DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

Interim Final 2/5/99

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

Current Human Exposures Under Control

Facility Name:	Childers Products
Facility Address:	2061 Hartel Street, Levittown, PA 19057
Facility EPA ID #:	PAD064361926

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

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 Controls" EI

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

Relationship of EI to Final Remedies

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

Duration / Applicability of EI Determinations

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

Current Human Exposures Under Control
Environmental Indicator (EI) RCRIS code (CA725)

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

	Yes	No	?	Rationale/Key Contaminants
Groundwater	X			Meets Site-Specific Standards (SSS).
Air (indoors)[2]			X	1988/89 soils data indicates potential for indoor air issue but analytical info is dated.
Surface Soil (e.g., <2 ft)		X		
Surface Water		X		
Sediment		X		
Subsurface Soil (e.g., >2 ft)	X			Meets SSS.
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 support documentation demonstrating that these "levels" are not exceeded.

_____ 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.

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

Rationale and Reference(s):

The information provided herein has been detailed in the Environmental Indicator (EI) Report, to which these checklists are an appendix. References to tables and figures provided in the discussion below refer to the tables and figures in the EI Report. Additionally, superscript numbers in the text herein apply to the reference documents presented in Appendix A of the EI Report. The former Childers Site (Site or Facility) has undergone investigation and groundwater remediation, with subsequent reporting and liability release per the Pennsylvania Department of Environmental Protection (PADEP) Land Recycling and Environmental Remediation Standards Act, Chapter 250, Administration of Land Recycling Program ('Act 2', June, 1997) (25 Pa. Code §§250.1 - 250.708), as revised November 24, 2001. The standards and requirements of Act 2 have been applied to the evaluation presented herein. As documented in the EI Report and the EI Vapor Intrusion (VI) to Indoor Air Pathway checklist (also located in this Appendix), any current assessment of the VI pathway has been in accordance with the PADEP Land Recycling Program's "Section IV.A.4 – Vapor Intrusion into Buildings from Groundwater and Soil Under the Act 2 Statewide Health Standard" Technical Guidance Manual, effective January 24, 2004. The PADEP VI guidance is closely modeled after the USEPA VI Guidance.

[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.

Background

In 1988, a tank tightness test indicated that a 4,000 gallon underground storage tank (UST) was leaking xylenes at a rate in excess of two gallons per hour. This 4,000 gallon UST was located inside the Site industrial building, beneath the concrete slab floor. Initial soil sampling was conducted by M&R Soil Investigations, Inc. of Hammonton, NJ, which indicated that xylene concentrations in the soil close to the UST were as high 8,100 mg/kg (**Table 2**). The PADEP was notified of the release and ERM-EnviroClean (ERM) was contracted to perform a Phase I hydrogeologic investigation to assess the nature and extent of soil and groundwater contamination, the results of which were documented in ERM's January 31, 1989, report[(5)]. The investigation included completion of a soil vapor survey screen, subsurface soil sampling, the installation of seven groundwater monitoring wells (MW-1 through MW-7, locations shown on **Figure 3**), slug testing of the monitoring wells, and the performance of a 24-hour pump test.

Based on the results of the Phase I hydrogeologic investigation, ERM recommended remedial action to include in-place abandonment of the leaking xylene UST and installing a groundwater remediation system. The presence of the building above the contaminated soil was cited as an effective cap. Additionally, following review of the January 31, 1989, hydrogeologic investigation report, PADEP recommended that further field investigation activities be performed to better characterize the extent of the soil and groundwater contamination prior to deciding upon specific remedial action.

The Phase II hydrogeologic investigation, which was performed in October 1989, included the following tasks:

- Abandonment of the 4,000 gallon xylene UST;
- Evaluation of the groundwater for tidal effects from the tidally-influenced Delaware River;
- Removal of free product from any monitoring wells;
- Further delineation of soil contamination by conducting a follow-up soil gas survey and advancement of more soil borings; and,
- Further characterization of the groundwater contaminant plume through additional sampling of the existing wells and through the installation of two new monitoring wells (MW-8 and MW-9, as shown on **Figure 3**).
- Completion of a permit and regulatory review to determine the necessary requirements for remedial action.

The results of these two investigations and the subsequent groundwater remediation (which was conducted form 1993 to 1996) and Act 2 reporting and PADEP-granted liability release are discussed, as applicable for specific site media, in the following sections.

Groundwater

Historical groundwater analytical results, collected from 1988 through 1998, are provided in **Table 3** and are screened against the Act 2 Non-Residential (NR) Used-Aquifer Statewide Health Standard (SHS) Medium-Specific Concentrations (MSCs) for groundwater. Based on the groundwater sampling, the wells most impacted by the release from the xylene UST were MW-3 and MW-5. Additionally, the results revealed the presence of 1,1,1-trichloroethane (TCA) and tetrachloroethene (PCE) in the two upgradient wells (MW-1 and MW-2).[(5)] Water levels obtained during the investigation indicated that groundwater was an average of seven feet below grade at the Site with flow was to the east-southeast at a gradient of 0.35 feet per 100 feet. The groundwater velocity was estimated at 1.1 feet per day. The results of the Phase II hydrogeologic investigation, as documented by ERM in their January 31, 1990, report, indicated that the groundwater contaminant plume had diluted and migrated off-site and now extended beneath the neighboring building to the southeast (Northeast Engraving).

The subsurface observations made during the hydrogeologic investigation indicated that the soils in the vicinity of the Site are fluvial deposits which consist of Olean gravel outwash, a brown poorly sorted, dirty, sandy gravel with numerous boulders; and the silty Binghamton sand, which may be calcareous in places. In addition, interstratified, impermeable clays are commonly encountered within these fluvial deposits. The surficial soils at the Site consist of an upper layer of poorly sorted silt, sand and boulders to an approximate depth of 15 feet below grade. Underlying the upper layer is a layer of medium grained, well sorted sand, with an approximate thickness of 20 feet. Underlying this sand at an approximate depth of 35 feet below grade is a stiff clay layer that serves to define the lower boundary of the surficial aquifer.[(5)]

A Remedial Action Plant (RAP), prepared by ERM and submitted in August 1992, and the Design Engineers Report included within the RAP report, addressed the scope of work required to remediate the groundwater contamination at the Site[8]. The chosen remediation system consisted of a groundwater recovery system with five recovery wells (RW-1, and VE-1 through VE-4), an air stripper, a post air stripper iron removal phase, soil vapor extraction using VE-1 through VE-4, a thermal oxidizer for destruction of vapor phase volatile organic compounds (VOCs), and an infiltration system consisting of four injection wells for reinjection of treated groundwater.[8]

Operation of the groundwater remediation system began in November 1993. The system ran for approximately three years, at which time Childers petitioned PADEP to shut down the remediation system.[11] ERM stated that a review of the groundwater influent and monitoring well analytical data during the system operation revealed that there was no consistent decrease in the concentration of VOCs in the air stripper influent and that there was no apparent decrease in the concentrations of VOCs in the monitoring wells (see **Table 3**). The groundwater extraction rates had declined from 10 gallons per minute (gpm) at startup in November 1993 to 1 gpm in July 1996, due to iron fouling that reduced reinjection capacity and increased remediation system maintenance. PADEP granted approval to Childers to shut down the system in August 1996, with the condition that the Facility continue to perform quarterly monitoring well sampling.[12]

The most recent groundwater analytical results are from April 22, 1998, which revealed the presence of several VOCs [1,1-dichloroethane (DCA), 1,1-dichloroethene (DCE), ethylbenzene, methylene chloride, PCE, toluene, 1,1,1-TCA, trichloroethene (TCE), and total xylenes] in excess of the Act 2 NR Used-Aquifer SHS MSCs for groundwater in one or more of the following wells: MW-2, MW-3, MW-5, MW-8, MW-9, PW-1, and RW-1.[13]

On behalf of Childers, ERM submitted a Revised Act 2 Final Report to PADEP on November 11, 1998, providing the information necessary to obtain Site closure and liability protection using Site-Specific Standards (SSS) for compounds in soil and groundwater exceeding the SHS. The report included the following:

- A review of the previous investigations and reports conducted by ERM;
- A summary of the groundwater monitoring results;
- An Act 2 Human Health Risk Assessment (HHRA);
- An Act 2 Soil and Groundwater Evaluation;
- Identification of sensitive receptors;
- Evaluation of exposure pathways;
- Results of fate and transport (F&T) of Site compounds in groundwater; and,
- Development of Risk-Based Screening Levels (RBSLs) for comparison to the modeling results.[13]

ERM concluded the following:

> "Institutional controls prohibiting on-site use of groundwater for potable purposes will be sufficiently protective of human health at the Site. Groundwater fate and transport modeling and risk assessment were used to demonstrate that no unacceptable impacts to human health would be posed to potential receptors downgradient of the Site, either through direct contact with groundwater or through inhalation of organics volatilized from groundwater into enclosed spaces. SSS were developed for benzene, 1,1-DCA, 1,1-DCE, 1,2-DCE, ethylbenzene, methylene chloride, PCE, toluene, 1,1,1-TCA, TCE, and total xylenes."[13]

In a letter dated December 10, 1998, PADEP granted Act 2 closure and approved the following SSS for the Childers facility, which represent the maximum detected concentrations of each of the VOCs detected in the on-site groundwater:[14]

SSS for Groundwater (ug/L)	
Benzene	36
1,1-DCA	2,900
1,1-DCE	1,000
1,2-DCE	110

Ethylbenzene	750,000

(Continued on the following page)

SSS for Groundwater (ug/L)	
Methylene chloride	17,000
PCE	210
Toluene	21,000
1,1,1-TCA	9,300
TCE	340
Xylenes (Total)	4,600,000

The possible exposure pathways to Site-impacted groundwater include the following, the completeness of which are further described below:

- On-site direct contact (ingestion, dermal contact) by on-site non-residential receptors;
- Off-site direct contact (ingestion, dermal contact) by residents or nearby non-residential receptors;
- Diffuse discharge to the nearest surface water body (Delaware River, located 1-mile east of the Site), thereby reaching potential ecological or human receptors; and,
- Volatilization from groundwater to indoor air.

The majority of residents within a three-mile radius of the Site are served by public water. ERM requested a well search from the Pennsylvania Geological Survey on September 18, 1997, for a 0.5-mile radius of the Site to determine the number of residents relying on private wells for potable water. The well search indicated that four registered wells were located within the search radius, with one of the wells (Well X0180) positioned 2,000 feet hydrologically downgradient of the Site. According to the local municipal code for Bristol Township, it was a violation for the property owner not to be connected to the municipal water supply. The well was located at 1808 Grieb Avenue, which is a residential property and, at the time of the investigation, the well was in fact being utilized as a potable water well by the owner of the property in violation of the local code.[13]

Childers was required to complete two consecutive quarterly rounds of sampling of the well at 1808 Grieb Avenue, as a condition of the PADEP Act 2 closure letter, dated December 10, 1998. The first round of sampling was conducted on May 13, 1999, and revealed maximum concentrations of 68 ug/L of TCE and 120 ug/L of PCE. The second round of sampling was conducted on August 20, 1999, and revealed maximum concentrations of 84 ug/L of TCE and 140 ug/L of PCE.[15] The Act 2 Residential Used Aquifer MSCs for both of these compounds is 5 ug/L. Xylenes were not detected in the residential well. According to a Quick Domenico (PADEP-recommended) F&T modeling exercise completed by ERM, the concentrations of TCE and PCE predicted at this well, based on concentrations of these compounds at the Site, was expected to be 0 ug/L. Therefore, it was summarized and accepted by the PADEP as unlikely that the compounds detected in this residential well originated from the Childers facility.

ERM, in their 1998 PADEP-approved Act 2 Final Report, concluded that groundwater F&T modeling and risk assessment demonstrated that, for downgradient residential and non-residential properties, there were no unacceptable risks to human health via direct contact with Site-impacted groundwater or through inhalation of organics volatilized from groundwater into enclosed spaces. Additionally, implementation of a deed restriction against Site groundwater use was deemed to be sufficiently protective of the human-health of on-site receptors. However, because groundwater on-site is an average of seven feet below grade, there is the potential for on-site or nearby off-site receptors to come in contact with impacted groundwater during excavation activities (for instance during future construction or utility work). Based on the materials reviewed by URS, there is no specific mention of deed amendment language to address this pathway (i.e. indication of where such impacts may occur and instruction for proper personal protective equipment (PPE) use when conducting subsurface activities in these areas at depths below the water table). Although exposure routes via this pathway are likely insignificant in comparison to, for instance, the ingestion route, it is recommended that such language be added to the deed, if appropriate. Furthermore, no known deed restriction was applied against groundwater use at the neighboring property to the southeast (formerly Northeast Engraving), under which the groundwater plume was also defined. Although groundwater was not used at this property at the time closure was granted, protection against future use should be implemented.

Based on the results of the F&T modeling conducted for the Grieb Avenue well, which was located 2,000 feet downgradient of the Site, the groundwater discharge-to-surface water pathway is incomplete (i.e. Site contaminants do not travel the one-mile downgradient distance to the Delaware River).

As discussed in the "Indoor Air" section, herein, there have been no exceedances of the default residential VI screening criteria in the Site's point-of-compliance (POC) wells and four exceedances of the default NR VI screening criteria for ethylbenzene in groundwater samples historically collected at the Site. All detected concentrations of VOCs in groundwater samples collected between October 1996 and April 1998 (eight sampling quarters) were below the NR default screening criteria. Therefore it is presumed that current concentrations of VOCs in groundwater, if present, are still below the default VI criteria, indicating an incomplete pathway to indoor air from volatilization of VOCs in Site groundwater.

Soils (Surface and Subsurface)

There have been no known releases to Site surface soils (0 to 2 feet below grade). Subsurface (>2 feet below grade) soil sampling was performed at the Site in 1988 as part of the initial discovery of the leaking 4,000 gallon xylene UST and during the Phase I and Phase II hydrogeologic investigations conducted by ERM. The historical soil sample results are presented in **Table 2** and are screened against Act 2 NR MSCs. Exceedances of the referenced Act 2 NR MSCs for xylenes and ethylbenzene occurred at boring B-5, and, with the exception of boring B-17, where toluene, 1,1,1-TCA, and 1,1-DCA were also detected, the occurrence and distribution of the xylene soil contamination appeared to be restricted to the area close to the 4,000 gallon xylene UST, beneath the building's concrete slab floor.[5] These results were confirmed during the Phase II soil sampling conducted in 1989. No additional soil sampling was conducted after 1989, because the majority of the contaminated soil was located beneath the concrete slab floor of the building and along the eastern side of the building beneath asphalt pavement.

In the Act 2 Final Report prepared for the Site in November 1998, ERM concluded the following:

> "A small number of volatile organics were identified in historic soil sampling activities at levels above the current Act 2 SHS for direct contact with soils and for migration via the soil-to-groundwater pathway. The engineering controls already in place (capping of these locations with asphalt and concrete) in conjunction with the deed restriction prohibiting residential development of the property will be sufficiently protective of human health at the Site. SSS were developed for 1,1-DCA, ethylbenzene, methylene chloride, 1,1,1-TCA, TCE, and total xylenes."[13]

In a letter dated December 10, 1998, PADEP granted Act 2 closure and approved the following SSS for the Childers facility, which represent the maximum detected concentrations of each of the VOCs detected in the on-site soils:[14]

SSS for Soils (mg/kg)	
1,1-DCA	13
Ethylbenzene	1,600
Methylene chloride	7.8
1,1,1-TCA	780
TCE	52
Xylenes (Total)	15,000

To date, as a result of completion of the Act 2 program, no soil removal activities have been conducted at the Site.

Possible exposure pathways to Site-impacted soils include the following:

- On-site direct contact by non-residential receptors;
- Leaching to groundwater via the soil-to-groundwater pathway; and,
- Volatilization from soil to the indoor air of the former Childers Products building.

While soil sample results from 1988 and 1989 contained exceedances of the PADEP Act 2 NR MSCs, the former Childers building and asphalted area on the eastern side of the building currently act as an effective barrier, eliminating contact by on-site receptors (both human and ecological) to the underlying contaminated soil. However, exposure by construction or utility workers could occur in the future, should the building be razed or asphalt disturbed. It is unclear whether deed restrictions have been applied which identify that the cap (building/asphalt) is not to be disturbed or, if it is, that appropriate PPE be used to mitigate risk.

The soil-to-groundwater pathway is currently complete, though the building cap likely reduces direct leaching of constituents from the underlying site soils into the groundwater (rather the natural variation in the water table is the likely mechanism by which soil contaminants are introduced to the groundwater). However, as discussed previously, groundwater conditions have been evaluated and shown to meet the SSS sought for and granted by the 1998 PADEP Act 2 closure.

The vapor intrusion pathway from soils to indoor air has been evaluated in detail in the following section, the results of which indicate that this pathway to non-residential receptors working in the current Modern Blending (former Childers) building, is potentially complete. However, it is unknown if natural attenuation of xylenes and other Site constituents has occurred since the 1988/89 soils data was collected, thus reducing the magnitude or completeness of the pathway. This pathway was not part of the Act 2 regulatory program at the time the Final Report was submitted and closure granted (1998) and the rationale at the time was that, since the building was slab on grade, the indoor air pathway was incomplete.

Indoor Air

The on-site indoor air pathway was not evaluated per current regulations as part of the previous site investigations because this pathway was not part of the Act 2 regulatory program at the time the Final Report was submitted (1998) and the rationale at the time was that, since the building was slab on grade, the indoor air pathway was incomplete. Therefore, to evaluate potential risks to on-site indoor air quality at the Childers building from the contaminated soil and groundwater, URS compared results of detected VOCs in the soil and groundwater samples (**Tables 2 and 3**) collected between 1988 and 1998, as reported in ERM's Act 2 Final Report[13], to current PADEP Default NR Volatilization to Indoor Air Screening values. The default screening criteria can only be used in situations where impacted environmental media are located within 100 feet of an occupiable building, presuming the following conditions have been met:

- There is no separate phase liquid present;
- There are no preferential pathways for vapor migration from the impacted environmental media to the building; and,
- At least five feet of soil or soil-like (not sand) material must be present between the impacted media and the occupiable building.

The results of this screening are discussed in the following paragraphs.

There have been four exceedances of the default NR VI screening criteria for ethylbenzene in groundwater samples historically collected at the Site, as shown below:

Compound	**Act 2 GW MSC, NR Used Aquifer (ug/L)**	**Act 2 Default NR VI Criteria (ug/L)**	**MW-3** 8/13/88 (ug/L)	**MW-5** 1/14/94 (ug/L)	**MW-5** 3/27/95 (ug/L)	**MW-5** 6/27/96 (ug/L)
Ethylbenzene	700	45,000	100,000	750,000	65,000	100,000

Although xylene was detected in high concentrations in the groundwater, this compound is considered to be "not of concern" relative to the VI pathway because the calculated default NR screening criteria is above its water solubility. As noted in **Table 3**, all detected concentrations of VOCs in groundwater samples collected between October 1996 and April 1998 (eight sampling quarters) were below the default NR screening criteria, therefore it is presumed that current concentrations of VOCs in groundwater, if present, are still below the default NR VI criteria. The groundwater-to-indoor air vapor intrusion screening provided above would also apply to the neighboring Northeast Engraving facility.

To assess potential indoor air impacts to downgradient residences, the analytical results from the POC wells (MW-7, MW-8, MW-9, and RW-1) were also screened against the PADEP Default Residential (R) Volatilization to Indoor Air Screening values (**Table 3**); for which there were no exceedances. Therefore, this default screening evaluation indicates that the vapor intrusion pathway from groundwater impacted by site-related contamination to downgradient residences is incomplete.

Furthermore, the HHRA, submitted with the Act 2 Final Report for the Site, assessed the indoor air pathway from off-site groundwater by calculating RBSLs for an industrial receptor 500 feet from the Site and using groundwater F&T modeling to estimate concentrations at this non-residential structure. The modeled groundwater concentrations were less than the calculated RBSLs. As discussed further in Section 4.2 of the EI Report, ERM also used groundwater F&T modeling to estimate applicable VOC concentrations approximately 2,000 feet downgradient of the Site for a known residential well. This groundwater modeling predicted concentrations for Site VOCs lower than drinking water standards, which was deemed protective of indoor air for off-site residences.[14]

URS also evaluated the results of the soils samples collected at the Site by M&R Soil Investigations, Inc., and ERM in August 1988 and October 1989.[5,6,13] These soil samples were collected from borings located in the immediate vicinity of the former 4,000 gallon xylene UST. Exceedances of the default NR VI screening criteria in these soil samples, as highlighted on **Table 2**, are summarized below:

Compound	Act 2 NR SGW MSC Used Aq (mg/kg)	Act 2 Default NR VI Criteria (mg/kg)	Soil sample results in mg/kg						
			M&R B-1 6-8' 8/4/88	M&R B-1 10-12' 8/4/88	M&R B-2 2-4' 8/4/88	M&R B-2 6-8' 8/4/88	M&R B-2 10-12' 8/4/88	M&R B-3 2-4' 8/4/88	M&R B-3 6-8' 8/4/88
1,1-DCA	11	2.7							
Ethylbenzene	70	9.5	79	30	84	360	170	490	1,400
1,1,1-TCA	20	170							
TCE	0.5	2.2				3.1	3.2	4.5	4.6
Xylenes	1,000	77	640		830	3,000	6,100	3,400	7,200

Compound	Act 2 NR SGW MSC Used Aq (mg/kg)	Act 2 Default NR VI Criteria (mg/kg)	Soil sample results in mg/kg					
			M&R B-3 10-12' 8/4/88	M&R B-5 2-4' 8/4/88	M&R B-5 6-8' 8/4/88	M&R B-5 10-12' 8/4/88	Ph. I B-2 2' 8/23/88	Ph. I MW-3/B-5 6' 8/24/88
1,1-DCA	11	2.7			13			
Ethylbenzene	70	9.5	620	10	1,500	630	26	1,600
1,1,1-TCA	20	170			780	310		
TCE	0.5	2.2	7.4		19	52		
Xylenes	1,000	77	3,000	98	8,100	3,500	140	15,000

As shown in this summary and the screening in **Table 2**, four of the above samples that exceed the default screening criteria, also do not meet the required assumptions for use of the screening criteria because they were collected from sample intervals shallower than five feet below grade.

Therefore, to further evaluate the pathway on a site-specific basis, URS conducted several preliminary modeling exercises using the PADEP/USEPA-recommended Johnson & Ettinger (J&E) vapor intrusion model, the input and results for which are summarized below:

- Depth below grade to bottom of enclosed space floor (cm): 15 cm, the default value recommended by PADEP.
- Depth below grade to top of contamination (cm): Varies, depth to the middle of the sample interval for key soil samples that were evaluated, presuming slab-on-grade construction.

- Average temperature (°C): 11.1 °C, the default value recommended by PADEP.
- Vadose zone soil type: Loamy sand (LS), as determined during soil boring and monitoring well installations on site (see Section 2.4.1).
- Target risk for carcinogens: 1E-5, default value recommended by PADEP.
- Cumulative target risk for carcinogens: 1E-4, default value recommended by PADEP for site-specific vapor intrusion assessments.
- Target hazard quotient (HQ) for noncarcinogens: 1, default value recommended by PADEP.
- Averaging time for carcinogens (years): 70 years, default value recommended by PADEP.
- Averaging time for noncarcinogens (years): 25 years, default value for non-residential scenarios as recommended by PADEP.
- Exposure duration (years): 25 years, default value for non-residential scenarios as recommended by PADEP.
- Exposure frequency (days/year): 250, default value for non-residential scenarios as recommended by PADEP.

Sample Evaluated	Compounds Evaluated	NR Carcinogenic Risk	NR Hazard Quotient**
B-5/MW-3, 6' bgs	Xylenes*	NA	260 to 380
M&R B-3, 2-4' bgs	Ethylbenzene, Toluene, TCE, Xylenes	0.19	737
M&R B-5, 2-4' bgs	Ethylbenzene, Xylenes	NA	344

*The J&E model only allows for selection of o-, m-, or p-xylene, not total. The B-5/MW-3 scenario was conducted for each of the three xylene isomers, thus a range for the HQ is provided. To provide the most conservative result, the isomer resulting in the highest HQ, p-xylene, was thereafter selected in the remaining scenarios to represent total xylenes.
**Several concentrations of compounds evaluated were high enough to be considered saturated. The results represent risk as calculated by the model at saturation (i.e. at concentrations less than the detected result).
bgs = below ground surface
NA = Not Applicable; compounds evaluated are non-carcinogens.

The samples chosen for evaluation were selected from those exceeding the default screening criteria, as presented on previous page, based on the following rationale:

- The xylenes result at B-5/MW-3 at 6 feet below grade was the maximum detection of all of the VOCs in the sample set, thus representing a worst-case evaluation;
- The VOCs detected in the M&R B-3 boring from 2 to 4 feet below grade represented the most VOCs detected at highest concentrations in a shallow (less than five feet below grade) sample, thus representing a worst-case evaluation; and,
- The VOCs detected in the M&R B-5 boring from 2 to 4 feet below grade represented the least number of VOCs detected at lowest concentrations in a shallow (less than five feet below grade) sample, thus representing a best-case evaluation.

These site-specific modeling exercises further indicate that, based on the available data from 1988/89, the VI pathway from soils to indoor air of the current Modern Blending (former Childers) building, is potentially complete (results exceed target cumulative carcinogenic risk of 0.0001 and HQ of 1). However, it is unknown if natural attenuation of xylenes and other Site constituents has occurred since data was collected, thus reducing the magnitude or completeness of the pathway. Further evaluation, either via collection of sub-slab vapor samples, indoor air sampling, and/or soil sampling with follow-up screening is warranted to provide a current assessment of this pathway and to determine if possible implementation of controls, such as building/vapor venting or pressurization or source removal, is warranted.

Lastly, exposure to on-site workers via the indoor air pathway can also be attributed to regular plant operations due to the usage of solvents, paints, etc. It is presumed that this exposure was/is controlled by compliance with OSHA regulations, however documentation of this nature was not reviewed as part of the scope of this EI.

Surface Water and Sediment

The nearest surface water is the Delaware River, located about one mile east (downgradient) of the Site. The Delaware River makes up the border between Pennsylvania and New Jersey. It travels southwesterly near the Site until it reaches the Delaware Bay. As discussed in detail in Section 4.2 of the EI Report, there are two surface water intakes on the Delaware River for potable water supply within three miles of the Site; one located 1.3 miles east of the Site in Tullytown, PA, and another approximately four stream miles south of the Site. Based on the results of the F&T modeling conducted for the Grieb Avenue well, located 2,000 feet downgradient of the Site, the groundwater discharge-to-surface water pathway is incomplete (i.e. Site contaminants do not travel the one-mile downgradient distance to the Delaware River).

There are two lakes within three miles, but not downgradient, of the Site. Silver Lake is 1.5 miles south of the Site and Van Sciver Lake is about 2 miles northeast of the Site.[7] Additionally, there are two wetlands larger than five acres within a ½-mile, but again not downgradient, of the Site. These palustrine wetlands are south of the Site near the 3M Airport.
Site drainage is either via overland flow or via storm sewers located on Hartel Street.

URS reviewed a copy of the Childers facility's NPDES Permit (No. PAR23005), dated February 23, 1996. The Site had one outfall (001), which ultimately discharged to the Delaware River. The source of Outfall 001 was the process and material storage roofs, loading dock and drum storage area, as well as valve controlled runoff from diked storage tanks.[21]

There is no documentation indicating that direct or diffuse releases from the Site have impacted surface waters or sediment in the vicinity of the former Childers facility.

Outdoor Air

As discussed in detail in Section 2.3.2 of the EI Report, Childers Products maintained an air permit for their emission sources when the Facility was in operation, and there were minimal violations of these permit requirements. Based on general compliance of the air permit during the Facility's operating period and because there are currently no active emission sources associated with the Site, it is presumed that there are no outdoor air issues as a result of the former Childers facility.

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	Daycare	Construction	Trespassers	Recreation	Food[3]
Groundwater							
Air (indoors)							
Soil (surface, e.g., <2 ft)							
Surface Water							
Sediment							
Soil (subsurface e.g., >2 ft)							
Air (outdoors)							

Instructions for Summary Exposure Pathway Evaluation Table:

1. Strikeout 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.

_____ 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):

No rationale warranted.

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

4. Can the **exposures** from any of the complete pathways identified in #3 be reasonably expected to be **"significant"** (i.e., potentially[4] " unacceptable" levels) because exposures can be reasonably expected to be: 1) greater in magnitude (intensity, frequency and/or duration) than assumed in the derivation of the acceptable "levels" (used to identify the "contamination"); or 2) the combination of exposure magnitude (perhaps even though low) and contaminant concentrations (which may be substantially above the acceptable "levels") could result in greater than acceptable risks)?

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

_____ 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):

No rationale warranted.

[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 a "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 a "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):

No rationale warranted.

Current Human Exposures Under Control
Environmental Indicator (EI) RCRIS code (CA725)

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

_____ YE – Yes, "Current Human Exposures Under Control" has been verified.

_____ NO – "Current Human Exposures" are NOT "Under Control."

X IN – More information is needed to make a determination.

Completed by: signed Date 6-18-10

Hon Lee

Project Manager – 3LC30

Supervisor: signed Date 6-18-10

Paul Gotthold

Associate Director, Office of PA Remediation (3CL30)

EPA Region III

Locations where References may be found:

A list of all reference documents is appended to the EI Report. Copies of the reference documents can be found at USEPA's Region III office in Philadelphia or PADEP's Southeast Regional office in Norristown, PA.

Contact telephone and e-mail numbers:

Hon Lee

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

Facility Name: Childers Products
EPA ID #: PAD064361926
Location: 2061 Hartel Street, Bristol, Pennsylvania

CURRENT HUMAN EXPOSURES UNDER CONTROL (CA 725)