DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

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

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

Facility Name: **Behlen Manufacturing Co.**
Facility Address: **4025 E. 23rd Street, Columbus, Nebraska, 68601**
Facility EPA ID #: **NED007268790**

DETERMINATION RESULT: YE

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.

The Behlen Manufacturing Company (Behlen) facility is located on about 99 acres in Columbus, Nebraska (see Figure 1). Since 1954, Behlen has manufactured metal buildings; grain handling, storage, and conditioning equipment; and products for livestock at the Columbus facility (Terracon 2000c). Manufacturing processes at the facility currently include shearing, deforming, welding, grinding, electroplating, hot dip galvanizing, conversion coating, and finishing sheet metal. Finishing processes include the use of both water- and oil-based paints. Prior to 1988, electroplating, hot dip galvanizing, and prepainting processes resulted in waste fluids that were pumped to two bentonite-lined surface impoundments, contained by earthen dikes. A variety of process wastewaters were sent to these impoundments including acidic solutions, alkaline solutions, pickling water containing zinc, electroplating bath water containing cyanide, and chrome electroplating bath water (Tetra Tech 2003). These impoundments were used for equalization and flocculation, and the effluent was discharged to the Loup Canal under a National Pollutant Discharge Elimination System (NPDES) permit (Nebraska Department of Environmental Control [NDEC] 1987).

The two surface impoundments are RCRA-regulated units. The impoundments were constructed in 1970. During operations, influents to the lagoons sometimes exhibited the characteristics of a RCRA hazardous waste with respect to chromium (D007) and pH (D002) (NDEC 1987). EPA identified the Behlen surface impoundments as hazardous waste treatment impoundments in 1982. Behlen stopped discharging wastewater to the impoundments in 1984, and they were closed during 1987 and 1988 (Terracon 2000c). During closure, standing fluids from the impoundments were removed and treated by the facility's wastewater treatment system. Sludge and soil excavated during the closure were dried and stabilized with fly ash. The stabilized sludge and soil were positioned in the eastern impoundment. Both impoundments were covered with clean fill and closed as a land disposal unit. A metal building with an impervious concrete foundation was built over a large portion of the disposal unit.

Postclosure groundwater detection monitoring has been routinely performed since closure (Nebraska Department of Environmental Quality [NDEQ] 1998).

Because of repeated detections of volatile organic compounds (VOC) in groundwater, Behlen continued to investigate groundwater in the eastern half of the facility using direct-push sampling. This sampling located elevated VOC concentrations east and southeast of the main plant building (Terracon 2000b). During excavation of a burn pit for a planned training exercise in June 2000, Behlen discovered three buried 55-gallon drums in an area now known as Area of Concern (AOC) 4 (Terracon 2000a). According to Behlen, the drums were intact while buried but were damaged during the fire pit's excavation. The origin of the drums was unknown, but they appeared to contain dried paint sludge and an unidentified liquid waste (Terracon 2000a). Soil from the fire pit was screened using a photoionization detector, and some samples were found to have high concentrations of VOCs (Terracon 2000a).

Discovery of the buried drums initiated the RCRA Facility Investigation (RFI) process and reinstatement of full-spectrum analysis for VOCs in groundwater. Initial RFI activities were completed in April 2001 (Terracon 2001). RFI activities included groundwater sampling from monitoring wells, temporary wells, off-site wells, and direct-push sample points, and soil sampling from direct-push sample points. The RFI found evidence of contamination of soil and groundwater with VOCs (Terracon 2001).

Because of the discovery of buried drums, new solid waste management units are being defined by NDEQ (NDEQ 2004b). Previous investigations by Behlen identified five AOCs at the facility (see Figure 2) (Terracon 2000b):

- **AOC 1 - Empty Drum Storage Area.** In this AOC—identified from aerial photographs dating to early 1970s—55-gallon drums may have been stored. Interviews with employees indicated that Behlen's practice had been to store empty drums temporarily in this area before reuse or off-site disposal. However, the drums probably were used to hold bolts rather than chemicals, and the pile of earth probably resulted from testing earthen-covered buildings rather than excavating. According to the RFI, soil and groundwater collected from the area and from immediately downgradient showed no evidence of impact (Terracon 2001).

- **AOC 2 - Intermediate Storage Area for Waste Cyanide.** This AOC—identified from aerial photos from the early 1970s—was the location of several 55-gallon drums. According to interviews with employees, the area was used to store dilute wastewater containing residual cyanide from site plating operations. The area has not been used since 1979, when the last drums were removed from the site. Employee interviews suggested that it was not the practice to dump or dispose of wastewater in this location. According to the RFI, soil collected from the area and from groundwater immediately downgradient showed no evidence of impact (Terracon 2001).

- **AOC 3 - Possible Drum Storage Area.** This AOC—identified from a 1962 aerial photo—was primarily for storage of wood waste with a few intermixed drums. Soil collected from the area during the RFI showed no evidence of impact, although groundwater collected from the area did have elevated concentrations of VOCs (Terracon 2001).

- **AOC 4 - Wood Waste Disposal Area.** This area—identified based on aerial photographs dating to the 1960s—apparently was used to store wood wastes and some 55-gallon drums. According to interviews with employees, dumping or burning paint wastes and spent solvents also may have occurred at AOC 4. It is also the area in which the buried drums were discovered. Based on groundwater results, AOC 4 was identified in the RFI as the primary VOC source (Terracon 2001).

- **AOC 5 - Land Disposal Area for Paint-booth Wastewater.** AOC 5 was identified through interviews with employees who indicated that spreading paint-booth wastewater on the ground in this area had been standard practice. At some time, this area also may have been the location of a disposal pit for paint booth wastewater. Based on groundwater results, AOC 5 was identified as a possible site of a secondary release in the RFI (Terracon 2001).

Although SWMUs have not been defined for the Behlen facility, NDEQ has proposed the following SWMUs (NDEQ 2004b):

- **SWMU 1 - Former Solvent Storage Shed.** This SWMU is located around MW-5 and is the former location of a solvent storage shed. MW-5 has been the location of some low-level detections of VOCs in groundwater.

- **SWMU 2 - Area Adjacent to NPDES Outfall 003.** This SWMU is located around MW-1, which has had groundwater contaminated with metals and low-level detections of VOCs.

- **SWMU 3 - Closed Surface Impoundment.** For this SWMU, NDEQ has combined the closed surface impoundment and the area around the impoundment where sludge wastepiles from the impoundment were put on the ground. Nearby monitoring wells (MW-3 and MW-4) have had groundwater contaminated with metals and low-level detections of VOCs.

- **SWMU 4 - Kettle Flux and Dross Disposal Area.** This SWMU is the area just upgradient of MW-6 associated with routine disposal of galvanizing kettle flux and dross. According to a 1982 report, flux and dross were dumped routinely on the ground near the rail spur line. Low levels of VOCs have been detected in groundwater from MW-6.

- **SWMU 5 - Wood Waste Disposal Area.** This SWMU is the area formerly designated AOC 4. Groundwater in the area is contaminated with VOCs.

- **SWMU 6 - Southeastern Corner of Main Plant.** This SWMU is the area around the southeastern corner of the main plant, downgradient of MW-8. Maps from 1982 and 1989 show waste solvent storage locations about 350 feet west of MW-8. Groundwater in the area is contaminated with VOCs.

- **SWMU 7 - Land Disposal Area for Paint-booth Wastewater.** This SWMU is the area formerly designated AOC 5. Groundwater in the area is contaminated with VOCs.

- **SWMU 8 - Empty Drum Storage Area.** This SWMU is the area formerly designated AOC 1. Although this area was discounted as a likely source of contamination in the RFI work plan because of the lack of soil contamination (Terracon 2000b), subsequent investigations have found groundwater contaminated with VOCs in the area.

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 "Current Human Exposures Under Control" EI

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

Relationship of EI to Final Remedies

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

Duration / Applicability of EI Determinations

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

2. Are groundwater, soil, surface water, sediments, or air **media** known or reasonably suspected to be **"contaminated"**[1] above appropriately protective risk-based "levels" (applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria [e.g., Maximum Contaminant Levels (MCLs), the maximum permissible level of a contaminant in water delivered to any user of a public water system under the Safe Drinking Water Act] from releases subject to RCRA Corrective Action (from SWMUs, RUs, or AOCs)?

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

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

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

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

Rationale and Reference(s):

The Behlen facility is located on about 99 acres in Columbus, Nebraska. The manufacturing and office facilities occupy about 19 acres, and the remaining 80 acres are used for employee parking and temporary storage of raw materials and finished products (Tetra Tech 2003). The land surrounding the Behlen facility is primarily

[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.

agricultural, with some light industrial and residential development (Tetra Tech 2003). The facility is fenced on the northern, eastern, and southern property lines. The facility is bounded on the east by property owned by Hubbard Feeds (Hubbard), on the south by Union Pacific railroad tracks, on the north by U.S. Highway 30, and on the west by the Loup Canal (Tetra Tech 2003). The facility is about 3 miles east of Columbus, Nebraska, which has a population of about 21,000 (City of Columbus 2002).

The Behlen facility lies within the flood plain of the Platte River (Tetra Tech 2003). The Loup Canal, which joins the Platte River about 2.5 miles south of the site, forms the western property line (Tetra Tech 2003). The Loup Canal is deep and perennially full, although up-canal hydraulic activity related to hydroelectric power generation does cause fluctuation in water level (NDEQ 1998). Behlen received a NPDES permit in 2003 that allows discharge of metal-finishing process wastewater and cooling water to the canal (EPA 2004). A levee appears to prevent surface runoff to the canal, causing runoff to flow southeast across the property, toward an ephemeral stream (see Figure 1).

The surficial geology and hydrogeology of the site is dominated by alluvial materials, principally consisting of poorly-graded fine and very fine sand with irregular gravel layers and lenses (Terracon 2003a). The uppermost, or principal, aquifer at the facility is the unconfined Quaternary alluvial aquifer. At the facility, the unconfined aquifer is about 140 feet thick, and the Cretaceous Carlile Shale forms the basal aquitard (NDEQ 1998). A fine-grained layer is present at about 60 feet below ground surface (bgs). This intermediate aquitard layer varies between highly plastic clay, silty clay, and clayey silt (NDEQ 1998; Terracon 2000b).

Monitoring wells at the facility are completed in the unconsolidated material, at two distinct depths. The groundwater monitoring system at Behlen consists of 30 permanent monitoring wells: 1 deep well, 17 medial wells, and 15 shallow wells (see Figure 2). The newer wells generally have been installed in two-well clusters, consisting of a shallow (20 feet deep or less) and a medial (between 40 and 60 feet deep) well (NDEQ 1998; Terracon 2000d, 2003a). One well, MW-3D, is substantially deeper (about 118 feet bgs). The water table in these wells is about 10 to 20 feet bgs (Tetra Tech 2003). Groundwater generally flows east and southeast across the facility (Tetra Tech 2003).

When the facility was planning the RFI, 43 registered and 73 unregistered wells were located within 1.5 miles of the facility (Terracon 2000c). These wells were originally surveyed for the Part B permit application. A recent survey of Nebraska Department of Natural Resource's (NDNR) database of registered wells located 93 active registered wells within 1.5 miles of the facility (NDNR 2004). Of those wells, 28 were classified as domestic wells, with total depths ranging between 22 and 160 feet and an average depth of about 75 feet (NDNR 2004). Most of the wells are used for irrigation, and several are used for industrial or drinking water. When a similar survey was conducted in 2002, at least three wells were classified as public supply wells; NDNR no longer lists public supply wells on its online database. A City of Columbus public supply well is within 0.25 mile of the facility, in the upgradient direction and on the western side of the Loup Canal, but this well is no longer in service (NDNR 2002; City of Columbus 2004) In addition, Hubbard, whose property is adjacent to and downgradient of the Behlen property (see Figure 2), has three industrial wells used for fire protection (Well A), process water (Well B), and irrigation (Well C) (Terracon 2000c). Well B at Hubbard previously was used for drinking water, but this use has been suspended because the City of Columbus has extended city water lines to Hubbard (NDEQ 2004c; City of Columbus 2004).

Groundwater

Groundwater samples at the Behlen facility have been collected since at least 1984, when monitoring wells were installed around the impoundments (NDEC 1987). Initial groundwater sampling revealed that groundwater at the facility had been impacted. Since 1987, Behlen has been performing groundwater monitoring in accordance with an NDEQ-approved RCRA closure and postclosure plan (Terracon 2000b). Locations of monitoring wells are

shown on Figure 2. Behlen has also collected groundwater samples from three nearby residential wells in April 2003 and August 2003 (see Figure 2). In addition, groundwater samples were collected from the wells at Hubbard (Terracon 2003b; NDEQ 2004a). Groundwater samples were analyzed for VOCs and total and dissolved lead and chromium (NDEQ 1998; Terracon 2003b).

The most contaminated groundwater samples were collected from the wells on the southeastern, most downgradient, portion of the facility. Table 1 shows the maximum concentrations of hazardous constituents in groundwater at the facility. At least two metals, cadmium and lead, were found in dissolved concentrations that exceeded their EPA action levels or maximum contaminant levels (MCL). VOCs have been detected at concentrations above EPA MCLs or EPA Region 9 preliminary remediation goals (PRG) in wells MW-8, MW-15M, MW-16, MW-16M, MW-17, MW-17M, MW-18, MW-18M, and MW-20M. VOCs exceeding MCLs or PRGs are: benzene (maximum of 9.6 micrograms per liter [µg/L]); chloroethane (16.7 µg/L); 1,2-dichloroethane (DCA) (15./6 µg/L); 1,1-dichloroethene (DCE) (486 µg/L); *cis*-1,2-DCE (83.8 µg/L); methylene chloride (34 µg/L); methyl isobutyl ketone (MIBK) (145,000 µg/L); tetrachloroethene (PCE) (186 µg/L);1,1,1-trichloroethane (TCA) (328 µg/L); 1,1,2-TCA (11.9 µg/L); trichloroethene (TCE) (44.6 µg/L); 1,2,4-trimethylbenzene (TMB) (96.6 µg/L); 1,3,5-TMB (28.6 µg/L); and vinyl chloride (8.44 µg/L).

TABLE 1

MAXIMUM CONCENTRATIONS OF CONSTITUENTS IN GROUNDWATER COLLECTED FROM BEHLEN MONITORING WELLS

Compound of Concern	Relevant Standard or Criteria (µg/L)	Maximum Concentration Detected (µg/L)	Location of Maximum Concentration	Sampling Date	Other Wells above MCL or PRG (2002-2003)
Acetone	PRG, 610	141	MW-15M	Jan-03	
Benzene	MCL, 5	**9.6**	MW-17M	Sep-02	MW-20M
Cadmium	MCL, 5	**15**	MW-2	Feb-97	
Chloroethane	PRG, 4.6	**16.7**	MW-17M	Apr-03	
1,1-Dichloroethane	PRG, 800	534	MW-15M	Jan-03	
1,2-Dichloroethane	MCL, 5	**15.6**	MW-20M	Sep-02	MW-18M
1,1-Dichloroethene	MCL, 7	**486**	MW-20M	Sep-02	MW-8, MW-15M, MW-16, MW-16M, MW-17, MW-17M, MW-18, MW-18M
cis-1,2-Dichloroethene	MCL, 70	**83.8**	MW-8	Apr-03	
Ethylbenzene	MCL, 700	54.8	MW-15M	Jan-03	
Lead	Action Level, 15	**130**	MW-5	Jan-92	
Methylene chloride	MCL, 5	**34**	MW-16	Sep-02	MW-15M

TABLE 1

MAXIMUM CONCENTRATIONS OF CONSTITUENTS IN GROUNDWATER COLLECTED FROM BEHLEN MONITORING WELLS

Compound of Concern	Relevant Standard or Criteria (µg/L)	Maximum Concentration Detected (µg/L)	Location of Maximum Concentration	Sampling Date	Other Wells above MCL or PRG (2002-2003)
Methyl ethyl ketone	PRG, 1,900	12	MW-15M	Jan-03	
Methyl isobutyl ketone	PRG, 2,900	**145,000**	MW-15M	Jan-03	MW-16, MW-18M, MW-20M
Naphthalene	PRG, 1,500	663	MW-15M	Jan-03	
Nitrate	MCL, 10,000	**75,000**	MW-2	Feb-95	
Styrene	MCL, 100	5.1	MW-15M	Jan-03	
Tetrachloroethene	MCL, 5	**186**	MW-8	Jul-03	MW-15M, MW-16M, MW-17M, MW-18M, MW-20M
Toluene	MCL, 1,000	657	MW-16	Apr-03	
1,1,1-Trichloroethane	MCL, 200	**328**	MW-8	Jul-03	MW-15M
1,1,2-Trichloroethane	MCL, 5	**11.9**	MW-15M	Jan-03	MW-16
Trichloroethene	MCL, 5	**44.6**	MW-8	Jul-03	MW-15M, MW-20M
1,2,4-Trimethylbenzene	PRG, 12	**96.6**	MW-15M	Jan-03	MW-8, MW-16, MW-20M
1,3,5-Trimethylbenzene	PRG, 12	**28.6**	MW-15M	Jan-03	MW-16
Vinyl chloride	MCL, 2	**8.44**	MW-15M	Apr-03	MW-17M, MW-18M, MW-20M
Xylene, Total	MCL, 10,000	264	MW-15M	Jan-03	

Notes:
Data provided by NDEQ (1998) and Terracon (2003b).
Concentrations in bold type exceed the EPA MCL or PRG for drinking water.
EPA U.S. Environmental Protection Agency
MCL EPA maximum contaminant level (EPA 2002a)
µg/L Micrograms per liter
NDEQ Nebraska Department of Environmental Quality
PRG EPA Region 9 preliminary remediation goal (EPA 2002b)

In addition to dissolved constituents, free product has been identified in wells around MW-15, near AOC 4. The source of these constituents was not identified by the RFI. Free product first was found in a groundwater sample collected from TW-2 during the RFI (Terracon 2001). About 1.5 feet of free product then was discovered in MW-15 during the September 2002 sampling event (Terracon 2003a). Since it was initially detected, free product

has varied in thickness between 0.15 and 1.34 feet (Terracon 2003b). Trace amounts of free product (0.01 feet or less) have been detected in OW-1, OW-2, OW-5, and OW-6 (Terracon 2003a, 2003b). The free product contained 1,1-DCA, 1,1-DCE, ethylbenzene, methyl isobutyl ketone, PCE, toluene, 1,1,1-TCA, TCE, and xylenes (Terracon 2003a).

Groundwater collected from Hubbard wells has also had detectable concentrations of hazardous constituents—the fire suppression well (Well A) is the most impacted, but the other two wells also have had positive detections (Terracon 2003b; NDEQ 2004a). Table 2 shows the maximum concentrations of hazardous constituents in groundwater at Hubbard. Chloroethane, 1,2-DCA, 1,1-DCE, and tetrahydrofuran have all been detected at concentrations that exceed EPA MCLs and EPA Region 9 PRGs.

Three residential wells were sampled quarterly during 2002 and 2003. These residences are shown on Figure 1. However, none had detectable concentrations of VOCs (Terracon 2003b).

TABLE 2

MAXIMUM CONCENTRATIONS OF CONSTITUENTS IN GROUNDWATER COLLECTED FROM HUBBARD FEEDS WELLS

Compound of Concern	Relevant Standard or Criteria (µg/L)	Maximum Concentration Detected (µg/L)	Location of Maximum Concentration	Sampling Date	Other Wells with Detections
Benzene	MCL, 5	1	Fire Well (A)	Dec-03	
Chloroethane	PRG, 4.6	**14**	Fire Well (A)	Dec-03	
1,1-Dichloroethane	PRG, 800	77	Fire Well (A)	Dec-03	Process Well (B), Irrigation Well (C)
1,2-Dichloroethane	MCL, 5	**5**	Fire Well (A)	Dec-03	
1,1-Dichloroethene	MCL, 7	**312**	Fire Well (A)	Dec-03	Process Well (B), Irrigation Well (C)
cis-1,2-Dichloroethene	MCL, 70	11	Fire Well (A)	Dec-03	
Ethylbenzene	MCL, 700	8	Fire Well (A)	Dec-03	
Isopropyl benzene	PRG, 660	2	Fire Well (A)	Dec-03	
Methyl isobutyl ketone	PRG, 2,900	1162	Fire Well (A)	Jun-00	
Methyl tertbutyl ether	PRG, 13	0.8 J	Irrigation Well (C)	Mar-02	
Naphthalene	PRG, 1,500	64	Fire Well (A)	Dec-03	
n-Propylbenzene	PRG, 240	1	Fire Well (A)	Dec-03	
Tetrachloroethene	MCL, 5	0.83 J	Fire Well (A)	Jun-00	
Tetrahydrofuran	PRG, 1.6	**32**	Process Well (B)	Dec-02	Irrigation Well (C)

Compound of Concern	Relevant Standard or Criteria (µg/L)	Maximum Concentration Detected (µg/L)	Location of Maximum Concentration	Sampling Date	Other Wells with Detections
Toluene	MCL, 1,000	33	Fire Well (A)	Dec-03	
1,1,1-Trichloroethane	MCL, 200	5	Fire Well (A)	Jun-00	
1,2,4-Trimethylbenzene	PRG, 12	3	Fire Well (A)	Dec-03	
1,3,5-Trimethylbenzene	PRG, 12	1	Fire Well (A)	Dec-03	
Vinyl chloride	MCL, 2	1	Fire Well (A)	Dec-03	
Xylene, Total	MCL, 10,000	37	Fire Well (A)	Dec-03	

Notes:
Data provided by NDEQ (2004a) and Terracon (2003b).
Concentrations in bold type exceed the EPA MCL or PRG for drinking water.
EPA U.S. Environmental Protection Agency
MCL EPA maximum contaminant level (EPA 2002a)
µg/L Micrograms per liter
NDEQ Nebraska Department of Environmental Quality
PRG EPA Region 9 preliminary remediation goal (EPA 2002b)

Surface Soil

Surface soil (less than 2 feet bgs) at the Behlen facility is likely contaminated with metals. The area around the closed surface impoundment was the site of sludge wastepiles that contained chromium and cyanide (SWMU 3) (NDEQ 2004b). The wastepiles were removed during the closure of the surface impoundments, and the impoundments were covered with clean fill, concrete, and a metal shelter (NDEQ 1995). However, the soil underneath the piles was not sampled during the SI closure in 1987, nor was it sampled during the RFI. Surface soil in this area likely was impacted by metals from the impoundments, and NDEQ will require additional sampling in this area as a condition of Behlen's new post-closure permit (NDEQ 2004b). Surface soil in the area around MW-6 also is likely contaminated with metals in the area in which galvanizing kettle flux and dross was disposed of on the ground (NDEQ 2004b). NDEQ will also require additional soil sampling in this area as a condition of Behlen's new post-closure permit (NDEQ 2004b).

Two other areas may have contaminated surface soil. As additional permit conditions, NDEQ will require that Behlen conduct soil sampling along NPDES Outfall 003 (SWMU 2), which discharged from the SI, and in the area around MW-5 (SWMU 1) (NDEQ 2004b). NPDES Outfall 003 is located near MW-1, a well that had frequent detections of cadmium and chromium above MCL. NDEQ believes that some portion of this groundwater contamination may derive from the outfall rather than from the surface impoundments (NDEQ 2004b). As contaminated surface water percolated to groundwater, surface soil would have been contaminated in the process. Similarly, elevated concentrations of VOCs in groundwater from MW-5 suggests that contaminants may derive from the former solvent storage shed, contaminating surface soil and percolating to groundwater (NDEQ 2004b)

Subsurface Soil

Subsurface soil at the Behlen facility is contaminated with metals and VOCs. Subsurface (collected from a depth of more than 2 feet) soil samples were collected in the eastern half of the facility after discovery of the buried drums in the fire pit, during the RFI, and during the installation of monitoring wells (Terracon 2000a, 2001, 2003a). Soil sample locations are shown in Figures 2 and 3. Samples collected from the fire pit and during the RFI were analyzed for metals and VOCs. Soil collected from the area of the fire pit had elevated concentrations of metals and VOCs, but none of the samples collected during the RFI had concentrations of metals or VOCs that exceeded EPA PRGs. Table 3 shows the maximum concentrations detected during the fire pit investigation. During monitoring well installation, soil cores were screened using a photoionization detector (PID), which indicates presence and intensity of VOC contamination but not specific compounds; some of the PID detections for subsurface soil may have resulted from saturation with contaminated groundwater. Results of subsurface soil screening are shown in Table 4. Because sludge was buried during closure, contaminated subsurface soil likely remains in the area of the closed surface impoundment.

TABLE 3

MAXIMUM CONCENTRATIONS OF CONSTITUENTS IN SUBSURFACE SOIL COLLECTED FROM FIRE PIT, JUNE 2000

Constituent	Concentration (mg/kg)	Sample	Depth (ft bgs)	EPA Region 9 Residential PRG (mg/kg)	EPA Region 9 Industrial PRG (mg/kg)
Barium	180	EB-5	5	5,400	67,000
n-Butylbenzene	50.6	EB-5	5	240	240
sec-Butylbenzene	8.09	EB-5	5	220	220
tert-Butylbenzene	23.7	EB-5	5	390	390
Chromium	**990**	EB-5	5	210	450
1,1-Dichloroethane	1.82	EB-5	5	510	1,700
1,1-Dichloroethene	0.727	EB-5	5	120	410
Ethylbenzene	*10.4*	EB-5	5	8.9	20
Isopropylbenzene	5.23	EB-5	5	570	2,000
Lead	**4,200**	EB-5	5	400	750
Tetrachloroethene	*3.18*	EB-5	5	1.5	3.4
Toluene	244	EB-5	5	520	520
1,1,1-Trichloroethane	81.7	EB-5	5	1,200	1,200
1,1,2-Trichloroethane	*0.738*	EB-5	5	0.73	1.6
1,2,4-Trimethylbenzene	*162*	EB-5	5	52	170
1,3,5-Trimethylbenzene	*41.7*	EB-5	5	21	70
Xylene	171	EB-5	5	270	420
Naphthalene	***743***	EB-5	5	5.6	190

Notes:
Values in regular boldface exceed EPA Region 9 industrial PRGs.

Values in italic boldface exceed industrial PRGs.
Values in regular italics exceed EPA Region 9 residential PRGs.
EPA U.S. Environmental Protection Agency
ft bgs Feet below ground surface
mg/kg Milligrams per kilogram
PRG EPA Region 9 preliminary remediation goal (EPA 2002b)

TABLE 4

SUBSURFACE SOIL VOC DETECTIONS – MONITORING WELL INSTALLATION, AUGUST 2002

Boring or Monitoring Well	Maximum Concentration (parts per million)	Depth (ft bgs)
B-2	2.9	48
B-3	1.3	46
MW-15	1,551	6
MW-15M	355	23
MW-16	3.2	13
MW-16M	153	16
MW-17M	347	23
MW-18	1.4	6
MW-18M	41.4	37
MW-20M	9.0	53

Notes:
ft bgs Feet below ground surface
VOC Volatile organic compounds

Subsurface soil at the facility is contaminated with metals and VOCs. The highest reported levels of contamination in subsurface soil are from the area around the fire pit. Two metals exceed EPA Region 9 industrial PRGs—chromium (maximum concentration of 990 milligrams per kilogram [mg/kg]) and lead (4,200 mg/kg). One VOC, naphthalene (743 mg/kg), exceeded industrial PRGs, and five VOCs exceeded EPA Region 9 residential PRGs—ethylbenzene (10.4 mg/kg); PCE (3.18 mg/kg); 1,1,2-TCA (0.738 mg/kg); 1,2,4-TMB (162 mg/kg); and 1,3,5-TMB (41.7 mg/kg).

Surface Water and Sediment

No surface water bodies are on the Behlen property, although the Loup Canal is adjacent to the facility. The facility discharges process and cooling water to the canal, but its NPDES permit requires regular monitoring of discharge. Although the facility has had a few violations—mostly related to temperature, oil and grease concentrations, and zinc concentrations—discharge to Loup Canal is generally below the limits established by the permit (EPA 2004). Moreover, groundwater flows away from the canal (Tetra Tech 2003), preventing discharge of contaminated groundwater to surface water. It is unlikely that recent activities at the Behlen facility have contributed significantly to contamination in Loup River Canal water or sediment.

Indoor Air

Because of the presence of VOCs in shallow groundwater at the facility, indoor air could be contaminated with organic vapors. However, preliminary estimates of volatilization from groundwater suggest that indoor air is not contaminated at the Behlen facility.

Vapors from contaminated soil and groundwater may intrude into buildings at the facility through cracks in the foundation or through underground electrical conduits or plumbing. No indoor air sampling has been conducted at Behlen. However, EPA guidance can be used to determine if indoor air contamination is likely at the facility, and the Johnson-Ettinger model can be used to estimate indoor air concentrations at locations that meet the screening criteria (EPA 2002c). The results of the screening and models are provided in Appendices A and B.

The first level of the EPA's indoor air screening consists of two criteria, both of which are met at the Behlen facility. First, environmental media at the site must be contaminated by constituents that are sufficiently volatile and sufficiently toxic. Groundwater at the facility is contaminated with several constituents that meet this standard, in particular, benzene, chloroethane, 1,1-DCA, 1,1-DCE, *cis*-1,2-DCE, naphthalene, PCE, 1,1,1-TCA, TCE, 1,2,4-TMB, and 1,3,5-TMB. Second, the contaminated media must be present under inhabited buildings. One well, MW-8, is located within 50 feet of the main building and has concentrations of VOCs that exceed EPA MCLs (see Figure 2 and Table 1). Because of the proximity of this well to the main building and the excessive concentrations of VOCs, it is reasonable to assume that groundwater under the main building is contaminated.

The next level of the EPA's indoor air screening compares the concentrations of contaminants to screening levels. Concentrations of VOCs in groundwater at Behlen are high enough to raise concerns about potential indoor air contamination. The screening levels are based on concentrations needed to generate vapors in indoor air at levels that would exceed risk levels for ambient air. Tables 2 and 3 in Appendix A compare the maximum concentrations of select VOCs in groundwater to the initial screening concentrations. The vapor attenuation factor of $5x10^{-4}$ was estimated based on depth to groundwater (15 feet for modeling purposes) and the type of soil at the site (sand, as shown in monitoring well boring logs); the actual depth to groundwater in well MW-8 is about 18 feet (Terracon 2003a, 2003b). Based on this level of screening, naphthalene, PCE, and TCE may cause contamination of indoor air and should be included in any modeling.

The last level of the EPA's indoor air screening specifies use of a model to estimate the risk generated by organic vapors in indoor air. Based on the results of Johnson-Ettinger models, volatilization of organic constituents in groundwater does not cause an increase in risk and contaminated indoor air (see Appendix B). Table 5 shows the results of the Johnson-Ettinger models. Of the three compounds modeled, none has an incremental risk above the minimum threshold of 10^{-6}. The hazard quotients, which estimate the noncarcinogenic risks, total less than 1, indicating that this component of risk is not significant.

TABLE 5

ESTIMATED INCREMENTAL RISK AND HAZARD QUOTIENTS, INDOOR AIR

Constituent	Concentration in Groundwater (µg/l)	Well	Date	Incremental Risk (carcinogen)	Hazard Quotient (noncarcinogen)
Naphthalene	359	MW-8	July 2003	Not applicable	$1.1x10^{-2}$
Tetrachloroethene	186	MW-8	July 2003	$2.0x10^{-7}$	Not applicable
Trichloroethene	44.6	MW-8	July 2003	$9.5X10^{-8}$	Not applicable

Notes:
Concentrations in Table 5 derive from the Terracon groundwater monitoring (Terracon 2003b)

µg/l micrograms per liter

Outdoor Air

Because confining features are absent, concentrations of organic vapors in outdoor air are probably not significant. Because areas of probable surface soil contamination are limited, and because most of these areas appear to be covered with pavement, gravel, vegetation, or finished products (Tetra Tech 2003), contamination of indoor or outdoor air with soil particulate likely is minimal.

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	N	N	–	Y	N	–	–
~~Air (indoors)~~	–	–	–	–	–	–	–
Soil (surface, e.g., <2 ft)	N	N	–	Y	N	–	–
~~Surface Water~~	–	–	–	–	–	–	–
~~Sediment~~	–	–	–	–	–	–	–
Soil (subsurface e.g., >2 ft)	N	N	–	Y	N	–	–
~~Air (outdoors)~~	–	–	–	–	–	–	–

Instructions for Summary Exposure Pathway Evaluation Table:

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

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

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

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

__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)

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

Four media—surface water, sediment, indoor air, and outdoor air—can be excluded from further consideration, because no evidence indicates that these media are contaminated at the Behlen facility. Three types of receptors—day care, recreational, and food—can also be excluded. The nearest school or church is about 0.5 mile southwest of the facility and on the opposite site of the canal (see Figure 1), and any private day care students are unlikely to have access to operational areas of the facility. The only potential food receptors would be linked to irrigation or livestock watering with contaminated groundwater, which does extend off the property. However, no registered wells with these uses are within or near the plume boundary, given current conditions (NDNR 2004). Because of the lack of recreational facilities such as parks on or near the facility (see Figure 1), significant recreational use is unlikely.

Four classes of receptors must be evaluated for potential exposure—residents, facility workers, construction workers, and trespassers. Maps of the facility indicate the facility is surrounded by a fence (see Figure 2). However, it is unclear how high or how well maintained the fence is. As a result, trespassers on the property are possible. Behlen is still operational, so facility workers must be considered. No information is available about Behlen's use of contract construction workers. However, contract workers likely would perform any on-site excavation, construction, or utility work, and this class of receptors must be considered. The properties immediately north of Behlen property are residential, so residential receptors must be considered (see Figure 1).

Contract workers may be exposed to contaminated surface soil. Because most of the probable areas of contaminated surface soil at Behlen are covered with pavement, crushed rock, buildings, or vegetation (Tetra Tech 2003), trespassers and Behlen workers likely are not exposed to contaminated surface soil. Residential receptors are not likely to come into contact with contaminated surface soil at the Behlen facility, which is surrounded by a fence. However, any excavation workers might be exposed to contaminated surface soil.

Only contract excavation workers likely are exposed to contaminated subsurface soils. Facility workers, trespassers, and nearby residents likely do not come into contact with soils at the facility deeper than 2 feet bgs.

No receptors likely are exposed to contaminated groundwater by ingestion. The Behlen facility, the downgradient Hubbard facility, and the nearby trailer parks are all served by city water (NDEQ 2004c; City of Columbus 2004). None of the three nearby residential wells sampled by Behlen had detectable concentrations of VOCs (see Figure 1) (Terracon 2003b). As a result, facility workers, contract workers, trespassers, and nearby residents all are unlikely to be exposed to contaminated groundwater through ingestion, given current conditions.

However, groundwater exposure pathways may be completed by dermal contact. Unattended monitoring wells provide a pathway through which trespassers could be exposed to contaminated groundwater. But the practice of padlocking well covers makes completion of this pathway unlikely (Tetra Tech 2003). Behlen has two industrial process water wells, so facility workers possibly could be exposed to contaminated groundwater (Terracon 2000c). However, it is unlikely that facility workers would be exposed to industrial process water on a regular basis. No registered private wells are located within the boundaries of the contaminated groundwater, so nearby residents are not likely to be exposed dermally. But because the water table at the site is as shallow as 10 feet bgs, contract excavation workers may come into dermal contact with contaminated groundwater.

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 can not be reasonably expected to be significant (i.e., potentially "unacceptable") for any complete exposure pathway) - skip to #6 and enter "YE" status code after explaining and/or referencing documentation justifying why the exposures (from each of the complete pathways) to "contamination" (identified in #3) are not expected to be "significant."

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

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

Rationale and Reference(s):

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

- contract construction workers—groundwater, subsurface soil, and sediment
- contract construction workers—surface soil
- contract construction workers—subsurface soil

While repairing or installing utilities or performing other excavation work, contract construction workers and utility workers would be exposed to contaminated groundwater, surface soil, and subsurface soil with concentrations of contaminants that exceed EPA Region 9 PRGs. However, because they are not full-time employees on site, their exposure is limited in duration. EPA Region 9 industrial PRGs for soil are calculated based on assumptions of 25 years, 250 days per year, of exposure (EPA 2002b). Because of the limited period of contact, exposure of contract construction workers to hazardous constituents in soil or sediment likely is not significant. Groundwater target concentrations are based predominantly on ingestion of water and are not applicable to dermal contact alone. The level of exposure of contract construction and utility workers to hazardous constituents in groundwater likely is not significant.

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

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

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

_____ 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 Behlen Manufacturing Co., facility, EPA ID #NED007268790, located at 4025 E. 23rd Street, Columbus, Nebraska, 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 7/30/04

(signature)
David Garrett
Project Manager, RCRA Corrective Action & Permits Branch
EPA Region 7

Supervisor _____ Date 7/30/04

(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
Kansas City, Kansas 66101

Contact telephone and e-mail numbers

David Garrett
(913) 551-7159
garrett.david@epa.gov

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

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FIGURES

(Three Pages)

APPENDIX A

BEHLEN MANUFACTURING INDOOR AIR SCREENING

VAPOR INTRUSION PATHWAY SUMMARY PAGE

Facility Name: Behlen Manufacturing (NED007268790)
Facility Address: 2005 S. 19th Street, Clinton, IA 52732

Primary Screening Summary

Q1: Constituents of concern Identified?
__X__ *Yes*
_____ *No* (If NO, skip to the conclusion section below and check NO to indicate the pathway is *incomplete*.)

Q2: Currently inhabited buildings near subsurface contamination?
__X__ *Yes*
_____ *No*

Areas of future concern near subsurface contamination?
__X__ *Yes*
_____ *No* (If NO, skip to the conclusion section below and check NO to indicate the pathway is *incomplete*.)

Q3: Immediate Actions Warranted?
_____ *Yes*
__X__ *No*

Secondary Screening Summary

Vapor source identified:
__X__ *Groundwater*
_____ *Soil*
_____ *Insufficient Data*

Indoor air data available?
_____ *Yes*
__X__ *No*

Indoor air concentrations exceed target levels?
_____ *Yes*
_____ *No*
__X__ *Not applicable*

Subsurface data evaluation: (Underline appropriate answers below)

Medium	Q4 Levels Exceeded?	Q5 Levels Exceeded?	Data Indicates Pathway is Complete?
Groundwater	***YES*** / NO / NA / INS	***YES*** / NO / NA / INS	YES / ***NO*** / INS
Soil Gas	YES / NO / NA / ***INS***	YES / NO / NA / ***INS***	YES / NO / ***INS***

Notes:

NA Not applicable
INS Insufficient data available to make a determination

Site-Specific Summary

Have the nature and extent of subsurface contamination, potential preferential pathways, and overlaying building characteristics been adequately characterized to identify the most-likely-to-be-impacted buildings?
_____*Yes*
_____*No*
_____*N/A*

EPA recommends that if a model was used, it be an appropriate and applicable model that represents the conceptual site model. If other means were used, document how you determined the potentially most impacted areas to sample. EPA recommends that predictive modeling can be used to support Current Human Exposures Under Control EI determinations without confirmatory sampling to support this determination. Current Human Exposures Under Control EI determinations are intended to reflect a reasonable conclusion by EPA or the State that current human exposures are under control with regard to the vapor intrusion pathway and current land use conditions. Therefore, if conducting evaluation for an EI determination, document that the **Pathway is Incomplete** and/or does not pose an unacceptable risk to human health for EI determinations.

Are you making an EI determination based on modeling and does the model prediction indicate that determination is expected to be adequately protective to support Current Human Exposures Under Control EI determinations?
_____*Yes*
_____*No*
_____*N/A*

Do subslab vapor concentrations exceed target levels?
_____*Yes*
_____*No*
_____*N/A*

Do indoor air concentrations exceed target levels?
_____*Yes*
_____*No*

Conclusion

Is there a Complete Pathway for subsurface vapor intrusion to indoor air?

Below, check the appropriate conclusion for the Subsurface Vapor to Indoor Air Pathway evaluation and attach supporting documentation as well as a map of the facility.

___*X*___NO - The "Subsurface Vapor Intrusion to Indoor Air Pathway" has been verified to be incomplete for the Behlen Manufacturing facility, EPA ID #NED007268790, located at 4025 E. 23rd Street, Columbus, Nebraska.

This determination is based on a review of site information, as suggested in this guidance, check as appropriate:

_____For current and reasonably expected conditions, or
_____Based on performance monitoring evaluations for engineered exposure controls. This determination may be re-evaluated, where appropriate, when the Agency/State becomes aware of any significant changes at the facility.

_____YES - The "Subsurface Vapor Intrusion to Indoor Air Pathway" is Complete. Engineered controls, avoidance actions, or removal actions taken include:

_____

_____

_____

_____UNKNOWN - More information is needed to make a determination.

APPENDIX B

JOHNSON-ETTINGER MODELS FOR BEHLEN FACILITY