells confirms the system's effectiveness.

Drainage in Sedgwick County, Kansas, is characterized by the Arkansas River–located about 6 miles east of Vulcan's Wichita facility–and its tributaries. The area to the north-northeast of Vulcan's Wichita facility is drained by intermittent streams into Cowskin Creek. Cowskin Creek discharges into the Wichita Valley Center Floodway located 1.5 miles northeast of Vulcan. The Wichita Valley Center Floodway enters the Arkansas River about 6 miles southeast of Vulcan. The remaining area surrounding Vulcan is drained by intermittent streams to Dry Creek and Spring Creek. About 9 miles southwest of Vulcan, these two creeks join the Ninnescah River that later enters the Arkansas River (Shaw 2002a).

All perennial surface-water bodies are located outside the boundary created by the perimeter monitoring wells (see Figure 2). Vulcan has identified no known groundwater seeps, springs, or groundwater-fed lakes or ponds in the contaminant management area. Groundwater sampling events conducted since activation of Vulcan's four new interceptor wells in 2003 have revealed contaminants of concern at concentrations that are nondetect or below EPA MCLs at the perimeter monitoring wells (Vulcan 2003b, 2004b, 2004c).

The current Vulcan groundwater management system consists of 10 interceptor wells pumping from both the shallow and the deep alluvial aquifers beneath the Wichita facility. Groundwater is extracted from 8 of the 10 wells at a combined rate of over 340 gallons per minute, and is conveyed by pipeline to the facility's Underground Injection Control Program permitted Class 1 hazardous deep wells for disposal. Groundwater is extracted from the other two interceptor wells at a combined rate of over 100 gallons per minute, treated by carbon adsorption, tested and monitored according to Kansas National Pollution Discharge Elimination System requirements, and discharged to a tributary of Cowskin Creek northeast of the facility (Vulcan 2004c).

5. Is the **discharge** of "contaminated" groundwater into surface water likely to be **"insignificant"** (i.e., the maximum concentration[3] of each contaminant discharging into surface water is less than 10 times their appropriate groundwater "level," and there are no other conditions (e.g., the nature, and number, of discharging contaminants, or environmental setting), which significantly increase the potential for unacceptable impacts to surface water, sediments, or eco-systems at these concentrations)?

   _____ If yes - skip to #7 (and enter "YE" status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentration[3] of key contaminants discharged above their groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgement/explanation (or reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments, or eco-system.

   _____ If no - (the discharge of "contaminated" groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration[3] of each contaminant discharged above its groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations[3] greater than 100 times their appropriate groundwater "levels," the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.

   _____ If unknown - enter "IN" status code in #8.

Rationale and Reference(s):

[3] As measured in groundwater prior to entry to the groundwater-surface water/sediment interaction (e.g., hyporheic) zone.

6. Can the **discharge** of "contaminated" groundwater into surface water be shown to be "**currently acceptable**" (i.e., not cause impacts to surface water, sediments or eco-systems that should not be allowed to continue until a final remedy decision can be made and implemented[4])?

[4] Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, appropriate specialist (e.g., ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies.

_____ If yes - continue after either: 1) identifying the Final Remedy decision incorporating these conditions, or other site-specific criteria (developed for the protection of the site's surface water, sediments, and eco-systems), and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater; OR 2) providing or referencing an interim-assessment[5], appropriate to the potential for impact, that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialists, including ecologist) adequately protective of receiving surface water, sediments, and eco-systems, until such time when a full assessment and final remedy decision can be made. Factors which should be considered in the interim-assessment (where appropriate to help identify the impact associated with discharging groundwater) include: surface water body size, flow, use/classification/habitats and contaminant loading limits, other sources of surface water/sediment contamination, surface water and sediment sample results and comparisons to available and appropriate surface water and sediment "levels," as well as any other factors, such as effects on ecological receptors (e.g., via bio-assays/benthic surveys or site-specific ecological Risk Assessments), that the overseeing regulatory agency would deem appropriate for making the EI determination.

_____ If no - (the discharge of "contaminated" groundwater can not be shown to be "**currently acceptable**") - skip to #8 and enter "NO" status code, after documenting the currently unacceptable impacts to the surface water body, sediments, and/or eco-systems.

_____ If unknown - skip to 8 and enter "IN" status code.

Rationale and Reference(s):

[5]The understanding of the impacts of contaminated groundwater discharges into surface water bodies is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration to be reasonably certain that discharges are not causing currently unacceptable impacts to the surface waters, sediments or eco-systems.

7. Will groundwater **monitoring** / measurement data (and surface water/sediment/ecological data, as necessary) be collected in the future to verify that contaminated groundwater has remained within the horizontal (or vertical, as necessary) dimensions of the "existing area of contaminated groundwater?"

__X__ If yes - continue after providing or citing documentation for planned activities or future sampling/measurement events. Specifically identify the well/measurement locations which will be tested in the future to verify the expectation (identified in #3) that groundwater contamination will not be migrating horizontally (or vertically, as necessary) beyond the "existing area of groundwater contamination."

_____ If no - enter "NO" status code in #8.

_____ If unknown - enter "IN" status code in #8.

Rationale and Reference(s):

Vulcan will continue conducting semiannual groundwater status reporting pursuant to Part II of their hazardous waste permit KSD007482029 (Vulcan 2004c). Vulcan currently reports on the concentrations of contaminants of concern in the Vulcan, Abbott and Air Products facility monitor wells listed in the response to question 2 above every spring and fall. Vulcan also measures groundwater elevations in these wells routinely in order to create contour maps, update the groundwater model, and anticipate changes to the aquifer system due to industrial or agricultural groundwater extraction or changes in precipitation and recharge. Semi-annually, Vulcan conducts groundwater monitoring of neighboring residential and industrial wells. The pumping rates of their interceptor wells are continuously monitored and recorded to ensure that hydraulic control of the groundwater contamination plume is maintained (Vulcan 2004b, 2004c).

8. Check the appropriate RCRA Info status codes for the Migration of Contaminated Groundwater Under Control EI (event code CA750), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (attach appropriate supporting documentation as well as a map of the facility).

__X__ YE - Yes, "Migration of Contaminated Groundwater Under Control" has been verified. Based on a review of the information contained in this EI determination, it has been determined that the "Migration of Contaminated Groundwater" is "Under Control" at the Vulcan Materials Company Wichita facility, EPA ID # KSD007482029, located at 6200 South Ridge Road, Wichita, Kansas 67215. Specifically, this determination indicates that the migration of "contaminated" groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the "existing area of contaminated groundwater" This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.

_____ NO - Unacceptable migration of contaminated groundwater is observed or expected.

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

Completed by _____ Date 7/19/04
(signature)
David Garrett
Project Manager, RCRA Corrective Action & Permits Branch
EPA Region 7

Supervisor _____ Date 7/19/04
(signature)
Jody Hudson,
Associate Director of RCRA
EPA Region 7

Locations where References may be found:

EPA Region 7 Headquarters
RCRA Files
901 North 5th Street
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Contact telephone and e-mail numbers

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FIGURES

(3 pages)

ATTACHMENT 1

(11 pages)

ATTACHMENT 2

(4 pages)

ATTACHMENT 3

(4 pages)

ATTACHMENT 4

(7 pages)