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25 September 2012

Ms. Mirtha Capiro
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics Division
US EPA Region 5
77 West Jackson Boulevard (DE-9J)
Chicago, IL 60604-3590

Re: 2010 Revised Baseline Risk Assessment Report – Errata Notice and Replacement Page
Rohm and Haas Chemicals LLC
Cincinnati Plant, Reading, Ohio

Dear Ms. Capiro:

On behalf of Rohm and Haas Chemicals LLC, Parsons is submitting two hard copies of a replacement page for the 2010 Revised Baseline Risk Assessment Report for the facility located in Reading, Ohio. It was recently brought to our attention by the facility environmental specialist that the report mistakenly states that ***methylene chloride*** was a raw material used at the facility (page 4, first line of the last paragraph). In fact, the facility uses ***methyl chloride*** (also synonymous with chloromethane) as a raw material, not methylene chloride. This text change does not affect the results or conclusions of the report. Please forward a copy of this replacement page to others who may have received the 2010 Revised Baseline Risk Assessment Report or have them contact me directly to receive the replacement page.

If you have any questions regarding this errata notice, please feel free to contact me at 513-552-7016 or Carl Coker at (215) 785-7193.

Sincerely,

Karen Fields

Karen A. Fields
Project Manager

cc: Carl Coker, Rohm and Haas Chemicals LLC
Willard Vaughn, Rohm and Haas Chemicals LLC

Cincinnati Milling Machine Co., Inc. originally developed the Rohm and Haas Facility for chemical operations associated with the Carlisle Chemical Works, which was acquired in 1948. The operation retained the Carlisle Chemical Works name from 1949 to 1970. The name was changed to Cincinnati Milacron Chemicals, Inc. in 1970 as part of the division of Cincinnati Milling Machine Co., Inc. into separate business entities. It operated under that name until 1980, when Carstab, a subsidiary of Thiokol, Inc. (Thiokol), purchased it. Morton International, Inc. and Thiokol merged in 1982, but separated in 1989, at which time Morton retained the ownership and operation of the facility. In 1999, Rohm and Haas purchased all of Morton's assets, and Morton became a wholly-owned subsidiary of Rohm and Haas.

The following chemical products have been manufactured at the Rohm and Haas Facility since approximately 1950:

- Synthetic waxes, used as lubricants in plastic extrusion processes and defoamers in the paper industry;
- Asphalt additives, specifically anti-stripping agents;
- Antioxidants (this process has been sold to another manufacturer and is anticipated to be terminated at the facility);
- Phosphonium salts, used as catalysts for epoxy and powder coatings; and
- Plastic stabilizers, specifically organotin and cyoglycolate organotin stabilizers.

The raw materials used to manufacture these products include metallic tin, methyl chloride, chlorine, ammonia, 2-mercaptyl ethanol, tall oil fatty acid, 2-ethyl hexanol, thioglycolic acid, ethylene diamine, stearic acid, paraffin waxes, ethyl chloride, benzyl chloride, triphenyl phosphene, and others. Chemical intermediates produced on-site include stannic chloride, dimethyl tin dichloride, esters, and glycolates. The Rohm and Haas facility has never been involved in the manufacture, blending, or compounding of pesticides or herbicides, mercury, methyl mercury or tributyltin (oxide). The pesticides and herbicides, which have been detected at low concentrations at and near the site, are likely associated with activities pre-dating chemical manufacture at the site (i.e., dairy farming) or the result of surface water run-off and aerial drift from surrounding industrial use and commercial and/or residential applications of these chemicals. This conclusion is based on the scattered and low concentrations of these compounds that have been detected at the site and the fact that there are no site records indicating manufacture, storage or spills of such compounds at the Site. In addition, it is

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22 October 2010

Ms. Mirtha Capiro
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics Division
US EPA Region 5
77 West Jackson Boulevard (DE-9J)
Chicago, IL 60604-3590

Re: Revised Baseline Risk Assessment – October 2010
Rohm and Haas Chemicals LLC
Reading, Ohio

Dear Ms. Capiro:

On behalf of Rohm and Haas Company, Parsons is submitting two hard copies and one electronic copy of the final revised baseline risk assessment (BRA) for the Rohm and Haas Chemicals LLC facility located in Reading, Ohio. This revised BRA follows current United States Environmental Protection Agency (USEPA) guidance for the performance of risk assessments and addresses USEPA comments on the previous risk assessments, as appropriate.

If you have any questions regarding this revised risk assessment, please feel free to contact me at 513-552-7016 or Carl Coker at (215) 785-7193.

Sincerely,

Karen Fields

Karen A. Fields
Project Manager

cc: Carl Coker, Rohm and Haas

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

SEP 29 2010

LU-9J

**VIA ELECTRONIC MAIL AND
CERTIFIED MAIL
RETURN RECEIPT REQUESTED**

Carl J. Coker
Rohm and Haas Company
Engineering Division
3100 State Road
Croydon, Pennsylvania 19021

Re: Revised Baseline Risk Assessment
Rohm and Haas Chemicals, LLC
U.S. EPA ID No. OHD 000 724 138

Dear Mr. Coker:

The United States Environmental Protection Agency (U.S. EPA) has reviewed the June 2010 draft revisions to the Baseline Risk Assessment (BRA) for Rohm and Haas Chemicals LLC (ROH). Parson prepared and submitted the BRA revisions on behalf of ROH. In addition, U.S. EPA consulted with the Ohio Environmental Protection Agency with regards to implementation of water quality criteria for the Ohio River Basin under the Ohio Administrative Code.

U.S. EPA considers that ROH's proposed draft revisions are adequate. U.S. EPA hereby approves the BRA on the condition that ROH incorporate all revisions based on the modifications identified in the enclosure to this letter. By October 30, 2010, ROH should submit a Final BRA in accordance with this conditional approval.

In addition, please contact me to plan for effective dialogue on resolving any potential information gaps in support of the agency's development of a Statement of Basis. The Statement of Basis will summarize the environmental conditions at the facility, describe evaluated remedial alternatives, and present and explain the proposed remedy for the ROH facility.

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For any questions regarding this letter, please contact me at (312) 886-7567 or at capiro.mirtha@epa.gov.

Sincerely,

Mirtha Cápiro
Project Manager/Coordinator
Land and Chemicals Division
Remediation and Reuse Branch
Corrective Action Section 2

cc: Harold O'Connell, OEPA
Thomas C. Nash, C-14J

Enclosure

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (U.S. EPA)
CONDITIONAL APPROVAL

MODIFICATIONS TO
BASELINE RISK ASSESSMENT
FOR
ROHM & HAAS CHEMICALS, LLC (ROH)
CINCINNATI PLANT
READING, OHIO
U.S. EPA ID No. OHD 000 724 138

Section 3.2, Selection of Chemicals of Potential Concern.
Section 6.4, The Potential Future Risk Associated with Migration of Impacted Groundwater to Surface Water
Table 8.11, Comparison of Groundwater Analytical Results and Human Health Surface Water Screening Values.

1. With respect to human health, there appears to be a disconnect between the text from Section 3.2 and the information presented in Section 6.4 and Table 8.11. The draft Baseline Risk Assessment (BRA) should be revised to more clearly present the process of and results from chemical screening for protection of human health in relation to the groundwater-to-surface water migration pathway, including potential future risk. Please refer to U.S. EPA comment 2 below for additional requirements regarding the selection of risk screening criteria.

Section 3.2, Selection of Chemicals of Potential Concern; Section 3.2.3, Surface Water.
Section 4.3, Exposure Quantifications; Section 4.3.1.3, Surface Water.
Section 6.3.1, Data Evaluation and Selection of Chemicals of Potential Concern.
Section 6.4, The Potential Future Risk Associated with Migration of Impacted Groundwater to Surface Water.
Table 1.3, Ocurrence, Distribution and Selection of Chemicals of Potential Concern – Surface Water.
Table 3.3, Exposure Point Concentration Summary - Surface Water.
Table 8.9, Comparison of Surface Water Analytical Results and Human Health Water Screening Values.

2. With respect to the evaluation of human health exposure pathways, the concentrations (total and dissolved) of all constituents detected in seep and surface water should be compared to the Ohio River Basin Human Health Tier I Criteria and Tier II Values under the Ohio Administrative Code (refer to information from the Ohio Environmental Protection Agency (OEPA) at http://www.epa.state.oh.us/portals/35/wqs/Ohioval13.pdf). This requirement also applies to the groundwater to surface water migration pathway. For transparency, ROH should include separate risk screening comparisons for seep and surface water data. Please provide appropriate text and table revisions/additions as necessary to address this comment within the assessment and its conclusions.

Section 4.3, Exposure Quantifications.
Section 7.3.2, Characterization of Exposure Pathways.

3. With respect to mercury, U.S. EPA considers that modeling concentrations in fish tissue would be highly uncertain given the preponderance of potential sources of this chemical that are unrelated to the site as documented in the BRA. The presence of multiple and varying factors that affect mercury uptake and methylation would add complexity to this issue. As a more practical, still conservative, approach, ROH should compare the levels in water to appropriate human health and ecological screening criteria for every identified pathway and provide a discussion of offsite impacts. As shown below, appropriate screening criteria has been laid out in Sections 3.2.2., 3.2.3, 7.2.3 and 7.2.4 (including corresponding tables) from the September 2009 draft BRA and the U.S. EPA comment 2 above. As clarification, the U.S. EPA Region 9 Preliminary Remediation Goals (PRGs) have been harmonized with similar risk-based screening levels used by Regions 3 and 6 into the Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites.

> Human health protection for surface water: a) comparison to the Maximum Contaminant Levels (MCLs) or the U.S. EPA Region 9 PRGs for tap water if an MCL is not available, and b) comparison to corresponding criterion from the OEPA's Ohio River Basin Human Health Tier I Criteria and Tier II Values.
>
> Human health protection for groundwater and groundwater-to-surface water: a) comparison to the MCLs or the U.S. EPA Region 9 PRGs for tap water if an MCL is not available, and b) comparison to corresponding criterion from the OEPA's Ohio River Basin Human Health Tier I Criteria and Tier II Values.
>
> Ecological protection for surface water (inclusive of seep water): a) comparison to the U.S. EPA Region 5 Ecological Screening Levels (ESLs) or surrogate values if Region 5 ESLs were not available, and b) comparison to OEPA's Ohio River Basin Aquatic Life for Outside Mixing Zone.
>
> Ecological protection for groundwater-to-surface water: comparison to OEPA's Ohio River Basin Aquatic Life for Outside Mixing Zone.

U.S. EPA comment 1 from the agency's November 25, 2008, correspondence on the August 14, 2007, draft BRA identified the agency's concern with respect to the need to appropriately characterize the pathway involving ingestion of fish in Mill Creek. Please note that the agency's concern remains valid since such pathway is considered significant. With the exception of mercury, ROH should conduct a quantitative evaluation of the risk from organics and inorganic contaminants involving exposures associated with the ingestion of fish in Mill Creek. Although this pathway is significant with respect to also exposure from mercury, as indicated above it would be appropriate

for ROH to complement the media screening results for mercury with a discussion of offsite impacts. Please revise the BRA to address these requirements. This comment pertains to the above cited and other sections from the BRA as applicable.

Section 7.3.2, Characterization of Exposure Pathways.

4. The BRA should include an evaluation of risks to fish as ecological receptors of concern in Mill Creek. Accordingly, ROH should revise the above cited and other sections of the BRA as applicable.

Section 7.3.3, Exposure Assessment.

5. This comment applies to bioaccumulative compounds whose concentrations are being modeled in fish tissue (refer to U.S. EPA comment 3 above). Please indicate that the intake parameters for mink in Table 12 (e.g., food ingestion rate – fish; and home range) are consistent with (or taken from) the values presented in the U.S. EPA (1993) Wildlife Exposure Factors Handbook. A corresponding citation should be included in the list of references from the BRA.

Section 7.6, Ecological Significance.
Section 8.0, Conclusions.

6. In the revised draft September 2009 BRA, text has been added to Sections 7.6 and 8 in response to U.S. EPA comments on the January 2009 report to include more discussion of risk estimates in concluding sections of the report. However, in addition to the information provided, those concluding sections should be revised to include quantitative indications of ecological risks, such as actual hazard quotients (HQs) for chemicals that exceed 1, rather than summary statements that HQs exceed thresholds. Also, ecological risk estimates should be summarized in the context of site data attributes (e.g., frequency of detection) and local/regional background concentrations (see the following comment for more specific requests regarding reporting of conclusions of the BRA). Note that any evaluation of the environmental medium/habitat would be a consideration at the screening stage and would not belong in risk management discussions. For soils, the lack of extensive suitable habitat for ecological receptor exposures is adequately discussed as part of risk screening. However, discussions on the presence of habitat and ecological receptors in Mill Creek should not be part of risk management arguments on limited exposures and low ecological significance. Refer to U.S. EPA comment 7 for additional information.

Section 8.0, Conclusions.

7. This section should include a detailed summary and analysis of the risk estimates in the context of site data conditions (such as frequency of detection) and background levels of chemicals of potential ecological concern (COPECs). The discussion of conclusions should be put into context with the risk estimate values for the COPECs for each of the receptors, and discussed in the context of local or regional background concentrations of

COPECs. Together, the analyses and supporting rationales need to be sufficiently comprehensive and detailed in terms of hazard quotients and relation to background levels in order to provide support for conclusions regarding the minimal ecological significance or lack of site-specificity in the risk estimates. Moreover, it should be noted in this section that further stream characterization will be undertaken as necessary in consistency with OEPA regulations in coordination with the development and implementation of Corrective Measures under U.S. EPA requirements.

Table 10.2, Comparison of Sediment and Seep Soil Data to ESLs.

8. Table 10.2 has been listed on the Table of Contents as "Comparison of Sediment and Seep Data to ESLs". Please correct the table's title from the listing to specify the screening of soil seep data. Although minor, this correction appears necessary to avoid confusion.

Table 10.3, Comparison of Seep and Surface Water Data to ESLs.

9. For transparency, ROH can consider including separate risk screening comparisons for seep and surface water data. U.S. EPA has previously concurred that the maximum detected surface water concentration collected from the reach of Mill Creek adjacent to the site is to be used for surface water intake calculations for the key receptor species. As stated in Section 7.4.3 of the revised draft September 2009 BRA, the seeps do not produce enough water to support their own aquatic life, and, thus, seep water data were not further evaluated with respect to exposure to key receptor species.

Table 11.4, Determination of Fish Tissue Concentrations.

10. This comment applies to bioaccumulative compounds whose concentrations are being modeled in fish tissue (refer to U.S. EPA comment 3 above). It is not necessary to show food chain multipliers (FCMs) in this table since, for inorganic chemicals, the baseline bioaccumulation factors (BAFs) for trophic level (TL) 3 fish and TL 4 are both assumed to equal the bioconcentration factor (BCF) determined for the chemical in fish (i.e., the FMC is assumed to be 1.0 for both TL 3 an TL 4; they are appropriate to include when modeling from a TL 2 organism up to a TL 3 or TL 4 fish). For example, the arsenic BCF in Table 11.4 is consistent with the range of BAFs reported in U.S. EPA (2003) for higher trophic level fish. Although the FCM values are all listed as 1 and have no impact on the risk calculations, their identification as applicable to TL 3 fish is incorrect (i.e., FCM values to calculate tissue concentrations in TL 3 fish would be greater than 1 and would be applied to tissue concentrations in TL 2 organisms); hence, the FCM column and values should be removed from Table 11.4. For clarification, a footnote to the table could be included that states that because the BCFs and BAFs are specific to TL 3 fish, FCM values were not used in the calculation of fish tissue concentrations, or were assumed to be 1.0.

REFERENCES

U.S. EPA. 2003. Technical Summary of Information Available on the Bioaccumulation of Arsenic in Aquatic Organisms. EPA-822-R-03-032. Office of Science and Technology Office of Water, U.S. Environmental Protection Agency, Washington, DC. December.

U.S. EPA. 1993. Wildlife Exposure Factors Handbook. EPA/600/R-93/187a. U.S. Environmental Protection Agency, Office of Research and Development, Washington, District of Columbia.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF: LU-9J

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VIA ELECTRONIC MAIL AND
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RETURN RECEIPT REQUESTED

Carl J. Coker
Rohm and Haas Company
Engineering Division
3100 State Road
Croydon, Pennsylvania 19021

Re: Revised Baseline Risk Assessment
Rohm and Haas Chemicals, LLC
U.S. EPA ID No. OHD 000 724 138

Dear Mr. Coker:

The United States Environmental Protection Agency (U.S. EPA) has reviewed and prepared comments on the January 2009 revised Baseline Risk Assessment (BRA) for Rohm and Haas Chemicals LLC (Rohm and Haas). Parson prepared and submitted the BRA on behalf of Rohm and Haas. The U.S. EPA's review also considered information from more recent discussions between the agency and Rohm and Haas. The U.S. EPA comments are enclosed.

By September 4, 2009, Rohm and Haas should submit a revised BRA that appropriately addresses the U.S. EPA comments enclosed with this letter. As you know, this expedited due date is agreeable to both U.S. EPA and Rohm and Haas since the parties have previously been engaged in detailed discussions of remaining BRA issues. To facilitate review of the revised document, please provide your submittal electronically using the track changes feature in Microsoft Word or similar device to highlight the revisions being made. We expect to request printed copy(ies) from Rohm and Haas upon BRA approval.

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For any questions regarding this letter, please contact me at (312) 886-7567 or at capiro.mirtha@epa.gov.

Sincerely,

Mirtha Cápiro
Project Manager/Coordinator
Land and Chemicals Division
Remediation and Reuse Branch
Corrective Action Section 2

cc: Harold O'Connell, OEPA
Thomas C. Nash, C-14J

Enclosure

Comments from the United States Environmental Protection Agency (U.S. EPA) on the January 2009 Revised Baseline Risk Assessment

Rohm and Haas Chemicals LLC
Reading, Ohio
U.S. EPA ID No. OHD 000 724 138

GENERAL COMMENTS

1. A number of minor errors in the most recent revisions to the Baseline Risk Assessment (BRA) from the Rohm and Haas Chemicals LLC (Rohm and Haas) facility were noted. A few examples include:

   - Chlorobenzene is still erroneously included in the list of chemicals at the end of Section 7.2.1.
   - In the next-to-last sentence at the bottom of page 100, the text states "...(fish for the mink and benthic macroinvertebrates for the sandpiper), when it should state "...(fish for the great blue heron and benthic macroinvertebrates for the sandpiper).
   - Table 10.2 and Section 7.2.2 (page 73) identify a surrogate screening value for carbazole, but carbazole is not included in Table 10.2.

   Rohm and Haas should revise the January 2009 BRA to correct these errors.

2. Please include as an additional appendix to the BRA the soil data for locations T-1-4 and T-1-6 (sampling date of 11/8/2001), which are being described in Section 2.2. Note that the data from those locations were earlier reported in the Fourth Quarter - October to December 2001 Progress Report. These data should be included in the BRA for documentation purposes.

3. Please include additional narrative clarifying the status of soil sample locations DP21 and DP22. These locations appear in most site figures. However, no description or data related to these locations have been presented under the facility investigation or BRA process.

4. With respect to groundwater, the BRA should clarify that information on chemical characterization and related assessment results will be considered in the development of corrective measures along with future groundwater monitoring data. This would include conditions such as newly detected compounds, changes in frequency of detection, and deviations from historical concentration range.

5. Please refer to the Wildlife Exposure Factors Handbook at http://cfpub.epa.gov/ncea/cfm/wefh.cfm?ActType=default for information on typical pray for Mink and Great Blue Heron with respect to fish ingestion (e.g.,

species and sizes) and provide any revisions necessary to the ecological exposure assessment from the BRA.

6. The discussions on risk characterization often involve narratives summarizing the evaluation of sampling results. Some of these narratives appear to need further clarification. An example would be the text from Section 7.4.2 (page 99) regarding ecological risks from lead in sediment, which reads as follows: "Since the majority of the detected concentrations were below the Region 5 ESLs…" In narratives such as the one from the example, the relationship between the sampling locations exceeding the screening criteria and the total number of locations could be more appropriately expressed in terms of ratios or proportions. As necessary, please revise this and other narratives addressing data evaluation to further clarify the information being presented.

   In Section 6.3.1, a brief revision oversight was noted at the end of the third paragraph. Please note that the sentence "Arsenic could be naturally occurring in the background" has minor significance within the context of the discussion being presented and should be removed. Arsenic is a constituent associated with the facility's processes, which serve as potential source. It should be noted that elevated concentrations of various constituents, among them arsenic, were present in soil at Trench T-1 area prior to soil excavation (refer to soil sampling results from locations T-1-4 and T-1-6). Under those past conditions, elevated concentrations of arsenic in soil may have potentially contributed to migration of leaching into groundwater at the site. Under present conditions, as pointed out elsewhere in the BRA, the concentrations of arsenic from soil at the site are consistent with concentrations in soil from background locations, which are subject to potential influences from other local sources.

   Also, the text related to discussion on risk to benthic macroinvertebrates from page 100 of Section 7.4.2 incorrectly indicates that "no PAH was detected in all seven [sediment] samples". The text should be revised to instead indicate that not all PAHs were detected in all seven sediment samples.

   In addition, the text from Section 7.5.2 indicates that "The evaluation of ecological effects involves the derivation of ecological TRVs for comparison the calculated exposures." Please check text for coherence. Further, please correct typographical error from footnotes to Tables 13.1 through 13.11.

SPECIFIC COMMENTS

Section 3.2.3, Surface Water
Section 4.3.1.7, Fish
Section 7.3.3, Exposure Assessment
Table 11.4, Determination of Fish Tissue Concentrations

1. It is unclear why fish tissue concentrations were not estimated for tributyltin (oxide) and methyl mercury along with the rest of bioaccumulative compounds that were detected in surface water and sediment. It should be assumed that the

concentration of these metals in site media would consist of bioaccumulative forms unless analytical data (e.g., chemical speciation) can show otherwise. Note that no chemical speciation data were collected for metals as part of the facility's investigations, with the exception of chromium. Therefore, the BRA should be revised to include estimated fish tissue concentrations for tributyltin (oxide) and methyl mercury, unless appropriate justification can be provided in text from relevant sections. Justification can be presented in terms of facility process knowledge and other site-specific factors. For example, information from Section 2.1 Setting from the Facility Investigation Report can be cited to assist in clarifying any potential relationship to tributyltin production and use. Tributyltin is associated with certain pesticide manufacturing processes and uses (refer to http://www.epa.gov/waterscience/criteria/tributyltin/draftfs.htm). In contrast, methyl mercury has no industrial uses; it is formed in the environment from the methylation of the inorganic mercurial ion, which is partly derived from industrial sources (refer to http://www.epa.gov/ttn/atw/hlthef/mercury.html#ref1). Knowledge of facility processes would not be helpful in evaluating the abundance of methyl mercury in media at the site.

It is recommended that the total surface water concentration (total water column concentration) of mercury should be used for the estimation of methyl mercury concentrations in fish.

In addition, Section 3.2.3 should be revised to include a description of the process used for selection of chemicals of potential concern (COPCs) in surface water involving potentially bioaccumulative compounds (note that this process has been appropriately described in Section 3.2.4 in relation to sediment).

Section 7.4.2, Sediment, Pages 96-102 (Table 10.2 and Table 15.4 as applicable)

2. This section often references Dutch Intervention Values (VROM, 2006 and 2007, as cited in the BRA) to discuss potential risk to benthic receptors from metals contamination in sediment. As noted in Section 7.4.2, these values are "levels indicative of serious contamination," and thus may be more equivalent to probable effect concentrations rather than low or no effect concentrations. U.S. EPA recommends using low or no effect concentrations for toxicity reference values in ecological risk assessments. Additionally, it appears that most or all of these Dutch values were developed for soils, based on toxicity to terrestrial organisms. It is noted that Region 5 Ecological Screening Levels (ESLs) for soil are available for barium, beryllium, thallium, tin, and vanadium. Accordingly, U.S. EPA has determined that these Region 5 ESLs for soil are more appropriate for use as surrogate values for sediment screening values than the Dutch soil values. Rohm and Haas should revise the Screening Ecological Risk Assessment (SERA) to use Region 5 ESLs for soil as sediment screening values wherever appropriate and to remove the use of Dutch Intervention Values.

It is also unclear why Rohm and Haas omitted discussion of the Ohio Environmental Protection Agency's (OEPA's) Sediment Reference Values (from OEPA 2008b, as cited in the BRA), which include values for barium, beryllium, thallium and vanadium. These values should be considered, as U.S. EPA previously recommended (U.S. EPA 2007, as cited in the BRA). In some cases, OEPA Sediment Reference Values can be used to rule out potential risk to benthic macroinvertebrates (e.g., the OEPA value for barium is 170 milligrams per kilogram (mg/kg) versus the maximum Mill Creek sediment barium concentration of 76.9 mg/kg). These OEPA values could have been used in Table 10.2 to inform the chemical of potential ecological concern (COPEC) selection process (i.e., chemicals with maximum values that are less than OEPA values do not need to be selected as COPECs).

The BRA should be revised to use Region 5 ESLs for soil as sediment screening values wherever appropriate and to remove the use of Dutch Intervention Values. When revising the BRA, Rohm and Haas should also consider the relevance of OEPA sediment values and apply them where appropriate.

Please note that this comment may also affect Table 15.4.

Section 7.6 Ecological Significance
Section 8.0 Conclusions

3. The SERA results described in Section 7.6 and the last bullet from Section 8.0 are said to suggest the potential for risks to ecological receptors in relation to the described facility-related pathways. The text from these sections adds that these potential effects have "minimal ecological significance." In light of its comprehensive review of the most recent BRA revisions, U.S EPA considers the presentation of this type of subjective statement in the BRA as inadequate. In addition, potential impact from changes in screening levels (as outlined in Specific Comment 1) should be considered. These and other applicable sections should be revised to delete subjective statements and provide clear and concise information on risk estimate(s). When appropriate, site specific information can be presented to support the decision-making process.

Section 8.0 Conclusions

4. In addition to the results being presented, this section should summarize findings and considerations regarding the drinking water pathway as described in Section 4.1.2 of the BRA (refer to last portion of that earlier section). Also, the last sentence from the ninth bullet in this section should be expanded to include leaching in groundwater associated with potential migration to the lower aquifer as described in Section 4.2.1 (refer to last sentence from discussion of "leaching (percolation)" from that section).

Table 1.4, Occurrence, Distribution and Selection of Chemicals of Potential Concern – Sediment

5. Table 1.4 inappropriately screens sediment biota against Region 9 Preliminary Remediation Goals for carcinogenic and noncarcinogenic risk. Please revise the table to clearly identify if the purpose of screening is to select COPCs for human ingestion and dermal contact pathway.

Table 11.3, Determination of Benthos Tissue Concentrations

6. Footnotes to this table indicate that the percent total organic carbon (TOC) used in the fish and benthos concentration calculations were based on a measured value from a single sediment sample location (SS-01). Rohm and Haas should clarify whether SS-01 was the only location where TOC was measured, or if not, why the data from this location were used exclusively. This comment is also applicable to Table 11.4.

Table 11.5, Determination of Earthworm Tissue Concentrations

7. The uptake equations for benzo(a)anthracene and benzo(a)pyrene are incorrect and should be corrected (e.g., the equation for benzo(a)anthracene should be Ce = 1.59 * Cs rather than Ce = 2.6 * Cs). Any results calculated using the incorrect equation should also be revised, as needed.

Appendix B, Table B-4

8. This table contains a typographical error regarding reported concentration units for constituents in groundwater. Concentrations units should be expressed in micrograms per liter. This typographical error should be corrected. In addition, note that a similar error appears in the site-wide groundwater monitoring sampling reports, which should also be corrected (e.g., using replacement pages).

References

OEPA, 2008b, Ecological Risk Assessment Guidance Document. Division of Emergency and Remedial Response. www.epa.state.oh.us/derr/rules/RR-031.pdf

VROM, 2007. Dutch Ministry of Housing, Spatial Planning and the Environment. Circular on Remediation of Water Bottoms. Government Gazette, No. 245.

U.S. EPA, 2007. Final Recommended Approach for Development of Groundwater Target Levels, Rohm and Haas Facility, Reading, Ohio. June 25, 2007.

VROM, 2006. Dutch Ministry of Housing, Spatial Planning and the Environment. Circular on Target Values and Intervention Values for Soil Remediation. February 4, 2000.

U.S. EPA, 2003. Technical Summary of Information Available on the Bioaccumulation of Arsenic in Aquatic Organisms. December 2003. http://www.epa.gov/waterscience/criteria/arsenic/tech-sum-bioacc.pdf

U.S. EPA, 1993. Wildlife Exposure Factors Handbook, Volumes I and II. Office of Research and Development. December 1993.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

DEC 1 2 2008

REPLY TO THE ATTENTION OF: DE-9J

VIA ELECTRONIC MAIL AND
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RETURN RECEIPT REQUESTED

Carl J. Coker
Rohm and Haas Company
Engineering Division
3100 State Road
Croydon, Pennsylvania 19021

Re: Revised Baseline Risk Assessment
Additional Comment 23; Modifications to Specific Comments 1, 11 and 20; and Revised Schedule
Rohm and Haas Chemicals LLC
U.S. EPA ID No. OHD 000 724 138

Dear Mr. Coker:

This is a follow up to our letter of November 25, 2008, with comments from the United States Environmental Protection Agency (U.S. EPA) on the August 14, 2007, revised Baseline Risk Assessment (BRA) for Rohm and Haas Chemicals LLC (Rohm and Haas). The purpose of this follow up letter is to issue a new specific comment 23 addressing exposure point concentrations in sediments from Mill Creek and formulate modifications to the previous U.S. EPA specific comments 1, 11 and 20 regarding the fish ingestion pathway and determination of terrestrial plant, earthworm and vole tissue concentrations. The additional comment and modifications are based on recent discussions and electronic mail communication between the agency and Rohm and Haas. In addition, we are revising the schedule for submittal of the revised BRA from January 2 to January 26, 2009.

SPECIFIC COMMENT 23

Section 4.3.1.4, Exposure Point Concentrations, Sediment, Page 29
Table 3.4, Exposure Point Concentration Summary – Sediments

It would be appropriate to calculate the 95% upper confidence level (UCL) value as an alternative exposure point concentration for constituents detected in sediments in the human health and ecological risk assessments. Rohm and Haas should use U.S. EPA's ProUCL 4.0 and

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accompanying technical guidance (http://www.epa.gov/esd/tsc/software.htm) for calculation of 95% UCLs. Rohm and Haas should also adhere to guidance in the following documents:

EPA. 2002. *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites*. OSWER 9285.6-10. U.S. Environmental Protection Agency. December 2002. Available at: http://www.orp.doe.gov/dqo/training/ucl.pdf

EPA. 2006. *On the Computation of a 95% Upper Confidence Limit of the Unknown Population Mean Based Upon Data Sets with Below Detection Limit Observations*. EPA/600/R-06/022. U.S. Environmental Protection Agency, Office of Research and Development, Las Vegas, NV. March 2006. Available at: http://www.epa.gov/esd/tsc/images/EPA%20600%20R-06%20022.pdf

MODIFICATION TO SPECIFIC COMMENTS 1 AND 11

Section 4.2.1, Bioaccumulation, Page 24
Section 6.3.1 Data Evaluation and Selection of Chemicals of Potential Concern, Page 43
Section 7.4.2, Sediment, Pages 84-88

This modification is intended as a supplement to the earliest U.S. EPA comment. In the proposed Fish Ingestion Pathway table provided by Karen Fields of Parson via a December 4, 2008 electronic mail, Rohm and Hass proposes to use 129 grams per meal for the ingestion rate at an exposure frequency of 20 meals per year. The exposure frequency based on professional judgment assumes that recreational fishing in this area is limited to once in a week, four weeks per month in the spring and summer season. With this limited frequency for recreational fishermen scenario, it is less conservative to assume that the fraction of ingestion from the contaminated source contributes only to 10%. Please remove this factor from the fish ingestion intake calculation. Further, in the fish ingestion intake calculation, averaging time should target both carcinogenic risk and non cancer hazard. In the case of carcinogenic risk the averaging time should be 25550 days.

All detected bioaccumulative compounds (as defined in Table 4-2 from the U.S. EPA guidance document entitled "Bioaccumulation Testing And Interpretation For The Purpose Of Sediment Quality Assessment", 2000) should be modeled into fish tissue for the human health and ecological risk assessments. To support the selection of Common Carp as the representative species, the revised BRA should include appropriate documentation, such as available fish data for Mill Creek from the Ohio Environmental Protection Agency, Division of Surface Water Ecological Assessment Unit.

It is recommended that the uptake of metals to fish from waterbodies for the human health and ecological risk assessments should be estimated from dissolved water concentrations of metals (which is the bioavailable form of metals for fish) using Bioconcentration Factors (BCFs), and uptake of organic constituents should be estimated from sediment concentrations using Biota Sediment Accumulation Factors (BSAF)s. Apparently, metals bound to sediments are likely to

be the more insoluble forms of metals and therefore not very bioavailable for fish which have a digestive system. As previously noted in U.S. EPA comments, uptake to fish (for metals) should be estimated based on Mill Creek surface water concentrations, and not seep concentrations. The selected species carp, being an omnivorous fish, consume a diversity of invertebrate life from a range of areas be it the water's surface, within the surface column or from the muddy sediment.

With respect to human health, cumulative risk assessment for recreational fisherman for the whole waterbody should be considered for the sake of completion. For the human fish ingestion pathway, include risk from surface water using BCF for inorganic constituents and risk from sediment using BSAF for organic constituents, and for the dermal and ingestion pathways include risk from surface water and sediments for inorganic and organic constituents.

MODIFICATION TO SPECIFIC COMMENT 20

Tables 11.1 through 11.6, Determination of Terrestrial Plant, Aquatic Plant, Benthos, Fish, Earthworm, and Vole Tissue Concentrations

This modification is intended as an amendment to the earliest U.S. EPA comment. For the sake of completeness, U.S. EPA requests that the concentrations in terrestrial plants, earthworms and voles be corrected in the revised BRA using appropriately revised uptake factors.

By January 26, 2009, Rohm and Haas should submit revisions to the BRA that appropriately address the U.S. EPA comments of November 25, 2008, and the additional comment and modifications enclosed with this letter. Rohm and Haas may opt to submit a marked-up version of the BRA highlighting the changes made, preferably in electronic form alone. Please expect an agency's request for printed copy(ies) upon BRA approval.

For any questions regarding this letter, please contact me at 312/ 886-7567 or at capiro.mirtha@epa.gov.

Sincerely,

Mirtha Cápiro
Project Manager/Coordinator
Land and Chemicals Division
Remediation and Reuse Branch
Corrective Action Section 2

cc: Harold O'Connell, OEPA
Thomas C. Nash, C-14J

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

NOV 25 2008

REPLY TO THE ATTENTION OF:

DE-9J

VIA ELECTRONIC MAIL AND
CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Carl J. Coker
Rohm and Haas Company
Engineering Division
3100 State Road
Croydon, Pennsylvania 19021

Re: Revised Baseline Risk Assessment
Rohm and Haas Chemicals LLC
U.S. EPA ID No. OHD 000 724 138

Dear Mr. Coker:

The United States Environmental Protection Agency (U.S. EPA) has reviewed and prepared comments on the August 14, 2007, revised Baseline Risk Assessment (BRA) for Rohm and Haas Chemicals LLC (Rohm and Haas). The BRA was prepared and submitted to U.S. EPA by Parsons on behalf of Rohm and Haas. The U.S. EPA's review also considered information from the 2007 Site-Wide Groundwater Sampling Report prepared by Parsons for Rohm and Haas, dated March 2008. As indicated by the groundwater sampling report, this most recent data collection event represents ongoing sampling not specifically dictated in the Facility Investigation Workplan, the Administrative Order, or by any agency requirement. The U.S. EPA comments on the BRA are enclosed with this letter.

By January 2, 2009, Rohm and Haas should submit revisions to the BRA that appropriately address the U.S. EPA comments enclosed with this letter. Rohm and Haas may opt to submit a marked-up version of the BRA highlighting the changes made, preferably in electronic form alone. Please expect an agency's request for printed copy(ies) upon BRA approval.

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For any questions regarding this letter, please contact me at 312/ 886-7567 or at capiro.mirtha@epa.gov.

Sincerely,

Mirtha Cápiro
Project Manager/Coordinator
Land and Chemicals Division
Remediation and Reuse Branch
Corrective Action Section 2

cc: Harold O'Connell, OEPA
Thomas C. Nash, C-14J

Enclosure

Comments from the United States Environmental Protection Agency (U.S. EPA) on the
August 14, 2007
Revised Baseline Risk Assessment
from
Rohm And Haas Chemicals LLC
Reading, Ohio
U.S. EPA ID No. OHD 000 724 138

November 25, 2008

GENERAL COMMENTS

1. The August 2007 revised Baseline Risk Assessment (BRA) has been adequately revised to address the majority of the previous comments from the United States Environmental Protection Agency (U.S. EPA); however, a few concerns remain. Below are the U.S. EPA comments on the revised BRA detailing these concerns. Rohm and Haas Chemicals LLC (Rohm and Haas) should make appropriate revisions to address these comments, and submit replacement pages for review and approval.

SPECIFIC COMMENTS

Section 4.2.1, Bioaccumulation, Page 24
Section 6.3.1 Data Evaluation and Selection of Chemicals of Potential Concern, Page 43

1. First, we acknowledge that the text revision from Section 4.2.1 concurs with the Rohm and Haas' September 23, 2005 responses to the U.S. EPA's August 24, 2005 comments on the BRA (see Rohm and Haas' response to U.S. EPA specific comment 5). Second, U.S. EPA has currently identified some concerns with regards to the approach described in Section 4.2.1, as follows:

   > "Bioaccumulation.....This pathway was considered an insignificant exposure pathway and was not quantitatively evaluated .....an independent USEPA [U.S. EPA] evaluation concluded that bioaccumulative contaminants in the Mill Creek were likely the result of adjacent industrial activities (Attachment 1 and 2 of *Final Recommended Approach for Development of Groundwater Target Levels, Rohm and Haas Facility, Reading, Ohio,* June 25, 2007)."

   U.S. EPA considers that the fish ingestion pathway should be quantitatively evaluated. Further COPC refinement can be conducted on the basis of frequency of detection and background data for relevant chemicals and potential contribution from off-site sources as illustrated in *Final Recommended Approach for Development of Groundwater Target Levels.*

Page 61 – "Section 7.1.3.3 Fate and Transport Mechanisms for Non-Site Related Chemicals Detected at the Site." (note: refer to section title and content).
Page 69 – "…thought to be associated with off-site sources…."
Page 89 – "… considered to be non-site related PAHs, pesticides or PCBs….non-site related SVOCs, pesticides and PCBs.."
Page 93 – "To determine the non-site related contamination…"
Page 94 – "… the presence of these chemicals at the site due to surrounding activities…"
Page 95 – "…initially assumed to be site-related, which may overestimate.."
Page 95 – "… dieldrin is likely to be…." (note: it would be appropriate to discuss frequency of detection in site soil and other pertinent site information).
Figure 4, Site Conceptual Model - .."No site related bioaccumulative chemicals of potential concern detected in surface water or sediments."

Section 6.4 The Potential Future Risk Associated with Migration of Impacted Groundwater to Surface Water
Tables 1.2 and 8.10

6. The text from this section describes the screening results shown in Table 8.10. This section should clarify the relationship between Tables 1.2 and 8.10 and provide a justification for the lack of inclusion of pesticides and polychlorinated biphenyls (PCBs) in Table 8.10. Further COPC refinement can consider frequency of detection in related media (e.g., soil-to-groundwater pathway) and background data.

Section 7.1.7, Screening Endpoints, Pages 68-69

7. This section does not specifically discuss the screening values used in Tables 10.1 through 10.3 (i.e., primarily Region 5 Ecological Screening Levels [ESLs]). This section should be revised to clarify the distinction between screening values used in Tables 10.1 through 10.3 and the toxicity values used later in the report (e.g., in Table 15.3). This section should also note that alternate sources of screening values were sometimes used in Tables 10.1 through 10.3, and the rationale for the use of these alternate sources should be provided (e.g., the Region 4 soil value used for tin in Table 10.2).

Section 7.2.1, Soil, Page 70
Section 7.2.2, Sediment, Pages 70-71

8. Review of the BRA revealed discrepancies between the constituents of potential ecological concern (COPECs) listed in this section and those identified in Section 7.4.1 and Table 10.1 (e.g., chlorobenzene is listed as a COPEC in Section 7.2.1, but is not identified as a COPEC in Section 7.4.1 and Table 10.1). Similar discrepancies between Section 7.2.2 and Section 7.4.2 and Table 10.2 were also noted. Based on the Rohm and Haas e-mail dated October 21, 2008, it is understood that the tables accurately identify COPECs detected in soil, and

and provide greater perspective on these risks. The Revised BRA should be revised accordingly.

12. In addition to presenting the wildlife risks based on no observed adverse effect levels (NOAELs) in the table on pages 84-85, the Revised BRA also discusses risks based on lowest observed adverse effect levels (LOAELs) on page 85. It appears that there are errors in the calculation or reporting of these LOAEL-based risks. For example, the NOAEL-based tin HQ for the great blue heron is reported to be 100, while the corresponding LOAEL-based HQ is reported to be 10. Review of toxicity data for tin indicates that the avian NOAEL is 6.76 milligrams per kilogram-day (mg/kg-d), and the LOAEL is 16.9 mg/kg-d (Sample et al. 1996, as cited in the Revised BRA). These toxicity values indicate that the LOAEL is only 2.5 times greater than the NOAEL for tin, not the ten times greater as suggested by the reported HQs. Rohm and Haas should review LOAELs and risk calculations for accuracy and make appropriate revisions in the Revised BRA.

13. While the risk characterization discussion presented in Section 7.4.2 of the Revised BRA is greatly improved from previous versions, additional revisions are recommended. Risks to benthic macroinvertebrates are tabulated, but not discussed, in this section. This section should briefly note these risks, and should refer the reader to Section 7.6 for a discussion of the ecological significance of these risks.

Section 7.5.1.1, Uncertainty Concerning the Selection of COPECs, Pages 88-90

14. This section includes a discussion regarding chemicals with detection limits that exceed screening values; however, the discussion does not provide adequate information for risk managers to determine whether or not the associated uncertainties are acceptable. For surface water and sediment, this section should list all site-related non-detected chemicals with detection limits that exceed screening values, and should consider the following questions for these chemicals:

⇒ Was the chemical detected in soil and/or groundwater? If not, there is minimal uncertainty that the chemical is actually present above risk-based screening values in surface water and sediment.
⇒ For what proportion of the samples do the detection limits exceed screening values?
⇒ By what magnitude do the detection limits exceed the screening values?
⇒ Are there other analytical methods with lower detection limits that could be used if additional sampling were conducted?

This section notes that, "even though the detection limits are indicated as being higher than the screening value, the laboratory may be able to estimate a concentration below the detection limit, using a qualifier to annotate that result." This qualitative statement has little meaning without additional information.

flow purging and sampling techniques for collection of groundwater data at wells MW-EPA-2, UAW04-20, UAW05-20, UA06-20, UAW08-20, UAW10-50, UAW10-80, UAW21-30, and UAW22-20. The BRA conclusions should specify that low-flow purging and sampling techniques will be performed for groundwater data collection supporting further evaluation of the groundwater to surface water pathway and potential migration to the lower aquifer allowing the confirmation of the BRA results and/or modifications as necessary.

Tables 11.1 through 11.6, Determination of Terrestrial Plant, Aquatic Plant, Benthos, Fish, Earthworm, and Vole Tissue Concentrations

20. The Revised BRA has not been revised in accordance with the recommendations discussed under "Specific Comments 22 and 23" in U.S. EPA's October 14, 2005 letter to Rohm and Haas. This letter included two recommendations with respect to uptake factors: 1) earthworm and vole uptake factors should be revised to use values from preferred reference documents, and 2) use of dry weight to wet weight conversion factors should be eliminated in cases where they were inappropriately applied. Given the BRA conclusions that terrestrial exposure pathways are incomplete or insignificant, further revision to uptake factors for terrestrial exposures appears unnecessary at this time. It is important, however, to ensure that risk calculations for aquatic receptors are accurate. Consequently, any errors involving inappropriate application of a dry weight to wet weight conversion factor for aquatic plant, benthos and fish tissue concentrations should be corrected, and all affected tables and text should be revised accordingly. U.S. EPA's October 14, 2005 letter provides a more detailed description of the conversion factor errors.

Table 1.3 Occurrence, Distribution and Selection of Chemicals of Potential Concern – Surface Water
Table 3.3 Exposure Point Concentration Summary – Surface Water

21. Please add appropriate footnote(s) to these tables to clarify the relevance of surface water and seep data.

Figure 4, Site Conceptual Model

22. The notes from this figure refer to the site as the "Morton site" based on previous ownership. Please update text.

PARSONS

2440 Crowne Point Drive • Sharonville • Ohio • 45241 • (513) 326-3040 • Fax (513) 552-7016 • www.parsons.com

14 August 2007

Ms. Mirtha Capiro
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics Division
US EPA Region 5
77 West Jackson Boulevard (DE-9J)
Chicago, IL 60604-3590

Re: Revised Baseline Risk Assessment
Rohm and Haas Chemicals LLC
Reading, Ohio

Dear Ms. Capiro:

On behalf of Rohm and Haas Company, Parsons is submitting three copies of the revised baseline risk assessment (BRA) for the Rohm and Haas Chemicals LLC facility located in Reading, Ohio. This revised BRA follows current United States Environmental Protection Agency (USEPA) guidance for the performance of risk assessments and addresses USEPA comments on the previous risk assessments, as appropriate. The analytical data collected as part of the Facility Investigation conducted in 2001 and 2002, the Revised Facility Investigation conducted in 2003 and 2004, and groundwater data collected through November 2006, were considered in this revised BRA.

If you have any questions regarding this revised risk assessment, please feel free to contact me at 513-552-7016 or Carl Coker at (215) 785-7193.

Sincerely,

Karen A. Fields

Karen A. Fields
Project Manager

cc: Carl Coker, Rohm and Haas

PARSONS

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30 June 2005

Ms. Mirtha Capiro
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics Division
US EPA Region 5
77 West Jackson Boulevard (DE-9J)
Chicago, IL 60604-3590

Re: Revised Baseline Risk Assessment
Rohm and Haas Chemicals LLC
Reading, Ohio

Dear Ms. Capiro:

On behalf of the Rohm and Haas Company, Parsons is submitting three copies of the revised baseline risk assessment (BRA) for the Rohm and Haas Chemicals LLC facility located in Reading, Ohio. This revised BRA follows current United States Environmental Protection Agency (USEPA) guidance for the performance of risk assessments and addresses USEPA comments on the previous risk assessment, as appropriate. The analytical data collected as part of the Facility Investigation conducted in 2001 and 2002, the Revised Facility Investigation conducted in 2003 and 2004, and the most recent groundwater data collected in November 2004, were considered in this revised BRA.

We look forward to meeting you in Chicago on July 26 to discuss the risk assessment results. If you have any questions regarding this revised risk assessment, please feel free to contact me at 513-552-7016 or Carl Coker at (215) 785-7193.

Sincerely,

Karen A. Fields

Karen A. Fields
Project Manager

cc: Jennifer Nystrom, Booz Allen Hamilton (3 copies)
Carl Coker, Rohm and Haas

Baseline Risk Assessment

Morton International, Inc. Facility
Reading, Ohio

Prepared for:

The Rohm and Haas Co.

Prepared by:

Geomatrix Consultants, Inc.
5725 Highway 290 West Suite 200B
Austin, Texas 78735

June 2002

Project No. 7168

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ACRONYMS AND ABBREVIATIONS

1,2-DCA	1,2-dichloroethane
AADD	annual average daily dose
AO	Administrative Order
App. IX-TAL	Appendix IX Target Analyte List
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
CDC	Centers for Disease Control
CLP-TAL	Contract Laboratory Program Target Analyte List
COPCs	chemicals of potential concern
COPECs	chemicals of potential environmental concern
CSS	combined sewer system
DERA	detailed ecological risk assessment
EDQLs	environmental data quality levels
FI	Facility Investigation
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
IRIS	USEPA Integrated Risk Information System
LADD	lifetime average daily dose
LOAEL	lowest observable effect level
MCLs	maximum contaminant limits
µg/l	micrograms per liter
mg/kg	milligrams per kilogram

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MSD	Metropolitan Sewer District
ND	non-detect
NOAEL	no observable effect level
OEPA	Ohio Environmental Protection Agency
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PCE	tetrachloroethene
PERA	preliminary ecological risk assessment
PRGs	USEPA Region 9 Preliminary Remediation Goals
QAPP	Quality Assurance Project Plan
RA	risk assessment
RAGS	Risk Assessment Guidance for Superfund
RBSLs	USEPA Region 5 Risk-Based Screening Levels
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RfDs	reference doses
RFI	RCRA Facility Investigation
RL	reporting limit
RME	reasonable maximum exposure
SCM	site conceptual model
SERA	screening-level ecological risk assessment
SFs	cancer slope factors
SQL	sample quantitation limit
SVOCs	semivolatile organic compounds
SWMUs	solid waste management units
UCL	upper confidence limit
USCS	Unified Soil Classification System
USEPA	U.S. Environmental Protection Agency
VOCs	volatile organic compounds

BASELINE RISK ASSESSMENT
Morton International, Inc.
Reading, Ohio

1.0 INTRODUCTION

This baseline risk assessment (RA) has been prepared by Geomatrix Consultants, Inc. (Geomatrix) on behalf of the Rohm and Haas Company (Rohm and Haas) for the facility at 2000 West Street in Reading, Ohio (the facility or the Morton Facility; Figure 1). The site has engaged in the manufacture of chemical products since approximately 1950, and has been operated by Morton International, Inc. (Morton), a wholly owned subsidiary of Rohm and Haas, or a related entity from the 1980s to the present. This baseline RA has been prepared to meet the requirements of a Section 3013 Administrative Order (AO) issued to Morton on August 18, 2000.

1.1 OBJECTIVES

The purpose of this baseline RA is to provide an analysis of the potential for adverse human health and ecological effects as a result of potential exposure to chemicals in soil and groundwater at the facility and in sediment and seeps at Mill Creek, which is adjacent to the facility. As a baseline RA, it presents an assessment of potential adverse human health effects and a screening evaluation of potential ecological effects under the no-action alternative; that is, the potential effects that may result if no further corrective action of the Morton Facility were to take place. The results of this assessment will indicate if further evaluation, controls, or remediation may be necessary.

1.2 APPROACH

A quantitative human health risk assessment (HHRA) and screening ecological risk assessment (SERA) were conducted to evaluate chemicals detected in soil and groundwater at the Morton Facility and chemicals detected in seeps and sediments from Mill Creek. This baseline RA follows standard and customary practice according to U.S. Environmental Protection Agency (USEPA) guidelines for the performance of risk assessments as specified in the following documents:

> Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual (Part A). USEPA. Office of Emergency and Remedial Response. OSWER Directive 9285.7-0la. September 1989.

Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual (Part D: Standardized Planning, Reporting, and Review of Superfund Risk Assessments). USEPA. Office of Emergency and Remedial Response. OSWER Directive 9285.7-01A. January, 1998).

Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual (Part E: Supplemental Guidance for Dermal Risk Assessment), Interim Final. USEPA. Office of Emergency and Remedial Response. OSWER Directive 9285.7-01e. September 2001.

Ecological Risk Assessment Guidance for RCRA Corrective Action. USEPA Region 5. Chicago, Illinois. 1994.

These documents were supplemented by additional USEPA guidance as necessary. Other guidance documents that were consulted are referenced in appropriate sections and presented in Section 9.0.

1.3 REPORT ORGANIZATION

This report is organized in a manner consistent with the referenced guidance documents. The remaining sections of the report are as follows:

- Section 2.0 – Site Characterization summarizes background information for the site, including location and description, geology and hydrogeology, land and water use, and previous investigations.
- Section 3.0 – Data Evaluation – Human Health Risk Assessment presents an evaluation of the data and the selection of the chemicals of potential concern that are evaluated in the human health risk assessment.
- Section 4.0 – Exposure Assessment – Human Health Risk Assessment presents the analysis of the mechanisms by which human receptors may be exposed to chemicals at this site.
- Section 5.0 – Toxicity Assessment – Human Health Risk Assessment presents the quantitative criteria developed by USEPA to evaluate potential adverse health effects of chemicals.
- Section 6.0 – Risk Characterization – Human Health Risk Assessment presents the results of the quantitative analysis of potential carcinogenic and non-carcinogenic risks to human health and a description of the uncertainty associated with those estimates.
- Section 7.0 – Screening Ecological Risk Assessment presents the process for identification of potential ecological receptors and exposure pathways, screening of

chemicals detected at the site, and identification of potential ecological receptors at the site.

- Section 8.0 – Conclusions presents the results of the baseline RA.
- Section 9.0 – References presents the sources of information cited in the text.

2.0 SITE CHARACTERIZATION

Information summarized in this section is based on the Current Conditions Report (Geomatrix, 2000a), the FI Work Plan (Geomatrix, 2000b), and the FI Report (Geomatrix, 2002). More detailed information is available in these reports.

The Morton Facility consists of a single tract of land totaling 34 acres. Approximately 27 acres comprise the fenced, operational area of the facility and the remaining 7 acres contain baseball fields used by the City of Reading. Chemical products continue to be manufactured at the site 24 hours per day, 7 days per week. The operational portion of the facility consists of approximately 28 buildings, including process, warehouse, office, laboratory, and waste treatment operational structures. The facility also includes approximately 70 aboveground storage tanks (ASTs) for feedstock, product, and waste storage. There are no active underground storage tanks (USTs) at the facility; three previous USTs have been removed or closed in place. The layout of the facility is presented on Figure 2.

2.1 SITE HISTORY

The Morton Facility was constructed in 1949 and commenced chemical manufacture operations in 1950. Prior to 1949, the northern portion of the property was used as a winery or distillery, and reportedly as a smokehouse and fireworks manufacturer. The southern portion of the property was a dairy, farm, and milk bottling facility.

Cincinnati Milling Machine Co., Inc. originally developed the Morton Facility for chemical operations associated with the Carlisle Chemical Works, which was acquired in 1948. The operation retained the Carlisle Chemical Works name from 1949 to 1970. The name was changed to Cincinnati Milacron Chemicals, Inc. in 1970 as part of the division of Cincinnati Milling Machine Co., Inc. into separate business entities. It operated under that name until 1980, when Carstab, a subsidiary of Thiokol, Inc. (Thiokol), purchased it. Morton International, Inc. and Thiokol merged in 1982, but separated in 1989, at which time Morton retained the ownership and operation of the facility. In 1999, Rohm and Haas purchased all of Morton's assets, and Morton became a wholly-owned subsidiary of Rohm and Haas.

The following chemical products have been manufactured at the Morton Facility since approximately 1950:

- Synthetic waxes, used as lubricants in plastic extrusion processes and defoamers in the paper industry;
- Asphalt additives, specifically anti-stripping agents;
- Antioxidants (this process has been sold to another manufacturer and is anticipated to be terminated at the facility);
- Organophosphates, specifically for epoxy catalysts; and
- Plastic stabilizers, specifically organotin and cyoglycolate organotin stabilizers.

The raw materials used to manufacture these products include metallic tin, methylene chloride, chlorine, ammonia, 2-mercaptyl ethanol, tall oil fatty acid, 2-ethyl hexanol, thioglycolic acid, ethylene diamine, stearic acid, paraffin waxes, ethyl chloride, benzyl chloride, triphenyl phosphene, and others. Chemical intermediates produced on-site include stannic chloride, dimethyl tin dichloride, esters, and glycolates.

2.2 PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

As described in the Current Conditions Report, several investigations were conducted at the facility between 1976 and 1992. These investigations included:

- Interviews with plant personnel;
- Collection and analysis of soil samples;
- Collection and analysis of samples from the Mill Creek bank;
- Collection and analysis of samples from Mill Creek seeps;
- Collection and analysis of surface water samples from Mill Creek;
- Installation of monitoring wells and collection and analysis of groundwater samples; and
- Collection and analysis of sediment samples from Mill Creek and its tributary streams.

The only investigation activity conducted within the last ten years was a "Preliminary Assessment/Visual Site Inspection" (TechLaw, 1998), but no samples were collected at the site at that time.

In 2001 and 2002, Geomatrix conducted a facility-wide investigation based on the scope of work outlined in the "Facility Investigation (FI) Work Plan" (Geomatrix, 2000b). The FI was performed to comply with the AO objective to "ascertain the nature and extent of the hazard posed by the hazardous wastes that are present at or that may have been released from the study areas at the [Morton] facility." Comprehensive sampling and analysis was implemented to provide current information on the concentrations of chemicals in soil and groundwater at the operational 27 acres, and in sediments and seep water at Mill Creek. The results of the FI are summarized in Section 2.4 and presented in detail in the FI Report.

Based on negotiations in the early 1980s between Thiokol and the Ohio Environmental Protection Agency (OEPA), Thiokol agreed to install a hydraulic control system in the western portion of the facility. The purpose of this system was to reduce or eliminate the volume of impacted shallow groundwater migrating to seeps on the eastern bank of Mill Creek. The system became operational at full scale in 1985 , and consists of the following:

- an approximately 500-foot long French drain extending to a depth of 21 feet along the western property boundary starting at the northwest corner of the facility;
- a collection sump at the southern end of the French drain;
- an Upper Aquifer extraction well in the west-central portion of the facility; and
- an approximately 350-foot long slurry wall that extends along the northern property boundary starting at the northwest corner of the facility.

2.3 SITE GEOLOGY AND HYDROGEOLOGY

The shallow transmissive strata at the Morton Facility consist of interbedded sand, gravel, silt, and clay outwash, till, and lacustrine deposits present within a buried valley. The valley is oriented generally north-south, along the course of Mill Creek; its boundaries comprise relatively non-transmissive shale and limestone bedrock. The outwash deposits range from approximately 130 to 160 feet thick, but pinch out to the east and west of the site, at the margins of the buried valley.

Parties historically performing investigation and remediation activities in the site vicinity have divided the glacial deposits into two aquifers: the Upper and the Lower. This classification has continued to be utilized for the FI and other activities performed in compliance with the AO.

The Upper Aquifer consists of transmissive interbeds within the shallow lacustrine deposits. The overall thickness of this aquifer is typically 50 to over 100 feet in the vicinity of the facil-

ity. For any given location within the Morton Facility, from one to four sand or gravelly sand interbeds may be present. Communication between deeper interbeds and the Lower Aquifer is generally good; little to no direct communication is present between the shallow interbeds and the Lower Aquifer (Geomatrix, 2002). A portion of the Upper Aquifer crops out in the Mill Creek bank west of the facility. Given that Upper Aquifer groundwater flow at the facility is predominantly to the west (i.e., toward the creek), groundwater underlying the Morton Facility is historically believed to have formed seeps along this outcrop. A groundwater collection system installed along the west facility boundary in 1985 reduces groundwater flow. There is no known use of the Upper Aquifer for water supply purposes in the vicinity of the facility.

The Lower Aquifer is generally divided into an upper and lower portion based on lithology. The upper portion predominately comprises silty sand, and is reportedly not used for local water supply. The lower portion is typically screened by local production wells, and predominantly comprises sands and gravels (CDM, 1986). The City of Reading formerly utilized local wells screened in this zone to produce their municipal water supply. Use of these wells has been discontinued due to environmental impact to Lower Aquifer groundwater. There are currently no known active supply wells at or in the immediate vicinity of the Morton Facility. Lower Aquifer groundwater continues to be used, however, by municipalities within three miles of the Morton Facility.

The thickness of the Lower Aquifer varies from approximately 17 to 122 feet in the immediate vicinity of the Morton Facility, with a mean thickness of approximately 80 feet (Conestoga-Rovers, 1996). The overall groundwater gradient within the Lower Aquifer is to the south (E&E, 1991), along the Mill Creek valley. Its gradient and groundwater flow direction are strongly affected, however, by local pumping. In the vicinity of the Morton Facility, the pumping of remediation wells for the Pristine Superfund Site ([Pristine] located immediately north of the Morton Facility) predominantly controls the gradient. The capture zone from these wells encompasses the entire Morton Facility property (Conestoga-Rovers, 2000).

2.4 CHEMICAL CHARACTERIZATION

This section briefly summarizes the nature and extent of chemicals detected in each medium at the site for purposes of providing context to the risk assessment. Five categories of compounds were analyzed during the FI: volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides and polychlorinated biphenyls (PCBs), chlorinated dioxin/furans, and inorganics. No chlorinated dioxins were detected in any samples, soil or groundwater. Summary tables of the chemicals detected in each medium are provided (Tables 1.1 through

1.4). These tables include the chemical name, the total number of samples analyzed, the total number of detections, the frequency of detection, the range of detection limits, and the range of concentrations detected. For the purpose of discussing the data, chemicals are considered "detected frequently" when they were detected in more than five percent of the samples. Chemicals detected in less than five percent of samples are not considered to be a significant source of exposure.

2.4.1 Soil

Table 1.1 presents a summary of the soil data for the Morton Facility. Soil samples were collected from the surface to the groundwater table (up to 24 feet bgs). Soil samples collected below these depths are not included in this summary because they are below the water table, which is not relevant for the purpose of risk assessment. Only three samples between 15 and 24 feet below ground surface (bgs) were collected across the site. Up to 113 soil samples on site were analyzed, depending upon the analyte. An additional 20 samples were collected from off-site locations to develop site-specific background concentrations. A discussion of these background results and characterization of background concentrations is presented in Appendix E.

Thirteen VOCs were detected frequently in soil samples. Acetone, chlorobenzene, methylene chloride, and toluene were detected most frequently in 25, 51, 26, and 24 samples, respectively. Maximum concentrations of acetone (23 milligrams per kilogram [mg/kg]), chlorobenzene (2.5 mg/kg), methylene chloride (11 mg/kg), and toluene (160 mg/kg) were detected in samples between 7.5 and 12.5 feet bgs.

Fourteen SVOCs were detected frequently in soil samples. Bis(2-ethylhexyl)phthalate and 1,2-dichlorobenzene were detected most frequently in 16 and 14 of the samples, respectively. Maximum concentrations of bis(2-ethylhexyl)phthalate (150 mg/kg) and 1,2-dichlorobenzene (21 mg/kg) were detected at 12.5 and 13 feet bgs, respectively.

Only one PCB mixture was detected frequently in soil. Concentrations detected were all less than 1 microgram per kilogram (μg/kg).

Of the pesticides analyzed, only 4,4'-DDE was detected in more than five percent of the samples analyzed (8 samples), up to a maximum concentration of 0.2 mg/kg.

Twenty-two inorganics were detected frequently in soil. Inorganics are expected in soil samples as they occur naturally in soil. The maximum observed concentrations of arsenic (580 mg/kg), lead (19,300 mg/kg), and tin (158,000 mg/kg) were present in the same sample (T-1-4). Concentrations of these metals in other soil samples were at least an order of magnitude lower than the T-1-4 levels.

2.4.2 Groundwater

Only shallow groundwater data from the Upper Aquifer were considered in the risk assessment (wells with screened intervals designated at or less than 30 feet bgs). Water in Upper Aquifer wells screened more than 30 feet bgs was not considered a potential source of vapors or direct contact (Section 4.1.2). Chemicals associated with the Morton Facility were not detected in the Lower Aquifer as discussed in the FI Report. Groundwater data generally represent two monitoring events at approximately 25 shallow wells (51 samples), conducted between May and November 2001. The groundwater data are presented in Table 1.2 and discussed below by chemical category.

Seventeen VOCs were detected frequently in shallow groundwater samples. The most frequently detected VOCs included acetone (29 samples), chlorobenzene (31 samples), and toluene (19 samples). These chemicals also had the highest detected concentrations among VOCs: acetone (45,000 micrograms per liter [μg/l]), chlorobenzene (3,200 μg/l) and toluene (21,000 μg/l). Maximum concentrations of other VOCs detected were less than 1,000 μg/l.

Six SVOCs were detected frequently in shallow groundwater. The most frequently detected SVOCs were 1,2-dichlorobenzene (26 samples), 1,4-dichlorobenzene (20 samples) and aniline (detected in all nine samples analyzed for this compound). Except for aniline (12,000 μg/l) and 1,2-dichlorobenzene (1,900 μg/l), the maximum concentrations of SVOCs detected were less than 1,000 μg/l.

One PCB mixture, Aroclor 1242 was detected frequently in shallow groundwater in 3 of 51 samples. The maximum concentration of Aroclor 1242 was 130 μg/l.

Thirteen pesticides were detected frequently in shallow groundwater. The most frequently detected pesticides were beta-BHC (9 samples), dieldrin (8 samples), and endosulfan II (8 samples). Detections of pesticides were less than 1 μg/l.

Twenty-three inorganics were detected frequently in shallow groundwater samples and are presented in Table 1.2.

2.4.3 Surface Water/Seeps

Chemicals potentially migrating from the site to surface water were assessed based on samples collected from two seeps along Mill Creek's bank. Based on the industrial nature of the surrounding area, known impact to Mill Creek from multiple sources, and the numerous sewer discharges to Mill Creek, samples from the creek would not be representative of potential discharge from the site. Based on the small sample size, any chemical detected was characterized as being detected frequently. As shown on Table 1.3, nine VOCs, two SVOCs, nine pesticides, and 14 inorganics were detected in seep water collected from Mill Creek's bank. Concentrations of VOCs, SVOCs, and pesticides were low, less than 25 μg/l.

2.4.4 Sediment

Table 1.4 presents a summary of the sediment data for the Morton Facility collected from along Mill Creek. In general, 20 sediment samples were collected and analyzed for all constituents except SVOCs. SVOCs were only analyzed in one sample (SS-12) with the exception of 1,2-dichlorobenzene, which was analyzed in 20 samples. Based on the small sample size, any chemical detected was characterized as being detected frequently.

Seven VOCs were detected in samples collected from Mill Creek. Acetone (6 samples) and chlorobenzene (4 samples) were detected most frequently, both at a maximum concentration of 0.018 mg/kg. Maximum detected concentrations of VOCs were primarily in samples SS-1 and SS-4.

Fifteen SVOCs were detected in the sample from SS-12. 1,2-Dichlorobenzene was detected in three of 20 samples at a maximum concentration of 0.17 mg/kg from sample SS-5.

Six pesticides were detected in at least one samples collected from Mill Creek. 4,4'-DDE was detected most frequently, in 5 samples. The maximum pesticide concentration was 0.094 mg/kg of 4,4'-DDE.

Twenty-two inorganics were detected in sediment samples collected from Mill Creek. Maximum concentrations occurred at SS-12 for 10 of the inorganics and at SS-4 for five of the inorganics.

3.0 DATA EVALUATION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Data evaluation is the process of analyzing site characteristics and analytical data to identify chemicals of potential concern (COPCs) to be evaluated in the HHRA. This section of the report identifies data of sufficient quality for use in the risk assessment, summarizes the chemical characterization of each environmental medium at the site, and provides a summary of all COPCs identified at the site by medium.

3.1 DATA QUALITY

The first step in this process is to identify and evaluate all of the available data to determine if they are of sufficient quality for inclusion in the risk assessment. Only analytical data collected as part of the FI conducted in 2001 and 2002 were considered in this evaluation. Samples from previous Morton Facility investigations are between 10 and 26 years old; many were collected prior to implementation of the groundwater remediation system. The more recent Pristine data does not address the Upper Aquifer groundwater. These data were not considered a valid representation of current site conditions. The FI was designed to provide comprehensive sampling results for the facility, and as such, was the only data considered in the baseline RA.

The following criteria were considered in evaluating analytical data collected as part of the FI.

- **Blank contamination** is evaluated based on the results of field and laboratory blank data. Typically, common laboratory contaminants [e.g., acetone and bis(2-ethylhexyl)phthalate] are eliminated if detected concentrations are within ten times the associated blank concentrations (USEPA, 1989a). All other chemicals are eliminated if detected concentrations are within five times blank concentrations (USEPA, 1989a).

- **Sample quantitation limits (SQLs)** must be sufficiently low such that chemicals can be detected at levels of potential concern. All data are reviewed to determine if SQLs are sufficiently low.

Blank contamination, as designated by the laboratory, occurred in soil, groundwater, seeps, and sediments. Typically, detections in blank samples correlated with chemicals that are known or expected to be COPCs at the site (e.g., acetone and methylene chloride). For these chemicals, chemical data were used in the risk assessment without qualification; these detections were considered to be representative of site conditions. One exception was the detection of tetrachloroethene (PCE) in trench samples (T-6-7.5 and T-6-10) and in associated blank samples. PCE was detected at concentrations comparable to those in the method blank; these detections

of PCE were not considered valid representations of site conditions and were not evaluated in the risk assessment.

SQLs varied with analyses and samples. In general, at least 50 percent of the nondetect results met the SQLs for the project for each analyte detected. The detection limits exceeded the SQLs in a majority of samples for the following chemicals detected at the site:

- benzo(a)pyrene, dibenz(a,h)anthracene, and thallium in soil;
- 1,3-dichlorobenzene, 2-methylphenol, bis(2-ethylhexyl)phthalate, aldrin, alpha-BHC, beta-BHC, dieldrin, Aroclor1242, antimony, beryllium and thallium in groundwater;
- beta-BHC and thallium in sediment; and
- dieldrin and heptachlor epoxide in seep samples.

These exceedances represent a limitation on the analytical method to consistently quantify the sampling results. Of these chemicals, those which are possibly associated with historical facility releases (e.g., 1,3-dichlorobenzene, antimony and thallium) were identified as COPCs. Detection limits, whether or not they were elevated, were used to characterize representative concentrations for COPCs each media.

Soil data considered in the COPC evaluation was limited to samples up to 15 feet bgs. These are the soil depths, as specified in the FI Work Plan, to which a construction worker may be exposed. Three samples (STR-01-21, STR-04-17.5, and STR-07-18) that were collected between 15 feet bgs and the maximum reported depth to groundwater (24 feet bgs) were not considered in the analysis. These sample results were not relevant to direct contact exposure and would not significantly alter the representative concentration of VOCs for indoor air. Also, as discussed in Section 2.4, groundwater samples from wells screened at depths greater than 30 feet bgs were not considered in development of representative concentrations in groundwater. Groundwater greater than 30 feet bgs would not be the first water encountered so it would not be a significant source of VOCs to indoor air or the first source for direct contact.

3.2 SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Not all chemicals detected at a site warrant a quantitative evaluation. In many cases, chemicals are detected at such low concentrations as to pose negligible risk, and may be eliminated from further consideration. Chemicals posing negligible risk were identified for each environmental medium by comparing detected concentrations to risk-based screening criteria and background

levels. The following sections summarize the selection of COPCs for each medium. For the purpose of identifying COPCs, the maximum chemical concentration detected in each media was used as the point of comparison.

3.2.1 Soil

Several tiers of screening criteria were used to identify COPCs in soil. These included background, toxicity, frequency of detection, and historical site use. In addition, some chemicals were excluded as essential nutrients or because of a lack of toxicity data. Table 1.1 summarizes the chemicals detected in soil for the site and the rationale for selecting COPCs.

Chemicals that occur naturally in soil (i.e., inorganics) were compared to site-specific background concentrations presented in Appendix E. In addition, as discussed in Appendix E, a background concentration for dieldrin in shallow soil was used as a screening criterion. Organics other than dieldrin were detected in background samples below the toxicity screening criteria and so background levels were not considered as independent criteria. Three metals (aluminum, barium, and vanadium) and dieldrin were eliminated as COPCs based on a comparison to background.

The toxicity screening criteria used to identify COPCs in soil were outlined in the FI Work Plan. Specifically, USEPA Region 5 Risk-Based Screening Levels (RBSLs; USEPA, 1998b) and the USEPA Region 9 Preliminary Remediation Goals (PRGs; USEPA, 2000) were considered as screening criteria. The RBSLs are soil criteria based on residential land use and the protection of groundwater used as a drinking water source. PRGs are soil criteria based on residential or industrial land use. Because the Morton Facility will continue to be an active industrial facility, the RBSLs based on ingestion, dermal contact, and inhalation under residential land use are not appropriate screening criteria for this facility. Thus, industrial land use PRGs were used as the screening criteria for selection of COPCs. Although shallow groundwater is not used (and is not anticipated to *be* used) as a drinking water source, the RBSLs for protection of groundwater were compared to the PRGs and the lower of the two values was used as a screening criteria.

Using the toxicity screening approach, fifty-nine organic chemicals were eliminated as COPCs in soil because these chemicals were not detected above the respective screening criteria. Of those eliminated, 46 were also infrequently detected.

Five chemicals were eliminated as COPCs in soil based on frequency of detection: acrylonitrile, 2,4-dimethylphenol, dibenz(a,h)anthracene, beta-BHC, and chlorobenzilate. These chemicals are not associated with operations at the facility and were detected in less than 5 percent of samples, which does not present a potentially significant exposure.

One group of chemicals was eliminated based on lack of historical site use. Three polycyclic aromatic hydrocarbons (PAHs), benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene, were detected in shallow soil on the western portion of the site. The maximum concentration of these PAHs was based on one shallow soil sample (UAW01-30-1.5') collected at the southwest corner of the facility, away from Morton Facility operations. PAHs are commonly found in industrial areas, were observed in off-site samples, and are not specifically associated with operations at the Morton Facility; thus, they are not included as COPCs.

Calcium, magnesium, potassium, and sodium were eliminated as COPCs because they are considered essential nutrients. Iodomethane was not considered further based on a lack of toxicity data.

With the above compounds eliminated, fourteen COPCs were identified in soil: acetone, benzene, chlorobenzene, methylene chloride, toluene, 1,2-dichlorobenzene, antimony, arsenic, chromium, lead, manganese, nickel, thallium, and tin. To identify primary areas of affected soil for each compound across the 27-acre site, the location of the maximum detected concentration was identified. This area was then expanded until only samples more than an order of magnitude lower than the maximum concentration were outside the designated area. For simplicity, these areas were approximated as rectangles (Figure 2).

3.2.2 Groundwater

Screening criteria used to identify COPCs in groundwater included toxicity, frequency of detection, historical site use, classification as an essential nutrient, or lack of toxicity data. Table 1.2 summarizes the chemicals detected in groundwater for the site and the rationale for selecting COPCs. Background concentrations in groundwater were not used for the purpose of screening chemicals in groundwater.

Chemicals detected in groundwater were compared to federal Maximum Contaminant Levels (MCLs) for drinking water, or to USEPA Region 9 PRGs for tap water if an MCL was not available. Chemicals detected in groundwater were considered COPCs if the maximum con-

centrations exceed the MCL or, in the absence of an MCL, the PRG. Four chemicals were excluded as COPCs because they were infrequently detected (1,1,2-trichloroethane, vinyl chloride, aldrin, and 2-methylphenol). In addition, VOCs associated with off-site sources (1,2-dichloroethane, tetrachloroethene, 1,1,2-trichloroethane (also infrequently detected), trichloroethene, and vinyl chloride (also infrequently detected)) and pesticides detected in groundwater were not considered COPCs as they were not related to site operations. In addition, some chemicals were excluded as essential nutrients (calcium, manganese, potassium, and sodium) or because of a lack of toxicity data (isodrin).

Table 1.2 presents the 21 COPCs identified in groundwater: acetone, benzene, chlorobenzene, methylene chloride, toluene, aniline, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 4-methylphenol, antimony, aluminum, arsenic, cadmium, chromium, copper, iron, lead, manganese, nickel, and thallium. Similar to soil, areas of affected groundwater were identified based on the location of the maximum concentration and expanded until concentrations outside the area were an order of magnitude or more lower than the maximum concentration (Figure 3).

3.2.3 Surface Water

Screening criteria used to identify COPCs in surface water included toxicity, historical site use, classification as an essential nutrient, or lack of toxicity data. Data collected from seeps was used to represent surface water. Since only two samples were collected, frequency of detection was not used to eliminate chemicals as COPCs. No background concentrations in surface water were used for the purpose of screening chemicals. Table 1.3 summarizes the chemicals detected in surface water for the site and the rationale for selecting COPCs.

Although surface water is not used as a drinking water source, COPCs for surface water (seep samples) were selected based on a comparison with federal MCLs, or USEPA Region 9 PRGs for tap water if an MCL was not available. Two pesticides detected in seeps were not considered COPCs, as they were not related to site operations (beta-BHC and dieldrin). In addition, some chemicals were excluded as essential nutrients (calcium, manganese, potassium, and sodium) or because of a lack of toxicity data (isodrin).

Table 1.3 presents the three COPCs detected in the seeps: aluminum, iron, and manganese. Seep sample locations are presented on Figure 4.

3.2.4 Sediment

Screening criteria used to identify COPCs in sediment included background, toxicity, historical site use, classification as an essential nutrient, or lack of toxicity data. Since only 20 samples were collected, frequency of detection was not used to eliminate chemicals as COPCs. Table 1.4 summarizes the chemicals detected in sediment for the site and the rationale for selecting COPCs.

Background concentrations in soil were used for the purpose of screening metals (Appendix E). Fourteen metals were detected at concentrations below background concentrations in soil and therefore eliminated as COPCs. Since there are no human health risk-based screening criteria for sediment, the RBSLs and PRGs discussed in Section 3.2.1 for soil were used to identify COPCs in sediment. Given the off-site location of the sediment in Mill Creek and the local residential area, industrial screening criteria were not considered appropriate for sediments. Therefore, any chemical detected in sediment above background concentrations in soil was considered a COPC if its maximum detected concentration exceeded the PRG for residential land use or the RBSL for groundwater protection. Residential PRGs represent a conservative approach for identifying COPCs in sediment because the degree of potential human exposure to sediments in a stream is significantly lower than for soil. Three PAHs (benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene) and beta-BHC were eliminated as COPCs based on historic site use. Calcium, magnesium, and potassium were eliminated as COPCs because they are considered essential nutrients.

As presented in Table 1.4, no chemicals were considered COPCs in sediment. Sediment sample locations are presented on Figure 4.

4.0 EXPOSURE ASSESSMENT

Exposure assessment is the process of describing, measuring or estimating the intensity, frequency, and duration of potential human exposure COPCs in environmental media (e.g., soil, water and air) at a site. This section of the report discusses the mechanisms by which people (receptors) might come in contact with COPCs at the Morton Facility. The exposure assessment follows the recommendations for conducting an exposure assessment provided in the USEPA's "Risk Assessment Guidance for Superfund" (USEPA, 1989a), and the more recent guidance in USEPA's "Guidelines for Exposure Assessment" (USEPA, 1992b), and associated guidance. In accordance with USEPA (1989a), an exposure assessment consists of three basic steps:

- Characterization of the exposure setting (physical environment and potential receptors).
- Identification of exposure pathways (potential sources, points of release, and exposure routes).
- Quantification of pathway-specific exposures (exposure point concentrations and intake (dose) assumptions).

The purpose of the first step is to characterize the salient features of the site that might influence current or future human exposure to COPCs, and to identify potential receptors. Potential pathways of human exposure are identified in the second step by characterizing the sources of COPCs released to the environment, points of release, and potential exposure routes. In the third step, the qualitative information from the first two steps is integrated with estimates of exposure concentrations and intake assumptions to quantitatively estimate exposure (dose).

Exposure assessment is conducted within the context of a site conceptual model (SCM). As described in USEPA's "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA" (USEPA, 1988), the purpose of the SCM is to describe what is known about chemical sources, migration pathways, exposure routes, and possible exposure scenarios. Figure 5 and Table 2 present the SCM developed for the Morton Facility.

4.1 CHARACTERIZATION OF EXPOSURE SETTING

Potential exposure to COPCs at a site depends on a number of factors related to the physical characteristics of a site and its surroundings. These factors include location, surrounding land use, surface topography, hydrogeology, meteorology, and vegetation. They also include factors related to the current and possible future site uses of the property, which determine the types of activities that might occur at the site, the degree to which the site is accessible to the general public, and the mechanisms that might result in migration of COPCs to on-site and off-site populations.

4.1.1 Physical Setting

The Morton Facility is located on approximately 34 acres in Reading, Ohio. Approximately 27 acres lie within the fenced operational area. The remaining 7 acres comprise baseball and soccer fields used by the City of Reading. A description of the physical setting is provided in Section 2.0 of this report, and in greater detail in the Current Conditions Report (Geomatrix, 2000a). The nearest residents are located approximately 350 feet south of the facility, immediately south of the swimming pool and recreation center.

4.1.2 Land and Water Use

Potential exposures to COPCs at a site are a function of the current and probable future land uses, both for the site and its surrounding area. USEPA guidance requires the evaluation of potential risks to human health under both current and foreseeable future land uses. Aside from the baseball/soccer fields, the Morton Facility is an active industrial facility, and is anticipated to remain such for the foreseeable future. Morton intends to retain ownership and will continue to operate as an industrial facility. This exposure assessment is based on zoning of the site for heavy industrial land use. Future residential development of the facility is not considered.

In addition to land use, water use also contributes to the degree of potential exposure to COPCs at a site. Groundwater beneath the facility occurs in two aquifers referred to as the Upper and Lower Aquifers. The Upper Aquifer begins between 5 and 24 feet bgs. A portion of the Upper Aquifer apparently outcrops to Mill Creek west of the facility. The Upper Aquifer is not known to be used as a source of potable water.

The Lower Aquifer consists of an upper and a lower portion. Regionally, the lower portion is widely used as a source of potable water. However, there are no known active supply wells at or in the immediate vicinity of the Morton Facility. Lower Aquifer groundwater at the facility is already being controlled by the remediation system for the neighboring Pristine Superfund site.

Until 1994, the City of Reading derived its municipal water supply from two well fields near the Morton Facility; one approximately 500 feet to the north, the other approximately 1600 feet south-southwest. These well fields were closed after chlorinated solvents attributable to the Pristine Superfund site were detected. Since 1994, Reading has obtained potable water from the City of Cincinnati.

The cities of Glendale, Lockland, and Wyoming, which are all within three miles of the Morton Facility, currently use the lower portion of the Lower Aquifer for potable water. The groundwater is also used by industries in the area. Groundwater is not known or suspected to be used for domestic water supplies in the immediate vicinity of the Morton Facility. Municipal water supply is available to all residential users in the area. Based on this information, potential exposure to groundwater as a potable water supply was not evaluated quantitatively in the risk assessment.

The nearest surface water body is Mill Creek, approximately 80 to 100 feet west of the facility.

4.1.3 Potential Receptors

The identification of potential human receptors is based on the characteristics of the site, the surrounding land uses, and the probable future land uses.

4.1.3.1 On-Site Receptors

Given the current and future industrial land use of the Morton Facility, the principal potential human receptor that may be exposed to COPCs in on-site media (e.g., soil) is an on-site industrial worker. Two types of on-site workers are considered: one who spends most or all of his/her day engaged in outdoor activities, and one who spends most of his/her day indoors. In addition to the industrial worker, the construction worker involved in occasional activities requiring excavation into the subsurface could also be exposed to on-site media.

There may also be occasional visitors to the facility, such as customers, vendors, or contractors. However, these individuals are unlikely to be present in areas potentially affected by COPCs in soil and groundwater. In addition, visits by the same individual are likely to be much less frequent than the daily contact assumed for an industrial worker.

Unauthorized access to the operational areas of the facility is physically and administratively restricted. The facility is operational 24 hours per day with a security system and fencing to prevent intrusion of trespassers. As a result, there is minimal potential for an occasional trespasser to gain access to the operational 27 acres of the site. Therefore, a trespasser was not considered a potential on-site receptor.

4.1.3.2 Off-Site Receptors

Potential off-site receptors include individuals residing or working downwind of the facility. For the purpose of this assessment, the off-site residents were evaluated qualitatively. Potential off-site receptors also include individuals using Mill Creek for recreational purposes, such as fishing, swimming, or wading.

4.2 IDENTIFICATION OF EXPOSURE PATHWAYS

This section describes the potential pathways by which the receptors described above could be exposed to COPCs located at or released from the Morton Facility. An exposure pathway is a description of the mechanism by which an individual may come into contact with COPCs in the environment. In accordance with USEPA RAGS (USEPA, 1989a), all potential exposure pathways applicable to the Morton Facility have been identified and addressed. An exposure pathway is defined by four elements (USEPA, 1989a):

1. A source and mechanism of COPC release to the environment;
2. An environmental receiving or transport medium (e.g., air, soil) for the released COPC;
3. A point of potential contact with the medium of concern; and
4. An exposure route (e.g., ingestion) at the contact point.

An exposure pathway is considered "complete" if all elements are present. Only complete exposure pathways need be evaluated. The characterization of the potential exposure pathways at the Morton Facility, based on existing information, is presented in the preliminary SCM in Figure 5 and Table 2. Potential on-site receptors may be exposed to COPCs in surface and subsurface soil, groundwater, and air. Potential off-site receptors may be exposed to COPCs in surface water and air. Further discussion of potential exposure pathways is presented in the following subsections.

4.2.1 Sources, Mechanisms of Releases, and Mechanisms of Transport

The primary on-site sources of chemicals in soils at the site were historical activities. Current activities at the facility, except for the combined sewer system (CSS), are not believed to have a significant potential for release of chemicals to the environment. Therefore, this analysis is based on historical sources only. The releases from historical sources and possibly from the CSS have potentially resulted in chemical impact in on-site soils and in on-site groundwater and off-site seeps. A brief summary of the nature and extent of impact to various media is provided in the FI Report (Geomatrix, 2002).

There are a number of mechanisms by which the COPCs identified above can migrate to other areas or to other media. USEPA (1989a) has identified several of these mechanisms. Based on current information, the relevance of these mechanisms to the Morton Facility is discussed below.

Fugitive Dust Generation. Non-volatile chemicals present in soil can be released to ambient air as a result of fugitive dust generation. Several non-volatile chemicals have historically been detected in soil at the facility, including some SVOCs and metals. Although most of the facility is covered by structures, pavement, or grassy, landscaped areas that would prevent the resuspension of dusts, this pathway was considered complete. This assumption also addresses the possibility that some of the structures may be removed.

Volatilization. Volatile chemicals present in soil and groundwater may be released to ambient or indoor air by volatilization through the vadose zone. Several volatile chemicals have been detected in both soil and groundwater at the facility. Therefore, the soil-to-air and groundwater-to-air pathways are potentially relevant to the Morton Facility.

Surface Water Runoff. Surface water drainage enters the facility's CSS where it is transported to the Mill Creek Wastewater Treatment Plant, which is operated by the Metropolitan Sewer District (MSD). Under torrential rain conditions surface drainage from the site could enter Mill Creek. Sediment samples from Mill Creek were collected and analyzed, which would represent deposition from runoff.

Leaching (percolation). Chemicals present in soil may migrate downward to groundwater as a result of meteoric water infiltration. Chemicals from the site are believed to have entered groundwater in the Upper Aquifer on site. This pathway is potentially relevant to the Morton Facility.

Groundwater Transport. Chemicals present within the Upper Aquifer beneath the Morton Facility may migrate with groundwater toward Mill Creek. A French drain and slurry wall have been installed at the Morton Facility to reduce chemical migration onto the site and migration off site toward Mill Creek. However, this pathway is considered potentially relevant to the Morton Facility.

Bioaccumulation. Certain chemicals, depending on their physicochemical properties, can be taken up from surface water and sediment by aquatic organisms and concentrated in their tissues. Exposure would then result from ingestion of those organisms, e.g., fish. This pathway was not evaluated because COPCs with bioaccumulative potential were not identified in Mill Creek during the FI. In addition, aquatic species were not identified during the field visit (Section 7.1.1.3).

4.2.2 Exposure Points and Routes

Based upon the migration pathways discussed above, points of potential human contact with site-related chemicals are on-site soil, on-site groundwater, on-site air, off-site air, and off-site surface water in Mill Creek. COPCs were not detected in sediment from Mill Creek.

Potential exposure routes associated with chemicals in soil are incidental ingestion, dermal contact, and inhalation of volatile chemicals and re-suspended particulates in air. Exposure routes associated with affected groundwater consist of inhalation of volatile chemicals released

to air through volatilization and incidental dermal contact when groundwater is encountered in an excavation trench. Exposure routes applicable to chemicals in surface water are incidental ingestion and dermal contact. No volatile COPCs were identified in surface water. Ingestion of fish was not considered since bioaccumulative chemicals were not identified as COPCs in Mill Creek.

4.2.3 Exposure Pathways

Given the release processes discussed above, the potential exposure pathways for current and future land use of the Morton Facility property are presented below.

Outdoor Industrial Worker. Morton Facility workers primarily involved in outdoor activities could be exposed to surface soil (typically the top 6 inches) via incidental ingestion and dermal contact. These worker receptors may also be exposed via inhalation to COPCs present on fugitive dusts generated by wind erosion or construction activities. These workers may also be exposed to volatile COPCs released to ambient air as a result of volatilization from groundwater or soil. These receptors could be present under current and future industrial land use conditions.

Indoor Industrial Worker. On-site facility workers who spend most of their day indoors are unlikely to be exposed to soil. These workers may be exposed via inhalation to volatile COPCs from soil and groundwater that are released to indoor air. These receptors could be present under current and future industrial land use conditions.

Construction Workers. Construction workers may be exposed to subsurface as well as surface soil via incidental ingestion and dermal contact. These receptors may also be exposed to ambient air containing volatile COPCs released from soil or exposed groundwater in an excavated trench. This receptor may also directly contact exposed groundwater in a trench containing COPCs as part of construction activities and inhale COPCs present on fugitive dusts generated by construction activities. These receptors could be present under current and future industrial land use conditions.

Off-site Residents. Off-site residents could be exposed to airborne COPCs as a result of fugitive dust and volatile emissions. However, the degree of exposure through these air pathways is likely to be less than that of the on-site workers, because residents are farther from the site although their exposure duration is assumed to be longer (365 days versus 250 days, and 30

years versus 25 years). These receptors were evaluated qualitatively based on the potential inhalation exposures of the outdoor industrial worker.

Recreational Users of Mill Creek. Because COPCs were detected in Mill Creek seeps, off-site receptors could be exposed to COPCs in surface water. A recreational user of Mill Creek could be exposed via direct contact with the creek or incidental ingestion of creek water. COPCs were not identified in creek sediments, so sediment exposure was not considered in this HHRA. Recreational users evaluated in this HHRA include adults and children.

4.3 EXPOSURE QUANTIFICATION

The following paragraphs describe how exposure was quantified for the above exposure scenarios. The assumptions and approaches to be used are consistent with a Reasonable Maximum Exposure (RME) approach as defined by USEPA (1989a). The RME scenario is defined by USEPA as the "highest exposure that is reasonably expected to occur at the site."

4.3.1 Exposure Point Concentrations

The concentrations of chemicals at specific exposure points will vary over space and time. However, a single estimate of an exposure point concentration is currently required by USEPA guidance (1989a, 1992a) for risk assessment calculations. This single value must be representative of the average concentration to which a person would be exposed over the duration of the exposure.

Exposure point concentrations are generally estimated using measured concentrations in environmental media, or estimated based on fate and transport models. Depending on a number of factors, including the distribution of the data (normal versus lognormal), the proportion of the samples reported as non-detect, and the total number of samples, there are several statistical parameters that may be used to estimate exposure point concentrations. USEPA (1992a) guidance recommends using the 95 percent upper confidence limit (95% UCL) of the mean as the exposure point concentration. USEPA presents two equations for calculating the 95% UCL: one based on a normal distribution and one on a log-normal distribution. The appropriate equation from USEPA (1992a) was used for each individual dataset.

To select the equation, statistical analyses of the data distribution was performed for soil and groundwater data using the distribution evaluation component of Crystal Ball software (2000). Data for the seeps (two samples) were not sufficient to support a statistical distribution analysis because of the small sample size. Goodness-of-fit tests were performed on the COPCs using

the Crystal Ball software to assess whether the data was better characterized as either a normal or lognormal distribution. The distribution was used to determine the most appropriate statistical method to calculate the 95% UCL; i.e., the exposure point concentration. In the event that the calculated 95% UCL exceeded the maximum detected value, the maximum value was used as the exposure point concentration.

The presence of a chemical in some, but not all, samples suggests that it may also be present in the non-detect samples at some concentration between zero and the SQL for each sample. There are several methods for estimating the concentration in these non-detect samples (USEPA, 1992b). These include simple substitution methods, distributional methods, and robust statistical methods. The current default position of USEPA (1989a) is to substitute ½ the SQL for all non-detects. Thus, if a COPC was not detected in a particular sample, it was assumed to be present at one-half the SQL for calculating exposure point concentrations.

4.3.1.1 Soil

A single exposure point concentration for soil was derived based on an analysis of data for two soil depths: surface soil and subsurface soil. Surface soil represents the soil to which the industrial worker may be exposed and was defined by soil samples collected between 0 and 2 feet bgs. Subsurface soil represents soil to which a construction worker may be exposed and was defined by soil samples collected between 0 and 15 feet bgs. Unsaturated zone soil was defined by all soil samples above the water table (24 feet bgs). Since there were only three samples between 15 and 24 feet bgs, an independent assessment of unsaturated soil was not conducted.

Because of the size of the site and variable distribution of chemicals in soil, areas of affected soil were identified within the site for each COPC, as shown on Figure 2 and described in Section 3.2.1. Exposure point concentrations were developed for each of these areas for the respective chemicals. Tables F-1 through F-6 in Appendix F present the data used to estimate exposure point concentrations for each chemical and the samples considered representative of each area.

To simplify the overall analysis, the arithmetic mean concentrations between surface and subsurface soil were compared to identify whether the chemical was present primarily in surface or subsurface soil. The higher mean value determined the depth of soil (surface or subsurface) used to develop the exposure point concentration. This is particularly conservative for the outdoor industrial worker since they are only likely to be exposed to shallow soil. A 95% UCL of

the arithmetic mean for normal or log-transformed data, as appropriate, was calculated as the representative concentration for each chemical. If the calculated value was higher than the maximum value detected, the maximum concentration detected was used as the representative concentration. Exposure point concentrations in soil are presented in Table 3.1.

This approach used in this assessment results in an exposure point concentration that is higher than a site-wide concentration. Focused areas of elevated COPC concentrations were used to represent potential exposure areas, but may result in overestimates of exposure if durations of exposure in these areas are less than those used in the analysis (e.g., the approach assumes a worker spends all their time outdoors in the northwest area). Use of the higher average concentration between surface and subsurface soil is also a conservative approach that will likely result in an overestimate of risk.

4.3.1.2 Groundwater

Similar to soil, areas of affected groundwater within the site were identified (Figure 3 and Section 3.2.2). Exposure point concentrations were developed for each of these areas for the respective chemical. The exposure point concentrations for all inorganic COPCs except for aluminum, antimony, and iron were developed based on a site-wide average because localized areas of elevated concentrations were not identified. Tables F-7 through F-17 in Appendix F present the data used to estimate exposure point concentrations for each chemical and identifies the samples considered representative of each area. A 95% UCL of the arithmetic mean for normal or log-transformed data, as appropriate, was calculated as the representative concentration for each chemical. If the calculated value was higher than the maximum value detected, the maximum concentration detected was used as the representative concentration. Exposure point concentrations in groundwater are presented in Table 3.2. The use of focused areas at the site are conservative approaches that result in an exposure point concentration that is higher than a site-wide concentration; this will result in higher estimates of risk.

4.3.1.3 Surface Water

Two seep samples were collected and used to represent concentrations in surface water related to the site. The maximum concentration detected in the seep samples was used as the representative concentration (Table 3.3).

4.3.1.4 Indoor Air

Exposure point concentrations in indoor air were estimated using the Johnson & Ettinger model (1991). The Johnson & Ettinger model was parameterized by USEPA (1997c) to evaluate potential emissions from subsurface soil or groundwater to indoor air. A more detailed description of the model is provided in Appendix H. Tables 3.4 and 3.5 summarize the exposure point concentrations in indoor air based on emissions from soil and groundwater, respectively.

4.3.1.5 Ambient Air

Ambient air concentrations were estimated independently for fugitive dust emissions and volatilization. Fugitive dust emissions from soil were estimated using the particulate emission factor model (USEPA, 2001). Volatilization from soil and groundwater was estimated using the volatilization factor model developed by USEPA (1996b). USEPA's quiescent surface impoundment model (1995a) was used to estimate emissions to ambient air from groundwater exposed during construction activities. A more detailed description of these models is presented in Appendix H. Tables 3.6 and 3.7 summarize the exposure point concentrations in ambient air based on emissions from soil and groundwater, respectively.

4.3.2 Exposure Equations

The "Annual Average Daily Dose" (AADD) or "Lifetime Average Daily Dose" (LADD) are the general parameters used to quantify exposure doses in site risk assessments. The AADD is used as a standard measure for characterizing long-term non-carcinogenic effects. The LADD addresses exposures that may occur over varying durations from a single event to an average 70-year human lifetime and are used to estimate potential carcinogenic risks.

The equations for calculating AADD and LADD for ingestion and inhalation exposures are those presented by the USEPA in their 1989 RAGS guidance (USEPA, 1989a). The AADD and LADD equations for dermal exposures are taken from the 2001 RAGS dermal guidance (USEPA, 2001).

4.3.3 Exposure Parameters

Exposure parameters are quantitative estimates of the frequency, duration, and magnitude of exposure to various media. The exposure parameters were selected from USEPA (1989a; 1991a; 1997a, 2001) guidance, as appropriate, or were based on site-specific factors when applicable. Tables 4.1 through 4.10b present the exposure parameters for each of the receptors.

5.0 TOXICITY ASSESSMENT

The toxicity assessment is comprised of two parts (USEPA, 1989a):

1. **Hazard Identification** evaluates available information regarding the potential for a chemical to cause adverse health effects in exposed individuals; and

2. **Dose-Response Assessment** estimates the relationship between the extent of exposure and the increased likelihood (e.g., probability or chance) and/or severity of adverse effects.

Hazard identification entails calculating whether a chemical can cause an increase in a particular adverse effect (e.g., cancer) and the likelihood that the adverse effect will occur in humans. The result of hazard identification is a profile of the available toxicological information and its relevance to human exposure under conditions present in the environment. The hazard identification process has been completed by USEPA for all the chemicals identified as COPCs at the Morton Facility.

Dose-response assessment entails quantifying the relationship between the dose of a chemical and the incidence of adverse effects in the exposed population. The results of the dose-response assessment are toxicity criteria that are used in the risk characterization to estimate the likelihood of adverse effects occurring in humans at different exposure levels. The toxicity criteria used to evaluate noncarcinogenic and carcinogenic health risks are commonly referred to as reference doses (RfDs) and slope factors (SFs), respectively. The basis for these criteria is described briefly in the following sections.

5.1 TOXICITY CRITERIA FOR NONCARCINOGENIC HEALTH RISKS

Observable adverse noncancer effects of chemicals occur only after a threshold dose is reached. For the purposes of establishing health criteria, this threshold dose is usually estimated from the no-observed adverse effect level (NOAEL) or the lowest-observed adverse effect level (LOAEL) determined in chronic animal exposure studies. The NOAEL is defined as the highest dose at which no adverse effects occur, whereas the LOAEL is defined as the lowest dose at which adverse effects begin to occur. NOAELs and LOAELs derived from animal studies are used by the USEPA and other regulatory agencies to establish RfDs for human intake of noncarcinogenic compounds. RfDs, which are expressed in terms of milligrams of chemical per kilogram of body weight per day (mg/kg-day), are criteria intended to represent the dose of a chemical that is not expected to cause adverse health effects over a lifetime of daily exposure, even in sensitive individuals, with a substantial margin of safety.

Uncertainty factors are used to set RfDs in an attempt to account for limitations in the quality or quantity of available toxicity data. Most RfDs include an uncertainty factor of 100, which is comprised of a factor of 10 to account for potential uncertainties in extrapolating animal data to human health effects, and another factor of 10 to account for possible differences in sensitivity within the human population. Furthermore, if the available database is incomplete and an LOAEL is used to establish an RfD, or if a chemical is persistent or bioaccumulative, then an additional safety factor of 10 may be applied.

The duration of exposure is considered in the development of RfDs. Exposure duration is divided into three categories for purposes of risk assessment (USEPA, 1989a):

- **Acute** refers to exposures for short durations measured in seconds, minutes, or hours and to effects that appear promptly after exposure.
- **Subchronic** refers to exposures of intermediate duration, from 2 weeks to 7 years.
- **Chronic** refers to prolonged or repeated exposures and effects that develop only after exposures from 7 years to a lifetime.

The exposure durations for complete exposure pathways in this risk assessment include chronic and subchronic exposures. The industrial worker and recreational user are considered to have chronic exposures, while the construction worker is considered to have a subchronic exposure. However, to be conservative, chronic RfDs have been used for both chronic and subchronic exposures.

5.2 TOXICITY CRITERIA FOR CARCINOGENIC HEALTH RISKS

Regulatory guidance assumes that chemicals that are carcinogenic should be treated as if they do not have thresholds (USEPA, 1989a). This approach assumes that the dose-response curve for carcinogens only allows for zero risk at zero dose (i.e., for all doses, some risk is assumed to be present). To estimate theoretically plausible responses at these low doses, various mathematical models are used. The accuracy of the projected risk depends on how well the model predicts the true relationship between dose and risk at dose levels where the relationship cannot be feasibly measured. The accuracy of these models is currently unknown, but they are believed not to underestimate the true risk.

Health risks for exposure to carcinogens are defined in terms of probabilities that quantify the likelihood of a carcinogenic response in an individual receiving a given dose of a particular

compound. The SF, which is expressed in units of $(mg/kg\text{-}day)^{-1}$, is defined as the 95% UCL of the probability of a carcinogenic response per unit daily intake of a chemical over 70 years. By using the 95% UCL, the estimate of carcinogenic response is conservative and purposefully overestimates the actual risk posed by the chemical.

5.3 TOXICITY CRITERIA USED IN HUMAN HEALTH RISK ASSESSMENT

The USEPA has completed toxicity assessments for most of the COPCs identified in this HHRA. The toxicity criteria used to evaluate noncarcinogenic and carcinogenic health risks are reference doses (RfDs) and cancer slope factors (SFs), respectively. The RfDs and SFs for the COPCs being evaluated were gathered from the following USEPA sources, listed in order of preference:

- USEPA Integrated Risk Information System (IRIS) on-line database, 2002.
- USEPA, 1997b, Health Effects Summary Tables, FY-1997 Annual, Office of Solid Waste and Emergency Response, Washington, D.C.
- USEPA, 2000, Region 9 Preliminary Remediation Goals (PRGs).

The associated toxicity criteria for the COPCs evaluated in this HHRA are presented in Tables 5.1 and 5.2 for noncarcinogenic chemicals and Tables 6.1 and 6.2 for carcinogenic chemicals.

In the event that an RfD or SF was not available for the oral or inhalation routes of exposure, the available RfD or SF (oral if inhalation was absent, inhalation if oral was absent) was used for both routes. In addition, toxicity values are not available for evaluating dermal exposure. In this case, the oral RfDs or SFs (Tables 5.1 and 6.1, respectively) for certain chemicals recommended by USEPA, 2001 were adjusted based on the absorption factors presented by the USEPA (2001).

5.4 TOXICITY ASSESSMENT FOR LEAD

RfDs and SFs currently are not available for lead. Lead was evaluated using the Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil (USEPA, 1996a). This approach focus on assessing potential blood lead concentrations in fetuses carried by women exposed to lead-contaminated soils. The blood-lead level is of interest because most adverse human health effects are correlated in terms of blood-lead levels (i.e., a blood-lead level of "x" is associated with a particular adverse health effect).

6.0 RISK CHARACTERIZATION

Risk characterization represents the final step in the risk assessment process. In this step, the results of the exposure and toxicity assessments are integrated into quantitative or qualitative estimates of potential health risks. Potential noncarcinogenic health effects and carcinogenic health risks are characterized separately.

6.1 NONCARCINOGENIC HEALTH EFFECTS

Potential adverse noncarcinogenic health effects were evaluated using the hazard index (also called HI) approach as recommended by USEPA (1989a). The first step in this approach is to compare the AADD for each chemical to the appropriate RfD. This comparison is expressed in terms of a "hazard quotient," which is calculated as follows:

$$\text{Hazard Quotient}_i = \frac{\text{AADD}_i}{\text{RfD}_i}$$

A hazard quotient less than or equal to 1 indicates that the predicted exposure to that chemical should not result in an adverse noncarcinogenic health effect (USEPA, 1989a). In cases where individual chemicals potentially act on the same organs or result in the same health endpoint (e.g., respiratory irritants), potential additive effects may be addressed by calculating a hazard index as follows:

$$\text{Hazard Index} = \sum_{i=1}^{n} \text{Hazard Quotient}_i$$

A hazard index of less than or equal to 1 indicates acceptable levels of exposure for chemicals having an additive effect. In this HHRA, a screening-level hazard index was calculated by summing the hazard quotients for all chemicals, regardless of toxic endpoint, as recommended by agency guidance (USEPA, 1989a). This approach is generally believed to overestimate the potential for noncarcinogenic health effects due to simultaneous exposure to multiple chemicals because it does not account for different toxic endpoints (USEPA, 1989a; NRC, 1988; Risk Commission, 1997; Seed, et al., 1995). However, it can be used as a screening tool to rapidly identify those exposure scenarios for which exposure to multiple chemicals does not pose a noncarcinogenic health risk.

It should be noted that hazard quotients or hazard indices greater than 1 do not necessarily mean that adverse health effects will be observed. As discussed in Section 5.0 and shown in

Tables 5.1 and 5.2, a substantial margin of safety has been incorporated into some of the RfDs developed for the COPCs. For these chemicals, adverse health effects may not be observed even if the hazard quotient or hazard index is much larger than 1. If the screening hazard index is greater than 1, a target organ-specific hazard index may be calculated to more accurately assess the potential for noncarcinogenic effects to specific target organs.

The following sections summarize the results of the noncarcinogenic risk characterization for the four receptors quantitatively evaluated. The summary hazard indices are presented in Tables 7.1 through 7.7; the calculations supporting these values are presented in Appendix I. The information presented in Appendix I is substantially equivalent to Tables 7 and 8 presented in Risk Assessment Guidance for Superfund, Part D (USEPA, 1998). As such, those tables have not been included in this risk assessment.

Indoor Industrial Worker

The potential noncancer hazard quotients and hazard indexes associated with exposure to the COPCs in soil and groundwater by indoor industrial workers are summarized in Table 7.1. The total hazard index is 0.5, indicating that exposure to chemicals in soil and groundwater that migrate to indoor air would not result in unacceptable noncarcinogenic health effects under the conditions evaluated.

Outdoor Industrial Worker

The potential noncancer hazard quotients and hazard indexes associated with exposure to the COPCs in soil and groundwater by outdoor industrial worker are summarized in Table 7.2. The total hazard index is 1.1, indicating that exposure to chemicals in soil may result in unacceptable noncarcinogenic health effects under the conditions evaluated. The chemicals contributing most significantly to the hazard index are arsenic in soil (65 percent), thallium in soil (7 percent), and tin in soil (14 percent). The potential exposure to these chemicals in soil is based on dermal contact and soil ingestion based on detections in the T-1 area. Concentrations of these chemicals outside the T-1 area are at least an order of magnitude lower than the T-1 detections. For example, the maximum T-1 concentration of tin (158,000 mg/kg) was used as a representative concentration; the highest concentration outside the T-1 area was 4150 mg/kg. Exposure to these metals outside the T-1 area would result in a hazard index below 1, indicating exposure would not result in unacceptable noncarcinogenic health effects under the conditions evaluated.

Construction Worker

The potential noncancer hazard quotients and hazard indexes associated with exposure to the COPCs in soil and groundwater by the construction worker are summarized in Table 7.3. The total hazard index is 20, indicating that exposure to chemicals in soil and groundwater may result in unacceptable noncarcinogenic health effects under the conditions evaluated. The chemicals contributing most significantly to the hazard index are acetone in groundwater (29 percent) and toluene in groundwater (16 percent). Arsenic in soil (18 percent), antimony in groundwater (9 percent), benzene in groundwater (8 percent), chlorobenzene in groundwater (5 percent), and 1,2-dichlorobenzene in groundwater (3 percent) also contribute to the hazard index. The exposure point concentration for acetone in groundwater was based on the maximum concentration in groundwater and a conservative model used to predict ambient air concentrations from exposed groundwater in a 6 by 30 foot trench over a 1-year excavation period. The exposure point concentration for toluene in groundwater was also based on the maximum detected value (21,000 μg/l). This value was an order of magnitude higher than all other concentrations at the site. Arsenic in soil is related to concentrations in the T-1 area, as discussed previously. The hazard index for benzene, chlorobenzene, and 1,2-dichlorobenzene in groundwater is based on concentrations in a localized area in the northwest portion of the site (Figure 3) and the conservative model used to predict ambient air concentrations from exposed groundwater. The hazard index for antimony in groundwater is based on a specific area and limited to exposure via dermal contact with groundwater. In summary, the contributions to hazard index for the construction worker are related to specific samples or areas of the site and specific conditions over a relatively large area of exposed groundwater possible only during construction.

Adult Recreational User of Mill Creek

The potential noncancer hazard quotients and hazard indexes associated with exposure to the COPCs in seep water by an adult recreational user of the creek are summarized in Table 7.4. The total hazard index is 0.005, indicating that exposure to chemicals in seep/surface water should not result in unacceptable noncarcinogenic health effects under the conditions evaluated. COPCs were not identified in sediments.

Child Recreational User of Mill Creek

The potential noncancer hazard quotients and hazard indexes associated with exposure to the COPCs in seep water by a child recreational user of the creek are summarized in Table 7.5. The total hazard index is 0.01, indicating that exposure to chemicals in seep/surface water

should not result in unacceptable noncarcinogenic health effects under the conditions evaluated. COPCs were not identified in sediments.

Off-site Residential Receptor

Based on the low contribution of the inhalation pathway (0.08) to the hazard index for the outdoor industrial worker at the Morton Facility, potential hazard index for off-site residential receptors are also considered to be well below one, as a result of dispersion of chemicals in air.

6.2 CARCINOGENIC EFFECTS

Carcinogenic health risks are defined in terms of the increased probability of an individual developing cancer as the result of exposure to a given chemical at a given concentration. As required by USEPA (1989a), lifetime excess cancer risks are estimated for any chemical as follows:

$$\text{Lifetime Excess Cancer Risk}_i = \text{LADD}_i \times \text{SF}_i$$

As with hazard indices, the estimated excess cancer risks for each chemical and exposure route are summed regardless of toxic endpoint to estimate the total excess cancer risk for the exposed individual.

Regulatory agencies such as USEPA have defined what is considered an acceptable level of risk in various ways. The USEPA considers $1x10^{-6}$ to $1x10^{-4}$ to be the target range for acceptable risks at sites where remediation is considered (USEPA, 1990a and 1990b). Estimates of lifetime excess cancer risk associated with exposure to chemicals of less than one-in-one-million ($1x10^{-6}$) are considered to be so low as to not warrant any further investigation or analysis (USEPA, 1990a).

It should be noted that cancer risks above the target range do not necessarily mean that adverse health effects will be observed. Current methodology for estimating the carcinogenic potential of chemicals is not believed to underestimate the true risk, but could overestimate the true risk by a considerable degree.

The following sections summarize the results of the carcinogenic risk characterizations for the receptors evaluated. The summary total estimated lifetime excess cancer risks are presented in Tables 7.1 through 7.5; the calculations supporting these values are presented in Appendix I.

Indoor Industrial Worker

The estimated theoretical lifetime excess cancer risks associated with exposure to the COPCs in soil and groundwater by a current indoor industrial worker are summarized in Table 7.1. The total estimated cancer risk is $6x10^{-6}$, which is within the acceptable risk range of $1x10^{-4}$ to $1x10^{-6}$. Therefore, exposure to chemicals in soil and groundwater that migrate to indoor air would not result in an unacceptable cancer risk under the conditions evaluated for this receptor.

Outdoor Industrial Worker

The estimated theoretical lifetime excess cancer risks associated with exposure to the COPCs in soil and groundwater by current outdoor industrial worker are summarized in Table 7.2. The total estimated cancer risk is $1x10^{-4}$, which is at the upper end of the acceptable risk range of $1x10^{-4}$ to $1x10^{-6}$. Therefore, exposure to chemicals in soil and groundwater should not result in an unacceptable cancer risk under the conditions evaluated for this receptor. Concentrations of arsenic in soil related to the T-1 area contribute to approximately 100 percent of the carcinogenic risk for this receptor. Arsenic detections outside the T-1 area are at least an order of magnitude lower, and are more consistent with site-wide background.

Construction Worker

The estimated theoretical lifetime excess cancer risks associated with exposure to the COPCs in soil and groundwater by current on-site construction workers are summarized in Table 7.3. The total estimated cancer risk is $3.5x10^{-5}$, which is within the acceptable risk range of $1x10^{-4}$ to $1x10^{-6}$. Therefore, exposure to chemicals in soil and groundwater should not result in an unacceptable cancer risk under the conditions evaluated for this receptor. The primary contribution to risk is arsenic in soil in the T-1 area.

Adult Recreational User of Mill Creek

No carcinogenic COPCs were detected in Mill Creek.

Child Recreational User of Mill Creek

No carcinogenic COPCs were detected in Mill Creek.

Off-site Residential Receptor

Based on the low contribution of the inhalation pathway (less than $1x10^{-6}$) to carcinogenic risk for the outdoor industrial worker at the Morton Facility, potential cancer risk for off-site resi-

dential receptors are also considered to be well within the acceptable risk range, based on dispersion of chemicals in air.

6.3 LEAD RISK CHARACTERIZATION

The Centers for Disease Control (CDC) have established a blood-lead level of concern at 10 micrograms per deciliter (µg/dl) of whole blood to protect young children from adverse neurological effects. Acceptance criteria for the probabilities of blood lead levels exceeding 10 µg/dl range from 95 to 99 percent. Using USEPA's Adult Lead Methodology, potential fetal blood levels were calculated based on representative concentrations of lead in soil. As shown in Appendix J, the exposure point concentration for lead results in a 95.5 percent probability that the blood lead level in the fetus would exceed 10 µg/dl. This exposure point concentration was based on the maximum concentration of lead at the site, which was in the T-1 area. Lead levels outside the T-1 area are considerably lower. The maximum concentration of lead outside the T-1 area (780 mg/kg) results in geometric mean blood lead estimate of 3 µg/dl with a 2 percent probability that the blood lead level in the fetus would exceed 10 µg/dl, which is within the acceptable probability range.

6.4 UNCERTAINTY ANALYSIS

Uncertainty is inherent in many aspects of the risk assessment process, and generally arises from a lack of knowledge of (1) site conditions, (2) toxicity and dose-response of the COPCs, and (3) the extent to which an individual will be exposed to those chemicals. This lack of knowledge means that assumptions must be made based on information presented in the scientific literature or professional judgment. While some assumptions have significant scientific bases, others do not. The assumptions that introduce the greatest amount of uncertainty and their effect on the noncarcinogenic and carcinogenic risk estimates are discussed below. This discussion is generally qualitative in nature, reflecting the difficulty in quantifying the uncertainty in specific assumptions. In general, assumptions were selected in a manner that purposefully biases the process toward health conservatism.

6.4.1 Data Evaluation and Selection of Chemicals of Potential Concern

The selection of site-related COPCs was based upon the results of the sampling and analytical program established for the Site. The factors that contribute to the uncertainties associated with the identification of COPCs are inherent in the data collection and data evaluation processes, including appropriate sample locations, adequate sample quantities, laboratory analyses, data validation, and treatment of validated samples.

The predominant sources of uncertainty and potential bias associated with site characterization are based on the procedures used for site investigation (including sampling plan design and the methods used for sample collection, handling, and analysis) and the procedures used for data evaluation. In general, a very comprehensive sampling program was implemented to account for the chemicals most likely to be present at the Site as a result of past Site history and activities. Although certain areas were not characterized due to limited access (e.g., areas underneath the buildings), it is reasonably expected that the impact from those areas is adequately represented by the data collected from nearby locations.

6.4.2 Exposure Assessment

Exposure Point Concentrations

For chemicals that were not detected in individual samples, it was assumed that one-half the SQL was representative of the concentration that may be present in soil or groundwater for purposes of calculating the arithmetic average and 95% UCL concentrations. The current default position of USEPA (1989a) is to substitute one-half the SQL (2 SQL) for all non-detects. USEPA guidance (1992b) indicates that substitution of one-half of the SQL is adequate when the proportion of non-detects is less than 10 to 15 percent. If the fraction of non-detects becomes large, then assuming that the value of each non-detect is equal to one-half of the SQL will generally overestimate the expected true mean concentrations, with the degree of overestimation increasing with increasing proportions of non-detects.

Exposure point concentrations for soil and groundwater for some chemicals were based on focused areas in the vicinity of the maximum concentration detected. For smaller areas, this is likely to overestimate risk as a receptor's exposure would not be limited to that one area.

As outlined in USEPA risk assessment guidance, the 95% UCL of the log-normally transformed data was used when a distribution was classified as lognormal. However, this value exceeded the maximum detected value for three out of 13 chemicals in soil and 12 out of 21 chemicals in groundwater samples. In these cases, the maximum concentration was used as the exposure point concentration, which would not be representative of large areas of the site.

The greater of shallow or subsurface soil was used to estimate the exposure point concentration in soil for both construction workers and outdoor industrial workers. This is a conservative assumption likely to overestimate risk for the industrial worker as they are likely to be exposed to only the top 6 inches of soil.

Environmental Fate and Transport

Fate and transport models were used to estimate indoor and ambient air concentrations of COPCs volatilized from soil and groundwater. While some site-specific conditions were incorporated into the model, the model results are typically conservative, which tends to over-estimate risk. In particular, a default value was used to represent particulate emissions during construction activities that is equivalent to the National Ambient Air Quality Standard for particulates (PM10).

Exposure Assumptions and Parameters

The exposure assessment is based on an RME scenario, which is defined by USEPA as the highest exposure that could reasonably be expected to occur for a given exposure pathway at a site (USEPA, 1989a). To achieve this goal, the RME is based on highly conservative exposure assumptions. For example, the evaluation assumes that a commercial worker will be present on-site for 250 days per year for 25 years. For a construction worker, exposure was assumed to occur over one year, which may be greater than most site construction projects. This and other upper-bound estimates of exposure most likely overestimate the potential health risks associated with exposure to the COPCs in soil.

6.4.3 Toxicity Assessment

Uncertainty in Toxicity Criteria

One of the largest sources of uncertainty in any risk assessment is associated with the scientific community's limited understanding of the toxicity of most chemicals in humans following exposure to the low concentrations generally encountered in the environment. The majority of available toxicity data are from animal studies, which are then extrapolated using mathematical models or multiple uncertainty factors to generate toxicity criteria used to predict what might occur in humans. Sources of conservatism in the toxicity criteria used in this evaluation include:

- The use of conservative methods and assumptions to extrapolate from high dose animal studies to predict the possible response in humans at exposure levels far below those administered to animals;
- The assumption that chemicals considered to be carcinogens do not have thresholds (i.e., for all doses greater than zero, some risk is assumed to be present); and
- The fact that epidemiological studies (i.e., human exposure studies) are limited and are not generally considered in a quantitative manner in deriving toxicity values.

The toxicity criteria used in the HHRA are based on an evaluation of noncarcinogenic and carcinogenic health risks that were developed using different methods. The noncarcinogenic criteria (i.e., oral and inhalation RfDs) incorporate multiple uncertainty factors to account for limitations in the quality or quantity of available data (e.g., animal data in lieu of human data). These uncertainty factors are applied without regard to available data on the true likelihood of a variation in human response. Therefore, RfDs may be hundreds of times smaller than doses that would actually cause adverse health effects. This purposeful bias in the development of RfDs overestimates the actual potential for noncarcinogenic health risks for these chemicals.

The carcinogenic toxicity criteria (i.e., oral and inhalation SFs) also are developed using techniques that purposefully bias the criteria toward health conservatism. For example, most SFs are based on the premise that cancer data from high dose animal studies will predict cancer response in humans at dose levels thousands of times lower. The process also assumes that the carcinogenicity of a chemical in an animal model is representative of the response in humans. Finally, the statistical techniques used by regulatory agencies to extrapolate data from animals to human exposures generally assume that the dose-response curve is linear and that the 95% UCL of the slope is representative of the chemical's carcinogenic potency. In aggregate, these assumptions overestimate the risk estimates. Given this, actual risks are unlikely to be higher than the risk estimates, but could be considerably lower.

Lack of Route-Specific Toxicity Criteria

In the absence of data for the inhalation route of exposure, the SF or RfD for the oral route was used in the evaluation. As a result, the health risk estimates for these chemicals may be over- or underestimated. When available, agency-derived toxicity values were used in the quantitative risk assessment. Although toxicity values were not available for every detected analyte, omission of these chemicals is not anticipated to underestimate the predicted overall health risks. In fact, there may be some overestimation of the adverse health effects due to the conservatism involved in toxicity assessment of toxic chemicals that drive the human health risks at the site.

Use of Chronic Toxicity Data for Subchronic Exposures

The exposure period for the construction worker is assumed to be one year, which is less than the typical duration required to be classified as chronic exposure (7 years). Use of chronic toxicity criteria for a subchronic exposure duration, however, is conservative and likely to overestimate the hazard index.

Weight of Evidence of Carcinogenicity

As shown in Tables 6.1 and 6.2, USEPA assigns weight-of-evidence classifications to potential carcinogens. Constituents evaluated in this assessment are classified as Group A, Group B1, Group B2, Group C, or Group D, defined as follows:

- Group A constituents (known human carcinogens) are agents for which there is sufficient evidence to support a causal association between exposure to the agents in humans and cancer.
- Group B1 constituents (probable human carcinogens) are agents for which there is limited evidence of carcinogenicity in humans.
- Group B2 constituents (probable human carcinogens) are agents for which there is sufficient evidence of carcinogenicity in animals, but inadequate or no evidence in humans.
- Group C constituents (possible human carcinogens) are agents for which there is limited evidence of carcinogenicity in animals and inadequate or no human data.
- Group D constituents are not classifiable as to their carcinogenicity in humans based on no human data and inadequate animal data.

Two of the chemicals evaluated were identified in Group A; three of the chemicals evaluated were identified in Group B2; two of the chemicals evaluated were identified in Group C; eight were identified in Group D; and seven are not currently assigned to a group by USEPA (Tables 6.1 and 6.2). Quantitative cancer risk characterization is generally performed for all Group A, B1, and B2 carcinogens identified at a site. A quantitative evaluation of Group C carcinogens and other chemicals identified as carcinogens is typically performed on a case-by-case basis because the weight of evidence in support of an association between constituent exposure and cancer is not as strong as Group A, B1, and B2. To be conservative, all five of these chemicals were evaluated quantitatively as carcinogens. Group D constituents are not quantitatively evaluated as carcinogens.

6.4.4 Uncertainty Associated with Risk Characterization

One source of uncertainty that is unique to risk characterization is the assumption that the total risk associated with exposure to multiple chemicals is equal to the sum of the individual risks for each chemical (i.e., the risks are additive). Other possible interactions include synergism, where the total risk is higher than the sum of the individual risks, and antagonism, where the total risk is lower than the sum of the individual risks. Relatively little data are available regarding potential chemical interactions following environmental exposure to chemical mix-

tures. Some studies have been carried out in rodents given simultaneous doses of multiple chemicals. The results of these studies indicated that no interactive effects were observed for mixtures of chemicals affecting different target organs (i.e., each chemical acted independently), whereas antagonism was observed for mixtures of chemicals affecting the same target organ, but by different mechanisms (Risk Commission, 1997).

While there are no data on chemical interactions in humans to chemical mixtures at the dose levels typically observed in environmental exposures, animal studies suggest that synergistic effects will not occur at levels of exposure below their individual effect levels (Seed, et al., 1995). As exposure levels approach the individual effect levels, a variety of interactions may occur, including additive, synergistic and antagonistic (Seed, et al., 1995).

Current USEPA guidance for risk assessment of chemical mixtures (USEPA, 1989a) recommends assuming an additive effect following exposure to multiple chemicals. Subsequent recommendations by other parties, such as the National Academy of Sciences (NRC, 1988) and the Presidential/Congressional Commission on Risk Assessment and Risk Management (Risk Commission, 1997) have also advocated a default assumption of additivity. As currently practiced, risk assessments of chemical mixtures generally sum cancer risks regardless of tumor type and sum non-cancer hazard indices regardless of toxic endpoint or mode of action. Given the available experimental data, this approach likely overestimates potential risks associated with simultaneous exposure to multiple chemicals.

6.4.5 Conclusions of Uncertainty Analysis

In summary, these and other assumptions contribute to the overall uncertainty in the risk assessment. However, given that the largest sources of uncertainty generally result in overestimates of exposure or risk, it is believed that results presented in this document are based on conservative estimates.

7.0 SCREENING ECOLOGICAL RISK ASSESSMENT

A Screening Ecological Risk Assessment (SERA) was performed for the Morton Facility. The goal of the SERA is to determine whether constituents suspected to be derived from the Morton Facility pose a potential risk to plants, animals, and ecologically valuable habitats in the vicinity of the Facility.

This SERA report identifies and analyzes the following:

- Potential ecological receptors, including sensitive and protected species, wetlands and water bodies, and natural areas in the site vicinity;
- Constituent sources, affected media, and constituents of potential ecological concern (COPECs); and
- Potential exposure pathways for plants and animals.

Based on this analysis, potential ecological risks are identified and areas of the site are prioritized according to the degree of the risks. Principal data gaps are identified and the need for further investigation is discussed.

The draft *Ecological Risk Assessment Guidance for RCRA Corrective Action* (USEPA, 1994) presents basic descriptions of ecological risk assessment under RCRA as viewed by Region 5. According to this guidance, the SERA is the first tier in the process of evaluating ecological risks at RCRA sites. The purpose of the SERA is to quickly screen available information to identify areas that need closer evaluation, and determine more specifically the type and degree of ecological risk. In cases where there is insufficient information, the SERA can identify data gaps that can be addressed by additional tiers of effort such as a Preliminary Ecological Risk Assessment (PERA) or a Detailed Ecological Risk Assessment (DERA). The PERA and the DERA may include field sampling and quantitative assessment of potential risks. Thus, the results of the SERA are not intended as a definitive description and characterization of ecological risks at the Morton Facility. Rather, consistent with the USEPA Region 5 approach, the SERA provides a preliminary analysis to assist Rohm and Haas and USEPA in determining whether more comprehensive and detailed ecological investigations are needed.

7.1 PROBLEM FORMULATION

The problem formulation establishes the goals and focus of the SERA. It establishes the assessment endpoints based on potentially complete exposure pathways and toxicological effects.

7.1.1 Environmental Setting

7.1.1.1 Terrestrial

An ecological characterization was performed to identify, map, and describe the upland, wetland and aquatic ecosystems that occur within the vicinity of the Morton Facility. Federal and state natural resource agencies were contacted regarding species of concern, significant habitats, and fishery resources within 2 miles of the Morton Facility. In addition, a biologist con-

ducted a reconnaissance survey of the site and surrounding area on May 29 and 30, 2001. The objectives of the survey were to describe plant communities and aquatic resources on and adjacent to the site, observe wildlife species, identify significant ecological resources, and observe evidence of stress to plants and animals (if any) from site-related activities.

The Morton Facility operational area (excluding the recreational fields) is mostly covered with buildings or asphalt. Little vegetation exists to support wildlife populations. The area surrounding the Morton Facility is a residential area that supports a diversity of wildlife species tolerant of human activities. A total of five distinct upland vegetation plant communities were identified within the vicinity of the Morton Facility. Plant species identified by cover type are presented in Table 9.1. Each terrestrial cover type is described below as to plant species composition, vegetation structure and land use.

Successional Old Field. A successional old field was identified along the western fence line of the property and south of the property. It was dominated by panic grasses (*Panicum sp.*) and goldenrods (*Solidago sp.*). Other herbs that occur in lesser abundance include yellow sweet clover (*Melilotus officinalis*), Queen Anne's lace (*Daucus carota*), and teasel (*Dipsacus sylvestris*). This cover type is periodically disturbed, especially near the park which borders the southern and western portion of the facility, and will likely remain in an early successional state. The successional old field serves as wildlife habitat that provides edge, cover and food. Songbirds and mammalian species, such as goldfinches (*Carduelis tristis*), song sparrows (*Melospiza melodia*), white-footed mice (*Peromyscus leucopus*), and meadow voles (*Microtus pennsylvanicus*), which consume the seeds of grass and forbs are typically observed in these areas. With an abundant prey base, carnivores, such as red fox (*Vulpes vulpes*), may also reside in the area.

Riparian Forest. A narrow riparian forest is located along the banks of Mill Creek. The dense canopy is dominated by red maple (*Acer rubrum*), box elder (*Acer negundo*), sycamore (*Platanus occidentalis*), and cottonwood (*Populus deltoides)* trees. The understory varies in density and is dominated by tartarian honeysuckle (*Lonicera tatarica*) and sandbar willow (*Salix interior*). The ground layer was sparse due to the lack of sunlight penetration. The predominant species noted in the ground layer included reed canary grass (*Phalaris arundinacea*), and goldenrods. The riparian corridor provides excellent habitat for many animals because of the seasonal or perennial presence of water. This water is likely used directly for drinking by animals in the general area. In addition, pooled water (relatively still water along the creek banks), which is essential for breeding populations of amphibians, was not observed during the

site visit. The creek banks are relatively steep in the vicinity of the site with consistently flowing water.

Residential Area. Residential areas lie to the south and east of the Morton Facility. They consist of buildings (mainly single family homes) surrounded by maintained lawns (i.e., frequent mowing) and ornamental plantings. The lawns consist of grasses and weed species, including English plantain (*Plantago lanceolata*), crab grass (*Digitaria ischaemum*), and dandelion (*Taraxacum officinale*). Ornamental shrubs and small trees are planted along the foundations of the homes. In addition, larger trees are planted in the yards. Several recreational areas (baseball diamonds and a school football stadium) and a cemetery are also found in this cover type. The mowed lawn areas surrounding the residences and constant disturbance from human activity create an environment that is of limited value to wildlife. Species more tolerant of human activity, such as American robins (*Turdus migratorius*) and raccoons (*Procyon lotor*), may typically be present. The ornamental plantings provide nesting sites and cover.

Industrial Area. The site itself and bordering lands to the north are industrial. With the exception of the southern portion of the Morton Facility, most of these areas are covered with gravel, concrete, asphalt, rubble piles or a gravel and dirt mixture. Areas to the north of the Morton Facility are essentially devoid of vegetation, with the exception of a few small weedy patches of grass, due to constant disturbances from heavy equipment. The southern portion of the Morton Facility (generally the area around Building 40, stretching across to the immediate north of the parking lot, to the area south of building 27) has trees, lawn, and landscaping. Therefore currently, there is little area currently for free growth of vegetation or development of wildlife habitats.

7.1.1.2 Freshwater Wetlands

A review of the U.S. Fish and Wildlife National Wetland Inventory (NWI) Maps (http://wetlands2.nwi.fws.gov/startmap/) indicates the presence of a palustrine forested broad-leaved deciduous temporarily-flooded (PFO1A) wetland on the western bank of Mill Creek across from the Morton Facility. In addition, the NWI Maps identify wetlands on the Glendale, Ohio quadrangle. Mill Creek is classified as a riverine wetland on the quadrangle.

7.1.1.3 Mill Creek

Mill Creek borders the Morton Facility to the west, and represents the only aquatic habitat in the facility's vicinity. On May 30, 2001, approximately 1,500 feet of Mill Creek adjacent to the site was observed via canoe. At the time of the field reconnaissance, the creek generally

contained approximately 24 inches of water in the center and three to six inches along the banks. Pool areas, suitable for swimming, with over three feet of water were found in several locations. The creek was flowing at a field estimate rate of about one cubic foot per second (cfs). The creek is approximately 25 feet wide with a bed predominantly comprised of rock and concrete debris. The earthen banks are steep (25° slope) and are well vegetated with a forested riparian habitat. During the reconnaissance, several outfalls, some of which were combined sewer overflows, were observed entering the stream. A sewer odor was observed along this stream, with the strongest odor in the vicinity of the CSOs. No aquatic fauna were observed in the stream during the survey.

Water quality standards described in Chapters 3745-1 and 3634-1 of the Ohio Administrative Code (OAC) define beneficial use designations, describing existing or potential uses for surface water bodies within the State of Ohio. These beneficial use designations consider the use and value of the water for public water supplies, the protection and propagation of aquatic life, recreation in and on the water, agriculture, industrial, and other use issues. Possible beneficial use designations include "aquatic life use," "recreational use," "public water supply," and "state resource water."

The State of Ohio has assigned Mill Creek the following beneficial use designations:

- Aquatic Life – warm-water habitat;
- Recreation – primary contact recreation; and
- Water Supply – agricultural and industrial.

The designation as a warm-water habitat defines the "typical" warm-water assemblage of aquatic organisms for the stream. Primary contact recreation waters are suitable for full body contact recreation (e.g., swimming). To qualify as a primary contact recreation use, a stream must have at least one pool with an area of at least 100 square feet and a depth of at least three feet. The water supply designation indicates Mill Creek may be used for irrigation and livestock watering and industrial and commercial use without treatment.

Currently, Mill Creek is not meeting applicable criteria for its assigned aquatic life designated use. Physically, the stream channel is capable of supporting the criteria, but the designation is not being attained due to chemical and biological criteria violations (OEPA, 1994). Mill Creek

has also exhibited exceedances of the primary contact recreation criteria for fecal coliform and *E. coli*.

7.1.1.4 Fish and Wildlife Resources

Wildlife uses of each cover type were evaluated using literature sources and field observations. Wildlife sightings included direct observations and also identifications based on vocalizations, tracks, browse, burrows, and scat. General wildlife values (e.g., food and cover availability) for each cover type were also noted.

No state-listed endangered, threatened, or species of concern occur within 2 miles of the Morton Facility (Knasel, 2000); nor were any observed during the field reconnaissance. One federally-listed endangered species, Indiana bat (*Myotis sodalis*), is listed as potentially occurring in the area (Kurey, 2000). Their preferred summer habitat is dead trees and snags along riparian corridors, especially those with exfoliating bark or cavities in the trunk or branches that may be used as maternity roosts, and live trees (such as shagbark hickory) which have exfoliating bark. Snag trees or shagbark hickory were not observed during the field reconnaissance; therefore, this species is unlikely to occur in the vicinity of the site.

The surrounding 2-mile radius is occupied predominantly by residential homes and industrial/commercial properties. The residential areas are dominated by mowed lawns interspersed with trees and shrubs. The industrial areas consist of paved areas and buildings. Because of the lack of vegetation and constant human activity, these areas do not support an abundance of wildlife. The wildlife expected to occur in the vicinity of the facility includes more urbanized bird and mammalian species, such as rock dove (*Columbia livia*), gray squirrel (*Sciurus carolinensis*), and Norway rat (*Rattus norvegicus*). Since limited areas of vegetation exist, the population size in the area will also be limited. Tables 9.2 through 9.4 list species that may potentially occur within and adjacent to the site based on the cover types identified during the field reconnaissance. The species observed during the field reconnaissance (which are representative for the point in time of the field reconnaissance) also are identified in the tables.

Portions of Mill Creek support a warm-water fishery, although no fish were observed in the creek during the SERA reconnaissance, or other creek reconnaissances performed as part of the FI (Geomatrix, 2002). However, due to degradation of the stream channel, fish species tolerant to a wide variety of environmental disturbances would be predominant in those areas of the creek supporting fish. These species include suckers, darters, and various minnows. Bass also may be present in reaches with lesser degrees of chemical and sewage impact. A visual survey

of the creek was completed in a canoe from Cincinnati Drum to the bridge south of the site on May 30, 2001. No fish of any species were observed in the water.

7.1.2 Source Areas

The Morton Facility was constructed in 1949, and chemical manufacture operations began in 1950. The character and extent of chemical impact to environmental media at the site is described in the FI Report (Geomatrix, 2002).

7.1.3 Fate and Transport

The fate and transport of chemicals in the environment are influenced by a variety of physicochemical- and site-specific factors. The chemical constituents detected in samples at the Morton Facility include VOCs, SVOCs (primarily PAHs), pesticides/PCBs, and inorganic constituents. Environmental fate and transport processes for chemicals potentially associated with the Morton Facility are briefly discussed in the following subsections.

7.1.3.1 Physicochemical Properties

The fate and transport of chemicals in the environment depend on the properties of both the chemicals and the environmental media in which they occur. Appendix G lists the primary organic compounds detected during the investigation of the site, with selected physical and chemical properties (e.g., water solubility, Henry's Law Constant, octanol-water partition coefficient, organic-carbon partition coefficient).

Water solubility is the maximum concentration of a compound that will dissolve in water at a specific temperature. Highly soluble compounds can be rapidly leached from soils and water and are generally mobile in groundwater and surface water. Chemicals of low water solubility are relatively immobile in aquifers but may be transported rapidly in turbulent surface waters as suspended particles. Some water-insoluble compounds become readily mobile when in contact with organic solvents.

Vapor pressure is a measure of the volatility of a chemical in its pure state and is an important determinant of vaporization from waste sites. A compound's tendency to volatilize from water depends upon its Henry's Law Constant. Henry's Law Constant is the ratio, at equilibrium, of a compound's vapor pressure to its water solubility. It may be expressed in units of atmospheres-cubic meters per mole (atm-m^3/mol). Compounds with Henry's Law Constants greater than 10^{-3} atm-m^3/mol readily volatilize from water. Those with Henry's Law Constants from

10^{-3} to 10^{-5} atm-m^3/mol volatile less readily, while those with Henry's Law Constants less than 10^{-5} atm-m^3/mol volatilize slowly.

The octanol-water partition coefficient (K_{ow}) expresses the equilibrium distribution of an organic compound between octanol and water. K_{ow} is often used to estimate the extent to which a chemical will partition from water into fatty tissues of animals. Log K_{ow} values range from -2.5 to 10.5. Organic chemicals with log K_{ow} values less than three are generally considered not to concentrate in animal tissues; that is, they do not bioaccumulate.

The organic carbon partition coefficient (K_{oc}) is a measure of the tendency of organic compounds to sorb to soil and sediment and is expressed by this equation:

$$K_{oc} = \frac{\text{(mg chemical sorbed / kg organic carbon)}}{\text{(mg chemical dissolved / l of solution)}}$$

K_{oc} values for organic compounds range from 1 to 10^7; higher values indicate greater sorption potential. Chemicals with K_{oc} values less than 10^3 generally do not sorb strongly to soil.

Bioconcentration factors (BCFs), which relate the concentration of the chemical in an organism at equilibrium to the concentration of the chemical in water, are used to assess the potential for chemical bioconcentration. BCFs correlate with the octanol/water partition coefficient and solubility of a chemical.

7.1.3.2 Fate and Transport Mechanisms for Chemicals Detected at the Site

Volatile Organic Compounds (VOCs)

VOCs have high vapor pressures and, therefore, would be expected to volatilize readily from environmental media to the atmosphere. Once released to the atmosphere, these compounds are rapidly photodegraded. These compounds have low octanol/water coefficients (log K_{ow}) and, therefore, do not adsorb well to soil, sediment, or water-borne particulate matter. Since VOCs have low octanol/water coefficients and high water solubilities, these chemicals have a low potential to bioconcentrate in organisms (Howard, 1990).

Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs contain only carbon and hydrogen and consist of two or more fused benzene rings in linear, angular, or cluster arrangements. In general, most PAHs can be characterized as having low vapor pressure, low to very low water solubility, low Henry's Law Constant, high log K_{ow},

and high K_{oc}, which means PAHs remain bound to soil and sediment particles and do not freely enter the water column.

High partition coefficients and low solubilities suggest that PAHs are likely to be adsorbed onto sediment particles. Conversely, these properties, in combination with their low vapor pressure, indicate that most PAHs will not readily volatilize into the atmosphere.

Although PAHs are regarded as persistent in the environment, they are degradable by micro-organisms. Environmental factors, microbial flora, and physicochemical properties of the PAHs themselves influence degradation rates and degree of degradation. Important environmental factors influencing degradation include temperature, pH, redox potential (the tendency of a chemical to accept or donate electrons, or to become reduced or oxidized), and microbial species present. Physicochemical properties that influence degradation include chemical structure, concentration, and lipophilicity ("fat-loving" tendency).

The fate of adsorbed PAHs in water is influenced by a number of factors, including duration of PAH exposure to sunlight, which will largely determine the extent of photodegradation. In general, only small amounts of PAHs in aquatic systems will be found in solution and could be expected to accumulate in sediments. The ultimate fate of PAHs that accumulate in sediments is biodegradation and biotransformation by benthic (sediment-dwelling) organisms. However, biodegradation is slow in the absence of penetrating solar radiation and oxygen (Eisler, 1987).

In general, PAHs show little tendency to biomagnify in food chains, despite their high lipid solubility, probably because most PAHs are rapidly metabolized by the organisms that are exposed to them (Eisler, 1987).

Metals

In a terrestrial setting, trace elements released to the environment tend to accumulate in the soil (Sposito and Page, 1984). Mobility of these trace elements in soil is low, and accumulated metals are depleted slowly by leaching, plant uptake, erosion, or chelation.

The transport of trace elements in soil may occur via the dissolution of metals into pore water and leaching to groundwater, or colloidal or bulk movement (i.e., wind or surface water erosion). The rate of trace element migration in soil is affected by the chemical, physical and biological characteristics of the soil. The most important characteristics include:

- Eh-pH system;
- Cation exchange capacity and salt content;
- Quantity of organic matter;
- Plant species;
- Water content and temperature; and
- Microbial activity.

Metals that do mobilize from the soil into the water column are most mobile under acid conditions, and increasing pH usually reduces their bioavailability. Generally, metals do not exist in soluble forms for long, and tend to accumulate in bottom sediment. Once in the sediment, most metals sorb onto hydrous iron and manganese oxides, clayey minerals and organic materials and are eventually partitioned into the sediments. Metal bioavailability from the sediment is enhanced under conditions of low pH, high dissolved oxygen, and high temperature. During these conditions, metals become more soluble and freely move in the interstitial pore water and the water column (McIntosh, 1992).

7.1.4 Mechanisms of Ecotoxicity and Potential Receptors

The ecological effect of a chemical constituent depends on many factors, such as the constituent's bioavailability, its concentration in the environment and/or receptor organism, synergistic interactions among constituents, the duration and frequency of receptor biota exposure to that constituent, the species of the receptor, the metabolic rate of the species, and the characteristics of the metabolic processes of the species (USEPA, 1988). Constituents in the environment can affect receptor biota and ecosystems in both lethal and sublethal ways, such as the following:

- Altered developmental rates, metabolic and physiologic processes and functions, or behavior;
- Increased susceptibility to disease, parasitism, or predation;
- Disrupted reproductive functions; and
- Mutations or other reduction in the viability of offspring (USEPA, 1989b)

When potential effects of an environmental constituent on biotic receptors are being evaluated, the toxicity of the constituent must be determined. The determination should be based on field data, monitoring data, and the results of toxicity testing of contaminated media (USEPA, 1989b).

7.1.5 Exposure Pathways

A conceptual site model, which illustrates complete exposure pathways, is presented in Figure 6. The exposure pathway is a course that a chemical may take from a source to an individual receptor, and includes a source, a release mechanism, an exposure point, and an exposure route. The exposure point is the location of potential contact between and individual and a chemical, while the exposure route is the way that a chemical comes in contact with that individual.

Ecological resources in the vicinity of the Morton Facility may be exposed to constituents through various exposure routes (see Figure 6). Surface soil is the environmental media most likely to be encountered by biota.

Upon their release, some of the chemicals detected are persistent and may be transformed to more bioavailable forms and mobilized in the food chain. Mobilization of chemicals in the terrestrial food chain could occur through the following pathways:

- Uptake by plants;
- Contact and absorption of chemicals in surface soils, incidental ingestion, and feeding on contaminated food by invertebrates;
- Incidental ingestion of or contact with surface soils by terrestrial wildlife; and/or
- Bioaccumulation from vegetation or prey at the base of the food chain by terrestrial wildlife.

Mobilization of chemicals in the aquatic food chain could occur through the following pathways:

- Uptake by aquatic macrophytes;
- Contact and absorption of chemicals in sediments, incidental ingestion, and feeding on contaminated food by aquatic invertebrates;
- Incidental ingestion and contact with sediments by aquatic and semi-aquatic wildlife; and
- Bioaccumulation from vegetation or prey at the base of the food chain by aquatic and semi-aquatic wildlife.

7.1.6 Ecological Receptors

Based on the pathways identified above, the following general classes of ecological receptors potentially might by exposed to chemicals at and in the vicinity of the Morton Facility:

- Terrestrial wildlife species that may be in contact with the soils and feed within the terrestrial food chain;
- Predatory fish species that are present on at least a seasonal basis and feed on resident forage species or benthic organisms;
- Benthic macroinvertebrates that are burrowers, tube dwellers, or found at the sediment-water interface, and are preferably deposit feeders, grazers, or suspension feeders;
- Obligate, permanent aquatic wildlife species that are in frequent contact with the sediments and/or feed primarily on fish and macroinvertebrates; and
- Facultative aquatic wildlife species that may be in contact with the estuarine sediments and/or frequently use the creek for foraging.

It should be reiterated, however, that fish and macroinvertebrates were not observed in Mill Creek during any creek reconnaissance.

7.1.7 Screening Endpoints

The ecological values of the Morton Facility and its vicinity include populations and communities of plants and animals in terrestrial habitats. No aquatic species were observed during the site visit, so aquatic habitats were not evaluated. In broad terms, the values to be protected (assessment endpoints) for each of these habitat types are the structure and function of site ecosystems, and the survival and reproduction of species typical of the region. Because there are no rare, threatened, or endangered species or communities known to occur on site or that are likely to come in frequent contact with site constituents, no special consideration will be given to protecting individuals or populations of rare species.

For purposes of this assessment, the measurement endpoints for the assessment endpoints (i.e., the ecological receptors) are the likelihood of their occurrence in areas where they could be adversely affected by chemicals detected within the Morton Facility and at the adjacent portions of Mill Creek. The likelihood of contact with site constituents can be evaluated by analyzing overlap of each of the broad habitat types with the impacted areas of the Morton Facility. The likelihood of adverse effects on survival or reproduction of ecological receptors can be evalu-

ated by determining whether exposure pathways are complete (Figure 6), and by comparing known concentrations of constituents with ecological data quality levels (EDQLs).

7.2 CHEMICAL SCREENING

Chemicals of potential environmental concern (COPECs) were identified by comparing available chemical concentrations detected in various media with EDQLs from USEPA Region 5. The levels used in this process are intended only for screening purposes and identification of COPECs. They are not meant to imply any definitive level of risk or to be indicative of risk-based cleanup or remediation goals. In addition, chemicals exceeding screening criteria were eliminated as COPECs if they were not associated with historical activities and/or were consistent with chemicals in background soil.

Appendix K of this report summarizes toxicological information from the scientific literature for COPECs detected at and in the vicinity of the Morton Facility. The summaries present information on constituent toxicity, likely mechanisms of toxicity, and potential effects on receptor biota, populations, and ecosystems.

7.2.1 Soil

Chemical screening results for soil samples, including frequency of detection and range of detected concentrations, are presented in Table 10.1. Surface and subsurface soil samples were collected on and in the vicinity of the Morton Facility. Most burrowing animals create dens in the upper four feet of soil. In addition, the deeper subsurface soil samples (i.e., greater than four feet) are below the root zone of most plants. Due to the lack of exposure routes to wildlife, data for deeper subsurface soils were not evaluated. Only the surface soil and shallow subsurface soil data (up to four feet below ground surface) were considered in this assessment.

7.2.1.1 Background Soil

Ten surface soil and all subsurface soil samples were collected from off-site locations and analyzed for parameters observed in on-site soil and groundwater samples. Results of comparing the maximum detected background concentration of each constituent to EDQLs were categorized as follows:

- **Below EDQL**: 2-Butanone, acetone, tetrachloroethene, acenaphthene, anthracene, benzo(b) fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bis(2-ethylhexyl) phthalate, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, 4,4'-DDE, aldrin, and total cyanide.

- **Exceed EDQL**: 2-Methylnaphthalene, benzo(a)anthracene, benzo(a)pyrene, chrysene, naphthalene, phenanthrene, pyrene, dieldrin, isodrin, Aroclor 1254, Aroclor 1260, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, nickel, selenium, thallium, tin, vanadium, and zinc. Sixteen of these chemicals are naturally-occurring metals in soils. The remaining chemicals are seven PAHs, two pesticides, and two PCB mixtures.

Methyl acetate, carbozole, dibenzofuran, endrin ketone, aluminum, calcium, iron, magnesium, manganese, potassium, and sodium were all detected in background samples, but do not have EDQLs and so are not considered COPECs.

These background samples were considered to represent background conditions in the industrial area surrounding the facility.

7.2.1.2 On-Site Soils

Forty-nine surface soil and shallow subsurface soil samples were collected on-site and analyzed for parameters observed in on-site soil and groundwater samples.

Benzene, carbon disulfide, chloromethane, dichlorodifluoromethane, ethylbenzene, isopropylbenzene, tetrachloroethene, acenaphthene, anthracene, carbazole, di-n-octylphthalate, dibenz(a,h)anthracene, dibenzofuran, fluorine, phenol, 4,4'-DDD, alpha-chlordane, dieldrin, endosulfan II, endosulfin sulfate, endrin, endrin ketone, heptachlor epoxide, methoxychlor, Aroclor 1242, Aroclor 1248, total cyanide, and antimony have frequencies of detection less than 5 percent and are therefore not considered COPECs. The maximum detected concentrations for remaining constituents were compared to EDQLs. Results of comparing the maximum detected concentration of each constituent to EDQLs were categorized as follows:

- **Below EDQL**: 2-Butanone, methylene chloride, toluene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene, 4,4'-DDE, 4,4'-DDT, endrin aldehyde, and beryllium.

- **Exceed EDQL**: Acetone, chlorobenzene, iodomethane, total xylene, benzo(a)anthracene, bis(2-ethylhexyl)phthalate, benzo(a)pyrene, chrysene, Aroclor 1254, Aroclor 1260, arsenic, barium, cadmium, chromium, cobalt, copper, lead, mercury, nickel, selenium, silver, thallium, tin, vanadium, and zinc.

Of the 10 organic chemicals exceeding EDQLs, only acetone, chlorobenzene, iodomethane, total xylenes, and bis(2-ethylhexyl)phthalate were not detected at levels above EDQLs in background samples, and are considered site-specific COPECs. Of the 16 metals, antimony, arsenic, cadmium, chromium, cobalt, copper, lead, silver, thallium, tin, and zinc were detected sig-

nificantly above concentrations in background samples and considered site-specific COPECs. Methyl acetate, methylcyclohexane, gamma-chlordane, aluminum, calcium, iron, magnesium, manganese, potassium, and sodium do not have EDQLs and so were not considered COPECs.

7.2.2 Sediment

Chemical screening results for sediment samples, including frequency of detection and range of detected concentration, are presented in Table 10.2. Twenty-two sediment samples were collected along the east bank of Mill Creek and analyzed for parameters from the Sediment Target Analyte List (SED TAL). Benzene, carbon disulfide and ethylbenzene have frequencies of detection less than 5 percent and are therefore not considered COPECs. Results of comparing the maximum detected concentration of each constituent to EDQLs were categorized as follows:

- **Below EDQL**: Chlorobenzene, 1,2-dichlorobenzene, benzo(b)fluoranthene, cadmium, chromium, cobalt, lead, mercury and zinc.
- **Exceed EDQL**: Anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene , benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno (1,2,3-cd)pyrene, phenanthrene, pyrene,4,4'-DDE, 4,4'-DDT, beta-BHC, dieldrin, arsenic, copper, lead, and nickel.

Four of these chemicals are naturally-occurring metals in sediment. As discussed in the HHRA, concentrations of these metals in sediment were consistent with background concentrations. The remaining chemicals, eleven PAHs and four pesticides, are not associated with Morton Facility releases and, thus, not considered site-specific COPECs. Acetone, methylcyclohexane, bis(2-ethylhexyl)phthalate, carbazole, aldrin, endrin ketone, aluminum, barium, beryllium, calcium, iron, magnesium, manganese, potassium, selenium, sodium thallium, tin, and vanadium do not have EDQLs, and so are not considered COPECs.

7.2.3 Seep

Chemical screening results for seep samples, including frequency of detection and range of detected concentration, are presented in Table 10.3. Two seep samples were collected along the east bank of Mill Creek and analyzed for full SW-TAL parameters. Since ecological receptors are exposed to water as it comes from the ground, results were compared to the unfiltered water. Results of comparing the maximum detected concentration of each constituent to EDQLs were categorized as follows:

- **Below EDQL**: 1,1-dichloroethane, acetone, benzene, carbon disulfide, ethylbenzene, toluene, xylene, 1,4-dichlorobenzene, beta-BHC, isodrin, arsenic, barium, and beryllium.
- **Exceed EDQL**: Chorobenzene, 1,2-dichlorobenzene, 4,4'-DDE, 4,4'-DDT, alpha-chlordane, dieldrin, endosulfan I, endosulfan II, heptachlor epoxide, cadmium, chromium, cobalt, copper, lead, mercury, nickel, tin, vanadium, and zinc.

The pesticides are not directly associated with site activities and thus, not considered site-specific COPECs. Methylcyclohexane, aluminum, calcium, iron, magnesium, manganese, potassium, and sodium do not have EDQLs and so were not considered COPECs. However, it should be noted that the volume of water emerging from the seeps is very limited compared to the volume of water in Mill Creek. A remediation system at the Morton Facility is already in place to minimize the contribution of groundwater from the site to the Creek. The relative contribution to potential ecological exposure from the seeps is very limited considering the abundance of water in Mill Creek.

7.3 RISK CHARACTERIZATION

Potential risks posed by COPECs were evaluated by calculating a hazard quotient (HQ) for each constituent, for each endpoint species. The HQ for all pathways was determined by dividing the maximum concentration by the appropriate EDQL for the constituent:

$$HQ = C_{max}/EDQL$$

If the resultant HQ is greater than 1, a potential risk for adverse effects from exposure to COPECs exists. The magnitude of the HQ indicates the relative risk posed to endpoint species. It is important to note that this approach is conservative, and probably overestimates the potential for adverse effects upon the wildlife populations.

7.3.1 Soil

Potential risks from site-specific COPECs detected in soil are shown in Table 10.1. The hazard quotients are greater than 1 for acetone, bis(2-ethylhexyl)phthalate, chlorobenzene, iodomethane, and xylenes. Eleven metals (antimony, arsenic, cadmium, chromium, cobalt, copper, lead, silver, thallium, tin, and zinc) also had hazard quotients greater than 1.

7.3.2 Sediment

No site-specific COPECs were identified in sediment, indicating no potential risk to ecological receptors from site-related compounds.

7.3.3 Seeps

Potential risks from site-specific COPECs detected in seeps are shown in Table 10.3. The hazard quotients are greater than 1 for chorobenzene and 1,2-dichlorobenzene. Ten metals (cadmium, chromium, cobalt, copper, lead, mercury, nickel, tin, vanadium, and zinc) had hazard quotients greater than 1, indicating potential risk.

7.4 ECOLOGICAL SIGNIFICANCE

This assessment suggests that potentially significant ecological risks (i.e., HQ≥1) may result from exposure to COPECs in soil at the site. No site-specific COPECs were detected in sediment samples. These effects are considered to have minimal ecological significance based upon the findings of the biological survey presented at the beginning of this assessment. There are several reasons for this conclusion. For a chemical in a soil to pose a risk, it must first be made available to a receptor through mobilization, transport, and exposure; and then the chemical must have the potential to elicit an adverse response from the ecological receptor associated with that exposure.

Regardless of their origin or age of chemical, the COPECs in soil have minimal ecological significance at the Morton Facility. Potential ecological risk is determined by exposure frequency, constituent concentration, mechanism of exposure, and duration of exposure. The Morton Facility and surrounding area is industrial and residential with minimal habitat available to support a wildlife population. This area also experiences constant physical disturbance that prevents populations of wildlife from developing. Since only transient species and a few individual animals would use this area, the frequency and duration of exposure is limited. Therefore, no further evaluation of soil will be required. As discussed, the abundance of water in Mill Creek compared to the flow from the seeps makes the seeps an unlikely source of ecologiocal exposure. Also, the contribution of the chemicals in the seeps to concentrations in Mill Creek are likely to be minimal given the significantly greater flow rate in Mill Creek. As a remediation system is in place to minimize the flow of groundwater from the Morton Faciltiy to Mill Creek, no further evaluation of the seeps will be required.

8.0 CONCLUSIONS

This baseline risk assessment was conducted to evaluate the potential for adverse human health and ecological effects as a result of potential exposure to chemicals in soil and groundwater at the Morton Facility and in sediment and seeps at Mill Creek, which is adjacent to the facility.

The results of the risk assessment indicated the following:

- For the indoor industrial worker, the hazard index (0.5) and carcinogenic risk estimates ($6x10^{-6}$) are below acceptable levels. Potential exposure to chemicals in soil and groundwater that may migrate to indoor air would not result in adverse health effects for this receptor.

- For the outdoor industrial worker, the hazard index (1.1) and carcinogenic risk estimates ($1x10^{-4}$) were at or slightly exceeded acceptable levels. However, the chemicals in soil contributing most significantly to risk were located in a localized area at T-1. Concentrations outside the T-1 area were at least an order of magnitude lower than the detections in samples from T-1, indicating exposure to chemicals in other areas of the site would be within the acceptable risk range or below the acceptable hazard index.

- For the construction worker, the hazard index (20) exceeded acceptable levels while the carcinogenic risk estimate ($3.5x10^{-5}$) was within the acceptable risk range. The chemicals in soil and groundwater contributing most significantly to risk were located in specific areas of the site. Contributions to hazard index from acetone, toluene, benzene, chlorobenzene, 1,2-dichlorobenzene in groundwater were driven by a conservative model used to estimate concentrations from exposed groundwater in a 6 by 30 foot trench and maximum concentrations or concentrations in a specific area of the site. Concentrations of arsenic were related to the localized T-1 area; concentrations beyond this area were at least an order of magnitude lower. Exposure for the construction worker was related to specific conditions during potential construction (e.g., exposed groundwater and high soil contact rates) in these areas over a continuous one-year period. No construction is currently occurring. Appropriate precautions can be taken to protect workers during future construction.

- For the recreational user, both adult and child, hazard indexes (0.012 and 0.012 , respectively) were below acceptable levels. No carcinogenic chemicals were identified as chemicals of potential concern in Mill Creek. Exposure to chemicals in surface water, based on seep data at Mill Creek, is not anticipated to result in adverse health effects. No COPCs were identified in sediment.

- For the off-site resident, the hazard index (0.11) and carcinogenic risk ($1x10^{-6}$) predicted for inhalation exposure for the outdoor industrial worker were at or below acceptable levels. Potential exposure to chemicals in ambient air from the Morton Facility is not anticipated to result in adverse health effects.

- The SERA resulted in hazard indices above 1.0 suggesting the potential for risks to ecological receptors due to constituents in on-site soils. These potential effects have minimal ecological significance, however, due to the limited potential for ecological receptors to inhabit the industrial Morton Facility setting. This limits the potential for receptors to be present and exposed to on-site soil constituents. The minimal

flow in the seeps also limits the potential for receptors to be exposed to constituents in the seeps. COPECs were not identified in sediment. Therefore, the SERA adequately assesses the potential risks to ecological receptors and a PERA is not considered necessary.

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TABLES

TABLE 1.1
SELECTION OF CHEMICALS OF POTENTIAL CONCERN - SOIL
Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Soil, Ambient and Indoor Air
Exposure Point:	On-Site

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	(2) Concentration Used for Screening	(3) Background Value	(4) Screening Toxicity Value			COPC Flag	(5) Rationale for Contaminant Deletion or Selection
	Volatile Organic Compounds															
67641	Acetone	0.0019	J	23	B	mg/kg	T-6-7.5	51 / 105	0.0071 -- 49	23	--	16	WQ	RBSL	Yes	ASL
107131	Acrylonitrile	1.1	J	1.1	J	mg/kg	DP17-13'	1 / 35	0.088 -- 250	1.1	--	0.51	C	PRG	No	IFD
71432	Benzene	0.0017	J	0.67	J	mg/kg	DP17-13'	5 / 105	0.004 -- 12	0.67	--	0.03	WQ	RBSL	Yes	ASL
75274	Bromodichloromethane	0.0015	J	0.0015	J	mg/kg	DP07-9'	1 / 105	0.004 -- 12	0.0015	--	0.6	WQ	RBSL	No	BSL
78933	2-Butanone	0.0031	J	0.64	J	mg/kg	DP01-2'	16 / 105	0.016 -- 49	0.64	--	28000	N	PRG	No	BSL
75150	Carbon disulfide	0.0018	J	1.5		mg/kg	DP14-3'	15 / 105	0.004 -- 12	1.5	--	32	WQ	RBSL	No	BSL
108907	Chlorobenzene	0.00053	J	2.5		mg/kg	T-6-10	25 / 105	0.004 -- 7.1	2.5	--	1	WQ	RBSL	Yes	ASL
67663	Chloroform	0.0036	J	0.0036	J	mg/kg	DP07-9'	1 / 105	0.004 -- 12	0.0036	--	0.52	C	PRG	No	BSL
74873	Chloromethane	0.014		1.7		mg/kg	T-1-4	2 / 105	0.0044 -- 14	1.7	--	2.7	C	PRG	No	BSL
75718	Dichlorodifluoromethane	0.0032	J	0.0032	J	mg/kg	DP19-2'	1 / 105	0.004 -- 12	0.0032	--	310	N	PRG	No	BSL
75343	1,1-Dichloroethane	0.022		0.022		mg/kg	STR10-11'	1 / 105	0.004 -- 12	0.022	--	23	WQ	RBSL	No	BSL
107062	1,2-Dichloroethane	0.0026		0.0026	J	mg/kg	STR10-11'	1 / 105	0.004 -- 12	0.0026	--	0.02	WQ	RBSL	No	BSL
156592	cis-1,2-Dichloroethene	0.0051		0.0051		mg/kg	STR10-11'	1 / 105	0.002 -- 6.1	0.0051	--	150	N	PRG	No	BSL
540590	1,2-Dichloroethene (total)	0.0051	J	0.0051	J	mg/kg	STR10-11'	1 / 105	0.004 -- 12	0.0051	--	0.7	WQ	RBSL	No	BSL
100414	Ethylbenzene	0.01		6.2	J	mg/kg	DP16-12.5'	9 / 105	0.004 -- 7.1	6.2	--	13	WQ	RBSL	No	BSL
74884	Iodomethane	0.18		36		mg/kg	T-1-4	3 / 35	0.0044 -- 12	36	--	N/A		N/A	No	NTX
98828	Isopropylbenzene	0.24		0.24	J	mg/kg	DP01-2'	1 / 70	0.004 -- 7.1	0.24	--	520	N	PRG	No	BSL
79209	Methyl acetate	0.0019	J	6		mg/kg	UAW17-40-5'	4 / 70	0.008 -- 14	6	--	96000	N	PRG	No	BSL
108872	Methylcyclohexane	0.00076	J	1.3	J	mg/kg	DP01-2'	5 / 70	0 -- 0	1.3	--	8800	N	PRG	No	BSL
75092	Methylene chloride	0.0014	JB	11	JB	mg/kg	DP16-12.5'	26 / 105	0.004 -- 1.4	11	--	0.02	WQ	RBSL	Yes	ASL
127184	Tetrachloroethene	0.0016	J	0.0092	J	mg/kg	UAW20-60-1.5'	4 / 105	0.004 -- 12	0.0092	--	0.06	WQ	RBSL	No	BSL
108883	Toluene	0.00052	J	160		mg/kg	UAW04-20-10'	24 / 105	0.004 -- 1.4	160	--	12	WQ	RBSL	Yes	ASL
79016	Trichloroethene	0.0025	J	0.0025	J	mg/kg	STR10-11'	1 / 105	0.004 -- 12	0.0025	--	0.06	WQ	RBSL	No	BSL
75014	Vinyl chloride	0.0084		0.0084		mg/kg	STR10-11'	1 / 105	0.0044 -- 14	0.0084	--	0.01	WQ	RBSL	No	BSL
1330207	Xylenes (total)	0.002	J	50		mg/kg	DP01-2'	14 / 105	0.008 -- 14	50	--	190	WQ	RBSL	No	BSL

TABLE 1.1

SELECTION OF CHEMICALS OF POTENTIAL CONCERN - SOIL

Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Soil, Ambient and Indoor Air
Exposure Point:	On-Site

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	(2) Concentration Used for Screening	(3) Background Value	(4) Screening Toxicity Value			COPC Flag	(5) Rationale for Contaminant Deletion or Selection
	Semi-Volatile Organic Compounds															
83329	Acenaphthene	0.069	J	0.58		mg/kg	UAW01-30-1.5'	2 / 105	0.34 -- 86	0.58	--	570	WQ	RBSL	No	BSL
208968	Acenaphthylene	3.3	J	3.3	J	mg/kg	UAW17-40-5'	1 / 105	0.34 -- 86	3.3	--	570	WQ	RBSL	No	BSL
62533	Aniline	0.16	J	22		mg/kg	UAW08-20-13'	4 / 35	0.35 -- 86	22	--	430	C	PRG	No	BSL
120127	Anthracene	0.18	J	1.5		mg/kg	UAW01-30-1.5'	2 / 105	0.34 -- 86	1.5	--	12000	WQ	RBSL	No	BSL
56553	Benzo(a)anthracene	0.07	J	5.4		mg/kg	UAW01-30-1.5'	8 / 105	0.34 -- 86	5.4	--	2	WQ	RBSL	No	NHIST
50328	Benzo(a)pyrene	0.085	J	6.2		mg/kg	UAW01-30-1.5'	7 / 105	0.34 -- 86	6.2	--	0.29	C	PRG	No	NHIST
205992	Benzo(b)fluoranthene	0.07	J	7		mg/kg	UAW01-30-1.5'	10 / 105	0.34 -- 86	7	--	2.9	C	PRG	No	NHIST
191242	Benzo(ghi)perylene	0.089	J	2.8		mg/kg	UAW01-30-1.5'	5 / 105	0.34 -- 86	2.8	--	4300	WQ	RBSL	No	BSL
207089	Benzo(k)fluoranthene	0.078	J	2.8		mg/kg	UAW01-30-1.5'	4 / 105	0.34 -- 86	2.8	--	29	C	PRG	No	BSL
117817	bis(2-Ethylhexyl) phthalate	0.07	J	150		mg/kg	STR03-12.5'	16 / 105	0.34 -- 86	150	--	180	C	PRG	No	BSL
86748	Carbazole	0.48		0.48		mg/kg	UAW01-30-1.5'	1 / 71	0.34 -- 8.4	0.48	--	120	C	PRG	No	BSL
218019	Chrysene	0.064	J	5.9		mg/kg	UAW01-30-1.5'	10 / 105	0.34 -- 86	5.9	--	160	WQ	RBSL	No	BSL
53703	Dibenz(a,h)anthracene	0.82		0.82		mg/kg	UAW01-30-1.5'	1 / 105	0.34 -- 86	0.82	--	0.29	C	PRG	No	IFD
132649	Dibenzofuran	0.32	J	3.5	J	mg/kg	UAW17-40-5'	3 / 105	0.34 -- 86	3.5	--	5100	N	PRG	No	BSL
95501	1,2-Dichlorobenzene	0.071	J	21	J	mg/kg	DP17-13'	14 / 105	0.34 -- 86	21	--	17	WQ	RBSL	Yes	ASL
541731	1,3-Dichlorobenzene	0.26	J	0.26	J	mg/kg	UAW12-20-12'	1 / 105	0.34 -- 86	0.26	--	52	N	PRG	No	BSL
106467	1,4-Dichlorobenzene	0.062	J	1.3		mg/kg	UAW12-20-12'	6 / 105	0.34 -- 86	1.3	--	2	WQ	RBSL	No	BSL
120832	2,4-Dimethylphenol	24		24		mg/kg	UAW17-40-5'	1 / 105	0.34 -- 86	24	--	9	WQ	RBSL	No	IFD
117840	Di-n-octyl phthalate	0.29	J	0.29	J	mg/kg	DP15-2'	1 / 105	0.34 -- 86	0.29	--	10000	SAT	PRG	No	BSL
206440	Fluoranthene	0.062	J	14		mg/kg	UAW01-30-1.5'	13 / 105	0.34 -- 86	14	--	4300	WQ	RBSL	No	BSL
86737	Fluorene	0.063	J	4.3	J	mg/kg	UAW17-40-5'	3 / 105	0.34 -- 86	4.3	--	560	WQ	RBSL	No	BSL
193395	Indeno(1,2,3-cd)pyrene	0.12	J	2.7		mg/kg	UAW01-30-1.5'	4 / 105	0.34 -- 86	2.7	--	2.9	C	PRG	No	BSL
91576	2-Methylnaphthalene	0.16	J	22	J	mg/kg	T-6-7.5	3 / 105	0.34 -- 35	22	--	84	WQ	RBSL	No	BSL
95487	2-Methylphenol	0.57		15		mg/kg	UAW17-40-5'	2 / 105	0.34 -- 86	15	--	15	WQ	RBSL	No	BSL
108394	3-Methylphenol	5.4	J #	5.4	J #	mg/kg	DP17-13'	1 / 35	0.35 -- 86	5.4	--	44000	N	PRG	No	BSL
106445	4-Methylphenol	0.46	#	35	#	mg/kg	UAW17-40-5'	3 / 105	0.34 -- 86	35	--	4400	N	PRG	No	BSL

TABLE 1.1

SELECTION OF CHEMICALS OF POTENTIAL CONCERN - SOIL

Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Soil, Ambient and Indoor Air
Exposure Point:	On-Site

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	(2) Concentration Used for Screening	(3) Background Value	(4) Screening Toxicity Value			COPC Flag	(5) Rationale for Contaminant Deletion or Selection
91203	Naphthalene	3.8	J	3.8	J	mg/kg	UAW17-40-5'	1 / 105	0.34 -- 86	3.8	--	84	WQ	RBSL	No	BSL
85018	Phenanthrene	0.07	J	9.8		mg/kg	UAW17-40-5'	10 / 105	0.34 -- 86	9.8	--	12000	WQ	RBSL	No	BSL
108952	Phenol	0.075	J	13		mg/kg	UAW17-40-5'	3 / 105	0.34 -- 86	13	--	100	WQ	RBSL	No	BSL
129000	Pyrene	0.063	J	11		mg/kg	UAW01-30-1.5'	12 / 105	0.34 -- 86	11	--	4200	WQ	RBSL	No	BSL
	Pesticides and PCBs															
12674112	Aroclor 1016	0.016	J	0.016	J	mg/kg	UAW08-20-13'	2 / 105	0.034 -- 75	0.016	--	29	C	PRG	No	BSL
53469219	Aroclor 1242	0.063		0.26		mg/kg	UAW12-20-12'	3 / 105	0.034 -- 75	0.26	--	1.00	C	PRG	No	BSL
12672296	Aroclor 1248	0.011	J	0.011	J	mg/kg	T-3-3	1 / 105	0.034 -- 75	0.011	--	1.00	C	PRG	No	BSL
11097691	Aroclor 1254	0.024		0.98		mg/kg	UAW17-40-1.5'	7 / 105	0.034 -- 75	0.98	--	1.00	C	PRG	No	BSL
11096825	Aroclor 1260	0.011	J	0.028	J	mg/kg	UAW13-20-1.5'	5 / 105	0.034 -- 75	0.028	--	1.00	C	PRG	No	BSL
319857	beta-BHC	0.0017	J	0.0038	J	mg/kg	DP10-10' Blind Dup	3 / 105	0.0018 -- 2	0.0038	--	0.003	WQ	RBSL	No	IFD
5103719	alpha-Chlordane	0.00083	J	0.00083	J	mg/kg	UAW22-20-2'	1 / 71	0.0018 -- 0.12	0.00083	--	10	WQ	RBSL	No	BSL
5103742	gamma-Chlordane	0.00047	J	0.0025	PG	mg/kg	STR11-2'	2 / 71	0.0018 -- 0.12	0.0025	--	10	WQ	RBSL	No	BSL
510156	Chlorobenzilate	10	PG	10	PG	mg/kg	DP13-11'	1 / 35	0.0035 -- 2.2	10	--	9.1	C	PRG	No	IFD
72548	4,4'-DDD	0.00064	J	0.00064	J	mg/kg	UAW22-20-2'	1 / 105	0.0018 -- 2	0.00064	--	16	WQ	RBSL	No	BSL
72559	4,4'-DDE	0.0002	J	0.2		mg/kg	UAW17-40-5'	8 / 105	0.0018 -- 2	0.2	--	12	C	PRG	No	BSL
50293	4,4'-DDT	0.00065	J	0.78	J	mg/kg	DP16-12.5'	5 / 105	0.0018 -- 2	0.78	--	12	C	PRG	No	BSL
60571	Dieldrin	0.00015	J	0.0041	PG	mg/kg	STR11-2'	3 / 105	0.0018 -- 2	0.0041	0.015	0.004	WQ	RBSL	No	BKG
33213659	Endosulfan II	0.0015	J	0.0015	J	mg/kg	UAW22-20-2'	1 / 105	0.0018 -- 2	0.0015	--	180	WQ	RBSL	No	BSL
1031078	Endosulfan sulfate	0.0028	PG	0.012	PG	mg/kg	UAW17-40-1.5'	2 / 105	0.0018 -- 2	0.012	--	180	WQ	RBSL	No	BSL
72208	Endrin	0.00048	J	0.0025	PG	mg/kg	T-1-6	3 / 105	0.0018 -- 2	0.0025	--	1	WQ	RBSL	No	BSL
7421934	Endrin aldehyde	0.0013		0.19	PG	mg/kg	STR03-12.5'	5 / 105	0.0018 -- 2	0.19	--	1	WQ	RBSL	No	BSL
53494705	Endrin ketone	0.0017	J	0.0017	J	mg/kg	STR11-2'	1 / 71	0.0018 -- 0.12	0.0017	--	1	WQ	RBSL	No	BSL
1024573	Heptachlor epoxide	0.0001	J	0.019	J	mg/kg	T-1-4	2 / 105	0.0018 -- 2	0.019	--	0.27	C	PRG	No	BSL
72435	Methoxychlor	0.0017	J	4.5	PG	mg/kg	DP16-12.5'	3 / 105	0.0035 -- 3.9	4.5	--	160	WQ	RBSL	No	BSL

TABLE 1.1

SELECTION OF CHEMICALS OF POTENTIAL CONCERN - SOIL

Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Soil, Ambient and Indoor Air
Exposure Point:	On-Site

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	(2) Concentration Used for Screening	(3) Background Value	(4) Screening Toxicity Value			COPC Flag	(5) Rationale for Contaminant Deletion or Selection
	Inorganics															
7429905	Aluminum	1380		14100	J	mg/kg	DP08-6'	78 / 78	0.00 -- 0	14100	18700	100000	MAX	PRG	No	BKG
7440360	Antimony	0.6	J	65.1		mg/kg	T-1-4	5 / 113	1.00 -- 1.4	65.1	0.7	5.0	WQ	RBSL	Yes	ASL
7440382	Arsenic	0.75	J	580		mg/kg	T-1-4	113 / 113	0.00 -- 0	580	21	2.7	C	PRG	Yes	ASL
74400393	Barium	2	J	691		mg/kg	DP17-13'	113 / 113	0.00 -- 0	691	997	1600	WQ	RBSL	No	BKG
7440417	Beryllium	0.052	J	1		mg/kg	STR10-1.5'	104 / 113	0.53 -- 0.72	1	0.64	63	WQ	RBSL	No	BSL
7440439	Cadmium	0.054	J	6.5		mg/kg	DP25-2.5'	101 / 113	0.21 -- 0.26	6.5	0.82	8	WQ	RBSL	No	BSL
7440702	Calcium	810		175000		mg/kg	STR02-12.5'	78 / 78	0.00 -- 0	175000	128800	N/A		N/A	No	NUT
16065831	Chromium	2.3		232		mg/kg	T-1-4	113 / 113	0.00 -- 0	232	81	38	WQ	RBSL	Yes	ASL
744484	Cobalt	1	J	82.8		mg/kg	DP15-9'	113 / 113	0.00 -- 0	82.8	11.9	100000	MAX	PRG	No	BSL
7440508	Copper	4.6		1260		mg/kg	T-1-4	113 / 113	0.00 -- 0	1260	66	76000	N	PRG	No	BSL
74908	Cyanide	0.19	J	1.7		mg/kg	UAW16-10-5.5'	17 / 105	0.51 -- 0.68	1.7	--	40	WQ	RBSL	No	BSL
7439896	Iron	3500		36200		mg/kg	STR11-9'	78 / 78	0.00 -- 0	36200	29500	100000	MAX	PRG	No	BSL
7439821	Lead	2.2		19300		mg/kg	T-1-4	113 / 113	0.00 -- 0	19300	40	750	N	PRG	Yes	ASL
7439954	Magnesium	885		95200		mg/kg	STR02-12.5'	78 / 78	0.00 -- 0	95200	45800	N/A		N/A	No	NUT
7439965	Manganese	130		2120		mg/kg	STR05-9'	78 / 78	0.00 -- 0	2120	1154	1800	N	PRG	Yes	ASL
7440224	Mercury	0.011	J	0.57		mg/kg	DP17-13'	82 / 113	0.10 -- 0.13	0.57	0	2.0	WQ	RBSL	No	BSL
7440020	Nickel	4.1	J	142		mg/kg	T-1-6	113 / 113	0.00 -- 0	142	21	130	WQ	RBSL	Yes	ASL
7440097	Potassium	224	J L	3810		mg/kg	DP44-1.5	78 / 78	0.00 -- 0	3810	417	N/A		N/A	No	NUT
7722492	Selenium	0.36	J	1.1		mg/kg	DP23-9'	38 / 113	0.52 -- 0.72	1.1	0.3	5.0	WQ	RBSL	No	BSL
7487947	Silver	0.37	J	5.6		mg/kg	T-1-4	6 / 105	0.51 -- 0.72	5.6	<0.5	34.0	WQ	RBSL	No	BSL
7440235	Sodium	72.5	J	2410		mg/kg	UAW20-60-1.5'	60 / 78	568.00 -- 640	2410	550	N/A		N/A	No	NUT
7446186	Thallium	0.61	J	31.8		mg/kg	T-1-4	36 / 113	1.00 -- 1.4	31.8	1.8	0.7	WQ	RBSL	Yes	ASL
7440315	Tin	0.96	J	158000	J	mg/kg	T-1-4	40 / 40	0.00 -- 0	158000	3.2	100000	MAX	PRG	Yes	ASL
7440622	Vanadium	1.6	J	30.4		mg/kg	STR10-1.5'	113 / 113	0.00 -- 0	30.4	60	6000	WQ	RBSL	No	BKG
7440666	Zinc	8.9		418	MBD	mg/kg	UAW17-40-5'	113 / 113	0.00 -- 0	418	117	12000	WQ	RBSL	No	BSL

TABLE 1.1

SELECTION OF CHEMICALS OF POTENTIAL CONCERN - SOIL

Morton International, Inc.
Reading, Ohio

(1) Minimum/maximum detected concentration.

(2) Maximum value used for screening concentration.

(3) Background values derived from statistical analysis presented separately.

(4) Screening toxicity value -- Lowest value reported between the Region 5 Risk Based Soil Screening Levels (RBSL) for groundwater protection (U.S. EPA, 1998) and the Region 9 Preliminary Remediation Goal (PRG) Industrial Screening Level (U.S. EPA, 2000). Additional notation indicates cancer (C) or non-cancer (N) or protection of water quality (WQ) endpoint. Screening criteria were not available for some compounds (N/A). Based on similarities in chemical and physical structure, the following surrogate screening criteria were used:

acenaphthylene = acenaphthene	endosulfan I and II and endosulfan sulfate = endosulfan (mixture)
abenzo(ghi)perylene = fluoranthene	endrin aldehyde and endrin ketone = endrin
alpha and gamma chlordane = chlordane	phenanthrene = anthracene
cyclohexane = n-hexane	2-methylnapthalene = naphthalene
delta-BHC = alpha-BHC	

(5) Rationale Codes

Selection Reason: Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)

Deletion Reason: Infrequent Detection (IFD)
Background Levels (BKG)
No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)
Not Historically Associated (NHIST)

Definitions:

B = Method Blank Contamination. The associated method blank contains the target analyte at a reportable level

C = Carcinogenic

COPC = Chemical of Potential Concern

J = Estimated Value

MBD = This analyte is present in the associated method blank at an amount that is less than two times the reporting limit.

MCL = Federal Maximum Contaminant Level

N = Non-Carcinogenic

N/A = Not Applicable

PG = The percentage difference between the original and confirmation analyses is greater than 40%

PRG = Preliminary Remediation Goal

SMCL = Secondary Maximum Contaminant Level

= Co-Elution of 3-Methylphenol and 4-Methylphenol.

TABLE 1.2
SELECTION OF CHEMICALS OF POTENTIAL CONCERN - GROUNDWATER
Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater, Ambient & Indoor Air
Exposure Point:	On and Off-site

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	(2) Concentration Used for Screening	(3) Background Value	(4) Screening Toxicity Value	COPC Flag	(5) Rationale for Contaminant Deletion or Selection
	Volatile Organic Compounds													
67641	Acetone	0.8	JB	45000		µg/L	UAW06-20	29 / 51	10 -- 10000	45000	--	610 N PRG	Yes	ASL
71432	Benzene	0.33	J	110		µg/L	UAW08-20	15 / 51	1 -- 1000	110	--	5 MCL	Yes	ASL
75274	Bromodichloromethane	0.2	J	0.49	J	µg/L	UAW09-20	2 / 51	1 -- 1000	0.49	--	100 MCL	No	BSL
78933	2-Butanone	0.42	J	750	JB	µg/L	UAW06-20	7 / 51	2 -- 10000	750	--	1900 N PRG	No	BSL
75150	Carbon disulfide	1.5		270	J	µg/L	UAW11-10	9 / 51	1 -- 1000	270	--	1000 N PRG	No	BSL
108907	Chlorobenzene	0.5	J	3200		µg/L	MWEPA1	31 / 51	1 -- 1000	3200	--	100 MCL	Yes	ASL
67663	Chloroform	0.23	J	67		µg/L	UAW23-20	9 / 51	1 -- 1000	67	--	80 MCL	No	BSL
110827	Cyclohexane	0.73	J	0.73	J	µg/L	UAW03-20	1 / 42	1 -- 1000	0.73	--	35000 N PRG	No	BSL
75718	Dichlorodifluoromethane	0.38	J	0.41	J	µg/L	UAW01-30	2 / 51	1 -- 1000	0.41	--	390 N PRG	No	BSL
75343	1,1-Dichloroethane	0.17	J	66		µg/L	UAW22-20	14 / 51	1 -- 1000	66	--	810 N PRG	No	BSL
107062	1,2-Dichloroethane	0.44	J	660		µg/L	UAW23-20	8 / 51	1 -- 1000	660	--	5 MCL	No	NHIST
156592	cis-1,2-Dichloroethene	1.7	J	25		µg/L	UAW23-20	5 / 51	0.5 -- 500	25	--	70 MCL	No	BSL
100414	Ethylbenzene	0.55	J	57	J	µg/L	UAW08-20	10 / 51	1 -- 1000	57	--	700 MCL	No	BSL
98828	Isopropylbenzene	0.34	J	0.34	J	µg/L	UAW03-20	1 / 42	1 -- 1000	0.34	--	660 N PRG	No	BSL
108101	4-Methyl-2-pentanone (MIBK)	22	J	22	J	µg/L	UAW13-20	1 / 51	10 -- 10000	22	--	160 N PRG	No	BSL
108872	Methylcyclohexane	0.41	J	3.5	J	µg/L	UAW05-20	3 / 42	1 -- 1000	3.5	--	5200 N PRG	No	BSL
75092	Methylene chloride	0.98	J	200	JB	µg/L	UAW04-20	14 / 51	1 -- 1000	200	--	5 MCL	Yes	ASL
127184	Tetrachloroethene	15		82		µg/L	UAW23-20	4 / 51	1 -- 1000	82	--	5 MCL	No	NHIST
108883	Toluene	0.22	J	21000		µg/L	UAW04-20	19 / 51	1 -- 670	21000	--	1000 MCL	Yes	ASL
71556	1,1,1-Trichloroethane	0.2	J	51		µg/L	UAW23-20	3 / 51	1 -- 1000	51	--	200 MCL	No	BSL
79005	1,1,2-Trichloroethane	6.3	J	6.3	J	µg/L	UAW23-20	1 / 51	1 -- 1000	6.3	--	5 MCL	No	IFD
79016	Trichloroethene	0.28	JB	8.8	J	µg/L	UAW23-20	6 / 51	1 -- 1000	8.8	--	5 MCL	No	NHIST
75014	Vinyl chloride	14		15		µg/L	UAW22-20	2 / 51	2 -- 2000	15	--	2 MCL	No	IFD, NHIST
1330207	Xylenes (total)	2.5		190		µg/L	UAW08-20	11 / 51	1 -- 1000	190	--	10000 MCL	No	BSL

TABLE 1.2
SELECTION OF CHEMICALS OF POTENTIAL CONCERN - GROUNDWATER
Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater, Ambient & Indoor Air
Exposure Point:	On and Off-site

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	(2) Concentration Used for Screening	(3) Background Value	(4) Screening Toxicity Value	COPC Flag	(5) Rationale for Contaminant Deletion or Selection
	Semi-Volatile Organic Compounds													
83329	Acenaphthene	6.4	J	6.4	J	µg/L	UAW06-20	1 / 51	10 -- 1700	6.4	--	370 N PRG	No	BSL
62533	Aniline	4.6	J	12000		µg/L	UAW08-20	9 / 9	0 -- 0	12000	--	12 C PRG	Yes	ASL
100527	Benzaldehyde	53		53		µg/L	UAW04-20	1 / 42	10 -- 500	53	--	3600 N PRG	No	BSL
92524	1,1'Biphenyl	7.3	J	7.3	J	µg/L	UAW06-20	1 / 42	10 -- 500	7.3	--	300 N PRG	No	BSL
85687	Butyl Benzyl phthalate	2.3	J	2.7	J	µg/L	UAW18-20	2 / 51	10 -- 1700	2.7	--	100 MCL	No	BSL
105602	Caprolactam	2.5	J	19		µg/L	UAW16-10	5 / 42	10 -- 500	19	--	18000 N PRG	No	BSL
95578	2-Chlorophenol	6.3	J	6.3	J	µg/L	UAW05-20	1 / 51	10 -- 1700	6.3	--	30 N PRG	No	BSL
95501	1,2-Dichlorobenzene	2.4	J	1900		µg/L	UAW12-20	26 / 50	10 -- 1700	1900	--	600 MCL	Yes	ASL
541731	1,3-Dichlorobenzene	1.6	J	41	J	µg/L	UAW12-20	7 / 51	10 -- 1700	41	--	5.5 N PRG	Yes	ASL
106467	1,4-Dichlorobenzene	2.8	J	260		µg/L	MWEPA1	20 / 50	10 -- 1700	260	--	75 MCL	Yes	ASL
120832	2,4-Dichlorophenol	2.8	J	2.8	J	µg/L	UAW05-20	1 / 51	10 -- 1700	2.8	--	110 N PRG	No	BSL
117840	Dinoctyl phthalate	1.2	J	1.2	J	µg/L	UAW22-20	1 / 51	10 -- 1700	1.2	--	730 N PRG	No	BSL
117817	bis(2Ethylhexyl) phthalate	3.4	J	3.4	J	µg/L	UAW01-30	1 / 51	10 -- 1700	3.4	--	4.8 C PRG	No	BSL
86737	Fluorene	5.9	J	5.9	J	µg/L	UAW06-20	1 / 51	10 -- 1700	5.9	--	240 N PRG	No	BSL
95487	2-Methylphenol	47	J	140		µg/L	UAW04-20	2 / 51	10 -- 1700	140	--	1800 N PRG	No	BSL
106445	4-Methylphenol	3.4	J #	330	J #	µg/L	UAW08-20	7 / 51	10 -- 1700	330	--	180 N PRG	Yes	ASL
120821	1,2,4-Trichlorobenzene	2.4	J	2.4	J	µg/L	UAW05-20	1 / 51	10 -- 1700	2.4	--	70 MCL	No	BSL
	Pesticides and PCBs													
309002	Aldrin	0.03	J	0.42		µg/L	UAW11-10	2 / 51	0.05 -- 25	0.42	--	0.004 C PRG	No	IFD
53469219	Aroclor 1242	0.45	J	130	J	µg/L	UAW16-10	3 / 51	1 -- 200	130	--	0.5 MCL	No	NHIST
319846	alpha-BHC	0.029	J	0.32	J	µg/L	UAW08-20	3 / 51	0.05 -- 25	0.32	--	0.011 C PRG	No	NHIST
319857	beta-BHC	0.017	J	0.51	PG	µg/L	UAW18-20	9 / 51	0.05 -- 25	0.51	--	0.037 C PRG	No	NHIST
319868	delta-BHC	0.023	J	0.11		µg/L	UAW11-10	3 / 51	0.05 -- 25	0.11	--	0.011 C PRG	No	NHIST
5103719	alpha-Chlordane	0.026	J	0.053	PG	µg/L	UAW03-20	3 / 43	0.05 -- 25	0.053	--	0.052 C PRG	No	NHIST
72548	4,4'-DDD	0.022	J	0.074	PG	µg/L	UAW03-20	4 / 51	0.05 -- 25	0.074	--	0.28 C PRG	No	BSL
72559	4,4'-DDE	0.021	J	0.024	J	µg/L	UAW06-20	2 / 51	0.05 -- 25	0.024	--	0.2 C PRG	No	BSL
50293	4,4'-DDT	0.022	J	0.022	J	µg/L	UAW06-20	1 / 51	0.05 -- 25	0.022	--	0.2 C PRG	No	BSL

TABLE 1.2
SELECTION OF CHEMICALS OF POTENTIAL CONCERN - GROUNDWATER
Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater, Ambient & Indoor Air
Exposure Point:	On and Off-site

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	(2) Concentration Used for Screening	(3) Background Value	(4) Screening Toxicity Value	COPC Flag	(5) Rationale for Contaminant Deletion or Selection
60571	Dieldrin	0.022	J	0.52	PG	µg/L	UAW08-20	8 / 51	0.05 -- 25	0.52	--	0.0042 C PRG	No	NHIST
959988	Endosulfan I	0.021	J	0.19	J	µg/L	UAW07-20	2 / 51	0.05 -- 25	0.19	--	220 N PRG	No	BSL
33213659	Endosulfan II	0.022	J	0.14		µg/L	UAW18-20	8 / 51	0.05 -- 25	0.14	--	220 N PRG	No	BSL
72208	Endrin	0.043	J	0.043	J	µg/L	UAW11-10	1 / 51	0.05 -- 25	0.043	--	2 MCL	No	BSL
7421934	Endrin aldehyde	0.033	J	0.35	J	µg/L	UAW07-20 DUP	3 / 51	0.05 -- 25	0.35	--	2 MCL	No	BSL
53494705	Endrin ketone	0.045	J	0.14	PG	µg/L	UAW03-20	2 / 43	0.05 -- 25	0.14	--	2 MCL	No	BSL
58899	gamma-BHC (Lindane)	0.041	PG	0.041	PG	µg/L	UAW16-10	1 / 51	0.05 -- 25	0.041	--	0.2 MCL	No	BSL
76448	Heptachlor	0.03	J	0.49	J	µg/L	UAW08-20	5 / 51	0.05 -- 25	0.49	--	0.4 MCL	No	NHIST
1024573	Heptachlor epoxide	0.022	J PG	0.91	PG	µg/L	UAW13-20	5 / 51	0.05 -- 25	0.91	--	0.2 MCL	No	NHIST
465736	Isodrin	0.017	J	0.017	J	µg/L	UAW12-20	1 / 9	0.1 -- 10	0.017	--	N/A N/A	No	NTX
	Inorganics													
7429905	Aluminum	39.6	J	39300	B	µg/L	MW-EPA-2	37 / 42	200 -- 200	39300	--	50 to 200 MCL	Yes	ASL
7440360	Antimony	2.5	J	1060		µg/L	UAW11-10	12 / 51	10 -- 10	1060	--	6 MCL	Yes	ASL
7440382	Arsenic	4.6	J	611		µg/L	MW-EPA-1	35 / 51	10 -- 10	611	--	50 MCL	Yes	ASL
74400393	Barium	20.3	J	771		µg/L	UAW04-20	51 / 51	0 -- 0	771	--	2,000 MCL	No	BSL
7440417	Beryllium	0.58	J	1.9	J	µg/L	MW-EPA-2	7 / 51	5 -- 5	1.9	--	4 MCL	No	BSL
7440439	Cadmium	0.28	J	8.6		µg/L	Recovery Well	18 / 51	2 -- 2	8.6	--	5 MCL	Yes	ASL
7440702	Calcium	72200		935000	J	µg/L	UAW08-20	50 / 50	0 -- 0	935000	--	N/A N/A	No	NUT
16065831	Chromium	1.5	J	1750		µg/L	MW-EPA-2	44 / 51	5 -- 5	1750	--	100 MCL	Yes	ASL
744484	Cobalt	1.3	J	51.2		µg/L	MW-EPA-2	36 / 51	7 -- 7	51.2	--	2,200 N PRG	No	BSL
7440508	Copper	4.5	J	4640		µg/L	Recovery Well	23 / 51	25 -- 25	4640	--	1,000 MCL	Yes	ASL
74908	Cyanide, Total	1.8	J	8.5	J	µg/L	UAW13-20	16 / 51	10 -- 10	8.5	--	200 MCL	No	BSL
7439896	Iron	109		34500		µg/L	UAW11-10	29 / 50	100 -- 100	34500	--	300 MCL	Yes	ASL
7439821	Lead	2.7	J	405		µg/L	Recovery Well	9 / 51	3 -- 3	405	--	15 MCL	Yes	ASL
7439954	Magnesium	13800		203000		µg/L	UAW08-20	50 / 50	0 -- 0	203000	--	N/A N/A	No	NUT
7439965	Manganese	12.4	J	8440		µg/L	UAW11-10	42 / 42	0 -- 0	8440	--	50 MCL	Yes	ASL
7440020	Nickel	2.3	J	910		µg/L	MW-EPA-4	50 / 51	40 -- 40	910	--	730 N PRG	Yes	ASL
7440097	Potassium	1300	J	26800	B	µg/L	UAW23-20	50 / 50	0 -- 0	26800	--	N/A N/A	No	NUT

TABLE 1.2
SELECTION OF CHEMICALS OF POTENTIAL CONCERN - GROUNDWATER
Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater, Ambient & Indoor Air
Exposure Point:	On and Off-site

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	(2) Concentration Used for Screening	(3) Background Value	(4) Screening Toxicity Value	COPC Flag	(5) Rationale for Contaminant Deletion or Selection
7722492	Selenium	5		9.5		µg/L	UAW23-20	3 / 51	5 -- 5	9.5	--	50 MCL	No	BSL
7440235	Sodium	31700		1610000	J	µg/L	UAW18-20	50 / 50	0 -- 0	1610000	--	N/A N/A	No	NUT
7446186	Thallium	5	J	16.6	J	µg/L	UAW13-20	31 / 51	10 -- 10	16.6	--	2 MCL	Yes	ASL
7440315	Tin	66.9	J	6090		µg/L	UAW08-20	9 / 9	0 -- 0	6090	--	22,000 N PRG	No	BSL
7440622	Vanadium	0.95		148		µg/L	UAW03-20	38 / 51	7 -- 7	148	--	260 N PRG	No	BSL
7440666	Zinc	12.4		1100		µg/L	Recovery Well	24 / 51	20 -- 20	1100	--	5,000 MCL	No	BSL

(1) Minimum/maximum detected concentration.
(2) Maximum value used for screening concentration.
(3) Background values not applied for groundwater.
(4) Screening toxicity value -- Either the Maximum Contaminant Limit (MCL) (U.S. EPA, 1998), or if unavailiable, Region 9 Preliminary Remediation Goal (PRG) for tap water (U.S. EPA, 2000). Additional notation indicates cancer (C) or non-cancer (N) endpoint. Screening criteria were not available for the following compounds (N/A). Based on similarities in chemical and physical structure, the following surrogate screening criteria were used:

acenaphthylene = acenaphthene
abenzo(ghi)perylene = fluoranthene
alpha and gamma chlordane = chlordane
cyclohexane = n-hexane
delta-BHC = alpha-BHC
endosulfan I and II and endosulfan sulfate = endosulfan (mixture)
endrin aldehyde and endrin ketone = endrin
phenanthrene = anthracene
2-methylnapthalene = naphthalene

(5) Rationale Codes

Selection Reason: Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)

Deletion Reason: Infrequent Detection (IFD)
Background Levels (BKG)
No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)
Not Historically Associated (NHIST)

Definitions:

B = Method Blank Contamination. The associated method blank contains the target analyte at a reportable level
C = Carcinogenic
COPC = Chemical of Potential Concern
J = Estimated Value
MBD = This analyte is present in the associated method blank at an amount that is less than two times the reporting limit.
MCL = Federal Maximum Contaminant Level
N = Non-Carcinogenic
N/A = Not Applicable
PG = The percentage difference between the original and confirmation analyses is greater than 40%
PRG = Preliminary Remediation Goal
SMCL = Secondary Maximum Contaminant Level
# = Co-Elution of 3-Methylphenol and 4-Methylphenol.

TABLE 1.3

SELECTION OF CHEMICALS OF POTENTIAL CONCERN - SEEPS

Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Seeps
Exposure Medium:	Surface Water, Ambient air, Biota
Exposure Point:	Off-site, Creek

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	(2) Concentration Used for Screening	(3) Background Value	(4) Screening Toxicity Value	COPC Flag	(5) Rationale for Contaminant Deletion or Selection
	Volatile Organic Compounds													
67641	Acetone	2.1	B	3.1	B	µg/L	SS-5	2 / 2	--	3.1	--	610 N PRG	No	BSL
71432	Benzene	0.92	J	1.1		µg/L	SS-1	2 / 2	--	1.1	--	5 MCL	No	BSL
75150	Carbon disulfide	0.97	J	1.1	J	µg/L	SS-5	2 / 2	--	1.1	--	1000 N PRG	No	BSL
108907	Chlorobenzene	11		24		µg/L	SS-5	2 / 2	--	24	--	100 MCL	No	BSL
75343	1,1-Dichloroethane	0.55	J	1		µg/L	SS-1	2 / 2	--	1	--	810 N PRG	No	BSL
100414	Ethylbenzene	0.39	J	0.39	J	µg/L	SS-1	1 / 2	1.8	0.39	--	700 MCL	No	BSL
108872	Methylcyclohexane	0.3	J	0.49	J	µg/L	SS-1	2 / 2	--	0.49	--	5200 N PRG	No	BSL
108883	Toluene	0.45	J	0.55	J	µg/L	SS-5	2 / 2	--	0.55	--	1000 MCL	No	BSL
1330207	Xylenes (total)	1.7		1.7		µg/L	SS-1	1 / 2	1.8	1.7	--	10000 MCL	No	BSL
	Semi-Volatile Organic Compounds													
95501	1,2-Dichlorobenzene	14		21		µg/L	SS-1	2 / 2	--	21	--	600 MCL	No	BSL
106467	1,4-Dichlorobenzene	1.7	J	2.6	J	µg/L	SS-1	3 / 3	--	2.6	--	75 MCL	No	BSL
	Pesticides													
319857	beta-BHC	0.042	J	0.056		µg/L	SS-5	2 / 2	--	0.056	--	0.037 C PRG	No	NHIST
12789036	alpha-Chlordane	0.02	J	0.02	J	µg/L	SS-5	1 / 2	0.05	0.02	--	0.052 C PRG	No	BSL
72559	4,4'-DDE	0.025	J	0.025	J	µg/L	SS-5	1 / 2	0.05	0.025	--	0.2 C PRG	No	BSL
50293	4,4'-DDT	0.028	J	0.028	PG	µg/L	SS-1	1 / 2	0.05	0.028	--	0.2 C PRG	No	BSL
60571	Dieldrin	0.053	PG	0.053	J	µg/L	SS-1	1 / 2	0.05	0.053	--	0.0042 C PRG	No	NHIST
959988	Endosulfan I	0.03	J	0.03	J	µg/L	SS-5	1 / 2	0.05	0.03	--	220 N PRG	No	BSL
33213659	Endosulfan II	0.046	J	0.046	J	µg/L	SS-1	1 / 2	0.05	0.046	--	220 N PRG	No	BSL
1024573	Heptachlor epoxide	0.033	J	0.033	J	µg/L	SS-1	1 / 2	0.05	0.033	--	0.2 MCL	No	BSL
465736	Isodrin	0.005	J	0.005	J	µg/L	SS-1	1 / 2	0.1	0.005	--	N/A N/A	No	NTX
	Inorganics													
7429905	Aluminum	47.8	J	112	J	µg/L	SS-5	2 / 2	--	112	--	50 MCL	Yes	ASL
7440382	Arsenic	4.7		4.7	J	µg/L	SS-5	1 / 2	10	4.7	--	50 MCL	No	BSL
74400393	Barium	73.8	J	233		µg/L	SS-5	2 / 2	--	233	--	2000 MCL	No	BSL
7440702	Calcium	257000		361000		µg/L	SS-1	2 / 2	--	361000	--	N/A N/A	No	NUT
744484	Cobalt	12.4		12.4		µg/L	SS-5	1 / 2	7	12.4	--	2200 N PRG	No	BSL
7439896	Iron	734		734		µg/L	SS-5	1 / 2	100	734	--	300 MCL	Yes	ASL

TABLE 1.3

SELECTION OF CHEMICALS OF POTENTIAL CONCERN - SEEPS

Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Seeps
Exposure Medium:	Surface Water, Ambient air, Biota
Exposure Point:	Off-site, Creek

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	(2) Concentration Used for Screening	(3) Background Value	(4) Screening Toxicity Value		COPC Flag	(5) Rationale for Contaminant Deletion or Selection
7439954	Magnesium	39000		45100		µg/L	SS-1	2 / 2	--	45100	--	N/A	N/A	No	NUT
7439965	Manganese	947		2070		µg/L	SS-1	2 / 2	--	2070	--	50	MCL	Yes	ASL
7440020	Nickel	22.3	J	85.9		µg/L	SS-5	2 / 2	--	85.9	--	730	N PRG	No	BSL
7440097	Potassium	7180	B	9600	B	µg/L	SS-1	2 / 2	--	9600	--	N/A	N/A	No	NUT
7440235	Sodium	159000		361000		µg/L	SS-5	2 / 2	--	361000	--	N/A	N/A	No	NUT
7440315	Tin	121		348		µg/L	SS-5	2 / 2	--	348	--	22000	N PRG	No	BSL
7440622	Vanadium	1.6	J	11.6		µg/L	SS-5	2 / 2	--	11.6	--	260	N PRG	No	BSL
7440666	Zinc	12.6	J	19.4	J	µg/L	SS-5	2 / 2	--	19.4	--	5000	MCL	No	BSL

(1) Minimum/maximum detected concentration.
(2) Maximum value used for screening concentration.
(3) Background values not applied to seeps.
(4) Screening toxicity value -- Maximum Contaminant Limit (MCL) (U.S. EPA, 1998), or if not available, the Region 9 Preliminary Remediation Goal (PRG) for tap water (U.S. EPA, 2000). Additional notation indicates cancer (C) or non-cancer (N) endpoint. Screening criteria were not available for the following compounds (N/A). Based on similarities in chemical and physical structure, the following surrogate screening criteria were used:

acenaphthylene = acenaphthene
abenzo(ghi)perylene = fluoranthene
alpha and gamma chlordane = chlordane
cyclohexane = n-hexane
delta-BHC = alpha-BHC
endosulfan I and II and endosulfan sulfate = endosulfan (mixture)
endrin aldehyde and endrin ketone = endrin
phenanthrene = anthracene
2-methylnapthalene = naphthalene

(5) Rationale Codes

Selection Reason: Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)

Deletion Reason: Infrequent Detection (IFD)
Background Levels (BKG)
No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)
Not Historically Associated (NHIST)

Definitions:

B = Method Blank Contamination. The associated method blank contains the target analyte at a reportable level.
C = Carcinogenic
COPC = Chemical of Potential Concern
J = Estimated Value
MCL = Federal Maximum Contaminant Level
N = Non-Carcinogenic
N/A = Not Applicable
PG = The percentage difference between the original and confirmation analyses is greater than 40%
PRG = Preliminary Remediation Goal
SMCL = Secondary Maximum Contaminant Level

TABLE 1.4

SELECTION OF CHEMICALS OF POTENTIAL CONCERN - SEDIMENT

Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Sediment
Exposure Medium:	Sediment, biota
Exposure Point:	Off-site, Creek

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	(2) Concentration Used for Screening	(3) Background Value	(4) Screening Toxicity Value	COPC Flag	(5) Rationale for Contaminant Deletion or Selection
	Volatile Organic Compounds													
67641	Acetone	0.0029	J	0.018	J	mg/kg	SS-4	6 / 20	0.019 -- 0.026	0.018	--	16 WQ RBSL	No	BSL
71432	Benzene	0.0036	J	0.0036	J	mg/kg	SS-1	1 / 20	0.0048 -- 0.0066	0.0036	--	0.03 WQ RBSL	No	BSL
75150	Carbon disulfide	0.0072	J	0.0072	J	mg/kg	SS-4	1 / 20	0.0048 -- 0.0066	0.0072	--	32 WQ RBSL	No	BSL
108907	Chlorobenzene	0.0011		0.018		mg/kg	SS-1	4 / 20	0.0048 -- 0.0066	0.018	--	1 WQ RBSL	No	BSL
100414	Ethylbenzene	0.00077		0.00077		mg/kg	SS-1	1 / 20	0.0048 -- 0.0066	0.00077	--	13 WQ RBSL	No	BSL
108872	Methylcyclohexane	0.00081	J	0.0011	J	mg/kg	SS-5 (Dup)	2 / 20	0.0097 -- 0.013	0.0011	--	2600 N PRG	No	BSL
1330207	Xylenes (total)	0.002	J	0.002	J	mg/kg	SS-1	1 / 20	0.0097 -- 0.013	0.002	--	190 WQ RBSL	No	BSL
	Semi-Volatile Organic Compounds													
120127	Anthracene	0.09	J	0.09	J	mg/kg	SS-12	1 / 1	0 -- 0	0.09	--	12000 WQ RBSL	No	BSL
56553	Benzo(a)anthracene	0.57		0.57		mg/kg	SS-12	1 / 1	0 -- 0	0.57	--	0.62 C PRG	No	BSL
50328	Benzo(a)pyrene	0.74		0.74		mg/kg	SS-12	1 / 1	0 -- 0	0.74	--	0.062 C PRG	No	NHIST
205992	Benzo(b)fluoranthene	0.99		0.99		mg/kg	SS-12	1 / 1	0 -- 0	0.99	--	0.62 C PRG	No	NHIST
191242	Benzo(ghi)perylene	0.68		0.68		mg/kg	SS-12	1 / 1	0 -- 0	0.68	--	2300 N PRG	No	BSL
207089	Benzo(k)fluoranthene	0.33	J	0.33	J	mg/kg	SS-12	1 / 1	0 -- 0	0.33	--	6.2 C PRG	No	BSL
117817	bis(2-Ethylhexyl) phthalate	0.14	J	0.14	J	mg/kg	SS-12	1 / 1	0 -- 0	0.14	--	35 C PRG	No	BSL
86748	Carbazole	0.073	J	0.073	J	mg/kg	SS-12	1 / 1	0 -- 0	0.073	--	24 C PRG	No	BSL
218019	Chrysene	0.8		0.8		mg/kg	SS-12	1 / 1	0 -- 0	0.8	--	62 C PRG	No	BSL
53703	Dibenz(a,h)anthracene	0.16	J	0.16	J	mg/kg	SS-12	1 / 1	0 -- 0	0.16	--	0.062 C PRG	No	NHIST
95501	1,2-Dichlorobenzene	0.13	J	0.20	J	mg/kg	SS-5 (Dup)	3 / 20	0.38 -- 0.43	0.17	--	17 WQ RBSL	No	BSL
206440	Fluoranthene	1.6		1.6		mg/kg	SS-12	1 / 1	0 -- 0	1.6	--	2300 N PRG	No	BSL
193395	Indeno(1,2,3-cd)pyrene	0.59		0.59		mg/kg	SS-12	1 / 1	0 -- 0	0.59	--	0.62 C PRG	No	BSL
85018	Phenanthrene	0.61		0.61		mg/kg	SS-12	1 / 1	0 -- 0	0.61	--	12000 WQ RBSL	No	BSL
129000	Pyrene	1.4		1.4		mg/kg	SS-12	1 / 1	0 -- 0	1.4	--	2300 N PRG	No	BSL
	Pesticides													
309002	Aldrin	0.001	J	0.001	J	mg/kg	Creek Sed.-1	1 / 20	0.0020 -- 0.022	0.001	--	0.004 C PRG	No	BSL
319857	beta-BHC	0.0046		0.094	PG	mg/kg	SS-4	3 / 20	0.0020 -- 0.022	0.01	--	0.003 WQ RBSL	No	NHIST
72559	4,4'-DDE	0.00091		0.023	PG	mg/kg	SS-12	5 / 20	0.0020 -- 0.022	0.023	--	1.7 C PRG	No	BSL

TABLE 1.4

SELECTION OF CHEMICALS OF POTENTIAL CONCERN - SEDIMENT

Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Sediment
Exposure Medium:	Sediment, biota
Exposure Point:	Off-site, Creek

CAS Number	Chemical	(1) Minimum Concentration	Minimum Qualifier	(1) Maximum Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	(2) Concentration Used for Screening	(3) Background Value	(4) Screening Toxicity Value			COPC Flag	(5) Rationale for Contaminant Deletion or Selection
50293	4,4'-DDT	0.004		0.0056		mg/kg	Creek Sed.-1	2 / 20	0.0020 -- 0.022	0.0056	--	1.7	C	PRG	No	BSL
60571	Dieldrin	0.0022	PG	0.0038	J	mg/kg	Creek Sed.-4	2 / 20	0.0020 -- 0.022	0.0038	--	0.004	WQ	RBSL	No	BSL
53494705	Endrin Ketone	0.0014		0.0014	J	mg/kg	Creek Sed.-2	1 / 20	0.0020 -- 0.022	0.0014	--	1	WQ	RBSL	No	BSL
	Inorganics															
7429905	Aluminum	1730		9330		mg/kg	SS-4	20 / 20	0 -- 0	9330	18700	76000	N	PRG	No	BKG
7440382	Arsenic	2.8		6.3		mg/kg	SS-12	20 / 20	0 -- 0	6.3	20.8	0.39	C	PRG	No	BKG
74400393	Barium	8.9		76.9		mg/kg	SS-4	20 / 20	0 -- 0	76.9	997	1600	WQ	RBSL	No	BKG
7440417	Beryllium	0.069	J	0.46		mg/kg	SS-4	20 / 20	0 -- 0	0.46	0.64	63	WQ	RBSL	No	BKG
7440439	Cadmium	0.11	J	0.54		mg/kg	SS-12	20 / 20	0 -- 0	0.54	0.82	8	WQ	RBSL	No	BKG
7440702	Calcium	18800		178000		mg/kg	Creek Sed.-4	20 / 20	0 -- 0	178000	128800	N/A		N/A	No	NUT
16065831	Chromium	5.6		22.9		mg/kg	SS-12	20 / 20	0 -- 0	22.9	80.6	38	WQ	RBSL	No	BKG
744484	Cobalt	2.4	J	7.8		mg/kg	SS-12	20 / 20	0 -- 0	7.8	11.9	4700	N	PRG	No	BKG
7440508	Copper	4.5		26		mg/kg	SS-12	20 / 20	0 -- 0	26	66.4	2900	N	PRG	No	BKG
7439896	Iron	6220		17400		mg/kg	SS-4	20 / 20	0 -- 0	17400	29470	23000	N	PRG	No	BKG
7439821	Lead	4.2		38.3		mg/kg	SS-12	20 / 20	0 -- 0	38.3	401	400	N	PRG	No	BKG
7439954	Magnesium	5450		64400		mg/kg	Creek Sed.-3	20 / 20	0 -- 0	64400	45800	N/A		N/A	No	NUT
7439965	Manganese	245		670		mg/kg	Creek Sed. -5	20 / 20	0 -- 0	670	1154	1800	N	PRG	No	BKG
7440224	Mercury	0.01	J	0.095	J	mg/kg	SS-12	15 / 20	0.12 -- 0.13	0.095	0.26	2	WQ	RBSL	No	BKG
7440020	Nickel	5.7		22		mg/kg	SS-12	20 / 20	0 -- 0	22	21	130	WQ	RBSL	No	BSL
7440097	Potassium	228		1230		mg/kg	SS-2	20 / 20	0 -- 0	1230	417	N/A		N/A	No	NUT
7722492	Selenium	0.39	J	0.48	J	mg/kg	SS-6	3 / 20	0.57 -- 0.66	0.63	0.3	5	WQ	RBSL	No	BSL
7440235	Sodium	124	J	360		mg/kg	SS-12	20 / 20	0 -- 0	360	550	N/A		N/A	No	BKG
7446186	Thallium	0.67	J	2.2		mg/kg	Creek Sed.-8	10 / 20	1.1 -- 1.3	2.2	2.4	0.7	WQ	RBSL	No	BKG
7440315	Tin	3.3	BJ	76.3	J	mg/kg	SS-2	20 / 20	0 -- 0	76.3	3.2	47000	N	PRG	No	BSL
7440622	Vanadium	6.6		17		mg/kg	SS-4	20 / 20	0 -- 0	17	60	550	N	PRG	No	BSL
7440666	Zinc	16.4		101		mg/kg	SS-12	20 / 20	0 -- 0	101	117	12000	WQ	RBSL	No	BSL

TABLE 1.4

SELECTION OF CHEMICALS OF POTENTIAL CONCERN - SEDIMENT

Morton International, Inc.
Reading, Ohio

(1) Minimum/maximum detected concentration.
(2) Maximum value used for screening concentration.
(3) Background values derived from statistical analysis are presented separately.
(4) Screening toxicity value -- Lowest value reported between the Region 5 Risk Based Soil Screening Levels (RBSLs) for groundwater protection (U.S. EPA, 1998) and the Region 9 Preliminary Remediation Goal (RPG) Residential Screening Level (U.S. EPA, 2000). Additional notation indicates cancer (C) or non-cancer (N) endpoint. Screening criteria were not available for some compounds (N/A). Based on similarities in chemical and physical structure, the following surrogate screening criteria were used:

acenaphthylene = acenaphthene
abenzo(ghi)perylene = fluoranthene
alpha and gamma chlordane = chlordane
cyclohexane = n-hexane
delta-BHC = alpha-BHC
endosulfan I and II and endosulfan sulfate = endosulfan (mixture)
endrin aldehyde and endrin ketone = endrin
phenanthrene = anthracene
2-methylnapthalene = naphthalene

(5) Rationale Codes

Selection Reason: Infrequent Detection but Associaed Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)

Deletion Reason: Infrequent Detection (IFD)
Background Levels (BKG)
No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)
Not Historically Associated (NHIST)

Definitions:

B = Method Blank Contamination. The associated method blank contains the target analyte at a reportable level
C = Carcinogenic
COPC = Chemical of Potential Concern
J = Estimated Value
MCL = Federal Maximum Contaminant Level
N = Non-Carcinogenic
N/A = Not Applicable
PG = The percentage difference between the original and confirmation analyses is greater than 40%
PRG = Preliminary Remediation Goal
SMCL = Secondary Maximum Contaminant Level

TABLE 2
SELECTION OF EXPOSURE PATHWAYS
Morton International, Inc.
Reading, Ohio

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusionof Exposure Pathway
Current/ Future	Soil	Soil	On-site Soil	On-site Outdoor Worker	Adult	Dermal Contact	On-site	Quant.	Industrial operations are present and will continue.
						Incidental Ingestion	On-site	Quant.	Industrial operations are present and will continue.
			On-site Soil	Construction Worker	Adult	Dermal Contact	On-site	Quant.	Industrial operations are present and will continue.
						Incidental Ingestion	On-site	Quant.	Industrial operations are present and will continue.
		Ambient Air	Fugitive Dust and Volatile COPCs from on-site soil may disperse on and off site.	On-site Outdoor Worker	Adult	Inhalation	On-site	Quant.	Industrial operations are present and will continue.
				Construction Worker	Adult	Inhalation	On-site	Quant.	Industrial operations are present and will continue.
				Off-site Resident	Adult & Child	Inhalation	Off-site	Qual	Off-site concentrations much less than on-site.
				Recreational Creek User	Adult & Child	Inhalation	Off-site	Qual.	Off-site concentrations much less than on-site.
		Indoor Air	Volatile COPCs from on-site soil	On-site Indoor Worker	Adult	Inhalation	On-site	Quant.	Industrial operations are present and will continue.
	Groundwater	Groundwater	On-site Groundwater	Construction Worker	Adult	Dermal Contact	On-site	Quant.	Industrial operations are present and will continue.
		Ambient Air	Volatile COPCs from groundwater may be dispersed on and off site.	On-site Outdoor Worker	Adult	Inhalation	On-site	Quant.	Industrial operations are present and will continue.
				Construction Worker	Adult	Inhalation	On-site	Quant.	Industrial operations are present and will continue.
				Off-site Resident	Adult & Child	Inhalation	Off-site	Qual	Off-site concentrations much less than on-site.
				Recreational Creek User	Adult & Child	Inhalation	Off-site	Qual.	Off-site concentrations much less than on-site.
		Indoor Air	Volatile COPCs from on-site groundwater	On-site Indoor Worker	Adult	Inhalation	On-site	Quant.	Industrial operations are present and will continue.
		Surface Water	Creek	Recreational Creek User	Adult & Child	Incidental Ingestion	Off-site	Quant.	Creek may be used for recreational purposes.
						Dermal Contact	Off-site	Quant.	Creek may be used for recreational purposes.
		Sediment	Creek	Recreational Creek User	Adult & Child	Incidental Ingestion	Off-site	Quant.	No COPCs in sediment
						Dermal Contact	Off-site	Quant.	No COPCs in sediment
	Surface Water	Biota	COPCs may be transferred to fish tissue from Creek	Recreational Creek User	Adult & Child	Ingestion	Off-site	None	No bioaccumulative COPCs in seep samples
		Ambient Air	Volatile COPCs may be dispersed on and off site.	On-site Outdoor Worker	Adult	Inhalation	On-site	None	No volatile COPCs in surface water
				Construction Worker	Adult	Inhalation	On-site	None	No volatile COPCs in surface water
				Off-site Resident	Adult & Child	Inhalation	Off-site	None	No volatile COPCs in surface water
				Recreational Creek User	Adult & Child	Inhalation	Off-site	None	No VOCs in seeps
	Sediment	Biota	COPCs may be transferred to fish tissue from Creek	Recreational Creek User	Adult & Child	Ingestion	Off-site	None	No COPCs in sediment

TABLE 3.1
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION (EPC) SUMMARY
SOIL

Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Soil
Exposure Point:	On-site Soil

Chemical of Potential Concern	Units	Site-Wide Arithmetic Mean	Site-wide 95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifer	EPC Units	Reasonable Maximum Exposure		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Volatile Organic Compounds									
Acetone	mg/kg	1.11	1.75	2.3E+01	B	mg/kg	1.59	95% UCL-T	95% UCL for site
Benzene	mg/kg	0.17	0.29	6.7E-01	J	mg/kg	0.67	Maximum Value	Maximum Value
Chlorobenzene	mg/kg	0.18	0.27	2.5E+00		mg/kg	1.43	95% UCL-T	95% UCL of designated area
Methylene chloride	mg/kg	0.28	0.49	1.1E+01	JB	mg/kg	1.41	95% UCL-T	95% UCL of designated area
Toluene	mg/kg	3.65	7.19	1.6E+02		mg/kg	15.1	95% UCL-T	95% UCL of designated area
Semi-Volatile Organic Compounds									
1,2-Dichlorobenzene	mg/kg	1.40	2.2	2.1E+01	J	mg/kg	2.10	95% UCL-T	95% UCL of designated area
Metals									
Antimony	mg/kg	1.25	2.20	6.5E+01		mg/kg	22.7	95% UCL-T	95% UCL of designated area
Arsenic	mg/kg	11.1	19.5	5.8E+02		mg/kg	305	95% UCL-T	95% UCL of designated area
Chromium	mg/kg	14.2	17.9	2.3E+02		mg/kg	71.0	95% UCL-T	95% UCL of designated area
Lead	mg/kg	195	478	1.9E+04		mg/kg	19300	Maximum Value	Maximum Value
Manganese	mg/kg	505	566	2.1E+03		mg/kg	640	95% UCL-T	95% UCL for site
Nickel	mg/kg	15.0	17.3	1.4E+02		mg/kg	79.3	95% UCL-T	95% UCL of designated area
Thallium	mg/kg	1.12	1.59	3.2E+01		mg/kg	10.4	95% UCL-T	95% UCL of designated area
Tin	mg/kg	5120	11902	1.6E+05	J	mg/kg	158000	Maximum Value	Maximum Value

Statistics:
Maximum Detected Value (Max)
95% UCL of Normal Data (95% UCL-N)
95% UCL of Log-transformed Data (95% UCL-T)
Mean of Log-transformed Data (Mean-T)
Mean of Normal Data (Mean-N)

TABLE 3.2
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION (EPC) SUMMARY
GROUNDWATER

Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater
Exposure Point:	On-site Groundwater

Chemical of Potential Concern	Units	Site-Wide Arithmetic Mean	Site-wide 95% UCL of Normal Data	Maximum Detected Concentration	EPC Units	Reasonable Maximum Exposure		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Volatile Organic Compounds								
Acetone	µg/L	2486	4358	45000	µg/L	4.5E+04	Maximum Value	Maximum Value
Benzene	µg/L	38.2	59.5	110	µg/L	1.1E+02	Maximum Value	Maximum Value
Chlorobenzene	µg/L	201	327	3200	µg/L	3.5E+02	95% UCL-T	95% UCL of designated area
Methylene chloride	µg/L	42.3	64.7	200	µg/L	2.0E+02	Maximum Value	Maximum Value
Toluene	µg/L	668	1410	21000	µg/L	2.1E+04	Maximum Value	Maximum Value
Semi-Volatile Organic Compounds								
Aniline	µg/L	2814	6043	12000	µg/L	12000	Maximum Value	Maximum Value
1,2-Dichlorobenzene	µg/L	201	310	1900	µg/L	1900	Maximum Value	Maximum Value
1,3-Dichlorobenzene	µg/L	51.5	86.7	41	µg/L	41	Maximum Value	Maximum Value
1,4-Dichlorobenzene	µg/L	65.7	103	260	µg/L	2.6E+02	Maximum Value	Maximum Value
4-Methylphenol	µg/L	50.8	81.5	330	µg/L	3.3E+02	Maximum Value	Maximum Value
Metals								
Aluminum	µg/L	3197	5506	39300	µg/L	39300	Maximum Value	Maximum Value
Antimony	µg/L	26.8	61.5	1060	µg/L	1060	Maximum Value	Maximum Value
Arsenic	µg/L	39.5	61.2	611	µg/L	47	95% UCL-T	95% UCL of designated area
Cadmium	µg/L	1.10	1.40	8.60	µg/L	1.24	95% UCL-T	95% UCL of designated area
Chromium	µg/L	102	175	1750	µg/L	128	95% UCL-T	95% UCL of designated area
Copper	µg/L	121	274	4640	µg/L	50	95% UCL-T	95% UCL of designated area
Iron	µg/L	1444	2628	34500	µg/L	34500	Maximum Value	Maximum Value
Lead	µg/L	11.6	24.9	405	µg/L	24	95% UCL-N	95% UCL-N of designated area
Manganese	µg/L	1525	2045	8440	µg/L	4889	95% UCL-T	95% UCL of designated area
Nickel	µg/L	99.8	141	910	µg/L	161	95% UCL-T	95% UCL of designated area
Thallium	µg/L	7.50	8.20	16.6	µg/L	7.8	95% UCL-N	95% UCL-N of designated area

Statistics:
Maximum Detected Value (Max)
95% UCL of Normal Data (95% UCL-N)
95% UCL of Log-transformed Data (95% UCL-T)
Mean of Log-transformed Data (Mean-T)
Mean of Normal Data (Mean-N)

TABLE 3.3
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION (EPC) SUMMARY
SEEPS

Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Seeps
Exposure Medium:	Surface Water
Exposure Point:	Creek

Chemical of Potential Concern	Units	Site-Wide Arithmetic Mean	Site-wide 95% UCL of Normal Data	Maximum Detected Concentration	EPC Units	Reasonable Maximum Exposure		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Metals								
Aluminum	µg/L	80	N/A	112	µg/L	112	Max	Maximum Value
Iron	µg/L	392	N/A	734	µg/L	734	Max	Maximum Value
Manganese	µg/L	1509	N/A	2070	µg/L	2070	Max	Maximum Value

Note: N/A - Not applicable, only two samples collected.

Statistics:
Maximum Detected Value (Max)
95% UCL of Normal Data (95% UCL-N)
95% UCL of Log-transformed Data (95% UCL-T)
Mean of Log-transformed Data (Mean-T)
Mean of Normal Data (Mean-N).

TABLE 3.4
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION (EPC) SUMMARY
SOIL TO INDOOR AIR

Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Indoor Air
Exposure Point:	On-site Buildings

Chemical of Potential Concern	Units	Site-Wide Arithmetic Mean	Site-wide 95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifer	EPC Units	Reasonable Maximum Exposure		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Volatile Organic Compounds									
Acetone	mg/kg	1.11	1.75	23	B	mg/m^3	2.3E-04	Johnson & Ettinger	Johnson & Ettinger
Benzene	mg/kg	0.17	0.29	0.67	J	mg/m^3	2.9E-03	Johnson & Ettinger	Johnson & Ettinger
Chlorobenzene	mg/kg	0.18	0.27	2.5		mg/m^3	1.2E-03	Johnson & Ettinger	Johnson & Ettinger
Methylene chloride	mg/kg	0.28	0.49	11	JB	mg/m^3	7.0E-03	Johnson & Ettinger	Johnson & Ettinger
Toluene	mg/kg	3.65	7.19	160		mg/m^3	2.8E-02	Johnson & Ettinger	Johnson & Ettinger
Semi-Volatile Organic Compounds									
1,2-Dichlorobenzene	mg/kg	1.40	2.17	21	J	mg/m^3	2.9E-04	Johnson & Ettinger	Johnson & Ettinger

Statistics:
Maximum Detected Value (Max)
95% UCL of Normal Data (95% UCL-N)
95% UCL of Log-transformed Data (95% UCL-T)
Mean of Log-transformed Data (Mean-T)
Mean of Normal Data (Mean-N).

TABLE 3.5
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION (EPC) SUMMARY
GROUNDWATER TO INDOOR AIR
Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Ground Water
Exposure Medium:	Indoor Air
Exposure Point:	On-site Buildings

Chemical of Potential Concern	Units	Site-Wide Arithmetic Mean	Site-wide 95% UCL of Normal Data	Maximum Detected Concentration	EPC Units	Reasonable Maximum Exposure		
						Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Volatile Organic Compounds								
Acetone	µg/L	2486	4358	45000	mg/m^3	8.8E-03	Johnson & Ettinger	Johnson & Ettinger
Benzene	µg/L	38.2	59.5	110	mg/m^3	3.4E-05	Johnson & Ettinger	Johnson & Ettinger
Chlorobenzene	µg/L	200.6	327	3200	mg/m^3	9.4E-05	Johnson & Ettinger	Johnson & Ettinger
Methylene chloride	µg/L	42.3	64.7	200	mg/m^3	7.2E-05	Johnson & Ettinger	Johnson & Ettinger
Toluene	µg/L	668	1410	21000	mg/m^3	5.8E-03	Johnson & Ettinger	Johnson & Ettinger
Semi-Volatile Organic Compounds								
1,2-Dichlorobenzene	µg/L	201	310	1900	mg/m^3	4.6E-04	Johnson & Ettinger	Johnson & Ettinger
1,3-Dichlorobenzene	µg/L	51.5	86.7	41	mg/m^3	9.9E-06	Johnson & Ettinger	Johnson & Ettinger
1,4-Dichlorobenzene	µg/L	65.7	103	260	mg/m^3	6.3E-05	Johnson & Ettinger	Johnson & Ettinger

Statistics:
Maximum Detected Value (Max)
95% UCL of Normal Data (95% UCL-N)
95% UCL of Log-transformed Data (95% UCL-T)
Mean of Log-transformed Data (Mean-T)
Mean of Normal Data (Mean-N)

TABLE 3.6
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION (EPC) SUMMARY
SOIL TO AMBIENT AIR

Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Ambient Air
Exposure Point:	On-site Soil

Chemical of Potential Concern	Units	Site-Wide Arithmetic Mean	Site-wide 95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifer	EPC Units	Reasonable Maximum Expoure			
							Medium EPC (IW) Value	Medium EPC (CW) Value	Medium EPC Statistic	Medium EPC Rationale
Volatile Organic Compounds										
Acetone	mg/kg	1.11	1.75	23	B	mg/m^3	0.0002	2.90E-03	Volatilization Factor & X/Q Model	US EPA, 1996
Benzene	mg/kg	0.17	0.29	0.67	J	mg/m^3	0.0002	8.50E-03	Volatilization Factor & X/Q Model	US EPA, 1996
Chlorobenzene	mg/kg	0.18	0.27	2.5		mg/m^3	0.0003	3.00E-02	Volatilization Factor & X/Q Model	US EPA, 1996
Methylene chloride	mg/kg	0.28	0.49	11	JB	mg/m^3	0.0008	4.20E-03	Volatilization Factor & X/Q Model	US EPA, 1996
Toluene	mg/kg	3.65	7.19	160		mg/m^3	0.0060	2.70E-02	Volatilization Factor & X/Q Model	US EPA, 1996
Semi-Volatile Organic Compounds										
1,2-Dichlorobenzene	mg/kg	1.4000	2.17	21	J	mg/m^3	0.0002	0.17	Volatilization Factor & X/Q Model	US EPA, 1996
Metals										
Antimony	mg/kg	1.25	2.20	65.1		mg/m^3	1.72E-08	2.30E-05	PEF Model	US EPA, 2001
Arsenic	mg/kg	11.1	19.5	580		mg/m^3	2.30E-07	3.10E-04	PEF Model	US EPA, 2001
Chromium	mg/kg	14.2	18	232		mg/m^3	5.40E-07	7.10E-05	PEF Model	US EPA, 2001
Lead	mg/kg	195	478	19300		mg/m^3	1.50E-05	1.90E-02	PEF Model	US EPA, 2001
Manganese	mg/kg	505	566	2120		mg/m^3	7.10E-07	6.40E-04	PEF Model	US EPA, 2001
Nickel	mg/kg	15	17.3	142		mg/m^3	6.00E-08	7.90E-05	PEF Model	US EPA, 2001
Thallium	mg/kg	1.12	1.59	31.8		mg/m^3	7.90E-09	1.00E-05	PEF Model	US EPA, 2001
Tin	mg/kg	5120	11902	158000	J	mg/m^3	1.20E-04	1.60E-01	PEF Model	US EPA, 2001

Notes: IW = Industrial Worker; CW = Construction Worker

Statistics:
Maximum Detected Value (Max)
95% UCL of Normal Data (95% UCL-N)
95% UCL of Log-transformed Data (95% UCL-T)
Mean of Log-transformed Data (Mean-T)
Mean of Normal Data (Mean-N)

TABLE 3.7
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION (EPC) SUMMARY
GROUNDWATER TO AMBIENT AIR

Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Ambient Air
Exposure Point:	On-site Outdoors

Chemical of Potential Concern	Units	Site-Wide Arithmetic Mean	Site-wide 95% UCL of Normal Data	Maximum Detected Concentration	EPC Units	Reasonable Maximum Expoure			
						Medium EPC (IW) Value	Medium EPC (CW) Value	Medium EPC Statistic	Medium EPC Rationale
Volatile Organic Compounds									
Acetone	µg/L	2486	4358	45000	mg/m^3	1.90E-05	2.9E+00	Volatilization Factor & X/Q Model	US EPA, 1996
Benzene	µg/L	38.2	59.5	110	mg/m^3	1.64E-05	8.5E-03	Volatilization Factor & X/Q Model	US EPA, 1996
Chlorobenzene	µg/L	201	327	3200	mg/m^3	8.90E-05	3.0E-02	Volatilization Factor & X/Q Model	US EPA, 1996
Methylene chloride	µg/L	42.3	64.7	200	mg/m^3	7.50E-06	1.5E-02	Volatilization Factor & X/Q Model	US EPA, 1996
Toluene	µg/L	668	1410	21000	mg/m^3	7.20E-03	1.6E+00	Volatilization Factor & X/Q Model	US EPA, 1996
Semi-Volatile Organic Compounds									
1,2-Dichlorobenzene	µg/L	201	310	1900	mg/m^3	5.8E-04	1.7E-01	Volatilization Factor & X/Q Model	US EPA, 1996
1,3-Dichlorobenzene	µg/L	51.5	86.7	41	mg/m^3	8.7E-06	3.6E-03	Volatilization Factor & X/Q Model	US EPA, 1996
1,4-Dichlorobenzene	µg/L	65.7	103	260	mg/m^3	7.2E-05	2.3E-02	Volatilization Factor & X/Q Model	US EPA, 1996

Notes: IW = Industrial Worker; CW = Construction Worker

Statistics:
Maximum Detected Value (Max)
95% UCL of Normal Data (95% UCL-N)
95% UCL of Log-transformed Data (95% UCL-T)
Mean of Log-transformed Data (Mean-T)
Mean of Normal Data (Mean-N)

TABLE 4.1

VALUES USED FOR DAILY INTAKE CALCULATIONS
SOIL - OUTDOOR WORKER

Morton International, Inc.
Reading, Ohio

Scenario Timeframe: Current	**Exposure Point:** On-Site
Medium: Soil	**Receptor Population:** Outdoor Worker
Exposure Medium: Soil	**Receptor Age:** Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/Model Name
Incidental Ingestion	Cs	Chemical Concentration in Soil	mg/kg	--	Chemical-specific	Chronic Daily Intake (CDI) (mg/kg-day) =
	IRs	Ingestion Rate of soil	mg/day	50	EPA, 1997	Cs x IRs x EF x ED x 1/BW x 1/AT
	EF	Exposure Frequency	days/year	250	EPA, 1991	
	ED	Exposure Duration	years	25	EPA, 1991	
	BW	Body Weight	kg	70	EPA, 1997	
	ATnc	Averaging Time - noncancer	days	9125	EPA, 1997	
	ATca	Averaging Time - cancer	days	25,550	EPA, 1997	
Dermal Contact	Cs	Chemical Concentration in Soil	mg/kg	–	Chemical-specific	Dermally Absorbed Dose (mg/kg-day) =
	SA	Skin Surface Area	cm^2	3300	EPA, 2001a	Cs x ED x EF x SA x SAF x CF2 / BW x AT
	EF	Exposure Frequency	days/year	250	EPA, 1991	
	ED	Exposure Duration	years	25	EPA, 1991	
	BW	Body Weight	kg	70	EPA, 1997	
	ATnc	Averaging Time - noncancer	days	9125	EPA, 1997	
	ATca	Averaging Time - cancer	days	25550	EPA, 1997	
	SAF	Soil-to-Skin Adherence Factor	mg/cm^2	0.2	EPA, 2001a	
	CF2	Conversion Factor 2 - milligrams to kilograms	kg/mg	0.000001	–	

EPA, 1991: Risk Assessment Guidance for Superfund. v.1: Human Health Evaluation Manual. Supplemental Guidance, "Standard Default Exposure Factors". OERR. OSWER 9285.6-03.
EPA, 1997: Exposure Factors Handbook. v.1: General Factors. ORD. EPA/600/P-95/002Fa.
EPA, 2001a: Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual, Part E, Supplemental Guidance Dermal Risk Assessment, Interim Review Draft, September 2001.

TABLE 4.2

VALUES USED FOR DAILY INTAKE CALCULATIONS
SOIL - CONSTRUCTION WORKER

Morton International, Inc.
Reading, Ohio

Scenario Timeframe: Current	**Exposure Point:** On-Site
Medium: Soil	**Receptor Population:** Construction Worker
Exposure Medium: Soil	**Receptor Age:** Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/Model Name
Incidental Ingestion	Cs	Chemical Concentration in Soil	mg/kg	--	Chemical-specific	Chronic Daily Intake (CDI) (mg/kg-day) =
	IRs	Ingestion Rate of Soil	mg/day	330	EPA, 2001b	Cs x IRs x EF x ED x 1/BW x 1/AT
	EF	Exposure Frequency	days/year	250	EPA, 1991	
	ED	Exposure Duration	years	1	(1)	
	BW	Body Weight	kg	70	EPA, 1997	
	ATnc	Averaging Time - noncancer	days	365	EPA, 1997	
	ATca	Averaging Time - cancer	days	25,550	EPA, 1997	
Dermal Contact	Cs	Chemical Concentration in soil	mg/kg	--	Chemical-specific	Dermally Absorbed Dose (mg/kg-day) =
	SA	Skin Surface Area	cm^2	3300	EPA, 2001a	$\frac{Cs \times ED \times EF \times SA \times SAF \times CF2}{BW \times AT}$
	EF	Exposure Frequency	days/year	250	EPA, 1991	
	ED	Exposure Duration	years	1	(1)	
	BW	Body Weight	kg	70	EPA, 1997	
	ATnc	Averaging Time - noncancer	days	365	EPA, 1997	
	ATca	Averaging Time - cancer	days	25550	EPA, 1997	
	SAF	Soil-to-Skin Adherence Factor	mg/cm^2	0.2	EPA, 2001a	
	CF2	Conversion Factor 2 - milligrams to kilograms	kg/mg	0.000001	--	

[1] Professional judgement

EPA, 1991: Risk Assessment Guidance for Superfund. v.1: Human Health Evaluation Manual. Supplemental Guidance, "Standard Default Exposure Factors". OERR. OSWER 9285.6-03.

EPA, 1997: Exposure Factors Handbook. v.1: General Factors. ORD. EPA/600/P-95/002Fa.

EPA, 2001a: Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual, Part E, Supplemental Guidance Dermal Risk Assessment, Interim Review Draft, September 2001.

EPA, 2001b: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, March.

TABLE 4.3

VALUES USED FOR DAILY INTAKE CALCULATIONS
SOIL TO AMBIENT AIR - OUTDOOR WORKER

Morton International, Inc.
Reading, Ohio

Scenario Timeframe: Current	**Exposure Point:** On-Site
Medium: Soil	**Receptor Population:** Outdoor Worker
Exposure Medium: Ambient Air	**Receptor Age:** Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/Model Name
Inhalation	Ca	Chemical Concentration in Air	mg/m^3	Modeled concentration	EPA, 1996	Particulate emission factor or VOC Emission Model and X/Q dispersion model
	Cs	Chemical Concentration in Soil	mg/kg	--	Chemical-specific	
	IRa	Inhalation Rate	m^3/hour	2.5	EPA, 1991	Chronic Daily Intake (CDI) (particulates) (mg/kg-day) =
	EF	Exposure Frequency	days/year	250	EPA, 1991	$\frac{Cs \times IRa \times EF \times ED \times ET}{BW \times AT \times PEF}$
	ED	Exposure Duration	years	25	EPA, 1991	
	BW	Body Weight	kg	70	EPA, 1997	
	ATnc	Averaging Time - noncancer	days	9125	EPA, 1997	CDI (volatiles) (mg/kg-day) = $\frac{Ca \times IRa \times EF \times ED \times ET}{BW \times AT}$
	ATca	Averaging Time - cancer	days	25550	EPA, 1997	
	PEF	Particulate Emission Factor	m^3/kg	1.32E+09	EPA, 1996	
				8.98E+08	Site-specific	
	VF	Volatilization Factor	m^3/kg	--	Chemical-specific	
	ET	Exposure Time	hours/day	8	Typical workday	

EPA, 1991: Risk Assessment Guidance for Superfund. v.1: Human Health Evaluation Manual. Supplemental Guidance, "Standard Default Exposure Factors". OERR. OSWER 9285.6-03.

EPA, 1996: Soil Screening Guidance: User's Guide. OSWER. Pub 9355.4-23.

EPA, 1997: Exposure Factors Handbook. v.1: General Factors. ORD. EPA/600/P-95/002Fa.

TABLE 4.4

VALUES USED FOR DAILY INTAKE CALCULATIONS
SOIL TO AMBIENT AIR - CONSTRUCTION WORKER

Morton International, Inc.
Reading, Ohio

Scenario Timeframe: Current	**Exposure Point:** On-Site
Medium: Soil	**Receptor Population:** Construction Worker
Exposure Medium: Ambient Air	**Receptor Age:** Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/Model Name
Inhalation	Ca	Chemical Concentration in Air	mg/m^3	Modeled concentration	EPA, 1996	VOC Emission Model and X/Q dispersion
	Cs	Chemical Concentration in Soil	mg/kg	--	Chemical-specific	Chronic Daily Intake (particulates) (CDI) (mg/kg-day) =
	IRa	Inhalation Rate	m^3/hour	2.5	EPA, 1991	$\frac{Cs \times IRa \times EF \times ED \times ET}{BW \times AT \times PEF}$
	EF	Exposure Frequency	days/year	250	EPA, 1991	
	ED	Exposure Duration	years	1	(1)	
	BW	Body Weight	kg	70	EPA, 1997	CDI (volatiles) (mg/kg-day) = $\frac{Ca \times IRa \times EF \times ED \times ET}{BW \times AT}$
	ATnc	Averaging Time - noncancer	days	365	EPA, 1997	
	ATca	Averaging Time - cancer	days	25550	EPA, 1997	
	PEF	Particulate Emission Factor	m^3/kg	4.40E+08	EPA, 1996	
	ET	Exposure Time	hours/day	8	Typical workday	

[1] Professional judgement

EPA, 1991: Risk Assessment Guidance for Superfund. v.1: Human Health Evaluation Manual. Supplemental Guidance, "Standard Default Exposure Factors". OERR. OSWER 9285.6-03.

EPA, 1996: Soil Screening Guidance: User's Guide. OSWER. Pub 9355.4-23.

EPA, 1997: Exposure Factors Handbook. v.1: General Factors. ORD. EPA/600/P-95/002Fa.

TABLE 4.5

VALUES USED FOR DAILY INTAKE CALCULATIONS
SOIL TO INDOOR AIR - INDOOR WORKER

Morton International, Inc.
Reading, Ohio

Scenario Timeframe: Current	**Exposure Point:** On-Site
Medium: Soil	**Receptor Population:** Indoor Worker
Exposure Medium: Indoor Air	**Receptor Age:** Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/Model Name
Inhalation	Cia	Chemical Concentration in Indoor Air	mg/m^3	Modeled concentration	EPA, 2000a	Johnson and Ettinger model
	Cs	Chemical Concentration in Soil	mg/kg	--	Chemical-specific	Chronic Daily Intake (CDI) (mg/kg-day) =
	IRa	Inhalation Rate	m^3/hour	2.5	EPA, 1991	$\frac{Cia \times IRa \times EF \times ED \times ET}{BW \times AT}$
	EF	Exposure Frequency	days/year	250	EPA, 1991	
	ED	Exposure Duration	years	25	EPA, 1991	
	BW	Body Weight	kg	70	EPA, 1997	
	ATnc	Averaging Time - noncancer	days	9125	EPA, 1997	
	ATca	Averaging Time - cancer	days	25550	EPA, 1997	
	VF	Volatilization Factor	m^3/kg	--	Chemical-specific	
	ET	Exposure Time	hours/day	8	Typical workday	

EPA, 1991: Risk Assessment Guidance for Superfund. v.1: Human Health Evaluation Manual. Supplemental Guidance, "Standard Default Exposure Factors". OERR. OSWER 9285.6-03.

EPA, 1997: Exposure Factors Handbook. v.1: General Factors. ORD. EPA/600/P-95/002Fa.

EPA, 2000a: The Johnson and Ettinger Model for Subsurface Vapor Intrusion Into Buildings, December.

TABLE 4.6

VALUES USED FOR DAILY INTAKE CALCULATIONS
GROUNDWATER - CONSTRUCTION WORKER

Morton International, Inc.
Reading, Ohio

Scenario Timeframe: Current	**Exposure Point:** On-Site
Medium: Groundwater	**Receptor Population:** Construction Worker
Exposure Medium: Groundwater	**Receptor Age:** Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/Model Name
Dermal	Cgw	Chemical Concentration in Groundwater	mg/L	--	Chemical-specific	Dermally Absorbed Dose (mg/kg-day) =
Contact	SA	Exposed Skin Surface Area	cm^2	7100	EPA 1997[2]	$\frac{DAevent \times EV \times ED \times EF \times SA}{BW \times AT}$
	EF	Exposure Frequency	days/year	60	(1)	
	ED	Exposure Duration	years	1	(1)	
	BW	Body Weight	kg	70	EPA, 1997	DAevent (organics) = $2 \times Kp \times Cw \times (6 \times t \times tevent/p)^{0.5}$
	ATnc	Averaging Time - noncancer	days	365	EPA, 1997	DAevent (inorganics) = Kp x Cw x tevent
	ATca	Averaging Time - cancer	days	25550	EPA, 1997	
	EV	Event Frequency	events/day	1	(1)	τ = lag time (hr)
	tevent	Event Duration	hours/event	2	(1)	Kp = Skin permeability constant (cm/hr)
	DAevent	Absorbed dose per event	mg/cm^2-event	--	Chemical-specific	

[1] Professional judgement

[2] Mean surface area, hands and lower extremities for men and women.

EPA, 1989: Risk Assessment Guidance for Superfund. v.1: Human Health Evaluation Manual (Part A). OERR. EPA/540/1-89/002.

EPA, 1997: Exposure Factors Handbook. v.1: General Factors. and v.3 Activity Factors. ORD. EPA/600/P-95/002Fa and EPA/600/P-95/002Fc.

EPA, 1998: Risk Assessment Guidance for Superfund. v.1: Human Health Evaluation Manual, Supplemental Guidance, Dermal Risk Assessment. OERR. NCEA-W-0364. External Review Draft

TABLE 4.7

VALUES USED FOR DAILY INTAKE CALCULATIONS
GROUNDWATER TO AMBIENT AIR - OUTDOOR WORKER

Morton International, Inc.
Reading, Ohio

Scenario Timeframe: Current	**Exposure Point:** On-Site
Medium: Groundwater	**Receptor Population:** Outdoor Worker
Exposure Medium: Ambient Air	**Receptor Age:** Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/Model Name
Inhalation	Ca	Chemical Concentration in Air	mg/m^3	Modeled concentration	EPA, 1996	VOC Emission Model and X/Q dispersion
	Cgw	Chemical Concentration in Groundwater	mg/L	--	Chemical-specific	Chronic Daily Intake (CDI) (mg/kg-day) =
	IRa	Inhalation Rate	m^3/hour	2.5	EPA, 1991	$\frac{Ca \times IRa \times EF \times ED \times ET}{BW \times AT}$
	EF	Exposure Frequency	days/year	250	EPA, 1991	
	ED	Exposure Duration	years	25	EPA, 1991	
	BW	Body Weight	kg	70	EPA, 1997	
	ATnc	Averaging Time - noncancer	days	9125	EPA, 1997	
	ATca	Averaging Time - cancer	days	25550	EPA, 1997	
	ET	Exposure Time	hours/day	8	Typical workday	

EPA, 1991: Risk Assessment Guidance for Superfund. v.1: Human Health Evaluation Manual. Supplemental Guidance, "Standard Default Exposure Factors". OERR. OSWER 9285.6-03.

EPA, 1996: Soil Screening Guidance: User's Guide. OSWER. Pub 9355.4-23.

EPA, 1997: Exposure Factors Handbook. v.1: General Factors. ORD. EPA/600/P-95/002Fa.

TABLE 4.8

VALUES USED FOR DAILY INTAKE CALCULATIONS
GROUNDWATER TO AMBIENT AIR - CONSTRUCTION WORKER

Morton International, Inc.
Reading, Ohio

Scenario Timeframe: Current	**Exposure Point:** On-Site
Medium: Groundwater	**Receptor Population:** Construction Worker
Exposure Medium: Ambient Air	**Receptor Age:** Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/Model Name
Inhalation	Ca	Chemical Concentration in Air	mg/m^3	Modeled concentration	EPA, 1996	Quiescent Surface Impoundment Model and X/Q dispersion model
	Cgw	Chemical Concentration in Groundwater	mg/L	--	Chemical-specific	Chronic Daily Intake (CDI) (mg/kg-day) =
	IRa	Inhalation Rate	m^3/hour	2.5	EPA, 1991	$\frac{Ca \times IRa \times EF \times ED \times ET}{BW \times AT}$
	EF	Exposure Frequency	days/year	250	EPA, 1991	
	ED	Exposure Duration	years	1	(1)	
	BW	Body Weight	kg	70	EPA, 1997	
	ATnc	Averaging Time - noncancer	days	365	EPA, 1997	
	ATca	Averaging Time - cancer	days	25550	EPA, 1997	
	ET	Exposure Time	hours/day	8	Typical workday	

[1] Professional judgement for subsurface/exterior construction activities.

EPA, 1991: Risk Assessment Guidance for Superfund. v.1: Human Health Evaluation Manual. Supplemental Guidance, "Standard Default Exposure Factors". OERR. OSWER 9285.6-03.

EPA, 1996: Soil Screening Guidance: User's Guide. OSWER. Pub 9355.4-23.

EPA, 1997: Exposure Factors Handbook. v.1: General Factors. ORD. EPA/600/P-95/002Fa.

TABLE 4.9

VALUES USED FOR DAILY INTAKE CALCULATIONS
GROUNDWATER TO INDOOR AIR - INDOOR WORKER

Morton International, Inc.
Reading, Ohio

Scenario Timeframe: Current	**Exposure Point:** On-Site
Medium: Groundwater	**Receptor Population:** Indoor Worker
Exposure Medium: Indoor Air	**Receptor Age:** Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/Model Name
Inhalation	Cia	Chemical Concentration in Indoor Air	mg/m^3	Modeled concentration	EPA, 2000a	Johnson and Ettinger model
	Cgw	Chemical Concentration in Groundwater	mg/kg	--	Chemical-specific	Chronic Daily Intake (CDI) (mg/kg-day) =
	IRa	Inhalation Rate	m^3/hour	2.5	EPA, 1991	Cia x IRa x EF x ED x ET
	EF	Exposure Frequency	days/year	250	EPA, 1991	BW x AT
	ED	Exposure Duration	years	25	EPA, 1991	
	BW	Body Weight	kg	70	EPA, 1997	
	ATnc	Averaging Time - noncancer	days	9125	EPA, 1997	
	ATca	Averaging Time - cancer	days	25550	EPA, 1997	
	ET	Exposure Time	hours/day	8	Typical workday	

EPA, 1991: Risk Assessment Guidance for Superfund. v.1: Human Health Evaluation Manual. Supplemental Guidance, "Standard Default Exposure Factors". OERR. OSWER 9285.6-03.

EPA, 1997: Exposure Factors Handbook. v.1: General Factors. ORD. EPA/600/P-95/002Fa.

EPA, 2000a: The Johnson and Ettinger Model for Subsurface Vapor Intrusion Into Buildings, December.

TABLE 4.10a

VALUES USED FOR DAILY INTAKE CALCULATIONS
SURFACE WATER - ADULT RECREATIONAL USER

Morton International, Inc.
Reading, Ohio

Scenario Timeframe: Current	**Exposure Point:** Off-Site
Medium: Groundwater	**Receptor Population:** Recreational Creek User
Exposure Medium: Surface Water	**Receptor Age:** Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/Model Name
Incidental Ingestion	Cw	Chemical Concentration in Surface Water	mg/L	--	Chemical-specific	Chronic Daily Intake (CDI) (mg/kg-day) =
	IRw	Ingestion Rate	L/event	0.05	EPA, 1989	Cw x IRw x ET x EF x ED x 1/BW x 1/AT
	EF	Exposure Frequency	events/year	26	(1)	
	ED	Exposure Duration	years	24	EPA, 1997	
	BW	Body Weight	kg	70	EPA, 1997	
	AT-nc	Averaging Time - noncancer	days	8760	EPA, 1997	
	AT-c	Averaging Time - cancer	days	25550	EPA, 1997	
	ET	Exposure Time	hours/event	1	EPA, 1997	
Dermal Contact	Cw	Chemical Concentration in Surface Water	mg/L	--	Chemical-specific	Dermally Absorbed Dose (mg/kg-day) =
	CF1	Conversion Factor 1	mg/µg	0.001	--	DAevent x EV x ED x EF x SA x 1/BW x 1/AT
	CF2	Conversion Factor 2	L/cm^3	0.001	--	
	DAevent	Dermally absorbed dose per event per area of skin exposed	mg/cm^2-event	Chemical-Specific	EPA, 2001a	For Inorganics, DAevent = K_P x Cw x ET x CF1 x CF2
	ET	Exposure Time	hr/event	0.25	EPA, 1997	For Organics,
	FA	Fraction of absorbed dose	--	Chemical-Specific	EPA, 2001a	if ET< t*, then: DAevent = 2FA x K_P x Cw x CF1 x CF2 x sqrt[6T x ET)/PI]
	K_P	Permeability Coefficient from Water	cm/hr	Chemical-Specific	EPA, 2001a	if ET> t*, then: DAevent =
	T	Lag time per event	hr/event	Chemical-Specific	EPA, 2001a	FA x K_P x Cw x CF1 x CF2 x {ET/(1+B)+2T[(1+3B+3B2)/(1+B)2]}
	t*	Time to reach steady-state	hr	Chemical-Specific	EPA, 2001a	
	B	Constant	--	Chemical-Specific	EPA, 2001a	
	EV	Event Frequency	events/day	1	EPA, 2001a	
	SA	Skin Surface Area Available for Contact	cm^2	18,000	EPA, 2001a	
	EF	Exposure Frequency	days/year	26	(1)	
	ED	Exposure Duration	years	24	EPA, 1997	
	BW	Body Weight	kg	70	EPA, 1997	
	AT-c	Averaging Time (Cancer)	days	25,550	EPA, 1997	
	AT-nc	Averaging Time (Non-Cancer)	days	8,760	EPA, 1997	

[1] 2 days/week, 13 weeks of the summer.

EPA, 1989: Risk Assessment Guidance for Superfund. v.1: Human Health Evaluation Manual (Part A).

EPA, 1997: Exposure Factors Handbook. v.1: General Factors. ORD. EPA/600/P-95/002Fa.

EPA, 2001a: Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual, Part E, Supplemental Guidance Dermal Risk Assessment, Interim Review Draft, September 2001.

TABLE 4.10b

VALUES USED FOR DAILY INTAKE CALCULATIONS
SURFACE WATER - CHILD RECREATIONAL USER

Morton International, Inc.
Reading, Ohio

Scenario Timeframe: Current
Medium: Groundwater
Exposure Medium: Surface Water
Exposure Point: Off-Site
Receptor Population: Recreational Creek User
Receptor Age: Child

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/Model Name
Incidental Ingestion	Cw	Chemical Concentration in Surface Water	mg/L	--	Chemical-specific	Chronic Daily Intake (CDI) (mg/kg-day) =
	IRw	Ingestion Rate	L/event	0.05	EPA, 1989	Cw x IRw x ET x EF x ED x 1/BW x 1/AT
	EF	Exposure Frequency	events/year	26	(1)	
	ED	Exposure Duration	years	6	EPA, 1997	
	BW	Body Weight	kg	15	EPA, 1991	
	AT-nc	Averaging Time - noncancer	days	2190	EPA, 1997	
	AT-c	Averaging Time - cancer	days	25550	EPA, 1997	
	ET	Exposure Time	hours/event	1	(2)	
Dermal Contact	Cw	Chemical Concentration in Surface Water	mg/L	--	Chemical-specific	Dermally Absorbed Dose (mg/kg-day) =
	CF1	Conversion Factor 1	mg/mg	0.001	--	DAevent x EV x ED x EF x SA x 1/BW x 1/AT
	CF2	Conversion Factor 2	L/cm^3	0.001	--	
	DAevent	Dermally absorbed dose per event per area of skin exposed	mg/cm^2-event	calculated	EPA, 2001a	For Inorganics, DAevent = K_P x Cw x ET x CF1 x CF2
	ET	Exposure Time	hr/event	0.25	(2)	For Organics,
	FA	Fraction of absorbed dose	--	Chemical-specific	EPA, 2001a	if ET< t*, then: DAevent = 2FA x K_P x Cw x CF1 x CF2 x sqrt[6T x ET)/PI]
	K_P	Permeability Coefficient from Water	cm/hr	Chemical-specific	EPA, 2001a	if ET> t*, then: DAevent =
	T	Lag time per event	hr/event	Chemical-specific	EPA, 2001a	FA x K_P x Cw x CF1 x CF2 x {ET/(1+B)+2T[(1+3B+3B2)/(1+B)2]}
	t*	Time to reach steady-state	hr	Chemical-specific	EPA, 2001a	
	B	Constant	--	Chemical-specific	EPA, 2001a	
	EV	Event Frequency	events/day	1	EPA, 2001a	
	SA	Skin Surface Area Available for Contact	cm^2	6,600	EPA, 2001a	
	EF	Exposure Frequency	days/year	26	(1)	
	ED	Exposure Duration	years	6	EPA, 1997	
	BW	Body Weight	kg	15	EPA, 1991	
	AT-c	Averaging Time (Cancer)	days	25,550	EPA, 1997	
	AT-nc	Averaging Time (Non-Cancer)	days	2,190	EPA, 1997	

[1] 2 days/week, 13 weeks of the summer.
[2] Professional judgement; based on assumed exposures to surface water.

EPA, 1989: Risk Assessment Guidance for Superfund. v.1: Human Health Evaluation Manual (Part A). OERR. EPA/540/1-89/002.
EPA, 1991: Risk Assessment Guidance for Superfund. v.1: Human Health Evaluation Manual. Supplemental Guidance, "Standard Default Exposure Factors". OERR. OSWER 9285.6-03.
EPA, 1997: Exposure Factors Handbook. v.1: General Factors. ORD. EPA/600/P-95/002Fa.
EPA, 2001a: Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual, Part E, Supplemental Guidance Dermal Risk Assessment, Interim Review Draft, September 2001.

Chemical of Potential Concern	ors	Sources of RfD: Target Organ	(3) Dates of RfD: Target Organ (MM/DD/YY)
Volatile Organic Constituuents			
Acetone		IRIS	04/17/02
Benzene		PRG	11/01/00
Chlorobenzene		IRIS	04/17/02
Methylene chloride		IRIS	04/17/02
Toluene		IRIS	04/17/02
Semi-Volatile Organic Constituuents			
Aniline		PRG	11/01/00
1,2-Dichlorobenzene		IRIS	04/17/02
1,3-Dichlorobenzene		PRG	11/01/00
1,4-Dichlorobenzene		PRG	11/01/00
4-Methylphenol		PRG	11/01/00
Metals			
Aluminum		PRG	11/01/00
Antimony		IRIS	04/17/02
Arsenic		IRIS	04/17/02
Cadmium		IRIS	04/17/02
Chromium		IRIS	04/17/02
Copper		HEAST	7/97
Iron		PRG	11/01/00
Lead		N/A	N/A
Manganese		IRIS	04/17/02
Nickel		IRIS	04/17/02
Thallium		IRIS	04/17/02
Tin		HEAST	7/97

(1) Refer to RAGS, Part E

(2) $RfD_{ABS} = RfD_O \times ABS_{GI}$

(3) For IRIS values, the date IRIS was searchec

For HEAST values, the date of HEAST is pr

For NCEA values, a reference to the PRGs i

TABLE 5.1

NON-CANCER TOXICITY DATA - ORAL/DERMAL

Morton International, Inc.
Reading, Ohio

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD Value (RfD_o)	Oral RfD Units	(1) Oral to Dermal Adjustment Factor (ABS_{GI})	(2) Adjusted Dermal RfD (RfD_{ABS})	Unit	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfD: Target Organ	(3) Dates of RfD: Target Organ (MM/DD/YY)
Volatile Organic Constituuents										
Acetone	Chronic	0.1	mg/kg-day	100%	0.1	mg/kg-day	Liver, Kidney	1000	IRIS	04/17/02
Benzene	Chronic	0.003	mg/kg-day	100%	0.003	mg/kg-day	Blood	N/A	PRG	11/01/00
Chlorobenzene	Chronic	0.02	mg/kg-day	100%	0.02	mg/kg-day	Liver	1000	IRIS	04/17/02
Methylene chloride	Chronic	0.06	mg/kg-day	100%	0.06	mg/kg-day	Liver	100	IRIS	04/17/02
Toluene	Chronic	0.2	mg/kg-day	100%	0.2	mg/kg-day	Liver/Kidney	1000	IRIS	04/17/02
Semi-Volatile Organic Constituuents										
Aniline	Chronic	0.007	mg/kg-day	100%	0.007	mg/kg-day	N/A	N/A	PRG	11/01/00
1,2-Dichlorobenzene	Chronic	0.09	mg/kg-day	100%	0.09	mg/kg-day	N/A	1000	IRIS	04/17/02
1,3-Dichlorobenzene	Chronic	0.0009	mg/kg-day	100%	0.0009	mg/kg-day	N/A	N/A	PRG	11/01/00
1,4-Dichlorobenzene	Chronic	0.03	mg/kg-day	100%	0.03	mg/kg-day	N/A	N/A	PRG	11/01/00
4-Methylphenol	Chronic	0.005	mg/kg-day	100%	0.005	mg/kg-day	N/A	N/A	PRG	11/01/00
Metals										
Aluminum	Chronic	1	mg/kg-day	100%	1	mg/kg-day	N/A	N/A	PRG	11/01/00
Antimony	Chronic	0.0004	mg/kg-day	15%	0.00006	mg/kg-day	Blood	1000	IRIS	04/17/02
Arsenic	Chronic	0.0003	mg/kg-day	100%	0.0003	mg/kg-day	Skin	3	IRIS	04/17/02
Cadmium	Chronic	0.0005	mg/kg-day	2.5%	0.000013	mg/kg-day	Kidney	10	IRIS	04/17/02
Chromium	Chronic	1.5	mg/kg-day	1.3%	0.02	mg/kg-day	None	1000	IRIS	04/17/02
Copper	Chronic	0.037	mg/kg-day	100%	0.037	mg/kg-day	Gastrointestinal	N/A	HEAST	7/97
Iron	Chronic	0.3	mg/kg-day	100%	0.3	mg/kg-day	N/A	N/A	PRG	11/01/00
Lead	N/A	N/A	mg/kg-day	N/A	N/A	mg/kg-day	N/A	N/A	N/A	N/A
Manganese	Chronic	0.14	mg/kg-day	4%	0.0056	mg/kg-day	CNS	1	IRIS	04/17/02
Nickel	Chronic	0.02	mg/kg-day	4%	0.0008	mg/kg-day	Various	300	IRIS	04/17/02
Thallium	Chronic	0.00008	mg/kg-day	100%	0.00008	mg/kg-day	Blood	3000	IRIS	04/17/02
Tin	Chronic	0.6	mg/kg-day	100%	0.6	mg/kg-day	Liver	100	HEAST	7/97

(1) Refer to RAGS, Part E

(2) $RfD_{ABS} = RfD_O \times ABS_{GI}$

(3) For IRIS values, the date IRIS was searched is provided.
For HEAST values, the date of HEAST is provided
For NCEA values, a reference to the PRGs is provided.

IRIS = Integrated Risk Information System
HEAST= Health Effects Assessment Summary Tables
PRG = U.S. EPA Region 9 Preliminary Remediation Goals
N/A = Not applicable

TABLE 5.2

NON-CANCER TOXICITY DATA - INHALATION

Morton International, Inc.
Reading, Ohio

Chemical of Potential Concern	Chronic/ Subchronic	Value Inhalation RfC	Units	(1) Inhalation RfD	Units	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfC:RfD: Target Order	(2) Dates (MM/DD/YY)
Volatile Organic Constituuents									
Acetone	N/A	N/A	N/A	0.1	mg/kg-day	N/A	N/A	RE	04/17/02
Benzene	Chronic	N/A	N/A	0.0017	mg/kg-day	N/A	N/A	PRG	01/11/00
Chlorobenzene	Chronic	0.02	mg/m^3	0.0057	mg/kg-day	Liver/Kidney	10000	HEAST	7/97
Methylene chloride	Chronic	3	mg/m^3	0.86	mg/kg-day	Liver	100	HEAST	7/97
Toluene	Chronic	0.4	mg/m^3	0.11	mg/kg-day	CNS	300	IRIS	04/17/02
Semi-Volatile Organic Constituuents									
Aniline	Chronic	0.001	mg/m^3	0.00029	mg/kg-day	Spleen	3000	IRIS	04/17/02
1,2-Dichlorobenzene	Chronic	0.2	mg/m^3	0.057	mg/kg-day	Whole Body	1000	HEAST	7/97
1,3-Dichlorobenzene	Chronic	N/A	N/A	0.057	mg/kg-day	Whole Body	1000	RE	11/01/00
1,4-Dichlorobenzene	Chronic	0.8	mg/m^3	0.23	mg/kg-day	Liver	100	IRIS	04/17/02
4-Methylphenol	Chronic	N/A	N/A	0.005	mg/kg-day	N/A	N/A	RE	01/01/00
Metals									
Aluminum	Chronic	N/A	N/A	0.0014	mg/kg-day	N/A	N/A	PRG	11/01/00
Antimony	Chronic	N/A	N/A	0.0004	mg/kg-day	N/A	N/A	RE	04/17/02
Arsenic	Chronic	N/A	N/A	0.0003	mg/kg-day	N/A	N/A	RE	04/17/02
Cadmium	Chronic	N/A	N/A	0.0005	mg/kg-day	N/A	N/A	RE	04/17/02
Chromium	Chronic	N/A	N/A	1.5	mg/kg-day	N/A	N/A	RE	04/17/02
Copper	Chronic	N/A	N/A	0.037	mg/kg-day	N/A	N/A	RE	7/97
Iron	Chronic	N/A	N/A	0.3	mg/kg-day	N/A	N/A	RE	11/01/00
Lead	N/A	N/A	N/A	N/A	mg/kg-day	N/A	N/A	N/A	N/A
Manganese	Chronic	0.00005	mg/m^3	0.000014	mg/kg-day	CNS	1000	IRIS	04/17/02
Nickel	Chronic	N/A	N/A	0.02	mg/kg-day	N/A	N/A	RE	04/17/02
Thallium	Chronic	N/A	N/A	0.00008	mg/kg-day	N/A	N/A	RE	04/17/02
Tin	Chronic	N/A	N/A	0.6	mg/kg-day	N/A	N/A	RE	7/97

N/A = Not Applicable

(1) RfD = RfC x 20 m^3/day/70 kg or oral RfD (RE) or inhalation RfD (PRG)

(2) For IRIS values, the date IRIS was searched is provided.
For HEAST values, the date of HEAST is provided
For NCEA values, a reference to the PRGs is provided.

IRIS = Integrated Risk Information System
HEAST= Health Effects Assessment Summary Tables
PRG = U.S. EPA Region 9 Preliminary Remediation Goals
RE = Route Extrapolation
N/A = Not applicable

TABLE 6.1

CANCER TOXICITY DATA - ORAL/DERMAL

Morton International, Inc.
Reading, Ohio

Chemical of Potential Concern	Oral Cancer Slope Factor (SF_O)	Oral to Dermal Adjustment Factor (ABS_{GI})	(1) Adjusted Dermal Cancer Slope Factor (SF_{ABS})	Units	Weight of Evidence/ Cancer Guideline Description	(2) Source	(3) Date (MM/DD/YY)
Volatile Organic Constituents							
Acetone	N/A	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	04/15/02
Benzene	0.055	100%	0.055	$(mg/kg\text{-}day)^{-1}$	A	IRIS	04/15/02
Chlorobenzene	N/A	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	04/15/02
Methylene chloride	0.0075	100%	0.0075	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	04/15/02
Toluene	N/A	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	04/15/02
Semi-Volatile Constituents							
Aniline	0.0057	100%	0.0057	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	04/17/02
1,2-Dichlorobenzene	N/A	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	04/17/02
1,3-Dichlorobenzene	N/A	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	04/17/02
1,4-Dichlorobenzene	0.024	100%	0.024	$(mg/kg\text{-}day)^{-1}$	C	HEAST	7/97
4-Methyl phenol	N/A	100%	N/A	$(mg/kg\text{-}day)^{-1}$	C	IRIS	4/20/02
Metals							
Aluminum	N/A	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Antimony	N/A	15%	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Arsenic	1.5	100%	1.5	$(mg/kg\text{-}day)^{-1}$	A	IRIS	04/17/02
Cadmium	N/A	2.5%	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	IRIS	04/17/02
Chromium	N/A	1.3%	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	04/17/02
Copper	N/A	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	04/17/02
Iron	N/A	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Lead	N/A	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	04/17/02
Manganese	N/A	4%	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	04/17/02
Nickel	N/A	4%	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Thallium	N/A	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Tin	N/A	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A

TABLE 6.1

CANCER TOXICITY DATA - ORAL/DERMAL

Morton International, Inc.
Reading, Ohio

(1) $SF_{ABS} = \frac{SF_O}{ABS_{GI}}$

(2) IRIS = Integrated Risk Information System
HEAST= Health Effects Assessment Summary Tables
PRG = U.S. EPA Region 9 Preliminary Remediation Goals
N/A = Not applicable

(3) For IRIS values, the date IRIS was searched is provided.
For HEAST values, the date of the HEAST is provided
For PRG values, the date of the PRG is provided

Weight of Evidence/EPA Group:

A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of noncarcinogenicity

TABLE 6.2

CANCER TOXICITY DATA - INHALATION

Morton International, Inc.
Reading, Ohio

Chemical of Potential Concern	Unit Risk	Units	Adjustment	(1) Inhalation Cancer Slope Factor (SFi)	Units	Weight of Evidence/ Cancer Guideline Description	(2) Source	(3) Date (MM/DD/YY)
Volatile Organic Constituuents								
Acetone	N/A	N/A	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	04/15/02
Benzene	0.0000078	$(\mu g/m^3)^{-1}$	3500	0.0273	$(mg/kg\text{-}day)^{-1}$	A	IRIS	04/15/02
Chlorobenzene	N/A	N/A	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	04/15/02
Methylene chloride	0.00000047	$(\mu g/m^3)^{-1}$	3500	0.0016	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	04/15/02
Toluene	N/A	N/A	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	04/15/02
Semi-Volatile Constituents								
Aniline	N/A	N/A	N/A	0.0057	$(mg/kg\text{-}day)^{-1}$	B2	RE	04/17/02
1,2-Dichlorobenzene	N/A	N/A	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	04/17/02
1,3-Dichlorobenzene	N/A	N/A	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	04/17/02
1,4-Dichlorobenzene	N/A	N/A	N/A	0.022	$(mg/kg\text{-}day)^{-1}$	C	PRG	11/01/00
4-Methylphenol	N/A	N/A	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	C	IRIS	04/20/20
Metals								
Aluminum	N/A	N/A	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Antimony	N/A	N/A	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Arsenic	0.0043	$(\mu g/m^3)^{-1}$	3500	15	$(mg/kg\text{-}day)^{-1}$	A	IRIS	04/17/02
Cadmium	0.0018	$(\mu g/m^3)^{-1}$	3500	6.3	$(mg/kg\text{-}day)^{-1}$	B1	IRIS	04/17/02
Chromium	N/A	N/A	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	04/17/02
Copper	N/A	N/A	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	04/17/02
Iron	N/A	N/A	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Lead	N/A	N/A	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	04/17/02
Manganese	N/A	N/A	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	04/17/02
Nickel	0.00024	$(\mu g/m^3)^{-1}$	3500	0.84	$(mg/kg\text{-}day)^{-1}$	A	IRIS	04/17/02
Thallium	N/A	N/A	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	N/A	N/A
Tin	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE 6.2

CANCER TOXICITY DATA - INHALATION

Morton International, Inc.
Reading, Ohio

(1) SFi = Unit Risk x Adjustment Factor or Inhalation RfD (PRG) or Oral Slope Factor (RE)

(2) IRIS = Integrated Risk Information System
HEAST= Health Effects Assessment Summary Tables
PRG = U.S. EPA Region 9 Preliminary Remediation Goals
RE = Route extrapolation
N/A = Not applicable

(3) For IRIS values, the date IRIS was searched is provided
For HEAST values, the date of HEAST is provided
For PRG values, the date of the PRG is provided

Weight of Evidence/EPA Group:
A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of noncarcinogenicity

TABLE 7.1
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE - INDOOR WORKER
Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current/Future
Receptor Population:	Indoor Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Indoor Air	Volatile COPCs	Acetone	NA	NA	NA	NA	Acetone	Liver; kidney	NA	0.000	NA	0.000
			Aluminum	NA	NA	NA	NA	Aluminum	N/A	NA	NA	NA	NA
			Aniline	NA	NA	NA	NA	Aniline	N/A	NA	NA	NA	NA
			Antimony	NA	NA	NA	NA	Antimony	Blood	NA	NA	NA	NA
			Arsenic	NA	NA	NA	NA	Arsenic	Skin	NA	NA	NA	NA
			Benzene	NA	5.5E-06	NA	5.5E-06	Benzene	Blood	NA	0	NA	0
			Cadmium	NA	NA	NA	NA	Cadmium	Kidney	NA	NA	NA	NA
			Chlorobenzene	NA	NA	NA	NA	Chlorobenzene	Liver	NA	0.0	NA	0.0
			Chromium	NA	NA	NA	NA	Chromium	None observed	NA	NA	NA	NA
			Copper	NA	NA	NA	NA	Copper	Gastrointestinal	NA	NA	NA	NA
			1,2-Dichlorobenzene	NA	NA	NA	NA	1,2-Dichlorobenzene	None observed	NA	0.00	NA	0.001
			1,3-Dichlorobenzene	NA	NA	NA	NA	1,3-Dichlorobenzene	N/A	NA	NA	NA	NA
			1,4-Dichlorobenzene	NA	NA	NA	NA	1,4-Dichlorobenzene	N/A	NA	NA	NA	NA
			Iron	NA	NA	NA	NA	Iron	N/A	NA	NA	NA	NA
			Lead	NA	NA	NA	NA	Lead	N/A	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Manganese	CNS	NA	NA	NA	NA
			Methylene Chloride	NA	7.8E-07	NA	7.8E-07	Methylene Chloride	Liver	NA	1.6E-03	NA	0.002
			4-Methylphenol	NA	NA	NA	NA	4-Methylphenol	N/A	NA	NA	NA	NA
			Nickel	NA	NA	NA	NA	Nickel	Various	NA	NA	NA	NA
			Thallium	NA	NA	NA	NA	Thallium	Blood	NA	NA	NA	NA
			Tin	NA	NA	NA	NA	Tin	Liver	NA	NA	NA	NA
			Toluene	NA	NA	NA	NA	Toluene	Liver; kidney	NA	0.0498	NA	0.050
						Total Risk Across Soil	**6.3E-06**						

TABLE 7.1
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE - INDOOR WORKER
Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current/Future
Receptor Population:	Indoor Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Indoor Air	Volatile COPCs	Acetone	NA	NA	NA	NA	Acetone	Liver; kidney	NA	0.017	NA	0.017
			Aluminum	NA	NA	NA	NA	Aluminum	N/A	NA	NA	NA	NA
			Aniline	NA	NA	NA	NA	Aniline	N/A	NA	NA	NA	NA
			Antimony	NA	NA	NA	NA	Antimony	Blood	NA	NA	NA	NA
			Arsenic	NA	NA	NA	NA	Arsenic	Skin	NA	NA	NA	NA
			Benzene	NA	6.5E-08	NA	6.5E-08	Benzene	Blood	NA	0.00	NA	0.00
			Cadmium	NA	NA	NA	NA	Cadmium	Kidney	NA	NA	NA	NA
			Chlorobenzene	NA	NA	NA	NA	Chlorobenzene	Liver	NA	0.00	NA	0.0
			Chromium	NA	NA	NA	NA	Chromium	None observed	NA	NA	NA	NA
			Copper	NA	NA	NA	NA	Copper	Gastrointestinal	NA	NA	NA	NA
			1,2-Dichlorobenzene	NA	NA	NA	NA	1,2-Dichlorobenzene	None observed	NA	0.002	NA	0.002
			1,3-Dichlorobenzene	NA	NA	NA	NA	1,3-Dichlorobenzene	N/A	NA	0.00003	NA	0.000
			1,4-Dichlorbenzene	NA	9.7E-08	NA	9.7E-08	1,4-Dichlorbenzene	N/A	NA	0.0001	NA	0.000
			Iron	NA	NA	NA	NA	Iron	N/A	NA	NA	NA	NA
			Lead	NA	NA	NA	NA	Lead	N/A	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Manganese	CNS	NA	NA	NA	NA
			Methylene Chloride	NA	8.1E-09	NA	8.1E-09	Methylene Chloride	Liver	NA	0.00002	NA	0.000
			4-Methylphenol	NA	NA	NA	NA	4-Methylphenol	N/A	NA	NA	NA	NA
			Nickel	NA	NA	NA	NA	Nickel	Various	NA	NA	NA	NA
			Thallium	NA	NA	NA	NA	Thallium	Blood	NA	NA	NA	NA
			Tin	NA	NA	NA	NA	Tin	Liver	NA	NA	NA	NA
			Toluene	NA	NA	NA	NA	Toluene	Liver; kidney	NA	0.0	NA	0.0
						Total Risk Across Groundwater	**1.7E-07**					**Total Hazard Index Across All Media and All Exposure Routes**	**0.5**

Total Risk Across All Media and All Exposure Routes **6E-06**

Total [Liver] HI = **0.1**

Total [Blood] HI = **0.3**

TABLE 7.2
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE - OUTDOOR WORKER
Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current
Receptor Population:	Outdoor Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	On-site soil	Acetone	NA	NA	NA	NA	Acetone	Liver; kidney	7.78E-06	4.01E-04	1.03E-05	4.19E-04
			Aluminum	ND	NA	ND	ND	Aluminum	N/A	ND	NA	ND	ND
Soil	Ambient Air	Fugitive Dust or Volatile COPCS	Aniline	ND	NA	ND	ND	Aniline	N/A	ND	NA	ND	ND
			Antimony	NA	NA	NA	NA	Antimony	Blood	2.78E-02	8.41E-06	2.44E-02	5.22E-02
			Arsenic	8.0E-05	2.4E-07	3.2E-05	1.1E-04	Arsenic	Skin	4.97E-01	1.51E-04	1.97E-01	6.94E-01
			Benzene	6.4E-09	4.8E-07	8.5E-09	4.9E-07	Benzene	Blood	1.09E-04	2.88E-02	1.44E-04	2.91E-02
			Cadmium	ND	NA	ND	ND	Cadmium	Kidney	ND	NA	ND	ND
			Chlorobenzene	NA	NA	NA	NA	Chlorobenzene	Liver	3.50E-05	1.13E-02	4.62E-05	1.14E-02
			Chromium	NA	NA	NA	NA	Chromium	None observed	2.32E-05	7.02E-09	2.29E-04	2.52E-04
			Copper	ND	NA	ND	ND	Copper	Gastrointestinal	ND	NA	ND	ND
			1,2-Dichlorobenzene	NA	NA	NA	NA	1,2-Dichlorobenzene	None observed	1.14E-05	6.59E-04	1.51E-05	6.85E-04
			1,3-Dichlorobenzene	ND	NA	ND	ND	1,3-Dichlorobenzene	N/A	ND	NA	ND	ND
			1,4-Dichlorobenzene	ND	NA	ND	ND	1,4-Dichlorobenzene	N/A	ND	NA	ND	ND
			Iron	ND	NA	ND	ND	Iron	N/A	ND	NA	ND	ND
			Lead	NA	NA	NA	NA	Lead	N/A	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Manganese	CNS	2.24E-03	9.96E-03	7.38E-03	1.96E-02
			Methylene Chloride	1.8E-09	9.4E-08	2.4E-09	9.8E-08	Methylene Chloride	Liver	1.15E-05	1.91E-04	1.52E-05	2.17E-04
			4-Methylphenol	ND	NA	ND	ND	4-Methylphenol	N/A	ND	NA	ND	ND
			Nickel	NA	3.5E-09	NA	3.5E-09	Nickel	Various	1.94E-03	5.88E-07	6.40E-03	8.34E-03
			Thallium	NA	NA	NA	NA	Thallium	Blood	6.36E-02	1.93E-05	8.40E-03	7.20E-02
			Tin	NA	NA	NA	NA	Tin	Liver	1.29E-01	3.90E-05	1.70E-02	1.46E-01
			Toluene	NA	NA	NA	NA	Toluene	Liver; kidney	3.69E-05	9.75E-03	4.88E-05	9.83E-03
						Total Risk Across Soil	**1.1E-04**						

TABLE 7.2
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE - OUTDOOR WORKER
Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current
Receptor Population:	Outdoor Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Ambient Air	Volatile COPCs from Groundwater	Acetone	NA	NA	NA	NA	Acetone	Liver; kidney	NA	3.65E-05	NA	3.65E-05
			Aluminum	NA	NA	NA	NA	Aluminum	N/A	NA	NA	NA	NA
			Aniline	NA	NA	NA	NA	Aniline	N/A	NA	NA	NA	NA
			Antimony	NA	NA	NA	NA	Antimony	Blood	NA	NA	NA	NA
			Arsenic	NA	NA	NA	NA	Arsenic	Skin	NA	NA	NA	NA
			Benzene	NA	3.1E-08	NA	3.1E-08	Benzene	Blood	NA	1.89E-03	NA	1.89E-03
			Cadmium	NA	NA	NA	NA	Cadmium	Kidney	NA	NA	NA	NA
			Chlorobenzene	NA	NA	NA	NA	Chlorobenzene	Liver	NA	3.06E-03	NA	3.06E-03
			Chromium	NA	NA	NA	NA	Chromium	None observed	NA	NA	NA	NA
			Copper	NA	NA	NA	NA	Copper	Gastrointestinal	NA	NA	NA	NA
			1,2-Dichlorobenzene	NA	NA	NA	NA	1,2-Dichlorobenzene	None observed	NA	1.98E-03	NA	1.98E-03
			1,3-Dichlorobenzene	NA	NA	NA	NA	1,3-Dichlorobenzene	N/A	NA	2.97E-05	NA	2.97E-05
			1,4-Dichlorbenzene	NA	1.1E-07	NA	1.1E-07	1,4-Dichlorbenzene	N/A	NA	6.09E-05	NA	6.09E-05
			Iron	NA	NA	NA	NA	Iron	N/A	NA	NA	NA	NA
			Lead	NA	NA	NA	NA	Lead	N/A	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Manganese	CNS	NA	NA	NA	NA
			Methylene Chloride	NA	8.4E-10	NA	8.4E-10	Methylene Chloride	Liver	NA	1.70E-06	NA	1.70E-06
			4-Methylphenol	NA	NA	NA	NA	4-Methylphenol	N/A	NA	NA	NA	NA
			Nickel	NA	NA	NA	NA	Nickel	Various	NA	NA	NA	NA
			Thallium	NA	NA	NA	NA	Thallium	Blood	NA	NA	NA	NA
			Tin	NA	NA	NA	NA	Tin	Liver	NA	NA	NA	NA
			Toluene	NA	NA	NA	NA	Toluene	Liver; kidney	NA	1.29E-02	NA	1.29E-02
						Total Risk Across Groundwater	**1.4E-07**					**Total Hazard Index Across All Media and All Exposure Routes**	**1.1E+00**

Total Risk Across All Media and All Exposure Routes **1.1E-04**

Total [Liver] HI =	**1.8E-01**
Total [Blood] HI =	**1.6E-01**
Total [Skin] HI =	**6.9E-01**

TABLE 7.3
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE - CONSTRUCTION WORKER
Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current/Future
Receptor Population:	Construction Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	On-site soil	Acetone	NA	NA	NA	NA	Acetone	Liver; kidney	5.13E-05	2.01E-03	1.03E-05	2.07E-03
			Aluminum	ND	NA	ND	ND	Aluminum	N/A	NA	NA	NA	NA
Soil	Ambient Air		Aniline	ND	NA	ND	ND	Aniline	N/A	NA	NA	NA	NA
			Antimony	NA	NA	NA	NA	Antimony	Blood	1.83E-01	5.55E-04	2.44E-02	2.08E-01
		Fugitive Dust or Volatile COPCs	Arsenic	2.11E-05	1.28E-05	1.27E-06	3.51E-05	Arsenic	Skin	3.28E+00	9.94E-03	1.97E-01	3.49E+00
			Benzene	1.70E-09	9.55E-08	3.40E-10	9.76E-08	Benzene	Blood	7.21E-04	1.44E-01	1.44E-04	1.45E-01
			Cadmium	ND	NA	ND	NA	Cadmium	Kidney	NA	NA	NA	NA
			Chlorobenzene	NA	NA	NA	NA	Chlorobenzene	Liver	2.31E-04	5.65E-02	4.62E-05	5.68E-02
			Chromium	NA	NA	NA	NA	Chromium	None observed	1.53E-04	4.63E-07	2.29E-04	3.83E-04
			Copper	ND	NA	ND	NA	Copper	Gastrointestinal	NA	NA	NA	NA
			1,2-Dichlorobenzene	NA	NA	NA	NA	1,2-Dichlorobenzene	None observed	7.53E-05	3.29E-03	1.51E-05	3.38E-03
			1,3-Dichlorobenzene	ND	NA	ND	ND	1,3-Dichlorobenzene	N/A	NA	NA	NA	NA
			1,4-Dichlorobenzene	ND	NA	ND	ND	1,4-Dichlorobenzene	N/A	NA	NA	NA	NA
			Iron	ND	NA	ND	ND	Iron	N/A	NA	NA	NA	NA
			Lead	NA	NA	NA	NA	Lead	N/A	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Manganese	CNS	1.48E-02	4.47E-01	7.38E-03	4.69E-01
			Methylene Chloride	4.88E-10	1.87E-08	9.76E-11	1.93E-08	Methylene Chloride	Liver	7.59E-05	9.53E-04	1.52E-05	1.04E-03
			4-Methylphenol	ND	NA	ND	ND	4-Methylphenol	N/A	NA	NA	NA	NA
			Nickel	NA	1.86E-07	NA	1.86E-07	Nickel	Various	1.28E-02	3.88E-05	6.40E-03	1.92E-02
			Thallium	NA	NA	NA	NA	Thallium	Blood	4.20E-01	1.27E-03	8.40E-03	4.29E-01
			Tin	NA	NA	NA	NA	Tin	Liver	8.50E-01	2.58E-03	1.70E-02	8.70E-01
			Toluene	NA	NA	NA	NA	Toluene	Liver; kidney	2.44E-04	4.87E-02	4.88E-05	4.90E-02
						Total Risk Across Soil	**3.5E-05**						

TABLE 7.3
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE - CONSTRUCTION WORKER
Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current/Future
Receptor Population:	Construction Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Groundwater	Acetone	NA	NA	NA	NA	Acetone	Liver; kidney	NA	5.75E+00	3.81E-02	5.79E+00
			Aluminum	NA	NA	NA	NA	Aluminum	N/A	NA	NA	3.13E-03	3.13E-03
	Ambient Air	Volatile COPCs	Aniline	NA	NA	1.7E-07	1.73E-07	Aniline	N/A	NA	NA	3.04E-01	3.04E-01
			Antimony	NA	NA	NA	NA	Antimony	Blood	NA	NA	1.85E+00	1.85E+00
			Arsenic	NA	NA	8.9E-08	8.92E-08	Arsenic	Skin	NA	NA	1.39E-02	1.39E-02
			Benzene	NA	6.5E-07	1.1E-07	7.64E-07	Benzene	Blood	NA	9.81E-01	4.79E-02	1.03E+00
			Cadmium	NA	NA	NA	NA	Cadmium	Kidney	NA	NA	9.26E-03	9.26E-03
			Chlorobenzene	NA	NA	NA	NA	Chlorobenzene	Liver	NA	1.02E+00	4.74E-02	1.07E+00
			Chromium	NA	NA	NA	NA	Chromium	None observed	NA	NA	5.35E-04	5.35E-04
			Copper	NA	NA	NA	NA	Copper	Gastrointestinal	NA	NA	1.16E-04	1.16E-04
			1,2-Dichlorobenzene	NA	NA	NA	NA	1,2-Dichlorobenzene	None observed	NA	5.71E-01	1.00E-01	6.71E-01
			1,3-Dichlorobenzene	NA	NA	NA	NA	1,3-Dichlorobenzene	N/A	NA	1.23E-02	3.06E-01	3.18E-01
			1,4-Dichlorbenzene	NA	1.4E-06	4.3E-07	1.83E-06	1,4-Dichlorbenzene	N/A	NA	1.94E-02	4.22E-02	6.16E-02
			Iron	NA	NA	NA	NA	Iron	N/A	NA	NA	9.70E-03	9.70E-03
			Lead	NA	NA	NA	NA	Lead	N/A	NA	NA	NA	NA
			Manganese	NA	NA	NA	NA	Manganese	CNS	NA	NA	7.35E-02	7.35E-02
			Methylene Chloride	NA	6.5E-08	6.8E-09	7.18E-08	Methylene Chloride	Liver	NA	3.31E-03	1.06E-03	4.37E-03
			4-Methylphenol	NA	NA	NA	NA	4-Methylphenol	N/A	NA	NA	4.52E-02	4.52E-02
			Nickel	NA	NA	NA	NA	Nickel	Various	NA	NA	3.42E-03	3.42E-03
			Thallium	NA	NA	NA	NA	Thallium	Blood	NA	NA	1.60E-02	1.60E-02
			Tin	NA	NA	NA	NA	Tin	Liver	NA	NA	NA	NA
			Toluene	NA	NA	NA	NA	Toluene	Liver; kidney	NA	2.91E+00	2.90E-01	3.20E+00
						Total Risk Across Groundwater	**2.9E-06**					**Total Hazard Index Across All Media and All Exposure Routes**	**2.0E+01**
						Total Risk Across All Media and All Exposure Routes	**3.8E-05**						

Total [Liver] HI =	**1.1E+01**
Total [Blood] HI =	**3.7E+00**
Total [Skin] HI =	**3.5E+00**

TABLE 7.4
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE - RECREATIONAL USER, ADULT
Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current
Receptor Population:	Recreational User
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Creek	Acetone	ND	NA	ND	ND	Acetone	Liver; kidney	ND	NA	ND	ND
			Aluminum	NA	NA	NA	NA	Aluminum	N/A	1.09E-06	NA	5.70E-06	6.79E-06
			Aniline	NA	NA	NA	NA	Aniline	N/A	ND	NA	ND	ND
			Antimony	ND	NA	ND	ND	Antimony	Blood	ND	NA	ND	ND
			Arsenic	ND	NA	ND	ND	Arsenic	Skin	ND	NA	ND	ND
			Benzene	ND	NA	ND	ND	Benzene	Blood	ND	NA	ND	ND
			Cadmium	ND	NA	ND	ND	Cadmium	Kidney	ND	NA	ND	ND
			Chlorobenzene	ND	NA	ND	ND	Chlorobenzene	Liver	ND	NA	ND	ND
			Chromium	ND	NA	ND	ND	Chromium	None observed	ND	NA	ND	ND
			Copper	ND	NA	ND	ND	Copper	Gastrointestinal	ND	NA	ND	ND
			1,2-Dichlorobenzene	ND	NA	ND	ND	1,2-Dichlorobenzene	None observed	ND	NA	ND	ND
			1,3-Dichlorobenzene	ND	NA	ND	ND	1,3-Dichlorobenzene	N/A	ND	NA	ND	ND
			1,4-Dichlorobenzene	ND	NA	ND	ND	1,4-Dichlorobenzene	N/A	ND	NA	ND	ND
			Iron	NA	NA	NA	NA	Iron	N/A	2.88E-05	NA	1.24E-04	1.53E-04
			Lead	ND	NA	ND	ND	Lead	N/A	ND	NA	ND	ND
			Manganese	NA	NA	NA	NA	Manganese	CNS	4.33E-03	NA	7.52E-04	5.08E-03
			Methylene Chloride	ND	NA	ND	ND	Methylene Chloride	Liver	ND	NA	ND	ND
			4-Methylphenol	ND	NA	ND	ND	4-Methylphenol	N/A	ND	NA	ND	ND
			Nickel	ND	NA	ND	ND	Nickel	Various	ND	NA	ND	ND
			Thallium	ND	NA	ND	ND	Thallium	Blood	ND	NA	ND	ND
			Tin	ND	NA	ND	ND	Tin	Liver	ND	NA	ND	ND
			Toluene	ND	NA	ND	ND	Toluene	Liver; kidney	ND	NA	ND	ND

Total Risk Across Surface Water	**0.0E+00**
Total Risk Across All Media and All Exposure Routes	**0.0E+00**
Total Hazard Index Across All Media and All Exposure Routes	**5E-03**
Total [Liver] HI =	**ND**
Total [Blood] HI =	**ND**

TABLE 7.5
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE - RECREATIONAL USER, CHILD
Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current
Receptor Population:	Recreational User
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Creek	Acetone	ND	NA	ND	ND	Acetone	Liver; kidney	ND	NA	ND	ND
			Aluminum	NA	NA	NA	NA	Aluminum	N/A	1.87E-06	NA	2.66E-05	2.85E-05
			Aniline	ND	NA	ND	ND	Aniline	N/A	ND	NA	ND	ND
			Antimony	ND	NA	ND	ND	Antimony	Blood	ND	NA	ND	ND
			Arsenic	ND	NA	ND	ND	Arsenic	Skin	ND	NA	ND	ND
			Benzene	ND	NA	ND	ND	Benzene	Blood	ND	NA	ND	ND
			Cadmium	ND	NA	ND	ND	Cadmium	Kidney	ND	NA	ND	ND
			Chlorobenzene	ND	NA	ND	ND	Chlorobenzene	Liver	ND	NA	ND	ND
			Chromium	ND	NA	ND	ND	Chromium	None observed	ND	NA	ND	ND
			Copper	ND	NA	ND	ND	Copper	Gastrointestinal	ND	NA	ND	ND
			1,2-Dichlorobenzene	ND	NA	ND	ND	1,2-Dichlorobenzene	None observed	ND	NA	ND	ND
			1,3-Dichlorobenzene	ND	NA	ND	ND	1,3-Dichlorobenzene	N/A	ND	NA	ND	ND
			1,4-Dichlorobenzene	ND	NA	ND	ND	1,4-Dichlorobenzene	N/A	ND	NA	ND	ND
			Iron	NA	NA	NA	NA	Iron	N/A	4.93E-05	NA	5.81E-04	6.30E-04
			Lead	ND	NA	ND	ND	Lead	N/A	ND	NA	ND	ND
			Manganese	NA	NA	NA	NA	Manganese	CNS	7.40E-03	NA	3.51E-03	1.09E-02
			Methylene Chloride	ND	NA	ND	ND	Methylene Chloride	Liver	ND	NA	ND	ND
			4-Methylphenol	ND	NA	ND	ND	4-Methylphenol	N/A	ND	NA	ND	ND
			Nickel	ND	NA	ND	ND	Nickel	Various	ND	NA	ND	ND
			Thallium	ND	NA	ND	ND	Thallium	Blood	ND	NA	ND	ND
			Tin	ND	NA	ND	ND	Tin	Liver	ND	NA	ND	ND
			Toluene	ND	NA	ND	ND	Toluene	Liver; kidney	ND	NA	ND	ND
						Total Risk Across Surface Water	**0.0E+00**					**Total Hazard Index Across All Media and All Exposure Routes**	**1E-02**
						Total Risk Across All Media and All Exposure Routes	**0.0E+00**						

Total [Liver] HI =	**ND**
Total [Blood] HI =	**ND**

TABLE 8.1
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE - INDOOR WORKER
Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current/Future
Receptor Population:	Indoor Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Indoor Air	Volatile COPCs	Benzene	NA	5.5E-06	NA	5.5E-06	Benzene	Blood	NA	0	NA	0
						Total Risk Across Soil	**5.5E-06**						
Groundwater	Indoor Air	Volatile COPCs	Toluene	NA	NA	NA	NA	Toluene	Liver; kidney	NA	0.0	NA	0.0
						Total Risk Across Groundwater	**0.0E+00**		**Total Hazard Index Across All Media and All Exposure Routes**				**0.4**

Total Risk Across All Media and All Exposure Routes **5.5E-06**

Total [Liver] HI =	**0.01**
Total [Blood] HI =	**0.3**

TABLE 8.2
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE - OUTDOOR WORKER
Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current/Future
Receptor Population:	Outdoor Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	On-Site Soil	Arsenic	8.0E-05	2.4E-07	3.2E-05	1.1E-04
						Total Risk Across Soil	**1.1E-04**
Groundwater							
						Total Risk Across Groundwater	**0.0E+00**
						Total Risk Across All Media and All Exposure Routes	**1.1E-04**

Chemical	Non-Carcinogenic Hazard Quotient				
	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Arsenic	Skin	4.97E-01	1.51E-04	1.97E-01	6.94E-01
Total Hazard Index Across All Media and All Exposure Routes					**6.9E-01**

Total [Liver] HI =	**NA**
Total [Blood] HI =	**NA**
Total [Skin] HI =	**6.9E-01**

TABLE 8.3
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE - CONSTRUCTION WORKER
Morton International, Inc.
Reading, Ohio

Scenario Timeframe:	Current/Future
Receptor Population:	Construction Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Soil						Arsenic	Skin	3.28E+00	0.00E+00	1.97E-01	3.48E+00
						Total Risk Across Soil	**0.0E+00**						
Groundwater	Ambient Air	Volatile COPCs						Acetone	Liver; kidney	NA	5.75E+00	3.81E-02	5.79E+00
	Groundwater	Groundwater						Antimony	Blood	NA	NA	1.85E+00	1.85E+00
	Ambient Air	Volatile COPCs						Benzene	Blood	NA	9.81E-01	4.79E-02	1.03E+00
	Ambient Air	Volatile COPCs						Chlorobenzene	Liver	NA	1.02E+00	4.74E-02	1.07E+00
	Ambient Air	Volatile COPCs						1,2-Dichlorobenzene	None observed	NA	5.71E-01	1.00E-01	6.71E-01
	Ambient Air	Volatile COPCs						Toluene	Liver; kidney	NA	2.91E+00	2.90E-01	3.20E+00
						Total Risk Across Groundwater	**0.0E+00**					**Total Hazard Index Across All Media and All Exposure Routes**	**1.9E+01**
						Total Risk Across All Media and All Exposure Routes	**0.0E+00**						

Total [Liver] HI =	**1.0E+01**
Total [Blood] HI =	**2.9E+00**
Total [Skin] HI =	**3.5E+00**

TABLE 9.1
PLANTS IDENTIFIED BY COVER TYPE
DURING SITE RECONNAISSANCE
Morton International, Inc.
Reading, Ohio

Common Name	Scientific Name	Cover Type
Black locust	*Robinia pseudo-acacia*	1
Box elder	*Acer negundo*	1, 2
Burdock	*Arctium minus*	2
Canada thistle	*Cirsium arvense*	3
Chickweed	*Stellaria media*	3
Chinese elm	*Solanum nigrum*	3
Choke cherry	*Prunus*	4
Coltsfoot	*Tussilago farfara*	3
Common cinquefoil	*Potenilla simplex*	3
Common plantain	*Plantago major*	3, 4
Cottonwood	*Populus deltoides*	1, 2
Crab grass	*Digitaria sanguinalis*	3
Curled dock	*Rumex crispus*	1
Dandelion	*Taraxacum officinale*	3, 4
English plantain	*Plantago lanceolata*	3, 4
Gill-over-the ground	*Glechoma hederacea*	3
Goldenrod	*Solidago sp.*	1, 2, 3
Hackberry	*Celtis occidentalis*	1
Holly	*Ilex opaca*	4
Moth mullein	*Verbascum thapsus*	1
Mugwort	*Gleditsia triacanthos*	3
Mulberry	*Morus rubra*	1, 3
Norway spruce	*Picea abies*	3
Poison ivy	*Rhus radicans*	1, 3
Privet	*Ligustrum vulgare*	3
Queen Anne's lace	*Daucus carrota*	1
Raspberry	*Rubus allegheniensis*	1
Red fescue	*Festuca rubra*	3
Red maple	*Acer rubra*	1, 2
Reed canary grass	*Phalaris arundinacea*	2
Sandbar willow	*Salix interior*	2
Scotch pine	*Pinus sylvestris*	3
Slippery elm	*Ulmas rubra*	2
Smooth sumac	*Rhus glabra*	2
Sycamore	*Platanus occidentalis*	2
Tartarian honeysuckle	*Lonicera tatarica*	1, 2

TABLE 9.1
PLANTS IDENTIFIED BY COVER TYPE
DURING SITE RECONNAISSANCE
Morton International, Inc.
Reading, Ohio

Common Name	Scientific Name	Cover Type
Teasel	*Dipsacus sylvestris*	1
Virginia creeper	*Parthenocissus quinquefolia*	1
Weeping willow	*Salix babylonica*	2
White birch	*Betula papyrifera*	3
White campion	*Lychnis alba*	3
White clover	*Trifolium repens*	1, 3, 4
White honeysuckle	*Acer saccharum*	2
White pine	*Pinus strobes*	3
Wild grape	*Vitis aestivalis*	1
Wild parsnip	*Pastinaca sativa*	1
Wood sorrel	*Oxalis Montana*	3
Yellow hop clover	*Trifolium agrarium*	3
Yellow sweet clover	*Melilotus officinalis*	1, 3
Yew	*Taxus canadensis*	4

Notes:

Cover Types:

1 = Successional Old Field
2 = Riparian Forest
3 = Residential/Recreational Area
4 = Industrial Area

Reconnaissance performed on May 29 and 30, 2001.

Results are representative of conditions present at the time of reconnaissance.

TABLE 9.2
REPTILES AND AMPHIBIANS THAT MAY POTENTIALLY OCCUR ON OR ADJACENT TO THE SITE BASED ON HABITAT TYPES PRESENT
Morton International, Inc.
Reading, Ohio

Common Name	Scientific Name	Habitat Requirements
American toad	*Bufo americanus*	Woods, gardens, open fields
Black rat snake	*Elaphe obsoleta obsoleta*	Woodlands, thickets, field edges
Box turtle	*Terrapene carolina*	Woodland, field edges
Eastern garter snake	*Thamnophis sirtalis sirtalis*	Ubiquitous
Eastern milk snake	*Lampropeltis triangulum triangulum*	Various habitat, usually with brushy cover
Fowler's toad	*Bufo woodhousii*	Sandy soil, roadsides
Gray treefrog	*Hyla versicolor*	Small trees and shrubs near water
Green Frog	*Rana clamitans*	Riparian habitat
Kirtland's snake	*Clonophis kirtlandii*	Parks and urban areas
Midland painted turtle	*Chrysemys picta marginata*	Shallow ponds, woodland streams
Northern leopard frog	*Rana pipiens*	Meadows, grassy fields near water
Northern water snake	*Nerodia sipedon sipedon*	Aquatic area with rocks for basking
Racer	*Coluber constrictor*	Wooded areas, roadsides, fields
Red-spotted newt	*Notophthalmus viridescens*	Weedy areas of slow moving streams
Snapping turtle	*Chelydra serpentina*	Streams, rivers, lakes, ponds
Spiny softshell	*Apalone spinifera*	Large water systems
Spring peepers	*Pseudacris crucifer*	Woodlots near water

Reference:

Conat and Collins, 1975

TABLE 9.3
BIRDS THAT MAY POTENTIALLY OCCUR ON OR ADJACENT TO THE SITE BASED ON HABITAT TYPES PRESENT

Morton International, Inc.
Reading, Ohio

Common Name	Scientific Name	Habitat Requirements
Birds Observed by Sight or Song		
American crow	*Corvus brachyrhynchos*	Forest edges
American goldfinch	*Carduelis tristis*	Open weedy fields
Barn swallow	*Hirundo rustica*	Man-made structures
Black-capped chickadee	*Poecile atricapillus*	Mixed woodlands
Blue jay	*Cyanocitta cristata*	Mixed woodlands, suburbs, parks
Cardinal	*Cardinalis cardinalis*	Forest edges, residential areas
Cedar waxwing	*Bombycilla cedrorum*	Open woodlands near water
Chipping sparrow	*Spizella passerina*	Open woodlands, forest edge, suburban residential areas
Downy Woodpecker	*Picoides pubescens*	Edge of open mixed woodlots
Gray catbird	*Dumatella carolinensis*	Dense thickets along woodland edges, shrubbery around dwellings
Great crested flycatcher	*Myiarchus crinitus*	Forest edge
House sparrow	*Passer domesticus*	Urban settings
Indigo bunting	*Passerina cyanea*	Woodland edges
Mockingbird	*Mimus polygloottus*	Woodland edges, often in cities
Mourning dove	*Zenaida macroura*	Open mixed woodlands, suburbs
Northern oriole	*Icterus galbula*	Roadsides, open woodlands, suburban shade trees
Purple finch	*Carpodacus purpureus*	Woods, groves, suburbs
Robin	*Turdus migratorius*	Woodland edges and clearings, shade trees
Rock dove	*Columba livia*	Common near human habitation
Song sparrow	*Melospiza melodia*	Brushy fields, cities, suburbs, forest edges
Starling	*Sturnus vulgaris*	Urban settings
Tree swallow	*Tachycineta bicolor*	Open country near water
Yellow warbler	*Dendroica petechia*	Farmlands, roadsides
Birds That May Potentially Occur		
American black duck	*Anas rubripes*	Lakes, river, ponds
American kestrel	*Falco sparverius*	Open areas, forest edges, farm buildings

TABLE 9.3
BIRDS THAT MAY POTENTIALLY OCCUR ON OR ADJACENT TO THE SITE BASED ON HABITAT TYPES PRESENT
Morton International, Inc.
Reading, Ohio

Common Name	Scientific Name	Habitat Requirements
American redstart	*Setophaga ruticilla*	Sapling woodlots, shade trees and shrubbery around dwellings
American tree sparrow	*Spizella arborea*	Brushy roadsides, weedy edges
Belted kingfisher	*Ceryle alcyon*	Streams, lakes
Bewick's wren	*Thryomanes bewickii*	Thickets, gardens
Black-crowned night-heron	*Nycticorax nycticorax*	Marshes, shores, roosts in trees
Blue-winged warbler	*Vermivora pinus*	Edges of woods, brushy overgrown fields
Brown thrasher	*Toxostooma rufum*	Woodland edges, bushes, low trees
Brown-headed cowbird	*Molothrus ater*	Forest edges, suburban areas
Canada Goose	*Branta candensis*	Lakes, ponds, rivers, fields
Carolina wren	*Thryothorus ludovicianus*	Brushy undergrowth, gardens
Chimney swift	*Chaetura pelagica*	Near buildings
Common grackle	*Quiscalus quiscula*	Farmlands, suburbs
Common nighthawk	*Chordeiles minor*	Open areas, cities
Cooper's hawk	*Accipiter cooperii*	Broken woodlands
Eastern bluebird	*Sialia sialis*	Roadsides, open country, woodland edges
Eastern kingbird	*Tyrannus tyrannus*	Forest edge, pastures
Eastern phoebe	*Sayornis phoebe*	Woodlands, suburbs
Eastern screech owl	*Otus asio*	Open woodlands, shade trees in towns
Eastern wood peewee	*Contoopus virens*	Roadsides, woodlots
Field sparrow	*Spizella pusilla*	Old fields, woodland edges
Great blue heron	*Ardea herodias*	Swamps, shores, rivers
Great horned owl	*Bubo virginianus*	Mixed countryside of forest and fields
Green heron	*Butorides virescens*	Streamside, lakes, ponds, marshes
Hairy woodpecker	*Picoides villosus*	Forests, woodlands, shade trees
House Finch	*Carpodacus mexicanus*	Open woods, suburban areas
House wren	*Troglodytes aedon*	Near human dwellings
Killdeer	*Charadrius vociferus*	Lawns, waste places, open meadows
Louisiana waterthrush	*Seiurus motacilla*	Brooks, rivers

TABLE 9.3
BIRDS THAT MAY POTENTIALLY OCCUR ON OR ADJACENT TO THE SITE BASED ON HABITAT TYPES PRESENT

Morton International, Inc.
Reading, Ohio

Common Name	Scientific Name	Habitat Requirements
Mallard duck	*Anas platyrhynchos*	Lakes, rivers, ponds
Northern flicker	*Colaptes auratus*	Open woodland edges, woodlots
Northern harrier	*Circus cyaneus*	Fields, farmlands
Northern junco	*Junco hyemalis*	Forest edges
Orchard oriole	*Icterus spurius*	Woodland edges, shade trees
Purple martin	*Progne subis*	Farmlands, parks, suburban yards
Red-bellied woodpecker	*Melanerpes carolinus*	Woodland, towns
Red-headed woodpecker	*Melanerpes erythrocephalus*	Farm country, shade trees
Red-tailed hawk	*Buteo jamaicensis*	Mixed woodlands interspersed with open areas
Rough-winged swallow	*Stelgidopteryx serripennis*	Suburban yards, woodland edges
Ruby-throated hummingbird	*Archilochus colubris*	Mixed woodlands, backyards
Rufous-sided towhee	*Pipilo erythropthalmus*	Woodland edges, dense brushy areas
Scarlet tanager	*Piranga olivacea*	Mixed woodlots
Tufted titmouse	*Baeolophus bicolor*	Residential areas in shade trees
Turkey vulture	*Cathartes aura*	Open fields and woodlands
Warbling vireo	*Vireo gilvuv*	Open woodlands, roadsides
White-breasted nuthatch	*Sitta carolinensis*	Mixed woodlands, orchards, villages
White-crowned sparrow	*Zonotrichia leucophrys*	Roadsides, brush, thickets
White-eyed vireo	*Vireo griseus*	Woodland edges, brush
Willow flycatcher	*Empidonax trailii*	Woodland edges, roadsides, brushy fields, hedgerows
Wood duck	*Aix sponsa*	Wooded lakes, rivers, ponds
Yellow-rumped warbler	*Dendroica coronata*	Mixed woodlands, brush
Yellow-throated vireo	*Vireo flavifrons*	Deciduous woodlands, shade trees
Yellow-throated warbler	*Dendroica dominica*	Open woodlands

Note:

Bold entries were observed by sight or song during May 29 and 30, 2001 field reconnaissance.

References:

Peterson, 1980.
Fazio, 1998.

TABLE 9.4
MAMMALS THAT MAY POTENTIALLY OCCUR ON OR ADJACENT TO THE SITE BASED ON HABITAT TYPES PRESENT

Morton International, Inc.
Reading, Ohio

Common Name	Scientific Name	Habitat Requirements
Observed by Sight or Tracks		
Eastern cottontail	*Sylvilagus floridanus*	Fallow fields, open woodlots, thickets
Gray squirrel	*Sciurus carolinenis*	Mixed woodlots, shade trees
Raccoon	*Procyon lotor*	Wooded areas interrupted by open areas
Woodchuck	*Marmota monax*	Woodland edges, meadows
May Potentially Occur		
Big brown bat	*Eptesicus fuscus*	Buildings, bridges, tunnels, caves
Chipmunk	*Tamias striatus*	Forest edges, semi-open brush lands
Common rat	*Rattus norvegicus*	Buildings, dumps
Coyote	*Canis latrans*	Open brushy fields
Deer mouse	*Peromyscus leucopus*	Forest edge, field boarders
Evening bat	*Nycticeius humeralis*	Buildings and hollow trees
Hairy-tailed mole	*Parascalops brewii*	Open woods, meadows with sandy loam
House mouse	*Mus musculus*	Fields, buildings
Keen myotis	*Myotis keenii*	Hollow trees, buildings, storm sewers, forested areas
Least shrew	*Cryptotis parva*	Open grassy areas, forest edges
Little brown bat	*Myotis lucifugus*	Woodlands near roosting crevices such as barns and attics
Meadow vole	*Microtus pennsylvanicus*	Fields, pastures, orchards
Mink	*Mustela vison*	Along streams and lakes
Prairie vole	*Microtus ochrogaster*	Open fields, railroad right-of-ways
Red fox	*Vulpes fulva*	Mixture of open and wooded areas
Silver-haired bat	*Lasionycteris noctivagans*	Forested areas, buildings
Striped skunk	*Mephitis mephitis*	Semi-open country, suburban areas
Virginia opposum	*Didelphis virginiana*	Dry woodlots near human habitation
White-footed mouse	*Peromyscus maniculatus*	Forest edge, pasture
White-tailed deer	*Odocoileus virginianus*	Forest edges

Note:

Bold entries were observed by sight or tracks during May 29 and 30, 2001 field reconnaissance

References:

Burt and Grossenheider, 1976.
Lewis, 1998.

TABLE 10.1
COMPARISON OF SURFACE SOIL DATA TO EDQLS
Morton International, Inc.
Reading, Ohio

	EDQL	Background	Background Soil			On-Site Soil		
			Frequency of Detection	Range of Detected Concentrations	HQ	Frequency of Detection	Range of Detected Concentrations	HQ[1]
Volatile Organic Compounds (mg/kg)								
2-Butanone	89.6		1/11	0.0033 - 0.0033	0.00004	12/49	0.0031 - 0.64	
Acetone	2.5		10/11	0.0039 - 0.012	0.005	27/49	0.0019 - 15	6
Benzene	0.114		0/11			2/49	0.0017 - 0.037	
Carbon disulfide	0.0841		0/11			1/49	1.5 - 1.5	
Chlorobenzene	0.01		0/11			4/49	0.0043 - 0.31	31
Chloromethane	10.4		0/11			1/49	1.7 - 1.7	
Dichlorodifluoromethane	39.5		0/11			1/49	0.0032 - 0.0032	
Ethylbenzene	5.16		0/11			2/49	0.13 - 5.7	
Iodomethane	1.23		0/0			1/16	36 - 36	29
Isopropylbenzene	NE		0/11			1/33	0.24 - 0.24	
Methyl acetate	NE		1/11	0.0031 - 0.0031		2/33	0.0019 - 0.0024	
Methylcyclohexane	NE		0/11			3/33	0.00076 - 1.3	
Methylene chloride	4.05		0/11			7/49	0.0014 - 0.29	
Tetrachloroethene	9.92		2/11	0.0028 - 0.0059	0.0006	2/49	0.0026 - 0.0092	
Toluene	5.45		0/11			3/48	0.063 - 0.47	
Xylenes (total)	10		0/11			3/49	0.045 - 50	5
Semivolatile Organic Compounds (mg/kg)								
2-Methylnaphthalene	3.24		1/11	4.3 - 4.3	1.33	0/49		
Acenaphthene	682		1/11	37 - 37	0.05	1/49	0.58 - 0.58	
Anthracene	1480		1/11	26 - 26	0.02	1/49	1.5 - 1.5	
Benzo(a)anthracene	5.21		3/11	0.063 - 36	6.91	7/49	0.07 - 5.4	
Benzo(a)pyrene	1.52		3/11	0.076 - 24	16	6/49	0.085 - 6.2	
Benzo(b)fluoranthene	59.8		3/11	0.1 - 29	0.48	9/49	0.07 - 7	
Benzo(ghi)perylene	119		3/11	0.072 - 9.2	0.08	4/49	0.089 - 2.8	
Benzo(k)fluoranthene	148		2/11	0.096 - 18	0.12	3/49	0.078 - 2.8	
bis(2-Ethylhexyl) phthalate	0.92594		2/11	0.06 - 0.18	0.19	8/49	0.07 - 6.5	7.0
Carbazole	NE		1/11	4.4 - 4.4		1/34	0.48 - 0.48	
Chrysene	4.73		3/11	0.082 - 37	7.82	9/49	0.064 - 5.9	
Di-n-octyl phthalate	709		0/11			1/49	0.29 - 0.29	

TABLE 10.1
COMPARISON OF SURFACE SOIL DATA TO EDQLS
Morton International, Inc.
Reading, Ohio

	EDQL	Background	Background Soil			On-Site Soil		
			Frequency of Detection	Range of Detected Concentrations	HQ	Frequency of Detection	Range of Detected Concentrations	HQ[1]
Dibenz(a,h)anthracene	18.4		1/11	3.5 - 3.5	0.19	1/49	0.82 - 0.82	
Dibenzofuran	NE		1/11	26 - 26		2/49	0.32 - 0.64	
Fluoranthene	122		3/11	0.15 - 120	0.98	10/49	0.084 - 14	
Fluorene	122		1/11	32 - 32	0.262	1/49	0.61 - 0.61	
Indeno(1,2,3-cd)pyrene	109		2/11	0.15 - 9.2	0.084	3/49	0.12 - 2.7	
Naphthalene	0.09939		1/11	3 - 3	30	0/49		
Phenanthrene	45.7		3/11	0.096 - 110	2.41	8/49	0.07 - 6.5	
Phenol	120		0/11			1/49	0.075 - 0.075	
Pyrene	78.5		3/11	0.14 - 83	1.06	10/49	0.063 - 11	
Pesticides/PCBs (mg/kg)								
4,4'-DDD	0.75815		0/11			1/49	0.00064 - 0.00064	
4,4'-DDE	0.59587		2/11	0.0015 - 0.019	0.0319	6/49	0.00074 - 0.0041	
4,4'-DDT	0.0175		0/11			3/49	0.0022 - 0.0081	
Aldrin	NE		1/11	0.11 - 0.11		0/49		
alpha-Chlordane	NE		0/11			1/34	0.00083 - 0.00083	
Dieldrin	0.00238		4/11	0.015 - 0.055	23	2/49	0.0012 - 0.0041	
Endosulfan II	0.11927		0/11			1/49	0.0015 - 0.0015	
Endosulfan sulfate	0.03578		0/11			2/49	0.0028 - 0.012	
Endrin	0.0101		0/11			1/49	0.0021 - 0.0021	
Endrin aldehyde	0.0105		0/11			3/49	0.0013 - 0.01	
Endrin ketone	NE		1/11	0.13 - 0.13		1/34	0.0017 - 0.0017	
gamma-Chlordane	NE		0/11			2/34	0.00047 - 0.0025	
Heptachlor epoxide	0.15188		0/11			1/48	0.0001 - 0.0001	
Isodrin	0.00332		1/11	0.0054 - 0.0054	1.63	0/16		
Methoxychlor	0.01988		0/11			1/49	0.003 - 0.003	
Aroclor 1242	0.000332		0/11			1/49	0.063 - 0.063	
Aroclor 1248	0.000332		0/11			1/49	0.011 - 0.011	
Aroclor 1254	0.000332		1/11	0.11 - 0.11	331	4/48	0.038 - 0.98	
Aroclor 1260	0.000332		2/11	0.015 - 0.24	723	4/49	0.011 - 0.028	

TABLE 10.1
COMPARISON OF SURFACE SOIL DATA TO EDQLS
Morton International, Inc.
Reading, Ohio

	EDQL	Background	Background Soil			On-Site Soil		
			Frequency of Detection	Range of Detected Concentrations	HQ	Frequency of Detection	Range of Detected Concentrations	HQ[1]
Inorganic Compounds (mg/kg)								
Aluminum	NE	18728	11/11	1870 - 13000		33/33	2900 - 14100	
Antimony	0.1423		1/11	3.3 - 3.3	23	2/49	1.5 - 65.1	457
Arsenic	5.7	20.8	11/11	3.7 - 16.2	2.84	49/49	3.3 - 580	102
Barium	1.04	997	11/11	9.8 - 985	947	49/49	16.3 - 132	
Beryllium	1.06	0.636	9/11	0.26 - 1.4	1.32	49/49	0.14 - 1	
Cadmium	0.00222	0.82	11/11	0.14 - 0.7	315	41/49	0.054 - 6.5	2928
Calcium	NE	128799	11/11	1210 - 97000		33/33	810 - 111000	
Chromium	0.4	80.6	11/11	3.7 - 69.7	174	49/49	4.9 - 232	580
Cobalt	0.14433	11.9	11/11	2.8 - 8.6	60	49/49	3.4 - 16.8	116
Copper	0.3132	66.4	11/11	6.8 - 64.8	207	49/49	6.5 - 1260	4023
Cyanide, Total	1.33		3/11	0.24 - 0.42	0.32	2/48	0.38 - 0.56	
Iron	NE	29470	11/11	4030 - 19800		33/33	8500 - 29900	
Lead	0.05373	400.7	11/11	4.1 - 410	7631	49/49	3.5 - 19300	359203
Magnesium	NE	45757	11/11	340 - 36200		33/33	1120 - 27900	
Manganese	NE	1154	11/11	14.6 - 854		33/33	212 - 1730	
Mercury	0.1	0.206	10/11	0.0098 - 0.16	1.60	45/49	0.012 - 0.18	
Nickel	13.6		11/11	6.2 - 15.7	1.15	49/49	8 - 35.4	
Potassium	NE		11/11	368 - 1810		33/33	520 - 1720	
Selenium	0.02765		4/11	0.69 - 2.5	90	23/49	0.36 - 0.91	
Silver	4.04		0/11			6/49	0.37 - 5.6	1.39
Sodium	NE		3/11	64.1 - 69.2		23/33	78.7 - 2410	
Thallium	0.05692	1.79	5/11	0.92 - 1.5	26	12/49	0.68 - 31.8	559
Tin	1.59	3.17	11/11	0.79 - 2.9	1.82	17/17	1.3 - 158000	99371
Vanadium	7.62	59.9	11/11	6.2 - 56.4	7.40	49/49	2.3 - 30.4	
Zinc	6.62	117.3	11/11	15.7 - 88.1	13	49/49	15.4 - 317	48

1. Hazard quotient calculated only for site-specific chemicals of potential ecological concern (COPECs).

TABLE 10.2
COMPARISON OF SEDIMENT DATA TO EDQLS
Morton International, Inc.
Reading, Ohio

	EDQL	Frequency of Detection	Range of Detected Concentrations	HQ[1]
Volatile Organic Compounds (mg/kg)				
Acetone	NE	7/22	0.0029 - 0.018	
Benzene	0.14157	1/22	0.0036	
Carbon disulfide	0.13397	1/22	0.0072	
Chlorobenzene	0.06194	5/22	0.0011 - 0.018	
Ethylbenzene	0.0001	1/22	0.00077	
Methylcyclohexane	NE	2/22	0.00081 - 0.0011	
Semivolatile Organic Compounds (mg/kg)				
1,2-Dichlorobenzene	231.32	4/22	0.13 - 0.2	
Anthracene	0.0469	1/1	0.09	
Benzo(a)anthracene	0.0317	1/1	0.57	
Benzo(a)pyrene	0.0319	1/1	0.74	
Benzo(b)fluoranthene	10.4	1/1	0.99	
Benzo(ghi)perylene	0.17	1/1	0.68	
Benzo(k)fluoranthene	0.24	1/1	0.33	
bis(2-Ethylhexyl) phthalate	NE	1/1	0.14	
Carbazole	NE	1/1	0.073	
Chrysene	0.0571	1/1	0.8	
Dibenz(a,h)anthracene	0.00622	1/1	0.16	
Fluoranthene	0.1113	1/1	1.6	
Indeno(1,2,3-cd)pyrene	0.2	1/1	0.59	
Phenanthrene	0.4119	1/1	0.61	
Pyrene	0.053	1/1	1.4	
Pesticides/PCBs (mg/kg)				
4,4'-DDE	0.00142	5/22	0.00091 - 0.023	
4,4'-DDT	0.0019	2/22	0.004 - 0.0056	
Aldrin	NE	1/22	0.001 - 0.001	
beta-BHC	0.005	3/22	0.0046 - 0.094	
Dieldrin	0.002	2/22	0.0022 - 0.0038	
Endrine ketone	NE	1/22	0.0014 - 0.0014	
Inorganic Compounds (mg/kg)				
Aluminum	NE	21/22	1730 - 9330	
Arsenic	5.9	21/22	2.8 - 6.3	
Barium	NE	21/22	8.9 - 76.9	
Beryllium	NE	21/22	0.069 - 0.46	
Cadmium	0.596	21/22	0.11 - 0.54	
Calcium	NE	21/22	18800 - 178000	
Chromium	26	21/22	5.8 - 22.9	
Cobalt	50	21/22	2.4 - 7.8	
Copper	16	21/22	4.5 - 26	

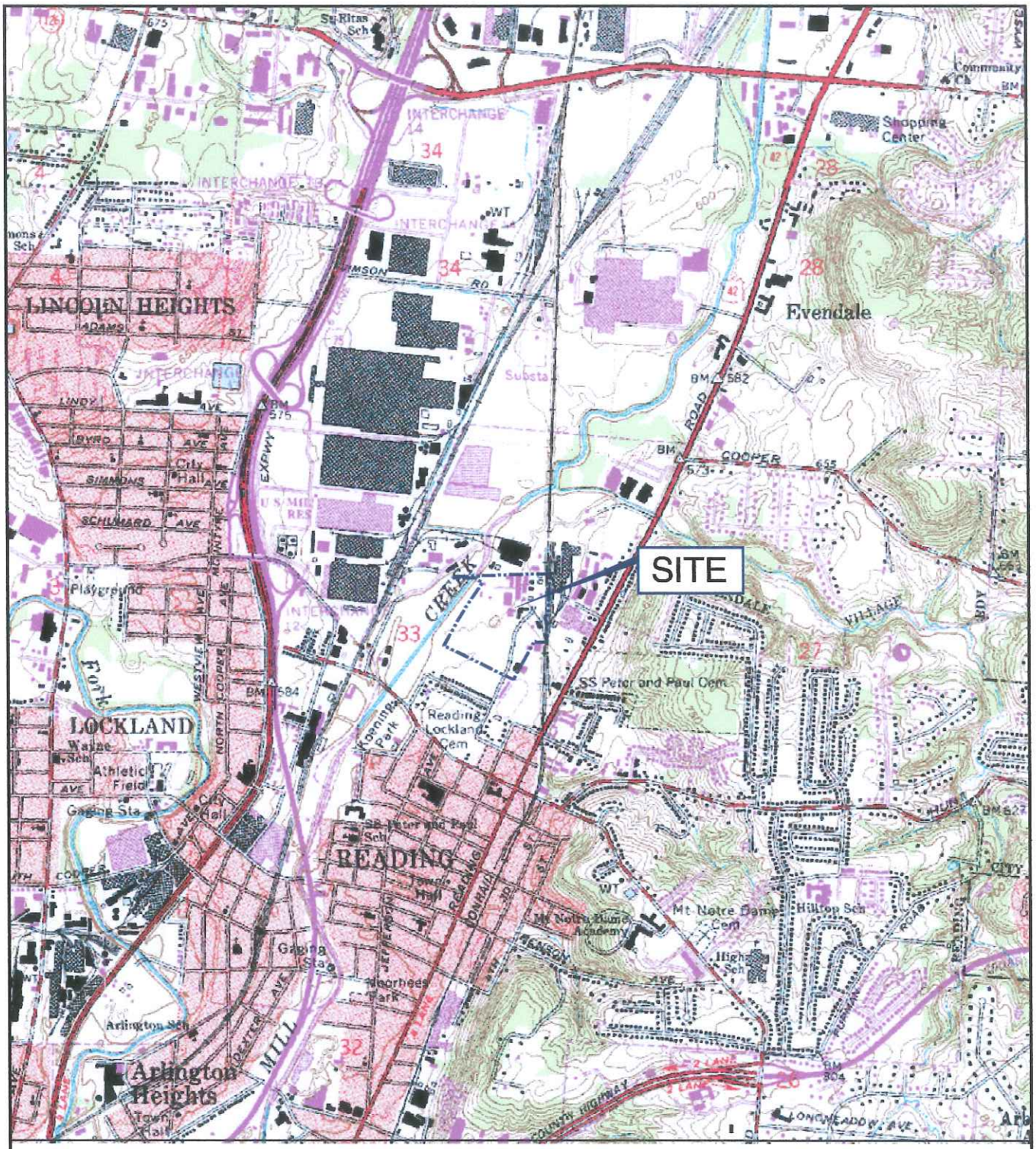
TABLE 10.2
COMPARISON OF SEDIMENT DATA TO EDQLS
Morton International, Inc.
Reading, Ohio

	EDQL	Frequency of Detection	Range of Detected Concentrations	HQ[1]
Iron	NE	21/22	6220 - 17400	
Lead	31	21/22	4.2 - 38.3	
Magnesium	NE	21/22	5450 - 64400	
Manganese	NE	21/22	245 - 670	
Mercury	0.174	15/22	0.01 - 0.095	
Nickel	16	21/22	5.7 - 22	
Potassium	NE	21/22	228 - 1230	
Selenium	NE	2/22	0.39 - 0.48	
Sodium	NE	21/22	124 - 360	
Thallium	NE	10/22	0.67 - 8	
Tin	NE	21/22	3.3 - 76.3	
Vanadium	NE	21/22	6.6 - 17	
Zinc	120	21/22	16.4 - 101	

1. Hazard quotient calculated only for site-specific chemicals of potential ecological concern (COPECs).

TABLE 10.3
COMPARISON OF SEEP DATA TO EDQLS
Morton International, Inc.
Reading, Ohio

	EDQL	Frequency of Detection	Range of Detected Concentrations	HQ
Volatile Organic Compounds (μg/l)				
1,1-Dichloroethane	190	2/2	0.55 - 1	
Acetone	7800	2/2	2.1 - 3.1	
Benzene	114	2/2	0.92 - 1.1	
Carbon disulfide	84.1	2/2	0.97 - 1.1	
Chlorobenzene	10	2/2	11 - 24	2.40
Ethylbenzene	17.2	1/2	0.39 - 0.39	
Methylcyclohexane	NE	2/2	0.3 - 0.49	
Toluene	253	2/2	0.45 - 0.55	
Xylenes (total)	117	1/2	1.7 - 1.7	
Semivolatile Organic Compounds (μg/l)				
1,2-Dichlorobenzene	11	2/2	14 - 21	1.91
1,4-Dichlorobenzene	43	2/2	1.7 - 2.6	
Pesticides/PCBs (μg/l)				
4,4'-DDE	4.57E-09	1/2	0.025 - 0.025	
4,4'-DDT	1.00E-03	1/2	0.028 - 0.028	
alpha-Chlordane	2.90E-04	1/2	0.02 - 0.02	
beta-BHC	4.95E-01	2/2	0.042 - 0.056	
Dieldrin	2.60E-05	1/2	0.053 - 0.053	
Endosulfan I	3.00E-03	1/2	0.03 - 0.03	
Endosulfan II	3.00E-03	1/2	0.046 - 0.046	
Heptachlor epoxide	4.80E-04	1/2	0.033 - 0.033	
Isodrin	3.09E-02	1/2	0.005 - 0.005	
Inorganic Compounds (μg/l)				
Aluminum	NE	2/2	14300 - 48300	
Arsenic	53	2/2	6.1 - 25.7	
Barium	5000	2/2	143 - 494	
Beryllium	7.6	2/2	1.2 - 3.1	
Cadmium	0.66	2/2	0.28 - 1.7	2.58
Calcium	NE	2/2	417000 - 430000	
Chromium	42	2/2	36.7 - 174	4.14
Cobalt	5	2/2	10.4 - 43.8	8.76
Copper	5	2/2	31.9 - 104	20.8
Iron	NE	2/2	23800 - 90100	
Lead	2.1	2/2	24.2 - 126	60.0
Magnesium	NE	2/2	67100 - 90100	
Manganese	NE	2/2	2150 - 2730	
Mercury	0.077	1/2	0.18 - 0.18	2.34
Nickel	29	2/2	57.7 - 214	7.38
Potassium	NE	2/2	14100 - 14200	
Sodium	NE	2/2	149000 - 375000	
Tin	73	2/2	782 - 1340	18.4
Vanadium	19	2/2	33.2 - 124	6.53
Zinc	58.9	2/2	219 - 411	6.98



Map Source: USGS 7.5 Min. Quad Sheets: CINCINNATI EAST, OHIO, 1961 Photorevised 1981 and GLENDALE, OHIO, 1965 Photorevised 1987.

0 2000 Feet

QUADRANGLE LOCATION

GEOMATRIX

SITE LOCATION MAP
Morton International, Inc.
Reading, Ohio

Project No.
7168

Figure
1

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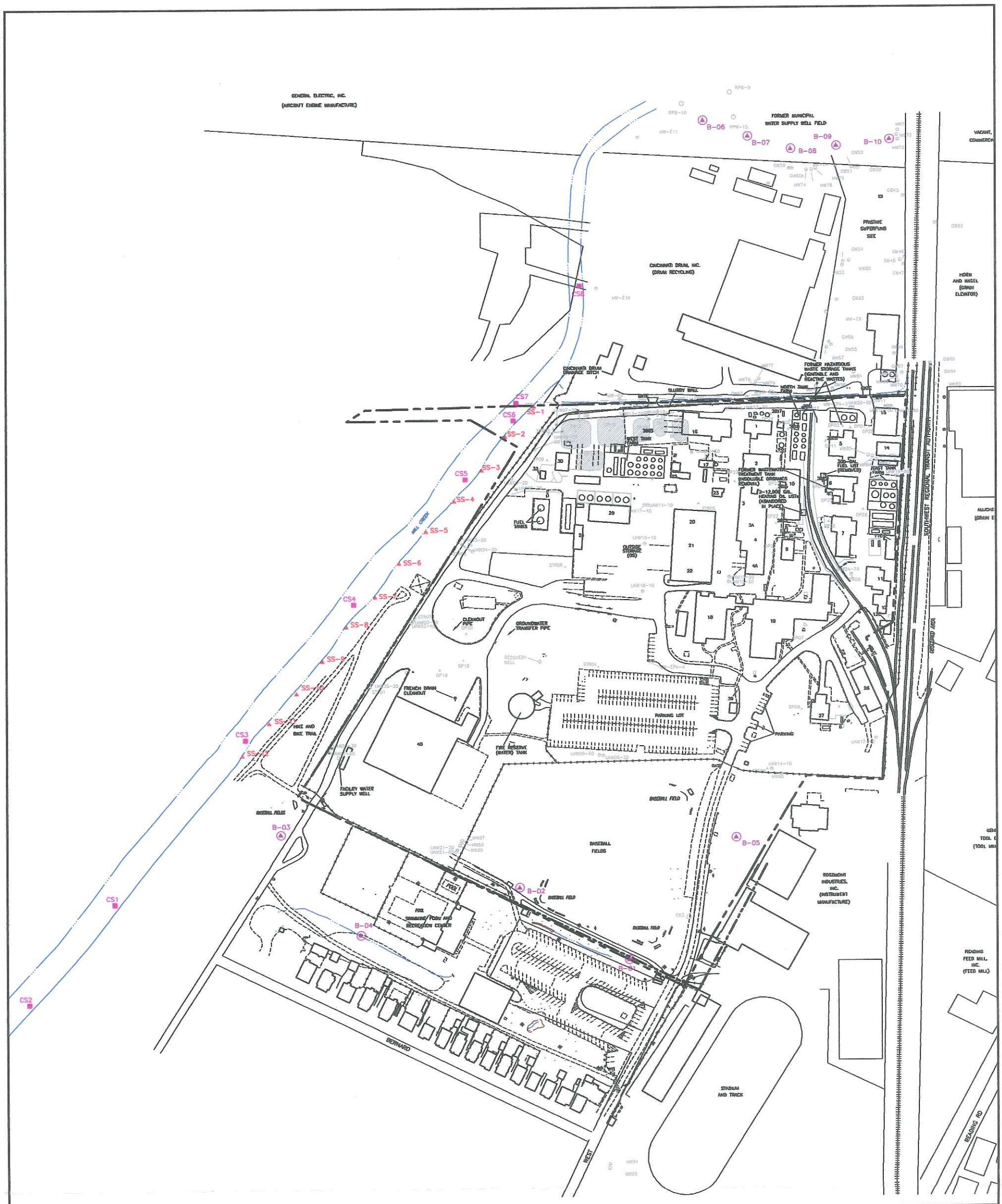

Base Map Source: Abercrombie & Associates, Inc., May 2001 and American Process Design, Inc., Cincinnati, OH, June 1988.

N

0 120 240

APPROXIMATE SCALE (FEET)

EXPLANATION

- BACKGROUND SAMPLE LOCATION
- DIRECT PUSH – NO GEOCHEMICAL (<25')
- DIRECT PUSH – SWMU, (<15'*)
  * – BORING ADVANCED TO 25'
- DIRECT PUSH – IMPOUNDMENT, APPENDIX IX (<15')
- DIRECT PUSH – GEOPHYSICAL ANOMALY, (<15')
- DIRECT PUSH – SEWER, (OFF-SET 5' FROM SEWER, 5' BELOW INVERT, 15' MIN.)
- DIRECT PUSH – FRENCH DRAIN AND SLURRY WALL LOCATION CONFIRMATION
- PHASE 2 STRATIGRAPHIC BORING LOCATION
- PHASE 2 UPPER AQUIFER WELL
- PHASE 2 LOWER AQUIFER WELL
- IMPOUNDMENT – (FROM 1960 AERIAL PHOTO)
- UAW21-B0 — MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (MAY 2001)
- STR09 — SOIL BORING LOCATION AND IDENTIFICATION NUMBER (MAY 2001)
- SS-2 — STREAM STATION LOCATION (JUNE 2001)
- PLUGGED AND ABANDONED (MAY 2001)
- MW-EPA-1 — UPPER AQUIFER MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (PRC, 1993)
- MORTON FACILITY PROPERTY BOUNDARY
- LOCATION OF REPORTED WASTE BURIAL
- RECOVERY WELL LOCATION (APPENDIX IX ANALYSIS)
- CW50 — PRISTINE SHALLOW AQUIFER MONITORING WELL LOCATION AND IDENTIFICATION NUMBER
- MW71 — PRISTINE LOWER AQUIFER MONITORING WELL LOCATION AND IDENTIFICATION NUMBER

NOTES:
1. BASED ON FIELD INDICATIONS OF CHEMICAL IMPACT, TWO SAMPLES FROM DP23 WERE SUBMITTED FOR GEOCHEMICAL ANALYSIS
2. ALL ANALYTICAL PARAMETERS WERE IN ACCORDANCE WITH THE CONTRACT LABORATORY PARAMETERS (CLP) LIST, UNLESS OTHERWISE INDICATED

SEEP/SAMPLE AND BACKGROUND SAMPLE LOCATION MAP
Morton International, Inc.
Reading, Ohio

GEOMATRIX

Project No.	Figure
7168.000	4

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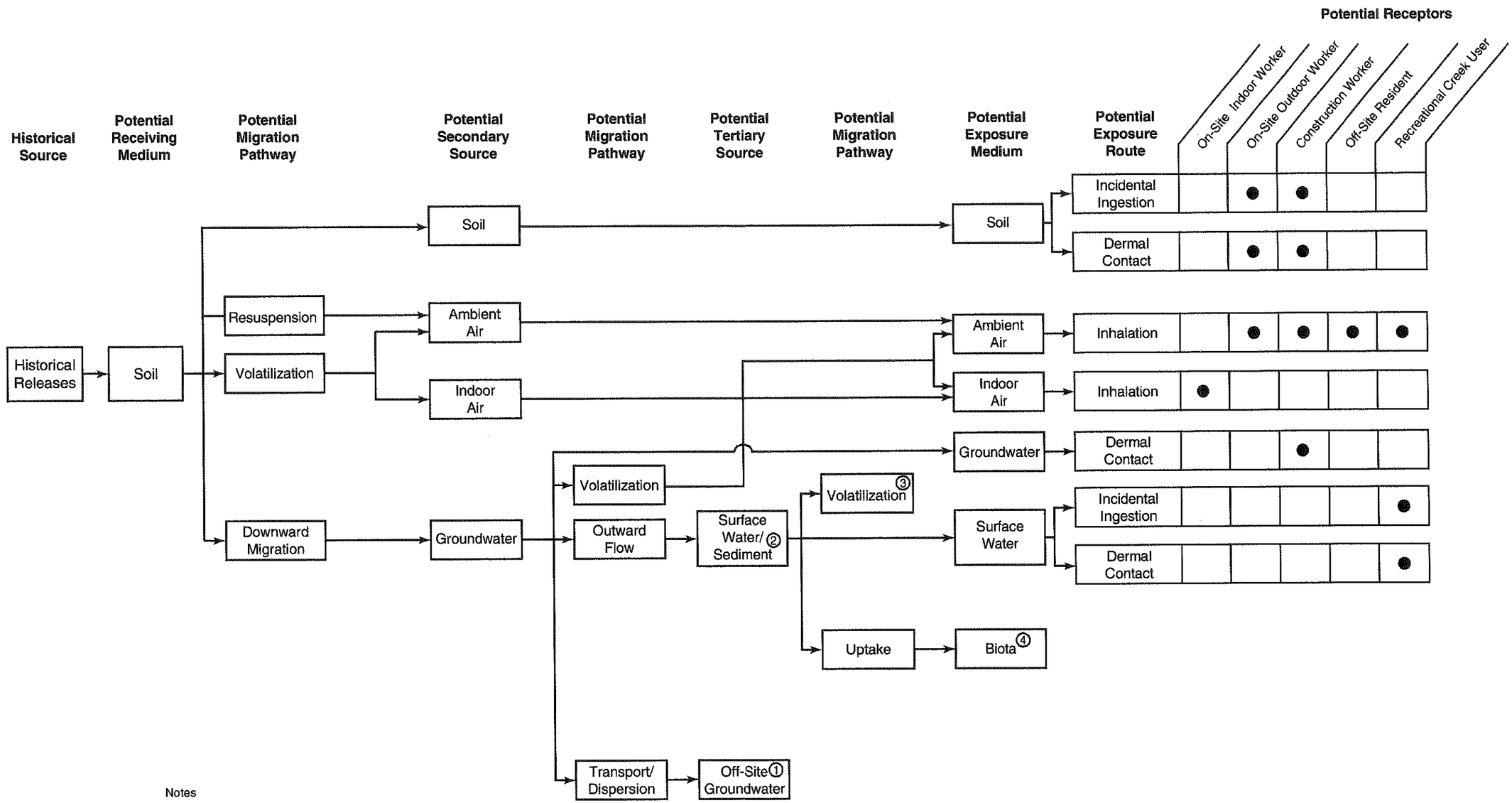

Notes

1 Off-site groundwater not significantly impacted by chemicals of potential concern associated with the Morton site. Predominant groundwater flow direction is west to Mill Creek. Pathway considered incomplete.

2 No chemicals of potential concern identified in sediment.

3 No volatile chemicals of potential concern identified in surface water.

4 No bioaccumulative chemicals of potential concern detected in surface water or sediments.

SITE CONCEPTUAL MODEL
Morton International, Inc.
Reading, Ohio

GEOMATRIX

Project No.	Figure
7168.000	5

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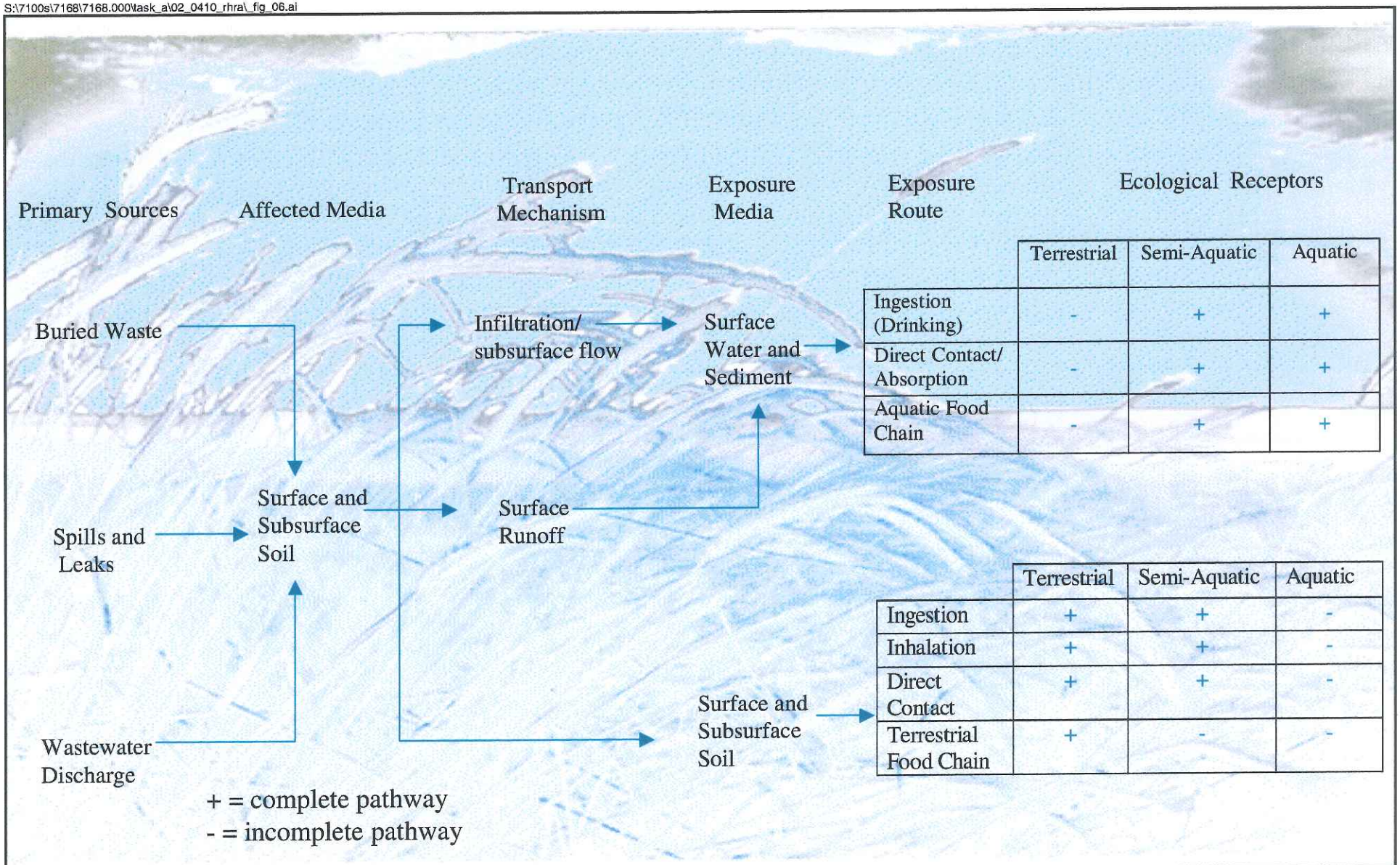

	Terrestrial	Semi-Aquatic	Aquatic
Ingestion (Drinking)	-	+	+
Direct Contact/ Absorption	-	+	+
Aquatic Food Chain	-	+	+

	Terrestrial	Semi-Aquatic	Aquatic
Ingestion	+	+	-
Inhalation	+	+	-
Direct Contact	+	+	-
Terrestrial Food Chain	+	-	-

GEOMATRIX

CONCEPTUAL ECOLOGICAL SITE MODEL
Morton International, Inc.
Reading, Ohio

Project No.
7168.000

Figure
6

Appendix A

Data Summary for Chemicals Detected in Soil

TABLE A-1
SUMMARY OF VOLATILE ORGANIC COMPOUND DATA
Soil Samples
Morton International, Inc.
Reading, Ohio
Units: mg/kg

Sample Location	Sample Date	Acetone	Acrylonitrile	Benzene	Bromodichloro-methane	2-Butanone	Carbon disulfide	Chlorobenzene	Chloroform	Chloromethane	Dichlorodifluoro-methane	1,1-Dichloroethane	1,2-Dichloroethane	cis-1,2-Dichloroethene	Ethylbenzene	Iodomethane	Isopropylbenzene	Methyl acetate	Methylcyclohexane	Methylene chloride	Tetrachloroethene	Toluene	Trichloroethene	Vinyl chloride	Xylenes (total)
DP01-2'	7/24/2001	15		-1.4	-1.4	0.64	-1.4	-1.4	-1.4	-2.8	-1.4	-1.4	-1.4	-0.71	5.7		0.24	2.8	1.3	-1.4	-1.4	-1.4	-1.4	-2.8	50
DP01-9.5'	7/24/2001	-1		-0.26	-0.26	-1	-0.26	-0.26	-0.26	-0.52	-0.26	-0.26	-0.26	-0.13	0.16		-0.26	-0.52	-0.52	0.086	-0.26	-0.26	-0.26	-0.52	1.4
DP02-2'	7/24/2001	0.015		-0.0044	-0.0044	-0.018	-0.0044	-0.0044	-0.0044	-0.0088	-0.0044	-0.0044	-0.0044	-0.0022	-0.0044		-0.0044	-0.0088	-0.0088	-0.0044	-0.0044	-0.0044	-0.0044	-0.0088	-0.0088
DP02-9.5'	7/24/2001	0.0093		-0.0055	-0.0055	-0.022	-0.0055	0.013	-0.0055	-0.011	-0.0055	-0.0055	-0.0055	-0.0028	-0.0055		-0.0055	-0.011	-0.011	-0.0055	-0.0055	-0.0055	-0.0055	-0.011	-0.011
DP03-2'	7/24/2001	-0.019		-0.0047	-0.0047	-0.019	-0.0047	-0.0047	-0.0047	-0.0093	-0.0047	-0.0047	-0.0047	-0.0023	-0.0047		-0.0047	-0.0093	-0.0093	-0.0047	-0.0047	-0.0047	-0.0047	-0.0093	-0.0093
DP03-8.5'	7/24/2001	-0.018		-0.0045	-0.0045	-0.018	-0.0045	-0.0045	-0.0045	-0.009	-0.0045	-0.0045	-0.0045	-0.0022	-0.0045		-0.0045	-0.009	-0.009	-0.0045	-0.0045	-0.0045	-0.0045	-0.009	-0.009
DP05-1'	7/25/2001	-0.018		-0.0046	-0.0046	-0.018	-0.0046	-0.0046	-0.0046	-0.0091	-0.0046	-0.0046	-0.0046	-0.0023	-0.0046		-0.0046	-0.0091	-0.0091	-0.0046	-0.0046	-0.0046	-0.0046	-0.0091	-0.0091
DP05-8.5'	7/25/2001	-0.017		-0.0044	-0.0044	-0.017	-0.0044	-0.0044	-0.0044	-0.0087	-0.0044	-0.0044	-0.0044	-0.0022	-0.0044		-0.0044	-0.0087	-0.0087	-0.0044	-0.0044	-0.0044	-0.0044	-0.0087	-0.0087
DP07-9'	7/26/2001	-0.018		-0.0046	0.0015	-0.018	-0.0046	-0.0046	0.0036	-0.0091	-0.0046	-0.0046	-0.0046	-0.0023	-0.0046		-0.0046	-0.0091	-0.0091	-0.0046	-0.0046	-0.0046	-0.0046	-0.0091	-0.0091
DP08-6'	7/26/2001	0.007		-0.0057	-0.0057	-0.023	-0.0057	-0.0057	-0.0057	-0.011	-0.0057	-0.0057	-0.0057	-0.0028	-0.0057		-0.0057	-0.011	-0.011	-0.0057	-0.0057	-0.0057	-0.0057	-0.011	-0.011
DP08-11'	7/26/2001	-0.02		-0.0049	-0.0049	-0.02	-0.0049	-0.0049	-0.0049	-0.0098	-0.0049	-0.0049	-0.0049	-0.0025	-0.0049		-0.0049	-0.0098	-0.0098	-0.0049	-0.0049	-0.0049	-0.0049	-0.0098	-0.0098
DP09-12'	7/27/2001	4.1		-0.0048	-0.0048	-0.019	0.2	-0.0048	-0.0048	-0.0095	-0.0048	-0.0048	-0.0048	-0.0024	-0.0048		-0.0048	0.07	-0.0095	-0.0048	-0.0048	-0.0048	-0.0048	-0.0095	-0.0095
DP10-2'	7/27/2001	0.0091	-0.095	-0.0048	-0.0048	0.0037	-0.0048	-0.0048	-0.0048	-0.0048	-0.0048	-0.0048	-0.0048	-0.0024	-0.0048	-0.0048				-0.0048	-0.0048	0.00056	-0.0048	-0.0048	-0.0095
DP10-10'	7/27/2001	-1.1	-5.3	-0.27	-0.27	0.17	0.18	-0.27	-0.27	-0.27	-0.27	-0.27	-0.27	-0.13	0.13	-0.27				-0.27	-0.27		-0.27	-0.27	0.32
DP10-10' Blind Dup	7/27/2001																					3.8			
DP12-1.5'	7/28/2001	0.0019		-0.004	-0.004	-0.016	-0.004	-0.004	-0.004	-0.008	-0.004	-0.004	-0.004	-0.002	-0.004		-0.004	-0.008	-0.008	-0.004	-0.004	-0.004	-0.004	-0.008	-0.008
DP12-9'	7/28/2001	-0.021		-0.0052	-0.0052	-0.021	-0.0052	-0.0052	-0.0052	-0.01	-0.0052	-0.0052	-0.0052	-0.0026	-0.0052		-0.0052	-0.01	-0.01	-0.0052	-0.0052	-0.0052	-0.0052	-0.01	-0.01
DP13-3'	7/29/2001	0.0085	-0.11	-0.0053	-0.0053	0.0031	-0.0053	-0.0053	-0.0053	-0.0053	-0.0053	-0.0053	-0.0053	-0.0027	-0.0053	-0.0053				-0.0053	-0.0053	-0.0053	-0.0053	-0.0053	-0.011
DP13-11'	7/29/2001	-21	-110	-5.3	-5.3	-21	-5.3	-5.3	-5.3	-5.3	-5.3	-5.3	-5.3	-2.7	-5.3	-5.3				5.7	-5.3	16	-5.3	-5.3	-11
DP14-3'	7/29/2001	-0.89	-4.5	-0.22	-0.22	-0.89	1.5	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.11	-0.22	-0.22				0.18	-0.22	0.076	-0.22	-0.22	-0.45
DP14-9'	7/29/2001	-1	-5.2	-0.26	-0.26	-1	0.89	-0.26	-0.26	-0.26	-0.26	-0.26	-0.26	-0.13	-0.26	-0.26				0.23	-0.26	0.76	-0.26	-0.26	-0.52
DP15-2'	7/29/2001	0.01	-0.097	0.0017	-0.0048	0.0051	-0.0048	-0.0048	-0.0048	-0.0048	-0.0048	-0.0048	-0.0048	-0.0024	-0.0048	-0.0048				-0.0048	-0.0048	-0.0048	-0.0048	-0.0048	-0.0097
DP15-9'	7/29/2001	-1.2	-6.2	-0.31	-0.31	-1.2	0.22	-0.31	-0.31	-0.31	-0.31	-0.31	-0.31	-0.16	-0.31	-0.31				0.7	-0.31	0.44	-0.31	-0.31	-0.62
DP16-2.8'	7/30/2001	-0.022	-0.11	-0.0055	-0.0055	-0.022	-0.0055	0.0043	-0.0055	-0.0055	-0.0055	-0.0055	-0.0055	-0.0027	-0.0055	-0.0055				0.0014	-0.0055	-0.0055	-0.0055	-0.0055	-0.011
DP16-12.5'	7/30/2001	-49	-250	-12	-12	-49	-12	1.5	-12	-12	-12	-12	-12	-6.1	6.2	-12				11	-12	150	-12	-12	24
DP17-3'	7/30/2001	-1	-5.2	-0.26	-0.26	-1	-0.26	-0.26	-0.26	-0.26	-0.26	-0.26	-0.26	-0.13	-0.26	-0.26				0.27	-0.26	0.063	-0.26	-0.26	0.045
DP17-13'	7/30/2001	0.52	1.1	0.67	-1.5	-6.1	0.95	0.81	-1.5	-1.5	-1.5	-1.5	-1.5	-0.76	1.7	-1.5				0.41	-1.5	35	-1.5	-1.5	9.1
DP18-2'	7/30/2001	-0.02		-0.005	-0.005	-0.02	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.0025	-0.005		-0.005	-0.0099	-0.0099	-0.005	-0.005	-0.005	-0.005	-0.005	-0.0099
DP18-14.5'	7/30/2001	-0.019		-0.0049	-0.0049	-0.019	-0.0049	0.00053	-0.0049	-0.0049	-0.0049	-0.0049	-0.0049	-0.0024	-0.0049		-0.0049	-0.0097	-0.0097	0.0015	-0.0049	-0.0049	-0.0049	-0.0049	-0.0097
DP19-2'	7/30/2001	0.02		-0.0059	-0.0059	0.0082	-0.0059	-0.0059	-0.0059	-0.0059	0.0032	-0.0059	-0.0059	-0.0029	-0.0059		-0.0059	0.0024	-0.012	-0.0059	-0.0059	-0.0059	-0.0059	-0.0059	-0.012
DP19-13'	7/30/2001	-0.023		-0.0057	-0.0057	-0.023	-0.0057	-0.0057	-0.0057	-0.0057	-0.0057	-0.0057	-0.0057	-0.0029	-0.0057		-0.0057	-0.011	-0.011	-0.0057	-0.0057	-0.0057	-0.0057	-0.0057	-0.011
DP20-2'	7/30/2001	-0.02		-0.005	-0.005	-0.02	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.0025	-0.005		-0.005	0.0019	-0.0099	-0.005	-0.005	-0.005	-0.005	-0.005	-0.0099
DP20-14.5'	7/30/2001	-1		-0.26	-0.26	-1	-0.26	0.079	-0.26	-0.26	-0.26	-0.26	-0.26	-0.13	-0.26		-0.26	-0.52	-0.52	0.25	-0.26	-0.26	-0.26	-0.26	-0.52
DP23-2.5'	8/1/2001	-0.025		-0.0062	-0.0062	-0.025	-0.0062	-0.0062	-0.0062	-0.012	-0.0062	-0.0062	-0.0062	-0.0031	-0.0062		-0.0062	-0.012	-0.012	-0.0062	-0.0062	-0.0062	-0.0062	-0.012	-0.012
DP23-9'	8/1/2001	-0.021		-0.0053	-0.0053	-0.021	-0.0053	-0.0053	-0.0053	-0.011	-0.0053	-0.0053	-0.0053	-0.0027	-0.0053		-0.0053	-0.011	-0.011	-0.0053	-0.0053	-0.0053	-0.0053	-0.011	-0.011
DP25-2.5'	8/7/2001	0.0045		-0.0053	-0.0053	-0.021	-0.0053	-0.0053	-0.0053	-0.011	-0.0053	-0.0053	-0.0053	-0.0027	-0.0053		-0.0053	-0.011	-0.011	-0.0053	-0.0053	-0.0053	-0.0053	-0.011	-0.011
DP25-2.5' Blind Dup	8/7/2001																								
DP25-7.5'	8/7/2001	0.0025		-0.0044	-0.0044	-0.018	-0.0044	-0.0044	-0.0044	-0.0089	-0.0044	-0.0044	-0.0044	-0.0022	-0.0044		-0.0044	-0.0089	-0.0089	-0.0044	-0.0044	-0.0044	-0.0044	-0.0089	-0.0089
DP29-5	11/9/2001	0.0036		-0.0056	-0.0056	-0.022	-0.0056	-0.0056	-0.0056	-0.011	-0.0056	-0.0056	-0.0056	-0.0028	-0.0056		-0.0056	-0.011	-0.011	0.0032	-0.0056	0.00065	-0.0056	-0.011	-0.011
STR01-3'	3/8/2001	-0.018		-0.0045	-0.0045	-0.018	-0.0045	-0.0045	-0.0045	-0.0091	-0.0045	-0.0045	-0.0045	-0.0023	-0.0045		-0.0045	-0.0091	-0.0091	-0.0045	-0.0045	-0.0045	-0.0045	-0.0091	-0.0091
STR01-21'	3/8/2001	0.015		-0.0052	-0.0052	-0.021	-0.0052	0.013	-0.0052	-0.01	-0.0052	-0.0052	-0.0052	-0.0026	-0.0052		-0.0052	-0.01	-0.01	-0.0052	-0.0052	-0.0052	-0.0052	-0.01	-0.01
STR02-1'	3/13/2001	-0.021		-0.0052	-0.0052	-0.021	-0.0052	-0.0052	-0.0052	-0.01	-0.0052	-0.0052	-0.0052	-0.0026	-0.0052		-0.0052	-0.01	-0.01	0.0018	-0.0052	-0.0052	-0.0052	-0.01	-0.01
STR02-12.5'	3/13/2001	-0.0071		-0.0051	-0.0051	-0.02	0.0039	0.026	-0.0051	-0.01	-0.0051	-0.0051	-0.0051	-0.0026	-0.0051		-0.0051	-0.01	-0.01	0.0024	-0.0051	-0.0051	-0.0051	-0.01	-0.01
STR03-4'	3/14/2001	-1	-5	-0.25	-0.25	-1	-0.25	0.31	-0.25	-0.25	-0.25	-0.25	-0.25	-0.13	-0.25	-0.25				-0.25	-0.25	-0.25	-0.25	-0.25	-0.5
STR03-12.5'	3/14/2001	0.019	-0.095	-0.0048	-0.0048	-0.019	0.0026	0.029	-0.0048	-0.0048	-0.0048	-0.0048	-0.0048	-0.0024	0.01	-0.0048				-0.0048	-0.0048	0.0057	-0.0048	-0.0048	0.02
STR04-1.5'	3/19/2001	-0.02		-0.0051	-0.0051	-0.02	-0.0051	-0.0051	-0.0051	-0.01	-0.0051	-0.0051	-0.0051	-0.0026	-0.0051		-0.0051	-0.01	-0.01	-0.0051	-0.0051	-0.0051	-0.0051	-0.01	-0.01
STR04-17.5'	3/19/2001	0.0076		-0.0052	-0.0052	-0.021	-0.0052	-0.0052	-0.0052	-0.01	-0.0052	-0.0052	-0.0052	-0.0026	-0.0052		-0.0052	-0.01	-0.01	-0.0052	-0.0052	-0.0052	-0.0052	-0.01	-0.01
STR04-17.5' DUP	3/19/2001																								
STR05-1.5'	3/10/2001	0.011		-0.0048	-0.0048	-0.019	-0.0048	-0.0048	-0.0048	-0.0096	-0.0048	-0.0048	-0.0048	-0.0024	-0.0048		-0.0048	-0.0096	-0.0096	-0.0048	-0.0048	-0.0048	-0.0048	-0.0096	-0.0096

TABLE A-1
SUMMARY OF VOLATILE ORGANIC COMPOUND DATA
Soil Samples
Morton International, Inc.
Reading, Ohio
Units: mg/kg

Sample Location	Sample Date	Acetone	Acrylonitrile	Benzene	Bromodichloro-methane	2-Butanone	Carbon disulfide	Chlorobenzene	Chloroform	Chloromethane	Dichlorodifluoro-methane	1,1-Dichloroethane	1,2-Dichloroethane	cis-1,2-Dichloroethene	Ethylbenzene	Iodomethane	Isopropylbenzene	Methyl acetate	Methylcyclohexane	Methylene chloride	Tetrachloroethene	Toluene	Trichloroethene	Vinyl chloride	Xylenes (total)
STR05-9'	3/10/2001	-0.019		-0.0046	-0.0046	-0.019	-0.0046	-0.0046	-0.0046	-0.0093	-0.0046	-0.0046	-0.0046	-0.0023	-0.0046		-0.0046	-0.0093	-0.0093	-0.0046	-0.0046	-0.0046	-0.0046	-0.0093	-0.0093
STR05-11.3'	3/10/2001	0.0072		-0.0044	-0.0044	-0.017	0.0029	0.0068	-0.0044	-0.0087	-0.0044	-0.0044	-0.0044	-0.0022	-0.0044		-0.0044	-0.0087	-0.0087	-0.0044	-0.0044	0.004	-0.0044	-0.0087	-0.0087
STR06-1'	3/11/2001	0.013		-0.0048	-0.0048	-0.019	-0.0048	-0.0048	-0.0048	-0.0097	-0.0048	-0.0048	-0.0048	-0.0024	-0.0048		-0.0048	-0.0097	-0.0097	-0.0048	-0.0048	-0.0048	-0.0048	-0.0097	-0.0097
STR06-15'	3/11/2001	-0.018		-0.0045	-0.0045	-0.018	-0.0045	-0.0045	-0.0045	-0.009	-0.0045	-0.0045	-0.0045	-0.0023	-0.0045		-0.0045	-0.009	-0.009	-0.0045	-0.0045	-0.0045	-0.0045	-0.009	-0.009
STR07-1.5'	3/21/2001	0.03		-0.0053	-0.0053	0.0091	-0.0053	-0.0053	-0.0053	-0.011	-0.0053	-0.0053	-0.0053	-0.0027	-0.0053		-0.0053	-0.011	-0.011	-0.0053	-0.0053	-0.0053	-0.0053	-0.011	-0.011
STR07-18'	3/21/2001	-1.1		-0.26	-0.26	-1.1	-0.26	1.1	-0.26	-0.53	-0.26	-0.26	-0.26	-0.13	-0.26		-0.26	-0.53	-0.53	-0.26	-0.26	-0.26	-0.26	-0.53	-0.53
STR08-1.5'	3/26/2001	-0.021		-0.0053	-0.0053	-0.021	-0.0053	-0.0053	-0.0053	-0.011	-0.0053	-0.0053	-0.0053	-0.0026	-0.0053		-0.0053	-0.011	-0.011	-0.0053	-0.0053	-0.0053	-0.0053	-0.011	-0.011
STR08-13'	3/26/2001			-0.24	-0.24	-0.96	0.38		-0.24	-0.48	-0.24	-0.24	-0.24	-0.12	-0.24		-0.24	-0.48	-0.48	-0.24	-0.24	-0.24	-0.24	-0.48	-0.48
STR08-13' DUP	3/26/2001	5.9						0.079																	
STR09-7.5'	4/4/2001	-0.022		-0.0054	-0.0054	-0.022	-0.0054	-0.0054	-0.0054	-0.011	-0.0054	-0.0054	-0.0054	-0.0027	-0.0054		-0.0054	-0.011	-0.011	-0.0054	-0.0054	-0.0054	-0.0054	-0.011	-0.011
STR10-1.5'	4/7/2001	-0.018	-0.088	-0.0044	-0.0044	-0.018	-0.0044	-0.0044	-0.0044	-0.0044	-0.0044	-0.0044	-0.0044	-0.0022	-0.0044	-0.0044				-0.0044	-0.0044	-0.0044	-0.0044	-0.0044	-0.0088
STR10-11'	4/7/2001	0.0081	-0.11	0.0022	-0.0056	-0.023	-0.0056	0.0038	-0.0056	-0.0056	-0.0056	0.022	0.0026	0.0051	-0.0056	-0.0056				-0.0056	0.0047	-0.0056	0.0025	0.0084	-0.011
STR11-2'	8/20/2001	-0.019		-0.0048	-0.0048	-0.019	-0.0048	-0.0048	-0.0048	-0.0096	-0.0048	-0.0048	-0.0048	-0.0024	-0.0048		-0.0048	-0.0096	-0.0096	-0.0048	0.0026	-0.0048	-0.0048	-0.0096	-0.0096
STR11-9'	8/20/2001																			-0.0045					
STR11-9' Blind Dup	8/20/2001	-0.019		-0.0047	-0.0047	-0.019	-0.0047	-0.0047	-0.0047	-0.0093	-0.0047	-0.0047	-0.0047	-0.0023	-0.0047		-0.0047	-0.0093	-0.0093		0.0016	-0.0047	-0.0047	-0.0093	-0.0093
T-1-4	11/8/2001	1.8	-27	-1.3	-1.3	-5.3	-1.3	-1.3	-1.3	1.7	-1.3	-1.3	-1.3	-0.67	-1.3	36				-1.3	-1.3	-1.3	-1.3	-1.3	-2.7
T-1-6	11/8/2001	0.012	-0.1	-0.005	-0.005	0.0066	-0.005	-0.005	-0.005	0.014	-0.005	-0.005	-0.005	-0.0025	-0.005	0.18				-0.005	-0.005	0.00085	-0.005	-0.005	-0.01
T-2-3	11/8/2001	0.0028	-0.11	-0.0054	-0.0054	-0.022	-0.0054	-0.0054	-0.0054	-0.0054	-0.0054	-0.0054	-0.0054	-0.0027	-0.0054	-0.0054				-0.0054	-0.0054	-0.0054	-0.0054	-0.0054	-0.011
T-2-9	11/8/2001	0.54	-5.1	-0.25	-0.25	0.13	-0.25	0.98	-0.25	-0.25	-0.25	-0.25	-0.25	-0.13	-0.25	-0.25				0.28	-0.25	0.027	-0.25	-0.25	0.11
T-3-3	11/8/2001	0.58	-5	0.037	-0.25	-1	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25	-0.13	0.13	-0.25				0.29	-0.25	0.47	-0.25	-0.25	0.96
T-3-11	11/8/2001	0.0027	-0.094	-0.0047	-0.0047	-0.019	-0.0047	-0.0047	-0.0047	-0.0047	-0.0047	-0.0047	-0.0047	-0.0023	-0.0047	-0.0047				-0.0047	-0.0047	0.00052	-0.0047	-0.0047	-0.0094
T-4-3	11/9/2001	0.007	-0.091	-0.0045	-0.0045	-0.018	-0.0045	-0.0045	-0.0045	-0.0045	-0.0045	-0.0045	-0.0045	-0.0023	-0.0045	-0.0045				-0.0045	-0.0045	-0.0045	-0.0045	-0.0045	-0.0091
T-4-9	11/9/2001	0.0033	-0.11	-0.0055	-0.0055	-0.022	-0.0055	-0.0055	-0.0055	-0.0055	-0.0055	-0.0055	-0.0055	-0.0027	-0.0055	-0.0055				0.0017	-0.0055	-0.0055	-0.0055	-0.0055	-0.011
T-5-3	11/9/2001	0.0035	-0.13	-0.0064	-0.0064	-0.026	-0.0064	-0.0064	-0.0064	-0.0064	-0.0064	-0.0064	-0.0064	-0.0032	-0.0064	-0.0064				0.0029	-0.0064	-0.0064	-0.0064	-0.0064	-0.013
T-5-9	11/9/2001	0.028	-0.11	-0.0053	-0.0053	0.0087	-0.0053	-0.0053	-0.0053	-0.0053	-0.0053	-0.0053	-0.0053	-0.0026	-0.0053	-0.0053				0.0028	-0.0053	0.00064	-0.0053	-0.0053	-0.011
T-6-3	########	0.027	-0.11	-0.0057	-0.0057	0.0045	-0.0057	0.017	-0.0057	-0.0057	-0.0057	-0.0057	-0.0057	-0.0028	-0.0057	-0.0057				0.0019	-0.0057	-0.0057	-0.0057	-0.0057	-0.011
T-6-7.5	########	23	-14	-0.68	-0.68	-2.7	0.27	-0.68	-0.68	-0.68	-0.68	-0.68	-0.68	-0.34	0.24	0.6				-0.68	R	0.35	-0.68	-0.68	2.1
T-6-10	########	0.42	-4.8	-0.24	-0.24	-0.95	-0.24	2.5	-0.24	-0.24	-0.24	-0.24	-0.24	-0.12	-0.24	-0.24				0.096	R	-0.24	-0.24	-0.24	0.088
T-8-3	########	0.0032	-0.11	-0.0055	-0.0055	-0.022	-0.0055	-0.0055	-0.0055	-0.0055	-0.0055	-0.0055	-0.0055	-0.0027	-0.0055	-0.0055				-0.0055	-0.0055	-0.0055	-0.0055	-0.0055	-0.011
T-8-9	########	0.0032	-0.11	-0.0054	-0.0054	-0.022	-0.0054	-0.0054	-0.0054	-0.0054	-0.0054	-0.0054	-0.0054	-0.0027	-0.0054	-0.0054				0.0014	-0.0054	-0.0054	-0.0054	-0.0054	-0.011
UAW01-30-1.5'	4/2/2001	-0.021		-0.0054	-0.0054	-0.021	-0.0054	-0.0054	-0.0054	-0.011	-0.0054	-0.0054	-0.0054	-0.0027	-0.0054		-0.0054	-0.011	-0.011	-0.0054	-0.0054	-0.0054	-0.0054	-0.011	-0.011
UAW01-30-15'	4/2/2001	-0.022		-0.0056	-0.0056	-0.022	-0.0056	-0.0056	-0.0056	-0.011	-0.0056	-0.0056	-0.0056	-0.0028	-0.0056		-0.0056	-0.011	-0.011	0.002	-0.0056	-0.0056	-0.0056	-0.011	-0.011
UAW04-20-10'	3/23/2001	-28		-7.1	-7.1	-28	-7.1	-7.1	-7.1	-14	-7.1	-7.1	-7.1	-3.5	-7.1		-7.1	-14	-14	5.6	-7.1	160	-7.1	-14	-14
UAW05-20-13'	3/23/2001	-0.9		-0.22	-0.22	-0.9	-0.22	1.6	-0.22	-0.45	-0.22	-0.22	-0.22	-0.11	-0.22		-0.22	-0.45	0.22	-0.22	-0.22	-0.22	-0.22	-0.45	-0.45
UAW06-20-1.5'	3/26/2001	0.029		-0.0053	-0.0053	0.0072	-0.0053	-0.0053	-0.0053	-0.011	-0.0053	-0.0053	-0.0053	-0.0026	-0.0053		-0.0053	-0.011	-0.011	-0.0053	-0.0053	-0.0053	-0.0053	-0.011	-0.011
UAW06-20-11.5'	3/26/2001	0.59		-0.005	-0.005	-0.02	0.036	0.043	-0.005	-0.0099	-0.005	-0.005	-0.005	-0.0025	-0.005		-0.005	-0.0099	-0.0099	-0.005	-0.005	0.0017	-0.005	-0.0099	0.0025
UAW08-20-13'	3/24/2001	-1.8	-9.2	0.19	-0.46	-1.8	0.28	0.26	-0.46	-0.92	-0.46	-0.46	-0.46	-0.23	0.32	-0.46				-0.46	-0.46	2	-0.46	-0.92	1.5
UAW09-20-1.5'	3/27/2001	-0.02		-0.0049	-0.0049	-0.02	-0.0049	-0.0049	-0.0049	-0.0098	-0.0049	-0.0049	-0.0049	-0.0025	-0.0049		-0.0049	-0.0098	-0.0098	-0.0049	-0.0049	-0.0049	-0.0049	-0.0098	-0.0098
UAW09-20-15'	3/27/2001	-0.021		-0.0054	-0.0054	-0.021	-0.0054	-0.0054	-0.0054	-0.011	-0.0054	-0.0054	-0.0054	-0.0027	-0.0054		-0.0054	-0.011	-0.011	-0.0054	-0.0054	-0.0054	-0.0054	-0.011	-0.011
UAW11-40-2'	4/17/2001	0.013		-0.0048	-0.0048	-0.019	-0.0048	-0.0048	-0.0048	-0.0097	-0.0048	-0.0048	-0.0048	-0.0024	-0.0048		-0.0048	-0.0097	-0.0097	-0.0048	-0.0048	-0.0048	-0.0048	-0.0097	-0.0097
UAW11-40-10'	4/17/2001	2.3		-0.28	-0.28	-1.1	-0.28	-0.28	-0.28	-0.56	-0.28	-0.28	-0.28	-0.14	-0.28		-0.28	-0.56	-0.56	0.099	-0.28	-0.28	-0.28	-0.56	-0.56
UAW12-20-12'	3/24/2001	-1.2	-6	-0.3	-0.3	-1.2	-0.3	0.86	-0.3	-0.6	-0.3	-0.3	-0.3	-0.15	-0.3	-0.3				-0.3	-0.3	-0.3	-0.3	-0.6	-0.6
UAW13-20-1.5'	3/24/2001	0.025	-0.093	-0.0047	-0.0047	-0.019	-0.0047	-0.0047	-0.0047	-0.0093	-0.0047	-0.0047	-0.0047	-0.0023	-0.0047	-0.0047				-0.0047	-0.0047	-0.0047	-0.0047	-0.0093	-0.0093
UAW13-20-11.5'	3/24/2001	-1.1	-5.7	-0.28	-0.28	-1.1	-0.28	-0.28	-0.28	-0.57	-0.28	-0.28	-0.28	-0.14	-0.28	-0.28				0.26	-0.28	0.15	-0.28	-0.57	-0.57
UAW14-10-1.5'	4/4/2001	-0.02		-0.0049	-0.0049	-0.02	-0.0049	-0.0049	-0.0049	-0.0099	-0.0049	-0.0049	-0.0049	-0.0025	-0.0049		-0.0049	-0.0099	-0.0099	-0.0049	-0.0049	-0.0049	-0.0049	-0.0099	-0.0099
UAW15-20-2'	4/9/2001																								
UAW15-20-2' DUP	4/9/2001	0.075		-0.0046	-0.0046	0.019	-0.0046	-0.0046	-0.0046	-0.0093	-0.0046	-0.0046	-0.0046	-0.0023	-0.0046		-0.0046	-0.0093	-0.0093	-0.0046	-0.0046	-0.0046	-0.0046	-0.0093	-0.0093
UAW15-20-8.5'	4/9/2001	-0.02		-0.0049	-0.0049	-0.02	-0.0049	-0.0049	-0.0049	-0.0098	-0.0049	-0.0049	-0.0049	-0.0025	-0.0049		-0.0049	-0.0098	-0.0098	-0.0049	-0.0049	-0.0049	-0.0049	-0.0098	-0.0098
UAW16-10-2'	8/22/2001	0.013		-0.0057	-0.0057	0.0039	-0.0057	0.0092	-0.0057	-0.011	-0.0057	-0.0057	-0.0057	-0.0029	-0.0057		-0.0057	-0.011	0.00082	-0.0057	-0.0057	-0.0057	-0.0057	-0.011	-0.011

TABLE A-1
SUMMARY OF VOLATILE ORGANIC COMPOUND DATA
Soil Samples
Morton International, Inc.
Reading, Ohio
Units: mg/kg

Sample Location	Sample Date	Acetone	Acrylonitrile	Benzene	Bromodichloro-methane	2-Butanone	Carbon disulfide	Chlorobenzene	Chloroform	Chloromethane	Dichlorodifluoro-methane	1,1-Dichloroethane	1,2-Dichloroethane	cis-1,2-Dichloroethene	Ethylbenzene	Iodomethane	Isopropylbenzene	Methyl acetate	Methylcyclohexane	Methylene chloride	Tetrachloroethene	Toluene	Trichloroethene	Vinyl chloride	Xylenes (total)
UAW16-10-5.5'	8/22/2001	0.013		-0.0061	-0.0061	0.0035	-0.0061	0.032	-0.0061	-0.012	-0.0061	-0.0061	-0.0061	-0.003	-0.0061		-0.0061	-0.012	0.0028	-0.0061	-0.0061	-0.0061	-0.0061	-0.012	-0.012
UAW17-40-1.5'	4/5/2001	-0.018		-0.0046	-0.0046	-0.018	-0.0046	-0.0046	-0.0046	-0.0091	-0.0046	-0.0046	-0.0046	-0.0023	-0.0046		-0.0046	-0.0091	-0.0091	-0.0046	-0.0046	-0.0046	-0.0046	-0.0091	-0.0091
UAW17-40-5'	4/5/2001	0.69		-0.24	-0.24	-0.96	-0.24	-0.24	-0.24	-0.48	-0.24	-0.24	-0.24	-0.12	-0.24		-0.24	6	-0.48	-0.24	-0.24	-0.24	-0.24	-0.48	-0.48
UAW18-20-1'	8/23/2001	1.3		-0.26	-0.26	-1	-0.26	-0.26	-0.26	-0.52	-0.26	-0.26	-0.26	-0.13	-0.26		-0.26	-0.52	-0.52	-0.26	-0.26	-0.26	-0.26	-0.52	-0.52
UAW18-20-15'	8/23/2001	0.0029		-0.0047	-0.0047	-0.019	0.0018	0.014	-0.0047	-0.0095	-0.0047	-0.0047	-0.0047	-0.0024	-0.0047		-0.0047	-0.0095	-0.0095	-0.0047	-0.0047	0.0015	-0.0047	-0.0095	-0.0095
UAW19-80-1.5'	4/6/2001	-0.02		-0.005	-0.005	-0.02	-0.005	-0.005	-0.005	-0.0099	-0.005	-0.005	-0.005	-0.0025	-0.005		-0.005	-0.0099	-0.0099	-0.005	-0.005	-0.005	-0.005	-0.0099	-0.0099
UAW19-80-15'	4/6/2001	-0.018		-0.0046	-0.0046	-0.018	-0.0046	-0.0046	-0.0046	-0.0091	-0.0046	-0.0046	-0.0046	-0.0023	-0.0046		-0.0046	-0.0091	-0.0091	-0.0046	-0.0046	-0.0046	-0.0046	-0.0091	-0.0091
UAW20-60-1.5'	4/9/2001	-0.019		-0.0047	-0.0047	-0.019	-0.0047	-0.0047	-0.0047	-0.0093	-0.0047	-0.0047	-0.0047	-0.0023	-0.0047		-0.0047	-0.0093	-0.0093	-0.0047	0.0092	-0.0047	-0.0047	-0.0093	-0.0093
UAW20-60-9.5'	4/9/2001	-0.021		-0.0053	-0.0053	-0.021	-0.0053	-0.0053	-0.0053	-0.011	-0.0053	-0.0053	-0.0053	-0.0026	-0.0053		-0.0053	-0.011	-0.011	-0.0053	-0.0053	-0.0053	-0.0053	-0.011	-0.011
UAW21-30-1.5'	4/11/2001	-0.02		-0.005	-0.005	-0.02	-0.005	-0.005	-0.005	-0.01	-0.005	-0.005	-0.005	-0.0025	-0.005		-0.005	-0.01	-0.01	-0.005	-0.005	-0.005	-0.005	-0.01	-0.01
UAW21-30-10'	4/11/2001	-0.018		-0.0046	-0.0046	-0.018	-0.0046	-0.0046	-0.0046	-0.0092	-0.0046	-0.0046	-0.0046	-0.0023	-0.0046		-0.0046	-0.0092	-0.0092	-0.0046	-0.0046	0.0034	-0.0046	-0.0092	0.002
UAW22-20-2'	9/5/2001	0.01		-0.0044	-0.0044	0.0036	-0.0044	-0.0044	-0.0044	-0.0088	-0.0044	-0.0044	-0.0044	-0.0022	-0.0044		-0.0044	-0.0088	0.00076	-0.0044	-0.0044	-0.0044	-0.0044	-0.0088	-0.0088
UAW22-20-11'	9/5/2001	0.0043		-0.0063	-0.0063	-0.025	0.0064	0.037	-0.0063	-0.013	-0.0063	-0.0063	-0.0063	-0.0031	-0.0063		-0.0063	-0.013	-0.013	-0.0063	-0.0063	-0.0063	-0.0063	-0.013	-0.013
Count		105	35	105	105	105	105	105	105	105	105	105	105	105	105	35	70	70	70	105	103	105	105	105	105
Number of Detects		51	1	5	1	16	15	25	1	2	1	1	1	1	9	3	1	4	5	26	4	24	1	1	14
Number of Non-Detects		54	34	100	104	89	90	80	104	103	104	104	104	104	96	32	69	66	0	79	99	81	104	104	91
Maximum Detection		23	1.1	0.67	0.0015	0.64	1.5	2.5	0.0036	1.7	0.0032	0.022	0.0026	0.0051	6.2	36	0.24	6	1.3	11	0.0092	160	0.0025	0.0084	50
Minimum Detection		0.0019	1.1	0.0017	0.0015	0.0031	0.0018	0.00053	0.0036	0.014	0.0032	0.022	0.0026	0.0051	0.01	0.18	0.24	0.0019	0.00076	0.0014	0.0016	0.00052	0.0025	0.0084	0.002
Maximum Detection Limit		49	250	12	12	49	12	7.1	12	14	12	12	12	6.1	7.1	12	7.1	14	0	1.4	12	1.4	12	14	14
Minimum Detection Limit		0.0071	0.088	0.004	0.004	0.016	0.004	0.004	0.004	0.0044	0.004	0.004	0.004	0.002	0.004	0.0044	0.004	0.008	0	0.004	0.004	0.004	0.004	0.0044	0.008
Location of Maximum		T-6-7.5	DP17-13'	DP17-13'	DP07-9'	DP01-2'	DP14-3'	T-6-10	DP07-9'	T-1-4'	DP19-2'	STR10-11'	STR10-11'	STR10-11'	DP16-12.5'	T-1-4	DP01-2'	UAW17-40-5'	DP01-2'	DP16-12.5'	UAW20-60-1.5'	UAW04-20-10'	STR10-11'	STR10-11'	DP01-2'

Notes:

Negative values (shaded boxes) represent non-detect values.

Highlight rows indicate duplicate samples. The highest duplicate sample result was used in the analysis.

R = Rejected data.

TABLE A-2
SUMMARY OF SEMIVOLATILE ORGANIC COMPOUND DATA
Soil Samples
Morton International, Inc.
Reading, Ohio
Units: mg/kg

Sample Location	Sample Date	Acenaphthene	Acenaphthylene	Aniline	Anthracene	Benzo(a) anthracene	Benzo(a)pyrene	Benzo(b) fluoranthene	Benzo(ghi) perylene	Benzo(k) fluoranthene	bis(2-Ethylhexyl) phthalate	Carbazole	Chrysene	Dibenz(a,h) anthracene	Dibenzofuran	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	2,4-Dimethylphenol	Di-n-octyl phthalate	Fluoranthene	Fluorene	Indeno(1,2,3-cd) pyrene	2-Methyl-naphthalene	2-Methylphenol	3-Methylphenol	4-Methylphenol	Naphthalene	Phenanthrene	Phenol	Pyrene
DP01-2'	7/24/2001	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38
DP01-9.5'	7/24/2001	-1.5	-1.5		-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5		-1.5	-1.5	-1.5	-1.5	-1.5
DP02-2'	7/24/2001	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	0.07	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38
DP02-9.5'	7/24/2001	-0.41	-0.41		-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41		-0.41	-0.41	-0.41	-0.41	-0.41
DP03-2'	7/24/2001	-0.39	-0.39		-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39		-0.39	-0.39	-0.39	-0.39	-0.39
DP03-8.5'	7/24/2001	-0.35	-0.35		-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35		-0.35	-0.35	-0.35	-0.35	-0.35
DP05-1'	7/25/2001	-0.39	-0.39		-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39		-0.39	-0.39	-0.39	-0.39	-0.39
DP05-8.5'	7/25/2001	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38
DP07-9'	7/26/2001	-0.39	-0.39		-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39		-0.39	-0.39	-0.39	-0.39	-0.39
DP08-6'	7/26/2001	-0.42	-0.42		-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42		-0.42	-0.42	-0.42	-0.42	-0.42
DP08-11'	7/26/2001	-0.39	-0.39		-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39		-0.39	-0.39	-0.39	-0.39	-0.39
DP09-12'	7/27/2001	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	0.072	-0.38	-0.38	-0.38	-0.38	0.13	-0.38	0.073	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38
DP10-2'	7/27/2001	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	0.16		-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37
DP10-10'	7/27/2001	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	1.5		-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5
DP10-10' Blind Dup	7/27/2001																														
DP12-1.5'	7/28/2001	-0.34	-0.34		-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34		-0.34	-0.34	-0.34	-0.34	-0.34
DP12-9'	7/28/2001	-0.41	-0.41		-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41		-0.41	-0.41	-0.41	-0.41	-0.41
DP13-3'	7/29/2001	-0.39	-0.39	-0.39	-0.39	0.07	-0.39	0.086	-0.39	-0.39	0.16	-0.39	0.076	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	0.14	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	0.13
DP13-11'	7/29/2001	0.069	-0.39	-0.39	0.18	0.46	0.45	0.49	0.25	0.23	0.26		0.47	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	1.1	0.063	0.22	-0.39	-0.39	-0.39	-0.39	-0.39	0.61	-0.39	0.85
DP14-3'	7/29/2001	-35	-35	-35	-35	-35	-35	-35	-35	-35	6.5		-35	-35	-35	-35	-35	-35	-35	-35	-35	-35	-35	-35	-35	-35	-35	-35	-35	-35	-35
DP14-9'	7/29/2001	-1.5	-1.5	0.25	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5		-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5
DP15-2'	7/29/2001	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	0.23		0.064	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	0.29	0.13	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	0.21	0.075	0.11
DP15-9'	7/29/2001	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6		-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6	-1.6
DP16-2.8'	7/30/2001	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35		-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35
DP16-12.5'	7/30/2001	-19	-19	-19	-19	-19	-19	-19	-19	-19	26		-19	-19	-19	-19	-19	-19	-19	-19	-19	-19	-19	-19	-19	-19	-19	-19	-19	-19	-19
DP17-3'	7/30/2001	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39		-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39
DP17-13'	7/30/2001	-22	-22	3.9	-22	-22	-22	-22	-22	-22	26		-22	-22	-22	21	-22	-22	-22	-22	-22	-22	-22	-22	-22	5.4	5.4	-22	-22	4.7	-22
DP18-2'	7/30/2001	-0.38	-0.38		-0.38	0.16	0.19	0.25	0.12	0.097	-0.38	-0.38	0.2	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	0.37	-0.38	0.12	-0.38	-0.38		-0.38	-0.38	0.14	-0.38	0.29
DP18-14.5'	7/30/2001	-0.36	-0.36		-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36		-0.36	-0.36	-0.36	-0.36	-0.36
DP19-2'	7/30/2001	-0.4	-0.4		-0.4	0.11	0.12	0.2	0.089	0.078	0.46	-0.4	0.14	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	0.27	-0.4	-0.4	-0.4	-0.4		-0.4	-0.4	0.1	-0.4	0.2
DP19-13'	7/30/2001	-0.36	-0.36		-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	0.062	-0.36	-0.36	-0.36	-0.36		-0.36	-0.36	-0.36	-0.36	-0.36
DP20-2'	7/30/2001	-0.38	-0.38		-0.38	0.1	0.085	0.11	-0.38	-0.38	-0.38	-0.38	0.099	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	0.25	-0.38	-0.38	-0.38	-0.38		-0.38	-0.38	0.19	-0.38	0.19
DP20-14.5'	7/30/2001	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	0.15	-0.38	0.062	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38
DP23-2.5'	8/1/2001	-0.42	-0.42		-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42		-0.42	-0.42	-0.42	-0.42	-0.42
DP23-9'	8/1/2001	-0.43	-0.43		-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43		-0.43	-0.43	-0.43	-0.43	-0.43
DP25-2.5'	8/7/2001	-0.41	-0.41		-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41		-0.41	-0.41	-0.41	-0.41	-0.41
DP25-2.5' Blind Du	8/7/2001																														
DP25-7.5'	8/7/2001	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38
DP29-5	11/9/2001	-0.41	-0.41		-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41		-0.41	-0.41	-0.41	-0.41	-0.41
STR01-3'	3/8/2001	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38
STR01-21'	3/8/2001	-0.37	-0.37		-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	0.17	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37		-0.37	-0.37	-0.37	-0.37	-0.37
STR02-1'	3/13/2001	-0.4	-0.4		-0.4	0.14	0.14	0.14	-0.4	-0.4	-0.4	-0.4	0.17	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	0.42	-0.4	-0.4	-0.4	-0.4		-0.4	-0.4	0.33	-0.4	0.36
STR02-12.5'	3/13/2001	-0.37	-0.37		-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	0.32	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37		-0.37	-0.37	-0.37	-0.37	-0.37
STR03-4'	3/14/2001	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38
STR03-12.5'	3/14/2001	-18	-18	-18	-18	-18	-18	-18	-18	-18	150		-18	-18	-18	-18	-18	-18	-18	-18	-18	-18	-18	-18	-18	-18	-18	-18	-18	-18	-18
STR04-1.5'	3/19/2001	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4
STR04-17.5'	3/19/2001	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4
STR04-17.5' DUP	3/19/2001										0.18																				

TABLE A-2
SUMMARY OF SEMIVOLATILE ORGANIC COMPOUND DATA
Soil Samples
Morton International, Inc.
Reading, Ohio
Units: mg/kg

Sample Location	Sample Date	Acenaphthene	Acenaphthylene	Aniline	Anthracene	Benzo(a) anthracene	Benzo(a)pyrene	Benzo(b) fluoranthene	Benzo(ghi) perylene	Benzo(k) fluoranthene	bis(2-Ethylhexyl) phthalate	Carbazole	Chrysene	Dibenz(a,h) anthracene	Dibenzofuran	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	2,4-Dimethylphenol	Di-n-octyl phthalate	Fluoranthene	Fluorene	Indeno(1,2,3-cd) pyrene	2-Methyl-naphthalene	2-Methylphenol	3-Methylphenol	4-Methylphenol	Naphthalene	Phenanthrene	Phenol	Pyrene
STR05-1.5'	3/10/2001	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38
STR05-9'	3/10/2001	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38
STR05-11.3'	3/10/2001	-0.36	-0.36		-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36		-0.36	-0.36	-0.36	-0.36	-0.36
STR06-1'	3/11/2001	-0.39	-0.39		-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39		-0.39	-0.39	-0.39	-0.39	-0.39
STR06-15'	3/11/2001	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4
STR07-1.5'	3/21/2001	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4
STR07-18'	3/21/2001	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	0.61	-0.38	0.18	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38
STR08-1.5'	3/26/2001	-0.4	-0.4		-0.4	-0.4	-0.4	0.14	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4
STR08-13'	3/26/2001															0.34															
STR08-13' DUP	3/26/2001	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38
STR09-7.5'	4/4/2001	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4
STR10-1.5'	4/7/2001	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38
STR10-11'	4/7/2001	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42		-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42
STR11-2'	8/20/2001	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4
STR11-9'	8/20/2001																														
STR11-9' Blind Dup	8/20/2001	-0.39	-0.39		-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39		-0.39	-0.39	-0.39	-0.39	-0.39
T-1-4	11/8/2001	-4.2	-4.2	-4.2	-4.2	-4.2	-4.2	-4.2	-4.2	-4.2	-4.2		-4.2	-4.2	0.64	-4.2	-4.2	-4.2	-4.2	-4.2	-4.2	-4.2	-4.2	-4.2	-4.2	-4.2	-4.2	-4.2	-4.2	-4.2	-4.2
T-1-6	11/8/2001	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37		-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37
T-2-3	11/8/2001	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4
T-2-9	11/8/2001	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37		-0.37	-0.37	-0.37	0.28	-0.37	0.074	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37
T-3-3	11/8/2001	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37		-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	0.084	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	0.063
T-3-11	11/8/2001	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37		-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37
T-4-3	11/9/2001	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	0.07	-0.37	-0.37	-0.37		0.064	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	0.098	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	0.07	-0.37	0.068
T-4-9	11/9/2001	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36		-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36
T-5-3	11/9/2001	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4
T-5-9	11/9/2001	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4
T-6-3	11/10/2001	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4
T-6-7.5	11/11/2001	-86	-86	-86	-86	-86	-86	-86	-86	-86	-86		-86	-86	-86	-86	-86	-86	-86	-86	-86	-86	-86	22	-86	-86	-86	-86	-86	-86	-86
T-6-10	11/10/2001	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36		-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36
T-8-3	11/11/2001	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42		-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42	-0.42
T-8-9	11/11/2001	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36		-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36
UAW01-30-1.5'	4/2/2001	0.58	-0.38		1.5	5.4	6.2	7	2.8	2.8	-0.38	0.48	5.9	0.82	0.32	-0.38	-0.38	-0.38	-0.38	-0.38	14	0.61	2.7	-0.38	-0.38		-0.38	-0.38	6.5	-0.38	11
UAW01-30-15'	4/2/2001	-0.35	-0.35		-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35		-0.35	-0.35	-0.35	-0.35	-0.35
UAW04-20-10'	3/23/2001	-0.45	-0.45		-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	-0.45	0.57		0.46	-0.45	-0.45	-0.45	-0.45
UAW05-20-13'	3/23/2001	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	3.3	-0.38	0.49	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38
UAW06-20-1.5'	3/26/2001	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4
UAW06-20-11.5'	3/26/2001	-0.37	-0.37		-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37		-0.37	-0.37	-0.37	-0.37	-0.37
UAW08-20-13'	3/24/2001	-2.4	-2.4	22	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4		-2.4	-2.4	-2.4	2.3	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4
UAW09-20-1.5'	3/27/2001	-0.39	-0.39		-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39		-0.39	-0.39	-0.39	-0.39	-0.39
UAW09-20-15'	3/27/2001	-0.35	-0.35		-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35		-0.35	-0.35	-0.35	-0.35	-0.35
UAW11-40-2'	4/17/2001	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	0.17	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4
UAW11-40-10'	4/17/2001	-0.37	-0.37		-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	0.12	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37		-0.37	-0.37	-0.37	-0.37	-0.37
UAW12-20-12'	3/24/2001	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4		-0.4	-0.4	-0.4	14	0.26	1.3	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4
UAW13-20-1.5'	3/24/2001	-0.38	-0.38	-0.38	-0.38	0.26	0.23	0.24	0.14	-0.38	-0.38		0.25	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	0.52	-0.38	0.13	-0.38	-0.38	-0.38	-0.38	-0.38	0.22	-0.38	0.38
UAW13-20-11.5'	3/24/2001	-0.39	-0.39	0.16	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39		-0.39	-0.39	-0.39	0.25	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	0.16	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39
UAW14-10-1.5'	4/4/2001	-0.39	-0.39		-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39		-0.39	-0.39	-0.39	-0.39	-0.39
UAW15-20-2'	4/9/2001	-0.37	-0.37		-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37		-0.37	-0.37	-0.37	-0.37	-0.37
UAW15-20-2' DUP	4/9/2001																														

TABLE A-2
SUMMARY OF SEMIVOLATILE ORGANIC COMPOUND DATA
Soil Samples
Morton International, Inc.
Reading, Ohio
Units: mg/kg

Sample Location	Sample Date	Acenaphthene	Acenaphthylene	Aniline	Anthracene	Benzo(a) anthracene	Benzo(a)pyrene	Benzo(b) fluoranthene	Benzo(ghi) perylene	Benzo(k) fluoranthene	bis(2-Ethylhexyl) phthalate	Carbazole	Chrysene	Dibenz(a,h) anthracene	Dibenzofuran	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	2,4-Dimethylphenol	Di-n-octyl phthalate	Fluoranthene	Fluorene	Indeno(1,2,3-cd) pyrene	2-Methyl-naphthalene	2-Methylphenol	3-Methylphenol	4-Methylphenol	Naphthalene	Phenanthrene	Phenol	Pyrene
UAW15-20-8.5'	4/9/2001	-0.37	-0.37		-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37		-0.37	-0.37	-0.37	-0.37	-0.37
UAW16-10-2'	8/22/2001	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38
UAW16-10-5.5'	8/22/2001	-0.36	-0.36		-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	0.13	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36	-0.36		-0.36	-0.36	-0.36	-0.36	-0.36
UAW17-40-1.5'	4/5/2001	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38		-0.38	-0.38	-0.38	-0.38	-0.38
UAW17-40-5'	4/5/2001	-8.4	3.3		-8.4	-8.4	-8.4	-8.4	-8.4	-8.4	-8.4	-8.4	-8.4	-8.4	3.5	-8.4	-8.4	-8.4	24	-8.4	4.6	4.3	-8.4	3.1	15		35	3.8	9.8	13	4.3
UAW18-20-1'	8/23/2001	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4
UAW18-20-15'	8/23/2001	-0.41	-0.41		-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41		-0.41	-0.41	-0.41	-0.41	-0.41
UAW19-80-1.5'	4/6/2001	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4
UAW19-80-15'	4/6/2001	-0.39	-0.39		-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39		-0.39	-0.39	-0.39	-0.39	-0.39
UAW20-60-1.5'	4/9/2001	-0.37	-0.37		-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37		-0.37	-0.37	-0.37	-0.37	-0.37
UAW20-60-9.5'	4/9/2001	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4		-0.4	-0.4	-0.4	-0.4	-0.4
UAW21-30-1.5'	4/11/2001	-0.39	-0.39		-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39		-0.39	-0.39	-0.39	-0.39	-0.39
UAW21-30-10'	4/11/2001	-0.37	-0.37		-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37		-0.37	-0.37	-0.37	-0.37	-0.37
UAW22-20-2'	9/5/2001	-0.73	-0.73		-0.73	-0.73	-0.73	-0.73	-0.73	-0.73	0.17	-0.73	-0.73	-0.73	-0.73	-0.73	-0.73	-0.73	-0.73	-0.73	-0.73	-0.73	-0.73	-0.73	-0.73		-0.73	-0.73	-0.73	-0.73	-0.73
UAW22-20-11'	9/5/2001	-0.37	-0.37		-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	0.071	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37		-0.37	-0.37	-0.37	-0.37	-0.37
Count		105	105	35	105	105	105	105	105	105	105	71	105	105	105	105	105	105	105	105	105	105	105	105	105	35	105	105	105	105	105
Number of Detects		2	1	4	2	8	7	10	5	4	16	1	10	1	3	14	1	6	1	1	13	3	4	3	2	1	3	1	10	3	12
Number of Non-Detects		103	104	31	103	97	98	95	100	101	89	70	95	104	102	91	104	99	104	104	92	102	101	102	103	34	102	104	95	102	93
Maximum Detection		0.58	3.3	22	1.5	5.4	6.2	7	2.8	2.8	150	0.48	5.9	0.82	3.5	21	0.26	1.3	24	0.29	14	4.3	2.7	22	15	5.4	35	3.8	9.8	13	11
Minimum Detection		0.069	3.3	0.16	0.18	0.07	0.085	0.07	0.089	0.078	0.07	0.48	0.064	0.82	0.32	0.071	0.26	0.062	24	0.29	0.062	0.063	0.12	0.16	0.57	5.4	0.46	3.8	0.07	0.075	0.063
Maximum Detection Limit		86	86	86	86	86	86	86	86	86	86	8.4	86	86	86	86	86	86	86	86	86	86	86	35	86	86	86	86	86	86	86
Minimum Detection Limit		0.34	0.34	0.35	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.35	0.34	0.34	0.34	0.34	0.34
Location of Maximum		UAW01-30-1.5'	UAW17-40-5'	UAW08-20-13'	UAW01-30-1.5'	UAW01-30-1.5'	UAW01-30-1.5'	UAW01-30-1.5'	UAW01-30-1.5'	UAW01-30-1.5'	STR03-12.5'	UAW01-30-1.5'	UAW01-30-1.5'	UAW01-30-1.5'	UAW17-40-5'	DP17-13'	UAW12-20-12'	UAW12-20-12'	UAW17-40-5'	DP15-2'	UAW01-30-1.5'	UAW17-40-5'	UAW01-30-1.5'	T-6-7.5	UAW17-40-5'	DP17-13'	UAW17-40-5'	UAW17-40-5'	UAW17-40-5'	UAW17-40-5'	UAW01-30-1.5'

Notes:

Negative values (shaded boxes) represent non-detect values.

Highlight rows indicate duplicate samples. The highest duplicate sample result was used in the analysis.

TABLE A-3
SUMMARY OF PESTICIDES AND PCB DATA
Soil Samples
Morton International, Inc.
Reading, Ohio
Units: mg/kg

Sample Location	Sample Date	Aroclor 1016	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	beta-BHC	alpha-Chlordane	gamma-Chlordane	Chlorobenzilate	4,4'-DDD	4,4'-DDE	4,4'-DDT	Dieldrin	Endosulfan II	Endosulfan sulfate	Endrin	Endrin aldehyde	Endrin ketone	Heptachlor epoxide	Methoxychlor
DP01-2'	7/24/2001	-0.038	-0.038	-0.038	-0.038	-0.038	-0.02	-0.02	-0.02		-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.038
DP01-9.5'	7/24/2001	-0.039	-0.039	-0.039	-0.039	0.016	-0.0099	-0.0099	-0.0099		-0.0099	-0.0099	-0.0099	-0.0099	-0.0099	-0.0099	-0.0099	-0.0099	-0.0099	-0.0099	-0.019
DP02-2'	7/24/2001	-0.038	-0.038	-0.038	0.038	-0.038	-0.0039	0.0039	-0.0039		-0.0039	-0.0039	-0.0039	-0.0039	-0.0039	-0.0039	-0.0039	-0.0039	-0.0039	-0.0039	-0.0076
DP02-9.5'	7/24/2001	-0.041	-0.041	-0.041	-0.041	-0.041	-0.0021	-0.0021	-0.0021		-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0041
DP03-2'	7/24/2001	-0.039	-0.039	-0.039	-0.039	-0.039	-0.002	-0.002	-0.002		-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.0039
DP03-8.5'	7/24/2001	-0.035	-0.035	-0.035	-0.035	-0.035	-0.0018	-0.0018	-0.0018		-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0035
DP05-1'	7/25/2001	-0.039	-0.039	-0.039	-0.039	-0.039	-0.002	-0.002	-0.002		-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.0039
DP05-8.5'	7/25/2001	-0.038	-0.038	-0.038	-0.038	-0.038	-0.002	-0.002	-0.002		-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.0038
DP07-9'	7/26/2001	-0.039	-0.039	-0.039	-0.039	-0.039	-0.002	-0.002	-0.002		-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.0039
DP08-6'	7/26/2001	-0.042	-0.042	-0.042	-0.042	-0.042	-0.0022	-0.0022	-0.0022		-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	0.0017
DP08-11'	7/26/2001	-0.039	-0.039	-0.039	-0.039	-0.039	-0.002	-0.002	-0.002		-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.0039
DP09-12'	7/27/2001	-0.38	-0.38	-0.38	-0.38	-0.38	-0.0039	-0.0039	-0.0039		-0.0039	-0.0039	-0.0039	-0.0039	-0.0039	-0.0039	-0.0039	-0.0039	-0.0039	-0.0039	-0.0076
DP10-2'	7/27/2001	-0.037	-0.037	-0.037	-0.037	-0.037	-0.0019			-0.0037	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019		-0.0019	-0.0037
DP10-10'	7/27/2001	-3.8	-3.8	-3.8	-3.8	-3.8				-0.38	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2		-0.2	-0.38
DP10-10' Blind Dup	7/27/2001						0.0038														
DP12-1.5'	7/28/2001	-0.034	-0.034	-0.034	-0.034	-0.034	-0.0035	-0.0035	-0.0035		-0.0035	-0.0035	-0.0035	-0.0035	-0.0035	-0.0035	-0.0035	-0.0035	-0.0035	-0.0035	-0.0068
DP12-9'	7/28/2001	-0.041	-0.041	-0.041	-0.041	-0.041	-0.0021	-0.0021	-0.0021		-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0041
DP13-3'	7/29/2001	-0.039	-0.039	-0.039	-0.039	-0.039	-0.002	-0.002	-0.002	-0.0039	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.0039
DP13-11'	7/29/2001	-3.9	-3.9	-3.9	-3.9	-3.9	-2			10	-2	-2	-2	-2	-2	-2	-2	-2		-2	-3.9
DP14-3'	7/29/2001	-69	-69	-69	-69	-69	-0.89			-1.7	-0.89	-0.89	-0.89	-0.89	-0.89	-0.89	-0.89	-0.89		-0.89	-1.7
DP14-9'	7/29/2001	-75	-75	-75	-75	-75	-0.39			-0.75	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39		-0.39	-0.75
DP15-2'	7/29/2001	-1.9	-1.9	-1.9	-1.9	-1.9	-0.39			-0.76	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39		-0.39	-0.76
DP15-9'	7/29/2001	-40	-40	-40	-40	-40	-0.02			-0.04	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02		-0.02	-0.04
DP16-2.8'	7/30/2001	-0.035	-0.035	-0.035	-0.035	-0.035	-0.0018			-0.0035	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018		-0.0018	-0.0035
DP16-12.5'	7/30/2001	-19	-19	-19	-19	-19	-0.99			-1.9	-0.99	-0.99	0.78	-0.99	-0.99	-0.99	-0.99	-0.99		-0.99	4.5
DP17-3'	7/30/2001	-0.039	-0.039	-0.039	-0.039	-0.039	-0.002			-0.0039	-0.002	0.0018	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002		-0.002	-0.0039
DP17-13'	7/30/2001	-22	-22	-22	-22	-22	-1.1			-2.2	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1		-1.1	-2.2
DP18-2'	7/30/2001	-0.038	-0.038	-0.038	-0.038	-0.038	-0.0039	-0.0039	-0.0039		-0.0039	-0.0039	-0.0039	-0.0039	-0.0039	-0.0039	-0.0039	-0.0039	-0.0039	-0.0039	-0.0075
DP18-14.5'	7/30/2001	-0.036	-0.036	-0.036	-0.036	-0.036	-0.0019	-0.0019	-0.0019		-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0036
DP19-2'	7/30/2001	-0.04	-0.04	-0.04	-0.04	0.021	-0.0021	-0.0021	-0.0021		-0.0021	0.0017	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.004
DP19-13'	7/30/2001	-0.036	-0.036	-0.036	-0.036	-0.036	-0.0038	-0.0038	-0.0038		-0.0038	-0.0038	-0.0038	-0.0038	-0.0038	-0.0038	-0.0038	-0.0038	-0.0038	-0.0038	-0.0073
DP20-2'	7/30/2001	-0.038	-0.038	-0.038	0.047	-0.038	-0.0019	-0.0019	-0.0019		-0.0019	0.0037	0.0081	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0038
DP20-14.5'	7/30/2001	-0.038	-0.038	-0.038	-0.038	-0.038	-0.0019	-0.0019	-0.0019		-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0038
DP23-2.5'	8/1/2001	-0.042	-0.042	-0.042	-0.042	-0.042	-0.0022	-0.0022	-0.0022		-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0042
DP23-9'	8/1/2001	-0.043	-0.043	-0.043	-0.043	-0.043	-0.0022	-0.0022	-0.0022		-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0043
DP25-2.5'	8/7/2001	-0.041	-0.041	-0.041	-0.041	-0.041	-0.0021	-0.0021	-0.0021		-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0041
DP25-2.5' Blind Dup	8/7/2001																				
DP25-7.5'	8/7/2001	-0.038	-0.038	-0.038	-0.038	-0.038	-0.002	-0.002	-0.002		-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.0038
DP29-5	11/9/2001	-0.041	-0.041	-0.041	-0.041	-0.041	-0.0021	-0.0021	-0.0021		-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0041
STR01-3'	3/8/2001	-0.038	0.063	-0.038	-0.038	-0.038	-0.02	-0.02	-0.02		-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.038
STR01-21'	3/8/2001	-0.07	0.26	-0.07	-0.07	-0.07	0.0017	-0.0019	-0.0019		-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0037
STR02-1'	3/13/2001	-0.04	-0.04	-0.04	-0.04	-0.04	-0.0021	-0.0021	-0.0021		-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.004
STR02-12.5'	3/13/2001	-0.037	-0.037	-0.037	-0.037	-0.037	-0.0096	-0.0096	-0.0096		-0.0096	-0.0096	-0.0096	-0.0096	-0.0096	-0.0096	-0.0096	-0.0096	-0.0096	-0.0096	-0.019
STR03-4'	3/14/2001	-0.038	-0.038	-0.038	-0.038	-0.038	-0.0079			-0.079	-0.0079	-0.0079	-0.0079	-0.0079	-0.0079	-0.0079	-0.0079	-0.0079		-0.0079	-0.015

TABLE A-3
SUMMARY OF PESTICIDES AND PCB DATA
Soil Samples
Morton International, Inc.
Reading, Ohio
Units: mg/kg

Sample Location	Sample Date	Aroclor 1016	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	beta-BHC	alpha-Chlordane	gamma-Chlordane	Chlorobenzilate	4,4'-DDD	4,4'-DDE	4,4'-DDT	Dieldrin	Endosulfan II	Endosulfan sulfate	Endrin	Endrin aldehyde	Endrin ketone	Heptachlor epoxide	Methoxychlor
STR03-12.5'	3/14/2001	-1.8	-1.8	-1.8	-1.8	-1.8	-0.074			-0.74	-0.074	-0.074	-0.074	-0.074	-0.074	-0.074	-0.074	0.19		-0.074	-0.14
STR04-1.5'	3/19/2001	-0.04	-0.04	-0.04	-0.04	-0.04	-0.002	-0.002	-0.002		-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.004
STR04-17.5'	3/19/2001	-0.04	-0.04	-0.04	-0.04	-0.04	-0.0021	-0.0021	-0.0021		-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.004
STR04-17.5' DUP	3/19/2001																				
STR05-1.5'	3/10/2001	-0.038	-0.038	-0.038	-0.038	-0.038	-0.0019	-0.0019	-0.0019		-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0038
STR05-9'	3/10/2001	-0.038	-0.038	-0.038	-0.038	-0.038	-0.002	-0.002	-0.002		-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.0038
STR05-11.3'	3/10/2001	-0.036	-0.036	-0.036	-0.036	-0.036	-0.0018	-0.0018	-0.0018		-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0036
STR06-1'	3/11/2001	-0.039	-0.039	-0.039	-0.039	-0.039	-0.002	-0.002	-0.002		-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.0039
STR06-15'	3/11/2001	-0.04	-0.04	-0.04	-0.04	-0.04	-0.0021	-0.0021	-0.0021		-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.004
STR07-1.5'	3/21/2001	-0.04	-0.04	-0.04	-0.04	-0.04	-0.002	-0.002	-0.002		-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	0.003
STR07-18'	3/21/2001	-0.038	-0.038	-0.038	-0.038	-0.038	-0.002	-0.002	-0.002		-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.0038
STR08-1.5'	3/26/2001	-0.04	-0.04	-0.04	-0.04	-0.04	-0.0021	-0.0021	-0.0021		-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.004
STR08-13'	3/26/2001																				
STR08-13' DUP	3/26/2001	-0.038	-0.038	-0.038	-0.038	-0.038	-0.039	-0.039	-0.039		-0.039	-0.039	-0.039	-0.039	-0.039	-0.039	-0.039	-0.039	-0.039	-0.039	-0.075
STR09-7.5'	4/4/2001	-0.04	-0.04	-0.04	-0.04	-0.04	-0.0021	-0.0021	-0.0021		-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.004
STR10-1.5'	4/7/2001	-0.038	-0.038	-0.038	-0.038	-0.038	-0.0019			-0.019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019		-0.0019	-0.0038
STR10-11'	4/7/2001	-0.042	-0.042	-0.042	-0.042	-0.042	-0.0022			-0.022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022	-0.0022		-0.0022	-0.0042
STR11-2'	8/20/2001	-0.04	-0.04	-0.04	0.37	-0.04	-0.002	-0.002	0.0025		-0.002	0.0041	-0.002	0.0041	-0.002	0.0028	-0.002	0.0032	0.0017	-0.002	-0.004
STR11-9'	8/20/2001	-0.039	-0.039	-0.039	-0.039	-0.039	-0.002	-0.002	-0.002		-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.0039
STR11-9' Blind Dup	8/20/2001																				
T-1-4	11/8/2001	-0.042	-0.042	-0.042	-0.042	-0.042	-0.022			-0.22	-0.022	-0.022	-0.022	-0.022	-0.022	-0.022	-0.022	-0.022		0.019	-0.042
T-1-6	11/8/2001	-0.037	-0.037	-0.037	-0.037	-0.037	-0.0019			-0.019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	0.0025	-0.0019		-0.0019	-0.0037
T-2-3	11/8/2001	-0.04	-0.04	-0.04	-0.04	-0.04	-0.0021			-0.021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021		-0.0021	-0.004
T-2-9	11/8/2001	-0.037	-0.037	-0.037	-0.037	-0.037	-0.0019			-0.019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019		-0.0019	-0.0037
T-3-3	11/8/2001	-0.037	-0.037	0.011	-0.037	-0.037	-0.0038			-0.038	-0.0038	-0.0038	-0.0038	-0.0038	-0.0038	-0.0038	-0.0038	-0.0038		-0.0038	-0.0074
T-3-11	11/8/2001	-0.037	-0.037	-0.037	-0.037	-0.037	-0.0019			-0.019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019		-0.0019	-0.0037
T-4-3	11/9/2001	-0.037	-0.037	-0.037	-0.037	-0.037	-0.0019			-0.0037	-0.0019	0.0016	0.0022	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019		-0.0019	-0.0037
T-4-9	11/9/2001	-0.036	-0.036	-0.036	-0.036	-0.036	-0.0018			-0.0036	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018		-0.0018	-0.0036
T-5-3	11/9/2001	-0.04	-0.04	-0.04	-0.04	-0.04	-0.002			-0.004	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002		-0.002	-0.004
T-5-9	11/9/2001	-0.04	-0.04	-0.04	-0.04	-0.04	-0.002			-0.004	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002		-0.002	-0.004
T-6-3	11/10/2001	-0.04	-0.04	-0.04	-0.04	-0.04	-0.0021			-0.021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021		-0.0021	-0.004
T-6-7.5	11/11/2001	-4.8	-4.8	-4.8	-4.8	-4.8	-0.098			-0.97	-0.098	-0.098	-0.098	-0.098	-0.098	-0.098	-0.098	-0.098		-0.098	-0.19
T-6-10	11/10/2001	-0.036	-0.036	-0.036	0.024	-0.036	-0.0019			-0.019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019		-0.0019	-0.0036
T-8-3	11/11/2001	-0.042	-0.042	-0.042	-0.042	-0.042	-0.0021			-0.021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021		-0.0021	-0.0042
T-8-9	11/11/2001	-0.036	-0.036	-0.036	-0.036	-0.036	-0.0019			-0.019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019		-0.0019	-0.0036
UAW01-30-1.5'	4/2/2001	-0.038	-0.038	-0.038	-0.038	0.012	-0.0099	-0.0099	-0.0099		-0.0099	-0.0099	-0.0099	-0.0099	-0.0099	-0.0099	-0.0099	-0.0099	-0.0099	-0.0099	-0.019
UAW01-30-15'	4/2/2001	-0.035	-0.035	-0.035	-0.035	-0.035	-0.0018	-0.0018	-0.0018		-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0035
UAW04-20-10'	3/23/2001	-0.045	-0.045	-0.045	-0.045	-0.045	-0.12	-0.12	-0.12		-0.12	-0.12	-0.12	-0.12	-0.12	-0.12	-0.12	-0.12	-0.12	-0.12	-0.22
UAW05-20-13'	3/23/2001	0.016	-0.038	-0.038	-0.038	-0.038	-0.098	-0.098	-0.098		-0.098	-0.098	-0.098	-0.098	-0.098	-0.098	-0.098	-0.098	-0.098	-0.098	-0.19
UAW06-20-1.5'	3/26/2001	-0.04	-0.04	-0.04	-0.04	-0.04	-0.0021	-0.0021	-0.0021		-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.004
UAW06-20-11.5'	3/26/2001	-0.037	-0.037	-0.037	-0.037	-0.037	-0.019	-0.019	-0.019		-0.019	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019	-0.037
UAW08-20-13'	3/24/2001	0.016	-0.037	-0.037	-0.037	-0.037	-0.095			-0.95	-0.095	-0.095	-0.095	-0.095	-0.095	-0.095	-0.095	-0.095		-0.095	-0.18
UAW09-20-1.5'	3/27/2001	-0.039	-0.039	-0.039	-0.039	-0.039	-0.002	-0.002	-0.002		-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.0039
UAW09-20-15'	3/27/2001	-0.035	-0.035	-0.035	-0.035	-0.035	-0.0018	-0.0018	-0.0018		-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0035

TABLE A-3
SUMMARY OF PESTICIDES AND PCB DATA
Soil Samples
Morton International, Inc.
Reading, Ohio
Units: mg/kg

Sample Location	Sample Date	Aroclor 1016	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	beta-BHC	alpha-Chlordane	gamma-Chlordane	Chlorobenziilate	4,4'-DDD	4,4'-DDE	4,4'-DDT	Dieldrin	Endosulfan II	Endosulfan sulfate	Endrin	Endrin aldehyde	Endrin ketone	Heptachlor epoxide	Methoxychlor
UAW11-40-2'	4/17/2001	-0.04	-0.04	-0.04	-0.04	-0.04	-0.002	-0.002	-0.002		-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.004
UAW11-40-10'	4/17/2001	-0.037	-0.037	-0.037	-0.037	-0.037	-0.0019	-0.0019	-0.0019		-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0037
UAW12-20-12'	3/24/2001	-0.04	0.26	-0.04	-0.04	-0.04	-0.1			-1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1		-0.1	-0.2
UAW13-20-1.5'	3/24/2001	-0.038	-0.038	-0.038	-0.038	0.028	-0.039			-0.39	-0.039	-0.039	-0.039	-0.039	-0.039	-0.039	-0.039	-0.039		-0.039	-0.076
UAW13-20-11.5'	3/24/2001	-0.039	-0.039	-0.039	-0.039	-0.039	-0.1			-1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1		-0.1	-0.2
UAW14-10-1.5'	4/4/2001	-0.039	-0.039	-0.039	-0.039	-0.039	-0.002	-0.002	-0.002		-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.0039
UAW15-20-2'	4/9/2001	-0.037	-0.037	-0.037	-0.037	-0.037	-0.0038	-0.0038	-0.0038		-0.0038	-0.0038	-0.0038	-0.0038	-0.0038	-0.0038	-0.0038	-0.0038	-0.0038	-0.0038	-0.0073
UAW15-20-2' DUP	4/9/2001																				
UAW15-20-8.5'	4/9/2001	-0.037	-0.037	-0.037	-0.037	-0.037	-0.0019	-0.0019	-0.0019		-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0037
UAW16-10-2'	8/22/2001	-0.038	-0.038	-0.038	-0.038	-0.038	-0.002	-0.002	-0.002		-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.0038
UAW16-10-5.5'	8/22/2001	-0.036	-0.036	-0.036	-0.036	-0.036	-0.0018	-0.0018	-0.0018		-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0018	-0.0036
UAW17-40-1.5'	4/5/2001	-0.38	-0.38	-0.38	0.98	-0.38	-0.0097	-0.0097	-0.0097		-0.0097	-0.0097	-0.0097	-0.0097	-0.0097	0.012	-0.0097	0.01	-0.0097	-0.0097	-0.019
UAW17-40-5'	4/5/2001	-0.042	-0.042	-0.042	0.071	-0.042	-0.11	-0.11	-0.11		-0.11	0.2	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11	-0.21
UAW18-20-1'	8/23/2001	-0.04	-0.04	-0.04	-0.04	-0.04	-0.0021	-0.0021	-0.0021		-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.004
UAW18-20-15'	8/23/2001	-0.041	-0.041	-0.041	-0.041	-0.041	0.0023	-0.0021	-0.0021		-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0041
UAW19-80-1.5'	4/6/2001	-0.04	-0.04	-0.04	-0.04	-0.04	-0.0021	-0.0021	-0.0021		-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.004
UAW19-80-15'	4/6/2001	-0.039	-0.039	-0.039	-0.039	-0.039	-0.002	-0.002	-0.002		-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.0039
UAW20-60-1.5'	4/9/2001	-0.037	-0.037	-0.037	-0.037	0.011	-0.0038	-0.0038	-0.0038		-0.0038	-0.0038	-0.0038	-0.0038	-0.0038	-0.0038	-0.0038	-0.0038	-0.0038	-0.0038	-0.0074
UAW20-60-9.5'	4/9/2001	-0.04	-0.04	-0.04	-0.04	-0.04	-0.0021	-0.0021	-0.0021		-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.004
UAW21-30-1.5'	4/11/2001	-0.039	-0.039	-0.039	-0.039	-0.039	-0.002	-0.002	-0.002		-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.0039
UAW21-30-10'	4/11/2001	-0.037	-0.037	-0.037	-0.037	-0.037	-0.0019	-0.0019	-0.0019		-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0019	-0.0037
UAW22-20-2'	9/5/2001	-0.037	-0.037	-0.037	0.26	-0.037	-0.0019	0.00083	0.00047		0.00064	0.00074	0.0027	0.0012	0.0015	-0.0019	0.0021	0.0013	-0.0019	0.0001	-0.0037
UAW22-20-11'	9/5/2001	-0.037	-0.037	-0.037	-0.037	-0.037	-0.0019	-0.0019	-0.0019		-0.0019	0.0002	0.00065	0.00015	-0.0019	-0.0019	0.00048	0.0013	-0.0019	-0.0019	-0.0037
Count		105	105	105	105	105	105	71	71	35	105	105	105	105	105	105	105	105	71	105	105
Number of Detects		2	3	1	7	5	3	1	2	1	1	8	5	3	1	2	3	5	1	2	3
Number of Non-Detects		103	102	104	98	100	102	70	69	34	104	97	100	102	104	103	102	100	70	103	102
Maximum Detection Limit		0.016	0.26	0.011	0.98	0.028	0.0038	0.00083	0.0025	10	0.00064	0.2	0.78	0.0041	0.0015	0.012	0.0025	0.19	0.0017	0.019	4.5
Minimum Detection		0.016	0.063	0.011	0.024	0.011	0.0017	0.00083	0.00047	10	0.00064	0.0002	0.00065	0.00015	0.0015	0.0028	0.00048	0.0013	0.0017	0.0001	0.0017
Maximum Detection Limit		75	75	75	75	75	2	0.12	0.12	2.2	2	2	2	2	2	2	2	2	0.12	2	3.9
Minimum Detection Limit		0.034	0.034	0.034	0.034	0.034	0.0018	0.0018	0.0018	0.0035	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018	0.0035
Location of Maximum		UAW08-20-13'	UAW12-20-12'	T-3-3	UAW17-40-1.5'	UAW13-20-1.5'	DP10-10' Blind Dup	UAW22-20-2'	STR11-2'	DF13-11'	UAW22-20-2'	UAW17-40-5'	DP16-12.5'	STR11-2'	UAW22-20-2'	UAW17-40-1.5'	T-1-6'	STR03-12.5'	STR11-2'	T-1-4'	DP16-12.5'

Notes:

Negative values (shaded boxes) represent non-detect values.

Highlight rows indicate duplicate samples. The highest duplicate sample result was used in the analysis.

TABLE A-4
SUMMARY OF METALS DATA - INORGANICS
Soil Samples
Morton International, Inc.
Reading, Ohio
Units: mg/kg

Sample Location	Sample Date	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide, Total	Iron	Lead	Magnesium	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Tin	Vanadium	Zinc
DP01-2'	7/24/2001	7090	-1.2	5.7	51.5	0.44	0.25	21600	8.4	5	13.3	-0.58	11100	22.6	7180	302	0.012	10.8	569	0.68	-0.58	-581	-1.2		14.9	37.2
DP01-9.5'	7/24/2001	8580	-1.2	7.2	55.3	0.5	0.84	10400	15.4	6.1	20.4	-0.58	16400	36.7	3000	430	0.022	15.8	648	0.68	-0.58	-585	-1.2		19.4	84
DP02-2'	7/24/2001	7260	-1.2	6	62.6	0.47	0.4	29900	11	5.7	18.5	-0.58	11900	25.8	8390	265	0.052	11.3	642	0.63	-0.58	-576	-1.2		16.1	56
DP02-9.5'	7/24/2001	11800	-1.3	9.2	72.8	0.67	0.52	8390	16.6	10.4	23.2	-0.63	25300	18.2	4290	484	0.023	25.1	1110	0.87	-0.63	112	-1.3		23	69
DP03-2'	7/24/2001	6390	-1.2	5.4	51.3	0.41	0.21	16100	9	5.8	10	-0.58	11500	11.5	2880	533	0.026	9.6	666	0.49	-0.58	-584	-1.2		14.6	39.6
DP03-8.5'	7/24/2001	4640	-1.1	8	57.4	0.44	0.42	107000	8.2	10.3	11	-0.53	16900	13.4	21000	1120	0.012	9.7	506	0.52	-0.53	101	-1.1		16.2	29.2
DP05-1'	7/25/2001	9420	-1.2	8.1	56.9	0.56	0.33	38100	12.8	5.8	15.4	-0.59	16900	19.9	13200	322	0.025	14.3	1050	0.66	-0.59	-592	-1.2		19.5	52.6
DP05-8.5'	7/25/2001	8990	-1.1	7.5	85.9	0.51	0.47	64000	12.2	8.6	16.5	-0.57	19500	9.3	22000	472	0.016	19.2	1670	0.68	-0.57	92.3	-1.1		17.9	50.9
DP07-9'	7/26/2001	8220	-1.2	4.4	44	0.46	0.4	102000	10.6	6.6	14.5	-0.58	16800	8.1	20800	325	-0.12	14.6	1560	0.37	-0.58	146	-1.2		15.4	43.7
DP08-6'	7/26/2001	14100	-1.3	10.2	92.8	0.73	0.4	12700	16.3	9.7	21.5	-0.64	25500	15.1	6140	429	0.026	20.6	1290	0.69	-0.64	-640	-1.3		28.8	59.2
DP08-11'	7/26/2001	8070	-1.2	5	40.9	0.55	0.17	6140	11.6	6.3	9.7	1.3	12800	11.6	2970	306	0.015	8.7	587	0.68	-0.59	-593	-1.2		23.4	28.3
DP09-12'	7/27/2001	2290	-1.1	1.2	9	0.13	0.18	112000	5.5	3.1	6.4	-0.57	5890	3.8	27600	350	-0.11	6.3	364	-0.57	-0.57	158	-1.1		7.5	29.4
DP10-2'	7/27/2001		-1.1	4.3	26.3	0.27	0.95		6.6	3.8	9.9	-0.56		7.7			-0.11	9.2		-0.56	-0.56		-1.1	27.2	10.7	31.7
DP10-10'	7/27/2001				13.9		0.25		7.9	3.7				2.9			0.09	7.8		-0.58	-0.58			531		100
DP10-10' Blind Dup	7/27/2001		-1.1	1.2		0.1					6.8	0.25											-1.1		6.5	
DP12-1.5'	7/28/2001	4930	-1	7.1	56.2	0.33	0.42	111000	7.5	8.4	17	-0.51	9380	12.9	8980	510	0.018	8.1	520	0.38	-0.51	596	-1		11.7	39.8
DP12-9'	7/28/2001	11600	-1.3	8.4	47.7	0.41	0.2	1910	11.4	5	14.1	-0.63	18300	10.1	1780	292	0.014	12.4	762	0.82	-0.63	432	-1.3		24.3	46.8
DP13-3'	7/29/2001		-1.2	5.4	51.1	0.37	0.35		7.8	4.7	11.2	-0.6		11.4			-0.12	10.2		-0.6	-0.6		-1.2	17	12.5	40.5
DP13-11'	7/29/2001		-1.2	1.4	3.1	0.096	0.17		2.3	1	9.9	-0.59		5.9			0.024	5.6		-0.59	-0.59		-1.2	887	1.6	8.9
DP14-3'	7/29/2001		-1	14.3	125	0.7	1.3		9.9	10	13.1	-0.52		39.8			0.049	13.9		-0.52	-0.52		-1	78.6	20	66.1
DP14-9'	7/29/2001		-1.1	2.1	10.9	0.32	0.16		14.9	1.8	11.2	-0.57		7.8			0.082	9.4		-0.57	-0.57		-1.1	299	14.8	58.4
DP15-2'	7/29/2001		-1.2	5.8	84.2	0.72	0.31		11.3	9.2	14	-0.58		29.9			0.045	16.2		-0.58	-0.58		-1.2	46.2	16.2	62.4
DP15-9'	7/29/2001		-1.2	1.5	4.9	0.37	1.1		12.3	82.8	7.5	0.36		52.2			-0.12	14.1		-0.6	-0.6		-1.2	283	13.9	110
DP16-2.8'	7/30/2001		-1.1	3.3	16.3	0.19	0.15		4.9	3.4	6.5	-0.53		3.5			-0.11	8		-0.53	-0.53		-1.1	2.5	6.4	23.3
DP16-12.5'	7/30/2001		-1.2	4.7	20.3	0.18	0.31		7.1	4.1	7	0.25		11.9			0.028	9		-0.58	-0.58		-1.2	2250	7	70
DP17-3'	7/30/2001		-1.2	6.7	85.1	0.57	0.29		13.2	6.4	19.2	-0.59		31.2			0.046	17.9		-0.59	-0.59		-1.2	2.4	19.1	61.2
DP17-13'	7/30/2001		-1.3	6.5	691	0.39	1.3		55.2	54.9	42.8	-0.67		57.6			0.57	21.1		-0.67	-0.67		-1.3	4150	11.4	289
DP18-2'	7/30/2001	7890	-1.1	7.2	49.4	0.45	0.49	59200	9.7	5.3	10.9	-0.57	13000	14.4	18200	539	0.025	11.3	610	-0.57	-0.57	373	-1.1		17.2	61
DP18-14.5'	7/30/2001	1560	-1.1	2.6	9.6	0.15	0.16	157000	3.5	1.7	7.1	-0.55	5750	2.6	48900	502	-0.11	5.1	321	-0.55	-0.55	165	-1.1		5.4	16.4
DP19-2'	7/30/2001	8850	-1.2	7.7	119	0.73	0.47	13800	18.6	7.5	18.5	-0.61	15200	29.8	6780	709	0.057	14.9	1540	-0.61	-0.61	1030	-1.2		16.9	77
DP19-13'	7/30/2001	2570	-1.1	3.1	11.3	0.22	0.15	91600	5.5	2.5	7.2	-0.55	7240	3.4	33700	302	-0.11	7.3	401	-0.55	-0.55	295	-1.1		9	24.9
DP20-2'	7/30/2001	7480	-1.1	8.3	65.8	0.53	0.38	37100	11.1	6.6	18.2	-0.57	14500	25.9	9230	529	0.08	14.5	659	-0.57	-0.57	-569	-1.1		15.6	58.1
DP20-14.5'	7/30/2001	1380	-1.1	2	8.2	0.17	0.13	107000	3.1	2.1	6.3	-0.57	3500	2.8	50100	261	-0.11	5.3	243	-0.57	-0.57	217	-1.1		5.4	16.7
DP23-2.5'	8/1/2001	12900	-1.3	14.2	106	0.75	0.098	13800	19.9	16.8	22.1	0.38	29900	21.6	4740	1730	0.03	25.9	1200	0.79	-0.63	192	4.7		29.6	67
DP23-9'	8/1/2001	13100	-1.3	12.7	112	0.76	-0.26	39800	19.6	14.4	26.5	-0.66	32900	16.9	13900	652	0.018	33.2	2120	1.1	-0.66	204	2.9		26.1	76.5
DP25-2.5'	8/7/2001		-1.2	8.8	100	0.55	6.5		15	7.6	16.2		20100	10.2			0.024				-0.62	574	1.5		25.8	54.6
DP25-2.5' Blind Du	8/7/2001	6530						110000				0.56			27900	404		15.8	1160	0.66						
DP25-7.5'	8/7/2001	9050	-1.2	6	75.1	0.35	2	103000	12.2	7.3	16	-0.58	17300	7.6	23700	575	-0.12	16.8	2050	0.49	-0.58	465	3.1		17	46.4
DP29-5	11/9/2001	10600	-1.3	7.5	59.4	0.42	0.14	54200	13.9	8.9	18.8	-0.63	21100	15.3	15900	515	0.049	22.2	1250	-0.63	-0.63	76.2	-1.3		18.6	70.2
DP39-10	3/5/2002	4500	-1.1	5	35.3	0.26	0.57	101000	6.7	17	7.3		9220	8.1	12100	450	0.021	59	421	-0.57		73	1.3	1230	10.1	23
DP40-6	3/5/2002			4.8		0.35	0.2	83500	9.2				14500	6.4	40500	301	0.035		583	-0.57		103		4	15.1	
DP40-6 Blind Dup	3/5/2002	6070	-1.1		39.4					5.1	8.2							9.1					1.4			31
DP41-6	3/5/2002	5820	-1.2	1.6	31.6	0.24	0.074	28800	8.1	4.4	6.2		7540	5.9	11000	146	0.036	8.2	532	-0.59		79	0.79	3.5	8.6	27
DP42-6	3/5/2002	7570	-1.2	4.2	45.1	0.36	0.15	20700	10.1	5.6	8.1		16600	6.9	9210	285	-0.12	11	709	-0.6		-600	1.1	3.9	15.3	32.6
DP43-1.5	3/5/2002	5500	-1.1	5.5	60.2	0.22	0.081	1230	8	6.3	8		11400	58.1	962	571	0.035	8.2	412	-0.57		-568	0.98		15.7	29.4
DP44-1.5	3/5/2002	5980	-1.2	6.6	50.1	0.22	0.21	20800	7.1	2.6	6.4		6720	12.4	4160	130	0.04	8.5	3810	0.36		139	-1.2		11.7	32.4

TABLE A-4
SUMMARY OF METALS DATA - INORGANICS
Soil Samples
Morton International, Inc.
Reading, Ohio
Units: mg/kg

Sample Location	Sample Date	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide, Total	Iron	Lead	Magnesium	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Tin	Vanadium	Zinc
DP45-1.5	3/5/2002	4580	-1.1	6.1	60.6	0.2	0.092	1040	6.6	6.2	7.3		10400	43.6	885	516	0.068	7.5	363	-0.57		-569	-1.1		13.4	27.5
DP46-1.5	3/5/2002	4840	-1.1	5.4	40	0.2	0.08	1160	7.7	5	8.7		11300	24.5	1020	406	0.018	8.3	459	-0.57		-569	-1.1		13.2	28.5
STR01-3'	3/8/2001	7920	-1.2	5.3	76	0.25	0.094	41000	9.7	5.4	12.8	-0.58	11800	8.6	18400	585	0.02	12.8	1130	-0.58	-0.58	135	1.6		17.2	48.2
STR01-21'	3/8/2001	1530	-1.1	3.7	6	-0.56	-0.23	117000	3.8	2.1	5.3	-0.56	4860	2.9	35200	264	-0.11	5	319	-0.56	-0.56	157	1.1		6.6	14.7
STR02-1'	3/13/2001	13700	-1.2	6.5	113	0.62	0.28	14800	58.9	9.4	16.5	-0.61	19700	19.5	4920	1120	0.072	18	1580	-0.61	-0.61	694	-1.2		23.4	64
STR02-12.5'	3/13/2001	2350	-1.1	2.1	11.8	0.11	0.16	175000	3.9	3.1	4.6	-0.56	5330	3.1	95200	192	-0.11	5.1	427	-0.56	-0.56	292	-1.1		8.2	16.2
STR03-4'	3/14/2001		-1.2	3.4	60.3	0.38	-0.23		10	6	6.9	-0.58		7.6			0.021	11.4		-0.58	-0.58		-1.2	1.3	14.5	30.9
STR03-12.5'	3/14/2001		-1.1	0.94	6.7	-0.55	0.1		7.6	2.6	5.6	-0.55		2.2			0.013	6.2		-0.55	-0.55		-1.1	225	6	42.7
STR04-1.5'	3/19/2001	11900	-1.2	8.1	83.5	0.43	0.2	20400	15.3	10	14.1	-0.6	17100	13.5	8880	531	0.036	17.6	1060	-0.6	-0.6	78.7	0.86		26.2	46.4
STR04-17.5'	3/19/2001	2780	-1.2	3	12.8					2.7	8.1			5.6			0.026	7	661	-0.61	-0.61		0.98		8.8	
STR04-17.5' DUP	3/19/2001					0.077	0.16	162000	5.2			0.21	7110		38800	318						258				41.1
STR05-1.5'	3/10/2001	10000	-1.1	15.1	63.4	0.45	-0.23	3520	13.3	6.7	14.1	-0.57	21700	12.4	2420	283	0.026	16	884	0.53	-0.57	229	-1.1		24.4	51
STR05-9'	3/10/2001	5400	-1.2	4.8	27	0.22	0.087	62400	7.3	4.2	5.4	0.28	14200	4.8	24500	2120	0.011	9.5	868	-0.58	-0.58	95	1.6		12.9	22.9
STR05-11.3'	3/10/2001	3910	-1.1	5.5	16.8	0.11	0.082	107000	7.3	4.7	6.7	0.23	9020	3.8	37800	432	-0.11	10.3	831	-0.54	-0.54	237	1.6		9.9	21.4
STR06-1'	3/11/2001	11000	-1.2	7.5	87	0.42	-0.24	2150	12.6	8.1	11.2	-0.59	16400	13.8	1690	729	0.028	13.3	672	-0.59	-0.59	1310	-1.2		24.3	42.9
STR06-15'	3/11/2001	13500	-1.2	8.4	198	0.66	0.34	42700	18	17	25.5	-0.61	27500	16.1	13200	937	0.028	36.3	2570	-0.61	-0.61	102	-1.2		25.4	77.9
STR07-1.5'	3/21/2001	10800	-1.2	7.4	103	0.66	0.3	7110	92.1	9.3	17.3	-0.6	19400	21.7	3440	844	0.035	17.3	1410	-0.6	-0.6	1470	-1.2		19.8	67.4
STR07-18'	3/21/2001	2130	-1.2	2.3	9.5	0.14	0.2	175000	4.1	2.8	10.4	-0.58	6390	6.7	35300	314	-0.12	7.4	517	-0.58	-0.58	247	1.1		7.9	30.8
STR08-1.5'	3/26/2001	13400	-1.2	5.9	120	0.73	-0.24	8260	20.2	9.4	15.8	-0.61	18600	19.5	4130	1010	0.033	15.9	1660	0.58	-0.61	-607	1.8		22.2	64
STR08-13'	3/26/2001	4460	-1.1	4.2	34.6	0.13	0.063	150000	9.4	5.2	9.7		13400	5.9	41700	587	-0.11	10.5				311	2.6		10.9	38.8
STR08-13' DUP	3/26/2001											0.29							1020	-0.57	-0.57					
STR09-7.5'	4/4/2001	11200	-1.2	10.7	80.8	0.34	0.32	2670	15.9	5.9	22.1	-0.61	21200	9.8	2390	555	0.033	21.7	1030	-0.61	-0.61	-606	-1.2		25.9	58.2
STR10-1.5'	4/7/2001		-1.1	16.2	105	1	0.57		15.6	10.9	21.4	-0.57		21.3			0.021	21.8		-0.57	-0.57		-1.1	1.6	30.4	61.4
STR10-11'	4/7/2001		-1.3	4.5	57.7	0.51	0.23		15.4	7.9	13.2	-0.63		10			0.031	17.4		-0.63	-0.63		-1.3	0.96	20.8	50.7
STR11-2'	8/20/2001	10000	-1.2	8.8	44.3	0.29	-0.24	810	10.3	6.8	13.3	-0.6	16700	10.2	1570	386	0.022	14.7	632	0.38	-0.6	-599	-1.2		21.2	48.1
STR11-9'	8/20/2001			19.4					15	14.8	23.9	-0.59	36200			317	0.012	36.1		0.57	-0.59					79.1
STR11-9' Blind Du	8/20/2001	10200	-1.2		56.9	0.57	0.29	54500						13.1	14400				1960			72.5	-1.2		21.5	
T-1-4	11/8/2001		65.1	580	25.8	0.14	1.3		232	7.9	1260	-0.64		19300			0.028	35.4		-0.64	5.6		31.8	158000	4.9	15.4
T-1-6	11/8/2001		-1.1	11	22.3	0.2	0.82		11.5	34.9	151	-0.56		94.7			-0.11	142		-0.56	-0.56		-1.1	36500	7	32.9
T-2-3	11/8/2001		-1.2	4.5	70	0.49	0.054		11.1	7.4	10.6	-0.6		13			0.02	14.2		0.73	-0.6		-1.2	7.4	15.4	38.4
T-2-9	11/8/2001		-1.1	2.7	19.1	0.064	0.085		5.6	3.7	7.7	-0.57		6.6			-0.11	8.7		0.43	-0.57		0.84	1.9	9.6	25.9
T-3-3	11/8/2001		1.5	9.1	132	0.29	0.52		13.8	6.4	44.8	-0.56		144			0.18	14.9		0.42	-0.56		-1.1	57.3	15.2	317
T-3-11	11/8/2001		-1.1	6.4	42.6	0.23	0.079		9.2	5.2	11.1	-0.56		7.9			0.017	11.2		0.4	-0.56		-1.1	4	14.4	33.4
T-4-3	11/9/2001		-1.1	8.9	72.6	0.36	0.11		10.9	6.7	13.4	-0.56		18.4			0.072	11.7		0.6	-0.56		-1.1	2.7	18.9	47.2
T-4-9	11/9/2001		0.6	6.8	83.3	0.3	0.18		10.2	6.1	44.8	-0.54		38.9			0.056	11.7		-0.54	-0.54		-1.1	6.7	16.1	87.6
T-5-3	11/9/2001		-1.2	4.8	106	0.65	0.11		17.5	9.2	15.2	-0.6		16.1			0.043	16.4		0.61	-0.6		-1.2	12.4	17.5	59.9
T-5-9	11/9/2001		-1.2	2.6	56.7	0.39	0.11		9.1	6.5	9.7	-0.6		8.1			-0.12	12		0.39	-0.6		-1.2	12.4	13.2	33.5
T-6-3	11/10/2001		-1.2	9.7	60.2	0.44	-0.24		14.5	8	16.5	-0.61		13.4			0.041	18.8		-0.61	-0.61		-1.2	3.3	23.2	55.8
T-6-7.5	11/11/2001		-1.4	5.2	112	-0.72	0.19		6.5	3.1	24.1	0.28		57.9			0.051	8.2		-0.72	-0.72		-1.4	37.8	7.1	103
T-6-10	11/10/2001		-1.1	6.9	78.3	0.4	0.056		9.5	5.9	11.9	-0.55		27.1			0.049	10.2		-0.55	-0.55		-1.1	2.1	17.4	47.6
T-8-3	11/11/2001		-1.3	5.1	92.1	0.59	0.066		13.5	9.3	11.9	-0.63		11.3			0.027	17.4		-0.63	-0.63		-1.3	1.6	19.7	43.6
T-8-9	11/11/2001		-1.1	4.2	56.4	0.19	0.11		6.3	4	6.1	-0.54		4.8			0.011	8.1		-0.54	-0.54		1.1	11.5	10	20.1
UAW01-30-1.5'	4/2/2001	11200	-1.2	8.6	109	0.48	0.63	23900	15.7	7.8	22	-0.58	18500	75.5	7000	429	0.071	17.3	915	-0.58	-0.58	92.9	-1.2	34.4	22.4	97.5
UAW01-30-15'	4/2/2001	2310	-1	3.5	8.4	0.052	0.21	118000	4.6	3.3	8.5	-0.52	5900	3.7	39500	201	-0.1	6.5	443	-0.52	-0.52	134	0.7		7.4	22.9
UAW04-20-10'	3/23/2001	8730	8.9	7.8	64.5	0.46	0.27	26300	11.3	7.3	12.2	-0.68	14600	10	7420	483	0.016	15	856	-0.68	-0.68	97.3	-1.4		15.7	44.1

TABLE A-4
SUMMARY OF METALS DATA - INORGANICS
Soil Samples
Morton International, Inc.
Reading, Ohio
Units: mg/kg

Sample Location	Sample Date	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide, Total	Iron	Lead	Magnesium	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Tin	Vanadium	Zinc
UAW05-20-13'	3/23/2001	10100	-1.2	3.4	52.6	0.48	0.36	99000	12.5	8	15.6	0.22	20500	8.8	20800	482	-0.12	18.3	2050	-0.58	-0.58	329	-1.2		17.9	45.6
UAW06-20-1.5'	3/26/2001	13300	-1.2	6.4	121	0.77	0.11	5520	30.3	9.5	16.6	-0.61	18700	23.8	2800	646	0.045	16.2	1720	0.91	-0.61	450	0.92		22.8	72
UAW06-20-11.5'	3/26/2001	1600	-1.1	1.2	5.6	-0.56	-0.23	124000	3.8	2	6.2	-0.56	4150	3.3	51000	387	-0.11	4.1	239	-0.56	-0.56	180	1.4		6.3	20.3
UAW08-20-13'	3/24/2001		-1.1	2	36.3	-0.56	0.23		51.7	28.8	20.8	0.19		6.1			0.024	22.9		-0.56	-0.56		1	24.8	10.8	142
UAW09-20-1.5'	3/27/2001	6280	-1.2	5.8	45.7	0.19	-0.23	1530	8.5	6.7	7.8	-0.58	11300	10.6	1260	516	0.013	9	572	0.51	-0.58	-584	-1.2		16.8	35.9
UAW09-20-15'	3/27/2001	1790	-1.1	4.2	7.5	-0.53	-0.21	106000	3.6	2.5	6	-0.53	5900	4.2	37100	156	-0.11	5.6	458	-0.53	-0.53	108	1.6		7.1	26.8
UAW11-40-2'	4/17/2001	11800	-1.2	5.2	79.8	0.6	-0.24	4100	13.1	8.7	12.5	-0.6	19400	11.9	2360	560	0.026	16.8	903	-0.6	-0.6	701	-1.2		19.6	44.8
UAW11-40-10'	4/17/2001	1920	-1.1	2.8	5.4	-0.57	0.061	125000	4.2	3.2	7.4	-0.57	6680	4.1	32600	232	-0.11	8.8	224	-0.57	-0.57	290	1.3		7.5	26
UAW12-20-12'	3/24/2001		-1.2	0.75	3.1	0.074	0.74		3.8	4	6.1	-0.61		3.1			-0.12	7.6		-0.61	-0.61		0.72	7.6	5.9	139
UAW13-20-1.5'	3/24/2001		-1.2	4.9	62.4	0.34	0.37		11.2	6.1	11.6	-0.58		15.4			0.067	12.2		-0.58	-0.58		0.68	18.1	17.3	50.6
UAW13-20-11.5'	3/24/2001		-1.2	0.75	2	0.07	0.21		3.9	3	5.1	0.22		3			-0.12	7.9		-0.6	-0.6		0.61	11.5	6.1	57.6
UAW14-10-1.5'	4/4/2001	11500	-1.2	6.4	117	0.72	0.34	5060	16.8	8.1	16.5	-0.59	16200	19.7	2110	1050	0.048	16	1340	-0.59	0.37	-589	-1.2		19.6	67.3
UAW15-20-2'	4/9/2001													13												
UAW15-20-2' DUP	4/9/2001	5940	-1.1	6.2	55.1	0.21	0.093	4310	7.6	5.8	10.3	-0.55	11400		1210	530	0.017	9.9	594	0.58	1.9	483	0.94		16.1	37.4
UAW15-20-8.5'	4/9/2001	6250	-1.1	6.9	38	0.18	0.057	1110	7.7	6.7	9.6	-0.56	13600	9	1590	431	0.018	12.5	608	0.44	-0.56	351	-1.1		16.9	38.2
UAW16-10-2'	8/22/2001	9160	-1.2	6.3	53.3	0.49	0.11	4430	12.8	5.3	11.3	-0.58	19500	11.6	1880	367	0.019	16	891	0.49	-0.58	133	-1.2		20.3	40
UAW16-10-5.5'	8/22/2001	1960	-1.1	2.6	8.4	-0.54	0.059	104000	4.7	2.5	6.6	1.7	5650	4.1	38800	371	-0.11	6.5	390	-0.54	-0.54	154	1.2		6.5	19.1
UAW17-40-1.5'	4/5/2001	10500	-1.1	7.5	118	0.26	0.73	39300	17.3	6.2	27.7	0.19	14800	28.4	10900	515	0.041	17.9	1330	-0.57	0.89	125	-1.1		19.4	97.5
UAW17-40-5'	4/5/2001	5160	1.8	9.1	559	0.34	1.8	63500	13.9	4.3	77.2	-0.64	16900	128	11100	940	-0.13	22.3	1150	-0.64	1.3	238	-1.3		11.2	418
UAW18-20-1'	8/23/2001	7790	-1.2	4	72.1	0.39	0.29	21600	15.2	6.9	11.2	-0.6	13900	14.2	7400	505	0.048	13.2	948	0.79	-0.6	737	0.71		15	47.2
UAW18-20-15'	8/23/2001	1980	-1.2	3.1	12.6	-0.61	0.076	135000	4.6	2.7	6.8	-0.61	7670	4	37000	295	-0.12	7	408	-0.61	-0.61	792	2.1		6.4	21.7
UAW19-80-1.5'	4/6/2001	13800	-1.2	8.5	60.3	0.36	0.15	2180	14.2	7.6	13.9	-0.61	16700	12.5	1850	212	0.015	14	962	-0.61	-0.61	-606	-1.2		26.4	48.9
UAW19-80-15'	4/6/2001	7980	-1.2	8.1	44.4	0.45	0.44	52800	11.7	9.3	19.2	-0.59	19100	10.3	14900	437	-0.12	23.5	1630	-0.59	-0.59	106	-1.2		16.2	62.6
UAW20-60-1.5'	4/9/2001	8300	-1.1	6.4	69.5	0.57	0.18	27800	8	5.6	13.3	-0.56	12600	22.2	4210	334	0.058	12.3	833	0.36	0.42	2410	-1.1		16.2	49.8
UAW20-60-9.5'	4/9/2001	12800	-1.2	7.7	48.9	0.66	0.38	50900	11.5	14.1	23	-0.61	25500	12.6	15900	318	0.032	32.8	2620	0.64	-0.61	317	-1.2		24.7	75.1
UAW21-30-1.5'	4/11/2001	6490	-1.2	7.8	93	0.32	0.13	1930	9.1	6.2	9.8	-0.59	12100	780	1260	608	0.11	9.8	543	0.41	-0.59	224	-1.2		17.1	56.4
UAW21-30-10'	4/11/2001	2220	-1.1	4.4	10.7	0.093	0.1	97800	3.5	2.7	8	-0.56	5820	9.1	30500	180	-0.11	6.4	447	-0.56	-0.56	131	-1.1		6.9	21.2
UAW22-20-2'	9/5/2001	6180	-1.1	6	48	0.32	0.56	90100	9.6	5.4	11.1	-0.56	12200	13.5	9680	760	0.03	10.9	777	-0.56	-0.56	252	1		12.5	53.3
UAW22-20-11'	9/5/2001	1510	-1.1	1.3	7.4	0.053	0.16	131000	3.2	1.8	5.4	0.44	5770	3.5	41200	257	0.019	4.5	287	-0.56	-0.56	203	1.9		5	16.3
Count		78	113	113	113	113	113	78	113	113	113	105	78	113	78	78	113	113	78	113	105	78	113	40	113	113
Number of Detects		78	5	113	113	104	101	78	113	113	113	17	78	113	78	78	82	113	78	38	6	60	36	40	113	113
Number of Non-Detects		0	108	0	0	9	12	0	0	0	0	88	0	0	0	0	31	0	0	75	99	18	77	0	0	0
Maximum Detection		14100	65.1	580	691	1	6.5	175000	232	82.8	1260	1.7	36200	19300	95200	2120	0.57	142	3810	1.1	5.6	2410	31.8	158000	30.4	418
Minimum Detection		1380	0.6	0.75	2	0.052	0.054	810	2.3	1	4.6	0.19	3500	2.2	885	130	0.011	4.1	224	0.36	0.37	72.5	0.61	0.96	1.6	8.9
Maximum Detection Limit		0	1.4	0	0	0.72	0.26	0	0	0	0	0.68	0	0	0	0	0.13	0	0	0.72	0.72	640	1.4	0	0	0
Minimum Detection Limit		0	1	0	0	0.53	0.21	0	0	0	0	0.51	0	0	0	0	0.1	0	0	0.52	0.51	568	1	0	0	0
Location of Maximum		DP08-6'	T-1-4	T-1-4	DP17-13'	STR10-1.5'	DP25-2.5'	STR02-12.5'	T-1-4	DP15-9'	T-1-4	UAW16-10-5.5'	STR11-9'	T-1-4	STR02-12.5'	STR05-9'	DP17-13'	T-1-6	DP44-1.5	DP23-9'	T-1-4	UAW20-60-1.5'	T-1-4	T-1-4	STR10-1.5'	UAW17-40-5'

Notes:

Negative values (shaded boxes) represent non-detect values.

Highlight rows indicate duplicate samples. The highest duplicate sample result was used in the analysis.

Appendix B

Data Summary for Chemicals Detected in Groundwater

TABLE B-1
SUMMARY OF VOLATILE ORGANIC COMPOUND DATA
Groundwater Samples
Morton International, Inc.
Reading, Ohio
Units: µg/L

Sample Location	Sample Data	Acetone	Benzene	Bromodichloro-methane	2-Butanone	Carbon disulfide	Chlorobenzene	Chloroform	Cyclohexane	Dichloro-difluoromethane	1,1-Dichloroethane	1,2-Dichloroethane	cis-1,2-Dichloroethene	Ethylbenzene	Isopropylbenzene	4-Methyl-2-pentanone (MIBK)	Methylcyclohexane	Methylene chloride	Tetrachloroethene	Toluene	1,1,1-Trichloroethane	1,1,2-Trichloroethane	Trichloroethene	Vinyl chloride	Xylenes (total)
MW-EPA-1	5/8/2001	-500	-50	-50	-500	-50	1600	-50	-50	-50	-50	-50	-25	19	-50	-500	-50	-50	-50	-50	-50	-50	-50	-100	30
MW-EPA-1	11/15/2001	63	31	-83	-830	-83	3200	-83	-83	-83	-83	-83	-42	40	-83	-830	-83	140	-83	59	-83	-83	-83	-170	93
MW-EPA-2	5/8/2001	-10	-1	-1	-10	-1	-1	1	-1	-1	-1	-1	-0.5	-1	-1	-10	-1	0.98	15	-1	-1	-1	-1	-2	-1
MW-EPA-2	11/14/2001	2	-3.3	-3.3	-33	-3.3	-3.3	0.81	-3.3	-3.3	-3.3	-3.3	-1.7	-3.3	-3.3	-33	-3.3	2	45	-3.3	-3.3	-3.3	-3.3	-6.7	-3.3
MW-EPA-3	5/6/2001	-10	-1	-1	-10	-1	-1	-1	-1	-1	-1	-1	-0.5	-1	-1	-10	-1	-1	-1	-1	-1	-1	-1	-2	-1
MW-EPA-3	11/13/2001	2.6	-1	-1	-10	-1	-1	-1	-1	-1	-1	-1	-0.5	-1	-1	-10	-1	-1	-1	0.3	-1	-1	-1	-2	-1
MW-EPA-4	5/8/2001	-10	-1	-1	-10	-1	-1	-1	-1	-1	-1	-1	-0.5	-1	-1	-10	-1	-1	-1	-1	-1	-1	-1	-2	-1
MW-EPA-4	11/13/2001	2.5	-1	-1	-10	-1	-1	-1	-1	-1	-1	-1	-0.5	-1	-1	-10	-1	-1	-1	-1	0.2	-1	-1	-2	-1
Recovery Well	7/29/2001	1600	-29	-29	-290	-29	8.7	-29		-57	-29	-29	-14	-29		-140		-29	-29	-29	-29	-29	-29	-57	-29
UAW01-30	5/4/2001	-10	-1	-1	-10	-1	1.6	-1	-1	0.41	-1	-1	-0.5	-1	-1	-10	-1	-1	-1	-1	-1	-1	-1	-2	-1
UAW01-30	11/8/2001	-10	-1	-1	-10	-1	0.5	-1	-1	0.38	-1	-1	-0.5	-1	-1	-10	-1	-1	-1	-1	-1	-1	-1	-2	-1
UAW02-20 DUP	5/7/2001	-12		-1.2	-12	-1.2		-1.2	-1.2	-1.2		0.44	-0.62	-1.2	-1.2	-10	-1.2	-1.2	-1.2	-1.2	-1.2	-1.2	-1.2	-2.5	-1.2
UAW02-20	5/7/2001		0.49				32				0.74														
UAW02-20	11/10/2001	-10	0.6	-1	-10	-1	32	-1	-1	-1	0.21	-1	-0.5	-1	-1	-10	-1	-1	-1	0.45	-1	-1	-1	-2	-1
UAW03-20	5/7/2001	3.4	1.2	-1	-10	1.5	8.6	-1	-1	-1	0.84	14	-0.5	0.55	-1	-10	0.41	-1	-1	12	-1	-1	-1	-2	2.5
UAW03-20	11/11/2001	3.8	1.4	-2.5	-25	-2.5	41	-2.5	0.73	-2.5	-2.5	1.2	-1.2	1.6	0.34	-25	2.6	1.3	-2.5	3.6	-2.5	-2.5	-2.5	-5	4.5
UAW04-20	5/7/2001	-10000	-1000	-1000	-10000	-1000	-1000	-1000	-1000	-1000	-1000	-1000	-500	-1000	-1000	-10000	-1000	-1000	-1000	21000	-1000	-1000	-1000	-2000	-1000
UAW04-20	11/11/2001	590	-250	-250	-2500	-250	-250	-250	-250	-250	-250	-250	-120	-250	-250	-2500	-250	200	-250	8800	-250	-250	-250	-500	-250
UAW05-20	5/6/2001	-400	-40	-40	-400	-40	460	-40	-40	-40	-40	-40	-20	-40	-40	-400	-40	-40	-40	-40	-40	-40	-40	-80	-40
UAW05-20	10/10/2001	22	-40	-40	-400	-40	440	-40	-40	-40	-40	-40	-20	-40	-40	-400	-40	-40	-40	-40	-40	-40	-40	-80	-40
UAW05-20	11/12/2001	-220	-22	-22	-220	-22	390	-22	-22	-22	-22	-22	-11	4	-22	-220	3.5	-22	-22	-22	-22	-22	-22	-44	10
UAW06-20	5/6/2001	720	-10	-10	-100	-10	70	-10	-10	-10	-10	-10	-5	-10	-10	-100	-10	-10	-10	-10	-10	-10	-10	-20	-10
UAW06-20	10/10/2001	11000	-170	-170	-1700	-170	100	-170	-170	-170	-170	-170	-83	-170	-170	-1700	-170	-170	-170	-170	-170	-170	-170	-330	-170
UAW06-20	11/13/2001	45000	-670	-670	750	-670	110	-670	-670	-670	-670	-670	-330	-670	-670	-6700	-670	-670	-670	-670	-670	-670	-670	-1300	-670
UAW07-20 DUP	5/8/2001	-25		-2.5	-25			-2.5		-5		-2.5	-1.2			-10		-2.5	-2.5	3.6	-2.5	-2.5	-2.5	-5	13
UAW07-20	5/8/2001		2.1			2.4	39				1.6			4.4											
UAW07-20	11/15/2001	3.3	5.2	-2	-2	-2	64	-2		-4	1.2	-2	-1	5.6		-10		2.3	-2	1.2	-2	-2	-2	-4	13
UAW08-20	5/6/2001	150	41	-33	-330	20	37	-33		-67	-33	-33	-17	32		-170		-33	-33	1100	-33	-33	-33	-67	140
UAW08-20	11/13/2001	580	110	-100	130	64	61	-100		-200	-100	-100	-50	57		-500		42	-100	1400	-100	-100	-100	-200	190
UAW09-20	5/5/2001	-10	-1	0.49	-10	-1	-1	0.4	-1	-1	-1	-1	-0.5	-1	-1	-10	-1	-1	-1	-1	-1	-1	-1	-2	-1
UAW09-20	11/9/2001	-10	-1	0.2	-10	-1	-1	-1	-1	-1	-1	-1	-0.5	-1	-1	-10	-1	-1	-1	-1	-1	-1	0.28	-2	-1
UAW11-10	5/8/2001	32000	-500	-500	-5000	270	-500	-500	-500	-500	-500	-500	-250	-500	-500	-5000	-500	-500	-500	-500	-500	-500	-500	-1000	-500
UAW11-10	11/10/2001	14000	-250	-250	-2500	-250	-250	-250	-250	-250	-250	-250	-120	-250	-250	-2500	-250	190	-250	-250	-250	-250	-250	-500	-250
UAW12-20	5/6/2001	-560	-56	-56	-560	-56	920	-56		-110	-56	-56	-28	-56		-280		-56	-56	-56	-56	-56	-56	-110	-56
UAW12-20	11/15/2001	-500	-50	-50	-500	-50	1400	-50		-100	-50	-50	-25	-50		-250		79	-50	-50	-50	-50	-50	-100	-50
UAW13-20	5/6/2001	180	21	-10	-100	170	20	-10		-20	4.9	-10	1.7	-10		-50		-10	-10	250	-10	-10	-10	-20	5.4
UAW13-20	11/15/2001	450	20	-17	38	140	31	-17		-33	-17	-17	-8.3	4.1		22		25	-17	350	-17	-17	-17	-33	9.1
UAW14-10	5/5/2001	-10	-1	-1	-10	-1	-1	0.37	-1	-1	-1	0.67	-0.5	-1	-1	-10	-1	-1	-1	-1	-1	-1	-1	-2	-1
UAW14-10	11/9/2001	-10	-1	-1	-10	-1	-1	-1	-1	-1	-1	-1	-0.5	-1	-1	-10	-1	-1	-1	-1	-1	-1	0.31	-2	-1
UAW15-20	5/6/2001	-10	-1	-1	-10	-1	-1	3.1	-1	-1	-1	-1	-0.5	-1	-1	-10	-1	-1	-1	-1	-1	-1	-1	-2	-1
UAW15-20	11/11/2001	-10	-1	-1	-10	-1	-1	14	-1	-1	-1	-1	-0.5	-1	-1	-10	-1	-1	-1	5.8	-1	-1	-1	-2	-1
UAW16-10 Blind Dup	10/12/2001						24																		

TABLE B-1
SUMMARY OF VOLATILE ORGANIC COMPOUND DATA
Groundwater Samples
Morton International, Inc.
Reading, Ohio
Units: µg/L

Sample Location	Sample Data	Acetone	Benzene	Bromodichloro-methane	2-Butanone	Carbon disulfide	Chlorobenzene	Chloroform	Cyclohexane	Dichloro-difluoromethane	1,1-Dichloroethane	1,2-Dichloroethane	cis-1,2-Dichloroethene	Ethylbenzene	Isopropylbenzene	4-Methyl-2-pentanone (MIBK)	Methylcyclohexane	Methylene chloride	Tetrachloroethene	Toluene	1,1,1-Trichloroethane	1,1,2-Trichloroethane	Trichloroethene	Vinyl chloride	Xylenes (total)
UAW16-10	10/12/2001	8000	-120	-120	-1200	-120		-120	-120	-120	-120	-120	-62	-120	-120	-1000	-120	-120	-120	-120	-120	-120	-120	-250	-120
UAW16-10	11/13/2001	6100	-100	-100	-1000	-100	23	-100	-100	-100	-100	-100	-50	-100	-100	-1200	-100	57	-100	-100	-100	-100	-100	-200	-100
UAW18-20	10/12/2001	1.4	-1	-1	0.42	5.7	2.2	-1	-1	-1	0.29	-1	-0.5	-1	-1	-10	-1	-1	-1	0.22	-1	-1	-1	-2	-1
UAW18-20	11/13/2001	4.5	-2	-2	1.4	1.9	1.7	-2	-2	-2	0.49	-2	-1	-2	-2	-20	-2	-2	-2	-2	-2	-2	-2	-4	-2
UAW21-30	5/5/2001	-10	-1	-1	-10	-1	-1	-1	-1	-1	-1	-1	-0.5	-1	-1	-10	-1	-1	-1	-1	-1	-1	-1	-2	-1
UAW21-30	11/11/2001	0.8	-1	-1	-10	-1	-1	0.23	-1	-1	-1	-1	-0.5	-1	-1	-10	-1	-1	-1	-1	-1	-1	-1	-2	-1
UAW22-20	10/13/2001	6.2	1.3	-2.5	-25	-2.5	29	-2.5	-2.5	-2.5	53	2.5	6.9	-2.5	-2.5	-25	-2.5	1.6	-2.5	0.92	-2.5	-2.5	0.39	14	-2.5
UAW22-20	11/13/2001	5.3	2.2	-6.9	10	-6.9	38	-6.9	-6.9	-6.9	66	2.3	16	-6.9	-6.9	-69	-6.9	4.4	-6.9	1.3	-6.9	-6.9	2	15	-6.9
UAW23-20	10/12/2001	11	-20	-20	-200	-20	-20	67	-20	-20	20	660	25	-20	-20	-200	-20	-20	82	-20	51	6.3	8.4	-40	-20
UAW23-20	11/14/2001	200	-20	-20	-200	-20	-20	60	-20	-20	17	510	21	-20	-20	-200	-20	15	61	-20	50	-20	8.8	-40	-20
UAW25-20	10/13/2001	1.5	0.6	-1	0.48	-1	9	-1	-1	-1	0.28	-1	-0.5	-1	-1	-10	-1	-1	-1	0.61	-1	-1	-1	-2	-1
UAW25-20	11/13/2001	2.3	0.33	-1	-10	-1	11	-1	-1	-1	0.17	-1	-0.5	-1	-1	-10	-1	-1	-1	0.77	-1	-1	-1	-2	-1
	Count	51	51	51	51	51	51	51	42	51	51	51	51	51	42	51	42	51	51	51	51	51	51	51	51
	Number of Detects	29	15	2	7	9	31	9	1	2	14	8	5	10	1	1	3	14	4	19	3	1	6	2	11
	Number of Non-Detects	22	36	49	44	42	20	42	41	49	37	43	46	41	41	50	39	37	47	32	48	50	45	49	40
	Minimum Detection	0.8	0.33	0.2	0.42	1.5	0.5	0.23	0.73	0.38	0.17	0.44	1.7	0.55	0.34	22	0.41	0.98	15	0.22	0.2	6.3	0.28	14	2.5
	Maximum Detection	45000	110	0.49	750	270	3200	67	0.73	0.41	66	660	25	57	0.34	22	3.5	200	82	21000	51	6.3	8.8	15	190
	Minimum Detection Limit	10	1	1	2	1	1	1	1	1	1	1	0.5	1	1	10	1	1	1	1	1	1	1	2	1
	Maximum Detection Limit	10000	1000	1000	10000	1000	1000	1000	1000	1000	1000	1000	500	1000	1000	10000	1000	1000	1000	670	1000	1000	1000	2000	1000
	Location of Maximum	UAW06-20	UAW08-20	UAW09-20	UAW06-20	UAW11-10	MW-EPA-1	UAW23-20	UAW03-20	UAW01-30	UAW22-20	UAW23-20	UAW23-20	UAW08-20	UAW03-20	UAW13-20	UAW05-20	UAW04-20	UAW23-20	UAW04-20	UAW23-20	UAW23-20	UAW23-20	UAW22-20	UAW08-20

Notes:

Negative values (shaded boxes) represent non-detect values.

Highlight rows indicate duplicate samples. The highest duplicate sample result was used in the analysis.

TABLE B-2
SUMMARY OF SEMIVOLATILE ORGANIC COMPOUND DATA
Groundwater Samples
Morton International, Inc.
Reading,Ohio
Units: µg/L

Sample Location	Sample Date	Acenaphthene	Aniline	Benzaldehyde	1,1'Biphenyl	Butyl Benzyl phthalate	Caprolactam	2-Chlorophenol	1,2-Dichloro-benzene	1,3-Dichloro-benzene	1,4-Dichlorobenzene	2,4-Dichlorophenol	Dinoctyl phthalate	bis(2Ethylhexyl) phthalate	Fluorene	2-Methylphenol	4-Methylphenol	1,2,4-Trichloro-benzene
MWEPA1	5/8/2001	-120		-120	-120	-120	-120	-120	940	-120	160	-120	-120	-120	-120	-120	-120	-120
MWEPA1	11/15/2001	-200		-200	-200	-200	-200	-200	1700	35	260	-200	-200	-200	-200	-200	-200	-200
MWEPA2	5/8/2001	-10		-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10
MWEPA2	11/14/2001	-10		-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10
MWEPA3	5/6/2001	-10		-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10
MWEPA3	11/13/2001	-10		-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10
MWEPA4	5/8/2001	-10		-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10
MWEPA4	11/13/2001	-10		-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10
Recovery Well	7/29/2001	-10	4.6			-10		-10	2.4	-10	-10	-10	-10	-10	-10	-10	-10	-10
UAW0130	5/4/2001	-10		-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	3.4	-10	-10	-10	-10
UAW0130	11/8/2001	-10		-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10
UAW0220	5/7/2001	-10		-10	-10	-10	-10	-10	12	-10	3.7	-10	-10	-10	-10	-10	-10	-10
UAW0220 DUP	5/7/2001																	
UAW0220	11/10/2001	-10		-10	-10	-10	-10	-10	12	-10	4.1	-10	-10	-10	-10	-10	-10	-10
UAW0320	5/7/2001	-10		-10	-10	-10	-10	-10	19	-10	3.3	-10	-10	-10	-10	-10	7.7	-10
UAW0320	11/11/2001	-20		-20	-20	-20	-20	-20	140	3.5	19	-20	-20	-20	-20	-20	-20	-20
UAW0420	5/7/2001	-40		53	-40	-40	-40	-40	-40	-40	-40	-40	-40	-40	-40	140	150	-40
UAW0420	11/11/2001	-100		-100	-100	-100	-100	-100	-100	-100	-100	-100	-100	-100	-100	47	57	-100
UAW0520	5/6/2001	-100		-100	-100	-100	-100	-100	880	-100	120	-100	-100	-100	-100	-100	-100	-100
UAW0520	10/10/2001	-10		-10	-10	-10	-10	6.3		20		2.8	-10	-10	-10	-10	-10	2.4
UAW0520	11/12/2001	-100		-100	-100	-100	-100	-100	590	16	82	-100	-100	-100	-100	-100	-100	-100
UAW0620	5/6/2001	-10		-10	-10	-10	-10	-10	14	-10	-10	-10	-10	-10	-10	-10	-10	-10
UAW0620	10/10/2001	-25		-25	-25	-25	-25	-25	16	-25	-25	-25	-25	-25	-25	-25	-25	-25
UAW0620	11/13/2001	6.4		-25	7.3	-25	-25	-25	25	-25	4	-25	-25	-25	5.9	-25	5.4	-25
UAW0720	5/8/2001	-100	150			-100		-100	37	-100	-100	-100	-100	-100	-100	-100	-100	-100
UAW0720 DUP	5/8/2001																	
UAW0720	11/15/2001	-40	120			-40		-40	57	-40	8	-40	-40	-40	-40	-40	-40	-40
UAW0820	5/6/2001	-1700	12000			-1700		-1700	-1700	-1700	-1700	-1700	-1700	-1700	-1700	-1700	-1700	-1700
UAW0820	11/13/2001	-1300	12000			-1300		-1300	530	-1300	-1300	-1300	-1300	-1300	-1300	-1300	330	-1300
UAW0920	5/5/2001	-10		-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10
UAW0920	11/9/2001	-10		-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10
UAW1110	5/8/2001	-500		-500	-500	-500	-500	-500	-500	-500	-500	-500	-500	-500	-500	-500	-500	-500
UAW1110	11/10/2001	-25		-25	-25	-25	-25	-25	13	-25	3.7	-25	-25	-25	-25	-25	9	-25
UAW1220	5/6/2001	-250	250			-250		-250	1600	-250	150	-250	-250	-250	-250	-250	-250	-250
UAW1220	11/15/2001	-200	200			-200		-200	1900	41	230	-200	-200	-200	-200	-200	-200	-200
UAW1320	5/6/2001	-200	400			-200		-200	-200	-200	-200	-200	-200	-200	-200	-200	-200	-200
UAW1320	11/15/2001	-200	200			-200		-200	49	-200	-200	-200	-200	-200	-200	-200	-200	-200
UAW1410	5/5/2001	-10		-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10
UAW1410	11/9/2001	-10		-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10

TABLE B-2
SUMMARY OF SEMIVOLATILE ORGANIC COMPOUND DATA
Groundwater Samples
Morton International, Inc.
Reading,Ohio
Units: µg/L

Sample Location	Sample Date	Acenaphthene	Aniline	Benzaldehyde	1,1'Biphenyl	Butyl Benzyl phthalate	Caprolactam	2-Chlorophenol	1,2-Dichloro-benzene	1,3-Dichloro-benzene	1,4-Dichlorobenzene	2,4-Dichlorophenol	Dinoctyl phthalate	bis(2Ethylhexyl) phthalate	Fluorene	2-Methylphenol	4-Methylphenol	1,2,4-Trichloro-benzene
UAW1520	5/6/2001	-10		-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10
UAW1520	11/11/2001	-10		-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10
UAW1610	10/12/2001	-10		-10	-10	-10	19	-10	6.9	-10	12	-10	-10	-10	-10	-10		-10
UAW1610 Blind Dup.	10/12/2001																3.4	
UAW1610	11/13/2001	-10		-10	-10	-10	-10	-10	7.5	-10	10	-10	-10	-10	-10	-10	-10	-10
UAW1820	10/12/2001	-10		-10	-10	-10	6	-10	5.7	-10	2.8	-10	-10	-10	-10	-10	-10	-10
UAW1820	11/13/2001	-10		-10	-10	2.7	14	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10
UAW2130	5/5/2001	-10		-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10
UAW2130	11/11/2001	-10		-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10
UAW2220	10/13/2001	-10		-10	-10	-10	2.5	-10	70	1.6	9.7	-10	-10	-10	-10	-10	-10	-10
UAW2220	11/13/2001	-10		-10	-10	2.3	2.6	-10	78	1.7	9.9	-10	1.2	-10	-10	-10	-10	-10
UAW2320	10/12/2001	-10		-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10
UAW2320	11/14/2001	-10		-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10
UAW2520	10/13/2001	-10		-10	-10	-10	-10	-10	11	-10	3	-10	-10	-10	-10	-10	-10	-10
UAW2520	11/13/2001	-10		-10	-10	-10	-10	-10	11	-10	3.2	-10	-10	-10	-10	-10	-10	-10
	Count	51	9	42	42	51	42	51	50	51	50	51	51	51	51	51	51	51
	Number of Detects	1	9	1	1	2	5	1	26	7	20	1	1	1	1	2	7	1
	Number of Non-Detects	50	0	41	41	49	37	50	24	44	30	50	50	50	50	49	44	50
	Minimum Detection	6.4	4.6	53	7.3	2.3	2.5	6.3	2.4	1.6	2.8	2.8	1.2	3.4	5.9	47	3.4	2.4
	Maximum Detection	6.4	12000	53	7.3	2.7	19	6.3	1900	41	260	2.8	1.2	3.4	5.9	140	330	2.4
	Minimum Detection Limit	10	0	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Maximum Detection Limit	1700	0	500	500	1700	500	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
	Location of Maximum	UAW0620	UAW0820	UAW0420	UAW0620	UAW1820	UAW1610	UAW0520	UAW1220	UAW1220	MWEPA1	UAW0520	UAW2220	UAW0130	UAW0620	UAW0420	UAW0820	UAW0520

Notes:

Negative values (shaded boxes) represent non-detect values.

Highlight rows indicate duplicate samples. The highest duplicate sample result was used in the analysis.

TABLE B-3
SUMMARY OF PESTICIDES AND PCB DATA
Groundwater Samples
Morton International, Inc.
Reading, Ohio
Units: µg/L

Sample Location	Sample Date	Aldrin	Aroclor 1242	alpha-BHC	beta-BHC	delta-BHC	alpha-Chlordane	4,4'-DDD	4,4'-DDE	4,4'-DDT	Dieldrin	Endosulfan I	Endosulfan II	Endrin	Endrin aldehyde	Endrin ketone	gamma-BHC (Lindane)	Heptachlor	Heptachlor epoxide	Isodrin
MW-EPA-1	5/8/2001	-0.25	-1	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25	0.11	-0.25	0.13	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25	
MW-EPA-1	11/15/2001	-2.5	-1	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	
MW-EPA-2	5/8/2001	-0.05	-1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	
MW-EPA-2	11/14/2001	-0.1	-1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	
MW-EPA-3	5/6/2001	-0.05	-1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	
MW-EPA-3	11/13/2001	-0.05	-1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	
MW-EPA-4	5/8/2001	-0.05	-1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	
MW-EPA-4	11/13/2001	-0.05	-1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	
Recovery Well	7/29/2001	-0.1	-200	-0.1	-0.1	-0.1		-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1		-0.1	-0.1	-0.1	-0.2
UAW01-30	5/4/2001	-0.05	-1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	0.03	-0.05	
UAW01-30	11/8/2001	-0.05	-1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	
UAW02-20	5/7/2001	-0.05	-1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	
UAW02-20 DUP	5/7/2001																			
UAW02-20	11/10/2001	-0.05	-1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	
UAW03-20	5/7/2001	-0.05	-2	-0.05	-0.05	-0.05	0.053	0.074	-0.05	-0.05	0.062	-0.05	-0.05	-0.05	-0.05	0.14	-0.05	-0.05	0.041	
UAW03-20	11/11/2001	-0.05	-1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	0.03	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	
UAW04-20	5/7/2001	-0.05	-1	-0.05	0.041	-0.05	0.039	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	
UAW04-20	11/11/2001	-0.05	-1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	
UAW05-20	5/6/2001	-0.05	-1	0.029	-0.05	-0.05	-0.05	0.03	-0.05	-0.05	-0.05	0.021	0.028	-0.05	0.097	-0.05	-0.05	-0.05	-0.05	
UAW05-20	10/10/2001	-0.05	-1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	0.022	-0.05	-0.05	-0.05	-0.05	-0.05	0.028	
UAW05-20	11/12/2001	-0.05	0.92	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	
UAW06-20	5/6/2001	-0.05	-1	-0.05	0.16	0.023	-0.05	-0.05	0.024	0.022	0.033	-0.05	0.039	-0.05	-0.05	0.045	-0.05	-0.05	-0.05	
UAW06-20	10/10/2001	-0.05	-1	-0.05	0.12	-0.05	0.026	-0.05	-0.05	-0.05	0.022	-0.05	0.034	-0.05	-0.05	-0.05	-0.05	0.054	-0.05	
UAW06-20	11/13/2001	-25	-1	-25	-25	-25	-25	-25	-25	-25	-25	-25	-25	-25	-25	-25	-25	-25	-25	
UAW07-20	5/8/2001											0.19	0.13							
UAW07-20 DUP	5/8/2001	-0.5	-10	-0.5	-0.5	-0.5		-0.5	-0.5	-0.5	-0.5			-0.5	0.35		-0.5	-0.5	-0.5	-1
UAW07-20	11/15/2001	-2.5	-1	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-5
UAW08-20	5/6/2001	-1	-1	-1	-1	-1		-1	-1	-1	-1	-1	-1	-1	-1		-1	-1	-1	-2
UAW08-20	11/13/2001	-0.5	-1	0.32	-0.5	-0.5		-0.5	-0.5	-0.5	0.52	-0.5	-0.5	-0.5	-0.5		-0.5	0.49	0.32	-1
UAW09-20	5/5/2001	-0.05	-1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	
UAW09-20	11/9/2001	-0.05	-1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	
UAW11-10	5/8/2001	0.42	-1	-0.05	-0.05	0.11	-0.05	-0.05	-0.05	-0.05	0.054	-0.05	-0.05	0.043	-0.05	-0.05	-0.05	0.1	-0.05	
UAW11-10	11/10/2001	-0.05	-1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	
UAW12-20	5/6/2001	-0.05	-1	-0.05	0.017	0.058		0.045	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05		-0.05	-0.05	-0.05	0.017
UAW12-20	11/15/2001	-0.05	-1	-0.05	-0.05	-0.05		0.022	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	0.033		-0.05	0.09	-0.05	-0.1
UAW13-20	5/6/2001	-0.5	-1	-0.5	-0.5	-0.5		-0.5	-0.5	-0.5	0.25	-0.5	-0.5	-0.5	-0.5		-0.5	-0.5	0.91	-1
UAW13-20	11/15/2001	-5	-1	-5	-5	-5		-5	-5	-5	-5	-5	-5	-5	-5		-5	-5	-5	-10
UAW14-10	5/5/2001	-0.05	-1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	
UAW14-10	11/9/2001	-0.05	-1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	
UAW15-20	5/6/2001	-0.05	-1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	
UAW15-20	11/11/2001	-0.05	-1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	
UAW16-10	10/12/2001	-2.5	130	-2.5	-2.5	-2.5	-2.5	-2.5			-25	-25	-25	-25	-2.5	-2.5	-2.5	-2.5	-2.5	

TABLE B-3
SUMMARY OF PESTICIDES AND PCB DATA
Groundwater Samples
Morton International, Inc.
Reading, Ohio
Units: µg/L

Sample Location	Sample Date	Aldrin	Aroclor 1242	alpha-BHC	beta-BHC	delta-BHC	alpha-Chlordane	4,4'-DDD	4,4'-DDE	4,4'-DDT	Dieldrin	Endosulfan I	Endosulfan II	Endrin	Endrin aldehyde	Endrin ketone	gamma-BHC (Lindane)	Heptachlor	Heptachlor epoxide	Isodrin
UAW16-10 Blind Dup.	10/12/2001								-10	-10										
UAW16-10	11/13/2001	-0.05	-1	0.053	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	0.041	-0.05	-0.05	
UAW18-20	10/12/2001	0.03	-1	-0.05	0.51	-0.05	-0.05	-0.05	0.021	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	
UAW18-20	11/13/2001	-0.1	-1	-0.1	0.24	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.14	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	
UAW21-30	5/5/2001	-0.05	-1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	
UAW21-30	11/11/2001	-0.05	0.45	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	
UAW22-20	10/13/2001	-0.25	-1	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25	
UAW22-20	11/13/2001	-0.05	-1	-0.05	0.21	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	
UAW23-20	10/12/2001	-2	-1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	
UAW23-20	11/14/2001	-2.5	-1	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	-2.5	
UAW25-20	10/13/2001	-0.05	-1	-0.05	0.16	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	
UAW25-20	11/13/2001	-0.05	-1	-0.05	0.14	-0.05	-0.05	-0.05	-0.05	-0.05	0.051	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	0.022	
	Count	51	51	51	51	51	43	51	51	51	51	51	51	51	51	43	51	51	51	9
	Number of Detects	2	3	3	9	3	3	4	2	1	8	2	8	1	3	2	1	5	5	1
	Number of Non-Detects	49	48	48	42	48	40	47	49	50	43	49	43	50	48	41	50	46	46	8
	Minimum Detection	0.03	0.45	0.029	0.017	0.023	0.026	0.022	0.021	0.022	0.022	0.021	0.022	0.043	0.033	0.045	0.041	0.03	0.022	0.017
	Maximum Detection	0.42	130	0.32	0.51	0.11	0.053	0.074	0.024	0.022	0.52	0.19	0.14	0.043	0.35	0.14	0.041	0.49	0.91	0.017
	Minimum Detection Limit	0.05	1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.1
	Maximum Detection Limit	25	200	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	10
	Location of Maximum	UAW11-10	UAW16-10	UAW08-20	UAW18-20	UAW11-10	UAW03-20	UAW03-20	UAW06-20	UAW06-20	UAW08-20	UAW07-20	UAW18-20	UAW11-10	UAW07-20 DUP	UAW03-20	UAW16-10	UAW08-20	UAW13-20	UAW12-20

Notes:

Negative values (shaded boxes) represent non-detect values.

Highlight rows indicate duplicate samples. The highest duplicate sample result was used in the analysis.

TABLE B-4
SUMMARY OF METALS DATA
Groundwater Samples
Morton International, Inc.
Reading, Ohio
Units: µg/l

Sample Location	Sample Date	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Calcium-DISS	Chromium	Cobalt	Copper	Cyanide, Total	Iron	Iron-DISS	Lead	Magnesium	Magnesium-DISS	Manganese	Nickel	Potassium	Potassium-DISS	Selenium	Sodium	Sodium-DISS	Thallium	Tin	Total Sulfide	Vanadium	Zinc
MW-EPA-1	5/8/2001	129	3.3	246	287	-5	-2	354000	365000	73	2.1	-25	-10	7800	-100	-3	126000	127000	330	112	12000	12000	-5	472000	474000	7.6		2600	4.6	-20
MW-EPA-1	11/15/2001	138	-10	611	217	-5	-2	435000	418000	9.8	1.4	-25	3.6	2140	240	-3	173000	152000	520	32.1	17600	15700	-5	642000	584000	5.6		7500	5.8	-20
MW-EPA-2	5/8/2001	38400	3.6	27.4	496	1.9	0.65	327000	266000	1250	38.9	74.3	-10	64800	-100	27.6	114000	91100	1610	271	15900	3860	5	480000	486000	10.4		4500	85.2	193
MW-EPA-2	11/14/2001	39300	5.4	31.7	292	1.8	5.2	254000	151000	1750	51.2	109	2.6	74600	-100	32.4	88100	50700	1640	369	13300	2190	-5	336000	340000	10.8		1100	91.7	280
MW-EPA-3	5/6/2001	1330	-10	-10	71.9	-5	1.5	188000	274000	29.9	2.8	11.2	-10	5540	-100	-3	68900	94600	357	34.4	1770	1500	-5	26300	31700	9.4		-1000	2.4	71.3
MW-EPA-3	11/13/2001	16400	-10	14.1	120	1.1	1.2	470000	332000	75.8	14.5	37.5	-10	40500	2700	13.7	175000	123000	1440	80.3	6910	1700	-5	48000	40400	-10		1800	32.1	163
MW-EPA-4	5/8/2001	-200	-10	-10	235	-5	0.31	269000	271000	37.7	2.8	-25	-10	950	-100	-3	63600	64000	352	140	4830	4740	-5	704000	684000	8.5		-1000	-7	-20
MW-EPA-4	11/13/2001	41.7	-10	-10	114	-5	-2	157000	136000	130	11.4	-25	-10	8220	398	-3	40600	35200	284	910	2430	2170	-5	104000	106000	-10		1300	-7	-20
Recovery Well	7/29/2001		-10	39.6	328	-5	8.6			264	11.1	4640	-10			405				311			-5			-10	1650	2700	76	1100
UAW01-30	5/4/2001	82.1	-10	13	339	-5	-2	341000	358000	7.7	2.2	-25	8	9970	150	-3	77200	84600	1240	109	13000	15900	-5	315000	335000	-10		-1000	-7	-20
UAW01-30	11/8/2001	81.8	-10	5.1	164	0.58	0.29	151000	146000	15.2	14.8	-25	-10	8940	7700	-3	31800	30900	569	802	13900	13500	-5	243000	236000	7.1		2900	-7	-20
UAW02-20	5/7/2001		-10		400	-5	-2	331000	316000		-7	-25	-10			-3	58700	59200	892		6670		-5	496000						-20
UAW02-20 DUP	5/7/2001	61.2		6.1						22.6				4480	659					47.2		6280			452000	8.5		1800	39.2	
UAW02-20	11/10/2001	-200	2.9	-10	169	-5	-2	177000	157000	-5	-7	-25	-10	1940	340	-3	33200	29800	686	35.9	2990	2650	-5	140000	124000	-10		-1000	16.6	-20
UAW03-20	5/7/2001	39.6	-10	20.4	422	-5	-2	524000	551000	2.8	3.8	-25	-10	2490	1650	-3	92100	80300	2860	39.4	8740	8150	-5	308000	289000	10		4000	148	54.7
UAW03-20	11/11/2001	124	-10	17.6	235	-5	-2	219000	210000	3.5	10.7	-25	-10	1720	978	-3	37500	36100	1500	39.5	6010	5920	-5	165000	161000	9.2		3700	36.4	-20
UAW04-20	5/7/2001	42.6	11.9	82.4	771	-5	-2	343000	339000	6	17.3	-25	7.3	10500	2410	-3	65600	64000	3170	28.9	7590	7380	-5	291000	285000	11.7		1100	110	14.8
UAW04-20	11/11/2001	78.5	7.6	20.5	600	-5	1.5	255000	235000	4	7.1	-25	-10	5060	1820	-3	43100	39600	2000	35.3	5790	5350	-5	183000	171000	6.1		1200	65.6	-20
UAW05-20	5/6/2001	2550	-10	8.7	102	-5	-2	338000	391000	8.1	2.2	7.8	-10	3900	-100	-3	60200	66900	938	15	7020	7400	-5	353000	395000	5.4		-1000	6.6	108
UAW05-20	10/10/2001	189	-10	21	67.9	-5	-2	292000	334000	7.3	-7	-25	-10	2750	-100	-3	45300	50300	901	57.3	3900	4290	-5	219000	245000	8.1	425	4300	3	-20
UAW05-20	11/12/2001	558	-10	18.7	68.6	-5	-2	265000	280000	8.8	1.8	5.3	-10	2930	-100	-3	49300	45900	802	24.9	4480	4270	-5	254000	236000	11.8		5000	3.1	-20
UAW06-20	5/6/2001	754	-10	13.4	105	-5	-2	310000	344000	3.9	2.6	4.5	-10	3880	1150	-3	48300	54200	1580	29.6	7400	8270	-5	218000	245000	-10		-1000	127	15.7
UAW06-20	10/10/2001	391	-10	26.7	132	-5	-2	343000	294000	10.8	1.5	-25	-10	1330	178	-3	43800	38800	2590	25	6430	5480	-5	309000	264000	5.6		2300	106	22.8
UAW06-20	11/13/2001	330	-10	34.3	154	-5	-2	407000	376000	13.4	-7	-25	4.2	1020	-100	-3	58000	52800	3000	24.5	6820	6190	-5	368000	335000	-10		7200	119	21.9
UAW07-20	5/8/2001		-10			-5				1.6	-7	-25	-10		-100	-3				2.5			-5			10.6				12.4
UAW07-20 DUP	5/8/2001			4.6	95.8		0.32	496000	479000					303			61600	60400			12100	11600		432000	417000		1010	7500	3.9	
UAW07-20	11/15/2001		-10	-10	80.4	-5	-2		421000	-5	-7	87.7	3.1		-100	-3		55200		2.3		10800	-5		395000	9.6	706	1600	3.1	-20
UAW08-20	5/6/2001		3.8	36.2	87.3	-5	0.44	810000	925000	15	8.7	13.8	-10	4680	-100	-3	179000	203000		30.5	17700	20200	-5	523000	596000	9.8	3420	3100	11.2	45.1
UAW08-20	11/13/2001		-10	113	144	0.96	0.61	969000	935000	67.6	15	41.9	-10	22000	132	15.8	141000	129000		53.4	21300	18900	-5	401000	400000	-10	6090	7900	27.1	132
UAW09-20	5/5/2001	90.6	-10	-10	80.3	-5	-2	108000	106000	-5	-7	-25	-10	-100	-100	-3	31000	31500	12.4	-40	1720	1850	-5	63200	62400	-10		-1000	-7	-20
UAW09-20	11/9/2001	-200	-10	-10	78.7	-5	-2	109000	101000	10.4	1.4	-25	-10	288	212	-3	25000	23100	17.1	81.9	2420	2220	-5	92500	84300	-10		1800	-7	-20
UAW11-10	5/8/2001	-200	1060	176	295	-5	-2	224000	154000	249	9.6	-25	8.1	50000	34500	4.4	41100	28400	8440	240	8730	5660	-5	2E+06	2E+06	-10		2700	113	310
UAW11-10	11/10/2001	47.3	62.6	62.9	41.3	-5	-2	110000	116000	11.3	1.5	-25	5.6	3900	3140	-3	45500	49400	470	39.3	7700	8050	-5	440000	454000	7		1300	15.6	22.4
UAW12-20	5/6/2001		-10	5.8	75.7	-5	-2	727000	679000	2.2	-7	-25	-10	3010	141	-3	54800	51300		18.2	10500	9700	-5	485000	455000	14.4	66.9	-1000	2.8	29.8
UAW12-20	11/15/2001		-10	-10	20.3	-5	-2		648000	-5	-7	19.7	5		114	-3		55200		5.3		8090	-5		348000	12.1	82.9	2000	6	-20
UAW13-20	5/6/2001		-10	36.1	21.2	-5	-2	818000	764000	3.4	-7	-25	-10	90.4	-100	-3	81900	87200		12.4	10400	9990	-5	491000	488000	5	1060	5800	14.8	22.1
UAW13-20	11/15/2001		4.2	83.1	27.4	-5	0.28		916000	315	-7	597	8.5		-100	-3		103000		23.2		13300	-5		948000	16.6	1930	2800	16.4	23.7
UAW14-10	5/5/2001	286	-10	-10	82.6	-5	-2	107000	108000	-5	-7	13.3	-10	294	-100	-3	30600	32200	53.8	6.1	1270	1300	-5	36500	35800	-10		1500	-7	-20
UAW14-10	11/9/2001	177	-10	-10	69.1	-5	-2	110000	109000	-5	-7	-25	1.8	453	387	-3	31700	31400	26.4	3.4	1530	1510	-5	37900	37500	-10		1200	-7	-20
UAW15-20	5/6/2001	147	-10	-10	221	-5	0.49	237000	253000	2	21.4	26.4	-10	156	-100	-3	61600	65300	397	55.1	2430	2490	-5	421000	443000	6.2		-1000	-7	23
UAW15-20	11/11/2001	271	-10	-10	330	-5	0.48	311000	297000	8.7	14.6	4.9	-10	398	-100	-3	77100	73700	231	102	3060	2840	-5	506000	480000	14		-1000	-7	-20
UAW16-10	10/12/2001		-10	24.9	55.5	-5	-2	223000	226000	7	1.9	-25	-10	1300	1570	-3	38900	39900	2760		7420	7400	-5	277000					59.3	-20
UAW16-10 lind Du	10/12/2001	98.6																		17.5					278000	8.6		6300		
UAW16-10	11/13/2001	94.1	3.6	20.6	49.6	-5	-2	277000	243000	4.3	-7	6.8	-10	1150	418	-3	45700	40200	2390	12.7	9650	8630	-5	281000	244000	-10		2500	29.1	-20
UAW18-20	10/12/2001	97.9	-10	12	169	-5	0.31	73100	72200	1.5	2	-25	4.7	5340	5300	-3	13900	13800	1220	28.8	6060	6200	-5	2E+06	1E+06	5.8		3100	1.7	-20
UAW18-20	11/13/2001	60.8	-10	11.7	186	-5	-2	89100	81900	-5	1.8	-25	5.4	4800	-100	-3	16800	15600	1130	28.6	6120	5510	-5	2E+06	2E+06	-10		2200	-7	-20
UAW21-30	5/5/2001	832	-10	-10	125	-5	-2	153000	191000	1.5	1.3	9.9	-10	923	-100	-3	40200	50200	82.8	17.7	5210	6420	-5	284000	347000	-10		-1000	0.95	-20

TABLE B-4
SUMMARY OF METALS DATA
Groundwater Samples
Morton International, Inc.
Reading, Ohio
Units: µg/l

Sample Location	Sample Date	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Calcium-DISS	Chromium	Cobalt	Copper	Cyanide, Total	Iron	Iron-DISS	Lead	Magnesium	Magnesium-DISS	Manganese	Nickel	Potassium	Potassium-DISS	Selenium	Sodium	Sodium-DISS	Thallium	Tin	Total Sulfide	Vanadium	Zinc
UAW21-30	11/11/2001	3170	2.5	-10	55.4	-5	-2	109000	107000	670	6.5	24.2	3.4	5520	-100	2.7	27000	25400	152	170	3610	2820	-5	53500	54100	6.7		-1000	6.4	30
UAW22-20	10/13/2001	12100	-10	14.3	182	0.9	0.29	283000	229000	22.2	8.5	29.2	-10	41400	169	12.2	68000	46600	8260	56.4	18400	15500	-5	661000	673000	-10		-1000	24	86.8
UAW22-20	11/13/2001	14700	-10	15.9	174	1.1	0.47	351000	244000	27.1	10.6	34.4	2.5	31600	253	15.4	97200	50200	6960	57.3	16600	12400	-5	706000	676000	-10		1800	29.6	132
UAW23-20	10/12/2001	117	-10	-10	29.6	-5	-2	408000	403000	6.9	-7	-25	-10	154	109	-3	97200	96200	31.5	12.8	26900	26800	6.1	167000	166000	8.9		2000	-7	-20
UAW23-20	11/14/2001	-200	-10	-10	25	-5	-2	394000	390000	5.6	6.2	-25	2.1	1980	488	-3	90900	90700	227	296	23200	23500	9.5	169000	169000	11.3		-1000	-7	-20
UAW25-20	10/13/2001	383	-10	26.1	171	-5	0.38	239000	239000	2.6	3	11.4	-10	3550	3530	-3	43200	43300	1000	27.7	3530	3540	-5	338000	340000	-10		1500	1.2	99.2
UAW25-20	11/13/2001	60.2	-10	32.4	162	-5	-2	223000	200000	10.5	2.6	9	-10	6370	327	-3	41800	37300	914	97.5	3480	3160	-5	328000	296000	-10		2200	5.2	20
	Count	42	51	51	51	51	51	47	50	51	51	51	51	47	50	51	47	50	42	51	47	50	51	47	50	51	9	48	51	51
	Number of Detects	37	12	35	51	7	18	47	50	44	36	23	16	46	29	9	47	50	42	50	47	50	3	47	50	31	9	34	38	24
	Number of Non-Detects	5	39	16	0	44	33	0	0	7	15	28	35	1	21	42	0	0	0	1	0	0	48	0	0	20	0	14	13	27
	Minimum Detection	39.6	2.5	4.6	20.3	0.58	0.28	73100	72200	1.5	1.3	4.5	1.8	90.4	109	2.7	13900	13800	12.4	2.3	1270	1300	5	13100	31700	5	66.9	1100	0.95	12.4
	Maximum Detection	39300	1060	611	771	1.9	8.6	969000	935000	1750	51.2	4640	8.5	74600	34500	405	179000	203000	8440	910	26900	26800	9.5	2E+06	2E+06	16.6	6090	7900	148	1100
	Minimum Detection Limit	200	10	10	0	5	2	0	0	5	7	25	10	100	100	3				40	0	0	5	0	0	10	0	1000	7	20
	Maximum Detection Limit	200	10	10	0	5	2	0	0	5	7	25	10	100	100	3				40	0	0	5	0	0	10	0	1000	7	20
	Location of Maximum	MW-EPA-2	UAW11-10	MW-EPA-1	UAW04-20	MW-EPA-2	Recovery Well	UAW08-20	UAW08-20	MW-EPA-2	MW-EPA-2	Recovery Well	UAW13-20	MW-EPA-2	UAW11-10	Recovery Well	UAW08-20	UAW08-20	UAW11-10	MW-EPA-4	UAW23-20	UAW23-20	UAW23-20	UAW11-10	UAW18-20	UAW13-20	UAW08-20	UAW08-20	UAW03-20	Recovery Well

Notes:

Negative values (shaded boxes) represent non-detect values.

Highlight rows indicate duplicate samples. The highest duplicate sample result was used in the analysis.

Appendix C

Data Summary for Chemicals Detected in Seeps

TABLE C-1
SUMMARY OF VOLATILE ORGANIC COMPOUND DATA
Seep Samples
Morton International, Inc.
Reading, Ohio
Units: µg/L

Sample Location	Sample Data	1,1-Dichloroethane	Acetone	Benzene	Carbon disulfide	Chlorobenzene	Ethylbenzene	Methylcyclohexane	Toluene	Xylenes (total)
SS-1 (Seep)	10/11/2001	1	2.1	1.1	0.97	11	0.39	0.49	0.45	1.7
SS-5 (Seep)	10/11/2001	0.55	3.1	0.92	1.1	24	-1.8	0.3	0.55	-1.8
	Count	2	2	2	2	2	2	2	2	2
	Number of Detects	2	2	2	2	2	1	2	2	1
	Number of Non-Detects	0	0	0	0	0	1	0	0	1
	Minimum Detection	0.55	2.1	0.92	0.97	11	0.39	0.3	0.45	1.7
	Maximum Detection	1	3	1.1	1.1	24	0.39	0.49	0.55	1.7
	Minimum Detection Limit	0	0	0	0	0	1.8	0	0	1.8
	Maximum Detection Limit	0	0	0	0	0	1.8	0	0	1.8

Note:

Negative values (shaded boxes) represent non-detect values.

TABLE C-2
SUMMARY OF SEMIVOLATILE ORGANIC COMPOUND DATA
Seep Samples
Morton International, Inc.
Reading,Ohio
Units: µg/L

Sample Location	Sample Date	1,2-Dichloro-benzene	1,4-Dichloro-benzene
SS-1 (Seep)	10/11/2001	21	2.6
SS-5 (Seep)	10/11/2001	14	1.7
	Count	2	2
	Number of Detects	2	2
	Number of Non-Detects	0	0
	Minimum Detection	14	1.7
	Maximum Detection	21	2.6
	Minimum Detection Limit	0	0
	Maximum Detection Limit	0	0

TABLE C-3
SUMMARY OF PESTICIDES AND PCB DATA
Seep Samples
Morton International, Inc.
Reading, Ohio
Units: µg/L

Sample Location	Sample Date	beta-BHC	alpha-Chlordane	4,4'-DDE	4,4'-DDT	Dieldrin	Endosulfan I	Endosulfan II	Heptachlor epoxide	Isodrin
SS-1 (Seep)	10/11/2001	0.042	-0.05	-0.05	0.028	0.053	-0.05	0.046	0.033	0.005
SS-5 (Seep)	10/11/2001	0.056	0.02	0.025	-0.05	-0.05	0.03	-0.05	-0.05	-0.1
	Count	2	2	2	2	2	2	2	2	2
	Number of Detects	2	1	1	1	1	1	1	1	1
	Number of Non-Detects	0	1	1	1	1	1	1	1	1
	Minimum Detection	0.042	0.02	0.025	0.028	0.053	0.03	0.046	0.033	0.005
	Maximum Detection	0.056	0.02	0.025	0.028	0.053	0.03	0.046	0.033	0.005
	Minimum Detection Limit	0	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.1
	Maximum Detection Limit	0	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.1

TABLE C-4
SUMMARY OF METALS DATA
Seep Samples
Morton International, Inc.
Reading, Ohio
Units: µg/L

Sample Location	Sample Date	Aluminum-DISS	Arsenic	Arsenic-DISS	Barium	Barium-DISS	Beryllium	Cadmium	Calcium	Calcium-DISS	Chromium	Cobalt	Cobalt-DISS	Copper	Iron	Iron-DISS	Lead	Magnesium	Magnesium-DISS	Manganese	Manganese-DISS	Mercury	Nickel	Nickel-DISS	Potassium	Potassium-DISS	Sodium	Sodium-DISS	Tin	Tin-DISS	Vanadium	Vanadium-DISS	Zinc	Zinc-DISS
SS-1 (Seep)	10/11/2001	47.8	25.7	-10	494	73.8	3.1	1.7	430000	361000	174	43.8	-7	104	90100	-100	126	90100	45100	2150	2070	-0.2	214	22.3	14200	9600	149000	361000	782	121	124	1.6	411	12.6
SS-5 (Seep)	10/11/2001	112	6.1	4.7	143	233	1.2	0.28	417000	257000	36.7	10.4	12.4	31.9	23800	734	24.2	67100	39000	2730	947	0.18	57.7	85.9	14100	7180	375000	159000	1340	348	33.2	11.6	219	19.4
Count		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Number of Detects		2	2	1	2	2	2	2	2	2	2	2	1	2	2	1	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2
Number of Non-Detects		0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Minimum Detection		47.8	6.1	4.7	143	73.8	1.2	0.28	417000	257000	36.7	10.4	12.4	31.9	23800	734	24.2	67100	39000	2150	947	0.18	57.7	22.3	14100	7180	149000	159000	782	121	33.2	1.6	219	12.6
Maximum Detection		112	25.7	4.7	494	233	3.1	1.7	430000	361000	174	43.8	12.4	104	90100	734	126	90100	45100	2730	2070	0.18	214	85.9	14200	9600	375000	361000	1340	348	124	11.6	411	19.4
Minimum Detection Limit		0	0	10	0	0	0	0	0	0	0	0	7	0	0	100	0	0	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0
Maximum Detection Limit		0	0	10	0	0	0	0	0	0	0	0	7	0	0	100	0	0	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0

Note:

Negative values (shaded boxes) represent non-detect values.

DISS = dissolved concentration.

Appendix D

Data Summary for Chemicals Detected in Sediments

TABLE D-1
SUMMARY OF VOLATILE ORGANIC COMPOUND DATA
Sediment Samples
Morton International, Inc.
Reading, Ohio
Units: mg/kg

Sample Location	Sample Date	Acetone	Benzene	Carbon disulfide	Chloro-benzene	Ethylbenzene	Methylcyclo-hexane	Xylenes (total)
Creek Sed.-1	3/6/2002	-0.026	-0.0065	-0.0065	-0.0065	-0.0065	-0.013	-0.013
Creek Sed.-2	3/6/2002	-0.022	-0.0055	-0.0055	-0.0055	-0.0055	-0.011	-0.011
Creek Sed.-3	3/6/2002	0.0091	-0.0055	-0.0055	-0.0055	-0.0055	-0.011	-0.011
Creek Sed.-4	3/6/2002	-0.023	-0.0057	-0.0057	0.0046	-0.0057	-0.011	-0.011
Creek Sed.-5	3/6/2002	-0.021	-0.0054	-0.0054	-0.0054	-0.0054	-0.011	-0.011
Creek Sed.-6	3/6/2002	-0.024	-0.006	-0.006	0.0011	-0.006	-0.012	-0.012
Creek Sed.-7	3/6/2002							
Creek Sed.-7 Blind Dup	3/6/2002	-0.024	-0.0059	-0.0059	-0.0059	-0.0059	-0.012	-0.012
Creek Sed - 8	3/6/2002	-0.023	-0.0058	-0.0058	-0.0058	-0.0058	-0.012	-0.012
SS-1	########	0.0047	0.0036	-0.0049	0.018	0.00077	0.00081	0.002
SS-2	########	-0.019	-0.0048	-0.0048	-0.0048	-0.0048	-0.0097	-0.0097
SS-3	########	-0.024	-0.0061	-0.0061	-0.0061	-0.0061	-0.012	-0.012
SS-4	########	0.018	-0.0054	0.0072	-0.0054	-0.0054	-0.011	-0.011
SS-5 ~25' South	########	0.0083			0.0043			
SS-5 Blind Dup.	########		-0.0059	-0.0059		-0.0059	0.0011	-0.012
SS-6	########	-0.022	-0.0054	-0.0054	-0.0054	-0.0054	-0.011	-0.011
SS-7	########	-0.02	-0.0051	-0.0051	-0.0051	-0.0051	-0.01	-0.01
SS-8	########	0.0029	-0.0066	-0.0066	-0.0066	-0.0066	-0.013	-0.013
SS-9	########	0.0029	-0.0059	-0.0059	-0.0059	-0.0059	-0.012	-0.012
SS-10	########	-0.02	-0.005	-0.005	-0.005	-0.005	-0.01	-0.01
SS-11	########	-0.023	-0.0059	-0.0059	-0.0059	-0.0059	-0.012	-0.012
SS-12	########	-0.022	-0.0055	-0.0055	-0.0055	-0.0055	-0.011	-0.011
	Count	20	20	20	20	20	20	20
	Number of Detects	6	1	1	4	1	2	1
	Number of Non-Detects	14	19	19	16	19	18	19
	Minimum Detection	0.0029	0.0036	0.0072	0.0011	0.00077	0.00081	0.002
	Maximum Detection	0.018	0.0036	0.0072	0.018	0.00077	0.0011	0.002
	Minimum Detection Limit	0.019	0.0048	0.0048	0.0048	0.0048	0.0097	0.0097
	Maximum Detection Limit	0.026	0.0066	0.0066	0.0066	0.0066	0.013	0.013
	Location of Maximum	SS-4	SS-1	SS-4	SS-1	SS-1	SS-5 (Dup)	SS-1

Notes:

Negative values (shaded boxes) represent non-detect values.

Highlight rows indicate duplicate samples. The highest duplicate sample result was used in the analysis.

TABLE D-2
SUMMARY OF SEMIVOLATILE ORGANIC DATA
Sediment Samples
Morton International, Inc.
Reading, Ohio
Units: mg/kg

Sample Location	Sample Date	Anthracene	Benzo(a) anthracene	Benzo(a)pyrene	Benzo(b) fluoranthene	Benzo(ghi) perylene	Benzo(k) fluoranthene	bis(2-Ethylhexyl) phthalate	Carbazole	Chrysene	Dibenz(a,h) anthracene	1,2-Dichlorobenzene	Fluoranthene	Indeno(1,2,3-cd) pyrene	Phenanthrene	Pyrene
Creek Sed.-1	3/6/2002											-0.4				
Creek Sed.-2	3/6/2002											-0.41				
Creek Sed.-3	3/6/2002											-0.38				
Creek Sed.-4	3/6/2002											0.16				
Creek Sed.-5	3/6/2002											-0.38				
Creek Sed.-6	3/6/2002											-0.41				
Creek Sed.-7	3/6/2002											-0.41				
Creek Sed.-7 Blind Dup	3/6/2002															
Creek Sed.- 8	3/6/2002											-0.4				
SS-1	10/11/2001											0.13				
SS-2	10/11/2001											-0.38				
SS-3	10/11/2001											-0.43				
SS-4	10/11/2001											-0.4				
SS-5 ~25' South	10/11/2001											0.17				
SS-5 Blind Dup.	10/11/2001															
SS-6	10/11/2001											-0.41				
SS-7	10/11/2001											-0.41				
SS-8	10/11/2001											-0.43				
SS-9	10/11/2001											-0.42				
SS-10	10/11/2001											-0.39				
SS-11	10/11/2001											-0.43				
SS-12	10/11/2001	0.09	0.57	0.74	0.99	0.68	0.33	0.14	0.073	0.8	0.16	-0.41	1.6	0.59	0.61	1.4
Count		1	1	1	1	1	1	1	1	1	1	20	1	1	1	1
Number of Detects		1	1	1	1	1	1	1	1	1	1	3	1	1	1	1
Number of Non-Detects		0	0	0	0	0	0	0	0	0	0	17	0	0	0	0
Minimum Detection		0.09	0.57	0.74	0.99	0.68	0.33	0.14	0.073	0.8	0.16	0.13	1.6	0.59	0.61	1.4
Maximum Detection		0.09	0.57	0.74	0.99	0.68	0.33	0.14	0.073	0.8	0.16	0.17	1.6	0.59	0.61	1.4
Minimum Detection Limit		0	0	0	0	0	0	0	0	0	0	0.38	0	0	0	0
Maximum Detection Limit		0	0	0	0	0	0	0	0	0	0	0.43	0	0	0	0
Location of Maximum		SS-12	SS-12	SS-12	SS-12	SS-12	SS-12	SS-12	SS-12	SS-12	SS-12	SS-5	SS-12	SS-12	SS-12	SS-12

Notes:

Negative values (shaded boxes) represent non-detect values.

Highlight rows indicate duplicate samples. The highest duplicate sample result was used in the analysis.

TABLE D-3
SUMMARY OF PESTICIDES AND PCBs DATA
Sediment Samples
Morton International, Inc.
Reading, Ohio
Units: mg/kg

Sample Location	Sample Date	Aldrin	beta-BHC	4,4'-DDE	4,4'-DDT	Dieldrin	Endrin Ketone
Creek Sed.-1	3/6/2002	0.001	-0.0021	0.0014	0.0056	0.0022	-0.0021
Creek Sed.-2	3/6/2002	-0.0043	-0.0043	-0.0043	-0.0043	-0.0043	0.0014
Creek Sed.-3	3/6/2002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Creek Sed.-4	3/6/2002	-0.002	0.010	0.0012	-0.002	0.0038	-0.002
Creek Sed.-5	3/6/2002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Creek Sed.-6	3/6/2002	-0.0021	0.0046	0.00091	-0.0021	-0.002	-0.002
Creek Sed.-7	3/6/2002	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021
Creek Sed.-7 Blind Dup	3/6/2002						
Creek Sed.-8	3/6/2002	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021	-0.0021
SS-1	10/11/2001	-0.0041	-0.0041	-0.0041	-0.0041	-0.0041	-0.0041
SS-2	10/11/2001	-0.0039	-0.0039	-0.0039	0.004	-0.0039	-0.0039
SS-3	10/11/2001	-0.022	-0.022	-0.022	-0.022	-0.022	-0.022
SS-4	10/11/2001	-0.0021	0.094	-0.0021	-0.0021	-0.0021	-0.0021
SS-5 ~25' South	10/11/2001	-0.021	-0.021	-0.021	-0.021	-0.021	-0.021
SS-5 Blind Dup.	10/11/2001						
SS-6	10/11/2001	-0.0043	-0.0043	-0.0043	-0.0043	-0.0043	-0.0043
SS-7	10/11/2001	-0.021	-0.021	-0.021	-0.021	-0.021	-0.021
SS-8	10/11/2001	-0.022	-0.022	-0.022	-0.022	-0.022	-0.022
SS-9	10/11/2001	-0.022	-0.022	-0.022	-0.022	-0.022	-0.022
SS-10	10/11/2001	-0.004	-0.004	0.0046	-0.004	-0.004	-0.004
SS-11	10/11/2001	-0.0044	-0.0044	-0.0044	-0.0044	-0.0044	-0.0044
SS-12	10/11/2001	-0.021	-0.021	0.023	-0.021	-0.021	-0.021
	Count	20	20	20	20	20	20
	Number of Detects	1	3	5	2	2	1
	Number of Non-Detects	19	17	15	18	18	19
	Minimum Detection	0.001	0.0046	0.00091	0.004	0.0022	0.0014
	Maximum Detection	0.001	0.094	0.023	0.0056	0.0038	0.0014
	Minimum Detection Limit	0.002	0.002	0.002	0.002	0.002	0.002
	Maximum Detection Limit	0.022	0.022	0.022	0.022	0.022	0.022
	Location of Maximum	Creek Sed.-1	SS-4	SS-12	Creek Sed.-1	Creek Sed.-4	Creek Sed.-2

Notes:

Negative values (shaded boxes) represent non-detect values.

Highlight rows indicate duplicate samples. The highest duplicate sample result was used in the analysis.

TABLE D-4
SUMMARY OF METALS DATA
Sediment Samples
Morton International, Inc.
Reading, Ohio
Units: mg/kg

Sample Location	Sample Date	Aluminum	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Nickel	Potassium	Selenium	Sodium	Thallium	Tin	Vanadium	Zinc
Creek Sed.-1	3/6/2002	1910	3	13.9	0.069	0.14	88900	6.5	2.7	5.1	6780	6.4	20300	287	-0.12	9.8	291	-0.61	147	1.1	9	6.7	33.5
Creek Sed.-2	3/6/2002	1890	2.8	19.1	0.099	0.11	77900	5.8	2.4	6.6	6220	12	18900	245	-0.13	5.9	311	-0.63	143	1.2	9.8	6.6	26.1
Creek Sed.-3	3/6/2002	1730	3.2	8.9	0.16	0.14	170000	6.9	2.4	4.9	6780	4.2	64400	342	-0.12	5.8	228	-0.58	258	1	4.6	6.9	16.4
Creek Sed.-4	3/6/2002	2440	3.2	14.4	0.25	0.16	178000	11.8	3.8	6.5	9360	14.2	19900	349	0.01	10.1	373	-0.6	174	1.1	9.3	8.8	31.8
Creek Sed.-5	3/6/2002	2400	4.2	22.3	0.19	0.18	148000	14.2	3.7	4.5	10800	5	38800	670	-0.12	10	359	-0.58	166	2	3.4	11.7	25.1
Creek Sed.-6	3/6/2002	2720	3.3	20.9	0.14	0.14	70000	7.8	3.3	5.5	7660	7.7	17200	344	0.014	7.4	461	-0.62	150	1.7	4.2	8.9	32.3
Creek Sed.-7	3/6/2002									4.9					0.028			-0.62	162				29.9
Creek Sed.-7 Blind Dup	3/6/2002	2160	4.7	42.6	0.18	0.16	123000	6	3.3		9920	7.5	37800	650		5.7	344			2	4	9.3	
Creek Sed. -8	3//2002	2160	3.7	18.3	0.17	0.12	163000	6.4	3.2	5.8	9470	5.4	19300	622	0.01	6.7	416	-0.6	134	2.2	3.8	7.5	26.1
SS-1	10/11/2001	4830	4.9	40.2	0.19	0.22	74400	10.3	5.3	12.3	12100	11.3	21200	333	-0.12	14.3	874	-0.6	223	-1.2	30.8	10.7	38.2
SS-2	10/11/2001	7840	6.1	62.5	0.36	0.41	83900	13.7	7.2	17.8	16500	28.9	14000	586	0.06	17	1230	-0.57	160	-1.1	76.3	14.8	54.1
SS-3	10/11/2001	5660	5.2	52.1	0.27	0.52	58600	16	6.6	19.2	14300	24.8	12100	601	0.051	17	610	-0.65	260	-1.3	4.7	13.3	82.8
SS-4	10/11/2001	9330	3.4	76.9	0.46	0.25	18800	16	7.5	11.9	17400	10.8	5450	344	0.016	14.9	754	-0.61	125	-1.2	24.8	17	42.5
SS-5 ~25' South	10/11/2001		3.9	37.2		0.27				11.3				283							4.9		
SS-5 Blind Dup.	10/11/2001	3870			0.21		67000	15.3	4.5		10400	14.1	14900		0.011	10	529	-0.62	196	-1.2		10.4	46.7
SS-6	10/11/2001	6190	5.5	52.4	0.29	0.32	46100	13.9	6.8	16.5	14100	29.8	12300	636	0.073	14.9	685	0.48	135	0.67	5.7	13.9	59.5
SS-7	10/11/2001	6080	4.9	46.8	0.28	0.38	54800	17.2	6.7	19.3	13500	24.5	14400	453	0.045	16.7	734	0.39	173	-1.2	5.2	13.4	68.2
SS-8	10/11/2001	5570	5.3	63	0.24	0.39	56300	14.1	6.3	18.2	14100	25.8	12500	592	0.056	15.9	661	-0.66	275	-1.3	7	13.5	62.4
SS-9	10/11/2001	5300	4.3	40.9	0.24	0.32	52900	14.5	5.7	16.2	11700	28.4	11500	325	0.038	14.6	739	-0.64	341	-1.3	3.3	12.4	64.2
SS-10	10/11/2001	4290	3.9	29.8	0.17	0.24	57100	12.7	4.2	14.2	9340	14.7	15800	345	0.045	12.9	590	-0.59	124	0.69	3.9	9.3	44.3
SS-11	10/11/2001	6630	5.5	55	0.29	0.32	53500	16.3	6.8	16.9	14900	27.6	13400	615	0.039	16.7	810	-0.64	340	-1.3	3.6	14.6	71.6
SS-12	10/11/2001	7760	6.3	68.2	0.34	0.54	47300	22.9	7.8	26	17200	38.3	12600	658	0.095	22	789	-0.63	360	-1.3	33.2	16.5	101
Count		20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Number of Detects		20	20	20	20	20	20	20	20	20	20	20	20	20	15	20	20	2	20	10	20	20	20
Number of Non-Detects		0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	18	0	10	0	0	0
Minimum Detection		1730	2.8	8.9	0.069	0.11	18800	5.8	2.4	4.5	6220	4.2	5450	245	0.01	5.7	228	0.39	124	0.67	3.3	6.6	16.4
Maximum Detection		9330	6.3	76.9	0.46	0.54	178000	22.9	7.8	26	17400	38.3	64400	670	0.095	22	1230	0.48	360	2.2	76.3	17	101
Minimum Detection Limit		0	0	0	0	0	0	0	0	0	0	0	0	0	0.12	0	0	0.57	0	1.1	0	0	0
Maximum Detection Limit		0	0	0	0	0	0	0	0	0	0	0	0	0	0.13	0	0	0.66	0	1.3	0	0	0
Location of Maximum		SS-4	S-12	SS-4	SS-4	S-12	Creek Sed.-4	S-12	S-12	S-12	SS-4	S-12	Creek Sed.-3	Creek Sed.-5	S-12	S-12	SS-2	SS-6	SS-12	Creek Sed. -8	SS-2	SS-4	SS-12

Notes:

Negative values (shaded boxes) represent non-detect values.

Highlight rows indicate duplicate samples. The highest duplicate sample result was used in the analysis.

Appendix E

Data Summary for Chemicals Detected in Background Samples

APPENDIX E

BACKGROUND DATA

Background samples were collected to evaluate chemicals occurring naturally in soil (e.g., metals) or regionally as a result of activities in the area (e.g., pesticides). A total of ten off-site background locations were sampled and two samples from each location were analyzed as part of the facility investigation program. Five locations were sampled near the Baseball Fields and Swimming Pool and Recreation Center (south of the site; B01 to B05), and five locations were sampled near the Former Municipal Water Supply Well Field (north of the site; B06 to B10). Two samples were collected at each location at depths of 1.5 to 2 feet bgs and 9 to 11.5 feet bgs. Background sample locations are shown on Figure 4.

As expected, metals and other naturally occurring chemicals (e.g., calcium) were detected in the majority of samples analyzed (Table E-1). Statistical analysis of the background concentrations was conducted independently for surface samples, subsurface samples, and for surface and subsurface samples combined. This evaluation indicated that with the exception of calcium, potassium, selenium, thallium, and tin, concentrations of metals and other naturally-occurring chemicals were higher in surface samples than in subsurface samples. In general, the higher concentrations in surface soil were detected in samples collected north of the site. For the purpose of identifying COPCs at the site, results for surface soils were used to define background concentrations. This estimate of background concentrations does include surficial impacts resulting from human activities. Background concentrations were represented by the 95 percent upper tolerance limit (95% UTL) of the surface data, which defines the 95 percentile of the population at a 95 percent confidence level.

Twenty-six SVOCs, pesticides, and PCBs were also detected in one or more samples from background locations (Table E-2). With the exception of B-4 at 1.5 feet, where nine SVOCs were detected, the remaining detections occurred at sample locations in the Former Municipal Water Supply Well Field. Concentrations of 18 SVOCs in B-08 at 2 feet were generally an order of magnitude higher than concentrations detected at any other sample locations. Thirteen of these SVOCs were detected in the sample B-08 at 9 feet bgs, the only sample at depth where SVOCs, pesticides or PCBs were reported. Considering B-08 at 2 feet bgs for SVOCs as an anomalous result, background concentrations of SVOCs, pesticides and PCBs were lower than the Human Health Screening Levels (HHSLs) for the project for all chemicals except dieldrin. For the purpose of identifying COPCs at the site, the 95 percent upper tolerance limit for

dieldrin in surface soil was used to represent background concentrations of dieldrin in soil (0.07 mg/kg). Only surface soil results were used because dieldrin is likely present in the area as a result of surficial use as a pesticide.

TABLE E-1
METALS BACKGROUND SAMPLE DATA
Morton International, Inc.
Reading, Ohio

Concentrations in milligrams per kilogram (mg/kg)

Sample Location	Sample Date	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Tin	Vanadium	Zinc
B01-1.5'	10/9/2001	9620	0.55	7.4	47.4	0.260	0.19	1210	10.1	7.1	12.5	15600	9.5	1680	424	0.026	12.5	655	0.28	0.28	278	0.55	0.88	20	39
B02-1.5'	10/9/2001	10800	0.55	8.4	58.7	0.370	0.21	1720	11.8	6.7	13.3	17200	10.1	1840	379	0.027	13.2	688	0.285	0.285	284.5	0.55	0.79	21.9	42
B03-1.5'	10/9/2001	10800	0.55	5.1	68.0	0.500	0.27	3870	12.2	8.0	13.4	18700	11.1	2380	589	0.026	15.1	976	0.285	0.285	284.5	0.55	0.9	18.3	41.1
B04-1.5'	10/9/2001	1870	0.55	4.0	9.8	0.270	0.16	86600	3.7	2.8	7.3	5760	4.1	31100	191	0.0098	6.5	368	0.27	0.27	69.2	1.5	0.93	6.2	22.3
B04-1.5' Blind Dup	10/9/2001	2200	0.55	3.7	11.4	0.265	0.16	97000	3.7	2.9	6.8	5980	4.3	36200	198	0.055	6.2	387	0.265	0.265	66.6	1.2	0.97	6.7	21.6
B05-1.5'	10/9/2001	13000	0.55	10.0	66.1	0.460	0.22	2370	15.7	8.0	15.6	19800	11.4	2090	393	0.03	14.9	660	0.28	0.28	282.5	0.55	0.82	23.9	51.4
B06-1.5'	10/9/2001	6950	0.55	6.2	67.7	0.350	0.52	38300	13.5	6.4	18.4	12600	25.3	9650	585	0.15	12.2	1130	0.285	0.285	64.1	1.1	1.5	19.9	63.3
B07-1'	10/9/2001	8140	0.6	6.2	134.0	0.64	0.43	35600	15.4	6.8	17.6	12600	29.0	8670	645	0.073	12.2	1210	0.69	0.295	292.5	0.6	1.5	16.3	49.9
B08-2'	10/9/2001	11500	0.6	7.5	123.0	0.61	0.70	8400	69.7	8.6	22.4	18800	59.3	2690	854	0.16	15.7	1810	1.6	0.29	290	0.6	2.9	56.4	88.1
B09-2'	10/9/2001	5780	3.3	16.2	985.0	0.85	0.33	3960	50.6	5.0	64.8	10600	410.0	838	69	0.046	10.6	674	2.5	0.33	328.5	0.92	1.9	24.9	85.2
B10-2'	10/9/2001	5020	0.65	13.5	327.0	1.4	0.14	1910	5.9	5.0	26.1	4030	16.1	340	15	0.047	11.1	993	1.7	0.33	329.5	0.96	1.3	22.8	15.7
B01-11.5'	10/9/2001	1620	0.5	2.3	6.9	0.260	0.15	115000	3.8	2.8	6.2	5010	3.2	37400	171	0.05	5.7	384	0.26	0.26	98.8	1.3	0.95	5.9	18.8
B02-11.5'	10/9/2001	1750	0.5	3.9	7.1	0.260	0.16	113000	3.8	3.0	6.9	6000	3.6	35700	182	0.05	6.2	369	0.26	0.26	91.7	0.74	1	6.1	20.1
B03-11.5'	10/9/2001	1650	0.5	3.0	7.5	0.260	0.15	126000	4.0	2.0	6.2	5620	2.8	37800	329	0.0089	4.8	370	0.26	0.26	105	1.5	0.93	5.5	15.6
B04-11.5'	10/9/2001	1550	0.55	2.7	6.0	0.265	0.13	114000	3.5	2.5	5.4	4670	3.0	37300	163	0.055	5.4	346	0.265	0.265	91.1	1.8	0.93	5.5	17.3
B05-11.5'	10/9/2001	1660	0.55	3.7	6.4	0.265	0.15	98200	3.2	2.3	7.9	5880	4.0	39400	158	0.055	4.8	370	0.265	0.265	92.9	1.5	1.1	6.4	21.9
B06-11'	10/9/2001	1860	0.6	1.4	9.4	0.059	0.20	119000	4.1	2.3	6.9	5380	3.7	36600	196	0.013	6.3	399	0.29	0.29	111	1.2	0.96	5.7	25
B07-9'	10/9/2001	6520	0.6	2.6	33.4	0.290	0.19	43800	8.4	5.4	8.8	9050	7.2	20500	221	0.013	9.9	729	0.295	0.295	67.3	1.5	5.9	12.1	31.7
B08-9'	10/9/2001	6210	0.55	3.0	20.4	0.230	0.26	65100	13.4	4.5	15.6	11300	7.0	23000	225	0.01	7	637	0.285	0.285	58.9	0.55	5.65	13	30.4
B09-10'	10/9/2001	12800	0.6	6.0	71.5	0.310	0.20	13000	25.1	3.7	41.8	22600	8.9	1710	82	0.026	14.2	1750	0.31	0.31	309	0.6	6.2	42.3	59.2
B10-11'	10/9/2001	9360	0.6	4.9	69.0	0.460	0.24	4160	16.5	3.6	20.4	17100	9.4	1640	123	0.018	11.5	730	0.3	0.3	299.5	0.6	0.89	20.8	41.5
Statistics																									
Surface Soils																									
Mean		7789.1	0.6	8.3	172.6	0.4	0.3	25540.0	19.3	6.1	19.8	12879.1	53.7	8861.6	394.7	0.1	11.8	377.5	0.3	N/A	233.6	0.8	1.3	21.6	47.2
Std. Deviation		3757.83	0.03	4.29	283.23	0.10	0.18	35471.83	21.07	1.97	15.99	5699.54	119.24	12674.47	260.71	0.05	3.16	13.44	0.01	N/A	108.65	0.33	0.64	13.16	24.08
Tolerance Factor, K*		2.911	2.911	2.911	2.911	2.911	2.911	2.911	2.911	2.911	2.911	2.911	2.911	2.911	2.911	2.911	2.911	2.911	2.911	2.911	2.911	2.911	2.911	2.911	2.911
Statistical Background Concentration**		**18728**	**0.7**	**20.8**	**997.0**	**0.636**	**0.82**	**128799**	**80.6**	**11.9**	**66.4**	**29470**	**400.7**	**45757**	**1154**	**0.206**	**21**	**417**	**0.30**	**N/A**	**550**	**1.79**	**3.17**	**59.9**	**117.3**
Subsurface Soils																									
Mean		4498.0	0.6	3.6	23.8	0.3	0.2	76917.8	7.7	3.2	12.6	5325.0	5.3	27105.0	185.0	0.0	7.6	373.0	0.3	N/A	132.5	1.1	2.5	12.3	28.2
Std. Deviation		4044.63	0.04	1.21	25.99	0.10	0.04	46910.68	7.34	1.09	11.34	597.47	2.57	14882.33	66.42	0.02	3.20	17.66	0.02	N/A	91.90	0.46	2.40	11.66	13.48
Tolerance Factor, K*		2.815	2.815	2.815	2.815	2.815	2.815	2.815	2.815	2.815	2.815	2.815	2.815	2.815	2.815	2.815	2.815	2.815	2.815	2.815	2.815	2.815	2.815	2.815	2.815
Statistical Background Concentration**		**15884**	**0.7**	**7.0**	**96.9**	**0.539**	**0.30**	**208971**	**28.4**	**6.3**	**44.5**	**7007**	**12.5**	**68999**	**372**	**0.086**	**17**	**423**	**0.33**	**N/A**	**391**	**2.44**	**9.19**	**45.1**	**66.1**
Surface and Subsurface Soils Combined																									
Mean		6221.9	0.6	5.9	101.7	0.3	0.2	48660.0	14.1	4.7	16.4	10864.7	30.6	17549.0	294.8	0.0	9.8	374.1	0.3	N/A	185.5	1.0	1.9	17.2	38.1
Std. Deviation		4154.39	0.04	3.91	214.97	0.10	0.14	47712.85	17.07	2.17	14.12	5936.01	87.89	16344.91	217.91	0.04	3.79	15.91	0.02	N/A	111.27	0.42	1.77	13.04	21.62
Tolerance Factor, K*		2.371	2.371	2.371	2.371	2.371	2.371	2.371	2.371	2.371	2.371	2.371	2.371	2.371	2.371	2.371	2.371	2.371	2.371	2.371	2.371	2.371	2.371	2.371	2.371
Statistical Background Concentration**		**16072**	**0.7**	**15.2**	**611.4**	**0.548**	**0.59**	**161787**	**54.6**	**9.9**	**49.9**	**24939**	**239.0**	**56303**	**811**	**0.142**	**19**	**412**	**0.31**	**N/A**	**449**	**1.97**	**6.05**	**48.1**	**89.4**

Notes:
Shaded results are for samples with non-detect analyses, and are listed at one-half the detection limit.
* Values are from "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities," 4/89 from Table 5, Page B-8 for n = 11, 10, and 21 respectively for surface, subsurface and total (varies with n).
**Upper Tolerance Limit = 95 percentile of referenced data set. UTL = Mean + Standard Dev. * K*

TABLE E-2
PESTICIDE, PCB, AND SVOC BACKGROUND SAMPLE DATA
Morton International, Inc.
Reading, Ohio

Concentrations in milligrams per kilogram (mg/kg)

Sample Location	Sample Date	4,4'-DDE	Aldrin	Dieldrin	Endrin ketone	Isodrin	Aroclor 1254	Aroclor 1260	2-Methyl-naphthalene	Acenaphthene	Anthracene	Benzo(a) anthracene	Benzo(a)pyrene	Benzo(b) fluoranthene	Benzo(ghi) perylene	Benzo(k) fluoranthene	bis(2-Ethylhexyl) phthalate	Carbazole	Chrysene	Dibenz(a,h) anthracene	Dibenzofuran	Fluoranthene	Fluorene	Indeno(1,2,3-cd) pyrene	Naphthalene	Phenanthrene	Pyrene
B01-1.5'	10/9/2001	-0.0019	-0.0019	-0.0019	-0.0019	-0.0037	-0.037	-0.037	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37
B02-1.5'	10/9/2001	-0.0039	-0.0039	-0.0039	-0.0039	-0.0075	-0.038	-0.038	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38
B03-1.5'	10/9/2001	-0.0019	-0.0019	-0.0019	-0.0019	-0.0038	-0.038	-0.038	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38
B04-1.5'	10/9/2001	-0.0036	-0.0036	-0.0036	-0.0036	-0.0071	-0.035	-0.035	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	0.06	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35
B04-1.5' Blind Dup	10/9/2001	-0.0036	-0.0036	-0.0036	-0.0036	-0.0071	-0.035	-0.035	-0.35	-0.35	-0.35	0.063	0.076	0.1	0.072	-0.35	-0.35	-0.35	0.082	-0.35	-0.35	0.15	-0.35	-0.35	-0.35	0.096	0.14
B05-1.5'	10/9/2001	-0.0019	-0.0019	-0.0019	-0.0019	-0.0037	-0.037	-0.037	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37
B06-1.5'	10/9/2001	-0.0039	-0.0039	0.041	-0.0039	-0.0075	-0.038	0.015	-0.38	-0.38	-0.38	0.12	0.19	0.18	0.16	0.096	-0.38	-0.38	0.14	-0.38	-0.38	0.19	-0.38	0.15	-0.38	0.12	0.19
B07-1'	10/9/2001	0.0015	0.11	0.055	-0.004	0.0054	0.11	-0.039	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39
B08-2'	10/9/2001	0.019	-0.02	0.031	0.13	-0.038	-0.038	-0.038	4.3	37	26	36	24	29	9.2	18	-19	4.4	37	3.5	26	120	32	9.2	3	110	83
B09-2'	10/9/2001	-0.0045	-0.0045	0.015	-0.0045	-0.0087	-0.043	0.24	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	0.18	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43	-0.43
B10-2'	10/9/2001	-0.0022	-0.0022	-0.0022	-0.0022	-0.0044	-0.044	-0.044	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44	-0.44
B01-11.5'	10/9/2001	-0.0018	-0.0018	-0.0018	-0.0018	-0.0034	-0.034	-0.034	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34
B02-11.5'	10/9/2001	-0.0018	-0.0018	-0.0018	-0.0018	-0.0034	-0.034	-0.034	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34
B03-11.5'	10/9/2001	-0.0018	-0.0018	-0.0018	-0.0018	-0.0034	-0.034	-0.034	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34	-0.34
B04-11.5'	10/9/2001	-0.0018	-0.0018	-0.0018	-0.0018	-0.0035	-0.035	-0.035	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35
B05-11.5'	10/9/2001	-0.0018	-0.0018	-0.0018	-0.0018	-0.0035	-0.035	-0.035	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35	-0.35
B06-11'	10/9/2001	-0.002	-0.002	-0.002	-0.002	-0.0038	-0.038	-0.038	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38
B07-9'	10/9/2001	-0.002	-0.002	-0.002	-0.002	-0.0039	-0.039	-0.039	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39	-0.39
B08-9'	10/9/2001	-0.0019	-0.0019	-0.0019	-0.0019	-0.0037	-0.037	-0.037	0.23	0.3	0.15	0.14	0.08	0.094	-0.37	-0.37	-0.37	-0.37	0.14	-0.37	0.33	0.51	0.32	-0.37	0.088	0.68	0.35
B09-10'	10/9/2001	-0.0021	-0.0021	-0.0021	-0.0021	-0.0041	-0.041	-0.041	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41	-0.41
B10-11'	10/9/2001	-0.002	-0.002	-0.002	-0.002	-0.004	-0.04	-0.04	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4

Statistics

Surface Soils			
Mean		0.0138	
Std. Deviation		0.0195	
Tolerance Factor, K*		2.911	
Statistical Background Concentration**		0.0707	
Subsurface Soils			
Mean		0.001	
Std. Deviation		6E-05	
Tolerance Factor, K*		2.815	
Statistical Background Concentration**		0.0011	
Surface and Subsurface Soils			
Mean		0.0077	
Std. Deviation		0.0153	
Tolerance Factor, K*		2.371	
Statistical Background Concentration**		0.0439	

Notes:
Shaded results are for samples with non-detect analyses.
* Values are from "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities," 4/89 from Table 5, Page B-8 for n = 11, 10, and 21 respectively for surface, subsurface and total (varies with n).
**Upper Tolerance Limit = 95 percentile of referenced data set. UTL = Mean + Standard Dev. * K*

Appendix I

Human Health Risk Assessment Calculations

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RISK EQUATIONS

INCIDENTAL INGESTION OF SOIL/SEDIMENT

AADD = $\frac{(Cs \times IRs \times ABSos \times EFig \times ED \times CFmg\text{-}kg)}{(BW \times ATnc)}$ Hazard Quotient = $\frac{AADD}{RfDo}$

LADD = $\frac{(Cs \times IRs \times ABSos \times EFig \times ED \times CFmg\text{-}kg)}{(BW \times ATca)}$ Excess Cancer Risk = LADD x SFo

DERMAL CONTACT WITH SOIL/SEDIMENT

AADD = $\frac{(Cs \times SAs \times SAF \times ABSds \times EFdc \times ED \times CFmg\text{-}kg)}{(BW \times ATnc)}$ Hazard Quotient = $\frac{AADD}{RfDo}$

LADD = $\frac{(Cs \times SAs \times SAF \times ABSds \times EFdc \times ED \times CFmg\text{-}kg)}{(BW \times ATca)}$ Excess Cancer Risk = LADD x SFo

INHALATION OF VOLATILES IN AMBIENT AIR

AADD = $\frac{(Caa \times IHRaa \times ETaa \times ABSiv \times EFaa \times ED)}{(BW \times ATnc)}$ Hazard Quotient = $\frac{AADD}{RfDi}$

LADD = $\frac{(Caa \times IHRaa \times ETaa \times ABSiv \times EFaa \times ED)}{(BW \times ATca)}$ Excess Cancer Risk = LADD x SFi

INHALATION OF VOLATILES IN INDOOR AIR

AADD = $\frac{(Cia \times IHRia \times ETia \times ABSiv \times EFia \times ED)}{(BW \times ATnc)}$ Hazard Quotient = $\frac{AADD}{RfDi}$

LADD = $\frac{(Cia \times IHRia \times ETia \times ABSiv \times EFia \times ED)}{(BW \times ATca)}$ Excess Cancer Risk = LADD x SFi

INHALATION OF RESUSPENDED SOIL PARTICULATES

AADD = $\frac{(Cs \times IHRaa \times ETaa \times ABSip \times EFaa \times ED)}{(BW \times PEF \times ATnc)}$ Hazard Quotient = $\frac{AADD}{RfDi}$

LADD = $\frac{(Cs \times IHRaa \times ETaa \times ABSip \times EFaa \times ED)}{(BW \times PEF \times ATca)}$ Excess Cancer Risk = LADD x SFi

INGESTION OF GROUNDWATER

AADD = $\frac{(Cgw \times IRdw \times ABSow \times EFdw \times ED)}{(BW \times ATnc)}$ Hazard Quotient = $\frac{AADD}{RfDo}$

LADD = $\frac{(Cgw \times IRdw \times ABSow \times EFdw \times ED)}{(BW \times ATca)}$ Excess Cancer Risk = LADD x SFo

DERMAL CONTACT WITH GROUNDWATER

AADD = $\frac{(DAevent \times SAswr \times EVswr \times EFswr \times ED)}{(BW \times ATnc)}$ Hazard Quotient = $\frac{AADD}{RfDo}$

LADD = $\frac{(DAevent \times SAswr \times EVswr \times EFswr \times ED)}{(BW \times ATca)}$ Excess Cancer Risk = LADD x SFo

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CONSTANTS

Parameter	Symbol	Value	Units
SITE-SPECIFIC PROPERTIES			
Soil Emission Area - industrial (ambient air) - Acetone	A	109,264	m^2
Soil Emission Area - industrial (ambient air) - Benzene	A	4,923	m^2
Soil Emission Area - industrial (ambient air) - Chlorobenzene	A	57,650	m^2
Soil Emission Area - industrial (ambient air) - 1,2-Dichlorobenzene	A	35,800	m^2
Soil Emission Area - industrial (ambient air) - Methylene Chloride	A	57,650	m^2
Soil Emission Area - industrial (ambient air) - Toluene	A	57,650	m^2
Groundwater Emission Area - industrial (ambient air)-Acetone	A	43,000	m^2
Groundwater Emission Area - industrial (ambient air)-Benzene	A	4,700	m^2
Groundwater Emission Area - industrial (ambient air)-Chlorobenzene	A	16,400	m^2
Groundwater Emission Area - industrial (ambient air)-1,2-Dichlorobenzene	A	16,400	m^2
Groundwater Emission Area - industrial (ambient air)-1,3-Dichlorobenzene	A	7,000	m^2
Groundwater Emission Area - industrial (ambient air)-1,4-Dichlorobenzene	A	2,800	m^2
Groundwater Emission Area - industrial (ambient air)-Methylene chloride	A	14,300	m^2
Groundwater Emission Area - industrial (ambient air)-Toluene	A	16,400	m^2
Area Building - industrial (indoor air)	A	119	m^2
Exposed Groundwater Emission Area - Construction Worker	A	17	m^2
Wind Speed	WS	2.25	m/sec
Mixing Height	MH	2	m
Fraction of Building Over Source-industrial	Fsource	1	--
Air Exchange Rate - commercial	ACH	0.83	1/hr
Volume - commercial building	V	580	m^3
SOIL PROPERTIES			
Fraction Organic Carbon	foc	0.006	unitless
Bulk Density	pb	1.5	g/cm^3
Water Filled Soil Porosity	Pw	0.15	unitless
Air Filled Soil Porosity	Pa	0.28	unitless
Total Porosity	Pt	0.43	unitless
Temperature	T	298	K
PHYSICAL CONSTANTS			
Universal Gas Constant	R	0.000082	atm-m^3/mole-K
UNITS CONVERSION FACTORS			
Conversion Factor from mg to kg	CF_{mg-kg}	1.E-06	kg/mg
Conversion Factor from m^2 to cm^2	CF_{m2-cm2}	1.E+04	cm^2/m^2
Conversion Factor from g to kg	CF_{g-kg}	1.E-03	kg/g
Conversion Factor from cm^3 to L	CF_{cm3-L}	1.E-03	L/cm^3

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EXPOSURE PARAMETERS

Parameter	Symbol	Units	Outdoor Industrial Worker	Construction Worker	Recreational User Adult	Recreational User Child	Indoor Industrial Worker
ALL PATHWAYS							
Exposure Frequency	EF	d/yr	250	250	26	26	250
Exposure Duration	ED	yr	25	1	24	6	25
Body Weight	BW	kg	70	70	70	15	70
Averaging Time-Non-cancer	ATnc	days	9,125	365	8,760	2,190	9125
Averaging Time-Cancer	ATca	days	25,550	25,550	25,550	25,550	2550
INCIDENTAL INGESTION OF SOIL/SEDIMENT							
Exposure Frequency	EFig	d/yr	250	250	26	26	NA
Ingestion Rate	IRs	mg/d	50	330	100	200	NA
DERMAL CONTACT WITH SOIL/SEDIMENT							
Exposure Frequency	EFdc	d/yr	250	250	26	26	NA
Surface Area	SAs	cm^2	3,300	3,300	5,700	2,800	NA
Soil-to-Skin Adherence Factor	SAF	mg/cm^2	0.2	0.2	0.07	0.2	NA
INHALATION OF VOLATILES IN AMBIENT AIR							
Exposure Frequency	EFaa	d/yr	250	250	26	26	NA
Inhalation Rate	IHRaa	m^3/hr	2.5	2.5	1.6	1.2	NA
Exposure Time	ETaa	hr/d	8	8	7	7	NA
INHALATION OF VOLATILES IN INDOOR AIR							
Exposure Frequency	EFia	d/yr	NA	NA	NA	NA	250
Inhalation Rate	IHRia	m^3/hr	NA	NA	NA	NA	2.5
Exposure Time	ETia	hr/d	NA	NA	NA	NA	8
INHALATION OF RESUSPENDED SOIL PARTICULATES							
Exposure Frequency	EFpe	d/yr	250	250	NA	NA	NA
Inhalation Rate	IHRpe	m^3/hr	2.5	2.5	NA	NA	NA
Exposure Time	ETpe	hr/d	8	8	NA	NA	NA
INGESTION OF GROUNDWATER/SURFACE WATER							
Exposure Frequency	EFdw	d/yr	NA	NA	26	26	NA
Ingestion Rate	IRdw	L/day	NA	NA	0.05	0.05	NA
DERMAL CONTACT WITH GROUNDWATER/SURFACE WATER							
Event Duration	tevent	hr/event	NA	2	0.25	0.25	NA
Event Frequency	EVswr	evt/day	NA	1	1	1	NA
Exposure Frequency	EFswr	d/yr	NA	125	26	26	NA
Surface Area	SAswr	cm^2	NA	7,100	18000	6600	NA

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AIR DISPERSION FACTOR (X/Q)

Source	Scenario	Chemical	Area of Source (acre)	Q/C (g/m^2-sec) per (kg/m^3)	X/Q (mg/m^3) per (mg/m^2-sec)
Soil	Industrial	Acetone	27.00	46.6	21
		Benzene	1.22	73.8	14
		Chlorobenzene	14.25	52.2	19
		1,2-Dichlrobenzene	8.85	56.4	18
		Methylene Chloride	14.25	52.2	19
		Toluene	14.25	52.2	19
Groundwater	Industrial	Acetone	10.63	54.8	18
		Benzene	1.16	74.2	13
		Chlorobenzene	4.05	63.2	16
		1,2-Dichlorobenzene	4.05	63.2	16
		1,3-Dichlorobenzene	1.73	70.7	14
		1,4-Dichlorobenzene	0.69	78.7	13
		Methylene Chloride	3.53	64.4	16
		Toluene	4.05	63.2	16

$$X/Q = \frac{CF_{kg\text{-}mg}}{Q/C \times CF_{g\text{-}mg}}$$

Source: U.S. EPA, 1996

Parameter	Symbol	Value	Units	Source(s)
Air Dispersion Factor	X/Q	see above	mg/m^3 per mg/m^2-sec	calculated
Inverse of Dispersion Factor	Q/C	see below	g/m^2-sec per kg/m^3	estimated
Area of Source	A	see above	acre	site-specific
Conversion Factor from kg to mg	$CF_{kg\text{-}mg}$	1.E+06	mg/kg	--
Conversion Factor from g to mg	$CF_{g\text{-}mg}$	1.E+03	mg/g	--

			Q/C (g/m^2-sec) / (kg/m^3)
Zone	State	City	Equations
7	OH	Cleveland	Q/C= -20.21 * log (A) + 75.51

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REPRESENTATIVE CONCENTRATIONS

Chemical	Soil (mg/kg)	Sediment (mg/kg)	Indoor Air -Soil (mg/m3)	Groundwater (mg/l)	Indoor Air - Groundwater (mg/m3)	Seeps (mg/l)
Acetone	1.59	ND	2.30E-04	45	8.80E-03	ND
Aluminum	ND	ND	ND	39.3	ND	0.112
Aniline	ND	ND	ND	12	ND	ND
Antimony	22.7	ND	ND	1.06	ND	ND
Arsenic	304.8	ND	ND	0.047	ND	ND
Benzene	0.67	ND	2.90E-03	0.11	3.40E-05	ND
Cadmium	ND	ND	ND	0.0012	ND	ND
Chlorobenzene	1.43	ND	1.20E-03	0.349	9.40E-05	ND
Chromium	71	ND	ND	0.128	ND	ND
Copper	ND	ND	ND	0.05	ND	ND
1,2-Dichlorobenzene	2.1	ND	2.90E-04	1.9	4.60E-04	ND
1,3-Dichlorobenzene	ND	ND	ND	0.041	9.90E-06	ND
1,4-Dichlorobezene	ND	ND	ND	0.26	6.30E-05	ND
Iron	ND	ND	ND	34.5	ND	0.734
Lead	19300	ND	ND	0.024	ND	ND
Manganese	640	ND	ND	4.89	ND	2.07
Methylene Chloride	1.41	ND	7.00E-03	0.2	7.20E-05	ND
4-Methylphenol	ND	ND	ND	0.33	ND	ND
Nickel	79.32	ND	ND	0.161	ND	ND
Thallium	10.4	ND	ND	0.0078	ND	ND
Tin	158000	ND	ND	ND	ND	ND
Toluene	15.1	ND	2.80E-02	21	5.80E-03	ND

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PARTICULATE EMISSION FACTOR (PEF)

Source	Scenario	Area (acre)	Q/C (g/m^2-sec) per (kg/m^3)	PEF (mg/kg) per (mg/m^3)
Soil	Industrial - Southwest Area(Mn)	4.7	61.9	8.98E+08
	Industrial - Trench 1	0.17	91.1	1.32E+09
	Construction	NA	NA	2.00E+07

$$PEF = \frac{Q/C \times 3600}{0.036 \times (1 - V) \times (Um/Ut)^3 \times F(x)}$$

Source: USEPA, 1996

Parameter	Symbol	Value	Units	Source(s)
Inverse of Dispersion Factor	Q/C	see above	g/m^2-sec per kg/m^3	estimated
Fraction of Vegetative Cover	V	0.5	--	site-specific
Mean Annual Windspeed	Um	4.69	m/sec	USEPA, 1996
Equivalent Threshold Value of Windspeed at 7 m	Ut	11.32	m/sec	USEPA, 1996
Function of Um/Ut	F(x)	2.E-01	--	USEPA, 1996

			Q/C (g/m^2-sec) / (kg/m^3)			
Zone	State	City	Equations			
7	OH	Cleveland	Q/C=	-20.21	* log (A) +	75.51

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TOXICITY CRITERIA

Chemical	Slope Factors (SF)			Reference Doses (RfD)		
	oral SFo $(mg/kg\text{-}d)^{-1}$	inhalation SFi $(mg/kg\text{-}d)^{-1}$	dermal SFd $(mg/kg\text{-}d)^{-1}$	chronic oral RfDo (mg/kg-d)	chronic inhalation RfDi (mg/kg-d)	chronic dermal RfDd (mg/kg-d)
Acetone	NA	NA	NA	0.1	0.1	0.1
Aluminum	NA	NA	NA	1	0.0014	1
Aniline	0.0057	0.0057	0.0057	0.007	0.00029	0.007
Antimony	NA	NA	NA	0.0004	0.0004	0.00006
Arsenic	1.5	15	1.5	0.0003	0.0003	0.0003
Benzene	0.055	0.027	0.055	0.003	0.0017	0.003
Cadmium	NA	6.3	NA	0.0005	0.0005	0.000013
Chlorobenzene	NA	NA	NA	0.02	0.0057	0.02
Chromium	NA	NA	NA	1.5	1.5	0.02
Copper	NA	NA	NA	0.037	0.037	0.037
1,2-Dichlorobenzene	NA	NA	NA	0.09	0.057	0.09
1,3-Dichlorobenzene	NA	NA	NA	0.0009	0.057	0.0009
1,4-Dichlorbenzene	0.024	0.022	0.024	0.03	0.23	0.03
Iron	NA	NA	NA	0.3	0.3	0.3
Lead	NA	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	0.14	0.000014	0.0056
Methylene Chloride	0.0075	0.0016	0.0075	0.06	0.86	0.06
4-Methylphenol	NA	NA	NA	0.005	0.005	0.005
Nickel	NA	0.84	NA	0.02	0.02	0.0008
Thallium	NA	NA	NA	0.00008	0.00008	0.00008
Tin	NA	NA	NA	0.6	0.6	0.6
Toluene	NA	NA	NA	0.2	0.11	0.2

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ABSORPTION FACTORS

Chemical	Oral soil ABSos (--)	Oral Water ABSow (--)	Oral Produce ABSop (--)	Inhalation VOC ABSiv (--)	Inhalation Dust ABSip (--)	Dermal Soil ABSds (--)	Permeability Constant Kp (USEPA) (cm/hr)	Steady-state Time t* (USEPA) (hr)
Acetone	1	1	1	1	1	0.1	NA	NA
Aluminum	1	1	1	1	1	0.01	0.001	NA
Aniline	1	1	1	1	1	0.1	1.90E-03	0.85
Antimony	1	1	1	1	1	0.01	0.001	NA
Arsenic	1	1	1	1	1	0.03	0.001	NA
Benzene	1	1	1	1	1	0.1	0.015	0.7
Cadmium	1	1	1	1	1	0.001	0.001	NA
Chlorobenzene	1	1	1	1	1	0.1	0.028	1.09
Chromium	1	1	1	1	1	0.01	0.001	NA
Copper	1	1	1	1	1	0.01	0.001	NA
1,2-Dichlorobenzene	1	1	1	1	1	0.1	0.041	1.71
1,3-Dichlorobenzene	1	1	1	1	1	0.1	0.058	1.71
1,4-Dichlorbenzene	1	1	1	1	1	0.1	0.042	1.71
Iron	1	1	1	1	1	0.01	0.001	NA
Lead	1	1	1	1	1	0.01	0.0001	NA
Manganese	1	1	1	1	1	0.01	0.001	NA
Methylene Chloride	1	1	1	1	1	0.1	0.0035	0.76
4-Methylphenol	1	1	1	1	1	0.1	NA	NA
Nickel	1	1	1	1	1	0.01	0.0002	NA
Thallium	1	1	1	1	1	0.01	0.001	NA
Tin	1	1	1	1	1	0.01	0.001	NA
Toluene	1	1	1	1	1	0.1	0.031	0.84

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PHYSICOCHEMICAL PROPERTIES

Chemical	Log Octanol Water Partition Coefficient (log Kow)	Henry's Law Constant (H)	Henry's Law Constant (H')	Aqueous Solubility (S)	Diffusivity in Air (Di)		Diffusivity in Water (Dw)	Organic Carbon Partition Coefficient (Koc)	Molecular Weight (MW)	VOC?
					given	calculated				
	(--)	(atm-m^3/mole)	(unitless)	(mg/l)	(cm^2/sec)	(cm^2/sec)	(cm^2/sec)	(l/kg)	(g/mole)	
Acetone	-0.24	3.88E-05	1.59E-03	1.00E+06	1.24E-01	NA	1.14E-05	5.80E-01	58	Yes
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	27	No
Aniline	0.90	2.02E-06	8.28E-05	3.41E+04	NA	9.20E-02	1.05E-05	4.07E+02	93.13	No
Antimony	NA	NA	NA	NA	NA	NA	NA	NA	122	No
Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	75	No
Benzene	2.13	5.55E-03	2.28E-01	1.75E+03	8.80E-02	NA	9.80E-06	5.89E+01	78.11	Yes
Chlorobenzene	2.86	3.70E-03	1.52E-01	4.70E+02	7.30E-02	NA	8.70E-06	2.19E+02	112.56	Yes
Chromium	NA	NA	NA	NA	NA	NA	NA	NA	52	No
Copper	NA	NA	NA	NA	NA	NA	NA	NA	64	No
1,2-Dichlorobenzene	3.43	1.90E-03	7.79E-02	1.56E+02	6.90E-02	NA	7.90E-06	6.17E+02	147	Yes
1,3-Dichlorobenzene	3.50	1.90E-03	7.79E-02	1.60E+02	6.90E-02	NA	7.90E-06	3.80E+02	147	Yes
1,4-Dichlorbenzene	3.42	2.43E-03	9.96E-02	7.38E+01	6.90E-02	NA	7.90E-06	6.17E+02	147	Yes
Iron	NA	NA	NA	NA	NA	NA	NA	NA	55.85	No
Lead	NA	NA	NA	NA	NA	NA	NA	NA	207	No
Manganese	NA	NA	NA	NA	NA	NA	NA	NA	55	No
Methylene Chloride	1.25	2.20E-03	9.02E-02	1.30E+04	1.00E-01	NA	1.20E-05	1.00E+01	85	Yes
Nickel	NA	NA	NA	NA	NA	NA	NA	NA	59	No
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	204	No
Tin	NA	NA	NA	NA	NA	NA	NA	NA	119	No
Toluene	2.75	6.64E-03	2.72E-01	5.26E+02	8.70E-02	NA	8.60E-06	1.82E+02	92.15	Yes

H' = H / RT

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CALCULATION OF SOIL SATURATION CONCENTRATIONS (Csat)

Chemical	Organic Carbon Partition Coefficient (Koc) (l/kg)	Aqueous Solubility (S) (mg/l)	Henry's Law Constant (H') (unitless)	Soil-Organic Partition Coefficient (Kd) (l/kg)	Saturation Concentration (Csat) (mg/kg)	Maximum Concentration Soil (Cs) (mg/kg)	Free Phase?
Acetone	5.80E-01	1.00E+06	1.59E-03	3.48E-03	1.04E+05	1.59E+00	No
Aluminum	NA	NA	NA	NA	NA	0.00E+00	NA
Aniline	4.07E+02	3.41E+04	8.28E-05	2.44E+00	8.67E+04	0.00E+00	No
Antimony	NA	NA	NA	NA	NA	2.27E+01	NA
Arsenic	NA	NA	NA	NA	NA	3.05E+02	NA
Benzene	5.89E+01	1.75E+03	2.28E-01	3.53E-01	8.68E+02	6.70E-01	No
Cadmium	NA	NA	NA	NA	NA	0.00E+00	NA
Chlorobenzene	2.19E+02	4.70E+02	1.52E-01	1.31E+00	6.78E+02	1.43E+00	No
Chromium	NA	NA	NA	NA	NA	7.10E+01	NA
Copper	NA	NA	NA	NA	NA	0.00E+00	NA
1,2-Dichlorobenzene	6.17E+02	1.56E+02	7.79E-02	3.70E+00	5.95E+02	2.10E+00	No
1,3-Dichlorobenzene	3.80E+02	1.60E+02	7.79E-02	2.28E+00	3.83E+02	0.00E+00	No
1,4-Dichlorbenzene	6.17E+02	7.38E+01	9.96E-02	3.70E+00	2.82E+02	0.00E+00	No
Iron	NA	NA	NA	NA	NA	0.00E+00	NA
Lead	NA	NA	NA	NA	NA	1.93E+04	NA
Manganese	NA	NA	NA	NA	NA	6.40E+02	NA
Methylene Chloride	1.00E+01	1.30E+04	9.02E-02	6.00E-02	2.30E+03	1.41E+00	No
4-Methylphenol	2.98E+02	1.80E+04	3.25E-05	1.79E+00	3.40E+04	0.00E+00	No
Nickel	NA	NA	NA	NA	NA	7.93E+01	NA
Thallium	NA	NA	NA	NA	NA	1.04E+01	NA
Tin	NA	NA	NA	NA	NA	1.58E+05	NA
Toluene	1.82E+02	5.26E+02	2.72E-01	1.09E+00	6.54E+02	1.51E+01	No

Csat = S/pb x (Kd x pb+ Pw + H' x Pa)

Kd = Koc x foc

Source: USEPA, 1996

Parameter	Symbol	Value	Units
Fraction Organic Carbon	foc	0.006	unitless
Bulk Density	pb	1.5	g/cm^3
Water Filled Soil Porosity	Pw	0.15	unitless
Air Filled Soil Porosity	Pa	0.28	unitless

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EFFECTIVE DIFFUSION COEFFICIENT IN SOIL

Chemical	Diffusivity in Air (Di) (cm^2/sec)	Diffusivity in Water (Dw) (cm^2/sec)	Henry's Law Constant (H') (unitless)	Soil-Organic Partition Coefficient (Kd) (cm^3/g)	Effective Diffusivity (Da) (cm^2/sec)
Acetone	1.24E-01	1.14E-05	1.59E-03	3.48E-03	9.91E-05
Aluminum	NA	NA	NA	NA	NA
Aniline	9.20E-02	1.05E-05	8.28E-05	2.44E+00	1.82E-07
Antimony	NA	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA	NA
Benzene	8.80E-02	9.80E-06	2.28E-01	3.53E-01	2.09E-03
Cadmium	NA	NA	NA	NA	NA
Chlorobenzene	7.30E-02	8.70E-06	1.52E-01	1.31E+00	3.98E-04
Chromium	NA	NA	NA	NA	NA
Copper	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	6.90E-02	7.90E-06	7.79E-02	3.70E+00	7.29E-05
1,3-Dichlorobenzene	6.90E-02	7.90E-06	7.79E-02	2.28E+00	1.16E-04
1,4-Dichlorbenzene	6.90E-02	7.90E-06	9.96E-02	3.70E+00	9.32E-05
Iron	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA
Methylene Chloride	1.00E-01	1.20E-05	9.02E-02	6.00E-02	2.64E-03
4-Methylphenol	7.40E-02	7.70E-06	3.25E-05	1.79E+00	9.23E-08
Nickel	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA
Tin	NA	NA	NA	NA	NA
Toluene	8.70E-02	8.60E-06	2.72E-01	1.09E+00	9.87E-04

$$Da = \frac{[\,(Pa^{10/3} \times Di \times H' + Pw^{10/3} \times Dw) / Pt^2\,]}{pb \times Kd + Pw + Pa \times H'}$$

Source: USEPA, 1996

Parameter	Symbol	Value	Units
Fraction Organic Carbon	foc	0.006	unitless
Air Filled Soil Porosity	Pa	0.28	unitless
Water Filled Soil Porosity	Pw	0.15	unitless
Total Porosity	Pt	0.43	unitless
Soil Bulk Density	pb	1.5	g/cm^3

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CALCULATION OF DERMALLY ABSORBED DOSE PER EVENT (DAevent)

Chemical	Molecular Weight (MW) (g/mole)	Log Octanol Water Partition Coefficient (log Kow)	Permeability Constant (Kp) (cm/hr)	Permeability Ratio (B) (--)	Diffusivity Through Skin (Dsc) (cm^2/hr)	Lag Time (tau) (hr)	Constant b (--)	Constant c (--)	Steady-state Time (t*) (hr)	Concentration Groundwater (Cgw) (mg/cm^3)	Dermal Absorbed Dose Per Event (DAevent) Construction (mg/cm^2-event)	Concentration in Surface Water (Csw) (mg/cm^3)	Dermal Absorbed Dose Per Event (DAevent) Recreational User (mg/cm^2-event)
Acetone	58	-0.24	0.001	2.93E-03	7.50E-07	2.22E-01	3.05E-01	3.35E-01	0.53	4.5E-02	1.1E-04	ND	ND
Aluminum	27	NA	0.001	2.00E-03	1.12E-06	1.49E-01	3.04E-01	3.35E-01	0.36	3.9E-02	9.0E-05	1.1E-04	6.0E-08
Aniline	93.13	0.90	0.0019	7.05E-03	4.77E-07	3.49E-01	3.08E-01	3.38E-01	0.85	1.2E-02	6.1E-05	ND	ND
Antimony	122	NA	0.001	4.25E-03	3.29E-07	5.07E-01	3.06E-01	3.36E-01	1.22	1.1E-03	3.2E-06	ND	ND
Arsenic	75	NA	0.001	3.33E-03	6.03E-07	2.77E-01	3.05E-01	3.36E-01	0.66	4.7E-05	1.2E-07	ND	ND
Benzene	78.11	2.13	0.015	5.10E-02	5.79E-07	2.88E-01	3.35E-01	3.68E-01	0.70	1.1E-04	4.1E-06	ND	ND
Cadmium	112	NA	0.001	4.07E-03	3.74E-07	4.46E-01	3.06E-01	3.36E-01	1.07	1.2E-06	3.5E-09	ND	ND
Chlorobenzene	112.56	2.86	0.028	1.14E-01	3.71E-07	4.49E-01	3.77E-01	4.13E-01	1.09	3.5E-04	2.7E-05	ND	ND
Chromium	52	NA	0.001	2.77E-03	8.11E-07	2.06E-01	3.05E-01	3.35E-01	0.49	1.3E-04	3.1E-07	ND	ND
Copper	64	NA	0.001	3.08E-03	6.94E-07	2.40E-01	3.05E-01	3.35E-01	0.58	5.0E-05	1.2E-07	ND	ND
1,2-Dichlorobenzene	147	3.43	0.041	1.91E-01	2.38E-07	7.00E-01	4.32E-01	4.71E-01	1.71	1.9E-03	2.6E-04	ND	ND
1,3-Dichlorobenzene	147	3.50	0.058	2.70E-01	2.38E-07	7.00E-01	4.95E-01	5.33E-01	1.71	4.1E-05	7.9E-06	ND	ND
1,4-Dichlorbenzene	147	3.42	0.042	1.96E-01	2.38E-07	7.00E-01	4.36E-01	4.75E-01	1.71	2.6E-04	3.6E-05	ND	ND
Iron	55.847	NA	0.001	2.87E-03	7.71E-07	2.16E-01	3.05E-01	3.35E-01	0.52	3.5E-02	8.4E-05	7.3E-04	4.7E-07
Lead	207	NA	0.0001	5.53E-04	1.10E-07	1.52E+00	3.04E-01	3.34E-01	3.64	2.4E-05	1.2E-08	ND	ND
Manganese	55	NA	0.001	2.85E-03	7.80E-07	2.14E-01	3.05E-01	3.35E-01	0.51	4.9E-03	1.2E-05	2.1E-03	1.3E-06
Methylene Chloride	85	1.25	0.0035	1.24E-02	5.30E-07	3.15E-01	3.11E-01	3.42E-01	0.76	2.0E-04	1.8E-06	ND	ND
4-Methylphenol	108.14	1.91	0.007	2.80E-02	3.93E-07	4.24E-01	3.21E-01	3.52E-01	1.02	3.3E-04	6.5E-06	ND	ND
Nickel	59	NA	0.0002	5.91E-04	7.41E-07	2.25E-01	3.04E-01	3.34E-01	0.54	1.6E-04	7.9E-08	ND	ND
Thallium	204	NA	0.001	5.49E-03	1.14E-07	1.46E+00	3.07E-01	3.37E-01	3.50	7.8E-06	3.7E-08	ND	ND
Tin	119	NA	0.001	4.20E-03	3.42E-07	4.88E-01	3.06E-01	3.36E-01	1.17	ND	ND	ND	ND
Toluene	92.15	2.75	0.031	1.14E-01	4.83E-07	3.45E-01	3.77E-01	4.14E-01	0.84	2.1E-02	1.7E-03	ND	ND

If tevent < t* DAevent = $2 * Kp * Cgw * (6 * tau * tevent/Pi)^{1/2}$

If tevent > t* DAevent = $Kp * Cgw * [tevent/(1+B) + 2*tau*(1 + 3*B + 3*B2) / (1+B2)]$

If log Kow < 4
Kp = Kp USEPA, 1998 Table B2 Kp if available, or
10^(-2.8 + 0.67*logKow - 0.0056*MW)
If log Kow >4
Kp = Kpmax from USEPA, 1998 Table B2 if available, or
Kp / (1 + B)

Source: USEPA, 1998

$B = \frac{Kp * (MW)^{1/2}}{2.6}$

t* = USEPA, 1998 Table B3, or

If B < 0.6, t* = 2.4 * tau

If B > 0.6, $t^* = \frac{(b - (b2 - c2)^{1/2}) * 1E-6}{Dsc}$

Dsc = 10^(-5.8 - 0.0056*MW)

$tau = \frac{1E-6}{6 * Dsc}$

$b = \frac{2*(1 + B)^2}{Pi}$

$c = \frac{1 + 3*B + 3*B^2}{3*(1 + B)}$

Parameter	Symbol	Value	Units
Event Duration - Recreational User	tevent	0.25	hr
Event Duration-Construction Worker	tevent	2.00	hr

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TOTAL SOLUTE CONCENTRATION OF VOLATILE COPCS IN GROUNDWATER

Chemical	Concentration Groundwater (Cgw) (mg/L)	Henry's Law Constant (H') (unitless)	Soil-Organic Partition Coefficient (Kd) (l/kg)	Diffusivity in Air (Di) (cm^2/sec)	Concentration Soil Vapor (Cv) (mg/cm^3)	Concentration Soil (CT) (mg/cm^3)
Acetone	45	1.6E-03	3.48E-03	1.24E-01	7.2E-05	2.5E-04
Aluminum	39.3	NA	NA	NA	NA	NA
Aniline	12	8.3E-05	2.44E+00	NA	NA	NA
Antimony	1.06	NA	NA	NA	NA	NA
Arsenic	0.047	NA	NA	NA	NA	NA
Benzene	0.11	2.3E-01	3.53E-01	8.80E-02	2.5E-05	6.6E-05
Cadmium	0.0012	NA	NA	NA	NA	NA
Chlorobenzene	0.349	1.5E-01	1.31E+00	7.30E-02	5.3E-05	7.0E-04
Chromium	0.128	NA	NA	NA	NA	NA
Copper	0.05	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	1.9	7.8E-02	3.70E+00	6.90E-02	1.5E-04	1.1E-02
1,3-Dichlorobenzene	0.041	7.8E-02	2.28E+00	6.90E-02	3.2E-06	1.4E-04
1,4-Dichlorbenzene	0.26	1.0E-01	3.70E+00	6.90E-02	2.6E-05	1.5E-03
Iron	34.5	NA	NA	NA	NA	NA
Lead	0.024	NA	NA	NA	NA	NA
Manganese	4.89	NA	NA	NA	NA	NA
Methylene Chloride	0.2	9.0E-02	6.00E-02	1.00E-01	1.8E-05	2.3E-05
4-Methylphenol	0.33	3.2E-05	1.79E+00	7.40E-02	NA	NA
Nickel	0.161	NA	NA	NA	NA	NA
Thallium	0.0078	NA	NA	NA	NA	NA
Tin	ND	NA	NA	NA	NA	NA
Toluene	21	2.7E-01	1.09E+00	8.70E-02	5.7E-03	3.6E-02

CT =	Cv x (pb x Kd/H' + Pw/H' + Pa)
Cv =	Cgw x H' x CF_{cm3-L}
Kd =	Koc x foc
Source:	USEPA, 1996

Parameter	Symbol	Value	Units
Bulk Density	pb	1.5	g/cm^3
Fraction Organic Carbon	foc	0.006	unitless
Water Filled Soil Porosity	Pw	0.15	unitless
Air Filled Soil Porosity	Pa	0.28	unitless
Conversion Factor from cm^3 to L	CF_{cm3-L}	1.E-03	L/cm^3

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EMISSION RATES OF VOLATILE COPCS FROM GROUNDWATER

Chemical	Concentration Soil (CT)	Effective Diffusivity (Da)	Emission Rate (Ei)	
			Industrial	Construction Worker
	(mg/cm^3)	(cm^2/sec)	(mg/m^2-sec)	(mg/m^2-sec)
Acetone	2.5E-04	9.91E-05	1.0E-06	5.1E-06
Aluminum	NA	NA	NA	NA
Aniline	NA	1.82E-07	NA	NA
Antimony	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA
Benzene	6.6E-05	2.09E-03	1.2E-06	6.1E-06
Cadmium	NA	NA	NA	NA
Chlorobenzene	7.0E-04	3.98E-04	5.6E-06	2.8E-05
Chromium	NA	NA	NA	NA
Copper	NA	NA	NA	NA
1,2-Dichlorobenzene	1.1E-02	7.29E-05	3.6E-05	1.8E-04
1,3-Dichlorobenzene	1.4E-04	1.16E-04	6.1E-07	3.1E-06
1,4-Dichlorbenzene	1.5E-03	9.32E-05	5.6E-06	2.8E-05
Iron	NA	NA	NA	NA
Lead	NA	NA	NA	NA
Manganese	NA	NA	NA	NA
Methylene Chloride	2.3E-05	2.64E-03	4.8E-07	2.4E-06
4-Methylphenol	NA	9.23E-08	NA	NA
Nickel	NA	NA	NA	NA
Thallium	NA	NA	NA	NA
Tin	NA	NA	NA	NA
Toluene	3.6E-02	9.87E-04	4.6E-04	2.3E-03

$$Ei = \frac{CT \times 2 \times Da \times CF_{m2\text{-}cm2}}{(3.14 \times Da \times T)^{1/2}}$$

Source: USEPA, 1996

Parameter	Symbol	Value	Units
Duration - Industrial	T	7.88E+08	sec
Duration - Construction Worker	T	3.15E+07	sec
Conversion Factor from m^2 to cm^2	$CF_{m2\text{-}cm2}$	1.E+04	cm^2/m^2

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AMBIENT AIR CONCENTRATIONS - VOLATILE COPCS FROM GROUNDWATER - X / Q MODEL

Chemical	Emission Rate (Ei)		Concentration Air (Caa)	
	Industrial (mg/m^2-sec)	Construction Worker (mg/m^2-sec)	Industrial (mg/m^3)	Construction Worker (mg/m^3)
Acetone	1.0E-06	5.1E-06	1.9E-05	9.3E-05
Aluminum	NA	NA	NA	NA
Aniline	NA	NA	NA	NA
Antimony	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA
Benzene	1.2E-06	6.1E-06	1.6E-05	8.2E-05
Cadmium	NA	NA	NA	NA
Chlorobenzene	5.6E-06	2.8E-05	8.9E-05	4.5E-04
Chromium	NA	NA	NA	NA
Copper	NA	NA	NA	NA
1,2-Dichlorobenzene	3.6E-05	1.8E-04	5.8E-04	2.9E-03
1,3-Dichlorobenzene	6.1E-07	3.1E-06	8.7E-06	4.3E-05
1,4-Dichlorbenzene	5.6E-06	2.8E-05	7.2E-05	3.6E-04
Iron	NA	NA	NA	NA
Lead	NA	NA	NA	NA
Manganese	NA	NA	NA	NA
Methylene Chloride	4.8E-07	2.4E-06	7.5E-06	3.7E-05
4-Methylphenol	NA	NA	NA	NA
Nickel	NA	NA	NA	NA
Thallium	NA	NA	NA	NA
Tin	NA	NA	NA	NA
Toluene	4.6E-04	2.3E-03	7.2E-03	3.6E-02

Caa = Ei x X/Q

Source: USEPA, 1996

Parameter	Symbol	Value	Units
Air Dispersion Factor	X/Q	chemical-specific	mg/m^3 per mg/m^2-sec

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EMISSION RATES OF VOLATILE COPCS FROM SUBSURFACE SOIL

Chemical	Concentration Soil (Cs) (mg/kg)	Effective Diffusivity (Da) (cm^2/sec)	Emission Rate (Ei) Industrial (mg/m^2-sec)	Emission Rate (Ei) Construction (mg/m^2-sec)
Acetone	1.59	9.91E-05	9.55E-06	4.77E-05
Aluminum	ND	NA	NA	NA
Aniline	ND	1.82E-07	NA	NA
Antimony	22.7	NA	NA	NA
Arsenic	304.8	NA	NA	NA
Benzene	0.67	2.09E-03	1.85E-05	9.24E-05
Cadmium	ND	NA	NA	NA
Chlorobenzene	1.43	3.98E-04	1.72E-05	8.60E-05
Chromium	71	NA	NA	NA
Copper	ND	NA	NA	NA
1,2-Dichlorobenzene	2.1	7.29E-05	1.08E-05	5.41E-05
1,3-Dichlorobenzene	ND	1.16E-04	NA	NA
1,4-Dichlorbenzene	ND	9.32E-05	NA	NA
Iron	ND	NA	NA	NA
Lead	19300	NA	NA	NA
Manganese	640	NA	NA	NA
Methylene Chloride	1.41	2.64E-03	4.37E-05	2.18E-04
4-Methylphenol	ND	9.23E-08	NA	NA
Nickel	79.32	NA	NA	NA
Thallium	10.4	NA	NA	NA
Tin	158000	NA	NA	NA
Toluene	15.1	9.87E-04	2.86E-04	1.43E-03

$$Ei = \frac{Cs \times pb \times 2 \times Da \times CF_{m2\text{-}cm2} \times CF_{g\text{-}kg}}{(3.14 \times Da \times T)^{1/2}}$$

Source: USEPA, 1996

Parameter	Symbol	Value	Units
Soil Bulk Density	pb	1.5	g/cm^3
Duration - Industrial	T	7.88E+08	sec
Duration - Construction	T	3.15E+07	sec
Conversion Factor from m^2 to cm^2	$CF_{m2\text{-}cm2}$	1.E+04	cm^2/m^2
Conversion Factor from g to kg	$CF_{g\text{-}kg}$	1.E-03	kg/g

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AMBIENT AIR CONCENTRATIONS DUE TO VOLATILE COPCS FROM SOIL - X / Q MODEL

Chemical	Emission Rate (Ei)		Concentration Air (Caa)	
	Industrial (mg/m^2-sec)	Construction (mg/m^2-sec)	Industrial (mg/m^3)	Construction (mg/m^3)
Acetone	9.55E-06	4.77E-05	2.05E-04	1.02E-03
Aluminum	NA	NA	NA	NA
Aniline	NA	NA	NA	NA
Antimony	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA
Benzene	1.85E-05	9.24E-05	2.50E-04	1.25E-03
Cadmium	NA	NA	NA	NA
Chlorobenzene	1.72E-05	8.60E-05	3.29E-04	1.65E-03
Chromium	NA	NA	NA	NA
Copper	NA	NA	NA	NA
1,2-Dichlorobenzene	1.08E-05	5.41E-05	1.92E-04	9.59E-04
1,3-Dichlorobenzene	NA	NA	NA	NA
1,4-Dichlorbenzene	NA	NA	NA	NA
Iron	NA	NA	NA	NA
Lead	NA	NA	NA	NA
Manganese	NA	NA	NA	NA
Methylene Chloride	4.37E-05	2.18E-04	8.37E-04	4.19E-03
4-Methylphenol	NA	NA	NA	NA
Nickel	NA	NA	NA	NA
Thallium	NA	NA	NA	NA
Tin	NA	NA	NA	NA
Toluene	2.86E-04	1.43E-03	5.48E-03	2.74E-02

Ca =	Ei x X/Q
Source:	USEPA, 1996

Parameter	Symbol	Value	Units
Air Dispersion Factor	X/Q	chemical-specific	mg/m3 per mg/m2-sec

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EMMISION RATES OF VOLATILE COPCS FROM EXPOSED GROUNDWATER

Chemical	Concentration in Groundwater (Cgw) (mg/l)	Concentration in Groundwater (Cgw) (g/cm^3)	Molecular Weight (MWi) (g/mol)	Henry's Law Constant (H) ($atm\text{-}m^3/mole$)	Universal Gas Constant (R) ($atm\text{-}m^3/mole\text{-}K$)	Temperature (T) (K)	Aqueous Phase Mass Transfer Coefficient (Kl) ($cm^3/cm^2\text{-}sec$)	Vapor Phase Mass Transfer Coefficient (Kg) ($cm^3/cm^2\text{-}sec$)	Overall Solute Mass Transfer Coefficient (Ki) ($cm^3/cm^2\text{-}sec$)	Emission Rate (Ei) ($g/sec\text{-}m^2$)	Emission Rate (Ei) ($mg/sec\text{-}m^2$)
Acetone	45.0	4.5E-02	1.24E-01	3.9E-05	8.20E-05	298	3.21E-02	4.41E+00	3.21E-02	1.45E-03	1.45E+00
Aluminum	39.3	3.9E-02	NA	NA	8.20E-05	298	NA	NA	NA	NA	NA
Aniline	12.0	1.2E-02	NA	2.0E-06	8.20E-05	298	NA	NA	NA	NA	NA
Antimony	1.1	1.1E-03	NA	NA	8.20E-05	298	NA	NA	NA	NA	NA
Arsenic	0.0	4.7E-05	NA	NA	8.20E-05	298	NA	NA	NA	NA	NA
Benzene	0.1	1.1E-04	8.80E-02	5.6E-03	8.20E-05	298	3.81E-02	4.95E+00	3.81E-02	4.20E-06	4.20E-03
Cadmium	0.0	1.2E-06	NA	NA	8.20E-05	298	NA	NA	NA	NA	NA
Chlorobenzene	0.3	3.5E-04	7.30E-02	3.7E-03	8.20E-05	298	4.19E-02	5.27E+00	4.19E-02	1.46E-05	1.46E-02
Chromium	0.1	1.3E-04	NA	NA	8.20E-05	298	NA	NA	NA	NA	NA
Copper	0.1	5.0E-05	NA	NA	8.20E-05	298	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	1.9	1.9E-03	6.90E-02	1.9E-03	8.20E-05	298	4.31E-02	5.37E+00	4.31E-02	8.18E-05	8.18E-02
1,3-Dichlorobenzene	0.0	4.1E-05	6.90E-02	1.9E-03	8.20E-05	298	4.31E-02	5.37E+00	4.31E-02	1.77E-06	1.77E-03
1,4-Dichlorobezene	0.3	2.6E-04	6.90E-02	2.4E-03	8.20E-05	298	4.31E-02	5.37E+00	4.31E-02	1.12E-05	1.12E-02
Iron	34.5	3.5E-02	NA	NA	8.20E-05	298	NA	NA	NA	NA	NA
Lead	0.0	2.4E-05	NA	NA	8.20E-05	298	NA	NA	NA	NA	NA
Manganese	4.9	4.9E-03	NA	NA	8.20E-05	298	NA	NA	NA	NA	NA
Methylene Chloride	0.2	2.0E-04	1.00E-01	2.2E-03	8.20E-05	298	3.58E-02	4.74E+00	3.58E-02	7.16E-06	7.16E-03
4-Methylphenol	0.3	3.3E-04	7.40E-02	7.9E-07	8.20E-05	298	4.16E-02	5.25E+00	4.15E-02	1.37E-05	1.37E-02
Nickel	0.2	1.6E-04	NA	NA	8.20E-05	298	NA	NA	NA	NA	NA
Thallium	0.0	7.8E-06	NA	NA	8.20E-05	298	NA	NA	NA	NA	NA
Tin	ND	NA	NA	NA	8.20E-05	298	NA	NA	NA	NA	NA
Toluene	21.0	2.1E-02	8.70E-02	6.6E-03	8.20E-05	298	3.84E-02	4.97E+00	3.84E-02	8.05E-04	8.05E-01

$Cw\ (g/cm^3) = Conc.\ (mg/l) / (1000\ cm^3/l \times 1000\ mg/g)$

$Ki = 1/ [1 / Kl + (R \times T) / (Kg \times H)]$ $\quad Kg = (MW_{H2O}/MWi)^{0.333} \times (T/298)^{1.005} \times (Kg_{H2O})$

$Ei = Ki \times Cw \times CF$

$Kl = (MW_{O2}/MWi)^{0.5} \times (T/298) \times (Kl_{O2})$

Source: U.S. EPA's Quiescent Surface Impoundment Model (1995)

Parameter	Symbol	Value	Units
Molecular Weight of Oxygen	MW_{O2}	32	g/mol
Molecular Weight of Water	MW_{H2O}	18	g/mol
Liquid-phase mass transfer coefficient of oxygen	Kl_{O2}	2.00E-03	cm/sec
Gas-phase mass transfer coefficient of water	Kg_{H2O}	8.33E-01	cm/sec
Conversion Factor	CF1	1E+04	g/cm2-s to g/m2-s

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AMBIENT AIR CONCENTRATIONS DUE TO VOLATILE COPCS FROM EXPOSED GROUNDWATER - BOX MODEL

Chemical	Emission Rate (Ei)	Concentration in Air (Ca)
	Construction Worker	Construction Worker
	(mg/m^2-sec)	(mg/m^3)
Acetone	1.45E+00	2.94E+00
Aluminum	NA	NA
Aniline	NA	NA
Antimony	NA	NA
Arsenic	NA	NA
Benzene	4.20E-03	8.52E-03
Chlorobenzene	1.46E-02	2.97E-02
Chromium	NA	NA
Copper	NA	NA
1,2-Dichlorobenzene	8.18E-02	1.66E-01
1,3-Dichlorobenzene	1.77E-03	3.59E-03
1,4-Dichlorbenzene	1.12E-02	2.28E-02
Iron	NA	NA
Lead	NA	NA
Manganese	NA	NA
Methylene Chloride	7.16E-03	1.45E-02
Nickel	NA	NA
Thallium	NA	NA
Tin	NA	NA
Toluene	8.05E-01	1.64E+00

$$Ca = \frac{Ei \times A}{WS \times Ls \times MH}$$

Source: Box Model

Parameter	Symbol	Value	Unit
Area of Emissions from Trench	A	16.7	(mg/m3) per (mg/m2-sec)
Wind Speed	WS	2.25	(m/s)
Length of Side	Ls	1.8	(m)
Mixing Height	MH	2	(m)

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INHALATION OF VOCS IN INDOOR AIR FROM SOIL EMISSIONS: INDOOR INDUSTRIAL WORKER

Chemical	Concentration Air (Cia) (mg/m^3)	Inhalation Absorption Factor-Volatiles (ABSiv) (--)	Annual Average Daily Dose (AADD) (mg/kg-d)	Inhalation Chronic Reference Dose (RfDi) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Inhalation Slope Factor (SFi) (mg/kg-d)$^{-1}$	Excess Cancer Risk (--)
Acetone	2.30E-04	1	4.5E-05	0.1	4.5E-04	1.6E-05	NA	NA
Aluminum	ND	1	NA	0.0014	NA	NA	NA	NA
Aniline	ND	1	NA	0.00029	NA	NA	0.0057	NA
Antimony	ND	1	NA	0.0004	NA	NA	NA	NA
Arsenic	ND	1	NA	0.0003	NA	NA	15	NA
Benzene	2.90E-03	1	5.7E-04	0.0017	3.3E-01	2.0E-04	0.0273	5.5E-06
Cadmium	ND	1	NA	0.0005	NA	NA	6.3	NA
Chlorobenzene	1.20E-03	1	2.3E-04	0.0057	4.1E-02	8.4E-05	NA	NA
Chromium	ND	1	NA	1.5	NA	NA	NA	NA
Copper	ND	1	NA	0.037	NA	NA	NA	NA
1,2-Dichlorobenzene	2.90E-04	1	5.7E-05	0.057	1.0E-03	2.0E-05	NA	NA
1,3-Dichlorobenzene	ND	1	NA	0.057	NA	NA	NA	NA
1,4-Dichlorbenzene	ND	1	NA	0.23	NA	NA	0.022	NA
Iron	ND	1	NA	0.3	NA	NA	NA	NA
Lead	ND	1	NA	NA	NA	NA	NA	NA
Manganese	ND	1	NA	0.000014	NA	NA	NA	NA
Methylene Chloride	7.00E-03	1	1.4E-03	0.86	1.6E-03	4.9E-04	0.0016	7.8E-07
4-Methylphenol	ND	1	NA	0.005	NA	NA	NA	NA
Nickel	ND	1	NA	0.02	NA	NA	0.84	NA
Thallium	ND	1	NA	0.00008	NA	NA	NA	NA
Tin	ND	1	NA	0.6	NA	NA	NA	NA
Toluene	2.80E-02	1	5.5E-03	0.11	5.0E-02	2.0E-03	NA	NA
					4E-01			6E-06

$$AADD = \frac{(Cia \times IHRia \times ETia \times ABSiv \times EFia \times ED)}{(BW \times ATnc)}$$

$$Hazard\ Quotient = \frac{AADD}{RfDi}$$

$$LADD = \frac{(Cia \times IHRia \times ETia \times ABSiv \times EFia \times ED)}{(BW \times ATca)}$$

$$Excess\ Cancer\ Risk = LADD \times SFi$$

Parameter	Symbol	Units	Values
Exposure Frequency	EFia	d/yr	NA
Exposure Duration	ED	yr	25
Body Weight	BW	kg	70
Averaging Time-Non-cancer	ATnc	days	9,125
Averaging Time-Cancer	ATca	days	25,550
Inhalation Rate	IHRia	m^3/hr	NA
Exposure Time	ETia	hr/d	NA

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INHALATION OF VOCS IN INDOOR AIR FROM GROUNDWATER EMISSIONS: INDOOR INDUSTRIAL WORKER

Chemical	Concentration Air (Caa) (mg/m^3)	Inhalation Absorption Factor-Volatiles (ABSiv) (--)	Annual Average Daily Dose (AADD) (mg/kg-d)	Inhalation Chronic Reference Dose (RfDi) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Inhalation Slope Factor (SFi) $(mg/kg\text{-}d)^{-1}$	Excess Cancer Risk (--)
Acetone	8.8E-03	1	1.7E-03	0.1	1.7E-02	6.2E-04	NA	NA
Aluminum	ND	1	NA	0.0014	NA	NA	NA	NA
Aniline	ND	1	NA	0.00029	NA	NA	0.0057	NA
Antimony	ND	1	NA	0.0004	NA	NA	NA	NA
Arsenic	ND	1	NA	0.0003	NA	NA	15	NA
Benzene	3.4E-05	1	6.7E-06	0.0017	3.9E-03	2.4E-06	0.0273	6.5E-08
Cadmium	ND	1	NA	0.0005	NA	NA	6.3	NA
Chlorobenzene	9.4E-05	1	1.8E-05	0.0057	3.2E-03	6.6E-06	NA	NA
Chromium	ND	1	NA	1.5	NA	NA	NA	NA
Copper	ND	1	NA	0.037	NA	NA	NA	NA
1,2-Dichlorobenzene	4.6E-04	1	9.0E-05	0.057	1.6E-03	3.2E-05	NA	NA
1,3-Dichlorobenzene	9.9E-06	1	1.9E-06	0.057	3.4E-05	6.9E-07	NA	NA
1,4-Dichlorbenzene	6.3E-05	1	1.2E-05	0.23	5.4E-05	4.4E-06	0.022	9.7E-08
Iron	ND	1	NA	0.3	NA	NA	NA	NA
Lead	ND	1	NA	NA	NA	NA	NA	NA
Manganese	ND	1	NA	0.000014	NA	NA	NA	NA
Methylene Chloride	7.2E-05	1	1.4E-05	0.86	1.6E-05	5.0E-06	0.0016	8.1E-09
4-Methylphenol	ND	1	NA	0.005	NA	NA	NA	NA
Nickel	ND	1	NA	0.02	NA	NA	0.84	NA
Thallium	ND	1	NA	0.00008	NA	NA	NA	NA
Tin	ND	1	NA	0.6	NA	NA	NA	NA
Toluene	5.8E-03	1	1.1E-03	0.11	1.0E-02	4.1E-04	NA	NA
					4E-02			2E-07

$$AADD = \frac{(Caa \times IHRaa \times ETaa \times ABSiv \times EFaa \times ED)}{(BW \times ATnc)}$$

$$Hazard\ Quotient = \frac{AADD}{RfDi}$$

$$LADD = \frac{(Caa \times IHRaa \times ETaa \times ABSiv \times EFaa \times ED)}{(BW \times ATca)}$$

$$Excess\ Cancer\ Risk = LADD \times SFi$$

Parameter	Symbol	Units	Values
Exposure Frequency	EFaa	d/yr	250
Exposure Duration	ED	yr	25
Body Weight	BW	kg	70
Averaging Time-Non-cancer	ATnc	days	9,125
Averaging Time-Cancer	ATca	days	25,550
Inhalation Rate	IHRaa	m^3/hr	2.5
Exposure Time	ETaa	hr/d	8

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SUMMARY RISK CHARACTERIZATION: INDOOR INDUSTRIAL WORKER

Chemical	Inhalation of Volatiles in Indoor Air from Soil	Inhalation of Volatiles in Indoor Air from Groundwater	Excess Cancer Risk
Acetone	NA	NA	NA
Aluminum	NA	NA	NA
Aniline	NA	NA	NA
Antimony	NA	NA	NA
Arsenic	NA	NA	NA
Benzene	**5.5E-06**	6.5E-08	**5.6E-06**
Cadmium	NA	NA	NA
Chlorobenzene	NA	NA	NA
Chromium	NA	NA	NA
Copper	NA	NA	NA
1,2-Dichlorobenzene	NA	NA	NA
1,3-Dichlorobenzene	NA	NA	NA
1,4-Dichlorbenzene	NA	9.7E-08	9.7E-08
Iron	NA	NA	NA
Lead	NA	NA	NA
Manganese	NA	NA	NA
Methylene Chloride	7.8E-07	8.1E-09	7.9E-07
4-Methylphenol	NA	NA	NA
Nickel	NA	NA	NA
Thallium	NA	NA	NA
Tin	NA	NA	NA
Toluene	NA	NA	NA
Total	**6.3E-06**	1.7E-07	**6.5E-06**

NA = not applicable

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SUMMARY RISK CHARACTERIZATION: INDOOR INDUSTRIAL WORKER

Chemical	Inhalation of Volatiles in Indoor Air from Soil	Inhalation of Volatiles in Indoor Air from Groundwater	Hazard Index
Acetone	4.5E-04	1.7E-02	1.8E-02
Aluminum	NA	NA	NA
Aniline	NA	NA	NA
Antimony	NA	NA	NA
Arsenic	NA	NA	NA
Benzene	3.3E-01	3.9E-03	3.4E-01
Cadmium	NA	NA	NA
Chlorobenzene	4.1E-02	3.2E-03	4.4E-02
Chromium	NA	NA	NA
Copper	NA	NA	NA
1,2-Dichlorobenzene	1.0E-03	1.6E-03	2.6E-03
1,3-Dichlorobenzene	NA	3.4E-05	3.4E-05
1,4-Dichlorbenzene	NA	5.4E-05	5.4E-05
Iron	NA	NA	NA
Lead	NA	NA	NA
Manganese	NA	NA	NA
Methylene Chloride	1.6E-03	1.6E-05	1.6E-03
4-Methylphenol	NA	NA	NA
Nickel	NA	NA	NA
Thallium	NA	NA	NA
Tin	NA	NA	NA
Toluene	5.0E-02	1.0E-02	6.0E-02
Total	4.3E-01	3.6E-02	4.6E-01

NA = not applicable

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INCIDENTAL INGESTION OF SOIL: OUTDOOR INDUSTRIAL WORKER

Chemical	Concentration Soil (Cs) (mg/kg)	Oral Absorption Factor-Soil (ABSos) (--)	Annual Average Daily Dose (AADD) (mg/kg-d)	Oral Chronic Reference Dose (RfDo) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Oral Slope Factor (SFo) $(mg/kg\text{-}d)^{-1}$	Excess Cancer Risk (--)
Acetone	1.59	1	7.8E-07	0.1	7.8E-06	2.8E-07	NA	NA
Aluminum	ND	1	ND	1	ND	ND	NA	ND
Aniline	ND	1	ND	0.007	ND	ND	0.0057	ND
Antimony	22.7	1	1.1E-05	0.0004	2.8E-02	4.0E-06	NA	NA
Arsenic	304.8	1	1.5E-04	0.0003	5.0E-01	5.3E-05	1.5	8.0E-05
Benzene	0.67	1	3.3E-07	0.003	1.1E-04	1.2E-07	0.055	6.4E-09
Cadmium	ND	1	ND	0.0005	ND	ND	NA	ND
Chlorobenzene	1.43	1	7.0E-07	0.02	3.5E-05	2.5E-07	NA	NA
Chromium	71	1	3.5E-05	1.5	2.3E-05	1.2E-05	NA	NA
Copper	ND	1	ND	0.037	ND	ND	NA	ND
1,2-Dichlorobenzene	2.1	1	1.0E-06	0.09	1.1E-05	3.7E-07	NA	NA
1,3-Dichlorobenzene	ND	1	ND	0.0009	ND	ND	NA	ND
1,4-Dichlorbenzene	ND	1	ND	0.03	ND	ND	0.024	ND
Iron	ND	1	ND	0.3	ND	ND	NA	ND
Lead	19300	1	9.4E-03	NA	NA	3.4E-03	NA	NA
Manganese	640	1	3.1E-04	0.14	2.2E-03	1.1E-04	NA	NA
Methylene Chloride	1.41	1	6.9E-07	0.06	1.1E-05	2.5E-07	0.0075	1.8E-09
4-Methylphenol	ND	1	ND	0.005	ND	ND	NA	ND
Nickel	79.32	1	3.9E-05	0.02	1.9E-03	1.4E-05	NA	NA
Thallium	10.4	1	5.1E-06	0.00008	6.4E-02	1.8E-06	NA	NA
Tin	158000	1	7.7E-02	0.6	1.3E-01	2.8E-02	NA	NA
Toluene	15.1	1	7.4E-06	0.2	3.7E-05	2.6E-06	NA	NA
					7.2E-01			8E-05

$$AADD = \frac{(Cs \times IRs \times ABSos \times EFig \times ED \times CFmg\text{-}kg)}{(BW \times ATnc)} \qquad \text{Hazard Quotient} = \frac{AADD}{RfDo}$$

$$LADD = \frac{(Cs \times IRs \times ABSos \times EFig \times ED \times CFmg\text{-}kg)}{(BW \times ATca)} \qquad \text{Excess Cancer Risk} = LADD \times SFo$$

Parameter	Symbol	Value	Units
Exposure Frequency	EFig	250	d/yr
Exposure Duration	ED	25	yr
Body Weight	BW	70	kg
Averaging Time-Non-cancer	ATnc	9,125	days
Averaging Time-Cancer	ATca	25,550	days
Ingestion Rate	IRs	50	mg/d
Conversion Factor from mg to kg	$CF_{mg\text{-}kg}$	1E-06	kg/mg

APPENDIX I
Human Health Risk Assessment
Morton International, Inc.
Reading, Ohio
6452

DERMAL CONTACT WITH SOIL: OUTDOOR INDUSTRIAL WORKER

Chemical	Concentration Soil (Cs) (mg/kg)	Dermal Absorption Factor-Soil (ABSds) (--)	Annual Average Daily Dose (AADD) (mg/kg-d)	Dermal Chronic Reference Dose (RfDd) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Dermal Slope Factor (SFd) $(mg/kg\text{-}d)^{-1}$	Excess Cancer Risk (--)
Acetone	1.59	0.1	1.0E-06	0.1	1.0E-05	3.7E-07	NA	NA
Aluminum	ND	0.01	ND	1	ND	ND	NA	ND
Aniline	ND	0.1	ND	0.007	ND	ND	0.0057	ND
Antimony	22.7	0.01	1.5E-06	0.00006	2.4E-02	5.2E-07	NA	NA
Arsenic	304.8	0.03	5.9E-05	0.0003	2.0E-01	2.1E-05	1.5	3.2E-05
Benzene	0.67	0.1	4.3E-07	0.003	1.4E-04	1.5E-07	0.055	8.5E-09
Cadmium	ND	0.001	ND	0.000013	ND	ND	NA	ND
Chlorobenzene	1.43	0.1	9.2E-07	0.02	4.6E-05	3.3E-07	NA	NA
Chromium	71	0.01	4.6E-06	0.02	2.3E-04	1.6E-06	NA	NA
Copper	ND	0.01	ND	0.037	ND	ND	NA	ND
1,2-Dichlorobenzene	2.1	0.1	1.4E-06	0.09	1.5E-05	4.8E-07	NA	NA
1,3-Dichlorobenzene	ND	0.1	ND	0.0009	ND	ND	NA	ND
1,4-Dichlorbenzene	ND	0.1	ND	0.03	ND	ND	0.024	ND
Iron	ND	0.01	ND	0.3	ND	ND	NA	ND
Lead	19300	0.01	1.2E-03	NA	NA	4.5E-04	NA	NA
Manganese	640	0.01	4.1E-05	0.0056	7.4E-03	1.5E-05	NA	NA
Methylene Chloride	1.41	0.1	9.1E-07	0.06	1.5E-05	3.3E-07	0.0075	2.4E-09
4-Methylphenol	ND	0.1	ND	0.005	ND	ND	NA	ND
Nickel	79.32	0.01	5.1E-06	0.0008	6.4E-03	1.8E-06	NA	NA
Thallium	10.4	0.01	6.7E-07	0.00008	8.4E-03	2.4E-07	NA	NA
Tin	158000	0.01	1.0E-02	0.6	1.7E-02	3.6E-03	NA	NA
Toluene	15.1	0.1	9.8E-06	0.2	4.9E-05	3.5E-06	NA	NA
					3E-01			3E-05

$$AADD = \frac{(Cs \times SAs \times SAF \times ABSds \times EFdc \times ED \times CFmg\text{-}kg)}{(BW \times ATnc)}$$

$$Hazard\ Quotient = \frac{AADD}{RfDo}$$

$$LADD = \frac{(Cs \times SAs \times SAF \times ABSds \times EFdc \times ED \times CFmg\text{-}kg)}{(BW \times ATca)}$$

$$Excess\ Cancer\ Risk = LADD \times SFo$$

Parameter	Symbol	Values	Units
Exposure Frequency	EFdc	250	d/yr
Exposure Duration	ED	25	yr
Body Weight	BW	70	kg
Averaging Time-Non-cancer	ATnc	9,125	days
Averaging Time-Cancer	ATca	25,550	days
Surface Area	SAs	3,300	cm^2
Soil-to-Skin Adherence Factor	SAF	0.2	mg/cm^2
Conversion Factor from mg to kg	$CF_{mg\text{-}kg}$	1E-06	kg/mg

Morton International, Inc.
Reading, Ohio
6452

INHALATION OF VOCS IN AMBIENT AIR FROM SOIL EMISSIONS: OUTDOOR INDUSTRIAL WORKER

Chemical	Concentration Air (Caa) (mg/m^3)	Inhalation Absorption Factor-Volatiles (ABSiv) (--)	Annual Average Daily Dose (AADD) (mg/kg-d)	Inhalation Chronic Reference Dose (RfDi) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Inhalation Slope Factor (SFi) (mg/kg-d)$^{-1}$	Excess Cancer Risk (--)
Acetone	2.0E-04	1	4.0E-05	0.1	4.0E-04	1.4E-05	NA	NA
Aluminum	NA	1	NA	0.0014	NA	NA	NA	NA
Aniline	NA	1	NA	0.00029	NA	NA	0.0057	NA
Antimony	NA	1	NA	0.0004	NA	NA	NA	NA
Arsenic	NA	1	NA	0.0003	NA	NA	15	NA
Benzene	2.5E-04	1	4.9E-05	0.0017	2.9E-02	1.7E-05	0.0273	4.8E-07
Cadmium	NA	1	NA	0.0005	NA	NA	6.3	NA
Chlorobenzene	3.3E-04	1	6.4E-05	0.0057	1.1E-02	2.3E-05	NA	NA
Chromium	NA	1	NA	1.5	NA	NA	NA	NA
Copper	NA	1	NA	0.037	NA	NA	NA	NA
1,2-Dichlorobenzene	1.9E-04	1	3.8E-05	0.057	6.6E-04	1.3E-05	NA	NA
1,3-Dichlorobenzene	NA	1	NA	0.057	NA	NA	NA	NA
1,4-Dichlorbenzene	NA	1	NA	0.23	NA	NA	0.022	NA
Iron	NA	1	NA	0.3	NA	NA	NA	NA
Lead	NA	1	NA	NA	NA	NA	NA	NA
Manganese	NA	1	NA	0.000014	NA	NA	NA	NA
Methylene Chloride	8.4E-04	1	1.6E-04	0.86	1.9E-04	5.9E-05	0.0016	9.4E-08
4-Methylphenol	NA	1	NA	0.005	NA	NA	NA	NA
Nickel	NA	1	NA	0.02	NA	NA	0.84	NA
Thallium	NA	1	NA	0.00008	NA	NA	NA	NA
Tin	NA	1	NA	0.6	NA	NA	NA	NA
Toluene	5.5E-03	1	1.1E-03	0.11	9.7E-03	3.8E-04	NA	NA
					5E-02			6E-07

$$AADD = \frac{(Caa \times IHRaa \times ETaa \times ABSiv \times EFaa \times ED)}{(BW \times ATnc)}$$

$$Hazard\ Quotient = \frac{AADD}{RfDi}$$

$$LADD = \frac{(Caa \times IHRaa \times ETaa \times ABSiv \times EFaa \times ED)}{(BW \times ATca)}$$

$$Excess\ Cancer\ Risk = LADD \times SFi$$

Parameter	Symbol	Units	Values
Exposure Frequency	EFaa	d/yr	250
Exposure Duration	ED	yr	25
Body Weight	BW	kg	70
Averaging Time-Non-cancer	ATnc	days	9,125
Averaging Time-Cancer	ATca	days	25,550
Inhalation Rate	IHRaa	m^3/hr	2.5
Exposure Time	ETaa	hr/d	8

APPENDIX I
Human Health Risk Assessment
Morton International, Inc.
Reading, Ohio
6452

INHALATION OF RESUSPENDED PARTICULATES FROM SOIL: OUTDOOR INDUSTRIAL WORKER

Chemical	Concentration Soil (Cs) (mg/kg)	Inhalation Absorption Factor-Dusts (ABSip) (--)	Annual Average Daily Dose (AADD) (mg/kg-d)	Inhalation Chronic Reference Dose (RfDi) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Inhalation Slope Factor (SFi) $(mg/kg\text{-}d)^{-1}$	Excess Cancer Risk (--)
Acetone	NA	1	NA	0.1	NA	NA	NA	NA
Aluminum	ND	1	NA	0.0014	NA	NA	NA	NA
Aniline	ND	1	NA	0.00029	NA	NA	0.0057	NA
Antimony	22.7	1	3.4E-09	0.0004	8.4E-06	1.2E-09	NA	NA
Arsenic	304.8	1	4.5E-08	0.0003	1.5E-04	1.6E-08	15	2.4E-07
Benzene	NA	1	NA	0.0017	NA	NA	0.0273	NA
Cadmium	ND	1	NA	0.0005	NA	NA	6.3	NA
Chlorobenzene	NA	1	NA	0.0057	NA	NA	NA	NA
Chromium	71	1	1.1E-08	1.5	7.0E-09	3.8E-09	NA	NA
Copper	ND	1	NA	0.037	NA	NA	NA	NA
1,2-Dichlorobenzene	NA	1	NA	0.057	NA	NA	NA	NA
1,3-Dichlorobenzene	NA	1	NA	0.057	NA	NA	NA	NA
1,4-Dichlorbenzene	NA	1	NA	0.23	NA	NA	0.022	NA
Iron	ND	1	NA	0.3	NA	NA	NA	NA
Lead	19300	1	2.9E-06	NA	NA	1.0E-06	NA	NA
Manganese	640	1	1.4E-07	0.000014	1.0E-02	5.0E-08	NA	NA
Methylene Chloride	NA	1	NA	0.86	NA	NA	0.0016	NA
4-Methylphenol	ND	1	NA	0.005	NA	NA	NA	NA
Nickel	79.32	1	1.2E-08	0.02	5.9E-07	4.2E-09	0.84	3.5E-09
Thallium	10.4	1	1.5E-09	0.00008	1.9E-05	5.5E-10	NA	NA
Tin	158000	1	2.3E-05	0.6	3.9E-05	8.4E-06	NA	NA
Toluene	NA	1	NA	0.11	NA	NA	NA	NA
					1E-02			2E-07

$$AADD = \frac{(Cs \times IHRaa \times ETaa \times ABSip \times EFaa \times ED)}{(BW \times PEF \times ATnc)}$$

$$LADD = \frac{(Cs \times IHRaa \times ETaa \times ABSip \times EFaa \times ED)}{(BW \times PEF \times ATca)}$$

$$\text{Hazard Quotient} = \frac{AADD}{RfDi}$$

$$\text{Excess Cancer Risk} = LADD \times SFi$$

Parameter	Symbol	Units	Values
Exposure Frequency	EFpe	d/yr	250
Exposure Duration	ED	yr	25
Body Weight	BW	kg	70
Averaging Time-Non-cancer	ATnc	days	9,125
Averaging Time-Cancer	ATca	days	25,550
Inhalation Rate	IHRpe	m^3/hr	2.5
Exposure Time	ETpe	hr/d	8
Particulate Emission Factor	PEF	m^3/kg	#NAME?

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Morton International, Inc.
Reading, Ohio
6452

INHALATION OF VOCS IN AMBIENT AIR FROM GROUNDWATER EMISSIONS: OUTDOOR INDUSTRIAL WORKER

Chemical	Concentration Air (Caa) (mg/m^3)	Inhalation Absorption Factor-Volatiles (ABSiv) (--)	Annual Average Daily Dose (AADD) (mg/kg-d)	Inhalation Chronic Reference Dose (RfDi) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Inhalation Slope Factor (SFi) (mg/kg-d)$^{-1}$	Excess Cancer Risk (--)
Acetone	1.9E-05	1	3.6E-06	0.1	3.6E-05	1.3E-06	NA	NA
Aluminum	NA	1	NA	0.0014	NA	NA	NA	NA
Aniline	NA	1	NA	0.00029	NA	NA	0.0057	NA
Antimony	NA	1	NA	0.0004	NA	NA	NA	NA
Arsenic	NA	1	NA	0.0003	NA	NA	15	NA
Benzene	1.6E-05	1	3.2E-06	0.0017	1.9E-03	1.1E-06	0.0273	3.1E-08
Cadmium	NA	1	NA	0.0005	NA	NA	6.3	NA
Chlorobenzene	8.9E-05	1	1.7E-05	0.0057	3.1E-03	6.2E-06	NA	NA
Chromium	NA	1	NA	1.5	NA	NA	NA	NA
Copper	NA	1	NA	0.037	NA	NA	NA	NA
1,2-Dichlorobenzene	5.8E-04	1	1.1E-04	0.057	2.0E-03	4.0E-05	NA	NA
1,3-Dichlorobenzene	8.7E-06	1	1.7E-06	0.057	3.0E-05	6.0E-07	NA	NA
1,4-Dichlorbenzene	7.2E-05	1	1.4E-05	0.23	6.1E-05	5.0E-06	0.022	1.1E-07
Iron	NA	1	NA	0.3	NA	NA	NA	NA
Lead	NA	1	NA	NA	NA	NA	NA	NA
Manganese	NA	1	NA	0.000014	NA	NA	NA	NA
Methylene Chloride	7.5E-06	1	1.5E-06	0.86	1.7E-06	5.2E-07	0.0016	8.4E-10
4-Methylphenol	NA	1	NA	0.005	NA	NA	NA	NA
Nickel	NA	1	NA	0.02	NA	NA	0.84	NA
Thallium	NA	1	NA	0.00008	NA	NA	NA	NA
Tin	NA	1	NA	0.6	NA	NA	NA	NA
Toluene	7.2E-03	1	1.4E-03	0.11	1.3E-02	5.1E-04	NA	NA
					2E-02			1E-07

$$AADD = \frac{(Caa \times IHRaa \times ETaa \times ABSiv \times EFaa \times ED)}{(BW \times ATnc)}$$

$$Hazard\ Quotient = \frac{AADD}{RfDi}$$

$$LADD = \frac{(Caa \times IHRaa \times ETaa \times ABSiv \times EFaa \times ED)}{(BW \times ATca)}$$

$$Excess\ Cancer\ Risk = LADD \times SFi$$

Parameter	Symbol	Units	Values
Exposure Frequency	EFaa	d/yr	250
Exposure Duration	ED	yr	25
Body Weight	BW	kg	70
Averaging Time-Non-cancer	ATnc	days	9,125
Averaging Time-Cancer	ATca	days	25,550
Inhalation Rate	IHRaa	m^3/hr	2.5
Exposure Time	ETaa	hr/d	8

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SUMMARY RISK CHARACTERIZATION: OUTDOOR INDUSTRIAL WORKER

Chemical	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Inhalation of Volatiles in Ambient Air from Soil	Inhalation of Volatiles in Ambient Air from Groundwater	Excess Cancer Risk
Acetone	NA	NA	NA	NA	NA	NA
Aluminum	ND	ND	NA	NA	NA	NA
Aniline	ND	ND	NA	NA	NA	NA
Antimony	NA	NA	NA	NA	NA	NA
Arsenic	**8.0E-05**	**3.2E-05**	2.4E-07	NA	NA	**1.1E-04**
Benzene	6.4E-09	8.5E-09	NA	4.8E-07	3.1E-08	5.2E-07
Cadmium	ND	ND	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA	NA
Copper	ND	ND	NA	NA	NA	NA
1,2-Dichlorobenzene	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	ND	ND	NA	NA	NA	NA
1,4-Dichlorbenzene	ND	ND	NA	NA	1.1E-07	1.1E-07
Iron	ND	ND	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA	NA
Methylene Chloride	1.8E-09	2.4E-09	NA	9.4E-08	8.4E-10	9.9E-08
4-Methylphenol	ND	ND	NA	NA	NA	NA
Nickel	NA	NA	3.5E-09	NA	NA	3.5E-09
Thallium	NA	NA	NA	NA	NA	NA
Tin	NA	NA	NA	NA	NA	NA
Toluene	NA	NA	NA	NA	NA	NA
Total	**8.0E-05**	**3.2E-05**	2.5E-07	5.7E-07	1.4E-07	**1E-04**

NA = not applicable

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Morton International, Inc.
Reading, Ohio
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SUMMARY RISK CHARACTERIZATION: OUTDOOR INDUSTRIAL WORKER

Chemical	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Particulates	Inhalation of Volatiles in Ambient Air from Soil	Inhalation of Volatiles in Ambient Air from Groundwater	Hazard Index
Acetone	7.8E-06	1.0E-05	NA	4.0E-04	3.6E-05	4.6E-04
Aluminum	ND	ND	NA	NA	NA	NA
Aniline	ND	ND	NA	NA	NA	NA
Antimony	2.8E-02	2.4E-02	8.4E-06	NA	NA	5.2E-02
Arsenic	5.0E-01	2.0E-01	1.5E-04	NA	NA	6.9E-01
Benzene	1.1E-04	1.4E-04	NA	2.9E-02	1.9E-03	3.1E-02
Cadmium	ND	ND	NA	NA	NA	NA
Chlorobenzene	3.5E-05	4.6E-05	NA	1.1E-02	3.1E-03	1.4E-02
Chromium	2.3E-05	2.3E-04	7.0E-09	NA	NA	2.5E-04
Copper	ND	ND	NA	NA	NA	NA
1,2-Dichlorobenzene	1.1E-05	1.5E-05	NA	6.6E-04	2.0E-03	2.7E-03
1,3-Dichlorobenzene	ND	ND	NA	NA	3.0E-05	3.0E-05
1,4-Dichlorbenzene	ND	ND	NA	NA	6.1E-05	6.1E-05
Iron	ND	ND	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA
Manganese	2.2E-03	7.4E-03	1.0E-02	NA	NA	2.0E-02
Methylene Chloride	1.1E-05	1.5E-05	NA	1.9E-04	1.7E-06	2.2E-04
4-Methylphenol	ND	ND	NA	NA	NA	NA
Nickel	1.9E-03	6.4E-03	5.9E-07	NA	NA	8.3E-03
Thallium	6.4E-02	8.4E-03	1.9E-05	NA	NA	7.2E-02
Tin	1.3E-01	1.7E-02	3.9E-05	NA	NA	1.5E-01
Toluene	3.7E-05	4.9E-05	NA	9.7E-03	1.3E-02	2.3E-02
Total	7.2E-01	2.6E-01	1.0E-02	5.1E-02	2.0E-02	**1.1E+00**

NA = not applicable

Appendix F

Calculation of Exposure Point Concentrations in Soil and Groundwater

TABLE F-1
CALCULATION OF EXPOSURE POINT CONCENTRATIONS
ACETONE IN SOIL
Morton International, Inc.
Reading, Ohio

1) Select Data Set: Highest Mean

(0 - 2') shallow mean ____ **0.348375**

(0 - 15') total mean__x__ **1.109**

2) Select Distribution

normal_____

lognormal__x__

Normal Data (mg/kg)

Sample Location	Acetone [1]
DP01-2'	15
DP01-9.5'	0.5
DP02-2'	0.015
DP02-9.5'	0.0093
DP03-2'	0.0095
DP03-8.5'	0.009
DP05-1'	0.009
DP05-8.5'	0.0085
DP07-9'	0.009
DP08-6'	0.007
DP08-11'	0.01
DP09-12'	4.1
DP10-2'	0.0091
DP10-10'	0.55
DP10-10' Blind Dup	
DP12-1.5'	0.0019
DP12-9'	0.0105
DP13-3'	0.0085
DP13-11'	10.5
DP14-3'	0.445
DP14-9'	0.5
DP15-2'	0.01
DP15-9'	0.6
DP16-2.8'	0.011
DP16-12.5'	24.5
DP17-3'	0.5
DP17-13'	0.52
DP18-2'	0.01
DP18-14.5'	0.0095
DP19-2'	0.02
DP19-13'	0.0115
DP20-2'	0.01
DP20-14.5'	0.5
DP23-2.5'	0.0125
DP23-9'	0.0105
DP25-2.5'	0.0045
DP25-2.5' Blind Dup	
DP25-7.5'	0.0025
DP29-5	0.0036
STR01-3'	0.009
STR02-1'	0.0105
STR02-12.5'	0.00355
STR03-4'	0.5
STR03-12.5'	0.019
STR04-1.5'	0.01
STR05-1.5'	0.011
STR05-9'	0.0095
STR05-11.3'	0.0072
STR06-1'	0.013
STR06-15'	0.009
STR07-1.5'	0.03

Lognormal Data

Sample Location	Acetone
DP01-2'	2.71
DP01-9.5'	-0.69
DP02-2'	-4.20
DP02-9.5'	-4.68
DP03-2'	-4.66
DP03-8.5'	-4.71
DP05-1'	-4.71
DP05-8.5'	-4.77
DP07-9'	-4.71
DP08-6'	-4.96
DP08-11'	-4.61
DP09-12'	1.41
DP10-2'	-4.70
DP10-10'	-0.60
DP10-10' Blind Dup	
DP12-1.5'	-6.27
DP12-9'	-4.56
DP13-3'	-4.77
DP13-11'	2.35
DP14-3'	-0.81
DP14-9'	-0.69
DP15-2'	-4.61
DP15-9'	-0.51
DP16-2.8'	-4.51
DP16-12.5'	3.20
DP17-3'	-0.69
DP17-13'	-0.65
DP18-2'	-4.61
DP18-14.5'	-4.66
DP19-2'	-3.91
DP19-13'	-4.47
DP20-2'	-4.61
DP20-14.5'	-0.69
DP23-2.5'	-4.38
DP23-9'	-4.56
DP25-2.5'	-5.40
DP25-2.5' Blind Dup	
DP25-7.5'	-5.99
DP29-5	-5.63
STR01-3'	-4.71
STR02-1'	-4.56
STR02-12.5'	-5.64
STR03-4'	-0.69
STR03-12.5'	-3.96
STR04-1.5'	-4.61
STR05-1.5'	-4.51
STR05-9'	-4.66
STR05-11.3'	-4.93
STR06-1'	-4.34
STR06-15'	-4.71
STR07-1.5'	-3.51

TABLE F-1
CALCULATION OF EXPOSURE POINT CONCENTRATIONS
ACETONE IN SOIL
Morton International, Inc.
Reading, Ohio

1) Select Data Set: Highest Mean

(0 - 2') shallow mean ____ **0.348375**

(0 - 15') total mean__x__ **1.109**

2) Select Distribution

normal_____

lognormal__x__

Normal Data (mg/kg)

Sample Location	Acetone [1]
STR08-1.5'	0.0105
STR08-13'	
STR08-13' DUP	5.9
STR09-7.5'	0.011
STR10-1.5'	0.009
STR10-11'	0.0081
STR11-2'	0.0095
STR11-9'	
STR11-9' Blind Dup	0.0095
T-1-4	1.8
T-1-6	0.012
T-2-3	0.0028
T-2-9	0.54
T-3-3	0.58
T-3-11	0.0027
T-4-3	0.007
T-4-9	0.0033
T-5-3	0.0035
T-5-9	0.028
T-6-3	0.027
T-6-7.5	23
T-6-10	0.42
T-8-3	0.0032
T-8-9	0.0032
UAW01-30-1.5'	0.0105
UAW01-30-15'	0.011
UAW04-20-10'	14
UAW05-20-13'	0.45
UAW06-20-1.5'	0.029
UAW06-20-11.5'	0.59
UAW08-20-13'	0.9
UAW09-20-1.5'	0.01
UAW09-20-15'	0.0105
UAW11-40-2'	0.013
UAW11-40-10'	2.3
UAW12-20-12'	0.6
UAW13-20-1.5'	0.025
UAW13-20-11.5'	0.55
UAW14-10-1.5'	0.01
UAW15-20-2'	
UAW15-20-2' DUP	0.075
UAW15-20-8.5'	0.01
UAW16-10-2'	0.013
UAW16-10-5.5'	0.013
UAW17-40-1.5'	0.009
UAW17-40-5'	0.69
UAW18-20-1'	1.3
UAW18-20-15'	0.0029
UAW19-80-1.5'	0.01
UAW19-80-15'	0.009
UAW20-60-1.5'	0.0095

Lognormal Data

Sample Location	Acetone
STR08-1.5'	-4.56
STR08-13'	
STR08-13' DUP	1.77
STR09-7.5'	-4.51
STR10-1.5'	-4.71
STR10-11'	-4.82
STR11-2'	-4.66
STR11-9'	
STR11-9' Blind Dup	-4.66
T-1-4	0.59
T-1-6	-4.42
T-2-3	-5.88
T-2-9	-0.62
T-3-3	-0.54
T-3-11	-5.91
T-4-3	-4.96
T-4-9	-5.71
T-5-3	-5.65
T-5-9	-3.58
T-6-3	-3.61
T-6-7.5	3.14
T-6-10	-0.87
T-8-3	-5.74
T-8-9	-5.74
UAW01-30-1.5'	-4.56
UAW01-30-15'	-4.51
UAW04-20-10'	2.64
UAW05-20-13'	-0.80
UAW06-20-1.5'	-3.54
UAW06-20-11.5'	-0.53
UAW08-20-13'	-0.11
UAW09-20-1.5'	-4.61
UAW09-20-15'	-4.56
UAW11-40-2'	-4.34
UAW11-40-10'	0.83
UAW12-20-12'	-0.51
UAW13-20-1.5'	-3.69
UAW13-20-11.5'	-0.60
UAW14-10-1.5'	-4.61
UAW15-20-2'	
UAW15-20-2' DUP	-2.59
UAW15-20-8.5'	-4.61
UAW16-10-2'	-4.34
UAW16-10-5.5'	-4.34
UAW17-40-1.5'	-4.71
UAW17-40-5'	-0.37
UAW18-20-1'	0.26
UAW18-20-15'	-5.84
UAW19-80-1.5'	-4.61
UAW19-80-15'	-4.71
UAW20-60-1.5'	-4.66

TABLE F-1
CALCULATION OF EXPOSURE POINT CONCENTRATIONS
ACETONE IN SOIL
Morton International, Inc.
Reading, Ohio

1) Select Data Set: Highest Mean

(0 - 2') shallow mean ____ **0.348375**

(0 - 15') total mean__x__ **1.109**

2) Select Distribution

normal_____

lognormal__x__

Normal Data (mg/kg)

Sample Location	Acetone [1]
UAW20-60-9.5'	0.0105
UAW21-30-1.5'	0.01
UAW21-30-10'	0.009
UAW22-20-2'	0.01
UAW22-20-11'	0.0043
count (n)	102
mean (x)	1.11
standard deviation (SD)	3.98
T value	1.66
95% upper confidence limit [2]	1.76
Kolmogorov-Smirnov:	0.29
Distribution:	0.61
Best fit:	Lognormal

Lognormal Data

Sample Location	Acetone
UAW20-60-9.5'	-4.56
UAW21-30-1.5'	-4.61
UAW21-30-10'	-4.71
UAW22-20-2'	-4.61
UAW22-20-11'	-5.45
count (n)	102
mean (x)	-3.33
standard deviation (SD)	2.40
H value	3.79
95% upper confidence limit [3]	1.59
maximum detected value	23
exposure point concentration	1.59

1. Non-detect values are presented at one-half the detection limit.
2. 95% upper confidence limit = x + t(SD/n0.5)
3. 95% upper confidence limit = e(x+0.5 * SD^2+SD*H/(n-1)^0.5)

TABLE F-2
CALCULATION OF EXPOSURE POINT CONCENTRATIONS
BENZENE IN SOIL
Morton International, Inc.
Reading, Ohio

1) Select Data Set: Highest Mean

(0 - 2') shallow mean	____	no samples
(0 - 15') total mean	x	0.74

2) Select Distribution

normal_____
lognormal__x__

Normal Data (mg/kg)

Sample Location	Benzene [1]
DP13-3'	0.0027
DP13-11'	2.65
DP14-3'	0.11
DP14-9'	0.13
DP15-2'	0.0017
DP15-9'	0.155
DP16-2.8'	0.0028
DP16-12.5'	6
DP17-3'	0.13
DP17-13'	0.67
UAW08-20-13'	0.19
UAW12-20-12'	0.15
UAW13-20-1.5'	0.0024
UAW13-20-11.5'	0.14
count (n)	**14**
mean (x)	**0.74**
standard deviation (SD)	**1.66**
T value	**1.77**
95% upper confidence limit[2]	**1.53**
Kolmogorov-Smirnov:	**0.27**
Distribution:	**1.83**
Best fit:	**Lognormal**

Lognormal Data

Sample Location	Benzene
DP13-3'	-5.93
DP13-11'	0.97
DP14-3'	-2.21
DP14-9'	-2.04
DP15-2'	-6.38
DP15-9'	-1.86
DP16-2.8'	-5.90
DP16-12.5'	1.79
DP17-3'	-2.04
DP17-13'	-0.40
UAW08-20-13'	-1.66
UAW12-20-12'	-1.90
UAW13-20-1.5'	-6.05
UAW13-20-11.5'	-1.97
count (n)	**14**
mean (x)	**-2.54**
standard deviation (SD)	**2.60**
H value	**5.91**
95% upper confidence limit[3]	**166**
maximum detected value	**0.67**
exposure point concentration	**0.67**

1. Non-detect values are presented at one-half the detection limit.
2. 95% upper confidence limit = x + t(SD/n0.5)
3. 95% upper confidence limit = e(x+0.5 * SD^2+SD*H/(n-1)^0.5)

TABLE F-3
CALCULATION OF EXPOSURE POINT CONCENTRATIONS
CHLOROBENZENE, METHYLENE CHLORIDE AND TOLUENE IN SOIL

Morton International, Inc.

Reading, Ohio

1) Select Data Set: Highest Mean	Chloro-benzene	Methylene chloride	Toluene
(0 - 2') shallow mean ____	0.011	0.010	0.010
(0 - 15') total mean __x__	0.28	0.44	5.89

2) Select Distribution

normal____

lognormal__x__

Normal Data (mg/kg) [1]

Sample Location	Chloro-benzene	Methylene chloride	Toluene
DP09-12'	0.0024	0.0024	0.0024
DP10-2'	0.0024	0.0024	0.00056
DP10-10'	0.135	0.135	
DP10-10' Blind Dup			3.8
DP13-3'	0.00265	0.00265	0.00265
DP13-11'	2.65	5.7	16
DP14-3'	0.11	0.18	0.076
DP14-9'	0.13	0.23	0.76
DP15-2'	0.0024	0.0024	0.0024
DP15-9'	0.155	0.7	0.44
DP16-2.8'	0.0043	0.0014	0.00275
DP16-12.5'	1.5	11	150
DP17-3'	0.13	0.27	0.063
DP17-13'	0.81	0.41	35
DP18-2'	0.0025	0.0025	0.0025
DP18-14.5'	0.00053	0.0015	0.00245
DP19-2'	0.00295	0.00295	0.00295
DP19-13'	0.00285	0.00285	0.00285
DP20-2'	0.0025	0.0025	0.0025
DP20-14.5'	0.079	0.25	0.13
STR01-3'	0.00225	0.00225	0.00225
STR02-1'	0.0026	0.0018	0.0026
STR02-12.5'	0.026	0.0024	0.00255
STR03-4'	0.31	0.125	0.125
STR03-12.5'	0.029	0.0024	0.0057
STR04-1.5'	0.00255	0.00255	0.00255
STR07-1.5'	0.00265	0.00265	0.00265
STR08-1.5'	0.00265	0.00265	0.00265
STR08-13'		0.12	0.12
STR08-13' DUP	0.079		
T-1-4	0.65	0.65	0.65
T-1-6	0.0025	0.0025	0.00085
T-2-3	0.0027	0.0027	0.0027
T-2-9	0.98	0.28	0.027
T-3-3	0.125	0.29	0.47
T-3-11	0.00235	0.00235	0.00052
T-4-3	0.00225	0.00225	0.00225
T-4-9	0.00275	0.0017	0.00275
T-5-3	0.0032	0.0029	0.00064
T-5-9	0.0027	0.0028	0.00258
T-6-3	0.017	0.0019	0.00285
T-6-7.5	0.34	0.34	0.35
T-6-10	2.5	0.096	0.12
T-8-3	0.00275	0.00275	0.00275
T-8-9	0.0027	0.0014	0.0027
UAW01-30-1.5'	0.0027	0.0027	0.0027
UAW01-30-15'	0.0028	0.002	0.0028
UAW04-20-10'	3.55	5.6	160
UAW05-20-13'	1.6	0.11	0.11
UAW06-20-1.5'	0.00265	0.00265	0.00265

Lognormal Data

Sample Location	Chloro-benzene	Methylene chloride	Toluene
DP09-12'	-6.03	-6.03	-6.03
DP10-2'	-6.03	-6.03	-7.49
DP10-10'	-2.00	-2.00	
DP10-10' Blind Dup			1.34
DP13-3'	-5.93	-5.93	-5.93
DP13-11'	0.97	1.74	2.77
DP14-3'	-2.21	-1.71	-2.58
DP14-9'	-2.04	-1.47	-0.27
DP15-2'	-6.03	-6.03	-6.03
DP15-9'	-1.86	-0.36	-0.82
DP16-2.8'	-5.45	-6.57	-5.90
DP16-12.5'	0.41	2.40	5.01
DP17-3'	-2.04	-1.31	-2.76
DP17-13'	-0.21	-0.89	3.56
DP18-2'	-5.99	-5.99	-5.99
DP18-14.5'	-7.54	-6.50	-6.01
DP19-2'	-5.83	-5.83	-5.83
DP19-13'	-5.86	-5.86	-5.86
DP20-2'	-5.99	-5.99	-5.99
DP20-14.5'	-2.54	-1.39	-2.04
STR01-3'	-6.10	-6.10	-6.10
STR02-1'	-5.95	-6.32	-5.95
STR02-12.5'	-3.65	-6.03	-5.97
STR03-4'	-1.17	-2.08	-2.08
STR03-12.5'	-3.54	-6.03	-5.17
STR04-1.5'	-5.97	-5.97	-5.97
STR07-1.5'	-5.93	-5.93	-5.93
STR08-1.5'	-5.93	-5.93	-5.93
STR08-13'		-2.12	-2.12
STR08-13' DUP	-2.54		
T-1-4	-0.43	-0.43	-0.43
T-1-6	-5.99	-5.99	-7.07
T-2-3	-5.91	-5.91	-5.91
T-2-9	-0.02	-1.27	-3.61
T-3-3	-2.08	-1.24	-0.76
T-3-11	-6.05	-6.05	-7.56
T-4-3	-6.10	-6.10	-6.10
T-4-9	-5.90	-6.38	-5.90
T-5-3	-5.74	-5.84	-7.35
T-5-9	-5.91	-5.88	-5.96
T-6-3	-4.07	-6.27	-5.86
T-6-7.5	-1.08	-1.08	-1.05
T-6-10	0.92	-2.34	-2.12
T-8-3	-5.90	-5.90	-5.90
T-8-9	-5.91	-6.57	-5.91
UAW01-30-1.5'	-5.91	-5.91	-5.91
UAW01-30-15'	-5.88	-6.21	-5.88
UAW04-20-10'	1.27	1.72	5.08
UAW05-20-13'	0.47	-2.21	-2.21
UAW06-20-1.5'	-5.93	-5.93	-5.93

TABLE F-3
CALCULATION OF EXPOSURE POINT CONCENTRATIONS
CHLOROBENZENE, METHYLENE CHLORIDE AND TOLUENE IN SOIL

Morton International, Inc.

Reading, Ohio

1) Select Data Set: Highest Mean	Chloro-benzene	Methylene chloride	Toluene
(0 - 2') shallow mean ____	0.011	0.010	0.010
(0 - 15') total mean __x__	0.28	0.44	5.89

2) Select Distribution

normal____

lognormal__x__

Normal Data (mg/kg) [1]

Sample Location	Chloro-benzene	Methylene chloride	Toluene
UAW06-20-11.5'	0.043	0.0025	0.0017
UAW08-20-13'	0.26	0.23	2
UAW11-40-2'	0.0024	0.0024	0.0024
UAW11-40-10'	0.14	0.099	0.14
UAW12-20-12'	0.86	0.15	0.15
UAW13-20-1.5'	0.00235	0.00235	0.00235
UAW13-20-11.5'	0.14	0.26	0.15
UAW16-10-2'	0.0092	0.00285	0.00285
UAW16-10-5.5'	0.032	0.00305	0.00305
UAW18-20-1'	0.13	0.13	0.13
UAW18-20-15'	0.014	0.00235	0.0015
UAW21-30-1.5'	0.0025	0.0025	0.0025
UAW21-30-10'	0.0023	0.0023	0.0034
UAW22-2	0.0022	0.0022	0.0022
UAW22-11	0.037	0.0032	0.0032
count (n)	**63**	**63**	**63**
mean (x)	**0.28**	**0.44**	**5.89**
standard deviation (SD)	**0.69**	**1.70**	**28**
T value	**1.67**	**1.67**	**1.67**
95% upper confidence limit[2]	**0.43**	**0.79**	**11.80**
Kolmogorov-Smirnov:	**0.27**	**0.36**	**0.32**
Distribution:	**0.38**	**0.34**	**1.93**
Best fit:	**Lognormal**	**Lognormal**	**Lognormal**

Lognormal Data

Sample Location	Chloro-benzene	Methylene chloride	Toluene
UAW06-20-11.5'	-3.15	-5.99	-6.38
UAW08-20-13'	-1.35	-1.47	0.69
UAW11-40-2'	-6.03	-6.03	-6.03
UAW11-40-10'	-1.97	-2.31	-1.97
UAW12-20-12'	-0.15	-1.90	-1.90
UAW13-20-1.5'	-6.05	-6.05	-6.05
UAW13-20-11.5'	-1.97	-1.35	-1.90
UAW16-10-2'	-4.69	-5.86	-5.86
UAW16-10-5.5'	-3.44	-5.79	-5.79
UAW18-20-1'	-2.04	-2.04	-2.04
UAW18-20-15'	-4.27	-6.05	-6.50
UAW21-30-1.5'	-5.99	-5.99	-5.99
UAW21-30-10'	-6.07	-6.07	-5.68
UAW22-2	-6.12	-6.12	-6.12
UAW22-11	-3.30	-5.74	-5.74
count (n)	**63**	**63**	**63**
mean (x)	**-3.90**	**-4.24**	**-4.06**
standard deviation (SD)	**2.44**	**2.54**	**3.10**
H value	**4.12**	**4.25**	**5.05**
95% upper confidence limit[3]	**1.43**	**1.41**	**15.1**
maximum detected value	**2.50**	**11.00**	**160**
exposure point concentration	**1.43**	**1.41**	**15.1**

1. Non-detect values are presented at one-half the detection limit.
2. 95% upper confidence limit = x + t(SD/n0.5)
3. 95% upper confidence limit = e(x+0.5 * SD^2+SD*H/(n-1)^0.5)

TABLE F-4
CALCULATION OF EXPOSURE POINT CONCENTRATIONS
1,2-DICHLOROBENZENE IN SOIL
Morton International, Inc.
Reading, Ohio

1) Select Data Set: Highest Mean

(0 - 2') shallow mean ____ **0.37**

(0 - 15') total mean__x__ **1.91**

2) Select Distribution

normal_____

lognormal__x__

Normal Data (mg/kg)[1]

Sample Location	1,2-Dichloro-benzene
DP09-12'	0.13
DP10-2'	0.185
DP10-10'	0.75
DP10-10' Blind Dup	
DP13-3'	0.195
DP13-11'	0.195
DP14-3'	17.5
DP14-9'	0.75
DP15-2'	0.19
DP15-9'	0.8
DP16-2.8'	0.175
DP16-12.5'	9.5
DP17-3'	0.195
DP17-13'	21
DP20-2'	0.19
DP20-14.5'	0.15
STR02-1'	0.2
STR02-12.5'	0.32
STR03-4'	0.19
STR03-12.5'	9
STR07-1.5'	0.2
STR08-1.5'	0.2
STR08-13'	0.34
STR08-13' DUP	
T-1-4	2.1
T-1-6	0.185
T-2-3	0.2
T-2-9	0.28
T-3-3	0.185
T-3-11	0.185
T-5-3	0.2
T-5-9	0.2
T-8-3	0.21
T-8-9	0.18
UAW04-20-10'	0.225
UAW05-20-13'	3.3
UAW06-20-1.5'	0.2
UAW06-20-11.5'	0.185
UAW08-20-13'	2.3
UAW11-40-2'	0.2
UAW11-40-10'	0.12
UAW12-20-12'	14
UAW13-20-1.5'	0.19
UAW13-20-11.5'	0.25
UAW16-10-2'	0.19

Lognormal Data

Sample Location	1,2-Dichloro-benzene
DP09-12'	-2.04
DP10-2'	-1.69
DP10-10'	-0.29
DP10-10' Blind Dup	
DP13-3'	-1.63
DP13-11'	-1.63
DP14-3'	2.86
DP14-9'	-0.29
DP15-2'	-1.66
DP15-9'	-0.22
DP16-2.8'	-1.74
DP16-12.5'	2.25
DP17-3'	-1.63
DP17-13'	3.04
DP20-2'	-1.66
DP20-14.5'	-1.90
STR02-1'	-1.61
STR02-12.5'	-1.14
STR03-4'	-1.66
STR03-12.5'	2.20
STR07-1.5'	-1.61
STR08-1.5'	-1.61
STR08-13'	-1.08
STR08-13' DUP	
T-1-4	0.74
T-1-6	-1.69
T-2-3	-1.61
T-2-9	-1.27
T-3-3	-1.69
T-3-11	-1.69
T-5-3	-1.61
T-5-9	-1.61
T-8-3	-1.56
T-8-9	-1.71
UAW04-20-10'	-1.49
UAW05-20-13'	1.19
UAW06-20-1.5'	-1.61
UAW06-20-11.5'	-1.69
UAW08-20-13'	0.83
UAW11-40-2'	-1.61
UAW11-40-10'	-2.12
UAW12-20-12'	2.64
UAW13-20-1.5'	-1.66
UAW13-20-11.5'	-1.39
UAW16-10-2'	-1.66

TABLE F-4
CALCULATION OF EXPOSURE POINT CONCENTRATIONS
1,2-DICHLOROBENZENE IN SOIL
Morton International, Inc.
Reading, Ohio

1) Select Data Set: Highest Mean

(0 - 2') shallow mean	____	0.37
(0 - 15') total mean	x	1.91

2) Select Distribution

normal	____
lognormal	x

Normal Data (mg/kg)[1]

Sample Location	1,2-Dichloro-benzene
UAW16-10-5.5'	0.18
UAW22-20-2'	0.365
UAW22-20-11'	0.071
count (n)	**46**
mean (x)	**1.91**
standard deviation (SD)	**4.64**
T value	**1.679**
95% upper confidence limit[2]	**3.06**
Kolmogorov-Smirnov:	**0.31**
Distribution:	**1.12**
Best fit:	**Lognormal**

Lognormal Data

Sample Location	1,2-Dichloro-benzene
UAW16-10-5.5'	-1.71
UAW22-20-2'	-1.01
UAW22-20-11'	-2.65
count (n)	**46**
mean (x)	**-0.92**
standard deviation (SD)	**1.45**
H value	**2.81**
95% upper confidence limit[3]	**2.10**
maximum detected value	**21**
exposure point concentration	**2.10**

1. Non-detect values are presented at one-half the detection limit.
2. 95% upper confidence limit = x + t(SD/n0.5)
3. 95% upper confidence limit = e(x+0.5 * SD^2+SD*H/(n-1)^0.5)

TABLE F-5
CALCULATION OF EXPOSURE POINT CONCENTRATIONS
METALS IN SOIL

Morton International, Inc.

Reading, Ohio

1) Select Data Set: Highest Mean	Antimony	Arsenic	Chromium	Lead	Nickel	Thallium	Tin
(0 - 2') shallow mean ____	no samples	no samples	no samples	no samples	no samples	no samples	no samples
(0 - 15') total mean __x__	6.40	56.66	29.45	1769.30	28.96	3.63	17798.12

2) Select Distribution

normal_____

lognormal__x__

Normal Data (mg/kg)[1]

Sample Location	Antimony	Arsenic	Chromium	Lead	Nickel	Thallium	Tin
DP39-10	0.55	5	6.7	8.1	59	1.3	1230
DP40-6		4.8	9.2	6.4			4
DP40-6 Blind Dup	0.55				9.1	1.4	
DP41-6	0.60	1.6	8.1	5.9	8.2	0.79	3.5
DP42-6	0.60	4.2	10.1	6.9	11	1.1	3.9
T-1-4	65.10	580	232	19300	35.4	31.8	158000
T-1-6	0.55	11	11.5	94.7	142	0.55	36500
T-5-3	0.60	4.8	17.5	16.1	16.4	0.6	12.4
T-5-9	0.60	2.6	9.1	8.1	12	0.6	12.4
T-8-3	0.65	5.1	13.5	11.3	17.4	0.65	1.6
T-8-9	0.55	4.2	6.3	4.8	8.1	1.1	11.5
count (n)	**10**	**10**	**10**	**10**	**10**	**10**	**10**
mean (x)	**7.04**	**62.33**	**32.40**	**1946.23**	**31.86**	**3.99**	**19577.93**
standard deviation (SD)	**20.40**	**182**	**70.21**	**6098**	**41.90**	**9.78**	**49961**
T value	**1.83**	**1.83**	**1.83**	**1.83**	**1.83**	**1.83**	**1.83**
95 % upper confidence limit[2]	**18.86**	**168**	**73.10**	**5481**	**56.15**	**9.66**	**48539**
Kolmogorov-Smirnov:	**0.50**	**0.38**	**0.30**	**0.35**	**0.24**	**0.35**	**0.36**
Distribution:	**2.54**	**23.06**	**21.93**	**391**	**28.95**	**2.32**	**154882**
Best fit:	**Lognormal**	**Lognormal**	**Lognormal**	**Lognormal**	**Lognormal**	**Lognormal**	**Lognormal**

TABLE F-5
CALCULATION OF EXPOSURE POINT CONCENTRATIONS
METALS IN SOIL

Morton International, Inc.

Reading, Ohio

1) Select Data Set: Highest Mean	Antimony	Arsenic	Chromium	Lead	Nickel	Thallium	Tin
(0 - 2') shallow mean ____	no samples	no samples	no samples	no samples	no samples	no samples	no samples
(0 - 15') total mean __x__	6.40	56.66	29.45	1769.30	28.96	3.63	17798.12

2) Select Distribution

normal_____

lognormal__x__

Lognormal Data

Sample Location	Antimony	Arsenic	Chromium	Lead	Nickel	Thallium	Tin
DP39-10	-0.60	1.61	1.90	2.09	4.08	0.26	7.11
DP40-6		1.57	2.22	1.86			1.39
DP40-6 Blind Dup	-0.60				2.21	0.34	
DP41-6	-0.51	0.47	2.09	1.77	2.10	-0.24	1.25
DP42-6	-0.51	1.44	2.31	1.93	2.40	0.10	1.36
T-1-4	4.18	6.36	5.45	9.87	3.57	3.46	11.97
T-1-6	-0.60	2.40	2.44	4.55	4.96	-0.60	10.51
T-5-3	-0.51	1.57	2.86	2.78	2.80	-0.51	2.52
T-5-9	-0.51	0.96	2.21	2.09	2.48	-0.51	2.52
T-8-3	-0.43	1.63	2.60	2.42	2.86	-0.43	0.47
T-8-9	-0.60	1.44	1.84	1.57	2.09	0.10	2.44
count (n)	**10**	**10**	**10**	**10**	**10**	**10**	**10**
mean (x)	**-0.07**	**1.94**	**2.59**	**3.09**	**2.95**	**0.20**	**4.15**
standard deviation (SD)	**1.49**	**1.63**	**1.05**	**2.53**	**0.96**	**1.20**	**4.16**
H value	**4.18**	**4.51**	**3.206**	**6.69**	**3.02**	**3.58**	**10.78**
95 % upper confidence limit[3]	**23**	**305**	**71**	**150978**	**79**	**10**	**1.15E+12**
maximum detected value	**65**	**580**	**232**	**19300**	**142**	**32**	**158000**
exposure point concentration	**23**	**305**	**71**	**19300**	**79**	**10**	**158000**

1. Non-detect values are presented at one-half the detection limit.
2. 95% upper confidence limit = x + t(SD/n0.5)
3. 95% upper confidence limit = e(x+0.5 * SD^2+SD*H/(n-1)^0.5)

TABLE F-6
CALCULATION OF EXPOSURE POINT CONCENTRATIONS
MANGANESE IN SOIL
Morton International, Inc.
Reading, Ohio

1) Select Data Set: Highest Mean

(0 - 2') shallow mean __x__ **540**

(0 - 15') total mean____ **513**

2) Select Distribution

normal_____

lognormal__x__

Normal Data (mg/kg)

Sample Location	Manganese[1]
DP01-2'	302
DP02-2'	265
DP03-2'	533
DP05-1'	322
DP10-2'	
DP12-1.5'	510
DP15-2'	
DP18-2'	539
DP19-2'	709
DP20-2'	529
DP43-1.5	571
DP44-1.5	130
DP45-1.5	516
DP46-1.5	406
STR02-1'	1120
STR04-1.5'	531
STR05-1.5'	283
STR06-1'	729
STR07-1.5'	844
STR08-1.5'	1010
STR10-1.5'	
STR11-2'	386
UAW01-30-1.5'	429
UAW06-20-1.5'	646
UAW09-20-1.5'	516
UAW11-40-2'	560
UAW13-20-1.5'	
UAW14-10-1.5'	1050
UAW15-20-2'DUP	530
UAW16-10-2'	367
UAW17-40-1.5'	515
UAW18-20-1'	505
UAW19-80-1.5'	212
UAW20-60-1.5'	334
UAW21-30-1.5'	608
UAW22-20-2'	760
count (n)	**32**
mean (x)	**540**
standard deviation (SD)	**234**
T value	**1.70**
95% upper confidence limit[2]	**610**
Kolmogorov-Smirnov:	**0.15**
Distribution:	**571**
Best fit:	**Lognormal**

Lognormal Data

Sample Location	Manganese
DP01-2'	5.71
DP02-2'	5.58
DP03-2'	6.28
DP05-1'	5.77
DP10-2'	
DP12-1.5'	6.23
DP15-2'	
DP18-2'	6.29
DP19-2'	6.56
DP20-2'	6.27
DP43-1.5	6.35
DP44-1.5	4.87
DP45-1.5	6.25
DP46-1.5	6.01
STR02-1'	7.02
STR04-1.5'	6.27
STR05-1.5'	5.65
STR06-1'	6.59
STR07-1.5'	6.74
STR08-1.5'	6.92
STR10-1.5'	
STR11-2'	5.96
UAW01-30-1.5'	6.06
UAW06-20-1.5'	6.47
UAW09-20-1.5'	6.25
UAW11-40-2'	6.33
UAW13-20-1.5'	
UAW14-10-1.5'	6.96
UAW15-20-2'	6.27
UAW16-10-2'	5.91
UAW17-40-1.5'	6.24
UAW18-20-1'	6.22
UAW19-80-1.5'	5.36
UAW20-60-1.5'	5.81
UAW21-30-1.5'	6.41
UAW22-20-2'	6.63
count (n)	**32**
mean (x)	**6.19**
standard deviation (SD)	**0.46**
H value	**1.92**
95% upper confidence limit[3]	**640**
maximum detected value	**2120**
exposure point concentration	**640**

1. Non-detect values are presented at one-half the detection limit.
2. 95% upper confidence limit = x + t(SD/n0.5)
3. 95% upper confidence limit = e(x+0.5 * SD^2+SD*H/(n-1)^0.5)

TABLE F-7
CALCULATION OF EXPOSURE POINT CONCENTRATIONS
ACETONE IN GROUNDWATER
Morton International, Inc.
Reading, Ohio

Normal Data (μg/l)

Sample Location	Acetone[1]
MW-EPA-1	250
MW-EPA-1	63
UAW03-20	3.4
UAW03-20	3.8
UAW04-20	5000
UAW04-20	590
UAW05-20	200
UAW05-20	22
UAW05-20	110
UAW06-20	720
UAW06-20	11000
UAW06-20	45000
UAW07-20	3.3
UAW08-20	150
UAW08-20	580
UAW11-10	32000
UAW11-10	14000
UAW16-10	8000
UAW16-10	6100
count (n)	19
mean (x)	12136
standard deviation (SD)	12095
T value	1.73
95 % upper confidence limit[2]	16948
Kolmogorov-Smirnov:	0.153
Distribution:	42091
Best fit:	Lognormal

Lognormal Data

Sample Location	Acetone
MW-EPA-1	5.52
MW-EPA-1	4.14
UAW03-20	1.22
UAW03-20	1.34
UAW04-20	8.52
UAW04-20	6.38
UAW05-20	5.30
UAW05-20	3.09
UAW05-20	4.70
UAW06-20	6.58
UAW06-20	9.31
UAW06-20	10.71
UAW07-20	1.19
UAW08-20	5.01
UAW08-20	6.36
UAW11-10	10.37
UAW11-10	9.55
UAW16-10	8.99
UAW16-10	8.72
count (n)	**19**
mean (x)	**8.80**
standard deviation (SD)	**1.50**
H value	**7.76**
95 % upper confidence limit[3]	**317615**
maximum detected value	**45000**
exposure point concentration	**45000**

1. Non-detect values are presented at one-half the detection limit.
2. 95% upper confidence limit = x + t(SD/n0.5)
3. 95% upper confidence limit = e(x+0.5 * SD^2+SD*H/(n-1)^0.5)

TABLE F-8
CALCULATION OF EXPOSURE POINT CONCENTRATIONS
BENZENE IN GROUNDWATER
Morton International, Inc.
Reading, Ohio

Normal Data (µg/l)

Sample Location	Benzene[1]
MW-EPA-1	25
MW-EPA-1	31
UAW07-20	2.1
UAW07-20	5.2
UAW08-20	41
UAW08-20	110
UAW12-20	28
UAW12-20	25
UAW13-20	21
UAW13-20	20
count (n)	**10**
mean (x)	**31**
standard deviation (SD)	**30**
T value	**1.83**
95 % upper confidence limit[2]	**48**
Kolmogorov-Smirnov:	**0.30**
Distribution:	**35**
Best fit:	**Lognormal**

Lognormal Data

Sample Location	Benzene
MW-EPA-1	3.22
MW-EPA-1	3.43
UAW07-20	0.74
UAW07-20	1.65
UAW08-20	3.71
UAW08-20	4.70
UAW12-20	3.33
UAW12-20	3.22
UAW13-20	3.04
UAW13-20	3.00
count (n)	**10**
mean (x)	**3.00**
standard deviation (SD)	**1.09**
H value	**3.29**
95 % upper confidence limit[3]	**121**
maximum detected value	**110**
exposure point concentration	**110**

1. Non-detect values are presented at one-half the detection limit.
2. 95% upper confidence limit = x + t(SD/n0.5)
3. 95% upper confidence limit = e(x+0.5 * SD^2+SD*H/(n-1)^0.5)

TABLE F-9
CALCULATION OF EXPOSURE POINT CONCENTRATIONS
CHLOROBENZENE AND TOLUENE IN GROUNDWATER

Morton International, Inc.
Reading, Ohio

Normal Data (µg/L)[1]

Sample Location	Chloro-benzene	Toluene
MW-EPA-1	1600	25
MW-EPA-1	3200	59
UAW03-20	8.6	12
UAW03-20	41	3.6
UAW04-20	500	21000
UAW04-20	125	8800
UAW05-20	460	20
UAW05-20	440	20
UAW05-20	390	11
UAW06-20	70	5
UAW06-20	100	85
UAW06-20	110	335
UAW07-20 DUP		3.6
UAW07-20	39	
UAW07-20	64	1.2
UAW08-20	37	1100
UAW08-20	61	1400
UAW11-10	250	250
UAW11-10	125	125
UAW12-20	920	28
UAW12-20	1400	25
UAW13-20	20	250
UAW13-20	31	350
count (n)	**22**	**22**
mean (x)	**454**	**1541**
standard deviation (SD)	**756**	**4730**
T value	**1.72**	**1.72**
95 % upper confidence limit[2]	**732**	**3276**
Kolmogorov-Smirnov:	**0.14**	**0.15**
Distribution:	**483**	**1561**
Best fit:	**Lognormal**	**Lognormal**

Lognormal Data

Sample Location	Chloro-benzene	Toluene
MW-EPA-1	7.38	3.22
MW-EPA-1	8.07	4.08
UAW03-20	2.15	2.48
UAW03-20	3.71	1.28
UAW04-20	6.21	9.95
UAW04-20	4.83	9.08
UAW05-20	6.13	3.00
UAW05-20	6.09	3.00
UAW05-20	5.97	2.40
UAW06-20	4.25	1.61
UAW06-20	4.61	4.44
UAW06-20	4.70	5.81
UAW07-20 DUP		1.28
UAW07-20	3.66	
UAW07-20	4.16	0.18
UAW08-20	3.61	7.00
UAW08-20	4.11	7.24
UAW11-10	5.52	5.52
UAW11-10	4.83	4.83
UAW12-20	6.82	3.33
UAW12-20	7.24	3.22
UAW13-20	3.00	5.52
UAW13-20	3.43	5.86
count (n)	**22**	**22**
mean (x)	**3.43**	**5.86**
standard deviation (SD)	**1.56**	**2.53**
H value	**3.56**	**5.34**
95 % upper confidence limit[3]	**349**	**166139**
maximum detected value	**3200**	**21000**
exposure point concentration	**349**	**21000**

1. Non-detect values are presented at one-half the detection limit.
2. 95% upper confidence limit = x + t(SD/n0.5)
3. 95% upper confidence limit = e(x+0.5 * SD^2+SD*H/(n-1)^0.5)

TABLE F-10
CALCULATION OF EXPOSURE POINT CONCENTRATIONS
METHYLENE CHLORIDE IN GROUNDWATER
Morton International, Inc.
Reading, Ohio

Normal Data (µg/l)

Sample Location	Methylene Chloride[1]
MW-EPA-1	25
MW-EPA-1	140
UAW03-20	0.5
UAW03-20	1.3
UAW04-20	500
UAW04-20	200
UAW05-20	20
UAW05-20	20
UAW05-20	11
UAW06-20	5
UAW06-20	85
UAW06-20	335
UAW07-20	1.25
UAW07-20	2.3
UAW08-20	17
UAW08-20	42
UAW11-10	250
UAW11-10	190
count (n)	**18**
mean (x)	**103**
standard deviation (SD)	**142**
T value	**1.74**
95 % upper confidence limit[2]	**160.69**
Kolmogorov-Smirnov:	**0.16**
Distribution:	**370.35**
Best fit:	**Lognormal**

Lognormal Data

Sample Location	Methylene Chloride
MW-EPA-1	3.22
MW-EPA-1	4.94
UAW03-20	-0.69
UAW03-20	0.26
UAW04-20	6.21
UAW04-20	5.30
UAW05-20	3.00
UAW05-20	3.00
UAW05-20	2.40
UAW06-20	1.61
UAW06-20	4.44
UAW06-20	5.81
UAW07-20	0.22
UAW07-20	0.83
UAW08-20	2.83
UAW08-20	3.74
UAW11-10	5.52
UAW11-10	5.25
count (n)	**18**
mean (x)	**3.22**
standard deviation (SD)	**2.12**
H value	**5.38**
95 % upper confidence limit[3]	**3739**
maximum detected value	**200**
exposure point concentration	**200**

1. Non-detect values are presented at one-half the detection limit.
2. 95% upper confidence limit = x + t(SD/n0.5)
3. 95% upper confidence limit = e(x+0.5 * SD^2+SD*H/(n-1)^0.5)

TABLE F-11
CALCULATION OF EXPOSURE POINT CONCENTRATIONS
1,2-DICHLOROBENZENE AND 4-METHYLPHENOL IN GROUNDWATER
Morton International, Inc.
Reading, Ohio

Normal Data (µg/l)

Sample Location	1,2-Dichloro-benzene[1]	4-Methyl-phenol
MWEPA1	940	60
MWEPA1	1700	100
UAW0320	19	7.7
UAW0320	140	10
UAW0420	20	150
UAW0420	50	57
UAW0520	880	50
UAW0520		5
UAW0520	590	50
UAW0620	14	5
UAW0620	16	12.5
UAW0620	25	5.4
UAW0720	37	50
UAW0720 DUP		
UAW0720	57	20
UAW0820	850	850
UAW0820	530	330
UAW1110	250	250
UAW1110	13	9
UAW1220	1600	125
UAW1220	1900	100
UAW1320	100	100
UAW1320	49	100
count (n)	**21**	**22**
mean (x)	**466**	**111**
standard deviation (SD)	**617**	**185**
T value	**2**	**2**
95 % upper confidence limit[2]	**698**	**179**
Kolmogorov-Smirnov:	**0.17**	**0.17**
Distribution:	**630**	**122**
Best fit:	**Lognormal**	**Lognormal**

Lognormal Data

Sample Location	1,2-Dichloro-benzene	4-Methyl-phenol
MWEPA1	6.85	4.09
MWEPA1	7.44	4.61
UAW0320	2.94	2.04
UAW0320	4.94	2.30
UAW0420	3.00	5.01
UAW0420	3.91	4.04
UAW0520	6.78	3.91
UAW0520		1.61
UAW0520	6.38	3.91
UAW0620	2.64	1.61
UAW0620	2.77	2.53
UAW0620	3.22	1.69
UAW0720	3.61	3.91
UAW0720 DUP		
UAW0720	4.04	3.00
UAW0820	6.75	6.75
UAW0820	6.27	5.80
UAW1110	5.52	5.52
UAW1110	2.56	2.20
UAW1220	7.38	4.83
UAW1220	7.55	4.61
UAW1320	4.61	4.61
UAW1320	3.89	4.61
count (n)	**21**	**22**
mean (x)	**4.91**	**3.78**
standard deviation (SD)	**1.80**	**1.47**
H value	**3.79**	**3.22**
95 % upper confidence limit[3]	**3114**	**359**
maximum detected value	**1900**	**330**
exposure point concentration	**1900**	**330**

1. Non-detect values are presented at one-half the detection limit.
2. 95% upper confidence limit = x + t(SD/n0.5)
3. 95% upper confidence limit = e(x+0.5 * SD^2+SD*H/(n-1)^0.5)

TABLE F-12
CALCULATION OF EXPOSURE POINT CONCENTRATIONS
1,3-DICHLOROBENZENE IN GROUNDWATER

Morton International, Inc.
Reading, Ohio

Normal Data (μg/l)

Sample Location	1,3-Dichloro-benzene[1]
MWEPA1	60
MWEPA1	35
UAW0520	50
UAW0520	20
UAW0520	16
UAW0620	5
UAW0620	12.5
UAW0620	12.5
UAW0720	50
UAW0720 DUP	
UAW0720	20
UAW0820	850
UAW0820	650
UAW1220	125
UAW1220	41
UAW1320	100
UAW1320	100
count (n)	**16**
mean (x)	**134.19**
standard deviation (SD)	**245.69**
T value	**1.75**
95 % upper confidence limit[2]	**241.86**
Kolmogorov-Smirnov:	**0.12**
Distribution:	**117**
Best fit:	**Lognormal**

Lognormal Data

Sample Location	1,3-Dichloro-benzene
MWEPA1	4.09
MWEPA1	3.56
UAW0520	3.91
UAW0520	3.00
UAW0520	2.77
UAW0620	1.61
UAW0620	2.53
UAW0620	2.53
UAW0720	3.91
UAW0720 DUP	
UAW0720	3.00
UAW0820	6.75
UAW0820	6.48
UAW1220	4.83
UAW1220	3.71
UAW1320	4.61
UAW1320	4.61
count (n)	**16**
mean (x)	**3.87**
standard deviation (SD)	**1.38**
H value	**3.33**
95 % upper confidence limit[3]	**408.41**
maximum detected value	**41**
exposure point concentration	**41**

1. Non-detect values are presented at one-half the detection limit.
2. 95% upper confidence limit = x + t(SD/n0.5)
3. 95% upper confidence limit = e(x+0.5 * SD^2+SD*H/(n-1)^0.5)

TABLE F-13
CALCULATION OF EXPOSURE POINT CONCENTRATIONS
1,4-DICHLOROBENZENE IN GROUNDWATER
Morton International, Inc.
Reading, Ohio

Normal Data (µg/l)

Sample Location	1,4-Dichloro-benzene[1]
MWEPA1	160
MWEPA1	260
UAW0520	120
UAW0520	
UAW0520	82
UAW0620	5
UAW0620	12.5
UAW0620	4
UAW0720	50
UAW0720 DUP	
UAW0720	8
UAW0820	850
UAW0820	650
count (n)	**11**
mean (x)	**200**
standard deviation (SD)	**287**
T value	**1.8**
95 % upper confidence limit[2]	**357**
Kolmogorov-Smirnov:	**0.2**
Distribution:	**301**
Best fit:	**Lognormal**

Lognormal Data

Sample Location	1,4-Dichloro-benzene
MWEPA1	5.08
MWEPA1	5.56
UAW0520	4.79
UAW0520	
UAW0520	4.41
UAW0620	1.61
UAW0620	2.53
UAW0620	1.39
UAW0720	3.91
UAW0720 DUP	
UAW0720	2.08
UAW0820	6.75
UAW0820	6.48
count (n)	**11**
mean (x)	**4.05**
standard deviation (SD)	**1.91**
H value	**4.93**
95 % upper confidence limit[3]	**6945**
maximum detected value	**260**
exposure point concentration	**260**

1. Non-detect values are presented at one-half the detection limit.
2. 95% upper confidence limit = x + t(SD/n0.5)
3. 95% upper confidence limit = e(x+0.5 * SD^2+SD*H/(n-1)^0.5)

TABLE F-14
CALCULATION OF EXPOSURE POINT CONCENTRATIONS
ANILINE IN GROUNDWATER
Morton International, Inc.
Reading, Ohio

Normal Data (µg/l)

Sample Location	Aniline[1]
UAW0720	150
UAW0720 DUP	
UAW0720	120
UAW0820	12000
UAW0820	12000
UAW12-20	250
UAW12-20	200
UAW1320	400
UAW1320	200
count (n)	**6**
mean (x)	**3165**
standard deviation (SD)	**5454**
T value	**2**
95 % upper confidence limit[2]	**7651**
Kolmogorov-Smirnov:	**0.33**
Distribution:	**2829**
Best fit:	**Lognormal**

Lognormal Data

Sample Location	Aniline
UAW0720	5.01
UAW0720 DUP	
UAW0720	4.79
UAW0820	9.39
UAW0820	9.39
UAW12-20	5.52
UAW12-20	5.30
UAW1320	5.99
UAW1320	5.30
count (n)	**8**
mean (x)	**6.34**
standard deviation (SD)	**1.92**
H value	**8.31**
95 % upper confidence limit[3]	**1474070**
maximum detected value	**12000**
exposure point concentration	**12000**

1. Non-detect values are presented at one-half the detection limit.
2. 95% upper confidence limit = x + t(SD/n0.5)
3. 95% upper confidence limit = e(x+0.5 * SD^2+SD*H/(n-1)^0.5)

TABLE F-15
CALCULATION OF EXPOSURE POINT CONCENTRATIONS
ALUMINUM IN GROUNDWATER
Morton International, Inc.
Reading, Ohio

Normal Data (µg/L)[1]

Sample Location	Aluminum
MW-EPA-1	129
MW-EPA-1	138
MW-EPA-2	38400
MW-EPA-2	39300
MW-EPA-3	1330
MW-EPA-3	16400
UAW05-20	2550
UAW05-20	189
UAW05-20	558
UAW07-20	
UAW07-20 DUP	
UAW07-20	
UAW08-20	
UAW08-20	
UAW12-20	
UAW12-20	
UAW13-20	
UAW13-20	
UAW22-20	12100
UAW22-20	14700
UAW23-20	117
UAW23-20	100
count (n)	**13**
mean (x)	**9693**
standard deviation (SD)	**14253**
T value	**1.78**
95 % upper confidence limit[2]	**16739**
Kolmogorov-Smirnov:	**0.21**
Distribution:	**20995**
Best fit:	**Lognormal**

Lognormal Data

Sample Location	Aluminum
MW-EPA-1	4.86
MW-EPA-1	4.93
MW-EPA-2	10.56
MW-EPA-2	10.58
MW-EPA-3	7.19
MW-EPA-3	9.71
UAW05-20	7.84
UAW05-20	5.24
UAW05-20	6.32
UAW07-20	
UAW07-20 DUP	
UAW07-20	
UAW08-20	
UAW08-20	
UAW12-20	
UAW12-20	
UAW13-20	
UAW13-20	
UAW22-20	9.40
UAW22-20	9.60
UAW23-20	4.76
UAW23-20	4.61
count (n)	**13**
mean (x)	**7.4**
standard deviation (SD)	**2.4**
H value	**6.00**
95 % upper confidence limit[2]	**1586488**
Max Detection	**39300**
exposure point concentration	**39300**

1. Non-detect values are presented at one-half the detection limit.
2. 95% upper confidence limit = x + t(SD/n0.5)
3. 95% upper confidence limit = e(x+0.5 * SD^2+SD*H/(n-1)^0.5)

TABLE F-16
CALCULATION OF EXPOSURE POINT CONCENTRATIONS
ANTIMONY AND IRON IN GROUNDWATER
Morton International, Inc.
Reading, Ohio

Normal Data (µg/l)

Sample Location	Antimony	Iron
UAW11-10	1060	34500
UAW11-10	62.6	3140
UAW16-10	5	1570
UAW16-10	3.6	418
count (n)	**4**	**4**
mean (x)	**283**	**9907**
standard deviation (SD)	**519**	**16433**
T value	**2.35**	**2.35**
95 % upper confidence limit[2]	**893**	**29244**
Kolmogorov-Smirnov:	**0.30**	**0.23**
Distribution:	**452**	**10478**
Best Fit:	**Lognormal**	**Lognormal**

Lognormal Data

Sample Location	Antimony	Iron
UAW11-10	6.97	10.4
UAW11-10	4.14	8.1
UAW16-10	1.61	7.4
UAW16-10	1.28	6.0
count (n)	**4**	**4**
mean (x)	**3.50**	**7.97**
standard deviation (SD)	**2.64**	**1.85**
H value	**35**	**11**
95 % upper confidence limit[3]	**1.66E+26**	**2.03E+09**
maximum detected value	**1060**	**34500**
exposure point concentration	**1060**	**34500**

1. Non-detect values are presented at one-half the detection limit.
2. 95% upper confidence limit = x + t(SD/n0.5)
3. 95% upper confidence limit = e(x+0.5 * SD^2+SD*H/(n-1)^0.5)

TABLE F-17
CALCULATION OF EXPOSURE POINT CONCENTRATIONS
SITE-WIDE METALS IN GROUNDWATER
Morton International, Inc.
Reading, Ohio

Normal Data (µg/L)[1]

Sample Location	Arsenic	Cadmium	Chromium	Copper	Lead	Man-ganese	Nickel	Thallium
MW-EPA-1	246	1	73	12.5	1.5	330	112	7.6
MW-EPA-1	611	1	9.8	12.5	1.5	520	32.1	5.6
MW-EPA-2	27.4	0.65	1250	74.3	27.6	1610	271	10.4
MW-EPA-2	31.7	5.2	1750	109	32.4	1640	369	10.8
MW-EPA-3	5	1.5	29.9	11.2	1.5	357	34.4	9.4
MW-EPA-3	14.1	1.2	75.8	37.5	13.7	1440	80.3	5
MW-EPA-4	5	0.31	37.7	12.5	1.5	352	140	8.5
MW-EPA-4	5	1	130	12.5	1.5	284	910	5
Recovery Well	39.6	8.6	264	4640	405		311	5
UAW01-30	13	1	7.7	12.5	1.5	1240	109	5
UAW01-30	5.1	0.29	15.2	12.5	1.5	569	802	7.1
UAW02-20		1		12.5	1.5	892		
UAW02-20 DUP	6.1		22.6				47.2	8.5
UAW02-20	5	1	2.5	12.5	1.5	686	35.9	5
UAW03-20	20.4	1	2.8	12.5	1.5	2860	39.4	10
UAW03-20	17.6	1	3.5	12.5	1.5	1500	39.5	9.2
UAW04-20	82.4	1	6	12.5	1.5	3170	28.9	11.7
UAW04-20	20.5	1.5	4	12.5	1.5	2000	35.3	6.1
UAW05-20	8.7	1	8.1	7.8	1.5	938	15	5.4
UAW05-20	21	1	7.3	12.5	1.5	901	57.3	8.1
UAW05-20	18.7	1	8.8	5.3	1.5	802	24.9	11.8
UAW06-20	13.4	1	3.9	4.5	1.5	1580	29.6	5
UAW06-20	26.7	1	10.8	12.5	1.5	2590	25	5.6
UAW06-20	34.3	1	13.4	12.5	1.5	3000	24.5	5
UAW07-20			1.6	12.5	1.5		2.5	10.6
UAW07-20 DUP	4.6	0.32						
UAW07-20	5	1	2.5	87.7	1.5		2.3	9.6
UAW08-20	36.2	0.44	15	13.8	1.5		30.5	9.8
UAW08-20	113	0.61	67.6	41.9	15.8		53.4	5
UAW09-20	5	1	2.5	12.5	1.5	12.4	20	5
UAW09-20	5	1	10.4	12.5	1.5	17.1	81.9	5
UAW11-10	176	1	249	12.5	4.4	8440	240	5
UAW11-10	62.9	1	11.3	12.5	1.5	470	39.3	7
UAW12-20	5.8	1	2.2	12.5	1.5		18.2	14.4
UAW12-20	5	1	2.5	19.7	1.5		5.3	12.1
UAW13-20	36.1	1	3.4	12.5	1.5		12.4	5
UAW13-20	83.1	0.28	315	597	1.5		23.2	16.6
UAW14-10	5	1	2.5	13.3	1.5	53.8	6.1	5
UAW14-10	5	1	2.5	12.5	1.5	26.4	3.4	5
UAW15-20	5	0.49	2	26.4	1.5	397	55.1	6.2
UAW15-20	5	0.48	8.7	4.9	1.5	231	102	14
UAW16-10	24.9	1	7	12.5	1.5	2760		
UAW16-10 lind Dup.							17.5	8.6

Lognormal Data

Sample Location	Arsenic	Cadmium	Chromium	Copper	Man-ganese	Nickel
MW-EPA-1	5.51	0.00	4.29	2.53	5.80	4.72
MW-EPA-1	6.42	0.00	2.28	2.53	6.25	3.47
MW-EPA-2	3.31	-0.43	7.13	4.31	7.38	5.60
MW-EPA-2	3.46	1.65	7.47	4.69	7.40	5.91
MW-EPA-3	1.61	0.41	3.40	2.42	5.88	3.54
MW-EPA-3	2.65	0.18	4.33	3.62	7.27	4.39
MW-EPA-4	1.61	-1.17	3.63	2.53	5.86	4.94
MW-EPA-4	1.61	0.00	4.87	2.53	5.65	6.81
Recovery Well	3.68	2.15	5.58	8.44		5.74
UAW01-30	2.56	0.00	2.04	2.53	7.12	4.69
UAW01-30	1.63	-1.24	2.72	2.53	6.34	6.69
UAW02-20		0.00		2.53	6.79	
UAW02-20 DUP	1.81		3.12			3.85
UAW02-20	1.61	0.00	0.92	2.53	6.53	3.58
UAW03-20	3.02	0.00	1.03	2.53	7.96	3.67
UAW03-20	2.87	0.00	1.25	2.53	7.31	3.68
UAW04-20	4.41	0.00	1.79	2.53	8.06	3.36
UAW04-20	3.02	0.41	1.39	2.53	7.60	3.56
UAW05-20	2.16	0.00	2.09	2.05	6.84	2.71
UAW05-20	3.04	0.00	1.99	2.53	6.80	4.05
UAW05-20	2.93	0.00	2.17	1.67	6.69	3.21
UAW06-20	2.60	0.00	1.36	1.50	7.37	3.39
UAW06-20	3.28	0.00	2.38	2.53	7.86	3.22
UAW06-20	3.54	0.00	2.60	2.53	8.01	3.20
UAW07-20			0.47	2.53		0.92
UAW07-20 DUP	1.53	-1.14				
UAW07-20	1.61	0.00	0.92	4.47		0.83
UAW08-20	3.59	-0.82	2.71	2.62		3.42
UAW08-20	4.73	-0.49	4.21	3.74		3.98
UAW09-20	1.61	0.00	0.92	2.53	2.52	3.00
UAW09-20	1.61	0.00	2.34	2.53	2.84	4.41
UAW11-10	5.17	0.00	5.52	2.53	9.04	5.48
UAW11-10	4.14	0.00	2.42	2.53	6.15	3.67
UAW12-20	1.76	0.00	0.79	2.53		2.90
UAW12-20	1.61	0.00	0.92	2.98		1.67
UAW13-20	3.59	0.00	1.22	2.53		2.52
UAW13-20	4.42	-1.27	5.75	6.39		3.14
UAW14-10	1.61	0.00	0.92	2.59	3.99	1.81
UAW14-10	1.61	0.00	0.92	2.53	3.27	1.22
UAW15-20	1.61	-0.71	0.69	3.27	5.98	4.01
UAW15-20	1.61	-0.73	2.16	1.59	5.44	4.62
UAW16-10	3.21	0.00	1.95	2.53	7.92	
UAW16-10 lind Dup.						2.86

TABLE F-17
CALCULATION OF EXPOSURE POINT CONCENTRATIONS
SITE-WIDE METALS IN GROUNDWATER
Morton International, Inc.
Reading, Ohio

Normal Data (µg/L)[1]

Sample Location	Arsenic	Cadmium	Chromium	Copper	Lead	Man-ganese	Nickel	Thallium
UAW16-10	20.6	1	4.3	6.8	1.5	2390	12.7	5
UAW18-20	12	0.31	1.5	12.5	1.5	1220	28.8	5.8
UAW18-20	11.7	1	2.5	12.5	1.5	1130	28.6	5
UAW21-30	5	1	1.5	9.9	1.5	82.8	17.7	5
UAW21-30	5	1	670	24.2	2.7	152	170	6.7
UAW22-20	14.3	0.29	22.2	29.2	12.2	8260	56.4	5
UAW22-20	15.9	0.47	27.1	34.4	15.4	6960	57.3	5
UAW23-20	5	1	6.9	12.5	1.5	31.5	12.8	8.9
UAW23-20	5	1	5.6	12.5	1.5	227	296	11.3
UAW25-20	26.1	0.38	2.6	11.4	1.5	1000	27.7	5
UAW25-20	32.4	1	10.5	9	1.5	914	97.5	5
count (n)	51	51	51	51	51	42	51	51
mean (x)	39	1	102	121	12	1525	100	7
standard deviation (SD)	93	1.27	310	651	57	2006	176	3.01
T value	1.68	1.68	1.68	1.68	1.68	1.68	1.68	1.68
95 % upper confidence limit[2]	61	1.40	175	274	25	2045	141	8.20
Maximum detected value					405			16.6
exposure point concentration					24			7.79
Kolmogorov-Smirnov:	0.18	0.34	0.16	0.35	0.43	0.13	0.11	0.21
Distribution:	31	1.04	59	33	12	2219	97	7.50
Best fit:	Lognormal	Lognormal	Lognormal	Lognormal	Normal	Lognormal	Lognormal	Normal

Lognormal Data

Sample Location	Arsenic	Cadmium	Chromium	Copper	Man-ganese	Nickel
UAW16-10	3.03	0.00	1.46	1.92	7.78	2.54
UAW18-20	2.48	-1.17	0.41	2.53	7.11	3.36
UAW18-20	2.46	0.00	0.92	2.53	7.03	3.35
UAW21-30	1.61	0.00	0.41	2.29	4.42	2.87
UAW21-30	1.61	0.00	6.51	3.19	5.02	5.14
UAW22-20	2.66	-1.24	3.10	3.37	9.02	4.03
UAW22-20	2.77	-0.76	3.30	3.54	8.85	4.05
UAW23-20	1.61	0.00	1.93	2.53	3.45	2.55
UAW23-20	1.61	0.00	1.72	2.53	5.42	5.69
UAW25-20	3.26	-0.97	0.96	2.43	6.91	3.32
UAW25-20	3.48	0.00	2.35	2.20	6.82	4.58
count (n)	51	51	51	51	42	51
mean (x)	2.74	-0.14	2.50	2.86	6.47	3.72
standard deviation (SD)	1.18	0.62	1.79	1.14	1.59	1.31
H value	2.5	1.95	2.93	2.45	3.06	2.65
95 % upper confidence limit[3]	47	1.24	128	50	4889	161
maximum detected value	611	8.6	1750	4640	8440	910
exposure point concentration	47	1.24	128	50	4889	161

1. Non-detect values are presented at one-half the detection limit.
2. 95% upper confidence limit = x + t(SD/n0.5)
3. 95% upper confidence limit = e(x+0.5 * SD^2+SD*H/(n-1)^0.5)

Appendix G

Chemical/Physical Constants for Chemicals Detected

APPENDIX G
PHYSICOCHEMICAL CONSTANTS
Morton International, Inc.
Reading, Ohio

CAS No.	Chemical	Molecular Weight (MW) (g/mole)	Physical State at 20oC	Water Solubility (S) (mg/l)	Reference	Henry's Law Constant (H) (atmm3/mole)	Reference	Vapor Pressure (atm)	Reference	Organic Carbon Partition Coefficient (Koc) (l/kg)	Reference	Log Octanol Water Coefficient (log Kow) (unitless)	Reference	Diffusivity in Air (Di) (cm2/sec)	Reference	Diffusivity in Water (Dw) (cm2/sec)	Reference
Volatile Organic Compounds																	
67641	Acetone	58.08	Liquid	1.00E+06	13	3.88E-05	13	2.35E+02	1	5.75E-01	13	0.24	3	1.24E-01	13	1.10E-05	13
107131	Acrylonitrile	53.06	Liquid	7.90E+04	1	1.38E-04	9	1.32E-01	9	1.26E+01	1	0.25	9	0.13	13	1.12E-05	1
71432	Benzene	78.11	Liquid	1.75E+03	13	5.55E-03	13	1.24E-01	1	6.20E+01	13	2.13	3	8.80E-02	13	9.80E-06	13
78933	2-Butanone	72.1	Liquid	2.56E+05	15	5.59E-05	16	1.25E-01	16	NA	--	0.29	3	9.20E-02	18	9.40E-06	18
75150	Carbon Disulfide	76.1	Liquid	1.19E+03	3	3.03E-02	3	4.71E-01	15	4.57E+01	3	2	3	1.00E-01	13	1.00E-05	13
108907	Chlorobenzene	112.56	Liquid	4.72E+02	13	3.70E-03	13	1.20E-02	1	2.19E+02	13	2.86	3	7.30E-02	13	8.70E-06	13
74873	Chloromethane	50.46	Liquid	5.33E+03	15	8.82E-03	15	5.66E+00	15	NA	--	0.91	15	1.10E-01	13	6.50E-06	13
75718	Dichlorodifluoromethane	120.91	Liquid	2.80E+02	15	3.45E-01	15	6.38E+00	15	NA	--	2.16	15	8.00E-02	13	1.10E-05	13
107062	1,2-Dichloroethane	98.96	Liquid	7.99E+03	1	1.12E-03	1	1.14E-01	1	1.07E+01	1	1.48	9	1.04E-01	2	1.01E-05	1
156592	cis-1,2-Dichloroethene	96.94	Liquid	3.50E+03	9	9.09E-03	1*	4.47E-01	1*	3.80E+01	1*	1.86	9	7.36E-02	2	1.03E-05	1*
75354	1,1-Dichloroethene (total)	96.94	Liquid	2.50E+03	9	2.61E-02	9	7.77E-01	9	2.88E+01	1	2.13	9	9.00E-02	2	9.80E-06	1
100414	Ethylbenzene	106.2	Liquid	1.69E+02	3	7.88E-03	3	1.26E-02	15	3.63E+02	3	3.14	3	7.50E-02	13	7.80E-06	13
74884	Iodomethane	141.9	Liquid	1.38E-01	15	5.26E-03	15	5.32E-01	15	NA	--	1.51	15	NA	--	NA	--
98828	Isopropylbenzene	120.2	Liquid	1.16E+00	15	4.99E-02	15	5.92E-03	15	NA	--	3.66	15	6.80E-02	18	7.30E-06	18
79209	Methyl acetate	74.08	Liquid	2.44E+05	15	1.15E-04	15	2.84E-01	15	NA	--	0.18	15	1.00E-01	13	1.00E-05	13
108872	Methylcyclohexane	98.19	Liquid	14	13	0.43	13	NA	--	2200	13	NA	--	7.00E-02	13	9.00E-06	13
75092	Methylene chloride	84.9	Liquid	1.30E+04	13	2.19E-03	13	4.77E-01	1	1.17E+01	13	1.25	3	1.01E-01	13	1.17E-05	13
127184	Tetrachloroethene	165.83	Liquid	2.00E+02	13	1.84E-02	3	2.54E-02	1	1.55E+02	2	2.67	3	7.20E-02	2	8.20E-06	2
108883	Toluene	92.14	Liquid	5.26E+02	13	6.64E-03	13	3.74E-02	1	1.40E+02	13	2.75	3	8.70E-02	13	8.60E-06	13
79016	Trichloroethene	131.39	Liquid	1.10E+03	2	1.03E-02	3	7.50E-02	1	1.66E+02	2	2.71	3	7.90E-02	2	9.10E-06	2
75014	Vinyl Chloride	62.5	Liquid	2.76E+03	13	2.70E-02	13	2.66E+03	1	1.86E+01	13	1.5	3	1.06E-01	13	1.23E-06	13
95476	o-Xylene	106.2	Liquid	1.78E+02	3	5.19E-03	3	8.70E-03	15	3.63E+02	3	3.13	3	7.00E-02	13	7.80E-06	13
108383	m-Xylene	106.2	Liquid	1.61E+02	3	7.34E-03	3	1.16E-02	15	4.07E+02	3	3.2	3	7.00E-02	13	7.80E-06	13
106423	p-Xylene	106.2	Liquid	1.85E+02	3	7.66E-03	3	1.11E-02	15	3.89E+02	3	3.17	3	7.00E-02	13	7.80E-06	13
Semivolatile Organic Compounds																	
62533	Aniline	93.13	NA	3.41E+04	1	2.02E-06	9	6.45E-04	9	4.07E+02	1	0.9	9	NA	--	1.05E-05	1
120127	Anthracene	178.2	Solid	4.34E-02	3	6.50E-05	3	3.51E-09	15	2.95E+04	3	4.55	3	3.20E-02	13	7.70E-06	13
56553	Benzo(a)anthracene	228.3	Solid	9.40E-03	2	3.35E-06	3	6.99E-10	1	3.98E+05	2	5.7	3	5.10E-02	2	9.00E-06	2
50328	Benzo(a)pyrene	252.32	Solid	1.62E-03	2	1.13E-06	3	3.46E-11	--	1.02E+06	2	6.11	3	4.30E-02	2	9.00E-06	2
205992	Benzo(b)fluoranthene	252.32	Solid	1.50E-03	2	1.11E-04	3	6.58E-10	--	1.23E+06	2	6.2	3	2.26E-02	2	5.56E-06	2
191242	Benzo(g,h,i)perlene	276	Solid	5.70E-03	16	1.41E-07	15	1.33E-13	15	1.38E+06	16	6.58	15	NA	--	4.90E-06	1
207089	Benzo(k)fluotanthene	252	Solid	8.00E-04	3	8.29E-07	3	2.63E-12	15	1.23E+06	3	6.2	3	2.60E-02	18	5.56E-06	18
117817	bis(2-ethylhexyl)phthalate	390.6	Liquid	3.40E-01	3	1.02E-07	3	8.92E-11	15	1.51E+07	3	7.3	3	3.50E-02	18	3.66E-06	18
86748	Carbazole	167.2	Solid	7.48E+00	3	1.53E-08	3	3.66E-15	--	3.39E+03	3	3.59	3	3.90E-02	18	7.03E-06	18
218019	Chrysene	228.2	Solid	1.60E-03	3	9.46E-05	3	8.20E-12	15	3.98E+05	3	5.7	3	2.50E-02	13	7.70E-06	13
53703	Dibenz(a,h)anthracene	278.36	Solid	2.49E-03	2	1.47E-08	3	NA	--	3.80E+06	2	6.69	3	2.02E-02	2	5.18E-06	2
132649	Dibenzofuran	168.2	Solid	3.10E+00	15	1.26E-05	15	2.37E-07	15	NA	--	4.12	15	NA	--	6.30E-06	1
95501	1,2Dichlorobenzene	147	NA	1.60E+02	13	1.90E-03	13	1.40E-03	1	3.80E+02	13	3.43	9	6.90E-02	13	7.90E-06	13
541731	1,3Dichlorobenzene	147	NA	1.60E+02	13	1.90E-03	13	2.10E+00	1	3.80E+02	13	3.5	1	6.90E-02	13	7.90E-06	13
105679	2,4Dimethylphenol	122	Solid	7.87E+03	9	1.70E-05	9	1.34E-04	9	1.20E+02	1	2.3	9	0.0584	2	7.70E-06	1
117840	di-n-Octylphthalate	390.6	Liquid	2.00E-02	3	6.68E-05	3	3.42E-09	16	8.32E+07	3	8.06	3	1.51E-02	18	3.58E-06	18
206440	Fluoranthene	202	Solid	2.06E-01	3	1.61E-05	3	1.62E-11	15	1.07E+05	3	5.12	3	3.02E-02	18	6.35E-06	18
86737	Fluorene	116	Solid	1.98E+00	3	6.36E-05	3	8.33E-07	16	1.38E+04	3	4.21	3	3.63E-02	18	7.20E-06	18
193395	Indeno(1,2,3cd)pyrene	276.34	Solid	2.20E-05	2	1.60E-06	3	1.33E-13	--	3.47E+06	2	6.65	3	1.90E-02	2	5.66E-06	2
91576	2-Methylnapthalene	142.2	Solid	2.46E+01	15	3.84E-04	17	8.96E-05	16	2.51E+03	17	3.86	16	6.60E-02	18	7.20E-06	18
106445	4-Methylphenol	108	Solid	1.80E+04	1	1.00E-06	9	1.44E-04	9	6.46E+02	1	1.94	9	NA	--	7.70E-06	1

APPENDIX G
PHYSICOCHEMICAL CONSTANTS
Morton International, Inc.
Reading, Ohio

CAS No.	Chemical	Molecular Weight (MW) (g/mole)	Physical State at 20oC	Water Solubility (S) (mg/l)	Reference	Henry's Law Constant (H) (atmm3/mole)	Reference	Vapor Pressure (atm)	Reference	Organic Carbon Partition Coefficient (Koc) (l/kg)	Reference	Log Octanol Water Coefficient (log Kow) (unitless)	Reference	Diffusivity in Air (Di) (cm2/sec)	Reference	Diffusivity in Water (Dw) (cm2/sec)	Reference
91203	Naphthalene	128.2	Solid	3.10E+01	3	4.83E-04	3	1.12E-04	16	2.00E+.3	3	3.36	3	NA	--	7.70E-06	1
85018	Phenanthrene	178.2	Solid	1.60E+00	17	2.28E-05	15	1.47E-07	15	1.41E+04	16	4.57	15	5.90E-02	18	7.50E-06	18
108952	Phenol	94.1	Solid	2.28E+04	3	3.97E-07	3	3.63E-04	15	2.88E+01	3	1.48	3	8.20E-02	18	9.10E-06	18
129000	Pyrene	202.3	Solid	1.35E-01	3	1.10E-05	3	3.22E-09	15	1.05E+05	3	5.11	3	2.70E-02	13	7.20E-06	13
Pesticides																	
309002	Aldrin	365	Solid	1.80E-01	2	1.70E-04	3	NA	--	2.45E+06	2	6.5	3	1.32E-02	2	4.86E-06	2
53469219	Aroclor 1242	261	Liquid	7.00E-01	2	5.60E-04	1	NA	--	4.21E+04	1	4.11	1	NA	2	6.10E-06	1
12672296	Aroclor 1248	288	Liquid	5.60E-02	15	0.00367	1	6.50E-09	1	3.09E+05	3	3.9	15	NA	--	6.60E-06	1
11097691	Aroclor 1254	327	Liquid	NA	--	0.0023	1	2.80E-08	1	3.09E+05	3	3.9	15	NA	--	5.60E-06	1
1336363	Aroclor 1260	370	Solid	NA	--	0.00017	1	5.32E-08	1	3.09E+05	3	3.9	15	NA	--	5.30E-06	1
319846	alphaBHC	290.83	Solid	2.00E+00	2	1.06E-05	3	NA	--	1.23E+03	2	3.8	3	1.42E-02	2	7.34E-06	2
319857	betaBHC	290.83	Solid	2.00E+00	2	1.06E-05	3	6.13E-10	15	1.23E+03	2	3.8	3	1.42E-02	2	7.34E-06	2
5103719	Alpha-chlordane	409.8	Liquid	5.60E-02	16	5.50E-02	16	1.29E-08	16	2.50E-05	1	5.54	3	NA	--	4.30E-06	1
12789036	Gamma-chlordane	409.8	Liquid	5.00E+00	15	3.60E-02	16	1.29E-08	16	NA	--	5.54	3	NA	--	NA	--
72548	4,4'-DDD	320.1	Solid	9.00E-02	3	4.00E-06	3	8.82E-10	16	1.00E+06	3	6.1	3	NA	--	4.50E-05	1
72559	4,4'-DDE	318	Solid	1.20E-01	3	2.10E-05	3	7.89E-09	16	4.47E+06	3	6.76	3	NA	--	4.60E-05	1
50293	4,4'-DDT	354.5	Solid	2.50E-02	3	8.10E-06	3	2.11E-10	16	2.63E+06	3	6.53	3	NA	--	3.70E-05	1
60571	Dieldrin	381	NA	1.95E-01	2	1.51E-05	3	7.75E-09	15	2.14E+04	2	4.56	4	1.25E-02	2	4.74E-06	2
115297	Endosulfan II	406.9	Solid	4.55E-06	3	1.12E-05	3	1.32E-08	15	2.14E+03	3	4.1	3	NA	--	4.50E-06	1
1031078	Endosulfan sulfate	422.92	Solid	NA	--	4.64E-05	1	1.28E-08	1	2.33E+03	1	3.66	1	NA	--	4.40E-06	1
72208	Endrin	380.9	Solid	4.74E-06	3	7.52E-06	3	3.95E-09	15	1.23E+04	3	5.06	3	NA	--	4.40E-06	1
7421934	Endrin aldehyde	380.92	Solid	NA	--	3.86E-07	1	2.63E-10	1	2.69E+04	1	5.6	1	NA	--	4.30E-06	1
	Endrin ketone	NA	NA	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--
76448	Heptachlor	373.4	NA	1.80E-01	9	1.48E-03	9	NA	--	3.01E+04	9	5.5	9	0.0112	2	4.60E-06	1
1024573	Heptachlor epoxide	389.4	NA	2.75E-01	1	3.20E-05	9	2.57E-08	15	2.09E+04	1	5.4	9	0.0132	2	4.60E-06	1
465736	Isodrin	264.9	NA	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--	NA	--
72435	Methoxychlor	345.7	Solid	4.46E-06	3	1.14E-02	3	7.89E-10	15	9.77E+04	3	4.83	15	NA	--	NA	--

(1*) trans-1,2-Dichlororethene

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NA = Not available
(--) = Not applicable

Appendix H

Vapor Migration Modeling

APPENDIX H

ESTIMATION OF AIR CONCENTRATIONS AND PARTICULATE EMISSION FACTORS

To address the soil/groundwater-to-air pathways, the following models were used to evaluate volatilization of chemicals and fugitive dust emissions:

1. Johnson & Ettinger Model to estimate indoor air concentrations from soil and groundwater,
2. VOC Emission Model to estimate vapor flux to ambient air from soil and groundwater,
3. Quiescent Surface Impoundment Model and Box Model to estimate vapor flux from exposed groundwater
4. X/Q dispersion model to estimate ambient air concentrations from vapor flux, and
5. PEF calculation to relate the concentration of respirable particles in the air to fugitive dust emission from soil.

These models are described in the following paragraphs. Chemical-specific input parameters are provided in Appendix G; Johnson and Ettinger model output files, including the predicted indoor air chemical concentrations, are attached to this Appendix. Calculations for other air models are included in Appendix I.

Johnson and Ettinger Model

Inhabitants of buildings currently on-site or in the future could be exposed to volatile organic chemicals (VOCs) that may infiltrate the indoor environment from subsurface soils and/or the shallow groundwater. VOC concentrations in indoor air of future structures were estimated using the Johnson and Ettinger model, as parameterized by U.S. EPA (1997c). The model incorporates both convective and diffusive mechanisms for estimating the transport of chemical vapors emanating from either subsurface soils or groundwater into indoor spaces located directly above or in close proximity to a source of chemicals. The model is a one-dimensional analytical solution to convective and diffusive vapor transport into indoor spaces and provides an estimated attenuation coefficient that relates the vapor concentration in the indoor space to the vapor concentration at the source. The Johnson and Ettinger model has two levels called tiers. Tier 1 is a screening model in which most model parameters have been set equal to central tendency or upper bound values; values for the most sensitive parameters may be user-

defined. In Tier 2, site-specific data may be input for all model parameters. Results from the Tier 1 model are therefore generally more conservative than results obtained from the more refined Tier 2 model. The Tier 2 model was used to estimate the indoor air concentration for the potential future receptors evaluated in this baseline RA. The predicted air concentrations for each of the COPCs were then used to estimate the dose and the resulting risks.

Inputs to the Tier 2 model used for this assessment include chemical properties, saturated and unsaturated zone soil properties, and exposure frequency and duration values. The input parameters to the model used for the scenarios evaluated are presented in Table H-1.

VOC Emissions Model

The VOC emission model presented in "Soil Screening Guidance: Users Guide and Technical Background Document" (U.S. EPA, 1996a and b) was used to estimate vapor flux of chemicals from soil as follows:

$$Ei = \frac{Cs \times pb \times 2 \times Da \times CFm2-cm2}{\sqrt{\pi \times Da \times T}} \qquad (1)$$

Where:

Ei = Emission rate (mg/sec)

Cs = Concentration in soil (mg/kg)

pb = Soil bulk density (g/cm^3)

Da = Chemical-specific effective diffusivity in soil (cm^2/sec); calculated as follows:

$$Da = \frac{(Pa^{3.333} \times Di \times H') + (Pw^{3.333} \times Dw) / Pt^2}{(pb \times Kd) + Pw + (Pa \times H')} \qquad (2)$$

Where: Di = chemical-specific diffusivity in air (cm^2/sec)

Pa = air-filled porosity (unitless)

H' = Henry's law constant (unitless)

Pw = water-filled porosity (unitless)

Dw = chemical-specific diffusivity in water (cm^2/sec)

Pt = total soil porosity (unitless)

Kd = Soil organic partition coefficient (cm^3/g)

CT = Total solute concentration (mg/cm3; see below)

$CF_{m2\text{-}cm2}$ = Conversion factor from square meters to square centimeters

T = Exposure interval (sec) (equal to exposure duration)

For chemicals in groundwater, the same equation was used with replacement of the soil concentration term (pbxCs) by the total solute concentration associated with measured groundwater concentrations. The total solute concentration is derived from the concentration in groundwater and the related concentration in soil vapor based on partitioning from groundwater to vapor as predicted by Henry's law. The equation is:

$$CT = Cv \times (pb \times Kd/H' + Pw / H' + Pa) \quad (3)$$

Where:

Cv = Soil vapor concentration (g/cm^3), calculated as follows:

$$Cv = Cgw \times H' \times CF_{cm3-1} \quad (4)$$

Where: Cgw = Concentration in groundwater (mg/l)

H' = Henry's Law Constant (unitless)

CF_{cm3-1} = Conversion Factor from cubic centimeters to liters

Other parameters were defined previously.

Quiescent Surface Impoundment Model

The U.S. EPA's Air Emission Model for Quiescent Surface Impoundments was used to calculate the air concentrations resulting from volatilization from surface water exposed during excavation activities (U.S. EPA, 1995). The vapor emission rate of organics from the exposed surface water is assumed to be proportional to the water concentration of the solute and the mass transfer coefficient (K_v).

$$E_i = K_i \times C_w \times CF_1 \quad (5)$$

Where:

E_i = Vapor emission rate from exposed water ($g/sec\text{-}cm^2$)

K_i = Overall mass transfer coefficient of solute into atmosphere ($cm^3/sec\text{-}cm^2$)

C_w = Chemical concentration in water (g/cm3)

CF_1 = Conversion factor from $g/cm^2\text{-}s$ to $g/m^2\text{-}s$ ($1x10^4$)

Water concentrations in units of mg/l can be converted to g/cm^3 using the following equation:

$$C_w\ (g/cm^3) = \frac{C_w\ (mg/l)}{1000\ (cm^3/l) \times 1000 (mg/g)} \tag{6}$$

The U.S. EPA has proposed a two-phase theory of volatilization from quiescent surface impoundments. The chemical is assumed to move upward from the bulk aqueous solution and the rate (K_i) is related to these two mass transfer coefficients (aqueous-phase and liquid-phase) as:

$$\frac{1}{K_i} = \frac{1}{Kl} + \frac{R \times T}{Kg \times H} \tag{7}$$

Where:

K_i	=	Overall mass transfer coefficient of solute into atmosphere (m/sec)
Kl	=	Mass transfer coefficient in aqueous phase (m/sec)
Kg	=	Transfer coefficient in the vapor phase (m/sec)
H	=	Chemical-specific Henry's Law constant (atm-m^3/mole)
R	=	Universal gas constant (atm-m^3/mole-K)
T	=	Absolute temperature (K)

The mass transfer coefficient in the aqueous phase (Kl) can be calculated using the following equation (U.S. EPA, 1995):

$$Kl = \left(\frac{MW_{O2}}{MW_i}\right) \times \left(\frac{T}{298}\right) \times \left(Kl_{O2}\right) \tag{8}$$

Where:

Kl	=	Mass transfer coefficient in aqueous phase (m/sec)
MW_{O2}	=	Molecular weight of oxygen (32 g/mol)
MW_i	=	Molecular weight of component i (g/mol)
T	=	Average system absolute temperature (K)
Kl_{O2}	=	Liquid-phase mass transfer coefficient of oxygen at 25°C (0.002 cm/s)

The gas phase transfer coefficient (Kg) is defined as (U.S. EPA, 1995):

$$Kg = \left(\frac{MW_{H2O}}{MW_i}\right)^{0.335} \times \left(\frac{T}{298}\right)^{1.005} \times \left(Kg_{H2O}\right) \qquad (9)$$

Where:

Kg	=	Transfer coefficient in the gas phase (m/s)
MW_{H2O}	=	Molecular weight of water (18 g/mol)
MWi	=	Molecular weight of component i
T	=	Average system absolute temperature (K)
Kg_{H2O}	=	Gas-phase mass transfer coefficient of water vapor at 25°C (0.833 cm/s)

The emission rates estimated using Equations (5) through (10) were combined with the box model. The box model is a simple mass balance equation that is based on the concept of a theoretically enclosed space over the area of interest. The model assumes that vapors enter the box and are removed by wind. The ambient air concentrations for each of the volatile COPCs were calculated using the following equation:

$$Caa = \frac{Ei \times A}{LS \times WS \times MH} \qquad (10)$$

Where:

Caa	=	Ambient air concentration (mg/m^3)
Ei	=	Emission rate (mg/m^2-sec)
A	=	Emission area (16.7 m^2; 6 foot by 30 foot trench; professional judgement)
LS	=	Length of emissions area (1.8 m shorter-side; site-specific)
WS	=	Wind speed (2.25 m/sec; Cal-EPA, 1994b)
MH	=	Mixing height (2 m; Cal-EPA, 1994b)

X/Q Model

Ambient air concentrations were estimated based on the emission rate from the VOC emission model and potential dispersion in ambient air. In U.S. EPA's Soil Screening Guidance (1996a/b), there is a log-linear relationship between the inverse of the dispersion factor (Q/C;g/m^2-sec per kg/m^3) and the area of the emission source (A; acre) defined as:

$$Q/C = -20.21 \times \text{LogA} + 75.51 \tag{11}$$

This equation is based on specific measurements in Cleveland, Ohio, the location most appropriate to the subject site. The inverse dispersion factor (Q/C) is related to the dispersion factor as follows (X/Q; mg/m^3 per mg/m^2-sec):

$$X/Q = \frac{CF_{kg-mg}}{Q/C \times CF_{g-mg}} \tag{12}$$

Where:

CF_{kg-mg}	=	Conversion factor from kilograms to milligrams
CF_{g-mg}	=	Conversion factor from grams to milligrams

The concentration in ambient air was then estimated as follows:

$$\text{Caa} = \text{Ei} \times \text{X/Q} \tag{13}$$

Where:

Caa	=	Concentration in ambient air (mg/m^3)
Ei	=	Emission rate (mg/m^2-sec)
X/Q	=	Dispersion factor (mg/m^3 per mg/m^2-sec)

Particulate Emission Factor Calculation

Inhalation of chemicals adsorbed to respirable particles (PM10) were assessed by calculating a PEF that relates the concentration of respirable particles in the air due to fugitive dust emission from soil. The relationship is derived by Cowherd (1985) for a rapid assessment procedure applicable to a typical hazardous waste site where the surface chemical concentration provides a relatively continuous and constant potential for emission over an extended period of time. The following equation, as described in U.S. EPA (1996a/b), was used:

$$PEF = \frac{Q/C \times 3600}{0.036 \times (1 - V) \times (Um/Ut)^3 \times F(x)} \quad (14)$$

Where:

Q/C	=	Dispersion factor (g/m2-sec per kg/m3)
V	=	Fraction of vegatative cover (0.5; U.S. EPA, 2000)
Um	=	Mean annual windspeed (4.69 m/sec; U.S. EPA, 1996a)
Ut	=	Equivalent threshold value of windspeed at 7 meters (11.32 m/sec; U.S. EPA, 1996a)
F(x)	=	Function of Um/Ut (0.2; U.S. EPA, 1996a)

Two separate areas were defined to develop estimates of Q/C for industrial workers: one for metals evaluated in the Trench 1 area and one for manganese. For the T-1 area, the potential emission area was based on the vicinity of the maximum concentrations of metals detected in T-1 (Figure 2). The area for manganese was based on southwest portion of the facility (4.7 acres) where the fewest number of buildings are present to minimize particulate generation. For construction/utility and maintenance workers, a default PEF of 2×10^7 m^3/kg was used to represent dusty site conditions based on U.S. EPA's national ambient air quality standard of 50 $\mu g/m^3$ for particulates (PM10).

TABLE H-1

JOHNSON AND ETTINGER MODEL INPUT PARAMETERS

Morton International, Inc.
Reading, Ohio

Parameter	Symbol	Units	Industrial Value	Rationale
Depth below grade to bottom of enclosed floor space	L_F	(cm)	15	Slab-on-grade
Depth to top of affected soil	L_t	(cm)/(ft)	30/1	One foot of clean soil below construction
Depth below grade to bottom of affected soil	L_b	(cm)/(ft)	122/4	Depth to shallowest groundwater
Soil type	–	–	C	Clay
Soil dry bulk density	ρ_b	(g/cm^3)	1.5	U.S. EPA, 1999a
Soil total porosity	P_T	(cm^3/cm^3)	0.43	U.S. EPA, 1999a
Soil water-filled porosity	P_w	(cm^3/cm^3)	0.15	U.S. EPA, 1999a
Soil organic carbon fraction	f_{oc}	(unitless)	0.006	U.S. EPA, 1999a
Length of building	L_B	(cm)/(ft)	975/32	Small on-site building
Width of building	W_B	(cm)/(ft)	1219/40	Small on-site building
Height of building	H_B	(cm)/(ft)	488/16	Industrial structure
Fraction of building above plume	–	%	100	Default
Indoor air exchange rate	ER	(1/hr)	0.83	ASTM, 1997

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [X]

SL-ADV Version 2.3

Geomatrix Version, 2.3.1 modified by RHC, Sept 2001 includes Cal-EPA CSFs

ENTER U.S. EPA or Cal-EPA: U.S. EPA

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (µg/kg)	Chemical
67641	1.59E+03	Acetone
71432	6.70E+02	Benzene
108907	1.43E+03	Chlorobenzene
95501	2.10E+03	1,2-Dichlorobenzene
75092	1.41E+03	Methylene chloride
108883	1.51E+04	Toluene
		CAS No. not found
		CAS No. not found
		CAS No. not found
		CAS No. not found
		CAS No. not found
		CAS No. not found
		CAS No. not found
		CAS No. not found
		CAS No. not found

MORE ↓

ENTER Average soil temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to top of contamination, L_t (cm)	ENTER Depth below grade to bottom of contamination, (enter value of 0 if value is unknown) L_b (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
				Totals must add up to value of L_t (cell D28)					
11.1	15	30.48	0	30.48	0	0	C		

MORE ↓

ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum A soil organic carbon fraction, f_{oc}^A (unitless)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum B soil organic carbon fraction, f_{oc}^B (unitless)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)	ENTER Stratum C soil organic carbon fraction, f_{oc}^C (unitless)
1.5	0.43	0.15	0.006	1.5	0.43	0.25	0.003	1.7	0.34	0.26	0.002

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)
15	40	975.36	1219.2	488	0.1	0.83
(ft.)		32	40			

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1
				Used to calculate risk-based soil concentration.	

END

RESULTS SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Physical state at soil temperature, (S,L,G)
1.24E-01	1.14E-05	3.88E-05	25	6,955	329.20	508.10	5.75E-01	1.00E+06	0.0E+00	3.5E-01	L
8.80E-02	9.80E-06	5.56E-03	25	7,342	353.24	562.16	5.89E+01	1.75E+03	7.8E-06	0.0E+00	L
7.30E-02	8.70E-06	3.71E-03	25	8,410	404.87	632.40	2.19E+02	4.72E+02	0.0E+00	2.0E-02	L
6.90E-02	7.90E-06	1.90E-03	25	9,700	453.57	705.00	6.17E+02	1.56E+02	0.0E+00	2.0E-01	L
1.01E-01	1.17E-05	2.19E-03	25	6,706	313.00	510.00	1.17E+01	1.30E+04	4.7E-07	3.0E+00	L
8.70E-02	8.60E-06	6.63E-03	25	7,930	383.78	591.79	1.82E+02	5.26E+02	0.0E+00	4.0E-01	L
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

END

RESU[illegible] [illegible]EET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_w (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	15.48	0.280	0.180	0.080	0.157	2.26E-09	0.918	2.08E-09	4.389	1.59E+03	1.34E+05
7.88E+08	15.48	0.280	0.180	0.080	0.157	2.26E-09	0.918	2.08E-09	4.389	8.70E+02	1.34E+05
7.88E+08	15.48	0.280	0.180	0.080	0.157	2.26E-09	0.918	2.08E-09	4.389	1.43E+03	1.34E+05
7.88E+08	15.48	0.280	0.180	0.080	0.157	2.26E-09	0.918	2.08E-09	4.389	2.10E+03	1.34E+05
7.88E+08	15.48	0.280	0.180	0.080	0.157	2.26E-09	0.918	2.08E-09	4.389	1.41E+03	1.34E+05
7.88E+08	15.48	0.280	0.180	0.080	0.157	2.26E-09	0.918	2.08E-09	4.389	1.51E+04	1.34E+05
7.88E+08	15.48	0.280	0.180	0.080	0.157	2.26E-09	0.918	2.08E-09	4.389	0.00E+00	1.34E+05
7.88E+08	15.48	0.280	0.180	0.080	0.157	2.26E-09	0.918	2.08E-09	4.389	0.00E+00	1.34E+05
7.88E+08	15.48	0.280	0.180	0.080	0.157	2.26E-09	0.918	2.08E-09	4.389	0.00E+00	1.34E+05
7.88E+08	15.48	0.280	0.180	0.080	0.157	2.26E-09	0.918	2.08E-09	4.389	0.00E+00	1.34E+05
7.88E+08	15.48	0.280	0.180	0.080	0.157	2.26E-09	0.918	2.08E-09	4.389	0.00E+00	1.34E+05
7.88E+08	15.48	0.280	0.180	0.080	0.157	2.26E-09	0.918	2.08E-09	4.389	0.00E+00	1.34E+05
7.88E+08	15.48	0.280	0.180	0.080	0.157	2.26E-09	0.918	2.08E-09	4.389	0.00E+00	1.34E+05
7.88E+08	15.48	0.280	0.180	0.080	0.157	2.26E-09	0.918	2.08E-09	4.389	0.00E+00	1.34E+05
7.88E+08	15.48	0.280	0.180	0.080	0.157	2.26E-09	0.918	2.08E-09	4.389	0.00E+00	1.34E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)	Convection path length, L_p (cm)
1.19E+06	3.69E-04	15	7.545	2.08E-05	8.92E-04	1.76E-04	9.80E-03	0.00E+00	0.00E+00	9.80E-03	15.48	15
1.19E+06	3.69E-04	15	8.111	2.83E-03	1.22E-01	1.76E-04	6.86E-03	0.00E+00	0.00E+00	6.86E-03	15.48	15
1.19E+06	3.69E-04	15	9.792	1.65E-03	7.09E-02	1.76E-04	5.70E-03	0.00E+00	0.00E+00	5.70E-03	15.48	15
1.19E+06	3.69E-04	15	11.676	7.25E-04	3.11E-02	1.76E-04	5.38E-03	0.00E+00	0.00E+00	5.38E-03	15.48	15
1.19E+06	3.69E-04	15	7.022	1.23E-03	5.26E-02	1.76E-04	7.88E-03	0.00E+00	0.00E+00	7.88E-03	15.48	15
1.19E+06	3.69E-04	15	9.143	3.12E-03	1.34E-01	1.76E-04	6.79E-03	0.00E+00	0.00E+00	6.79E-03	15.48	15
1.19E+06	3.69E-04	15	#N/A	#N/A	#N/A	1.76E-04	#N/A	0.00E+00	0.00E+00	#N/A	15.48	15
1.19E+06	3.69E-04	15	#N/A	#N/A	#N/A	1.76E-04	#N/A	0.00E+00	0.00E+00	#N/A	15.48	15
1.19E+06	3.69E-04	15	#N/A	#N/A	#N/A	1.76E-04	#N/A	0.00E+00	0.00E+00	#N/A	15.48	15
1.19E+06	3.69E-04	15	#N/A	#N/A	#N/A	1.76E-04	#N/A	0.00E+00	0.00E+00	#N/A	15.48	15
1.19E+06	3.69E-04	15	#N/A	#N/A	#N/A	1.76E-04	#N/A	0.00E+00	0.00E+00	#N/A	15.48	15
1.19E+06	3.69E-04	15	#N/A	#N/A	#N/A	1.76E-04	#N/A	0.00E+00	0.00E+00	#N/A	15.48	15
1.19E+06	3.69E-04	15	#N/A	#N/A	#N/A	1.76E-04	#N/A	0.00E+00	0.00E+00	#N/A	15.48	15
1.19E+06	3.69E-04	15	#N/A	#N/A	#N/A	1.76E-04	#N/A	0.00E+00	0.00E+00	#N/A	15.48	15
1.19E+06	3.69E-04	15	#N/A	#N/A	#N/A	1.76E-04	#N/A	0.00E+00	0.00E+00	#N/A	15.48	15

Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} (µg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m^3)	Finite source β term (unitless)	Finite source ψ term $(sec)^{-1}$	Time for source depletion, τ_D (sec)	Exposure duration > time for source depletion (YES/NO)
3.45E-03	1.37E+04	0.10	2.29E+00	9.80E-03	4.39E+02	2.93E+03	1.71E-05	2.34E-01	NA	NA	NA	NA
3.63E-01	1.72E+05	0.10	2.29E+00	6.86E-03	4.39E+02	8.88E+04	1.70E-05	2.92E+00	NA	NA	NA	NA
1.31E+00	7.10E+04	0.10	2.29E+00	5.70E-03	4.39E+02	9.22E+05	1.70E-05	1.21E+00	NA	NA	NA	NA
3.70E+00	1.71E+04	0.10	2.29E+00	5.38E-03	4.39E+02	2.04E+06	1.70E-05	2.92E-01	NA	NA	NA	NA
7.02E+02	4.12E+05	0.10	2.29E+00	7.88E-03	4.39E+02	2.05E+04	1.70E-05	7.02E+00	NA	NA	NA	NA
1.09E+00	1.66E+06	0.10	2.29E+00	6.79E-03	4.39E+02	1.01E+05	1.70E-05	2.82E+01	NA	NA	NA	NA
#N/A	#N/A	0.10	2.29E+00	#N/A	4.39E+02	#N/A	#N/A	#N/A	NA	NA	NA	NA
#N/A	#N/A	0.10	2.29E+00	#N/A	4.39E+02	#N/A	#N/A	#N/A	NA	NA	NA	NA
#N/A	#N/A	0.10	2.29E+00	#N/A	4.39E+02	#N/A	#N/A	#N/A	NA	NA	NA	NA
#N/A	#N/A	0.10	2.29E+00	#N/A	4.39E+02	#N/A	#N/A	#N/A	NA	NA	NA	NA
#N/A	#N/A	0.10	2.29E+00	#N/A	4.39E+02	#N/A	#N/A	#N/A	NA	NA	NA	NA
#N/A	#N/A	0.10	2.29E+00	#N/A	4.39E+02	#N/A	#N/A	#N/A	NA	NA	NA	NA
#N/A	#N/A	0.10	2.29E+00	#N/A	4.39E+02	#N/A	#N/A	#N/A	NA	NA	NA	NA
#N/A	#N/A	0.10	2.29E+00	#N/A	4.39E+02	#N/A	#N/A	#N/A	NA	NA	NA	NA

Finite source indoor attenuation coefficient, <α> (unitless)	Mass limit bldg. conc., $C_{building}$ (µg/m^3)	Finite source bldg. conc., $C_{building}$ (µg/m^3)	Final finite source bldg. conc., $C_{building}$ (µg/m^3)	Unit risk factor, URF (µg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
NA	NA	NA	NA	NA	3.3E-01
NA	NA	NA	NA	7.8E-06	NA
NA	NA	NA	NA	NA	2.0E-02
NA	NA	NA	NA	NA	2.0E-01
NA	NA	NA	NA	4.7E-07	3.0E+00
NA	NA	NA	NA	NA	4.0E-01
NA	NA	NA	NA	#N/A	#N/A
NA	NA	NA	NA	#N/A	#N/A
NA	NA	NA	NA	#N/A	#N/A
NA	NA	NA	NA	#N/A	#N/A
NA	NA	NA	NA	#N/A	#N/A
NA	NA	NA	NA	#N/A	#N/A
NA	NA	NA	NA	#N/A	#N/A
NA	NA	NA	NA	#N/A	#N/A

END

RESULTS SHEET

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

INCREMENTAL RISK CALCULATI

	Indoor exposure soil conc., carcinogen (μg/kg)	Indoor exposure soil conc., noncarcinogen (μg/kg)	Risk-based indoor exposure soil conc., (μg/kg)	Soil saturation conc., C_{sat} (μg/kg)	Final indoor exposure soil conc., (μg/kg)	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
Acetone	NA	NA	NA	1.04E+08	NA	NA	4.6E-04
Benzene	NA	NA	NA	8.33E+05	NA	5.6E-06	NA
Chlorobenzene	NA	NA	NA	6.74E+05	NA	NA	4.1E-02
1,2-Dichlorobenzene	NA	NA	NA	5.94E+05	NA	NA	1.0E-03
Methylene chloride	NA	NA	NA	2.34E+06	NA	8.1E-07	1.6E-03
Toluene	NA	NA	NA	6.40E+05	NA	NA	4.8E-02
CAS No. not found	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR
CAS No. not found	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR
CAS No. not found	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR
CAS No. not found	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR
CAS No. not found	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR
CAS No. not found	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR
CAS No. not found	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR
CAS No. not found	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR
CAS No. not found	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR
CAS No. not found	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR	ERROR

DATA ENTRY SHEET

GW-ADV Version 2.3; 03/01	Geomatrix Version, 2.3.1 modified by RHC, Sept 2001 includes Cal-EPA CSFs

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER U.S. EPA or Cal-EPA: U.S. EPA

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
67641	4.50E+04	Acetone
71432	1.10E+02	Benzene
108907	3.49E+02	Chlorobenzene
95501	1.90E+03	1,2-Dichlorobenzene
541731	4.10E+01	1,3-Dichlorobenzene
106467	2.60E+02	1,4-Dichlorobenzene
75092	2.00E+02	Methylene chloride
108883	2.10E+04	Toluene
		CAS No. not found
		CAS No. not found
		CAS No. not found
		CAS No. not found
		CAS No. not found
		CAS No. not found
		CAS No. not found

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell D28)							
11.1	15	121.92	122	0	0	A	C	S		

(in feet) 4

MORE ↓

ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
1.5	0.43	0.15	1.5	0.43	0.15	1.5	0.43	0.15

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)
15	40	975.36	1219.2	487.68	0.1	0.83

(in feet) 32 40 16

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1
				Used to calculate risk-based groundwater concentration.	

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1.24E-01	1.14E-05	3.88E-05	25	6,955	329.20	508.10	5.75E-01	1.00E+06	0.0E+00	3.5E-01
8.80E-02	9.80E-06	5.56E-03	25	7,342	353.24	562.16	5.89E+01	1.75E+03	7.8E-06	0.0E+00
7.30E-02	8.70E-06	3.71E-03	25	8,410	404.87	632.40	2.19E+02	4.72E+02	0.0E+00	2.0E-02
6.90E-02	7.90E-06	1.90E-03	25	9,700	453.57	705.00	6.17E+02	1.56E+02	0.0E+00	2.0E-01
6.90E-02	7.90E-06	1.90E-03	25	9,700	453.57	705.00	3.80E+02	1.60E+02	0.0E+00	2.0E-01
6.90E-02	7.90E-06	2.43E-03	25	9,271	447.21	684.75	6.17E+02	7.38E+01	6.3E-06	8.0E-01
1.01E-01	1.17E-05	2.19E-03	25	6,706	313.00	510.00	1.17E+01	1.30E+04	4.7E-07	3.0E+00
8.70E-02	8.60E-06	6.63E-03	25	7,930	383.78	591.79	1.82E+02	5.26E+02	0.0E+00	4.0E-01
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
7.88E+08	106.92	0.280	0.280	0.280	0.257	9.94E-08	0.703	6.99E-08	81.52	0.43	0.018	0.412	4,389
7.88E+08	106.92	0.280	0.280	0.280	0.257	9.94E-08	0.703	6.99E-08	81.52	0.43	0.018	0.412	4,389
7.88E+08	106.92	0.280	0.280	0.280	0.257	9.94E-08	0.703	6.99E-08	81.52	0.43	0.018	0.412	4,389
7.88E+08	106.92	0.280	0.280	0.280	0.257	9.94E-08	0.703	6.99E-08	81.52	0.43	0.018	0.412	4,389
7.88E+08	106.92	0.280	0.280	0.280	0.257	9.94E-08	0.703	6.99E-08	81.52	0.43	0.018	0.412	4,389
7.88E+08	106.92	0.280	0.280	0.280	0.257	9.94E-08	0.703	6.99E-08	81.52	0.43	0.018	0.412	4,389
7.88E+08	106.92	0.280	0.280	0.280	0.257	9.94E-08	0.703	6.99E-08	81.52	0.43	0.018	0.412	4,389
7.88E+08	106.92	0.280	0.280	0.280	0.257	9.94E-08	0.703	6.99E-08	81.52	0.43	0.018	0.412	4,389
7.88E+08	106.92	0.280	0.280	0.280	0.257	9.94E-08	0.703	6.99E-08	81.52	0.43	0.018	0.412	4,389
7.88E+08	106.92	0.280	0.280	0.280	0.257	9.94E-08	0.703	6.99E-08	81.52	0.43	0.018	0.412	4,389
7.88E+08	106.92	0.280	0.280	0.280	0.257	9.94E-08	0.703	6.99E-08	81.52	0.43	0.018	0.412	4,389
7.88E+08	106.92	0.280	0.280	0.280	0.257	9.94E-08	0.703	6.99E-08	81.52	0.43	0.018	0.412	4,389
7.88E+08	106.92	0.280	0.280	0.280	0.257	9.94E-08	0.703	6.99E-08	81.52	0.43	0.018	0.412	4,389
7.88E+08	106.92	0.280	0.280	0.280	0.257	9.94E-08	0.703	6.99E-08	81.52	0.43	0.018	0.412	4,389

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.34E+05	1.19E+06	3.69E-04	15	7,545	2.08E-05	8.92E-04	1.76E-04	9.80E-03	0.00E+00	0.00E+00	3.60E-03	4.24E-03	106.92
1.34E+05	1.19E+06	3.69E-04	15	8,111	2.85E-03	1.22E-01	1.76E-04	6.86E-03	0.00E+00	0.00E+00	2.34E-05	3.07E-05	106.92
1.34E+05	1.19E+06	3.69E-04	15	9,792	1.65E-03	7.09E-02	1.76E-04	5.70E-03	0.00E+00	0.00E+00	3.52E-05	4.61E-05	106.92
1.34E+05	1.19E+06	3.69E-04	15	11,676	7.25E-04	3.11E-02	1.76E-04	5.38E-03	0.00E+00	0.00E+00	7.23E-05	9.44E-05	106.92
1.34E+05	1.19E+06	3.69E-04	15	11,676	7.25E-04	3.11E-02	1.76E-04	5.38E-03	0.00E+00	0.00E+00	7.23E-05	9.44E-05	106.92
1.34E+05	1.19E+06	3.69E-04	15	11,232	9.62E-04	4.12E-02	1.76E-04	5.38E-03	0.00E+00	0.00E+00	5.46E-05	7.14E-05	106.92
1.34E+05	1.19E+06	3.69E-04	15	7,022	1.23E-03	5.26E-02	1.76E-04	7.88E-03	0.00E+00	0.00E+00	6.36E-05	8.32E-05	106.92
1.34E+05	1.19E+06	3.69E-04	15	9,143	3.12E-03	1.34E-01	1.76E-04	6.79E-03	0.00E+00	0.00E+00	1.89E-05	2.48E-05	106.92
1.34E+05	1.19E+06	3.69E-04	15	#N/A	#N/A	#N/A	1.76E-04	#N/A	0.00E+00	0.00E+00	#N/A	#N/A	106.92
1.34E+05	1.19E+06	3.69E-04	15	#N/A	#N/A	#N/A	1.76E-04	#N/A	0.00E+00	0.00E+00	#N/A	#N/A	106.92
1.34E+05	1.19E+06	3.69E-04	15	#N/A	#N/A	#N/A	1.76E-04	#N/A	0.00E+00	0.00E+00	#N/A	#N/A	106.92
1.34E+05	1.19E+06	3.69E-04	15	#N/A	#N/A	#N/A	1.76E-04	#N/A	0.00E+00	0.00E+00	#N/A	#N/A	106.92
1.34E+05	1.19E+06	3.69E-04	15	#N/A	#N/A	#N/A	1.76E-04	#N/A	0.00E+00	0.00E+00	#N/A	#N/A	106.92
1.34E+05	1.19E+06	3.69E-04	15	#N/A	#N/A	#N/A	1.76E-04	#N/A	0.00E+00	0.00E+00	#N/A	#N/A	106.92
1.34E+05	1.19E+06	3.69E-04	15	#N/A	#N/A	#N/A	1.76E-04	#N/A	0.00E+00	0.00E+00	#N/A	#N/A	106.92

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	4.02E+04	0.10	7.69E+01	9.80E-03	4.39E+02	3.74E+116	2.19E-04	8.78E+00	NA	3.5E-01
15	1.34E+04	0.10	7.69E+01	6.86E-03	4.39E+02	2.30E+166	2.54E-06	3.41E-02	7.8E-06	NA
15	2.47E+04	0.10	7.69E+01	5.70E-03	4.39E+02	3.35E+200	3.81E-06	9.43E-02	NA	2.0E-02
15	5.90E+04	0.10	7.69E+01	5.38E-03	4.39E+02	1.25E+212	7.75E-06	4.57E-01	NA	2.0E-01
15	1.27E+03	0.10	7.69E+01	5.38E-03	4.39E+02	1.25E+212	7.75E-06	9.87E-03	NA	2.0E-01
15	1.07E+04	0.10	7.69E+01	5.38E-03	4.39E+02	1.32E+212	5.88E-06	6.30E-02	6.3E-06	8.0E-01
15	1.05E+04	0.10	7.69E+01	7.88E-03	4.39E+02	8.41E+144	6.84E-06	7.19E-02	4.7E-07	3.0E+00
15	2.81E+06	0.10	7.69E+01	6.79E-03	4.39E+02	1.89E+168	2.05E-06	5.76E+00	NA	4.0E-01
15	ERRORS	0.10	7.69E+01	#N/A	4.39E+02	#N/A	#N/A	#N/A	#N/A	#N/A
15	ERRORS	0.10	7.69E+01	#N/A	4.39E+02	#N/A	#N/A	#N/A	#N/A	#N/A
15	ERRORS	0.10	7.69E+01	#N/A	4.39E+02	#N/A	#N/A	#N/A	#N/A	#N/A
15	ERRORS	0.10	7.69E+01	#N/A	4.39E+02	#N/A	#N/A	#N/A	#N/A	#N/A
15	ERRORS	0.10	7.69E+01	#N/A	4.39E+02	#N/A	#N/A	#N/A	#N/A	#N/A
15	ERRORS	0.10	7.69E+01	#N/A	4.39E+02	#N/A	#N/A	#N/A	#N/A	#N/A
15	ERRORS	0.10	7.69E+01	#N/A	4.39E+02	#N/A	#N/A	#N/A	#N/A	#N/A

END

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

	Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
Acetone	NA	NA	NA	1.00E+09	NA
Benzene	NA	NA	NA	1.75E+06	NA
Chlorobenzene	NA	NA	NA	4.72E+05	NA
1,2-Dichlorobenzene	NA	NA	NA	1.56E+05	NA
1,3-Dichlorobenzene	NA	NA	NA	1.60E+05	NA
1,4-Dichlorobenzene	NA	NA	NA	7.38E+04	NA
Methylene chloride	NA	NA	NA	1.30E+07	NA
Toluene	NA	NA	NA	5.26E+05	NA
CAS No. not found	ERROR	ERROR	ERROR	ERROR	ERROR
CAS No. not found	ERROR	ERROR	ERROR	ERROR	ERROR
CAS No. not found	ERROR	ERROR	ERROR	ERROR	ERROR
CAS No. not found	ERROR	ERROR	ERROR	ERROR	ERROR
CAS No. not found	ERROR	ERROR	ERROR	ERROR	ERROR
CAS No. not found	ERROR	ERROR	ERROR	ERROR	ERROR
CAS No. not found	ERROR	ERROR	ERROR	ERROR	ERROR

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	1.7E-02
6.5E-08	NA
NA	3.2E-03
NA	1.6E-03
NA	3.4E-05
9.7E-08	5.4E-05
8.3E-09	1.6E-05
NA	9.9E-03
ERROR	ERROR
ERROR	ERROR
ERROR	ERROR
ERROR	ERROR
ERROR	ERROR
ERROR	ERROR
ERROR	ERROR

INCIDENTAL INGESTION OF SOIL: CONSTRUCTION WORKER

Chemical	Concentration Soil (Cs) (mg/kg)	Oral Absorption Factor-Soil (ABSos) (--)	Annual Average Daily Dose (AADD) (mg/kg-d)	Oral Chronic Reference Dose (RfDo) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Oral Slope Factor (SFo) $(mg/kg\text{-}d)^{-1}$	Excess Cancer Risk (--)
Acetone	1.59E+00	1	5.1E-06	0.1	5.1E-05	7.3E-08	NA	NA
Aluminum	ND	1	NA	1	NA	NA	NA	ND
Aniline	ND	1	NA	0.007	NA	NA	0.0057	ND
Antimony	2.27E+01	1	7.3E-05	0.0004	1.8E-01	1.0E-06	NA	NA
Arsenic	3.05E+02	1	9.8E-04	0.0003	3.3E+00	1.4E-05	1.5	2.1E-05
Benzene	6.70E-01	1	2.2E-06	0.003	7.2E-04	3.1E-08	0.055	1.7E-09
Cadmium	ND	1	NA	0.0005	NA	NA	NA	ND
Chlorobenzene	1.43E+00	1	4.6E-06	0.02	2.3E-04	6.6E-08	NA	NA
Chromium	7.10E+01	1	2.3E-04	1.5	1.5E-04	3.3E-06	NA	NA
Copper	ND	1	NA	0.037	NA	NA	NA	ND
1,2-Dichlorobenzene	2.10E+00	1	6.8E-06	0.09	7.5E-05	9.7E-08	NA	NA
1,3-Dichlorobenzene	ND	1	NA	0.0009	NA	NA	NA	ND
1,4-Dichlorbenzene	ND	1	NA	0.03	NA	NA	0.024	ND
Iron	ND	1	NA	0.3	NA	NA	NA	ND
Lead	1.93E+04	1	6.2E-02	NA	NA	8.9E-04	NA	NA
Manganese	6.40E+02	1	2.1E-03	0.14	1.5E-02	3.0E-05	NA	NA
Methylene Chloride	1.41E+00	1	4.6E-06	0.06	7.6E-05	6.5E-08	0.0075	4.9E-10
4-Methylphenol	ND	1	NA	0.005	NA	NA	NA	ND
Nickel	7.93E+01	1	2.6E-04	0.02	1.3E-02	3.7E-06	NA	NA
Thallium	1.04E+01	1	3.4E-05	0.00008	4.2E-01	4.8E-07	NA	NA
Tin	1.58E+05	1	5.1E-01	0.6	8.5E-01	7.3E-03	NA	NA
Toluene	1.51E+01	1	4.9E-05	0.2	2.4E-04	7.0E-07	NA	NA
					5E+00			2E-05

$$AADD = \frac{(Cs \times IRs \times ABSos \times EFig \times ED \times CFmg\text{-}kg)}{(BW \times ATnc)}$$

$$Hazard\ Quotient = \frac{AADD}{RfDo}$$

$$LADD = \frac{(Cs \times IRs \times ABSos \times EFig \times ED \times CFmg\text{-}kg)}{(BW \times ATca)}$$

$$Excess\ Cancer\ Risk = LADD \times SFo$$

Parameter	Symbol	Values	Units
Exposure Frequency	EFig	250	d/yr
Exposure Duration	ED	1	yr
Body Weight	BW	70	kg
Averaging Time-Non-cancer	ATnc	365	days
Averaging Time-Cancer	ATca	25,550	days
Ingestion Rate	IRs	330	mg/d
Conversion Factor from mg to kg	$CF_{mg\text{-}kg}$	1E-06	kg/mg

DERMAL CONTACT WITH SOIL: CONSTRUCTION WORKER

Chemical	Concentration Soil (Cs) (mg/kg)	Dermal Absorption Factor-Soil (ABSds) (--)	Annual Average Daily Dose (AADD) (mg/kg-d)	Dermal Chronic Reference Dose (RfDd) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Dermal Slope Factor (SFd) $(mg/kg\text{-}d)^{-1}$	Excess Cancer Risk (--)
Acetone	1.59E+00	0.1	1.0E-06	0.1	1.0E-05	1.5E-08	NA	NA
Aluminum	ND	0.01	NA	1	NA	NA	NA	ND
Aniline	ND	0.1	NA	0.007	NA	NA	0.0057	ND
Antimony	2.27E+01	0.01	1.5E-06	0.00006	2.4E-02	2.1E-08	NA	NA
Arsenic	3.05E+02	0.03	5.9E-05	0.0003	2.0E-01	8.4E-07	1.5	1.3E-06
Benzene	6.70E-01	0.1	4.3E-07	0.003	1.4E-04	6.2E-09	0.055	3.4E-10
Cadmium	ND	0.001	NA	0.000013	NA	NA	NA	ND
Chlorobenzene	1.43E+00	0.1	9.2E-07	0.02	4.6E-05	1.3E-08	NA	NA
Chromium	7.10E+01	0.01	4.6E-06	0.02	2.3E-04	6.6E-08	NA	NA
Copper	ND	0.01	NA	0.037	NA	NA	NA	ND
1,2-Dichlorobenzene	2.10E+00	0.1	1.4E-06	0.09	1.5E-05	1.9E-08	NA	NA
1,3-Dichlorobenzene	ND	0.1	NA	0.0009	NA	NA	NA	ND
1,4-Dichlorbenzene	ND	0.1	NA	0.03	NA	NA	0.024	ND
Iron	ND	0.01	NA	0.3	NA	NA	NA	ND
Lead	1.93E+04	0.01	1.2E-03	NA	NA	1.8E-05	NA	NA
Manganese	6.40E+02	0.01	4.1E-05	0.0056	7.4E-03	5.9E-07	NA	NA
Methylene Chloride	1.41E+00	0.1	9.1E-07	0.06	1.5E-05	1.3E-08	0.0075	9.8E-11
4-Methylphenol	ND	0.1	NA	0.005	NA	NA	NA	ND
Nickel	7.93E+01	0.01	5.1E-06	0.0008	6.4E-03	7.3E-08	NA	NA
Thallium	1.04E+01	0.01	6.7E-07	0.00008	8.4E-03	9.6E-09	NA	NA
Tin	1.58E+05	0.01	1.0E-02	0.6	1.7E-02	1.5E-04	NA	NA
Toluene	1.51E+01	0.1	9.8E-06	0.2	4.9E-05	1.4E-07	NA	NA
					3E-01			1E-06

$$AADD = \frac{(Cs \times SAs \times SAF \times ABSds \times EFdc \times ED \times CFmg\text{-}kg)}{(BW \times ATnc)}$$

$$Hazard\ Quotient = \frac{AADD}{RfDo}$$

$$LADD = \frac{(Cs \times SAs \times SAF \times ABSds \times EFdc \times ED \times CFmg\text{-}kg)}{(BW \times ATca)}$$

$$Excess\ Cancer\ Risk = LADD \times SFo$$

Parameter	Symbol	Values	Units
Exposure Frequency	EFdc	250	d/yr
Exposure Duration	ED	1	yr
Body Weight	BW	70	kg
Averaging Time-Non-cancer	ATnc	365	days
Averaging Time-Cancer	ATca	25,550	days
Surface Area	SAs	3,300	cm^2
Soil-to-Skin Adherence Factor	SAF	0.2	mg/cm^2
Conversion Factor from mg to kg	$CF_{mg\text{-}kg}$	1E-06	kg/mg

APPENDIX I
Human Health Risk Assessment
Morton International, Inc.
Reading, Ohio
6452

INHALATION OF VOCS IN AMBIENT AIR FROM SOIL EMISSIONS: CONSTRUCTION WORKER

Chemical	Concentration Air (Caa) (mg/m^3)	Inhalation Absorption Factor-Volatiles (ABSiv) (--)	Annual Average Daily Dose (AADD) (mg/kg-d)	Inhalation Chronic Reference Dose (RfDi) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Inhalation Slope Factor (SFi) $(mg/kg\text{-}d)^{-1}$	Excess Cancer Risk (--)
Acetone	1.02E-03	1	2.0E-04	0.1	2.0E-03	2.9E-06	NA	NA
Aluminum	NA	1	NA	0.0014	NA	NA	NA	NA
Aniline	NA	1	NA	0.00029	NA	NA	0.0057	NA
Antimony	NA	1	NA	0.0004	NA	NA	NA	NA
Arsenic	NA	1	NA	0.0003	NA	NA	15	NA
Benzene	1.25E-03	1	2.4E-04	0.0017	1.4E-01	3.5E-06	0.0273	9.6E-08
Cadmium	NA	1	NA	0.0005	NA	NA	6.3	NA
Chlorobenzene	1.65E-03	1	3.2E-04	0.0057	5.7E-02	4.6E-06	NA	NA
Chromium	NA	1	NA	1.5	NA	NA	NA	NA
Copper	NA	1	NA	0.037	NA	NA	NA	NA
1,2-Dichlorobenzene	9.59E-04	1	1.9E-04	0.057	3.3E-03	2.7E-06	NA	NA
1,3-Dichlorobenzene	NA	1	NA	0.057	NA	NA	NA	NA
1,4-Dichlorbenzene	NA	1	NA	0.23	NA	NA	0.022	NA
Iron	NA	1	NA	0.3	NA	NA	NA	NA
Lead	NA	1	NA	NA	NA	NA	NA	NA
Manganese	NA	1	NA	0.000014	NA	NA	NA	NA
Methylene Chloride	4.19E-03	1	8.2E-04	0.86	9.5E-04	1.2E-05	0.0016	1.9E-08
4-Methylphenol	NA	1	NA	0.005	NA	NA	NA	NA
Nickel	NA	1	NA	0.02	NA	NA	0.84	NA
Thallium	NA	1	NA	0.00008	NA	NA	NA	NA
Tin	NA	1	NA	0.6	NA	NA	NA	NA
Toluene	2.74E-02	1	5.4E-03	0.11	4.9E-02	7.7E-05	NA	NA
					3E-01			1E-07

$$AADD = \frac{(Caa \times IHRaa \times ETaa \times ABSiv \times EFaa \times ED)}{(BW \times ATnc)}$$

$$Hazard\ Quotient = \frac{AADD}{RfDi}$$

$$LADD = \frac{(Caa \times IHRaa \times ETaa \times ABSiv \times EFaa \times ED)}{(BW \times ATca)}$$

$$Excess\ Cancer\ Risk = LADD \times SFi$$

Parameter	Symbol	Units	Values
Exposure Frequency	EFaa	d/yr	250
Exposure Duration	ED	yr	1
Body Weight	BW	kg	70
Averaging Time-Non-cancer	ATnc	days	365
Averaging Time-Cancer	ATca	days	25,550
Inhalation Rate	IHRaa	m^3/hr	2.5
Exposure Time	ETaa	hr/d	8

APPENDIX I
Human Health Risk Assessment
Morton International, Inc.
Reading, Ohio
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INHALATION OF RESUSPENDED PARTICULATES FROM SOIL: CONSTRUCTION WORKER

Chemical	Concentration Soil (Cs) (mg/kg)	Inhalation Absorption Factor-Dusts (ABSip) (--)	Annual Average Daily Dose (AADD) (mg/kg-d)	Inhalation Chronic Reference Dose (RfDi) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Inhalation Slope Factor (SFi) $(mg/kg\text{-}d)^{-1}$	Excess Cancer Risk (--)
Acetone	NA	1	NA	0.1	NA	NA	NA	NA
Aluminum	ND	1	NA	0.0014	NA	NA	NA	NA
Aniline	ND	1	NA	0.00029	NA	NA	0.0057	NA
Antimony	2.27E+01	1	2.2E-07	0.0004	5.6E-04	6.3E-08	NA	NA
Arsenic	3.05E+02	1	3.0E-06	0.0003	9.9E-03	8.5E-07	15	1.3E-05
Benzene	NA	1	NA	0.0017	NA	NA	0.0273	NA
Cadmium	ND	1	NA	0.0005	NA	NA	6.3	NA
Chlorobenzene	NA	1	NA	0.0057	NA	NA	NA	NA
Chromium	7.10E+01	1	6.9E-07	1.5	4.6E-07	2.0E-07	NA	NA
Copper	ND	1	NA	0.037	NA	NA	NA	NA
1,2-Dichlorobenzene	NA	1	NA	0.057	NA	NA	NA	NA
1,3-Dichlorobenzene	NA	1	NA	0.057	NA	NA	NA	NA
1,4-Dichlorbenzene	NA	1	NA	0.23	NA	NA	0.022	NA
Iron	ND	1	NA	0.3	NA	NA	NA	NA
Lead	1.93E+04	1	1.9E-04	NA	NA	5.4E-05	NA	NA
Manganese	6.40E+02	1	6.3E-06	0.000014	4.5E-01	1.8E-06	NA	NA
Methylene Chloride	NA	1	NA	0.86	NA	NA	0.0016	NA
4-Methylphenol	ND	1	NA	0.005	NA	NA	NA	NA
Nickel	7.93E+01	1	7.8E-07	0.02	3.9E-05	2.2E-07	0.84	1.9E-07
Thallium	1.04E+01	1	1.0E-07	0.00008	1.3E-03	2.9E-08	NA	NA
Tin	1.58E+05	1	1.5E-03	0.6	2.6E-03	4.4E-04	NA	NA
Toluene	NA	1	NA	0.11	NA	NA	NA	NA
					5E-01			1E-05

$$AADD = \frac{(Cs \times IHRaa \times ETaa \times ABSip \times EFaa \times ED)}{(BW \times PEF \times ATnc)}$$

$$Hazard\ Quotient = \frac{AADD}{RfDi}$$

$$LADD = \frac{(Cs \times IHRaa \times ETaa \times ABSip \times EFaa \times ED)}{(BW \times PEF \times ATca)}$$

$$Excess\ Cancer\ Risk = LADD \times SFi$$

Parameter	Symbol	Units	Values
Exposure Frequency	EFpe	d/yr	250
Exposure Duration	ED	yr	1
Body Weight	BW	kg	70
Averaging Time-Non-cancer	ATnc	days	365
Averaging Time-Cancer	ATca	days	25,550
Inhalation Rate	IHRpe	m^3/hr	2.5
Exposure Time	ETpe	hr/d	8
Particulate Emission Factor	PEF	m^3/kg	2E+07

INHALATION OF VOCS IN AMBIENT AIR FROM GROUNDWATER EMISSIONS: CONSTRUCTION WORKER

Chemical	Concentration Air (Caa) (mg/m^3)	Inhalation Absorption Factor-Volatiles (ABSiv) (–)	Annual Average Daily Dose (AADD) (mg/kg-d)	Inhalation Chronic Reference Dose (RfDi) (mg/kg-d)	Hazard Quotient (–)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Inhalation Slope Factor (SFi) $(mg/kg\text{-}d)^{-1}$	Excess Cancer Risk (–)
Acetone	2.9E+00	1	5.7E-01	0.1	5.7E+00	8.2E-03	NA	NA
Aluminum	NA	1	NA	0.0014	NA	NA	NA	NA
Aniline	NA	1	NA	0.00029	NA	NA	0.0057	NA
Antimony	NA	1	NA	0.0004	NA	NA	NA	NA
Arsenic	NA	1	NA	0.0003	NA	NA	15	NA
Benzene	8.5E-03	1	1.7E-03	0.0017	9.8E-01	2.4E-05	0.0273	6.5E-07
Cadmium	NA	1	NA	0.0005	NA	NA	6.3	NA
Chlorobenzene	3.0E-02	1	5.8E-03	0.0057	1.0E+00	8.3E-05	NA	NA
Chromium	NA	1	NA	1.5	NA	NA	NA	NA
Copper	NA	1	NA	0.037	NA	NA	NA	NA
1,2-Dichlorobenzene	1.7E-01	1	3.3E-02	0.057	5.7E-01	4.6E-04	NA	NA
1,3-Dichlorobenzene	3.6E-03	1	7.0E-04	0.057	1.2E-02	1.0E-05	NA	NA
1,4-Dichlorbenzene	2.3E-02	1	4.5E-03	0.23	1.9E-02	6.4E-05	0.022	1.4E-06
Iron	NA	1	NA	0.3	NA	NA	NA	NA
Lead	NA	1	NA	NA	NA	NA	NA	NA
Manganese	NA	1	NA	0.000014	NA	NA	NA	NA
Methylene Chloride	1.5E-02	1	2.8E-03	0.86	3.3E-03	4.1E-05	0.0016	6.5E-08
4-Methylphenol	NA	1	NA	0.005	NA	NA	NA	NA
Nickel	NA	1	NA	0.02	NA	NA	0.84	NA
Thallium	NA	1	NA	0.00008	NA	NA	NA	NA
Tin	NA	1	NA	0.6	NA	NA	NA	NA
Toluene	1.6E+00	1	3.2E-01	0.11	2.9E+00	4.6E-03	NA	NA
					1E+01			2E-06

$$AADD = \frac{(Caa \times IHRaa \times ETaa \times ABSiv \times EFaa \times ED)}{(BW \times ATnc)} \qquad \text{Hazard Quotient} = \frac{AADD}{RfDi}$$

$$LADD = \frac{(Caa \times IHRaa \times ETaa \times ABSiv \times EFaa \times ED)}{(BW \times ATca)} \qquad \text{Excess Cancer Risk} = LADD \times SFi$$

Parameter	Symbol	Units	Values
Exposure Frequency	EFaa	d/yr	250
Exposure Duration	ED	yr	1
Body Weight	BW	kg	70
Averaging Time-Non-cancer	ATnc	days	365
Averaging Time-Cancer	ATca	days	25,550
Inhalation Rate	IHRaa	m^3/hr	2.5
Exposure Time	ETaa	hr/d	8

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Human Health Risk Assessment
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DERMAL CONTACT WITH GROUNDWATER: CONSTRUCTION WORKER

Chemical	Dermal Absorbed Dose Per Event (DAevent) (mg/cm^2-event)	Annual Average Daily Dose (AADD) (mg/kg-d)	Dermal Chronic Reference Dose (RfDd) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Dermal Oral Slope Factor (SFd) (mg/kg-d)$^{-1}$	Excess Cancer Risk (--)
Acetone	1.10E-04	3.8E-03	0.1	3.8E-02	5.4E-05	NA	NA
Aluminum	9.02E-05	3.1E-03	1	3.1E-03	4.5E-05	NA	NA
Aniline	6.13E-05	2.1E-03	0.007	3.0E-01	3.0E-05	0.0057	1.7E-07
Antimony	3.19E-06	1.1E-04	0.00006	1.8E+00	1.6E-06	NA	NA
Arsenic	1.20E-07	4.2E-06	0.0003	1.4E-02	5.9E-08	1.5	8.9E-08
Benzene	4.14E-06	1.4E-04	0.003	4.8E-02	2.1E-06	0.055	1.1E-07
Cadmium	3.46E-09	1.2E-07	0.000013	9.3E-03	1.7E-09	NA	NA
Chlorobenzene	2.73E-05	9.5E-04	0.02	4.7E-02	1.4E-05	NA	NA
Chromium	3.08E-07	1.1E-05	0.02	5.4E-04	1.5E-07	NA	NA
Copper	1.24E-07	4.3E-06	0.037	1.2E-04	6.1E-08	NA	NA
1,2-Dichlorobenzene	2.60E-04	9.0E-03	0.09	1.0E-01	1.3E-04	NA	NA
1,3-Dichlorobenzene	7.93E-06	2.8E-04	0.0009	3.1E-01	3.9E-06	NA	NA
1,4-Dichlorbenzene	3.65E-05	1.3E-03	0.03	4.2E-02	1.8E-05	0.024	4.3E-07
Iron	8.38E-05	2.9E-03	0.3	9.7E-03	4.2E-05	NA	NA
Lead	1.16E-08	4.0E-07	NA	NA	5.7E-09	NA	NA
Manganese	1.18E-05	4.1E-04	0.0056	7.3E-02	5.9E-06	NA	NA
Methylene Chloride	1.83E-06	6.4E-05	0.06	1.1E-03	9.1E-07	0.0075	6.8E-09
4-Methylphenol	6.51E-06	2.3E-04	0.005	4.5E-02	3.2E-06	NA	NA
Nickel	7.89E-08	2.7E-06	0.0008	3.4E-03	3.9E-08	NA	NA
Thallium	3.68E-08	1.3E-06	0.00008	1.6E-02	1.8E-08	NA	NA
Tin	ND	ND	0.6	NA	ND	NA	NA
Toluene	1.67E-03	5.8E-02	0.2	2.9E-01	8.3E-04	NA	NA
				3.2E+00			8.2E-07

$$AADD = \frac{(DAevent \times SAswr \times EVswr \times EFswr \times ED)}{(BW \times ATnc)}$$

$$Hazard\ Quotient = \frac{AADD}{RfDo}$$

$$LADD = \frac{(DAevent \times SAswr \times EVswr \times EFswr \times ED)}{(BW \times ATca)}$$

$$Excess\ Cancer\ Risk = LADD \times SFo$$

Parameter	Symbol	Units	Value
Event Frequency	EVswr	evt/day	1
Exposure Frequency	EFswr	d/yr	125
Exposure Duration	ED	yr	1
Body Weight	BW	kg	70
Averaging Time-Non-cancer	ATnc	days	365
Averaging Time-Cancer	ATca	days	25,550
Skin Surface Area	SAswr	cm2	7,100

SUMMARY RISK CHARACTERIZATION: CONSTRUCTION WORKER

Chemical	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Volatiles in Ambient Air from Soil	Inhalation of Particulates	Inhalation of Volatiles in Ambient Air from Groundwater	Dermal Contact with Groundwater	Excess Cancer Risk
Acetone	NA	NA	NA	NA	NA	NA	NA
Aluminum	ND	ND	NA	NA	NA	NA	NA
Aniline	ND	ND	NA	NA	NA	1.7E-07	1.7E-07
Antimony	NA	NA	NA	NA	NA	NA	NA
Arsenic	**2.1E-05**	**1.3E-06**	NA	**1.3E-05**	NA	8.9E-08	**3.5E-05**
Benzene	1.7E-09	3.4E-10	9.6E-08	NA	6.5E-07	1.1E-07	8.6E-07
Cadmium	ND	ND	NA	NA	NA	NA	NA
Chlorobenzene	NA	NA	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA	NA	NA
Copper	ND	ND	NA	NA	NA	NA	NA
1,2-Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	ND	ND	NA	NA	NA	NA	NA
1,4-Dichlorbenzene	ND	ND	NA	NA	**1.4E-06**	4.3E-07	**1.8E-06**
Iron	ND	ND	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	4.9E-10	9.8E-11	1.9E-08	NA	6.5E-08	6.8E-09	9.1E-08
4-Methylphenol	ND	ND	NA	NA	NA	NA	NA
Nickel	NA	NA	NA	1.9E-07	NA	NA	1.9E-07
Thallium	NA	NA	NA	NA	NA	NA	NA
Tin	NA	NA	NA	NA	NA	NA	NA
Toluene	NA	NA	NA	NA	NA	NA	NA
Total	**2.1E-05**	**1.3E-06**	1.1E-07	**1.3E-05**	**2.1E-06**	8.2E-07	**3.8E-05**

NA = not applicable

SUMMARY RISK CHARACTERIZATION: CONSTRUCTION WORKER

Chemical	Incidental Ingestion of Soil	Dermal Contact with Soil	Inhalation of Volatiles in Ambient Air from Soil	Inhalation of Particulates	Inhalation of Volatiles in Ambient Air from Groundwater	Dermal Contact with Groundwater	Hazard Index
Acetone	5.1E-05	1.0E-05	2.0E-03	NA	**5.7E+00**	3.8E-02	**5.8E+00**
Aluminum	NA	NA	NA	NA	NA	3.1E-03	3.1E-03
Aniline	NA	NA	NA	NA	NA	3.0E-01	3.0E-01
Antimony	1.8E-01	2.4E-02	NA	5.6E-04	NA	**1.8E+00**	**2.1E+00**
Arsenic	**3.3E+00**	2.0E-01	NA	9.9E-03	NA	1.4E-02	**3.5E+00**
Benzene	7.2E-04	1.4E-04	1.4E-01	NA	9.8E-01	4.8E-02	**1.2E+00**
Cadmium	NA	NA	NA	NA	NA	9.3E-03	9.3E-03
Chlorobenzene	2.3E-04	4.6E-05	5.7E-02	NA	**1.0E+00**	4.7E-02	**1.1E+00**
Chromium	1.5E-04	2.3E-04	NA	4.6E-07	NA	5.4E-04	9.2E-04
Copper	NA	NA	NA	NA	NA	1.2E-04	1.2E-04
1,2-Dichlorobenzene	7.5E-05	1.5E-05	3.3E-03	NA	5.7E-01	1.0E-01	6.7E-01
1,3-Dichlorobenzene	NA	NA	NA	NA	1.2E-02	3.1E-01	3.2E-01
1,4-Dichlorbenzene	NA	NA	NA	NA	1.9E-02	4.2E-02	6.2E-02
Iron	NA	NA	NA	NA	NA	9.7E-03	9.7E-03
Lead	NA	NA	NA	NA	NA	NA	NA
Manganese	1.5E-02	7.4E-03	NA	4.5E-01	NA	7.3E-02	5.4E-01
Methylene Chloride	7.6E-05	1.5E-05	9.5E-04	NA	3.3E-03	1.1E-03	5.4E-03
4-Methylphenol	NA	NA	NA	NA	NA	4.5E-02	4.5E-02
Nickel	1.3E-02	6.4E-03	NA	3.9E-05	NA	3.4E-03	2.3E-02
Thallium	4.2E-01	8.4E-03	NA	1.3E-03	NA	1.6E-02	4.5E-01
Tin	8.5E-01	1.7E-02	NA	2.6E-03	NA	NA	8.7E-01
Toluene	2.4E-04	4.9E-05	4.9E-02	NA	**2.9E+00**	2.9E-01	**3.3E+00**
Total	**4.76E+00**	2.6E-01	2.6E-01	4.6E-01	**1.1E+01**	**3.2E+00**	**2.0E+01**

NA = not applicable

DERMAL CONTACT WITH SURFACE WATER: ADULT RECREATIONAL USER

Chemical	Dermal Absorbed Dose Per Event (DAevent) (mg/cm2-event)	Annual Average Daily Dose (AADD) (mg/kg-d)	Dermal Chronic Reference Dose (RfDd) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Dermal Slope Factor (SFd) (mg/kg-d)-1	Excess Cancer Risk (--)
Acetone	ND	ND	0.1	ND	ND	NA	ND
Aluminum	6.0E-08	1.1E-06	1	1.1E-06	3.8E-07	NA	NA
Aniline	ND	ND	0.007	ND	ND	0.0057	ND
Antimony	ND	ND	0.00006	ND	ND	NA	ND
Arsenic	ND	ND	0.0003	ND	ND	1.5	ND
Benzene	ND	ND	0.003	ND	ND	0.055	ND
Cadmium	ND	ND	0.000013	ND	ND	NA	ND
Chlorobenzene	ND	ND	0.02	ND	ND	NA	ND
Chromium	ND	ND	0.02	ND	ND	NA	ND
Copper	ND	ND	0.037	ND	ND	NA	ND
1,2-Dichlorobenzene	ND	ND	0.09	ND	ND	NA	ND
1,3-Dichlorobenzene	ND	ND	0.0009	ND	ND	NA	ND
1,4-Dichlorobezene	ND	ND	0.03	ND	ND	0.024	ND
Iron	4.7E-07	8.6E-06	0.3	2.9E-05	3.0E-06	NA	NA
Lead	ND	ND	NA	ND	ND	NA	ND
Manganese	1.3E-06	2.4E-05	0.0056	4.3E-03	8.3E-06	NA	NA
Methylene Chloride	ND	ND	0.06	ND	ND	0.0075	ND
4-Methylphenol	ND	ND	0.005	ND	ND	NA	ND
Nickel	ND	ND	0.0008	ND	ND	NA	ND
Thallium	ND	ND	0.00008	ND	ND	NA	ND
Tin	ND	ND	0.6	ND	ND	NA	ND
Toluene	ND	ND	0.2	ND	ND	NA	ND
				4.4E-03			0.0E+00

$$AADD = \frac{(DAevent \times SAswr/dc \times EVswr/dc \times EFswr/dc \times ED)}{(BW \times ATnc)}$$

$$Hazard\ Quotient = \frac{AADD}{RfDo}$$

$$LADD = \frac{(DAevent \times SAswr/dc \times EVswr/dc \times EFswr/dc \times ED)}{(BW \times ATca)}$$

$$Excess\ Cancer\ Risk = LADD \times SFo$$

Parameter	Symbol	Units	Value
Exposure Frequency	EFswdc	d/yr	26
Exposure Duration	ED	yr	24
Body Weight	BW	kg	70
Averaging Time-Non-cancer	ATnc	days	8,760
Averaging Time-Cancer	ATca	days	25,550
Skin Surface Area	SAswdc	cm2	18,000

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DERMAL CONTACT WITH SURFACE WATER: CHILD RECREATIONAL USER

Chemical	Dermal Absorbed Dose Per Event (DAevent) (mg/cm2-event)	Annual Average Daily Dose (AADD) (mg/kg-d)	Dermal Chronic Reference Dose (RfDd) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Dermal Slope Factor (SFd) (mg/kg-d)-1	Excess Cancer Risk (--)
Acetone	ND	ND	0.1	ND	ND	NA	ND
Aluminum	6.0E-08	1.9E-06	1	1.9E-06	1.6E-07	NA	NA
Aniline	ND	ND	0.007	ND	ND	0.0057	ND
Antimony	ND	ND	0.00006	ND	ND	NA	ND
Arsenic	ND	ND	0.0003	ND	ND	1.5	ND
Benzene	ND	ND	0.003	ND	ND	0.055	ND
Cadmium	ND	ND	0.000013	ND	ND	NA	ND
Chlorobenzene	ND	ND	0.02	ND	ND	NA	ND
Chromium	ND	ND	0.02	ND	ND	NA	ND
Copper	ND	ND	0.037	ND	ND	NA	ND
1,2-Dichlorobenzene	ND	ND	0.09	ND	ND	NA	ND
1,3-Dichlorobenzene	ND	ND	0.0009	ND	ND	NA	ND
1,4-Dichlorobezene	ND	ND	0.03	ND	ND	0.024	ND
Iron	4.7E-07	1.5E-05	0.3	4.9E-05	1.3E-06	NA	NA
Lead	ND	ND	NA	ND	ND	NA	ND
Manganese	1.3E-06	4.1E-05	0.0056	7.4E-03	3.6E-06	NA	NA
Methylene Chloride	ND	ND	0.06	ND	ND	0.0075	ND
4-Methylphenol	ND	ND	0.005	ND	ND	NA	ND
Nickel	ND	ND	0.0008	ND	ND	NA	ND
Thallium	ND	ND	0.00008	ND	ND	NA	ND
Tin	ND	ND	0.6	ND	ND	NA	ND
Toluene	ND	ND	0.2	ND	ND	NA	ND
				7.5E-03			0.0E+00

$$AADD = \frac{(DAevent \times SAswr/dc \times EVswr/dc \times EFswr/dc \times ED)}{(BW \times ATnc)}$$

$$Hazard\ Quotient = \frac{AADD}{RfDo}$$

$$LADD = \frac{(DAevent \times SAswr/dc \times EVswr/dc \times EFswr/dc \times ED)}{(BW \times ATca)}$$

$$Excess\ Cancer\ Risk = LADD \times SFo$$

Parameter	Symbol	Units	Value
Exposure Frequency	EFswdc	d/yr	26
Exposure Duration	ED	yr	6
Body Weight	BW	kg	15
Averaging Time-Non-cancer	ATnc	days	2,190
Averaging Time-Cancer	ATca	days	25,550
Skin Surface Area	SAswdc	cm2	6,600

INGESTION OF SURFACE WATER: ADULT RECREATIONAL USER

Chemical	Concentration Groundwater (Cgw) (mg/L)	Oral Absorption Factor-Groundwater (ABSow) (--)	Annual Average Daily Dose (AADD) (mg/kg-d)	Oral Chronic Reference Dose (RfDo) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Oral Slope Factor (SFo) $(mg/kg\text{-}d)^{-1}$	Excess Cancer Risk (--)
Acetone	ND	1	ND	0.1	ND	ND	NA	ND
Aluminum	0.112	1	5.7E-06	1	5.7E-06	2.0E-06	NA	NA
Aniline	ND	1	ND	0.007	ND	ND	0.0057	ND
Antimony	ND	1	ND	0.0004	ND	ND	NA	ND
Arsenic	ND	1	ND	0.0003	ND	ND	1.5	ND
Benzene	ND	1	ND	0.003	ND	ND	0.055	ND
Cadmium	ND	1	ND	0.0005	ND	ND	NA	ND
Chlorobenzene	ND	1	ND	0.02	ND	ND	NA	ND
Chromium	ND	1	ND	1.5	ND	ND	NA	ND
Copper	ND	1	ND	0.037	ND	ND	NA	ND
1,2-Dichlorobenzene	ND	1	ND	0.09	ND	ND	NA	ND
1,3-Dichlorobenzene	ND	1	ND	0.0009	ND	ND	NA	ND
1,4-Dichlorbenzene	ND	1	ND	0.03	ND	ND	0.024	ND
Iron	0.734	1	3.7E-05	0.3	1.2E-04	1.3E-05	NA	NA
Lead	ND	1	ND	NA	ND	ND	NA	ND
Manganese	2.07	1	1.1E-04	0.14	7.5E-04	3.6E-05	NA	NA
Methylene Chloride	ND	1	ND	0.06	ND	ND	0.0075	ND
4-Methylphenol	ND	1	ND	0.005	ND	ND	NA	ND
Nickel	ND	1	ND	0.02	ND	ND	NA	ND
Thallium	ND	1	ND	0.00008	ND	ND	NA	ND
Tin	ND	1	ND	0.6	ND	ND	NA	ND
Toluene	ND	1	ND	0.2	ND	ND	NA	ND
					8.8E-04			0E+00

$$AADD = \frac{(Cgw \times IRdw \times ABSow \times EFdw \times ED)}{(BW \times ATnc)}$$

$$\text{Hazard Quotient} = \frac{AADD}{RfDo}$$

$$LADD = \frac{(Cgw \times IRdw \times ABSow \times EFdw \times ED)}{(BW \times ATca)}$$

$$\text{Excess Cancer Risk} = LADD \times SFo$$

Parameter	Symbol	Units	Value
Exposure Frequency	EFsw	d/yr	26
Exposure Duration	ED	yr	24
Body Weight	BW	kg	70
Averaging Time-Non-cancer	ATnc	days	8,760
Averaging Time-Cancer	ATca	days	25,550
Ingestion Rate	IRsw	mg/d	0.05

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INGESTION OF SURFACE WATER: CHILD RECREATIONAL USER

Chemical	Concentration Groundwater (Cgw) (mg/L)	Oral Absorption Factor-Groundwater (ABSow) (--)	Annual Average Daily Dose (AADD) (mg/kg-d)	Oral Chronic Reference Dose (RfDo) (mg/kg-d)	Hazard Quotient (--)	Lifetime Average Daily Dose (LADD) (mg/kg-d)	Oral Slope Factor (SFo) $(mg/kg\text{-}d)^{-1}$	Excess Cancer Risk (--)
Acetone	ND	1	ND	0.1	ND	ND	NA	ND
Aluminum	0.112	1	2.7E-05	1	2.7E-05	2.3E-06	NA	NA
Aniline	ND	1	ND	0.007	ND	ND	0.0057	ND
Antimony	ND	1	ND	0.0004	ND	ND	NA	ND
Arsenic	ND	1	ND	0.0003	ND	ND	1.5	ND
Benzene	ND	1	ND	0.003	ND	ND	0.055	ND
Cadmium	ND	1	ND	0.0005	ND	ND	NA	ND
Chlorobenzene	ND	1	ND	0.02	ND	ND	NA	ND
Chromium	ND	1	ND	1.5	ND	ND	NA	ND
Copper	ND	1	ND	0.037	ND	ND	NA	ND
1,2-Dichlorobenzene	ND	1	ND	0.09	ND	ND	NA	ND
1,3-Dichlorobenzene	ND	1	ND	0.0009	ND	ND	NA	ND
1,4-Dichlorbenzene	ND	1	ND	0.03	ND	ND	0.024	ND
Iron	0.734	1	1.7E-04	0.3	5.8E-04	1.5E-05	NA	NA
Lead	ND	1	ND	NA	ND	ND	NA	ND
Manganese	2.07	1	4.9E-04	0.14	3.5E-03	4.2E-05	NA	NA
Methylene Chloride	ND	1	ND	0.06	ND	ND	0.0075	ND
4-Methylphenol	ND	1	ND	0.005	ND	ND	NA	ND
Nickel	ND	1	ND	0.02	ND	ND	NA	ND
Thallium	ND	1	ND	0.00008	ND	ND	NA	ND
Tin	ND	1	ND	0.6	ND	ND	NA	ND
Toluene	ND	1	ND	0.2	ND	ND	NA	ND
					4.1E-03			0E+00

$$AADD = \frac{(Cgw \times IRdw \times ABSow \times EFdw \times ED)}{(BW \times ATnc)}$$

$$Hazard\ Quotient = \frac{AADD}{RfDo}$$

$$LADD = \frac{(Cgw \times IRdw \times ABSow \times EFdw \times ED)}{(BW \times ATca)}$$

$$Excess\ Cancer\ Risk = LADD \times SFo$$

Parameter	Symbol	Units	Value
Exposure Frequency	EFsw	d/yr	26
Exposure Duration	ED	yr	6
Body Weight	BW	kg	15
Averaging Time-Non-cancer	ATnc	days	2,190
Averaging Time-Cancer	ATca	days	25,550
Ingestion Rate	IRsw	mg/d	0.05

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SUMMARY CARCINOGENIC RISK CHARACTERIZATION:
RECREATIONAL USER

Chemical	Child		Excess Cancer Risk - Child
	Dermal Contact with Surface Water	Incidental Ingestion of Surface Water	
Acetone	ND	ND	NA
Aluminum	NA	NA	NA
Aniline	ND	ND	NA
Antimony	ND	ND	NA
Arsenic	ND	ND	NA
Benzene	ND	ND	NA
Cadmium	ND	ND	NA
Chlorobenzene	ND	ND	NA
Chromium	ND	ND	NA
Copper	ND	ND	NA
1,2-Dichlorobenzene	ND	ND	NA
1,3-Dichlorobenzene	ND	ND	NA
1,4-Dichlorobezene	ND	ND	NA
Iron	NA	NA	NA
Lead	ND	ND	NA
Manganese	NA	NA	NA
Methylene Chloride	ND	ND	NA
4-Methylphenol	ND	ND	NA
Nickel	ND	ND	NA
Thallium	ND	ND	NA
Tin	ND	ND	NA
Toluene	ND	ND	NA
Total	0.0E+00	0.0E+00	0.0E+00

Chemical	Dermal Contact with Surface Water	Incidental Ingestion of Surface Water	Excess Cancer Risk - Adult	Excess Cancer Risk - Total
Acetone	ND	ND	NA	NA
Aldrin	ND	0.0E+00	NA	NA
Aluminum	NA	NA	NA	NA
Aniline	ND	ND	NA	NA
Antimony	ND	ND	NA	NA
Arsenic	ND	ND	NA	NA
Benzene	ND	ND	NA	NA
Cadmium	ND	ND	NA	NA
Chlorobenzene	ND	ND	NA	NA
Copper	ND	ND	NA	NA
1,2-Dichlorobenzene	ND	ND	NA	NA
1,3-Dichlorobenzene	ND	ND	NA	NA
1,4-Dichlorobezene	ND	ND	NA	NA
Iron	NA	NA	NA	NA
Lead	ND	ND	NA	NA
Manganese	NA	NA	NA	NA
Methylene Chloride	ND	ND	NA	NA
4-Methylphenol	ND	ND	NA	NA
Nickel	ND	ND	NA	NA
Thallium	ND	ND	NA	NA
Tin	ND	ND	NA	NA
Toluene	ND	ND	NA	NA
Total	0.0E+00	0.0E+00	0.0E+00	0.0E+00

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SUMMARY NON-CANCER RISK CHARACTERIZATION: CHILD RECREATIONAL USER

Child			
Chemical	Dermal Contact with Surface Water	Incidental Ingestion of Surface Water	Hazard Index
Acetone	ND	ND	NA
Aluminum	1.9E-06	2.7E-05	2.8E-05
Aniline	ND	ND	NA
Anthracene	ND	ND	NA
Antimony	ND	ND	NA
Arsenic	ND	ND	NA
Benzene	ND	ND	NA
Cadmium	ND	ND	NA
Chlorobenzene	ND	ND	NA
Chloroform	ND	ND	NA
Chromium	ND	ND	NA
Copper	ND	ND	NA
1,2-Dichlorobenzene	ND	ND	NA
1,3-Dichlorobenzene	ND	ND	NA
1,4-Dichlorobezene	ND	ND	NA
Iron	4.9E-05	5.8E-04	6.3E-04
Lead	ND	ND	NA
Manganese	7.4E-03	3.5E-03	1.1E-02
Methylene Chloride	ND	ND	NA
4-Methylphenol	ND	ND	NA
Nickel	ND	ND	NA
Thallium	ND	ND	NA
Tin	ND	ND	NA
Toluene	ND	ND	NA
Total	7.5E-03	4.1E-03	1.2E-02

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SUMMARY NON-CANCER RISK CHARACTERIZATION: ADULT RECREATIONAL USER

Adult			
Chemical	Dermal Contact with Surface Water	Incidental Ingestion of Surface Water	Hazard Index
Acetone	ND	ND	NA
Aluminum	1.1E-06	5.7E-06	6.8E-06
Aniline	ND	ND	NA
Anthracene	ND	ND	NA
Antimony	ND	ND	NA
Arsenic	ND	ND	NA
Benzene	ND	ND	NA
Cadmium	ND	ND	NA
Chlorobenzene	ND	ND	NA
Chloroform	ND	ND	NA
Chromium	ND	ND	NA
Copper	ND	ND	NA
1,2-Dichlorobenzene	ND	ND	NA
1,3-Dichlorobenzene	ND	ND	NA
1,4-Dichlorobezene	ND	ND	NA
Iron	2.9E-05	1.2E-04	1.5E-04
Lead	ND	ND	NA
Manganese	4.3E-03	7.5E-04	5.1E-03
Methylene Chloride	ND	ND	NA
4-Methylphenol	ND	ND	NA
Nickel	ND	ND	NA
Thallium	ND	ND	NA
Tin	ND	ND	NA
Toluene	ND	ND	NA
Total	4.4E-03	8.8E-04	5.2E-03

Appendix J

Blood Lead Evaluation

Appendix J
Evaluation of Adult Blood Lead Concentrations
Morton International, Inc.
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Potential fetal blood lead levels = R*(PbBadult,0 + (BKSF*Irs*Afs*Efs*Pbs)/AT)

Lead Concentration	Constant of Proportionality between Fetal and Maternal Blood Lead R	Typical Blood Lead Concentration PbBadult,0 ug/dl	Biokinetic Slope Factor BKSF ug/dl/ug/day	Intake Rate of Soil Irs g/day	Absolute Gastrointestinal Absorption Fraction Afs dimensionless	Exposure Frequency Efs days/year	Soil Lead Concentration Pbs mg/kg	Averaging Time AT days/year	Central Estimate of Blood Lead ug/dl	Z-Score	Probability
Maximum	0.9	2.2	0.4	0.05	0.12	219	19300	365	27	-1.7	0.955
Excluding T-1	0.9	2.2	0.4	0.05	0.12	219	780	365	3	2.1	0.02

Equation: U.S. EPA, 1999. Memorandum on Use of the TRW Interim Adult Lead Methodology in Risk Assessment, April 7.

Appendix K

Ecological Effects of Detected Compounds

APPENDIX K

ECOLOGICAL EFFECTS OF DETECTED COMPOUNDS

The ecological effect of a chemical contaminant depends on many factors, such as the contaminant's bioavailability, its concentration in the environment and/or receptor organism, synergistic interactions among contaminants, the duration and frequency of receptor biota exposure to that contaminant, the species of the receptor, the metabolic rate of the species, and the characteristics of the metabolic processes of the species (USEPA, 1988). Contaminants in the environment can affect receptor biota and ecosystems in both lethal and sublethal ways, such as the following:

- Altered developmental rates, metabolic and physiologic processes and functions, or behavior.
- Increased susceptibility to disease, parasitism, or predation.
- Disrupted reproductive functions.
- Mutations or other reduction in the viability of offspring (USEPA, 1989a).

When the potential effects of an environmental contaminant on biotic receptors are being evaluated, the toxicity of the contaminant must be determined. The determination should be based on field data, monitoring data, and the results of toxicity testing of contaminated media (USEPA, 1989a).

The following sections summarize toxicology information from scientific literature for Morton Plant. The summaries present information on contaminant toxicity; likely mechanisms of toxicity; and potential effects on receptor biota, populations, and ecosystem.

Volatile Organic Compounds

Acetone. Acetone is a chemical that is naturally found in the environment. It is also normally present in animals from the breakdown of fat. It can also be used in normal processes that make sugar and fats for energy. Chronic exposure to acetone can cause liver and nerve damage, birth defects, and impaired reproduction (in males only) in animals. Acetone does not cause skin cancer when applied dermally. It is unknown whether ingesting or inhaling acetone can cause cancer (ATSDR, 1994a).

Acute oral $_{LD50}$ values were calculated only for rats. In general, the lethality of acetone decreases with the age of the rat (Kimura et al., 1971). The LD_{50} values ranged from 1,726 mg/kg for newborn rats to 6,667 mg/kg for older adults.

No effects were observed in male rats exposed to 1,071 mg/kg/day for 6 weeks in drinking water (Larsen et al., 1991). Mice treated with 3,500 mg/kg/day during gestation had reduced postnatal pup survival, increased gestation duration, and reduced reproduction index (EHRT, 1987)

Acetone is moderately toxic to the liver and kidney of animals. In a 13-week drinking water study, increased liver weights were observed in rats treated with 1,600 mg/kg/day (Dietz et al., 1991). Acetone also induces liver microsomal enzymes. Kidney weights were increased in male and female rats exposed to 3,400 mg/kg and 1,600 mg/kg, respectively for 14-days in drinking water (Dietz et al., 1991).

1,2-Dichlorobenzene. 1,2-Dichlorobenzene is used as a solvent, as a starting material in the manufacture of 3,4-dichloroaniline, and as an insecticide. It exists as a vapor in the ambient atmosphere. 1,2-dichlorobenzene exhibits low to moderate mobility in soils. It is expected to adsorb to sediment and particulate matter. The potential for bioconcentration in aquatic organisms is considered moderate to high based on BCF values in the range of 90 to 560 measured in fish (HSDB, 2002).

In rats who were fed 1,2-dichlorobenzene by gavage, five days per week at a dose of 376 mg/kg of body weight per day, moderate increases in liver weight and slight increases in average kidney weight were noted. There were also slight histopathological changes in the liver at 188 mg/kg-day (Clayton and Clayton, eds., 1993-1994). The maximum tolerated dose for rats administered 1,2-dichlorobenzene by stomach tube lies between 19 and 190 mg/kg body weight per day. This is based on a study in which the compound was administered by gavage five days a week for approximately 28 weeks (IARC, 1994). 1,2-dichlorobenzene was evaluated for teratogenic potential in rats and rabbits. Bred rats and inseminated rabbits were exposed to 0, 100, 200, or 400 ppm of 1,2-dichlorobenzene for 6 hours per day on days 6 through 15 (rats) or days 6 through 18 (rabbits) of gestation. Maternal toxicity, indicated by a significant decrease in body weight gain, was observed in all groups of 1,2-dichlorobenzene exposed rats and liver weight was significantly increased in the 400 ppm 1,2-dichlorobenzene exposed group. Slight maternal toxicity was observed in groups of rabbits exposed to 400 ppm 1,2-dichlorobenzene as evidenced by significantly decreased body weight gain during

the first three days of exposure. Inhalation of up to 400 ppm of 1,2-dichlorobenzene was neither teratogenic nor fetotoxic in rats and rabbits (Hayes et al., 1985).

Two year toxicology and carcinogenicity studies were conducted by administering 1,2-dichlorobenzene in corn oil by gavage 5 days per week for 103 weeks to groups of 50 male and 50 female F344/N rats and B6C3F1 mice at doses of 60 and 120 mg/kg. Under the study conditions, there was no evidence of carcinogenicity of 1,2-dichlorobenzene for male or female F344/N rats or B6C3F1 mice (NIH, 1985).

Xylene. Acute oral $_{LD50}$ values in male and female mice are 5,627 and 5,251 mg/kg, respectively (NTP 1986). Rat LD_{50} values vary depending on mode of intake. The oral LD_{50} value of undiluted xylene is 5,251 mg/kg (Hine and Zuidema 1970) compared with 3,523 mg/kg if administered diluted in corn oil (NTP, 1986). The LD_{50} value for m-xylene in rats is 6,661 mg/kg (Smyth *et al.*, 1962). The differences in LD_{50} values may be due to specific isomer composition of the xylene mixtures, sex, nutritional status, and solvent in which xylene is administered (ATSDR, 1993c).

The NOAEL in rats and mice is 1,000 mg/kg above which respiratory, cardiovascular, gastrointestinal, hematopoietic, musculo-skeletal, hepatic, and renal systems are adversely affected (NTP, 1986). Information of toxicity values on avifauna is scarce. The oral LD_{50} value in Japanese quail is greater than 2,876 mg/kg and evidence of overt toxicity is observed above concentrations of 719 mg/kg (Hill and Camardese, 1986).

Semi-Volatile Organic Compounds

Bis(2-ethylhexyl)phthalate. Oral LD_{50} values of 30 g/kg, 30.6 g/kg, and 34 g/kg have been listed for mice, rats and rabbits respectively (Sittig, 1985; Sax and Lewis, 1989). Gray et al., (1977) observed a variety of symptoms after feeding groups of 15 male and 15 female Sprague Dawley rats 0, 0.2, 1.0, or 2% *bis*(2-ethylhexyl)phthalate (0, 150, 750, or 1,500 mg/kg/day, respectively) in their diet for 17 weeks. Increased absolute and relative liver weights were observed in all treated groups. Food consumption and growth rates were reduced in the 1 and 2% treated groups. A dose-related reduction in testicular weight and an increase in testicular damage were observed. Decreased hemoglobin concentration was observed in male rats, and decreased packed red cell volume was also observed in both sexes in the two highest dose groups. An interstitial nephritis, increased SGPT and decreased blood glucose were reported by Nagasaki et al., (1974) in a 48 week rat study (U.S.EPA, 1987a). Animals in this study were fed 500 or 1,000 ppm *bis*(2-ethylhexyl)phthalate in the diet (25 or 50 mg/kg/day, respectively). Ota et al., (1974) reported degenerative changes in the kidneys

and liver of mice given 0.5 to 5 g/kg/day in the diet for 1 to 3 months. Male albino ferrets fed 1% *bis*(2-ethylhexyl)phthalate in the diet for 14 months exhibited decreased body weight, increased liver weight with morphological and biochemical changes, and testicular damage (Lake et al., 1976; USEPA, 1987b).

Carpenter et al., (1953) fed groups of 32 male and 32 female Sherman rats 0, 0.04, 0.13, or 0.4% *bis*(2-ethylhexyl)phthalate (0, 20, 60, or 200 mg/kg/day, respectively) in the diet for one year during which time they were allowed to breed. After one year, groups of eight males and eight females were continued on the same regimen and groups of 32 male and 32 female offspring were fed 0, and 0.4% (200 mg/kg/day) *bis*(2-ethylhexyl)phthalate in the diet. Significantly increased liver and kidney weights were observed with the high dose in the male parental group and in both sexes of the F_1 groups. No other treatment related effects were reported in the rats. The same study also included guinea pigs and dogs. Groups of 22 to 24 male and 22 to 24 female guinea pigs were fed the equivalent of 0, 19 or 64 mg/kg/day *bis*(2-ethylhexyl)phthalate for one year. Groups of 4 dogs randomly selected were given the equivalent of 54.7 mg/kg/day for about four weeks and then 0.06 mg/kg/day for about 48 weeks. One dog was given a TWA dose of 79.3 mg/kg/day for a total of 246 days. Increased relative liver weight was seen in all treated groups of female guinea pigs, however, no histological changes were reported. The dog that received the TWA dose of 79.3 mg/kg/day developed fatty vacuolation and congestion in the liver and cloudy swelling and congestion in the kidneys. No effects were reported for the other groups of dogs (USEPA, 1987a).

Two year dietary studies have been performed on groups of 50 male and 50 female F344 rats and $B6C3F_1$ mice (NTP, 1982; Kluwe et al., 1982). Rats were given 0; 6,000; or 12,000 ppm in the diet (0, 322, 674 mg/kg/day for males; 0, 394, 774 mg/kg/day for females). Mice were given 0; 3,000; or 6,000 ppm in the diet (0; 672; 1,325 mg/kg/day for males; 0; 799; 1,821 mg/kg/day for females). Decreased body weight was observed in all treated male rats, and female rats in the high dose group, and in all treated female mice. An increased incidence of seminiferous tubule degeneration was observed at the highest dose in both rats and mice (USEPA, 1987b). Renal cysts have been reported to appear in rats fed 150 mg/kg three times/week for a year, but not when the chemical is given for six months (Woodward, 1990).

Metals

Antimony. Antimony, a silvery-white metal that occurs naturally in the environment, has no known essential biological functions (Wood and Wang, 1985 and Puls, 1988). Antimony is a potential carcinogen (Sax 1992). Toxicity of antimony is dependent on its valence state with

the trivalent form being more toxic than the pentavalent form (Puls, 1988). Sittig (1985) reported permissible antimony concentrations to protect freshwater aquatic life on an acute basis as 9,000 μg/l, and on a chronic basis as 1,600 μg/l.

Important processes influencing the fate of antimony in the aquatic environment include chemical speciation, volatilization, and sorption to sediments. Biomethylation is also an important process that may act to remobilize antimony from sediments (Andreae et al., 1981). Acute toxicity of antimony (III) to several freshwater species (a worm, aquatic insect, crustaceans, and fish), did not occur below the limits of solubility of antimony salts. Growth of juvenile fathead minnows was reduced at a concentration of 2,310 μg/l (Kimball manuscript).

Data on the effects of antimony on aquatic plants is limited. An EC_{50} (chlorophyll a) of 610 μg/l was determined during a 4-day exposure with green algae. However, Brooke et al., (1986) reported the EC_{50} for duckweed to be greater than solubility. No effects were observed at the highest concentrations attainable 25,200 μg/l.

Antimony is one of several elements known to form methyl-metal compounds in environmental exposures which readily bioaccumulate. Barrows et al., (1980) found no antimony residues significantly greater than those of controls in a 28-day study conducted with bluegills. A BCF value of 9E-01 has been determined by USEPA (1991).

Toxicity of antimony to plants is moderate and that plants concentrate this element slightly above the concentration in the soils (Gough et al., 1979). Little is known about antimony in terrestrial wildlife. Holdgate (1971) reported livers of dead birds exposed to industrial waste contained 40 to 400 ppm of antimony. Tucker (1972) stated that the 400 ppm that was found could be considered the lethal limit.

Arsenic. Background concentrations of arsenic are generally <10 μg/l in surface water and <15 mg/kg in soil; uncontaminated soils in the United States have a mean arsenic concentration of 7.4 mg/kg soil (Eisler, 1988a). Commercial use and production of arsenic compounds, such as agricultural insecticides and herbicides, have raised local concentrations above natural background concentrations in some areas. In the United States, arsenic levels >240,000 μg/l in surface water and 2.5 x 106 mg/kg soil (DW) in arsenic-pesticide-treated soils have been reported (Eisler, 1988a). Arsenic concentrations of up to 3,500 mg/kg sediment (DW) in contaminated areas (Eisler, 1988a), up to 30 mg/kg sediment in Lake

Michigan (Eisler, 1988a), and 47 to 209 μg/g sediment in Lake Texoma (Hunter et al., 1981) have been reported.

Arsenic toxicity depends strongly on its chemical form and oxidation state. In general, inorganic arsenic compounds are more toxic than organic compounds, and trivalent forms are the most toxic (Eisler, 1988a). Biota may take up arsenic via ingestion, inhalation, or absorption through body surfaces, and cells take up arsenic via the active transport system normally used in phosphate transport (Eisler, 1988a).

Adverse effects on crops and vegetation, such as poor growth, seedling death, defoliation, and inhibition of photosynthesis, have been reported at concentrations of 1 to 25 mg water soluble arsenic/kg soil (equivalent to approximately 25 to 85 mg total arsenic/kg soil) (Eisler, 1988a). Data on effects of arsenic on soil biota and insects are limited. Tolerant soil microbiota can withstand arsenic concentrations as high as 1,600 mg/kg soil (NAS, 1977). In contrast, reduced growth and metabolism in sensitive species have been reported at arsenic concentrations of 375 mg/kg soil (NAS, 1977), and soils with arsenic levels of 150 to165 mg/kg soil lost their earthworm biota and showed reduced quantities of microfauna (Eisler, 1988a).

Mammals and birds are exposed to arsenic primarily by ingestion of contaminated vegetation and water. Arsenic is bioconcentrated by organisms but is not biomagnified in the food chain (Eisler, 1988a). In birds, arsenic poisoning produces many effects, including loss of muscular coordination, slowness, loss of righting reflex, seizures, and death. Single oral doses producing 50% fatality in sensitive species (such as the turkey) range from 17 to 33 mg/kg body weight. In mammals, arsenic toxicosis can produce trembling, extreme weakness, vomiting, and death (Eisler, 1988a). Because arsenic detoxification and excretion are rapid, poisoning is generally caused by acute or subacute exposures. Single doses reported to produce 50% fatality in sensitive mammal species ranged in concentration from 2.5 to 33.0 mg/kg body weight. Susceptible species have been adversely affected at chronic arsenic doses of 1 to 10 mg/kg body weight or 50 mg/kg diet (Eisler, 1988a).

Adverse effects on aquatic biota have been reported at concentrations of 19 to 85 μg/l (Eisler, 1988a). Fish exposed to 1 to 2 mg/l total arsenic for 2-3 days exhibited gill hemorrhages; fatty infiltration of the liver; and necroses of the heart, liver, and ovarian tissues. Developing toad embryos exhibited increased malformity or mortality following a 7-day exposure to 40 μg trivalent arsenic/L, and concentrations of 48 μg pentavalent arsenic/L significantly reduced growth in freshwater algae (USEPA, 1986). Many organisms accumulate arsenic

from water, but there is little evidence of magnification through aquatic food chains (NAS, 1977; Eisler, 1988a). The AWQC for trivalent arsenic for the protection of aquatic life are 360 and 190 μg/l for acute and chronic exposure, respectively (USEPA, 1986). Although no criteria for the protection of aquatic life have been developed for pentavalent arsenic because of insufficient data, the lowest-observed-effect levels for freshwater acute and chronic exposure are 850 and 48 μg/l.

Cadmium. Soil pH, organic matter, and hydrous oxides strongly influence cadmium adsorption and its bioavailability; in general, adsorption increases with increasing soil pH (Page et al., 1981; Xian and Shokohifard, 1989). Typical soil concentrations range from 0.5 to 1.0 μg/g, although concentrations of up to 30 μg/g have been reported for unpolluted shale-derived soils in California (Page et al., 1981). In freshwater systems, cadmium availability is strongly controlled by the adsorption and desorption process, pH, and Eh. Background cadmium concentrations in uncontaminated waters have been reported as 0.05 to 0.02 μg/l (Eisler, 1985).

Plants readily take up cadmium from the soil (Fassett, 1980; Eisler, 1985). The soil concentration of cadmium that will adversely affect plants depends strongly on the species. For example, cadmium concentrations of 4 to 640 μg/g soil reduced yield by 25% among 15 crop species (Page et al., 1981).

Birds and mammals are comparatively resistant to the biocidal properties of cadmium. For example, adult drake mallards fed up to 200 mg/kg body weight showed no ill effects; the lowest oral doses producing death in rats and guinea pigs ranged from 150 to 250 mg/kg body weight (Eisler, 1985). Sublethal effects of cadmium exposure in birds include growth retardation, anemia, and testicular damage (Eisler, 1985). Dietary concentrations of 4 to 20 mg/kg body weight resulted in altered blood chemistry, mild to severe kidney lesions, and hyperresponsiveness in ducks (Cain et al., 1983; Heinz and Haseltine, 1983). In small laboratory mammals, dietary cadmium concentrations of 1.8 mg/kg body weight depressed hematocrit and hemoglobin values; altered other blood chemistry factors; and produced teratogenic, mutagenic, and carcinogenic effects (Eisler, 1985). Among mammals, evidence suggests cadmium may bioaccumulate at higher trophic levels (Eisler, 1985; Scanlon, 1987).

In freshwater biota, ambient cadmium concentrations of >10 μg/1- are associated with high mortality, reduced growth, inhibited reproduction, and other adverse effects (Eisler, 1985); concentrations of 0.8-9.9 μg/l produced significant mortality in several species of

invertebrates and fishes. Freshwater organisms bioaccumulate cadmium to a greater extent than does terrestrial wildlife. Bioconcentration factors in freshwaters range from 164 to 4,190 for algae and invertebrates and from 3 to 7,440 for fishes (Eisler, 1985; USEPA, 1986). The AWQC for cadmium for the protection of aquatic life are 3.9 and 1.1 μg/l (at a hardness of 200) for acute and chronic exposure, respectively (USEPA, 1986).

Chromium. Chromium concentrations range from 5 to 300 mg/kg in soils and 1 to 10 μg/l in contaminated rivers and lakes (Eisler, 1986). Sheppard and Evenden (1990) reported a mean chromium concentration of 38 μg/g for soil collected from 64 sites throughout Canada, and the World Health Organization (WHO, 1988) reported an average concentration of 53 mg/kg for 863 samples collected in the United States. Chromium is most frequently encountered in the trivalent (III) or hexavalent (VI) oxidation states; the hexavalent form is more toxic because it has a higher oxidation potential and can easily penetrate biological membranes (Eisler, 1986).

A variety of plants take up and accumulate chromium. Adverse effects include decreased growth and leaf necrosis (Peterson and Girling, 1981). Treatment of plants with nutrient solutions containing chromium (VI) concentrations of 5 mg/l or less resulted in decreased chlorophyll concentration, inhibition of seed germination and growth, and decreased root uptake of nutrients (WHO, 1988). The high chromium concentrations reported in many plants may represent a significant pathway of chromium transport to herbivorous biota. Adverse effects of chromium on sensitive wildlife species have been reported at concentrations of 5.1 and 10.0 mg/kg of diet for chromium (VI) and chromium (III), respectively (Eisler, 1986). Documented effects in birds include limb deformities, everted viscera, and stunting. In mammals, chromium exposure has resulted in altered blood chemistry, skin ulcerations, bronchial carcinomas, kidney and liver lesions, and teratogenic effects (Eisler, 1986).

In aquatic systems, exposure to 10 μ/L of chromium (VI) inhibited growth in algae; frond growth in common duckweed; and survival and fecundity in Daphnia (Eisler, 1986). For chromium (VI), acute toxicity values range from 23.07 μg/1- for a cladoceran to 1,870,000 μg/l for a stonefly; chronic values range from <2.5 μg/l for a daphnid to 1,987 μg/l for fathead minnows (USEPA, 1986). Acute values for chromium (VI) range from 2,221 μg/l for a mayfly to 71,060 μg/l for a caddisfly; chronic values range from 66 μg/l for Daphnia to 1,025 μg/l for fathead minnows (USEPA, 1986). For fish, chromium (VI) concentrations of 16 to 21 μg/l resulted in reduced growth; altered plasma cortisol metabolism; altered enzyme activities; chromosomal aberrations; and morphological changes in gill, stomach, and kidney

tissues. The AWQC for chromium (VI) for the protection of freshwater biota are 16 and 11 μg/l for acute and chronic exposure, respectively (USEPA, 1986). The AWQC for chromium (III) is hardness dependent. At a hardness of 200, the AWQC are 3,100 and 370 μg/l for acute and chronic exposure, respectively.

Cobalt. Total cobalt soil concentrations typically range from 1 to 100 mg/kg soil (Peterson and Girling, 1981); Sheppard and Evenden (1990) reported a mean concentration of 11 μg/g for Canadian soils. Many plant species take up cobalt; the swamp black gum was reported to bioaccumulate up to 845 mg/kg plant (DW). Reported plant-soil concentration ratios range from 0.27 to 0.87 (Peterson and Girling, 1981). The effects of cobalt on plants depend on the species. For example, cobalt-accumulating plants with tissue concentrations up to 3,300 mg/kg (ash weight) showed no signs of cobalt toxicity, although cobalt-sensitive plants with leaf-tissue cobalt concentrations of only 11 mg/kg exhibited marked growth depression and chlorosis (Peterson and Girling, 1981). No information was found in the literature regarding adverse effects of cobalt on aquatic biota or terrestrial wildlife.

Copper. Copper causes lethal and sublethal effects in aquatic systems, including reduced primary productivity and decreased growth, increased mortality, inhibited spawning, and altered foraging behavior in fish (Benoit, 1975; Harrison, 1986; Sandheinrich and Atchison 1989). Copper toxicity in aquatic systems decreases with increased hardness, alkalinity, and total organic carbon (USEPA, 1986). At a hardness of 50, acute values for 41 genera of freshwater organisms ranged from 16.74 μg/l for Ptychocheilus to 10,240 μg/l for the stonefly Acroneuria. Chronic toxicity values at a hardness of 50 for 15 freshwater species ranged from 3.873 μg/l for brook trout to 60.36 μg/l for northern pike (USEPA, 1986). The AWQC for copper is hardness dependent. At a hardness of 200, the AWQC for copper for the protection of aquatic biota is 34 and 21.4 μg/l for acute and chronic exposures, respectively (USEPA, 1986).

Soil copper concentrations range from 9.3 to 159.4 μg/g soil (average 38.3 μg/g) in forests of the northeastern United States (Herrick and Friedland, 1990) and from 29.2 to 129.8 μg/g soil in an urban forest in southwestern Ohio (Tong and Farrell, 1991). Sheppard and Evenden (1990) reported a mean soil copper concentration of 14 μg/g soil at 64 sites throughout Canada. In terrestrial systems, soil copper concentrations of <500 mg/kg induce a wide range of adverse impacts, such as reduced microbial and fungal abundance and biomass, and decreased species diversity, density, and biomass in invertebrates. Soil concentrations of 50

to 100 μg copper/g soil have been reported to be toxic to nontolerant plants (Tyler et al., 1989).

Lead. Lead concentrations have been reported as 26 μg/g of soil at 64 sites through Canada (Sheppard and Evenden, 1990), 69.4 to 180.8 μg/g of soil (average 115.3 μg/g) in montane forests of the northeastern United States (Herrick and Friedland, 1990), and 160.7 to 196.3 μg/g of soil (average 178.5 μg/g) among urban maple and maple-pine forest sites in southeastern Ohio (Tong and Farrel, 1991). In the United States, lead concentrations are generally <2 μg/l in lakes, but the average lead concentration in major rivers has been reported as 23 μg/l (Biddinger and Gloss, 1984).

Plants readily take up lead (under certain soil conditions such as low pH and low organic matter levels) via absorption in ionic solution through the roots. Lead can also enter plants across vegetative surfaces following aerosol deposition; little translocation occurs after uptake (Koeppe 1981; Eisler, 1988b; Xian and Shokohifard, 1989). Elevated lead levels generally cause negligible damage to plants, depending on species. Very high concentrations (several hundred milligrams per kilogram or more), however, have inhibited growth and reduced photosynthesis, water absorption, and mitosis (Demayo et al., 1982). Elevated levels of particulate lead may occur on plant surfaces as a result of aerosol deposition. This topical lead coating typically does not affect the plant but may represent a significant route of lead entry into higher trophic levels via food chain transfer to herbivores (Koeppe 1981; Eisler, 1988b).

Soil invertebrate communities exposed to soil lead levels as low as 34 mg/kg soil exhibited a significant decrease in species diversity, while exposure to lead soil levels of 34 to 4,800 mg/kg soil significantly altered biomass, density, species number, and vertical distributions in individual soil groups, such as earthworms, ants, and spiders (Tyler et al., 1989). Terrestrial invertebrates take up and accumulate lead, and some taxa (e.g., woodlice and spiders) have been proposed for use as environmental monitors of lead concentrations in soil and litter.

Elevated levels of lead (up to 270 mg/kg body [DW]) have been reported in amphibians and reptiles collected near lead mines and smelters. Lead in tadpoles may contribute to the lead levels observed in wildlife that prey on tadpoles (Eisler, 1988b). Lead poisoning in frogs may result in sloughing of the integument; sluggishness; decreases in red and white blood cells, neutrophils, and monocytes; and death. Death has been reported in frogs at lead concentrations of 25 mg/l and in salamanders at 1.4 mg/l (Eisler, 1988b).

Lead concentrations in birds tend to be highest in specimens collected from urban areas and near lead mining and smelting facilities (Eisler, 1988b). Lead poisoning in birds has been extensively documented. Its effects include loss of appetite; impaired locomotion, balance, and depth perception; microscopic lesions in brain, kidney, muscle, and bone tissues; and altered blood composition and chemistry and immune system (Eisler, 1988b). Birds of prey may be exposed to lead by feeding on dead or dying game animals that contain lead shot or by consuming prey (such as waterfowl and small mammals) that contain high levels of biologically incorporated lead (Eisler, 1988b). Ingestion of lead-contaminated prey may represent a significant source of mortality in golden and bald eagles (Frenzel and Anthony, 1989; Craig, 1990).

The highest body burdens of lead in mammals have been reported for specimens collected from urban areas and near lead mining and smelting facilities (Eisler, 1988b). The lead exposure route for mammals is via diet; species high on the food chain are apparently more susceptible to lead contamination (Scanlon, 1987; Eisler, 1988b). Reported effects of lead poisoning in mammals include altered structure and function in kidneys, bone, and the hematopoietic and central nervous systems, as well as biochemical, histopathological, teratogenic, and reproductive effects. The effects are species specific; younger developmental stages are the most sensitive; and organolead compounds are more toxic than inorganic ones (Eisler, 1988b). Little is known about the toxic and sublethal effects of lead on mammalian wildlife. In laboratory and domestic mammals, adverse effects have been observed with lead doses ranging from 0.05 mg lead/kg body weight (mice) to 5 mg lead/kg body weight (rats and dogs) (Eisler, 1988b).

Lead is toxic to all phyla of aquatic organisms. Its effects are determined by species and physical and chemical factors. Dissolved waterborne lead is more toxic than total lead; organic lead forms are more toxic than inorganic ones; toxicity decreases with increasing hardness; and toxic effects generally increase under conditions of rapid growth (USEPA, 1986; Eisler, 1988b). Although lead is concentrated by aquatic biota, little evidence of biomagnification exists (Demayo et al., 1982; Eisler, 1988b). In fishes, toxic and sublethal effects of lead include increased mucus production, which interferes with the respiratory and ion-exchange functions of gills; spinal curvature; anemia; destruction of spinal neurons; reduced swimming ability; growth inhibition; altered blood chemistry; and death (Holcombe et al., 1976; Demayo et al., 1982; Eisler, 1988b).

Reduced survival, impaired reproduction, and reduced growth have been reported in aquatic organisms at lead concentrations of 1.0 to 5.1 μg/l (Eisler, 1988b); lead concentrations of >10 μg/l are expected to cause increasingly severe long-term effects on aquatic biota (Demayo et al., 1982). At a hardness level of 200, the AWQC for lead for the protection of freshwater life is 200 and 7.7 μg/l for acute and chronic exposure, respectively (USEPA, 1986).

Mercury. Mercury and its compounds have no known normal biological function, and the presence of mercury in living cells is undesirable and potentially hazardous (NAS, 1978). Mercury exists in three oxidation states: elemental mercury, mercurous ion (Hg_2^{+2}) , and mercuric ion (Hg^{+2}). All mercury compounds interfere with thiol metabolism. Chemical speciation is probably the most important factor affecting the ecotoxicology of mercury (Boudou and Ribeyre, 1983).

In general, organic forms of mercury are more readily absorbed than inorganic forms. Organic mercury compounds are also more soluble in organic solvents and lipids, pass more readily through biological membranes, and are slower to be excreted (Eisler, 1987a). In aquatic systems, low toxicity forms of mercury may become methylated by biological or chemical processes. Methylmercury is the most hazardous mercury species owing to its high stability, high lipid solubility, and high ability to penetrate biological membranes (Eisler, 1987a; Hobson, 1988).

Total mercury concentrations range from about 0.001 to 0.05 μg/l in uncontaminated natural waters and are typically <1.0 mg/kg in uncontaminated sediments (Eisler, 1987b). In aquatic systems, sediments act as mercury sinks, while methylation tends to release mercury from sediments into the ecosystem (Hobson, 1988). Mercury levels are usually <1 mg/kg (fresh weight) in biota from uncontaminated areas and > 1 mg/kg in biota from areas that have received mercury from anthropogenic sources. Mercury can bioconcentrate in biota and biomagnify through food chains (Eisler, 1987b).

Early developmental stages are most sensitive to the effects of mercury, and organomercury compounds are more toxic than inorganic forms. In addition to its lethal effects, mercury is a mutagen, teratogen, and carcinogen. Lethal concentrations of total mercury range from 0.1 to 200 μg/l in aquatic biota; 2.2 to 31 mg/kg body weight (acute oral dose) and 4.0 to 40 mg/kg (dietary) for birds; and 0. 1 to 0.5 mg/kg body weight (daily dose) and 1.0 to 5.0 mg/kg (dietary) for mammals (Eisler, 1987b). Sublethal effects of mercury have been observed at concentrations of 0.03 to 0.1 μg/l for aquatic species, 604 μg/kg body weight (daily dose) and

50 to 500 μg/kg (dietary) for birds, and 250 μg/kg body weight (daily dose) and 1,100 μg/kg (dietary) for mammals (Eisler, 1987b).

No information was found regarding the effects of mercury on terrestrial vegetation. Mercury poisoning in fish can result in increased respiratory movements, loss of equilibrium, emaciation, brain lesions, inability to capture food, abnormal motor coordination, and death. Sublethal effects can include inhibited reproduction; reduced growth; and altered behavior, metabolism, blood chemistry, and osmoregulation (Eisler, 1987b). The AWQC for mercury for the protection of freshwater biota is 2.4 and 0.012 μg/l for acute and chronic exposure, respectively. However, the AWQC of 2.4 μg/l for acute exposure is above the mercury concentration of 0.03 to 0.1 μg/l reported to produce sublethal effects and also above the lower limit (0.1 μg/l) reported to be fatal to sensitive aquatic biota. On the basis of these data, the U.S. Fish and Wildlife Service considers the acute mercury AWQC to provide no significant protection for freshwater aquatic biota (Eisler, 1987b).

Mercury poisoning produces muscular incoordination, falling, slowness, and death in birds. Sublethal effects in birds include decreased growth, developmental abnormalities, inhibited reproduction, altered blood chemistry and composition, altered metabolism, and behavioral modifications (Eisler, 1987b). Mercury bioaccumulation and biomagnification has been observed in birds, and young are more sensitive than older individuals. In mammals, methylmercury affects the central nervous system and the kidneys. Toxic effects include convulsions, widespread brain damage, kidney damage, and increased stillbirths. Sublethal effects include reduced fertility, increased anomalous fetuses, behavioral changes, visual disturbances, tremors, and motor incoordination (Eisler, 1987b).

Nickel. Nickel concentrations in soils range from 5 to 500 mg/kg, with an average of about 100 mg/kg (Hutchinson, 1981). Reported nickel concentrations in surface waters from the major U.S. river and lake basins range from 3 μg/l in the western gulf to 56 μg/l in Lake Erie (Snodgrass, 1980).

Nickel concentrations in plants grown in uncontaminated soils are typically <10 mg/kg. The bioavailability and uptake of nickel by plants depend on the soil type and plant species (Hutchinson 1981). Plants collected near nickel smelters had nickel concentrations ranging from 2 to 40 mg/kg DW (Hutchinson 1981), while concentrations ranged from 0.2 to 4.5 μg/g for nearly 2,000 specimens of field crops and natural vegetation in the United States (Brooks 1980). The effects of nickel toxicity in plants include induced iron-deficiency chlorosis, foliar

necrosis, stunted root and shoot growth, deformation, leaf and stem spotting, abnormal starch accumulation, and accumulation of apolar soluble phenolics (Hutchinson 1981).

Nickel accumulation has been reported for only a few wildlife species. Nickel concentrations were <3.67 μg/g (wet weight) in liver, heart, and kidney tissues collected from white-tailed deer, gray and red squirrels, and cottontail rabbit (Jenkins, 1980). Scanlon (1989) measured heavy metal concentrations in several species of small mammals living in roadside environments and reported average body burdens of nickel ranging from 0.23 μg/g (DW) in the house mouse to 4.19 μg/g in the masked shrew. Scanlon (1989) suggested that small mammals at higher trophic levels are more vulnerable to heavy metal contamination. Reported nickel levels in kidney tissues collected from the ruffed grouse and the American robin were 4.96 and 1.66 μg/g (wet weight), respectively (Jenkins, 1980).

No information was found regarding nickel toxicity in wildlife. In laboratory animals, reported effects of nickel include inhibition of enzyme systems, elevated ATPase levels, inhibition of RNA synthesis, significant increases in serum glucose, loss of ATPase activity in brain capillaries, interference with spermatogenesis, reduced litter size, and enhanced neonatal mortality (Mushak, 1980). Oral intake of nickel is associated with the lowest level of toxicological response; dogs and cats that received daily oral doses of 12 mg/kg for more than 6 months exhibited no adverse effects (Mushak, 1980).

In freshwater systems, nickel toxicity decreases with increasing hardness (USEPA, 1986). Nickel results in a variety of adverse effects in freshwater biota. Adverse effects on algae exposed to nickel concentrations of 1.0 to 45 mg/l included reduced growth, inhibition of flagellar movement, decreased capacity for phototaxis and geotaxis, and changes in community structure and species diversity (Spencer, 1980). In aquatic invertebrates, nickel adversely affected locomotion, reproduction, development, and growth. In fish, exposure to nickel reduced fecundity and egg hatchability, increased embryo and larvae mortality, and increased incidence of abnormal larvae (Birge and Black, 1980).

Acute toxicity values for 21 freshwater species ranged from 1,101 μg/l for a cladoceran to 43,240 μg/l for fish. Chronic toxicity values for two invertebrates and two fish in freshwaters ranged from 14.77 μg/l for Daphnia magna in soft water to 526.7 μg/l for the fathead minnow in hard water (USEPA, 1986). Reported bioconcentration factors range from 0.8 for fish to 193 for a cladoceran. The AWQC for nickel for the protection of freshwater biota is 2,500 and 280 μg/l (hardness of 200) for acute and chronic exposure, respectively (USEPA, 1986).

Silver. Silver is one of the most toxic of the heavy metals, but because it is easily reduced and has a low solubility, it is not readily available to iota (Peterson and Girling, 1981; Biddinger and Gloss, 1984). The toxic actions of silver include enzyme inhibition, complexation with nitrogenous bases in DNA, inhibition of DNA synthesis and transcription, reduced yields in plants, and reduced germination of fungal spores. A tissue concentration of 180 mg/kg (DW) reduced root growth in maize and barley seedlings; significant reductions in shoot growth were evident at tissue concentrations >60 mg/kg (DW) (Peterson and Girling, 1980).

No data were found regarding the effects of silver on wildlife. In aquatic systems, silver can bioaccumulate, but there is no evidence of biomagnification (Biddinger and Gloss, 1984).

Thallium. Thallium is a trace metal widely distributed in the earth's crust. It exists in two chemical states, thallous and thallic. The thallous state is the more common and stable form (ATSDR, 1991a).

The lowest oral doses of thallium compounds showing lethality ranged from 12 (guinea pig) to 29 (rat) mg thallium acetate/kg and 5 (guinea pig) to 30 (dog) mg thallic oxide/kg (Downs et al., 1960). Subchronic exposure has caused reproductive effects. Abnormalities in testicular morphology, function, or biochemistry were evident in rats that received an average daily intake of 0.7 mg/kg/day as thallium sulfate during a 60-day-treatment period (Formigli *et al.,* 1986). Hair loss was observed in rats exposed to 1.2 mg/kg/day as thallium acetate for 15 weeks (Downs et al., 1960).

The thallium content of plants seems to be a function of the thallium concentration in soils. Increased thallium levels in plant tissues are highly toxic to both plants and animals. The concentration of 5 ppm thallium in the soil solution decreased by 50% the length of roots of collards and wheat, with no visual symptoms of thallium toxicity (Kabata-Pendias and Pendias, 1992).

Tin. Metallic tin causes nonspecific smooth surface carcinogenesis in experimental animals where small tin disks are implanted subcutaneously or intramuscularly (Venugopal T.D. Luckey, 1978).

Results of animal experiments indicate that ingestion of considerable quantities of powdered tin may cause vomiting but not permanent injury. (International Labour Office, 1983).

Zinc. Soil levels of zinc typically range from 10 to 300 mg/kg (Collins, 1981); Sheppard and Evenden (1990) reported an average zinc concentration of 80 μg/g for 64 Canadian sites, and Herrick and Friedland (1990) reported zinc concentrations of 56.5 to 207.4 μg/g in montane forest soils of the northeastern United States.

In plants, zinc is actively taken up by the roots and can be translocated throughout the plant (Collins, 1981). Zinc concentrations of 18 mg/l in soil moisture (as measured in lysimeter solutions) resulted in appreciable damage to coniferous forest understory plants. Nutrient concentrations of 0.02 to 0.1 mg/l caused cytological changes, reduced root elongation, and decreased growth in some plants (Tyler et al., 1989). The symptoms of zinc toxicity include retardation of growth and chlorosis of older leaves; zinc may also inhibit CO_2 fixation, inhibit photosynthesis and respiration, disrupt electron transport, and restrict phloem translocation (Collins, 1981).

Zinc concentration of >170 mg/kg in soils reduced density, biomass, species diversity, and vertical distributions of soil invertebrates (Tyler et al., 1989). Zinc concentrations in small mammals living in roadside environments ranged from 50.94 to 146.18 μg/g, with higher levels found in species at higher trophic levels (Scanlon, 1987).

In aquatic systems, zinc damages gill surfaces in fishes and invertebrates, affecting ion regulation and gas exchange (de March, 1988). Zinc is bioaccumulated but does not appear to biomagnify in aquatic food chains (Biddinger and Gloss 1984). Acute toxicity in freshwater varies with hardness. At a hardness of 50, acute sensitivities for eight species ranged from 50.7 μg/l for Ceriodaphnia reticulate to 88,960 μg/l for a damselfly (USEPA, 1986). For invertebrates, chronictoxicity values were 46.73 μg/l for Daphnia magna and >5,243 μg/l for a caddisfly. Among seven fish species, chronic toxicity values ranged from 36.41 μg/l for the flagfish to 854.7 μg/l for the brook trout (USEPA, 1986). Freshwater plants are more sensitive than are animals; a zinc concentration of 30 μg/l inhibited growth of the alga Selenastrum capriocomutum (USEPA, 1986). In freshwater, zinc bioaccumulates in animal tissues 51 to 1,130 times the ambient water concentration. The AWQC for zinc for the protection of aquatic life is 210 and 190 μg/l for acute and chronic exposure, respectively (USEPA, 1986).

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Conference Call between U.S. EPA and Rohm and Haas Chemical LLC
Re: Parson's 1 June 2007 letter [Re: U.S. EPA comments on Rohm and Haas June 1, 2007, letter

12 June 2007

U.S. EPA Responses prepared by Mirtha Capiro based on June 12, 2007 Conference Call between U.S. EPA and Rohm and Haas Chemical LLC.

06/12/07

Refer to highlighted comment following Rohm and Haas' questions 1, 7 and 8.

1) In the original 2002 BRA document, background data were used to eliminate compounds of potential concern (COPCs). Based on comments received on this document, it was agreed that comparison to background concentrations should not be used in the initial screening process, but comparison to background data could be used in the uncertainty discussion of the report to assist in determining which compounds should be the focus of future remedial actions. Thus, a qualitative discussion of the background data was included in the uncertainty section of the Revised BRA document in 2005. Subsequent comments from USEPA indicated that the background data and associated statistics should still be included as an appendix to the Revised BRA. In the additional comments received on May 22, 2007, USEPA indicated that the background statistics should be re-calculated according guidance published by the USEPA in 2002 and 2006. Thus, Rohm and Haas can present the data and updated statistics in an appendix as suggested, but, once the additional statistics are calculated, how should we compare these new statistics to the site data since the background data was not used to determine final compounds of concern for the human health risk assessment and it was agreed that there are no soil pathways of concern for ecological receptors? [Comment: Rohm and Haas may prepare and present in the BRA an assessment of background data, including comparison between site and background data. As discussed at the conference call, the background data available may not be fully representative of overall off-site conditions. Therefore, this assessment would be useful only for risk management decisions. As discussed at the conference call, the background data available may not be representative of overall off-site conditions.]

2) In the 22 May 2007 comments, USEPA indicated that the lower 95% confidence limit for background samples should be used for comparison to site data, assuming the data are normally distributed. If the data are not normally distributed, then the limits should be calculated as the mean plus or minus three times the standard deviation of the mean. To evaluate normality and to calculate summary statistics, we propose to use the ProUCL software available for download at USEPA's website as follows: http://www.epa.gov/esd/tsc/download.htm. The ProUCL software tests for normality, lognormality, gamma distribution, and computes a conservative and stable 95% UCL of the mean. Please inform us if another method should be used instead of the ProUCL software.

3) In Section 4.7.5 (page 136) of the 2006 USEPA document "Data Quality Assessment: Statistical Methods for Practitioners", it is recommended that the upper percentile be used when greater than 50% of the data are non-detects and the coefficient of variation is greater than 1.5. If less than 50% of the data are non-detect, then it is recommended that either should be used. If the coefficient of variation is less than 0.5, then may be used.

4) What value should be substituted for the non-detected values when calculating the mean? Previously, ½ the detection limit was used.

5) What concentration should be used when a compound was detected in a duplicate sample but not the original sample? For example, in sample B04-1.5', benzo(a)anthracene was detected in the duplicate sample at a concentration of 0.063 mg/kg; however, benzo(a)anthracene was not detected in the original sample (detection limit = 0.35 mg/kg).

6) Should the background statistics be calculated for surface soils and subsurface soils separately or grouped together since the sample set is relatively small?

7) Previously, background statistics were calculated only for those parameters that had concentrations above screening levels for organics. Thus, summary statistics were previously only calculated for dieldrin and detected inorganics. Should summary statistics be calculated for all detected parameters or only those that exceed applicable screening values? [Comment: No further consideration for constituents that do not exceed screening values]

8) USEPA commented on 23 May 2007 that similar statistical evaluations should be conducted for concentrations detected in the sediments of Mill Creek. Since Rohm and Haas did not collect sediment background data, USEPA stated that comparison to data collected by the Ohio EPA upstream of the facility would be acceptable to use as surrogate data. Parsons, on behalf of Rohm and Haas, has requested the raw analytical data from the Ohio EPA for the years 1990 – present for river miles 13 – 19 (the site is located at river mile 13.5). Rohm and Haas will share this data with USEPA once it is received. [Comment: Need to examine the set of parameters and sampling locations associated with the upstream data to determine appropriate use for the data in the project].

Comments received from Arthur Lubin
RE: Rohm and Haas facility
6/6/07

Refer to highlighted text following Rohm and Haas' questions 2,3,4,5,6.

1) In the original 2002 BRA document, background data were used to eliminate compounds of potential concern (COPCs). Based on comments received on this document, it was agreed that comparison to background concentrations should not be used in the initial screening process, but comparison to background data could be used in the uncertainty discussion of the report to assist in determining which compounds should be the focus of future remedial actions. Thus, a qualitative discussion of the background data was included in the uncertainty section of the Revised BRA document in 2005. Subsequent comments from USEPA indicated that the background data and associated statistics should still be included as an appendix to the Revised BRA. In the additional comments received on May 22, 2007, USEPA indicated that the background statistics should be re-calculated according guidance published by the USEPA in 2002 and 2006. Thus, Rohm and Haas can present the data and updated statistics in an appendix as suggested, but, once the additional statistics are calculated, how should we compare these new statistics to the site data since the background data was not used to determine final compounds of concern for the human health risk assessment and it was agreed that there are no soil pathways of concern for ecological receptors?

2) In the 22 May 2007 comments, USEPA indicated that the lower 95% confidence limit for background samples should be used for comparison to site data, assuming the data are normally distributed. If the data are not normally distributed, then the limits should be calculated as the mean plus or minus three times the standard deviation of the mean. To evaluate normality and to calculate summary statistics, we propose to use the ProUCL software available for download at USEPA's website as follows: http://www.epa.gov/esd/tsc/download.htm. The ProUCL software tests for normality, lognormality, gamma distribution, and computes a conservative and stable 95% UCL of the mean. Please inform us if another method should be used instead of the ProUCL software. [Comment: It would be appropriate for Rohm and Haas to use the ProUCL software for the purpose stated.]

3) In Section 4.7.5 (page 136) of the 2006 USEPA document "Data Quality Assessment: Statistical Methods for Practitioners", it is recommended that the upper percentile be used when greater than 50% of the data are non-detects and the coefficient of variation is greater than 1.5. If less than 50% of the data

are non-detect, then it is recommended that either [Comment: the mean or the 95th or higher percentile] should be used. If the coefficient of variation is less than 0.5, then [Comment: the mean or median] may be used.

4) What value should be substituted for the non-detected values when calculating the mean? Previously, ½ the detection limit was used. [Comment: In Section 4.7.5 (pages 130 - 136) of the 2006 USEPA document "Data Quality Assessment: Statistical Methods for Practitioners" the document concurs with the use of ½ the detection limit if the proportion of non-detects is less than or equal to 15%. On pages 132 -134 of the above mentioned document it is recommended that the Atchison or Cohen approaches be used to estimate the sample average and standard deviation. Please note the differences in the assumptions of the two approaches when deciding which to use. If there are more than ½ non-detects, use the test of proportions with the 95th percentile.]

5) What concentration should be used when a compound was detected in a duplicate sample but not the original sample? For example, in sample B04-1.5', benzo(a)anthracene was detected in the duplicate sample at a concentration of 0.063 mg/kg; however, benzo(a)anthracene was not detected in the original sample (detection limit = 0.35 mg/kg). [Comment: Use the average of the duplicates with ½ the detection limit replacing the individual value for non-detects.]

6) Should the background statistics be calculated for surface soils and subsurface soils separately or grouped together since the sample set is relatively small? [Comment: Do the calculations for both the grouped and individual surface and subsurface data sets individually presenting both sets of conclusions. Clearly discuss that the data were analyzed both ways and explain why the aggregated and disaggregated data were analyzed.]

7) Previously, background statistics were calculated only for those parameters that had concentrations above screening levels for organics. Thus, summary statistics were previously only calculated for dieldrin and detected inorganics. Should summary statistics be calculated for all detected parameters or only those that exceed applicable screening values?

8) USEPA commented on 23 May 2007 that similar statistical evaluations should be conducted for concentrations detected in the sediments of Mill Creek. Since Rohm and Haas did not collect sediment background data, USEPA stated that comparison to data collected by the Ohio EPA upstream of the facility would be acceptable to use as surrogate data. Parsons, on behalf of Rohm and Haas, has requested the raw analytical data from the Ohio EPA for the years 1990 – present for river miles 13 – 19 (the site is located at river mile 13.5). Rohm and Haas will share this data with USEPA once it is received.

"Fields, Karen"
<Karen.Fields@parsons.com
>

06/01/2007 01:07 PM

To Mirtha Capiro/R5/USEPA/US@EPA

cc Bhooma Sundar/R5/USEPA/US@EPA, "Carl J Coker" <CCoker@rohmhaas.com>, "Wangcahill, Fan" <Fan.Wangcahill@parsons.com>

bcc

Subject RE: Follow up clarification --Fw: Request for supplemental information from Rohm and Haas facility

Hi Mirtha,

Attached is ou list of clarification questions concerning the comments below as discussed with you earlier this week. Please let me know if you have any questions. Thanks!

- Karen

PARSONS
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-----Original Message-----
From: Capiro.Mirtha@epamail.epa.gov [mailto:Capiro.Mirtha@epamail.epa.gov]
Sent: Wednesday, May 23, 2007 11:21 AM
To: Carl J Coker
Cc: Sundar.Bhooma@epamail.epa.gov; Fields, Karen
Subject: Follow up clarification --Fw: Request for supplemental information from Rohm and Haas facility

Carl,

I would like to add the clarification below regarding the previous USEPA's comment on Item 2 on the Baseline Risk Assessment.

With respect to the USEPA request for information, Rohm and Haas should follow the guidance provided to also conduct a statistical comparison between sediment background levels and facility data. Rohm and Haas' response to Item 2 indicated that since Rohm and Haas did not collect sediment background samples, site results can be compared to a study of the Mill Creek conducted by OEPA in 1992. This approach seems appropriate; however, the background data selected for the comparison should be from upstream of the facility.

Please let me know if you have any questions. As I indicated earlier, please contact me to discuss a schedule regarding this request for information.

Thanks.

Mirtha Cápiro
Environmental Scientist
U.S. Environmental Protection Agency
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----- Forwarded by Mirtha Capiro/R5/USEPA/US on 05/23/2007 09:59 AM -----

Mirtha Capiro/R5/USEPA/US

05/22/2007 05:37 PM

To: Carl J Coker <CCoker@rohmhaas.com>

cc: Bhooma Sundar/R5/USEPA/US@EPA, Karen.Fields@parsons.com

Subject: Request for supplemental information from Rohm and Haas facility

Carl,

We received your May 17, 2007, responses regarding the Baseline Risk Assessment and are in the process of reviewing them in detail. However, we would like to request some further information regarding your response to Item 2 to be able to fully evaluate the use of background data in the risk assessment. At the same time, we would like to point out some issues on the statistical evaluation of site data you discussed in your response to Item 2 to enable you to address those issues concurrently. Please see request for information and USEPA comment on item 2 below.

Request for information:
Provide a statistical comparison of soil concentrations from background and the Rohm and Haas facility based on the attached USEPA guidance.
Also, refer to USEPA comment on Item 2 and related guidance cited in the comment.
(See attached file: background.pdf)

USEPA comment on Item 2:
The analysis performed uses approximately 95 per cent upper tolerance limits for background level used for comparison purposes with the facility data. The use of the upper tolerance value for data evaluation is not acceptable. A

tolerance limit is a range about which one may be X per cent confident (95 % approximately for this case) that X per cent of the values are within. If one wanted to use tolerance limits, the upper and lower limits should be calculated. With respect to the above USEPA request for information, only if the value of the facility is < the lower tolerance limit, should it be concluded that the facility data do not indicate conditions above background. Furthermore, the tolerance limit is based on assumptions about individual values. The background value used for comparison purposes should be derived from the mean or average summary statistic. Thus, it is recommended that the comparison value for background be the lower 95 per cent confidence limit. A confidence interval is a range of values which span from the lower to the upper X per cent (in this case the recommended per cent is approximately 95) confidence limits. One may expect that this range encompass the population mean with approximately 95 per cent certainty or likelihood of being correct. The use of the usual confidence limit requires the assumption that the sample data are at least approximately normally distributed. The appropriateness of the normality assumption can be assessed via statistical tools, such as the Shapiro Wilks test and the normal probability plot. If the data are not at least approximately normally distributed, the limits should be calculated as the sample mean from the background data plus/minus three times the standard deviation of the mean or the standard error (s/(square root of n). S is the standard deviation and n is the number of background sample measurements.

Another approach to compare the background and facility values is the use of statistical tests of significance. If the data are at least approximately normally distributed the T or Z tests may be used. The T test is appropriate for this application because the comparison groupings have less than 30 values. The test should be one-tailed and an alpha probability of five per cent is recommended. If the data are not approximately normally distributed, use the Wilcoxon Rank Sum Test for the comparisons. The statistical techniques discussed may be obtained from Data Quality Assessment: Statistical Methods for Practitioners, EPA QA/G-9S, February 2006, found at http://www.epa.gov/quality/dqa.html.

Please contact me to discuss a schedule regarding this request and for any questions.

Thanks.

Mirtha Cápiro
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ROH Cincy 1 June 2007 Response Ltr.pdf

PARSONS

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1 June 2007

Ms. Mirtha Capiro
U.S. Environmental Protection Agency
Region 5
77 W. Jackson Blvd. (DE-9J)
Chicago, IL 60604

Re: Clarification for Comments Received on May 22 and May 23, 2007
Rohm and Haas Chemicals, LLC
Reading, Ohio

Dear Ms. Capiro:

As discussed with you on 30 May 2007, below are a list of questions concerning clarification for comments received on our Responses to May 3, 2007 Comments from the USEPA for the Baseline Risk Assessment for the Rohm and Haas Cincinnati Plant. In order to respond to USEPA's comments concerning Item #2 (exclusion of certain compounds and evaluation of background data), we have the following questions concerning the background evaluation process recommended in the May 22-23, 2007 comments.

1) In the original 2002 BRA document, background data were used to eliminate compounds of potential concern (COPCs). Based on comments received on this document, it was agreed that comparison to background concentrations should not be used in the initial screening process, but comparison to background data could be used in the uncertainty discussion of the report to assist in determining which compounds should be the focus of future remedial actions. Thus, a qualitative discussion of the background data was included in the uncertainty section of the Revised BRA document in 2005. Subsequent comments from USEPA indicated that the background data and associated statistics should still be included as an appendix to the Revised BRA. In the additional comments received on May 22, 2007, USEPA indicated that the background statistics should be re-calculated according guidance published by the USEPA in 2002 and 2006. Thus, Rohm and Haas can present the data and updated statistics in an appendix as suggested, but, once the additional statistics are calculated, how should we compare these new statistics to the site data since the background data was not used to determine final compounds of concern for the human health risk assessment and it was agreed that there are no soil pathways of concern for ecological receptors?

2) In the 22 May 2007 comments, USEPA indicated that the lower 95% confidence limit for background samples should be used for comparison to site data, assuming the data are normally distributed. If the data are not normally distributed, then the limits should be calculated as the mean plus or

minus three times the standard deviation of the mean. To evaluate normality and to calculate summary statistics, we propose to use the ProUCL software available for download at USEPA's website as follows: http://www.epa.gov/esd/tsc/download.htm. The ProUCL software tests for normality, lognormality, gamma distribution, and computes a conservative and stable 95% UCL of the mean. Please inform us if another method should be used instead of the ProUCL software.

3) In Section 4.7.5 (page 136) of the 2006 USEPA document "Data Quality Assessment: Statistical Methods for Practitioners", it is recommended that the upper percentile be used when greater than 50% of the data are non-detects and the coefficient of variation is greater than 1.5. If less than 50% of the data are non-detect, then it is recommended that either the mean or the upper percentile should be used. If the coefficient of variation is less than 0.5, then a median value may be used. This appears to contradict USEPA's comment that the lower 95% confidence limit be used for comparison purposes. Please clarify the value that should be used for comparison with site data. We suggest that the ProUCL recommended value be used, given the robustness of the software. This clarification is especially critical for the background data for the organic parameters, where there are a high number of non-detects and the coefficient of variations are typically greater than 1.5.

4) What value should be substituted for the non-detected values when calculating the mean? Previously, ½ the detection limit was used.

5) What concentration should be used when a compound was detected in a duplicate sample but not the original sample? For example, in sample B04-1.5', benzo(a)anthracene was detected in the duplicate sample at a concentration of 0.063 mg/kg; however, benzo(a)anthracene was not detected in the original sample (detection limit = 0.35 mg/kg).

6) Should the background statistics be calculated for surface soils and subsurface soils separately or grouped together since the sample set is relatively small?

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8) USEPA commented on 23 May 2007 that similar statistical evaluations should be conducted for concentrations detected in the sediments of Mill Creek. Since Rohm and Haas did not collect sediment background data, USEPA stated that comparison to data collected by the Ohio EPA upstream of the facility would be acceptable to use as surrogate data. Parsons, on behalf of Rohm and Haas, has requested the raw analytical data from the Ohio EPA for the years 1990 – present for river miles 13 – 19 (the site is located at river mile 13.5). Rohm and Haas will share this data with USEPA once it is received.

If you have any questions concerning this information, please contact Ms. Karen Fields at 513-552-7016 or Mr. Carl Coker of Rohm and Haas at 215-785-7193.

Very truly yours,

Karen Fields

Karen Fields
Project Manager

Mirtha Capiro/R5/USEPA/US
05/23/2007 10:20 AM

To Carl J Coker <CCoker@rohmhaas.com>
cc Bhooma Sundar/R5/USEPA/US@EPA, Karen.Fields@parsons.com
bcc

Subject Follow up clarification --Fw: Request for supplemental information from Rohm and Haas facility

Carl,

I would like to add the clarification below regarding the previous USEPA's comment on Item 2 on the Baseline Risk Assessment.

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Please let me know if you have any questions. As I indicated earlier, please contact me to discuss a schedule regarding this request for information.

Thanks.

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----- Forwarded by Mirtha Capiro/R5/USEPA/US on 05/23/2007 09:59 AM -----

Mirtha Capiro/R5/USEPA/US
05/22/2007 05:37 PM

To Carl J Coker <CCoker@rohmhaas.com>
cc Bhooma Sundar/R5/USEPA/US@EPA, Karen.Fields@parsons.com

Subject Request for supplemental information from Rohm and Haas facility

Carl,

We received your May 17, 2007, responses regarding the Baseline Risk Assessment and are in the process of reviewing them in detail. However, we would like to request some further information regarding your response to Item 2 to be able to fully evaluate the use of background data in the risk assessment. At

the same time, we would like to point out some issues on the statistical evaluation of site data you discussed in your response to Item 2 to enable you to address those issues concurrently. Please see request for information and USEPA comment on item 2 below.

Request for information:
Provide a statistical comparison of soil concentrations from background and the Rohm and Haas facility based on the attached USEPA guidance. Also, refer to USEPA comment on Item 2 and related guidance cited in the comment.

background.pdf

USEPA comment on Item 2:
The analysis performed uses approximately 95 per cent upper tolerance limits for background level used for comparison purposes with the facility data. The use of the upper tolerance value for data evaluation is not acceptable. A tolerance limit is a range about which one may be X per cent confident (95 % approximately for this case) that X per cent of the values are within. If one wanted to use tolerance limits, the upper and lower limits should be calculated. With respect to the above USEPA request for information, only if the value of the facility is $\leq$ the lower tolerance limit, should it be concluded that the facility data do not indicate conditions above background. Furthermore, the tolerance limit is based on assumptions about individual values. The background value used for comparison purposes should be derived from the mean or average summary statistic. Thus, it is recommended that the comparison value for background be the lower 95 per cent confidence limit. A confidence interval is a range of values which span from the lower to the upper X per cent (in this case the recommended per cent is approximately 95) confidence limits. One may expect that this range encompass the population mean with approximately 95 per cent certainty or likelihood of being correct. The use of the usual confidence limit requires the assumption that the sample data are at least approximately normally distributed. The appropriateness of the normality assumption can be assessed via statistical tools, such as the Shapiro Wilks test and the normal probability plot. If the data are not at least approximately normally distributed, the limits should be calculated as the sample mean from the background data plus/minus three times the standard deviation of the mean or the standard error (s/(square root of n). S is the standard deviation and n is the number of background sample measurements.

Another approach to compare the background and facility values is the use of statistical tests of significance. If the data are at least approximately normally distributed the T or Z tests may be used. The T test is appropriate for this application because the comparison groupings have less than 30 values. The test should be one-tailed and an alpha probability of five per cent is recommended. If the data are not approximately normally distributed, use the Wilcoxon Rank Sum Test for the comparisons. The statistical techniques discussed may be obtained from Data Quality Assessment: Statistical Methods for Practitioners, EPA QA/G-9S, February 2006, found at http://www.epa.gov/quality/dqa.html.

Please contact me to discuss a schedule regarding this request and for any questions.

Thanks.

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From: "Fields, Karen" <Karen.Fields@parsons.com>
Recipients: Mirtha Capiro/R5/USEPA/US@EPA, Bhooma Sundar/R5/USEPA/US@EPA, "Carl J Coker" <CCoker@rohmhaas.com>,"Wangcahill, Fan" <Fan.Wangcahill@parsons.com>
Subject: ROH Cincinnati Plant - Responses to Comments Received May 3, 2007
Date: 05/17/2007 02:15:23 PM

Hi Mirtha,

Attached are our responses to the comments on the Baseline Risk Assessment report for the Rohm and Haas Cincinnati Plant as discussed on May 3, 2007. Should you have any questions or trouble opening this file, please let me know. Thanks!

- Karen

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<<Resp to USEPA Comments - 5-17-07.pdf>> Resp to USEPA Comments - 5-17-07.pdf

RESPONSES TO MAY 3, 2007 COMMENTS FROM THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (U.S. EPA) ON THE REVISED BASELINE RISK ASSESSMENT

ROHM AND HAAS CHEMICALS LLC (ROHM AND HAAS)
READING, OHIO

17 May 2007

Below are the responses to the additional comments received from Mirtha Capiro of the U.S. EPA on 3 May 2007 for the Baseline Risk Assessment (BRA) for the Rohm and Haas, Cincinnati Plant. These additional comments were received following a conference call held on 30 March 2007 and were further discussed during a conference call held on 3 May 2007.

COMMENTS RECEIVED 3 MAY 2007:

Item 1

2.1 Site History: "This section discusses the chemicals manufactures and the raw materials used in the site since 1950. Organophosphates have been manufactured in the site since 1950. Please clarify what types of organophosphates were manufactured at the facility in term of their industrial use (e.g., for use as pesticides, or esters used in the polymer industry, etc)."

Response: Traditional organophosphates such as the insecticides parathion, malathion, chlorpyrifos, and the nerve gases Sarin and VX, have never been produced at the Rohm and Haas Cincinnati Plant. Instead, the class of chemicals manufactured at the plant is "phosphonium salts", which are used as catalysts for epoxy and powder coatings. Specific phosphonium salts produced at the plant are the following:

- Ethyl Triphenyl Phosphonium Iodide (ETPPI)
- Ethyl Triphenyl Phosphonium Acid Acetate (ETPPAAC)
- Benzyl Triphenyl Phosphonium Chloride (BTPPCL)
- Tetra Butyl Phosphonium Acid Acetate (TBPAAC)
- Triphenyl Phosphine (TPP)

The term "organophosphates" will be replaced with "phosphonium salts" for clarity.

Item 2

4.2.1: "The discussion on bioaccumulation concludes that fish ingestion pathway is considered insignificant due to the presence of very few chemicals and their low concentration. This statement is based on screening the detected chemicals in the sediment against Region 9 PRG industrial soil screening criteria for direct contact not related to fish bioaccumulation. The response from Rohm and Hass to comments on the revised BRA on 9/23/005 stated that in section 4.2.1 under bioaccumulation, the text would be revised to state that fish ingestion would not be quantitatively evaluated based on the USEPA evaluation results that no site-related bio accumulative contaminants were detected at Rohm & Hass. Among the COPC's identified, eldrin is the chemical found to be significantly bio accumulative. Table 1.1 and Table 1.2 of

revised BRA list dieldrin as COPC at the maximum concentration of 3.1 ppm below 15 ft and 0.395 ppm at <1 ft respectively. The BRA needs to provide appropriate justification for exclusion of pesticides, such as eldrin and dieldrin, from the risk assessment. The justification should address background data and frequency of detection of pesticide compounds."

Response: For potentially bioaccumulative compounds, an evaluation of the soil data collected from the site shows that of the twenty-five pesticides detected, only gamma-Chlordane, 4,4'-DDE, endosulfan sulfate, endrin, endrin ketone, and methoxychlor were detected in more than five percent of the samples analyzed. Maximum concentrations of gamma-Chlordane (1.7 mg/kg), 4.4'-DDE (0.2 mg/kg), endosulfan sulfate (0.48 mg/kg), endrin (3.1 mg/kg), endrin ketone (1 mg/kg) and methoxychlor (5.5 mg/kg) were detected in samples between 10.5 and 13.5 feet bgs. Dieldrin was detected in only six of 126 soil samples, with a maximum detected concentration of 0.064 mg/kg at location DP66A-9.5. Five PCB mixtures were also detected in soil; however only one (Aroclor-1254) was detected in more than five percent of the 126 soil samples collected at the site. The maximum detected concentration was 0.98 mg/kg at location UAW17-40, at a depth of 1.5 feet bgs. Based on USEPA guidance that the frequency of detection should be greater than 5 percent and the maximum detected concentration exceed an applicable screening level to be considered a COPC, the following two potentially bioaccumulative compounds were retained for further analysis for the human health risk assessment soil exposure pathways: Aroclor-1254 and endrin.

Comparatively, of the twenty background soil samples collected, only five pesticides (4,4'-DDE, aldrin, dieldrin, endrine ketone and isodrin) were variously detected in four surface samples collected at depths ranging from 1-2 feet. Two PCB mixtures (Aroclor 1254 and Aroclor 1260) were also detected in three surface soil samples at depths of 1-2 feet. The detections of the pesticides and PCBs were all below human health screening levels except for dieldrin. Thus, a background concentration (0.07 mg/kg) was calculated only for dieldrin in surface soils. Since the maximum soil concentration of dieldrin from the site was 0.064 mg/kg, which is similar to area background levels, dieldrin concentrations in site soils appear to be consistent with background levels.

When comparing detections of pesticides and PCBs in soil to detections of these same compounds in the sediments and surface waters of Mill Creek, only two PCBs (Aroclor-1248 and Aroclor-1254) and eight pesticides (aldrin, beta-BHC, chlorobenzilate, 4,4'-DDE, 4,4'-DDT, diedrin, endrin ketone and methoxychlor) were also detected in the sediments and there were no detections of pesticides or PCBs in the surface water. (Note that endrin was not detected in the sediments or surface water of Mill Creek and thus would not be a COPC for the fish ingestion pathway.) And for these ten compounds that were detected in both site soils and Mill Creek sediments, only two (beta-BHC and dieldrin) were detected at concentrations that exceeded human health screening levels in both media; however, beta-BHC and diedrin were not selected as COPCs in soil since the frequency of detection in soil for these two compounds was less than 5 percent and dieldrin concentrations are consistent with area background levels. Thus, for Mill Creek sediments, beta-BHC and dieldrin were retained as COPCs for the human health risk

assessment since these are the only two potentially bioaccumulative COPCs that would be associated with the fish ingestion pathway.

Since no background samples were collected of the Mill Creek sediments, site results were compared to a study of the Mill Creek conducted by the Ohio EPA in 1992. For this study, the Ohio EPA collected surface water, sediment and fish tissue samples from Mill Creek, including locations in the vicinity of the site (OEPA, 1994). Near River Mile (R.M.) 13.35 at West Columbia Road (approximately ¼-mile downstream of the site), the following pesticides were detected in surface water in 1992: alpha-BHC (0.009 ug/L), gamma-BHC (0.004 – 0.018 ug/L), 4,4'-DDE (0.004 – 0.013 ug/L), 4,4'-DDT (0.017 – 0.033 ug/L), dieldrin (0.014 ug/L), Endosulfan II (0.002 ug/L), and methoxychlor (0.015 ug/L). In 2004, Rohm and Haas contractors collected surface water samples from six areas adjacent to the site and no pesticides or PCBs were detected in the samples.

For sediments, the Ohio EPA reported that 84% of the sites sampled in the Mill Creek had some level of organochlorine pesticide concentration. In addition, two PCBs (Aroclor 1248 and Aroclor 1260) were detected in the sediments of Mill Creek in 1992. Dieldrin was the most frequently detected pesticide, occurring in eleven of the twelve sediment locations sampled. Dieldrin concentrations in sediment ranged from 1.00 – 16.4 ug/kg. Aroclor 1248 was detected in eight of twelve sample locations. The maximum detected concentration of both dieldrin and Aroclor 1248 occurred at R.M. 13.13, which is approximately ½-mile downstream of the Rohm and Haas plant. Ohio EPA attributed the elevated Aroclor concentrations at this location due to the proximity to the G.E. Aircraft Engine facility, which discharged wastewater into a small tributary directly upstream (at R.M. 13.85) of the sampling location (and the Rohm and Haas facility). The Ohio EPA based this conclusion on the presence of elevated levels of Aroclor 1248 that were also detected in the G.E. tributary. The elevated dieldrin concentration at R.M. 13.13 was thought to be due to pesticide contamination at the Pristine Superfund site, which is directly upstream of the Rohm and Haas facility.

The Ohio EPA also collected tissue samples from four different fish species from the Mill Creek in 1992. The two closest locations to the site (R.M. 16.5—approximately 3 miles upstream of the Rohm and Haas plant and R.M. 7.8—approximately 6 miles downstream of the site) did not contain any detectable levels of pesticides in the samples, but Aroclor 1260 was detected in one fish sample at R.M. 16.5 and Aroclor 1248 was detected in three of five samples collected at R.M. 7.8. PCB concentrations in fish are apparently an issue throughout Mill Creek, as to this day, the state of Ohio has issued an advisory of no more than one meal per month for the consumption of fish caught from the main stem of the Mill Creek due elevated levels of PCBs.

Thus, based on these data comparisons, the fish ingestion pathway is not a concern for the Rohm and Haas site.

Item 3

4.3. "Exposure quantification: It is not clear for an active site such as Rohm and Hass, why risk characterization was conducted on a site wide basis rather than SWMU and Area of Concern (AOC) wide basis. Based on Region 5 risk management policy guidance June 2005, at least 8 samples are required per SWMU or unit exposure area. Pooling all the data for an active site tends to underestimate the exposure point concentration if the worker exposure is associated with a small area in a site. At least for onsite indoor and outdoor routine workers, the risk characterization should have been done on a SWMU and AOC wide basis. For instance, this raises a concern with respect to benzo(a)pyrene and chlorobenzene in soil. Refer to Tables 2-1for existing SWMUs and Section 5.3.1 for AOCs identified as a result of the facility investigations (FI). Also, see last comment regarding data discrepancy."

Response: All samples collected at the Rohm and Haas facility were done in accordance with guidance that existed at the time the samples were collected (2001 – 2004). Thus, the samples in question were collected prior to the issuance of the cited Region 5 risk management policy guidance in 2005. However, to address the concern that the use of a 95% UCL exposure point concentration may underestimate the risk to receptors that are confined to a specific SWMU or AOC, the risk to an outdoor maintenance worker will be re-evaluated using the maximum detected concentration in the near surface (0-2') soils. The preliminary results show that the total cancer risk and total hazard index for an outdoor industrial worker are 4.7×10^{-5} and 0.17, respectively. Both the total cancer risk and the total hazard index are within the USEPA acceptable risk range of 1×10^{-4} and 1×10^{-6}, and the acceptable hazard level of 1. The maximum COPC concentrations, input parameters and preliminary risk calculation sheets from this re-evaluation are provided in Attachment A.

Item 4

Baseball field. "Soil sampling was conducted in the baseball field as part of the background characterization sampling. Although no site operations took place in this field, this area may have been subject to migration pathways, such as runoff. Onsite recreational exposure risk characterization should typically have included this area."

Response: Risk to recreational users (age groups 6-13 and 13-17) will be calculated using the six soil sample locations closest to the baseball fields on the southern portion of the Rohm and Haas facility. Specifically, the soil sample locations include background samples 1 through 5 and UAW9-20. The comparison of the maximum detected concentrations from these samples and the screening toxicity values (Region 9 PRGs) show that arsenic and benzo(a)pyrene are the only COPCs. The preliminary results show that the total cancer risk and total hazard index for a recreational receptor (Age 6-13) are 2.0×10^{-6} and 0.037, respectively; and the total cancer risk and total hazard index for a recreational receptor (Age 13-17) are 1.2×10^{-6} and 0.036, respectively. The total cancer risks and the total hazard indices for both age groups 6-13 and 13-17 are within the USEPA acceptable risk range of 1×10^{-4} and 1×10^{-6}, and the acceptable

hazard level of 1. COPC selection, the exposure point concentrations, input parameters and preliminary risk calculation sheets from this evaluation are provided in Attachment B.

Item 5
6.3 Uncertainty: Table 1.1: "Given the number of soil borings collected, it is unclear why there are a limited number of surface soil samples available from the FI. Explain the reason for this limitation. Discuss the lack of sufficient data while addressing the worker exposure to site contamination in the uncertainty analysis section."

Response: See response to Item #3 above.

Item 6
6.3.1: "Third paragraph in this section, provides the rationale as to why vinyl chloride was eliminated as a COPC based on the fact that the one and only detection was due to an off-site source and it is also stated that few chemicals including vinyl chloride were eliminated due to their concentration in groundwater being less than the screening criteria. The data from table 1.2 however contradicts the statements mentioned above. The detection frequency of vinyl chloride in ground water was 5/126. The highest concentration observed at 15 ug/l exceeds the screening criteria of 2 ug/l. Please correct this discrepancy. Vinyl chloride, a VOC degradation product, should not be eliminated from the risk assessment on the basis of low frequency of detection. Also, confirm that VC will be included in the groundwater monitoring list."

Response: Vinyl chloride will be included in the groundwater exposure pathway since the maximum detected concentration exceeds the applicable screening value and since vinyl chloride is a breakdown product of other COPCs. Upon review of other potential "daughter" products, no additional compounds were added to the list of COPCs for the groundwater pathway.

Item 7
Soil-groundwater migration/leaching criteria for soil. "Any consideration of this criteria is lacking in the BRA. All maximum concentrations need to be compared to soil-groundwater migration/leaching criteria, followed by a discussion on how media are affected based on the screening results. Lastly, the BRA needs to discuss how the affected media will be addressed (e.g., discuss whether measures will be implemented to address groundwater contamination)."

Response: Per the teleconference on May 3, 2007, it was agreed that mention would be made that soil to groundwater migration/leaching is a potential future pathway of concern in the

revised BRA report; however, actual measures to address this pathway will be discussed in a future memorandum or as part of a Corrective Measures Study.

Item 8
Benzo(a)pyrene concentrations in soil. "There appears to be a discrepancy on the maximum concentration reported in the BRA for this chemical in soil."

Response: The maximum detected concentration for benzo(a)pyrene was 6.2 mg/kg. The discrepancy in concentrations is due to high detection limits for some samples. The use of ½ of the detection limit for non-detections of benzo(a)pyrene when calculating the 95% UCL concentration resulted in a higher calculated 95% UCL concentration of 8.5 mg/kg. Per discussions regarding Item 3 above, the maximum detected concentration of benzo(a)pyrene (6.2 mg/kg) will be used as the exposure point concentration.

ATTACHMENT A

TABLE A-1

EXPOSURE POINT CONCENTRATION SUMMARY

SOIL

Rohm and Haas Chemicals LLC

Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Soil, Ambient Air

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
On-site Soil (<2 feet)	Acetone	mg/kg	-	-	1.50E+01	1.50E+01	mg/kg	max.	Samples are limited
	Benzene	mg/kg	-	-	1.70E-03	1.70E-03	mg/kg	max.	Samples are limited
	Chlorobenzene	mg/kg	-	-	9.20E-03	9.20E-03	mg/kg	max.	Samples are limited
	Methylene chloride	mg/kg	-	-	1.80E-03	1.80E-03	mg/kg	max.	Samples are limited
	Toluene	mg/kg	-	-	5.60E-04	5.60E-04	mg/kg	max.	Samples are limited
	1,2-Dichlorobenzene	mg/kg	-	-	3.65E-01	3.65E-01	mg/kg	half of detection	Samples are limited
	1,4-Dichlorobenzene	mg/kg	-	-	3.65E-01	3.65E-01	mg/kg	half of detection	Samples are limited
	Benzo(a)anthracene	mg/kg	-	-	5.40E+00	5.40E+00	mg/kg	max.	Samples are limited
	Benzo(a)pyrene	mg/kg	-	-	6.20E+00	6.20E+00	mg/kg	max.	Samples are limited
	Benzo(b)fluoranthene	mg/kg	-	-	7.00E+00	7.00E+00	mg/kg	max.	Samples are limited
	bis(2-Ethylhexyl) phthalate	mg/kg	-	-	4.60E-01	4.60E-01	mg/kg	max.	Samples are limited
	Endrin	mg/kg	-	-	2.10E-03	2.10E-03	mg/kg	max.	Samples are limited
	Aroclor 1254	mg/kg	-	-	9.80E-01	9.80E-01	mg/kg	max.	Samples are limited
	Antimony	mg/kg	-	-	6.00E-01	6.00E-01	mg/kg	half of detection	Samples are limited
	Arsenic	mg/kg	-	-	1.62E+01	1.62E+01	mg/kg	max.	Samples are limited
	Chromium	mg/kg	-	-	2.17E+02	2.17E+02	mg/kg	max.	Samples are limited

(1) 95% UCL was not calculated because samples are limited from the 0-2' bgs depth.

(2) max. - maximum detected value

TABLE A-2A

VALUES USED FOR DAILY INTAKE CALCULATIONS

SOIL - OUTDOOR WORKER

Rohm and Haas Chemicals LLC

Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Nonintrusive Outdoor Industrial Workers	Adult	On-site surface soil	CS	Chemical Concentration in Soil	see Table A-1	mg/kg	see Table A-1	Chronic Daily Intake(CDI) (mg/kg-d) = (CS x IR x CF x FI x EF x ED)/(BW x AT)
				IR	Soil Ingestion Rate	100	mg/day	Default adult worker soil ingestion rate/EPA, 2001	
				CF	Conversion Factor	1.00E-06	kg/mg	Unit conversion factor/EPA, 1989	
				FI	Fraction Ingested	1	unitless	Conservatively assume 100 % of daily soil ingestion occurs on-site.	
				EF	Exposure Frequency	250	days/year	Assume 5 days/week and absence of 10 days/year for vacation/EPA, 1991	
				ED	Exposure Duration	25	years	Upper bound time for employment at a job/EPA, 1991	
				BW	Body Weight	70	kg	Standard reference weight for adult males/EPA, 1991 and 2001	
				AT-C	Averaging Time -Cancer	25550	days	Conventional human lifespan (exposure averaged over lifespan)/EPA, 1991 and 2001	
				AT-N	Averaging Time-Non-Cancer	9125	days	Average over the exposure duration/EPA, 1991 and 2001	
Dermal Contact	Nonintrusive Outdoor Industrial Workers	Adult	On-site surface soil	CS	Chemical Concentration in Soil	see Table A-1	mg/kg	see Table A-1	Dermal Absorbed Dose (DAD) (mg/kg-d) = (DAevent x EV x EF x ED x SA)/(BW x AT) where Absorbed Dose per Event (DA event) (mg/cm²-event) = (CS x CF) x AF x ABS
				CF	Conversion Factor	1.00E-06	kg/mg	Unit conversion factor/EPA, 1989	
				AF	Soil to Skin Adherence Factor	0.2	mg/cm²	EPA, 2004	
				ABS	Dermal Absorption Factor	chemical-specific	unitless	EPA, 2004	
				SA	Skin Surface Area	3300	cm²	EPA, 2004	
				EV	Event Frequency	1	events/day	EPA, 2004	
				EF	Exposure Frequency	250	days/year	Assume 5 days/week and absence of 10 days/year for vacation/EPA, 1991	
				ED	Exposure Duration	25	years	Upper bound time for employment at a job/EPA, 1991	
				BW	Body Weight	70	kg	Standard reference weight for adult males/EPA, 1991 and 2001	
				AT-C	Averaging Time -Cancer	25550	days	Conventional human lifespan (exposure averaged over lifespan)/EPA, 1991 and 2001	
				AT-N	Averaging Time-Non-Cancer	9125	days	Average over the exposure duration/EPA, 1991 and 2001	

USEPA, 1989a: Risk Assessment Guidance for Superfund. v.1: Human Health Evaluation Manual (Part A).

USEPA, 1991b: Risk Assessment Guidance for Superfund. v.1: Human Health Evaluation Manual. Supplemental Guidance, "Standard Default Exposure Factors". OERR. OSWER 9285.6-03.

USEPA, 2001d: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, March.

USEPA, 2004a: Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual, Part E, Supplemental Guidance Dermal Risk Assessment, Final, July 2004.

TABLE A-2B

VALUES USED FOR DAILY INTAKE CALCULATIONS

SOIL TO AMBIENT AIR - OUTDOOR WORKER

Rohm and Haas Chemicals LLC

Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Ambient air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Nonintrusive Outdoor Industrial Workers	Adult	Surface soil	CA	Chemical Concentration in Air	calculated	ug/m^3	calculated	Risk = [CA x EF x ED x ET x URF]/(AT-C)
				CS	Chemical Concentration in Soil	see Table A-1	mg/kg	see Table A-1	HQ = (CA x EF x ED x ET)/(RfC x AT-N)
				EF	Exposure Frequency	250	days/year	Assume 5 days/week and absence of 10 days/year for vacation/EPA, 1991	CA = (1/VF+1/PEF) x CS
				ED	Exposure Duration	25	years	Upper bound time for employment at a job/EPA, 1991	$VF = Q/C \times [(3.1416 \times Da \times T)^{1/2}]/[2 \times \rho b \times Da] \times (10^{-4}\ m^2/cm^2)$
				ET	Fraction of EF in Contact with Soil	1	Unitless	professional Judgement	$PEF = Q/C \times (3600)/(0.036 \times (1-V) \times (Um/Ut)^3 \times F(x))$
				AT-C	Averaging Time -Cancer	25550	days	Conventional human lifespan (exposure averaged over lifespan)/EPA, 1991 and 2001	See Appendix J for definitions and input values of Q/C, Da, T, ρb, V, Um, Ut and F(x).
				AT-N	Averaging Time-Non-Cancer	9125	days	Average over the exposure duration/EPA, 1991 and 2001	
				URF	Inhalation Unit Risk Factor	chemical-specific	$(ug/m^3)^{-1}$	see Table 6.2	
				RfC	Inhalation Reference Concentration	chemical-specific	ug/m^3	see Table 5.2	
				VF	Volatilization Factor	calculated	m^3/kg	see Appendix J	
				PEF	Particulate Emission Factor	calculated	m^3/kg	see Appendix J	

USEPA, 1991b: Risk Assessment Guidance for Superfund. v.1: Human Health Evaluation Manual. Supplemental Guidance, "Standard Default Exposure Factors". OERR. OSWER 9285.6-03.

USEPA, 1996b: Soil Screening Guidance: User's Guide. OSWER. Pub 9355.4-23.

USEPA, 2001d: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, March.

TABLE A-3

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE - OUTDOOR WORKER

Rohm and Haas Chemicals LLC

Reading, Ohio

Scenario Timeframe:	Current/Future
Receptor Population:	Industrial Worker (Outdoor)
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC (maximum)		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard
Soil	Soil	On-site soil	Ingestion	1,2-Dichlorobenzene	3.65E-01	mg/kg	1.3E-07	mg/kg-d	--	(mg/kg-d)$^{-1}$	--	3.57E-07	mg/kg-d	1.40E-01	mg/kg-d	2.6E-06
				1,4-Dichlorobenzene	3.65E-01	mg/kg	1.3E-07	mg/kg-d	1.3E-02	(mg/kg-d)$^{-1}$	1.7E-09	3.57E-07	mg/kg-d	2.40E-03	mg/kg-d	1.5E-04
				Acetone	1.50E+01	mg/kg	5.2E-06	mg/kg-d	--	(mg/kg-d)$^{-1}$	--	1.47E-05	mg/kg-d	9.00E-01	mg/kg-d	1.6E-05
				Benzene	1.70E-03	mg/kg	5.9E-10	mg/kg-d	5.5E-02	(mg/kg-d)$^{-1}$	3.3E-11	1.66E-09	mg/kg-d	4.00E-03	mg/kg-d	4.2E-07
				Chlorobenzene	9.20E-03	mg/kg	3.2E-09	mg/kg-d	--	(mg/kg-d)$^{-1}$	--	9.00E-09	mg/kg-d	2.00E-02	mg/kg-d	4.5E-07
				Methylene Chloride	1.80E-03	mg/kg	6.3E-10	mg/kg-d	7.5E-03	(mg/kg-d)$^{-1}$	4.7E-12	1.76E-09	mg/kg-d	6.00E-02	mg/kg-d	2.9E-08
				Toluene	5.60E-04	mg/kg	2.0E-10	mg/kg-d	--	(mg/kg-d)$^{-1}$	--	5.48E-10	mg/kg-d	2.00E-01	mg/kg-d	2.7E-09
				Benzo(a)anthracene	5.40E+00	mg/kg	1.9E-06	mg/kg-d	7.3E-01	(mg/kg-d)$^{-1}$	1.4E-06	5.28E-06	mg/kg-d	--	mg/kg-d	--
				Benzo(a)pyrene	6.20E+00	mg/kg	2.2E-06	mg/kg-d	7.3E+00	(mg/kg-d)$^{-1}$	1.6E-05	6.07E-06	mg/kg-d	--	mg/kg-d	--
				Benzo(b)fluoranthene	7.00E+00	mg/kg	2.4E-06	mg/kg-d	7.3E-01	(mg/kg-d)$^{-1}$	1.8E-06	6.85E-06	mg/kg-d	--	mg/kg-d	--
				PCB-1254 (Arochlor 1254)	9.80E-01	mg/kg	3.4E-07	mg/kg-d	2.0E+00	(mg/kg-d)$^{-1}$	6.8E-07	9.59E-07	mg/kg-d	2.00E-05	mg/kg-d	4.8E-02
				bis(2-Ethylhexyl) Phthalate	4.60E-01	mg/kg	1.6E-07	mg/kg-d	1.4E-02	(mg/kg-d)$^{-1}$	2.3E-09	4.50E-07	mg/kg-d	2.00E-02	mg/kg-d	2.3E-05
				Endrin	2.10E-03	mg/kg	7.3E-10	mg/kg-d	--	(mg/kg-d)$^{-1}$	--	2.05E-09	mg/kg-d	3.00E-04	mg/kg-d	6.8E-06
				Antimony	6.00E-01	mg/kg	2.1E-07	mg/kg-d	--	(mg/kg-d)$^{-1}$	--	5.87E-07	mg/kg-d	4.00E-04	mg/kg-d	1.5E-03
				Arsenic	1.62E+01	mg/kg	5.7E-06	mg/kg-d	1.5E+00	(mg/kg-d)$^{-1}$	8.5E-06	1.59E-05	mg/kg-d	3.00E-04	mg/kg-d	5.3E-02
				Chromium, Total	2.17E+02	mg/kg	7.6E-05	mg/kg-d	--	(mg/kg-d)$^{-1}$	--	2.12E-04	mg/kg-d	2.10E-02	mg/kg-d	1.0E-02
			Exp. Route Total								2.8E-05					1.1E-01
		Exposure Point Total									2.8E-05					1.1E-01
	Exposure Medium Total										2.8E-05					1.1E-01
Medium Total											2.8E-05					1.1E-01
Soil	Soil	On-site soil	Dermal Contact	1,2-Dichlorobenzene	3.65E-01	mg/kg	--	mg/kg-d	--	(mg/kg-d)$^{-1}$	--	--	mg/kg-d	1.4E-01	mg/kg-d	--
				1,4-Dichlorobenzene	3.65E-01	mg/kg	--	mg/kg-d	1.3E-02	(mg/kg-d)$^{-1}$	--	--	mg/kg-d	2.4E-03	mg/kg-d	--
				Acetone	1.50E+01	mg/kg	--	mg/kg-d	--	(mg/kg-d)$^{-1}$	--	--	mg/kg-d	9.0E-01	mg/kg-d	--
				Benzene	1.70E-03	mg/kg	--	mg/kg-d	5.5E-02	(mg/kg-d)$^{-1}$	--	--	mg/kg-d	4.0E-03	mg/kg-d	--
				Chlorobenzene	9.20E-03	mg/kg	--	mg/kg-d	--	(mg/kg-d)$^{-1}$	--	--	mg/kg-d	6.2E-03	mg/kg-d	--
				Methylene Chloride	1.80E-03	mg/kg	--	mg/kg-d	7.5E-03	(mg/kg-d)$^{-1}$	--	--	mg/kg-d	6.0E-02	mg/kg-d	--
				Toluene	5.60E-04	mg/kg	--	mg/kg-d	--	(mg/kg-d)$^{-1}$	--	--	mg/kg-d	2.0E-01	mg/kg-d	--
				Benzo(a)anthracene	5.40E+00	mg/kg	1.6E-06	mg/kg-d	7.3E-01	(mg/kg-d)$^{-1}$	1.2E-06	4.5E-06	mg/kg-d	--	mg/kg-d	--
				Benzo(a)pyrene	6.20E+00	mg/kg	1.9E-06	mg/kg-d	7.3E+00	(mg/kg-d)$^{-1}$	1.4E-05	5.2E-06	mg/kg-d	--	mg/kg-d	--
				Benzo(b)fluoranthene	7.00E+00	mg/kg	2.1E-06	mg/kg-d	7.3E-01	(mg/kg-d)$^{-1}$	1.5E-06	5.9E-06	mg/kg-d	--	mg/kg-d	--
				PCB-1254 (Arochlor 1254)	9.80E-01	mg/kg	3.2E-07	mg/kg-d	2.0E+00	(mg/kg-d)$^{-1}$	6.3E-07	8.9E-07	mg/kg-d	2.0E-05	mg/kg-d	4.4E-02

TABLE A-3

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE - OUTDOOR WORKER

Rohm and Haas Chemicals LLC

Reading, Ohio

Scenario Timeframe:	Current/Future
Receptor Population:	Industrial Worker (Outdoor)
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC (maximum)		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard
				bis(2-Ethylhexyl) Phthalate	4.60E-01	mg/kg	1.1E-07	mg/kg-d	7.4E-02	(mg/kg-d)$^{-1}$	7.8E-09	3.0E-07	mg/kg-d	3.8E-03	mg/kg-d	7.8E-05
				Endrin	2.10E-03	mg/kg	4.8E-10	mg/kg-d	--	(mg/kg-d)$^{-1}$	--	1.4E-09	mg/kg-d	6.0E-06	mg/kg-d	2.3E-04
				Antimony	6.00E-01	mg/kg	--	mg/kg-d	--	(mg/kg-d)$^{-1}$	--	--	mg/kg-d	6.0E-05	mg/kg-d	--
				Arsenic	1.62E+01	mg/kg	1.1E-06	mg/kg-d	1.5E+00	(mg/kg-d)$^{-1}$	1.7E-06	3.1E-06	mg/kg-d	3.0E-04	mg/kg-d	1.0E-02
				Chromium, Total	2.17E+02	mg/kg	--	mg/kg-d	--	(mg/kg-d)$^{-1}$	--	--	mg/kg-d	2.7E-04	mg/kg-d	--
			Exp. Route Total								1.9E-05					5.5E-02
		Exposure Point Total									1.9E-05					5.5E-02
	Exposure Medium Total										1.9E-05					5.5E-02
Medium Total											1.9E-05					5.5E-02
Soil	Soil	On-site soil	Inhalation	1,2-Dichlorobenzene	3.7E+02	ug/kg	4.0E-02	ug/m^3	--	(ug/m^3)$^{-1}$	--	4.0E-02	ug/m^3	2.0E+02	ug/m^3	1.4E-04
				1,4-Dichlorobenzene	3.7E+02	ug/kg	4.6E-02	ug/m^3	6.3E-06	(ug/m^3)$^{-1}$	7.0E-08	4.6E-02	ug/m^3	8.0E+02	ug/m^3	3.9E-05
				Acetone	1.5E+04	ug/kg	1.9E+00	ug/m^3	--	(ug/m^3)$^{-1}$	--	1.9E+00	ug/m^3	--	ug/m^3	--
				Benzene	1.7E+00	ug/kg	1.0E-03	ug/m^3	7.8E-06	(ug/m^3)$^{-1}$	1.9E-09	1.0E-03	ug/m^3	3.0E+01	ug/m^3	2.3E-05
				Chlorobenzene	9.2E+00	ug/kg	2.4E-03	ug/m^3	--	(ug/m^3)$^{-1}$	--	2.4E-03	ug/m^3	6.0E+01	ug/m^3	2.7E-05
				Methylene Chloride	1.8E+00	ug/kg	1.2E-03	ug/m^3	4.7E-07	(ug/m^3)$^{-1}$	1.4E-10	1.2E-03	ug/m^3	3.0E+03	ug/m^3	2.7E-07
				Toluene	5.6E-01	ug/kg	2.2E-04	ug/m^3	--	(ug/m^3)$^{-1}$	--	2.2E-04	ug/m^3	4.0E+02	ug/m^3	3.8E-07
				Benzo(a)anthracene	5.4E+03	ug/kg	9.3E-04	ug/m^3	--	(ug/m^3)$^{-1}$	--	9.3E-04	ug/m^3	--	ug/m^3	--
				Benzo(a)pyrene	6.2E+03	ug/kg	4.1E-04	ug/m^3	--	(ug/m^3)$^{-1}$	--	4.1E-04	ug/m^3	--	ug/m^3	--
				Benzo(b)fluoranthene	7.0E+03	ug/kg	2.4E-03	ug/m^3	--	(ug/m^3)$^{-1}$	--	2.4E-03	ug/m^3	--	ug/m^3	--
				PCB-1254 (Arochlor 1254)	9.8E+02	ug/kg	2.1E-03	ug/m^3	1.0E-04	(ug/m^3)$^{-1}$	5.1E-08	2.1E-03	ug/m^3	--	ug/m^3	--
				bis(2-Ethylhexyl) Phthalate	4.6E+02	ug/kg	3.5E-06	ug/m^3	--	(ug/m^3)$^{-1}$	--	3.5E-06	ug/m^3	--	ug/m^3	--
				Endrin	2.1E+00	ug/kg	1.5E-06	ug/m^3	--	(ug/m^3)$^{-1}$	--	1.5E-06	ug/m^3	--	ug/m^3	--
				Antimony	6.0E+02	ug/kg	9.6E-07	ug/m^3	--	(ug/m^3)$^{-1}$	--	9.6E-07	ug/m^3	--	ug/m^3	--
				Arsenic	1.6E+04	ug/kg	2.6E-05	ug/m^3	4.3E-03	(ug/m^3)$^{-1}$	2.7E-08	2.6E-05	ug/m^3	--	ug/m^3	--
				Chromium, Total	2.2E+05	ug/kg	3.5E-04	ug/m^3	1.7E-03	(ug/m^3)$^{-1}$	1.5E-07	3.5E-04	ug/m^3	7.0E-01	ug/m^3	3.4E-04
			Exp. Route Total								3.0E-07					5.7E-04
		Exposure Point Total									3.0E-07					5.7E-04
	Exposure Medium Total										3.0E-07					5.7E-04
Medium Total											3.0E-07					5.7E-04
										Total of Receptor Risks Across All Media	4.7E-05				Total of Receptor Hazards Across All Media	1.7E-01

TABLE A-4

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE - OUTDOOR WORKER

Rohm and Haas Chemicals LLC

Reading, Ohio

Scenario Timeframe:	Current/Future
Receptor Population:	Outdoor Worker (maximum concentration)
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	On-site soil	1,2-Dichlorobenzene	--	--	--	--	Whole Body	2.6E-06	1.4E-04	--	1.4E-04
			1,4-Dichlorobenzene	1.7E-09	7.0E-08	--	7.2E-08	Liver	1.5E-04	3.9E-05	--	1.9E-04
			Acetone	--	--	--	--	Liver, Kidney	1.6E-05	--	--	1.6E-05
			Benzene	3.3E-11	1.9E-09	--	1.9E-09	blood	4.2E-07	2.3E-05	--	2.3E-05
			Chlorobenzene	--	--	--	--	Liver	4.5E-07	2.7E-05	--	2.8E-05
			Methylene Chloride	4.7E-12	1.4E-10	--	1.4E-10	Liver	2.9E-08	2.7E-07	--	3.0E-07
			Toluene	--	--	--	--	neuro,Liver, Kidney	2.7E-09	3.8E-07	--	3.9E-07
			Benzo(a)anthracene	1.4E-06	--	1.2E-06	2.6E-06	NA	--	--	--	--
			Benzo(a)pyrene	1.6E-05	--	1.4E-05	2.9E-05	NA	--	--	--	--
			Benzo(b)fluoranthene	1.8E-06	--	1.5E-06	3.3E-06	NA	--	--	--	--
			PCB-1254 (Arochlor 1254)	6.8E-07	5.1E-08	6.3E-07	1.4E-06	NA	4.8E-02	--	4.4E-02	9.2E-02
			bis(2-Ethylhexyl) Phthalate	2.3E-09	--	7.8E-09	1.0E-08	NA	2.3E-05	--	7.8E-05	1.0E-04
			Endrin	--	--	--	--	Liver	6.8E-06	--	2.3E-04	2.3E-04
			Antimony	--	--	--	--	blood	1.5E-03	--	--	1.5E-03
			Arsenic	8.5E-06	2.7E-08	1.7E-06	1.0E-05	Liver	5.3E-02	--	1.0E-02	6.3E-02
			Chromium, Total	--	1.5E-07	--	1.5E-07	NA	1.0E-02	3.4E-04	--	1.0E-02
			Chemical Total	2.8E-05	3.0E-07	1.9E-05	4.7E-05		1.1E-01	5.7E-04	5.5E-02	1.7E-01
		Exposure Point Total					4.7E-05					1.7E-01
	Exposure Medium Total						4.7E-05					1.7E-01
Medium Total							4.7E-05					1.7E-01
Receptor Total							4.7E-05				Receptor HI Total	1.7E-01
											Total Liver HI Across All Media =	6.4E-02
											Total Blood HI Across All Media =	1.5E-03
											Total Unknown Target Organ HI Across All	1.0E-01

INGESTION WITH COPCS IN SURFACE SOIL
OUTDOOR WORKER

NON-CARCINOGEN

Intake (mg/kg-d) = (CS x IR x CF x FI x EF x ED)/(BW x AT)
Hazard Quotient = Intake/RfD

Chemical of Concern	Maximum Soil Conc. (CS) (mg/kg)	Conversion Factor (CF) (kg/mg)	Ingestion Rate (IR) (mg/day)	Fraction Ingested (FI) (unitless)	Exposure Frequency (EF) (days/yr)	Exposure Duration (ED) (yrs)	Body Weight (BW) (kg)	Averaging Time (AT) (days)	Intake (mg/kg-d)	RfD (mg/kg-d)	Hazard Quotient
1,2-Dichlorobenzene	3.65E-01	1.00E-06	100	1	250	25	70	9125	3.57E-07	0.14	2.55E-06
1,4-Dichlorobenzene	3.65E-01	1.00E-06	100	1	250	25	70	9125	3.57E-07	0.002	1.49E-04
Acetone	1.50E+01	1.00E-06	100	1	250	25	70	9125	1.47E-05	0.9	1.63E-05
Benzene	1.70E-03	1.00E-06	100	1	250	25	70	9125	1.66E-09	0.004	4.16E-07
Chlorobenzene	9.20E-03	1.00E-06	100	1	250	25	70	9125	9.00E-09	0.02	4.50E-07
Methylene chloride	1.80E-03	1.00E-06	100	1	250	25	70	9125	1.76E-09	0.06	2.94E-08
Toluene	5.60E-04	1.00E-06	100	1	250	25	70	9125	5.48E-10	0.20	2.74E-09
Benzo(a)anthracene	5.40E+00	1.00E-06	100	1	250	25	70	9125	5.28E-06	--	--
Benzo(a)pyrene	6.20E+00	1.00E-06	100	1	250	25	70	9125	6.07E-06	--	--
Benzo(b)fluoranthene	7.00E+00	1.00E-06	100	1	250	25	70	9125	6.85E-06	--	--
Aroclor 1254	9.80E-01	1.00E-06	100	1	250	25	70	9125	9.59E-07	0.00002	4.79E-02
bis(2-Ethylhexyl) phthalate	4.60E-01	1.00E-06	100	1	250	25	70	9125	4.50E-07	0.02	2.25E-05
Endrin	2.10E-03	1.00E-06	100	1	250	25	70	9125	2.05E-09	0.0003	6.85E-06
Antimony	6.00E-01	1.00E-06	100	1	250	25	70	9125	5.87E-07	0.0004	1.47E-03
Arsenic	1.62E+01	1.00E-06	100	1	250	25	70	9125	1.59E-05	0.0003	5.28E-02
Chromium	2.17E+02	1.00E-06	100	1	250	25	70	9125	2.12E-04	0.021	1.01E-02

total hazard index= 1.13E-01

INGESTION WITH COPCS IN SURFACE SOIL
OUTDOOR WORKER

CARCINOGEN

Intake (mg/kg-d) = (CS x IR x CF x FI x EF x ED)/(BW x AT)
Cancer Risk = Intake x SF

Chemical of Concern	Maximum Soil Conc. (CS) (mg/kg)	Conversion Factor (CF) (kg/mg)	Ingestion Rate (IR) (mg/day)	Fraction Ingested (FI) (unitless)	Exposure Frequency (EF) (days/yr)	Exposure Duration (ED) (yrs)	Body Weight (BW) (kg)	Averaging Time (AT) (days)	Intake (mg/kg-d)	SF $(mg/kg\text{-}d)^{-1}$	Cancer Risk
1,2-Dichlorobenzene	3.65E-01	1.00E-06	100	1	250	25	70	25550	1.28E-07	--	--
1,4-Dichlorobenzene	3.65E-01	1.00E-06	100	1	250	25	70	25550	1.28E-07	0.013	1.66E-09
Acetone	1.50E+01	1.00E-06	100	1	250	25	70	25550	5.24E-06	--	--
Benzene	1.70E-03	1.00E-06	100	1	250	25	70	25550	5.94E-10	0.055	3.27E-11
Chlorobenzene	9.20E-03	1.00E-06	100	1	250	25	70	25550	3.21E-09	--	--
Methylene chloride	1.80E-03	1.00E-06	100	1	250	25	70	25550	6.29E-10	0.0075	4.72E-12
Toluene	5.60E-04	1.00E-06	100	1	250	25	70	25550	1.96E-10	--	--
Benzo(a)anthracene	5.40E+00	1.00E-06	100	1	250	25	70	25550	1.89E-06	0.73	1.38E-06
Benzo(a)pyrene	6.20E+00	1.00E-06	100	1	250	25	70	25550	2.17E-06	7.3	1.58E-05
Benzo(b)fluoranthene	7.00E+00	1.00E-06	100	1	250	25	70	25550	2.45E-06	0.73	1.79E-06
Aroclor 1254	9.80E-01	1.00E-06	100	1	250	25	70	25550	3.42E-07	2	6.85E-07
bis(2-Ethylhexyl) phthalate	4.60E-01	1.00E-06	100	1	250	25	70	25550	1.61E-07	0.014	2.25E-09
Endrin	2.10E-03	1.00E-06	100	1	250	25	70	25550	7.34E-10	--	--
Antimony	6.00E-01	1.00E-06	100	1	250	25	70	25550	2.10E-07	--	--
Arsenic	1.62E+01	1.00E-06	100	1	250	25	70	25550	5.66E-06	1.5	8.49E-06
Chromium	2.17E+02	1.00E-06	100	1	250	25	70	25550	7.58E-05	--	--

total Cancer Risk= 2.82E-05

DERMAL CONTACT WITH COPCS IN SURFACE SOIL
OUTDOOR WORKER

NON-CARCINOGEN

Intake= (CS x CF x AF x DAF x EF x ED x SA x EV)/(BW x AT)

Chemical of Concern	Maximum Soil Conc. (CS) (mg/kg)	Conversion Factor (CF) (kg/mg)	Adherence Factor (AF) (mg/cm^2-event)	DAF	Event Frequency (EV) (events/d)	Exposure Frequency (EF) (days/yr)	Exposure Duration (ED) (yrs)	Skin Surface Area (SA) (cm^2)	Body Weight (BW) (kg)	Averaging Time (AT) (days)	Intake (mg/kg-d)
1,2-Dichlorobenzene	3.65E-01	1.00E-06	0.2	--	1	250	25	3300	70	9125	--
1,4-Dichlorobenzene	3.65E-01	1.00E-06	0.2	--	1	250	25	3300	70	9125	--
Acetone	1.50E+01	1.00E-06	0.2	--	1	250	25	3300	70	9125	--
Benzene	1.70E-03	1.00E-06	0.2	--	1	250	25	3300	70	9125	--
Chlorobenzene	9.20E-03	1.00E-06	0.2	--	1	250	25	3300	70	9125	--
Methylene chloride	1.80E-03	1.00E-06	0.2	--	1	250	25	3300	70	9125	--
Toluene	5.60E-04	1.00E-06	0.2	--	1	250	25	3300	70	9125	--
Benzo(a)anthracene	5.40E+00	1.00E-06	0.2	0.13	1	250	25	3300	70	9125	4.53E-06
Benzo(a)pyrene	6.20E+00	1.00E-06	0.2	0.13	1	250	25	3300	70	9125	5.21E-06
Benzo(b)fluoranthene	7.00E+00	1.00E-06	0.2	0.13	1	250	25	3300	70	9125	5.88E-06
Aroclor 1254	9.80E-01	1.00E-06	0.2	0.14	1	250	25	3300	70	9125	8.86E-07
bis(2-Ethylhexyl) phthalate	4.60E-01	1.00E-06	0.2	0.1	1	250	25	3300	70	9125	2.97E-07
Endrin	2.10E-03	1.00E-06	0.2	0.1	1	250	25	3300	70	9125	1.36E-09
Antimony	6.00E-01	1.00E-06	0.2	--	1	250	25	3300	70	9125	--
Arsenic	1.62E+01	1.00E-06	0.2	0.03	1	250	25	3300	70	9125	3.14E-06
Chromium	2.17E+02	1.00E-06	0.2	--	1	250	25	3300	70	9125	--

DERMAL CONTACT WITH COPCS IN SURFACE SOIL
OUTDOOR WORKER

CARCINOGEN

Intake= (CS x CF x AF x DAF x EF x ED x SA x EV)/(BW x AT)

Chemical of Concern	Maximum Soil Conc. (CS) (mg/kg)	Conversion Factor (CF) (kg/mg)	Adherence Factor (AF) (mg/cm^2-event)	DAF	Event Frequency (EV) (events/d)	Exposure Frequency (EF) (days/yr)	Exposure Duration (ED) (yrs)	Skin Surface Area (SA) (cm^2)	Body Weight (BW) (kg)	Averaging Time (AT) (days)	Intake (mg/kg-d)
1,2-Dichlorobenzene	3.65E-01	1.00E-06	0.2	--	1	250	25	3300	70	25550	--
1,4-Dichlorobenzene	3.65E-01	1.00E-06	0.2	--	1	250	25	3300	70	25550	--
Acetone	1.50E+01	1.00E-06	0.2	--	1	250	25	3300	70	25550	--
Benzene	1.70E-03	1.00E-06	0.2	--	1	250	25	3300	70	25550	--
Chlorobenzene	9.20E-03	1.00E-06	0.2	--	1	250	25	3300	70	25550	--
Methylene chloride	1.80E-03	1.00E-06	0.2	--	1	250	25	3300	70	25550	--
Toluene	5.60E-04	1.00E-06	0.2	--	1	250	25	3300	70	25550	--
Benzo(a)anthracene	5.40E+00	1.00E-06	0.2	0.13	1	250	25	3300	70	25550	1.62E-06
Benzo(a)pyrene	6.20E+00	1.00E-06	0.2	0.13	1	250	25	3300	70	25550	1.86E-06
Benzo(b)fluoranthene	7.00E+00	1.00E-06	0.2	0.13	1	250	25	3300	70	25550	2.10E-06
Aroclor 1254	9.80E-01	1.00E-06	0.2	0.14	1	250	25	3300	70	25550	3.16E-07
bis(2-Ethylhexyl) phthalate	4.60E-01	1.00E-06	0.2	0.1	1	250	25	3300	70	25550	1.06E-07
Endrin	2.10E-03	1.00E-06	0.2	0.1	1	250	25	3300	70	25550	4.84E-10
Antimony	6.00E-01	1.00E-06	0.2	--	1	250	25	3300	70	25550	--
Arsenic	1.62E+01	1.00E-06	0.2	0.03	1	250	25	3300	70	25550	1.12E-06
Chromium	2.17E+02	1.00E-06	0.2	--	1	250	25	3300	70	25550	--

DERMAL CONTACT WITH COPCS IN SURFACE SOIL
OUTDOOR WORKER

Hazard Quotient = Intake/RfD

Chemical of Concern	Intake (mg/kg-d)	RfD (mg/kg-d)	Hazard Quotient
1,2-Dichlorobenzene	--	1.40E-01	--
1,4-Dichlorobenzene	--	2.40E-03	--
Acetone	--	0.9	--
Benzene	--	0.004	--
Chlorobenzene	--	6.20E-03	--
Methylene chloride	--	6.00E-02	--
Toluene	--	2.00E-01	--
Benzo(a)anthracene	4.53E-06	--	--
Benzo(a)pyrene	5.21E-06	--	--
Benzo(b)fluoranthene	5.88E-06	--	--
Aroclor 1254	8.86E-07	0.00002	4.43E-02
bis(2-Ethylhexyl) phthalate	2.97E-07	0.0038	7.82E-05
Endrin	1.36E-09	0.000006	2.26E-04
Antimony	--	0.00006	--
Arsenic	3.14E-06	0.0003	1.05E-02
Chromium	--	0.000273	--
		total hazard index=	5.51E-02

DERMAL CONTACT WITH COPCS IN SURFACE SOIL
OUTDOOR WORKER

Cancer Risk = Intake x SF

Chemical of Concern	Intake (mg/kg-d)	SF $(mg/kg\text{-}d)^{-1}$	Cancer Risk
1,2-Dichlorobenzene	--	--	--
1,4-Dichlorobenzene	--	0.013	--
Acetone	--	--	--
Benzene	--	0.055	--
Chlorobenzene	--	--	--
Methylene chloride	--	0.0075	--
Toluene	--	--	--
Benzo(a)anthracene	1.62E-06	0.73	1.18E-06
Benzo(a)pyrene	1.86E-06	7.3	1.36E-05
Benzo(b)fluoranthene	2.10E-06	0.73	1.53E-06
Aroclor 1254	3.16E-07	2	6.33E-07
bis(2-Ethylhexyl) phthalate	1.06E-07	7.37E-02	7.82E-09
Endrin	4.84E-10	--	--
Antimony	--	--	--
Arsenic	1.12E-06	1.5	1.68E-06
Chromium	--	--	--
		total Cancer Risk=	1.86E-05

INHALATION WITH COPCS IN SURFACE SOIL
OUTDOOR WORKER

NON-CARCINOGEN

HQ = [CS x (1/VF) x ED x ET x EF]/(RfC x AT) (organics) HQ = [CS x (1/PEF) x ED x ET x EF]/(RfC x AT) (inorganics)

Constituent of Concern	Concent. in Soil (CS) (ug/kg)	Volatilize Factor (VF) (m^3/kg)	Exposure Duration (ED) (yrs)	Fraction of EF in contact with soil (ET) (unitless)	Exposure Frequency (EF) (days/yr)	Particulate Emission Factor (PEF) (m^3/kg)	Reference Concentration (RfC) (µg/m^3)	Averaging Time (AT) (days)	Hazard Quotient
1,2-Dichlorobenzene	3.65E+02	9.10E+03	25	1	250	--	199.5	9125	1.38E-04
1,4-Dichlorobenzene	3.65E+02	8.00E+03	25	1	250	--	800	9125	3.91E-05
Acetone	1.50E+04	7.80E+03	25	1	250	--	--	9125	--
Benzene	1.70E+00	1.70E+03	25	1	250	--	30	9125	2.28E-05
Chlorobenzene	9.20E+00	3.90E+03	25	1	250	--	59.5	9125	2.72E-05
Methylene chloride	1.80E+00	1.50E+03	25	1	250	--	3010	9125	2.73E-07
Toluene	5.60E-01	2.50E+03	25	1	250	--	400	9125	3.84E-07
Benzo(a)anthracene	5.40E+03	5.80E+06	25	1	250	--	--	9125	--
Benzo(a)pyrene	6.20E+03	1.50E+07	25	1	250	--	--	9125	--
Benzo(b)fluoranthene	7.00E+03	2.90E+06	25	1	250	--	--	9125	--
Aroclor 1254	9.80E+02	4.70E+05	25	1	250	--	--	9125	--
bis(2-Ethylhexyl) phthalate	4.60E+02	1.30E+08	25	1	250	--	--	9125	--
Endrin	2.10E+00	1.40E+06	25	1	250	--	--	9125	--
Antimony	6.00E+02	--	25	1	250	6.24E+08	--	9125	--
Arsenic	1.62E+04	--	25	1	250	6.24E+08	--	9125	--
Chromium	2.17E+05	--	25	1	250	6.24E+08	0.7	9125	3.40E-04

total hazard index= 5.67E-04

INHALATION WITH COPCS IN SURFACE SOIL
OUTDOOR WORKER

CARCINOGEN

Risk = [CS x (1/VF) x ED x EF x ET x URF]/(AT) (organics)

Risk = [CS x (1/PEF) x ED x EF x ET x URF]/(AT) (inorganics)

Constituent of Concern	Concent. in Soil (CS) (ug/kg)	Volatilize Factor (VF) (m^3/kg)	Exposure Duration (ED) (yrs)	Fraction of EF in contact with soil (ET)	Exposure Frequency (EF) (days/yr)	Particulate Emission Factor (PEF) (m^3/kg)	Unit Risk Factor $(\mu g/m^3)^{-1}$	Averaging Time (AT) (days)	Cancer Risk
1,2-Dichlorobenzene	3.65E+02	9.10E+03	25	1	250	--	--	25550	--
1,4-Dichlorobenzene	3.65E+02	8.00E+03	25	1	250	--	6.285E-06	25550	7.01E-08
Acetone	1.50E+04	7.80E+03	25	1	250	--	--	25550	--
Benzene	1.70E+00	1.70E+03	25	1	250	--	0.0000078	25550	1.91E-09
Chlorobenzene	9.20E+00	3.90E+03	25	1	250	--	--	25550	--
Methylene chloride	1.80E+00	1.50E+03	25	1	250	--	4.70E-07	25550	1.38E-10
Toluene	5.60E-01	2.50E+03	25	1	250	--	--	25550	--
Benzo(a)anthracene	5.40E+03	5.80E+06	25	1	250	--	--	25550	--
Benzo(a)pyrene	6.20E+03	1.50E+07	25	1	250	--	--	25550	--
Benzo(b)fluoranthene	7.00E+03	2.90E+06	25	1	250	--	--	25550	--
Aroclor 1254	9.80E+02	4.70E+05	25	1	250	--	0.0001	25550	5.10E-08
bis(2-Ethylhexyl) phthalate	4.60E+02	1.30E+08	25	1	250	--	--	25550	--
Endrin	2.10E+00	1.40E+06	25	1	250	--	--	25550	--
Antimony	6.00E+02	--	25	1	250	6.24E+08	--	25550	--
Arsenic	1.62E+04	--	25	1	250	6.24E+08	0.0043	25550	2.73E-08
Chromium	2.17E+05	--	25	1	250	6.24E+08	0.00171	25550	1.45E-07

total Cancer Risk= 2.96E-07

ATTACHMENT B

Table B-1A
Summary of Volatile Organic Detections in
Soil Samples near the Baseball Field
Rohm and Haas Chemicals LLC
Reading, Ohio
Units: mg/kg

Sample Location	Sample Date	1,1-Dichloroethane	1,2-Dichloroethane	1,2-Dichloroethene (total)	2-Butanone	Acetone	Acrylonitrile	Benzene	Bromodichloromethane	Carbon disulfide	Chlorobenzene	Chloroform	Chloromethane	cis-1,2-Dichloroethene	Cyclohexane	Dichlorodifluoromethane	Ethylbenzene	Iodomethane	Isopropylbenzene	Methyl acetate	Methylcyclohexane	Methylene chloride	Tetrachloroethene	Toluene	Trichloroethene	Vinyl chloride	Xylenes (total)
UAW09-20-1.5'	3/27/2001	<0.0049	<0.0049	<0.0049	<0.02	<0.02	NA	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0098	<0.0025	<0.0098	<0.0049	<0.0049	NA	<0.0049	<0.0098	<0.0098	<0.0049	<0.0049	<0.0049	<0.0049	<0.0098	<0.0098
Background Soil																											
B01-1.5'	10/9/2001	<0.0046	<0.0046	<0.0046	<0.018	0.0044 J B	NA	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046	<0.0092	<0.0023	<0.0092	<0.0046	<0.0046	NA	<0.0046	<0.0092	<0.0092	<0.0046	<0.0046	<0.0046	<0.0046	<0.0092	<0.0092
B02-1.5'	10/9/2001	<0.0046	<0.0046	<0.0046	<0.018	0.0044 J B	NA	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046	<0.0092	<0.0023	<0.0092	<0.0046	<0.0046	NA	<0.0046	<0.0092	<0.0092	<0.0046	<0.0046	<0.0046	<0.0046	<0.0092	<0.0092
B03-1.5'	10/9/2001	<0.0048	<0.0048	<0.0048	<0.019	0.004 J B	NA	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048	<0.0096	<0.0024	<0.0096	<0.0048	<0.0048	NA	<0.0048	<0.0096	<0.0096	<0.0048	<0.0048	<0.0048	<0.0048	<0.0096	<0.0096
B04-1.5'	10/9/2001	<0.0054	<0.0054	<0.0054	<0.022	0.0044 J B	NA	<0.0054	<0.0054	<0.0054	<0.0054	<0.0054	<0.011	<0.0027	<0.011	<0.0054	<0.0054	NA	<0.0054	<0.011	<0.011	<0.0054	<0.0054	<0.0054	<0.0054	<0.011	<0.011
B04-1.5' (Dup)	10/9/2001	<0.0055	<0.0055	<0.0055	<0.022	0.005 J B	NA	<0.0055	<0.0055	<0.0055	<0.0055	<0.0055	<0.011	<0.0027	<0.011	<0.0055	<0.0055	NA	<0.0055	<0.011	<0.011	<0.0055	<0.0055	<0.0055	<0.0055	<0.011	<0.011
B05-1.5'	10/9/2001	<0.0046	<0.0046	<0.0046	<0.018	0.0039 J B	NA	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046	<0.0092	<0.0023	<0.0092	<0.0046	<0.0046	NA	<0.0046	<0.0092	<0.0092	<0.0046	<0.0046	<0.0046	<0.0046	<0.0092	<0.0092

Notes:
J = Estimated result: result is less than reporting limit.
B = Method blank contamination. The associated method blank contains the target analyte at a reportable level.
This table only includes target analytes detected in one or more Facility Investigation samples.

NA = The data qualifier [illegible] was not an [illegible] qualifier.
<RL = The new qualifier for reporting [illegible] data below the [illegible] limit.

* = Indicates that Environmental Standards qualified the data as a "non-detect" as part of the IDW data validation. The analyte was detected in a field and/or laboratory blank at a similar level.
The only validation qualifiers that have been annotated into the summary tables are qualifications of detected compounds. Please refer to Appendix D of the Supplemental RI for excerpts from the Quality Assurance Review (Environmental Standards, 2004) and to review this qualification of "non-detect" results.
E = Detection exceeded laboratory calibration range.

Table B-1B
Summary of Semivolatile Organic Detections in
Soil Samples near the Baseball Fields
Rohm and Haas Chemicals LLC
Reading, Ohio
Units: mg/kg

Sample Location	Sample Date	1,1'-Biphenyl	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	2,4-Dimethylphenol	2-Methylnaphthalene	2-Methylphenol	3-Methylphenol	4-Methylphenol	Acenaphthene	Acenaphthylene	Acetophenone	Aniline	Anthracene	Benzaldehyde	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(ghi)perylene	Benzo(k)fluoranthene	bis(2-Ethylhexyl) phthalat	Carbazole	Chrysene	Dibenz(a,h)anthracene	Dibenzofuran	Diethyl phthalate	Di-n-octyl phthalate	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Phenol	Pyrene
UAW09-20-1.5'	3/27/2001	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	NA	<0.39	<0.39	<0.39	<0.39	NA	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39	<0.39
Background Soil																																			
B01-1.5'	10/9/2001	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	NA	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37
B02-1.5'	10/9/2001	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	NA	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38
B03-1.5'	10/9/2001	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	NA	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38	<0.38
B04-1.5'	10/9/2001	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	NA	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	0.06 J	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35
B04-1.5' (Dup)	10/9/2001	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	NA	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	0.063 J	0.076 J	0.1 J	0.072 J	<0.35	<0.35	<0.35	0.082 J	<0.35	<0.35	<0.35	<0.35	0.15 J	<0.35	<0.35	<0.35	0.096 J	<0.35	0.14 J
B05-1.5'	10/9/2001	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	NA	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37	<0.37

Notes:
J = Estimated result; result is less than reporting limit.
# = Co-Elution of 3-Methylphenol and 4-Methylphenol.
This table only includes target analytes detected in one or more Facility Investigation samples.

NA = Indicates compound was not in the target analyte list for that sample.
<0.# = Indicates compound not detected at or above indicated detection limit.

* = Indicates that Environmental Standards qualified the data as a "non-detect" as part of the 10% data validation. The analyte was detected in a field and/or laboratory blank at a similar level.
The only validation qualifiers that have been annotated into the summary tables are qualifications of detected compounds. Please refer to Appendix D of the Supplemental RI for excerpts from the Quality Assurance Review (Environmental Standards, 2004) and to review data qualification of "non-detect" results.

Table B-1C
Summary of Pesticide and Polychlorinated Biphenyl Detections in Soil Samples near the Baseball Fields
Rohm and Haas Chemicals LLC
Reading, Ohio
Units: mg/kg

Sample Location	Sample Date	4,4'-DDD	4,4'-DDE	4,4'-DDT	Aldrin	alpha-BHC	beta-BHC	gamma-BHC (Lindan	alpha-Chlordane	gamma-Chlordane	Chlorobenzilate	Diallate	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan sulfate	Endrin	Endrin aldehyde	Endrin ketone	Heptachlor	Heptachlor epoxide	Isodrin	Methoxychlor	Aroclor 1016	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260
UAW09-20-1.5'	3/27/2001	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	NA	NA	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	NA	<0.0039	<0.039	<0.039	<0.039	<0.039	<0.039
Background Soil																												
B01-1.5'	10/9/2001	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	NA	NA	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0037	<0.0037	<0.037	<0.037	<0.037	<0.037	<0.037
B02-1.5'	10/9/2001	<0.0039	<0.0039	<0.0039	<0.0039	<0.0039	<0.0039	<0.0039	<0.0039	<0.0039	NA	NA	<0.0039	<0.0039	<0.0039	<0.0039	<0.0039	<0.0039	<0.0039	<0.0039	<0.0039	<0.0076	<0.0076	<0.038	<0.038	<0.038	<0.038	<0.038
B03-1.5'	10/9/2001	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	NA	NA	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0038	<0.0038	<0.038	<0.038	<0.038	<0.038	<0.038
B04-1.5'	10/9/2001	<0.0036	<0.0036	<0.0036	<0.0036	<0.0036	<0.0036	<0.0036	<0.0036	<0.0036	NA	NA	<0.0036	<0.0036	<0.0036	<0.0036	<0.0036	<0.0036	<0.0036	<0.0036	<0.0036	<0.0071	<0.0071	<0.035	<0.035	<0.035	<0.035	<0.035
B04-1.5' (Dup)	10/9/2001	<0.0036	<0.0036	<0.0036	<0.0036	<0.0036	<0.0036	<0.0036	<0.0036	<0.0036	NA	NA	<0.0036	<0.0036	<0.0036	<0.0036	<0.0036	<0.0036	<0.0036	<0.0036	<0.0036	<0.0071	<0.0071	<0.035	<0.035	<0.035	<0.035	<0.035
B05-1.5'	10/9/2001	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	NA	NA	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0037	<0.0037	<0.037	<0.037	<0.037	<0.037	<0.037

Notes:
J = Estimated result; result is less than reporting limit
PG = The percentage difference between the original and confirmation analyses is greater than 40%
This table only includes target analytes detected in one or more Facility Investigation samples.

NA = Indicates chemical was not an the target analyte list for that sample
<0.02 = Indicates constituent not detected at or above indicated detection limit

Table B-1D
Summary of Inorganic Detections in
Soil Samples near the Baseball Fields
Rohm and Haas Chemicals LLC
Reading, Ohio
Units: mg/kg

Sample Location	Sample Date	Acid-insoluble Sulfide	Acid-Soluble Sulfide	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide, Total	Iron	Lead	Magnesium	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Tin	Vanadium	Zinc
UAW09-20-1.5'	3/27/2001	<58	NA	6280	<1.2	5.8	45.7	0.19 B	<0.23	1530	8.5	6.7	7.8	<0.58	11300	10.6	1260	516	0.013 B	9	572 B	0.51 B	<0.58	<584	<1.2	NA	16.8	35.9 MBD
Background Soil																												
B01-1.5'	10/9/2001	NA	<56	9620	<1.1	7.4	47.4 J	0.26 B	0.19 B	1210 L	10.1	7.1 L	12.5	<0.56	15600	9.5	1680	424 J	0.026 B	12.5 L	655	<0.56	<0.56	<556	<1.1	0.88 B J	20	39 L
B02-1.5'	10/9/2001	NA	79	10800	<1.1	8.4	58.7 J	0.37 B	0.21 B	1720	11.8	6.7	13.3	<0.57	17200	10.1	1840	379 J	0.027 B	13.2	688	<0.57	<0.57	<569	<1.1	0.79 B J	21.9	42
B03-1.5'	10/9/2001	NA	79	10800	<1.1	5.1	68 J	0.5 B	0.27	3870	12.2	8	13.4	<0.57	18700	11.1	2380	589 J	0.026 B	15.1	976	<0.57	<0.57	<569	<1.1	0.9 B J	18.3	41.1
B04-1.5'	10/9/2001	NA	<54	1870	<1.1	4	9.8 B J	<0.54	0.16 B	86600	3.7	2.8 B	7.3	<0.54	5760	4.1	31100	191 J	0.0098 B	6.5	368 B	<0.54	<0.54	69.2 B	1.5	0.93 B J	6.2	22.3
B04-1.5' (Dup)	10/9/2001	NA	<53	2200	<1.1	3.7	11.4 B J	<0.53	0.16 B	97000	3.7	2.9 B	6.8	<0.53	5980	4.3	36200	198 J	<0.11	6.2	387 B	<0.53	<0.53	66.6 B	1.2	0.97 B J	6.7	21.6
B05-1.5'	10/9/2001	NA	<56	13000	<1.1	10	66.1 J	0.46 B	0.22 B	2370	15.7	8	15.6	<0.56	19800	11.4	2090	393 J	0.03 B	14.9	660	<0.56	<0.56	<565	<1.1	0.82 B J	23.9	51.4

Notes:
B = Estimated result; result is less than reporting limit.
E = Matrix Interference.
J = Method blank contamination. The associated method blank contains the target analyte at a reportable level.
L = Serial dilution of a digestate in the analytical batch indicates that physical and chemical interferences are present.
MBD = This analyte is present in the associated method blank at an amount that is less than two times the reporting limit.
MBB = This analyte is present at a reportable level in the associated method blank but is less than 5% of the sample amount.
This table only includes target analytes detected in one or more Facility Investigation samples.

NA = Indicates chemical was not on the target analyte list for that sample.
<1.1 = Indicates constituent not detected at or above indicated detection limit.
* = Indicates that Environmental Standards qualified the data as a "non-detect" as part of the 10% data validation. The analyte was detected in a field and/or laboratory blank at a similar level.
The only validation qualifiers that have been annotated into the summary tables are qualifications of detected compounds.

TABLE B-2

EXPOSURE POINT CONCENTRATION SUMMARY

SOIL

Rohm and Haas Chemicals LLC

Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Soil (off-site)
Exposure Medium:	Soil, Ambient Air

Exposure Point	Chemical of Potential Concern	Units	Detected Maximum Concentration (Qualifier)	Screening Toxicity Value	Selection as COPC	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
Off-site Soil (<2 feet)	Acetone	mg/kg	0.005 J B	1.60E+01	No	NA	mg/kg	NA	NA
	Benzo(a)anthracene	mg/kg	0.063 J	0.62	No	NA	mg/kg	NA	NA
	Benzo(a)pyrene	mg/kg	0.076 J	0.062	Yes	7.60E-02	mg/kg	max.	Samples are limited
	Benzo(b)fluoranthene	mg/kg	0.1 J	0.62	No	NA	mg/kg	NA	NA
	Benzo(ghi)perylene*	mg/kg	0.072 J	2300	No	NA	mg/kg	NA	NA
	bis(2-Ethylhexyl) phthalate	mg/kg	0.06 J	35	No	NA	mg/kg	NA	NA
	Chrysene	mg/kg	0.082 J	62	No	NA	mg/kg	NA	NA
	Fluoranthene	mg/kg	0.15 J	2300	No	NA	mg/kg	NA	NA
	Phenanthrene*	mg/kg	0.096 J	12000	No	NA	mg/kg	NA	NA
	Pyrene	mg/kg	0.14 J	2300	No	NA	mg/kg	NA	NA
	Aluminum	mg/kg	13000	76000	No	NA	mg/kg	NA	NA
	Arsenic	mg/kg	10	0.39	Yes	1.00E+01	mg/kg	max.	Samples are limited
	Barium	mg/kg	68	1600	No	NA	mg/kg	NA	NA
	Beryllium	mg/kg	0.5	63	No	NA	mg/kg	NA	NA
	Cadmium	mg/kg	0.27	8	No	NA	mg/kg	NA	NA
	Calcium	mg/kg	97000	NA	No	NA	mg/kg	NA	NA
	Chromium	mg/kg	15.7	38	No	NA	mg/kg	NA	NA
	Cobalt	mg/kg	8	900	No	NA	mg/kg	NA	NA
	Copper	mg/kg	15.6	3100	No	NA	mg/kg	NA	NA
	Iron	mg/kg	19800	23000	No	NA	mg/kg	NA	NA
	Lead	mg/kg	11.4	400	No	NA	mg/kg	NA	NA
	Magnesium	mg/kg	36200	NA	No	NA	mg/kg	NA	NA
	Manganese	mg/kg	589	1800	No	NA	mg/kg	NA	NA
	Mercury	mg/kg	0.03	23	No	NA	mg/kg	NA	NA
	Nickel	mg/kg	15.1	130	No	NA	mg/kg	NA	NA

TABLE B-2

EXPOSURE POINT CONCENTRATION SUMMARY

SOIL

Rohm and Haas Chemicals LLC

Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Soil (off-site)
Exposure Medium:	Soil, Ambient Air

Exposure Point	Chemical of Potential Concern	Units	Detected Maximum Concentration (Qualifier)	Screening Toxicity Value	Selection as COPC	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
	Potassium	mg/kg	976	NA	No	NA	mg/kg	NA	NA
	Selenium	mg/kg	0.51	5	No	NA	mg/kg	NA	NA
	Thallium	mg/kg	1.5	5.2	No	NA	mg/kg	NA	NA
	Tin	mg/kg	0.97	47000	No	NA	mg/kg	NA	NA
	Vanadium	mg/kg	23.9	78	No	NA	mg/kg	NA	NA
	Zinc	mg/kg	51.4	12000	No	NA	mg/kg	NA	NA

NA - not applicable

max. - maximum concentration

* fluoranthene is used as a surrogate for benzo(ghi)perylene; and anthracene is used as a surrogate for phenanthrene.

TABLE B-3A

VALUES USED FOR DAILY INTAKE CALCULATIONS

SOIL - OUTDOOR WORKER

Rohm and Haas Chemicals LLC

Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Recreational Receptor	Child 6-13	Off-site surface soil	CS	Chemical Concentration in Soil	see Table B-2	mg/kg.	see Table B-2	Chronic Daily Intake(CDI) (mg/kg-d) = (CS x IR x CF x FI x EF x ED)/(BW x AT)
				IR	Soil Ingestion Rate	200	mg/day	Default child soil ingestion rate/EPA, 2001	
				CF	Conversion Factor	1.00E-06	kg/mg	Unit conversion factor/EPA, 1989	
				FI	Fraction Ingested	1	unitless	Conservatively assume 100 % of daily soil ingestion occurs on-site.	
				EF	Exposure Frequency	64	days/year	Assume 2 days/week for 8 months between April to November baseball season.	
				ED	Exposure Duration	8	years	Age 6-13	
				BW	Body Weight	35	kg	Calculated average body weight for child age 6-13 (USEPA Exposure Factors Handbook, 1997, Table 7-3)	
				AT-C	Averaging Time -Cancer	25550	days	Conventional human lifespan (exposure averaged over lifespan)/EPA, 1991 and 2001	
				AT-N	Averaging Time-Non-Cancer	2920	days	Average over the exposure duration	
Dermal Contact	Recreational Receptor	Child 6-13	Off-site surface soil	CS	Chemical Concentration in Soil	see Table B-2	mg/kg	see Table B-2	Dermal Absorbed Dose (DAD) (mg/kg-d) = (DAevent x EV x EF x ED x SA)/(BW x AT) where Absorbed Dose per Event (DA event) (mg/cm^2-event) = (CS x CF) x AF x ABS
				CF	Conversion Factor	1.00E-06	kg/mg	Unit conversion factor/EPA, 1989	
				AF	Soil to Skin Adherence Factor	0.3	mg/cm^2	EPA, 2004	
				ABS	Dermal Absorption Factor	chemical-specific	unitless	EPA, 2004	
				SA	Skin Surface Area	2626	cm^2	Calculated for child age 6-13 (EPA, 2004, Exhibit C-1).	
				EV	Event Frequency	1	events/day	EPA, 2004	
				EF	Exposure Frequency	64	days/year	Assume 2 days/week for 8 months between April to November baseball season.	
				ED	Exposure Duration	8	years	Age 6-13	
				BW	Body Weight	35	kg	Calculated average body weight for child age 6-13 (USEPA Exposure Factors Handbook, 1997, Table 7-3)	
				AT-C	Averaging Time -Cancer	25550	days	Conventional human lifespan (exposure averaged over lifespan)/EPA, 1991 and 2001	
				AT-N	Averaging Time-Non-Cancer	2920	days	Average over the exposure duration	

USEPA, 1989a: Risk Assessment Guidance for Superfund. v.1: Human Health Evaluation Manual (Part A).

USEPA, 1991b: Risk Assessment Guidance for Superfund. v.1: Human Health Evaluation Manual. Supplemental Guidance, "Standard Default Exposure Factors". OERR. OSWER 9285.6-03.

USEPA, 2001d: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, March.

USEPA, 2004a: Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual, Part E, Supplemental Guidance Dermal Risk Assessment, Final, July 2004.

TABLE B-3B

VALUES USED FOR DAILY INTAKE CALCULATIONS
SOIL TO AMBIENT AIR - OUTDOOR WORKER
Rohm and Haas Chemicals LLC
Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Ambient air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Recreational Receptor	Child 6-13	Surface soil	CA	Chemical Concentration In Air	calculated	ug/m^3	calculated	Risk = [CA x EF x ED x ET x URF]/(AT-C)
				CS	Chemical Concentration In Soil	see Table B-2	mg/kg	see Table B-2	HQ = (CA x EF x ED x ET)/(RfC x AT-N)
				EF	Exposure Frequency	64	days/year	Assume 2 days/week for 8 months between April to November baseball season.	CA = (1/VF) x CS (organics); CA=(1/PEF) x CS (inorganics)
				ED	Exposure Duration	8	years	Age 6-13	$VF = Q/C \times [(3.1416 \times Da \times T)^{1/2}]/[2 \times \rho b \times Da] \times (10^{-4}\ m^2/cm^2)$
				ET	Fraction of EF in Contact with Soil	1	Unitless	professional Judgement	$PEF=Q/C \times (3600)/(0.036 \times (1-V) \times (Um/Ut)^3 \times F(x))$
				AT-C	Averaging Time -Cancer	25550	days	Conventional human lifespan (exposure averaged over lifespan)/EPA, 1991 and 2001	See Appendix J for definitions and input values of Q/C, Da, T, ρb, V, Um, Ut and F(x).
				AT-N	Averaging Time-Non-Cancer	2920	days	Average over the exposure duration	
				URF	Inhalation Unit Risk Factor	chemical-specific	$(ug/m^3)^{-1}$	see Table 6.2	
				RfC	Inhalation Reference Concentration	chemical-specific	ug/m^3	see Table 5.2	
				VF	Volatilization Factor	calculated	m^3/kg	see Appendix J	
				PEF	Particulate Emission Factor	calculated	m^3/kg	see Appendix J	

USEPA, 1991b: Risk Assessment Guidance for Superfund. v.1: Human Health Evaluation Manual. Supplemental Guidance, "Standard Default Exposure Factors". OERR. OSWER 9285.6-03.
USEPA, 1996b: Soil Screening Guidance: User's Guide. OSWER. Pub 9355.4-23.
USEPA, 2001d: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, March.

TABLE B-4A

VALUES USED FOR DAILY INTAKE CALCULATIONS
SOIL - OUTDOOR WORKER
Rohm and Haas Chemicals LLC
Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Recreational Receptor	Child 13-17	Off-site surface soil	CS	Chemical Concentration in Soil	see Table B-2	mg/kg	see Table B-2	Chronic Daily Intake(CDI) (mg/kg-d) = (CS x IR x CF x FI x EF x ED)/(BW x AT)
				IR	Soil Ingestion Rate	200	mg/day	Default child soil ingestion rate/EPA, 2001	
				CF	Conversion Factor	1.00E-06	kg/mg	Unit conversion factor/EPA, 1989	
				FI	Fraction Ingested	1	unitless	Conservatively assume 100 % of daily soil ingestion occurs on-site.	
				EF	Exposure Frequency	96	days/year	Assume 3 days/week for 8 months between April to November baseball season.	
				ED	Exposure Duration	5	years	Age 13-17	
				BW	Body Weight	58.1	kg	Calculated average body weight for child age 13-17 (USEPA Exposure Factors Handbook, 1997, Table 7-3)	
				AT-C	Averaging Time -Cancer	25550	days	Conventional human lifespan (exposure averaged over lifespan)/EPA, 1991 and 2001	
				AT-N	Averaging Time-Non-Cancer	1825	days	Average over the exposure duration	
Dermal Contact	Recreational Receptor	Child 13-17	Off-site surface soil	CS	Chemical Concentration in Soil	see Table B-2	mg/kg	see Table B-2	Dermal Absorbed Dose (DAD) (mg/kg-d) = (DAevent x EV x EF x ED x SA)/(BW x AT) where Absorbed Dose per Event (DA event) (mg/cm²-event) = (CS x CF) x AF x ABS
				CF	Conversion Factor	1.00E-06	kg/mg	Unit conversion factor/EPA, 1989	
				AF	Soil to Skin Adherence Factor	0.3	mg/cm²	EPA, 2004	
				ABS	Dermal Absorption Factor	chemical-specific	unitless	EPA, 2004	
				SA	Skin Surface Area	4003	cm²	Calculated for child age 13-17 (EPA, 2004, Exhibit C-1).	
				EV	Event Frequency	1	events/day	EPA, 2004	
				EF	Exposure Frequency	96	days/year	Assume 3 days/week for 8 months between April to November baseball season.	
				ED	Exposure Duration	5	years	Age 13-17	
				BW	Body Weight	58.1	kg	Calculated average body weight for child age 13-17 (USEPA Exposure Factors Handbook, 1997, Table 7-3)	
				AT-C	Averaging Time -Cancer	25550	days	Conventional human lifespan (exposure averaged over lifespan)/EPA, 1991 and 2001	
				AT-N	Averaging Time-Non-Cancer	1825	days	Average over the exposure duration	

USEPA, 1989a: Risk Assessment Guidance for Superfund. v.1: Human Health Evaluation Manual (Part A).
USEPA, 1991b: Risk Assessment Guidance for Superfund. v.1: Human Health Evaluation Manual. Supplemental Guidance, "Standard Default Exposure Factors". OERR. OSWER 9285.6-03.
USEPA, 2001d: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, March.
USEPA, 2004a: Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual, Part E, Supplemental Guidance Dermal Risk Assessment, Final, July 2004.

TABLE B-4B

VALUES USED FOR DAILY INTAKE CALCULATIONS

SOIL TO AMBIENT AIR - OUTDOOR WORKER

Rohm and Haas Chemicals LLC

Reading, Ohio

Scenario Timeframe:	Current/Future
Medium:	Soil
Exposure Medium:	Ambient air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Recreational Receptor	Child 13-17	Surface soil	CA	Chemical Concentration in Air	calculated	ug/m^3	calculated	Risk = [CA x EF x ED x ET x URF]/(AT-C)
				CS	Chemical Concentration in Soil	see Table B-2	mg/kg	see Table B-2	HQ = (CA x EF x ED x ET)/(RfC x AT-N)
				EF	Exposure Frequency	96	days/year	Assume 3 days/week for 8 months between April to November baseball season.	CA = (1/VF) x CS (organics); CA=(1/PEF) x CS (inorganics)
				ED	Exposure Duration	5	years	Age 13-17	$VF = Q/C \times [(3.1416 \times Da \times T)^{1/2}]/[2 \times \rho b \times Da] \times (10^{-4}\ m^2/cm^2)$
				ET	Fraction of EF in Contact with Soil	1	Unitless	professional Judgement	$PEF=Q/C \times (3600)/(0.036 \times (1-V) \times (Um/Ut)^3 \times F(x))$
				AT-C	Averaging Time -Cancer	25550	days	Conventional human lifespan (exposure averaged over lifespan)/EPA, 1991 and 2001	See Appendix J for definitions and input values of Q/C, Da, T, ρb, V, Um, Ut and F(x).
				AT-N	Averaging Time-Non-Cancer	1825	days	Average over the exposure duration	
				URF	Inhalation Unit Risk Factor	chemical-specific	$(ug/m^3)^{-1}$	see Table 6.2	
				RfC	Inhalation Reference Concentration	chemical-specific	ug/m^3	see Table 5.2	
				VF	Volatilization Factor	calculated	m^3/kg	see Appendix J	
				PEF	Particulate Emission Factor	calculated	m^3/kg	see Appendix J	

USEPA, 1991b: Risk Assessment Guidance for Superfund. v.1: Human Health Evaluation Manual. Supplemental Guidance, "Standard Default Exposure Factors". OERR. OSWER 9285.6-03.

USEPA, 1996b: Soil Screening Guidance: User's Guide. OSWER. Pub 9355.4-23.

USEPA, 2001d: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, March.

TABLE B-5

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE - OUTDOOR WORKER

Rohm and Haas Chemicals LLC

Reading, Ohio

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational Receptor (Outdoor)
Receptor Age:	Child Age 6-13

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC (maximum) Value	EPC (maximum) Units	Cancer Risk Calculations: Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Non-Cancer Hazard Calculations: Intake/Exposure Concentration		RfD/RfC		Hazard
Soil	Soil	Off-site soil	Ingestion	Benzo(a)pyrene	7.60E-02	mg/kg	8.70E-09	mg/kg-d	7.30E+00	$(mg/kg\text{-}d)^{-1}$	6.4E-08	7.6E-08	mg/kg-d	--	mg/kg-d	--
				Arsenic	1.00E+01	mg/kg	1.1E-06	mg/kg-d	1.5E+00	$(mg/kg\text{-}d)^{-1}$	1.7E-06	1.00E-05	mg/kg-d	3.00E-04	mg/kg-d	3.3E-02
			Exp. Route Total								1.8E-06					3.3E-02
		Exposure Point Total									1.8E-06					3.3E-02
	Exposure Medium Total										1.8E-06					3.3E-02
Medium Total											1.8E-06					3.3E-02
Soil	Soil	Off-site soil	Dermal Contact	Benzo(a)pyrene	7.60E-02	mg/kg	1.0E-09	mg/kg-d	7.3E+00	$(mg/kg\text{-}d)^{-1}$	7.5E-09	9.0E-09	mg/kg-d	--	mg/kg-d	--
				Arsenic	1.00E+01	mg/kg	1.4E-07	mg/kg-d	1.5E+00	$(mg/kg\text{-}d)^{-1}$	2.0E-07	1.2E-06	mg/kg-d	3.0E-04	mg/kg-d	3.9E-03
			Exp. Route Total								2.1E-07					3.9E-03
		Exposure Point Total									2.1E-07					3.9E-03
	Exposure Medium Total										2.1E-07					3.9E-03
Medium Total											2.1E-07					3.9E-03
Soil	Soil	Off-site soil	Inhalation	benzo(a)pyrene	7.6E+02	ug/kg	4.2E-06	ug/m^2	--	$(ug/m^3)^{-1}$	--	4.2E-06	ug/m^3	--	ug/m^3	--
				Arsenic	1.0E+04	ug/kg	1.4E-05	ug/m^3	4.3E-03	$(ug/m^3)^{-1}$	1.2E-09	1.4E-05	ug/m^3	--	ug/m^3	--
			Exp. Route Total								1.2E-09					0.0E+00
		Exposure Point Total									1.2E-09					0.0E+00
	Exposure Medium Total										1.2E-09					0.0E+00
Medium Total											1.2E-09					0.0E+00
										Total of Receptor Risks Across All Media	2.0E-06				Total of Receptor Hazards Across All Media	3.7E-02

TABLE B-6

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE - OUTDOOR WORKER

Rohm and Haas Chemicals LLC

Reading, Ohio

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational Receptor (Outdoor)
Receptor Age:	Child Age 13-17

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC (maximum) Value	EPC (maximum) Units	Cancer Risk Calculations: Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Non-Cancer Hazard Calculations: Intake/Exposure Concentration		RfD/RfC		Hazard
Soil	Soil	Off-site soil	Ingestion	Benzo(a)pyrene	7.60E-02	mg/kg	4.90E-09	mg/kg-d	7.30E+00	$(mg/kg\text{-}d)^{-1}$	3.6E-08	6.9E-08	mg/kg-d	–	mg/kg-d	–
				Arsenic	1.00E+01	mg/kg	6.5E-07	mg/kg-d	1.5E+00	$(mg/kg\text{-}d)^{-1}$	9.7E-07	9.05E-06	mg/kg-d	3.00E-04	mg/kg-d	3.0E-02
			Exp. Route Total								1.0E-06					3.0E-02
		Exposure Point Total									1.0E-06					3.0E-02
	Exposure Medium Total										1.0E-06					3.0E-02
Medium Total											1.0E-06					3.0E-02
Soil	Soil	Off-site soil	Dermal Contact	Benzo(a)pyrene	7.60E-02	mg/kg	8.9E-10	mg/kg-d	7.3E+00	$(mg/kg\text{-}d)^{-1}$	6.5E-09	1.2E-08	mg/kg-d	–	mg/kg-d	–
				Arsenic	1.00E+01	mg/kg	1.2E-07	mg/kg-d	1.5E+00	$(mg/kg\text{-}d)^{-1}$	1.7E-07	1.6E-06	mg/kg-d	3.0E-04	mg/kg-d	5.4E-03
			Exp. Route Total								1.8E-07					5.4E-03
		Exposure Point Total									1.8E-07					5.4E-03
	Exposure Medium Total										1.8E-07					5.4E-03
Medium Total											1.8E-07					5.4E-03
Soil	Soil	Off-site soil	Inhalation	benzo(a)pyrene	7.6E+02	ug/kg	4.2E-06	ug/m^2	–	$(ug/m^3)^{-1}$	–	4.2E-06	ug/m^3	–	ug/m^3	–
				Arsenic	1.0E+04	ug/kg	1.4E-05	ug/m^3	4.3E-03	$(ug/m^3)^{-1}$	1.1E-09	1.4E-05	ug/m^3	–	ug/m^3	–
			Exp. Route Total								1.1E-09					0.0E+00
		Exposure Point Total									1.1E-09					0.0E+00
	Exposure Medium Total										1.1E-09					0.0E+00
Medium Total											1.1E-09					0.0E+00
										Total of Receptor Risks Across All Media	1.2E-06				Total of Receptor Hazards Across All Media	3.6E-02

TABLE B-7

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE - OUTDOOR WORKER

Rohm and Haas Chemicals LLC

Reading, Ohio

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational Receptor
Receptor Age:	Child (Age 6-13)

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Off-site soil	Benzo(a)pyrene	6.4E-08	--	7.5E-09	7.2E-08	NA	--	--	--	--
			Arsenic	1.7E-06	1.2E-09	2.0E-07	1.9E-06	Liver	3.3E-02	--	3.9E-03	3.7E-02
			Chemical Total	1.7E-06	1.2E-09	2.0E-07	2.0E-06		3.3E-02	0.0E+00	3.9E-03	3.7E-02
		Exposure Point Total					2.0E-06					3.7E-02
	Exposure Medium Total						2.0E-06					3.7E-02
Medium Total							2.0E-06					3.7E-02
											Receptor HI Total	3.7E-02
Receptor Total							2.0E-06				Total Liver HI Across All Media =	3.7E-02

TABLE B-8

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE - OUTDOOR WORKER

Rohm and Haas Chemicals LLC

Reading, Ohio

Scenario Timeframe:	Current/Future
Receptor Population:	Recreational Receptor
Receptor Age:	Child (Age 13-17)

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Off-site soil	Benzo(a)pyrene	3.6E-08	--	6.5E-09	4.3E-08	NA	--	--	--	--
			Arsenic	9.7E-07	1.1E-09	1.7E-07	1.1E-06	Liver	3.0E-02	--	5.4E-03	3.6E-02
			Chemical Total	9.7E-07	1.1E-09	1.7E-07	1.2E-06		3.0E-02	0.0E+00	5.4E-03	3.6E-02
		Exposure Point Total					1.2E-06					3.6E-02
	Exposure Medium Total						1.2E-06					3.6E-02
Medium Total							1.2E-06					3.6E-02
											Receptor HI Total	3.6E-02
Receptor Total							1.2E-06				Total Liver HI Across All Media =	3.6E-02

INGESTION WITH COPCS IN SURFACE SOIL
RECREATIONAL RECEPTOR (AGE 6-13)

NON-CARCINOGEN

Intake (mg/kg-d) = (CS x IR x CF x FI x EF x ED)/(BW x AT)
Hazard Quotient = Intake/RfD

Chemical of Concern	Maximum Soil Conc. (CS) (mg/kg)	Conversion Factor (CF) (kg/mg)	Ingestion Rate (IR) (mg/day)	Fraction Ingested (FI) (unitless)	Exposure Frequency (EF) (days/yr)	Exposure Duration (ED) (yrs)	Body Weight (BW) (kg)	Averaging Time (AT) (days)	Intake (mg/kg-d)	RfD (mg/kg-d)	Hazard Quotient
Benzo(a)pyrene	0.076	1.00E-06	200	1	64	8	35	2920	7.61E-08	--	--
Arsenic	1.00E+01	1.00E-06	200	1	64	8	35	2920	1.00E-05	0.0003	3.3E-02
										total hazard index=	3.3E-02

CARCINOGEN

Intake (mg/kg-d) = (CS x IR x CF x FI x EF x ED)/(BW x AT)
Cancer Risk = Intake x SF

Chemical of Concern	Maximum Soil Conc. (CS) (mg/kg)	Conversion Factor (CF) (kg/mg)	Ingestion Rate (IR) (mg/day)	Fraction Ingested (FI) (unitless)	Exposure Frequency (EF) (days/yr)	Exposure Duration (ED) (yrs)	Body Weight (BW) (kg)	Averaging Time (AT) (days)	Intake (mg/kg-d)	SF $(mg/kg\text{-}d)^{-1}$	Cancer Risk
Benzo(a)pyrene	0.076	1.00E-06	200	1	64	8	35	25550	8.70E-09	7.3	6.4E-08
Arsenic	1.00E+01	1.00E-06	200	1	64	8	35	25550	1.15E-06	1.5	1.7E-06
										total Cancer Risk=	1.8E-06

INHALATION WITH COPCS IN SURFACE SOIL
RECREATIONAL RECEPTOR (AGE 6-13)

NON-CARCINOGEN

HQ = [CS x (1/VF) x ED x ET x EF]/(RfC x AT) (organics) HQ = [CS x (1/PEF) x ED x ET x EF]/(RfC x AT) (inorganics)

Constituent of Concern	Concent. in Soil (CS) (ug/kg)	Volatilize Factor (VF) (m^3/kg)	Exposure Duration (ED) (yrs)	Fraction of EF in contact with soil (ET) (unitless)	Exposure Frequency (EF) (days/yr)	Particulate Emission Factor (PEF) (m^3/kg)	Reference Concentration (RfC) (µg/m^3)	Averaging Time (AT) (days)	Hazard Quotient
Benzo(a)pyrene	76	1.8E+07	8	1	64	--	--	2920	--
Arsenic	1.00E+04	--	8	1	64	7.3E+08	--	2920	--
								total hazard index=	0.00E+00

CARCINOGEN

Risk = [CS x (1/VF) x ED x EF x ET x URF]/(AT) (organics) Risk = [CS x (1/PEF) x ED x EF x ET x URF]/(AT) (inorganics)

Constituent of Concern	Concent. in Soil (CS) (ug/kg)	Volatilize Factor (VF) (m^3/kg)	Exposure Duration (ED) (yrs)	Fraction of EF in contact with soil (ET)	Exposure Frequency (EF) (days/yr)	Particulate Emission Factor (PEF) (m^3/kg)	Unit Risk Factor (µg/m^3)$^{-1}$	Averaging Time (AT) (days)	Cancer Risk
Benzo(a)pyrene	76	1.8E+07	8	1	64	--	--	25550	--
Arsenic	1.00E+04	--	8	1	64	7.3E+08	0.0043	25550	1.2E-09
								total Cancer Risk=	1.2E-09

INHALATION WITH COPCS IN SURFACE SOIL
RECREATIONAL RECEPTOR (AGE 6-13)

		Benzo(a)pyrene
$VF=(Q/C(3.14xDaxT)^{1/2}x10^{-4})/(2xPbxDa)$		1.8E+07
VF	Volatilization Factor (m^3/kg)	50.38 (10 acre for Cleveland)
Q/C	Inverse of the mean concentration at the center of source (g/m^2-s per Kg/m^3)	9.5E+08
T	Exposure Interval (s)	1.5E+00
Pb	Dry Soil Bulk Density (g/cm^3)	
Da	Apparent Diffusivity (cm^2/s)	2.7E-11
$Da=[(\Theta a^{10/3}DiH'+\Theta w^{10/3}Dw)/n^2]/(PbKd+\Theta w+\Theta aH')$		0.28
Θa	Air-filled Soil Porosity (Lair/Lsoil)	0.043
Di	Diffusivity in Air (cm^2/s)	4.60E-05
H'	Henry's Law Constant (dimensionless)	0.15
Θw	Water-filled Soil Porosity (Lwater/Lsoil)	9.E-06
Dw	Diffusivity in Water (cm^2/s)	0.43
n	Total Soil Porosity (Lpore/Lsoil)	6.E+03
Kd	Soil-water Partion Coefficient (cm^3/g) = Koc x foc (organics)	1.E+06
Koc	Soil Organic Carbon Partition Coefficient (cm^3/g)	0.006
foc	Fraction of Organic Carbon (unitless)	

$PEF=Q/C((3600seconds/hr)/(0.036(1-V)(Um/Ut)^3(F(x)))$		7.3E+08
PEF	Particulate Emission Factor (m^3/kg)	50.38 (10 acre for Cleveland)
Q/C	Inverse of the mean concentration at the center of source (g/m^2-s per Kg/m^3)	0.5
V	Fraction of vegetative cover (unitless)	4.69
Um	Mean annual wind speed (m/s)	11.32
Ut	Equivalent threshold value of wind speed at 7 m (m/s)	0.194
F(x)	Function dependent on Um/Ut derived using Cowherd et al. (1985) (unitless)	

DERMAL CONTACT WITH COPCS IN SURFACE SOIL
RECREATIONAL RECEPTOR (AGE 6-13)

NON-CARCINOGEN

Intake= (CS x CF x AF x DAF x EF x ED x SA x EV)/(BW x AT)

Chemical of Concern	Maximum Soil Conc. (CS) (mg/kg)	Conversion Factor (CF) (kg/mg)	Adherence Factor (AF) (mg/cm^2-event)	DAF	Event Frequency (EV) (events/d)	Exposure Frequency (EF) (days/yr)	Exposure Duration (ED) (yrs)	Skin Surface Area (SA) (cm^2)	Body Weight (BW) (kg)	Averaging Time (AT) (days)	Intake (mg/kg-d)
Benzo(a)pyrene	0.076	1.00E-06	0.3	0.03	1	64	8	2626	35	2920	9.00E-09
Arsenic	1.00E+01	1.00E-06	0.3	0.03	1	64	8	2626	35	2920	1.18E-06

CARCINOGEN

Intake= (CS x CF x AF x DAF x EF x ED x SA x EV)/(BW x AT)

Chemical of Concern	Maximum Soil Conc. (CS) (mg/kg)	Conversion Factor (CF) (kg/mg)	Adherence Factor (AF) (mg/cm^2-event)	DAF	Event Frequency (EV) (events/d)	Exposure Frequency (EF) (days/yr)	Exposure Duration (ED) (yrs)	Skin Surface Area (SA) (cm^2)	Body Weight (BW) (kg)	Averaging Time (AT) (days)	Intake (mg/kg-d)
Benzo(a)pyrene	0.076	1.00E-06	0.3	0.03	1	64	8	2626	35	25550	1.03E-09
Arsenic	1.00E+01	1.00E-06	0.3	0.03	1	64	8	2626	35	25550	1.35E-07

Hazard Quotient =

Chemical of Concern	Intake (mg/kg-d)	RfD (mg/kg-d)	Hazard Quotient
Benzo(a)pyrene	9.00E-09	--	--
Arsenic	1.18E-06	0.0003	3.9E-03
		total hazard index=	3.9E-03

Cancer Risk = Intake x SF

Chemical of Concern	Intake (mg/kg-d)	SF $(mg/kg\text{-}d)^{-1}$	Cancer Risk
Benzo(a)pyrene	1.03E-09	7.3	7.5E-09
Arsenic	1.35E-07	1.5	2.0E-07
		total Cancer Risk=	2.1E-07

RECREATIONAL RECEPTOR (Age 6-13)
Average Body Weight
Rohm and Haas Chemicals LLC
Reading, Ohio

Age(yr)	Body Weight of Children (Boys and Girls Mean) (kg)
6	22.6
7	24.9
8	28.1
9	31.5
10	36.3
11	41.1
12	45.3
13	50.4
Average body weight for Jvenile (6-13yr)	35.0

Source: Bodyweight from USEPA Exposure Factors Handbook, 1997, Table 7-3.

RECREATIONAL RECEPTOR (Age 6-13)
Average Surface Soil Skin Contact Area
Rohm and Haas Chemicals LLC
Reading, Ohio

	Fraction of Total SA (unitless)				Total Body SA (m2, 50th %tile)	Total Body SA (m2, 50th %tile)	Total Body SA (m2, 50th %tile)	Exposed Surface (3)=(1)*(2) *10000
Age(yr)	hands	forearms	lower legs	Total (hands, forearms, lower legs, and feet) (1)	Female	Male	Male & Female	(cm^2)
6<7	0.0471	0.059	0.108	0.2141	0.843	0.866	0.85	1829
7<8	0.053	0.0554	0.115	0.2234	0.917	0.936	0.93	2070
8<9	0.053	0.0554	0.115	0.2234	1	1	1.00	2234
9<10	0.053	0.0554	0.115	0.2234	1.06	1.07	1.07	2379
10<11	0.0539	0.0617	0.122	0.2376	1.17	1.18	1.18	2792
11<12	0.0539	0.0617	0.122	0.2376	1.3	1.23	1.27	3006
12<13	0.0539	0.0617	0.122	0.2376	1.4	1.34	1.37	3255
13	0.0511	0.0545	0.128	0.2336	1.48	1.47	1.48	3446

Average Surface Area for Jvenile (6-13yr) **2626**

Source: Fraction of total surface area (SA) and total body SA for male and female children are from Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), Final, July 2004, Exhibit C-1.

INGESTION WITH COPCS IN SURFACE SOIL
RECREATIONAL RECEPTOR (AGE 13-17)

NON-CARCINOGEN

Intake (mg/kg-d) = (CS x IR x CF x FI x EF x ED)/(BW x AT)
Hazard Quotient = Intake/RfD

Chemical of Concern	Maximum Soil Conc. (CS) (mg/kg)	Conversion Factor (CF) (kg/mg)	Ingestion Rate (IR) (mg/day)	Fraction Ingested (FI) (unitless)	Exposure Frequency (EF) (days/yr)	Exposure Duration (ED) (yrs)	Body Weight (BW) (kg)	Averaging Time (AT) (days)	Intake (mg/kg-d)	RfD (mg/kg-d)	Hazard Quotient
Benzo(a)pyrene	0.076	1.00E-06	200	1	96	5	58.1	1825	6.88E-08	–	–
Arsenic	1.00E+01	1.00E-06	200	1	96	5	58.1	1825	9.05E-06	0.0003	3.0E-02
										total hazard index=	3.0E-02

CARCINOGEN

Intake (mg/kg-d) = (CS x IR x CF x FI x EF x ED)/(BW x AT)
Cancer Risk = Intake x SF

Chemical of Concern	Maximum Soil Conc. (CS) (mg/kg)	Conversion Factor (CF) (kg/mg)	Ingestion Rate (IR) (mg/day)	Fraction Ingested (FI) (unitless)	Exposure Frequency (EF) (days/yr)	Exposure Duration (ED) (yrs)	Body Weight (BW) (kg)	Averaging Time (AT) (days)	Intake (mg/kg-d)	SF $(mg/kg\text{-}d)^{-1}$	Cancer Risk
Benzo(a)pyrene	0.076	1.00E-06	200	1	96	5	58.1	25550	4.91E-09	7.3	3.6E-08
Arsenic	1.00E+01	1.00E-06	200	1	96	5	58.1	25550	6.47E-07	1.5	9.7E-07
										total Cancer Risk=	1.0E-06

INHALATION WITH COPCS IN SURFACE SOIL
RECREATIONAL RECEPTOR (AGE 13-17)

NON-CARCINOGEN

HQ = [CS x (1/VF) x ED x ET x EF]/(RfC x AT) (organics)

HQ = [CS x (1/PEF) x ED x ET x EF]/(RfC x AT) (inorganics)

Constituent of Concern	Concent. in Soil (CS) (ug/kg)	Volatilize Factor (VF) (m^3/kg)	Exposure Duration (ED) (yrs)	Fraction of EF in contact with soil (ET) (unitless)	Exposure Frequency (EF) (days/yr)	Particulate Emission Factor (PEF) (m^3/kg)	Reference Concentration (RfC) (µg/m^3)	Averaging Time (AT) (days)	Hazard Quotient
Benzo(a)pyrene	76	1.8E+07	5	1	96	--	--	1825	--
Arsenic	1.00E+04	--	5	1	96	7.3E+08	--	1825	--
								total hazard index=	0.0E+00

CARCINOGEN

Risk = [CS x (1/VF) x ED x EF x ET x URF]/(AT) (organics)

Risk = [CS x (1/PEF) x ED x EF x ET x URF]/(AT) (inorganics)

Constituent of Concern	Concent. in Soil (CS) (ug/kg)	Volatilize Factor (VF) (m^3/kg)	Exposure Duration (ED) (yrs)	Fraction of EF in contact with soil (ET)	Exposure Frequency (EF) (days/yr)	Particulate Emission Factor (PEF) (m^3/kg)	Unit Risk Factor (µg/m^3)$^{-1}$	Averaging Time (AT) (days)	Cancer Risk
Benzo(a)pyrene	76	1.8E+07	5	1	96	--	--	25550	--
Arsenic	1.00E+04	--	5	1	96	7.3E+08	0.0043	25550	1.1E-09
								total Cancer Risk=	1.1E-09

INHALATION WITH COPCS IN SURFACE SOIL
RECREATIONAL RECEPTOR (AGE 13-17)

		Benzo(a)pyrene
$VF=(Q/C(3.14xDaxT)^{1/2}x10^{-4})/(2xPbxDa)$		1.8E+07
VF	Volatilization Factor (m^3/kg)	50.38 (10 acre for Cleveland)
Q/C	Inverse of the mean concentration at the center of source (g/m^2-s per Kg/m^3)	9.5E+08
T	Exposure Interval (s)	1.5E+00
Pb	Dry Soil Bulk Density (g/cm^3)	
Da	Apparent Diffusivity (cm^2/s)	2.7E-11
$Da=[(\Theta a^{10/3}DiH'+\Theta w^{10/3}Dw)/n^2]/(PbKd+\Theta w+\Theta aH')$		0.28
Θa	Air-filled Soil Porosity (Lair/Lsoil)	0.043
Di	Diffusivity in Air (cm^2/s)	4.60E-05
H'	Henry's Law Constant (dimensionless)	0.15
Θw	Water-filled Soil Porosity (Lwater/Lsoil)	9.E-06
Dw	Diffusivity in Water (cm^2/s)	0.43
n	Total Soil Porosity (Lpore/Lsoil)	6.E+03
Kd	Soil-water Partion Coefficient (cm^3/g) = Koc x foc (organics)	1.E+06
Koc	Soil Organic Carbon Partition Coefficient (cm^3/g)	0.006
foc	Fraction of Organic Carbon (unitless)	
$PEF=Q/C((3600seconds/hr)/(0.036(1-V)(Um/Ut)^3(F(x)))$		7.3E+08
PEF	Particulate Emission Factor (m^3/kg)	50.38 (10 acre for Cleveland)
Q/C	Inverse of the mean concentration at the center of source (g/m^2-s per Kg/m^3)	0.5
V	Fraction of vegetative cover (unitless)	4.69
Um	Mean annual wind speed (m/s)	11.32
Ut	Equivalent threshold value of wind speed at 7 m (m/s)	0.194
F(x)	Function dependent on Um/Ut derived using Cowherd et al. (1985) (unitless)	

DERMAL CONTACT WITH COPCS IN SURFACE SOIL
RECREATIONAL RECEPTOR (AGE 13-17)

NON-CARCINOGEN

Intake= (CS x CF x AF x DAF x EF x ED x SA x EV)/(BW x AT)

Chemical of Concern	Maximum Soil Conc. (CS) (mg/kg)	Conversion Factor (CF) (kg/mg)	Adherence Factor (AF) (mg/cm^2-event)	DAF	Event Frequency (EV) (events/d)	Exposure Frequency (EF) (days/yr)	Exposure Duration (ED) (yrs)	Skin Surface Area (SA) (cm^2)	Body Weight (BW) (kg)	Averaging Time (AT) (days)	Intake (mg/kg-d)
Benzo(a)pyrene	0.076	1.00E-06	0.3	0.03	1	96	5	4003	58.1	1825	1.24E-08
Arsenic	1.00E+01	1.00E-06	0.3	0.03	1	96	5	4003	58.1	1825	1.63E-06

CARCINOGEN

Intake= (CS x CF x AF x DAF x EF x ED x SA x EV)/(BW x AT)

Chemical of Concern	Maximum Soil Conc. (CS) (mg/kg)	Conversion Factor (CF) (kg/mg)	Adherence Factor (AF) (mg/cm^2-event)	DAF	Event Frequency (EV) (events/d)	Exposure Frequency (EF) (days/yr)	Exposure Duration (ED) (yrs)	Skin Surface Area (SA) (cm^2)	Body Weight (BW) (kg)	Averaging Time (AT) (days)	Intake (mg/kg-d)
Benzo(a)pyrene	0.076	1.00E-06	0.3	0.03	1	96	5	4003	58.1	25550	8.85E-10
Arsenic	1.00E+01	1.00E-06	0.3	0.03	1	96	5	4003	58.1	25550	1.16E-07

Hazard Quotient =

Chemical of Concern	Intake (mg/kg-d)	RfD (mg/kg-d)	Hazard Quotient
Benzo(a)pyrene	1.24E-08	--	--
Arsenic	1.63E-06	0.0003	5.4E-03
		total hazard index=	5.4E-03

Cancer Risk = Intake x SF

Chemical of Concern	Intake (mg/kg-d)	SF $(mg/kg\text{-}d)^{-1}$	Cancer Risk
Benzo(a)pyrene	8.85E-10	7.3	6.5E-09
Arsenic	1.16E-07	1.5	1.7E-07
		total Cancer Risk=	1.8E-07

RECREATIONAL RECEPTOR (AGE 13-17)
Average Body Weight
Rohm and Haas Chemicals LLC
Reading, Ohio

Age(yr)	Body Weight of Children (Boys and Girls Mean) (kg)
13	50.4
14	56.0
15	58.1
16	62.6
17	63.2
Average body weight for Jvenile (13-17yr)	58.1

Source: Bodyweight from USEPA Exposure Factors Handbook, 1997, Table 7-3.

RECREATIONAL RECEPTOR (Age 13-17)
Average Surface Soil Skin Contact Area
Rohm and Haas Chemicals LLC
Reading, Ohio

	Fraction of Total SA (unitless)				Total Body SA (m2, 50th %tile)	Total Body SA (m2, 50th %tile)	Total Body SA (m2, 50th %tile)	Exposed Surface (3)=(1)*(2) *10000
Age(yr)	hands	forearms	lower legs	Total (hands, forearms, lower legs, and feet) (1)	Female	Male	Male & Female	(cm^2)
13<14	0.0511	0.0545	0.128	0.2336	1.48	1.47	1.48	3446
14<15	0.0568	0.0590	0.134	0.2498	1.55	1.61	1.58	3947
15<16	0.0568	0.0590	0.134	0.2498	1.57	1.7	1.64	4084
16<17	0.0568	0.0590	0.134	0.2498	1.6	1.76	1.68	4197
17	0.0513	0.0788	0.123	0.2531	1.63	1.8	1.72	4341

Average Surface Area for Jvenile (13-17yr) **4003**

Source: Fraction of total surface area (SA) and total body SA for male and female children are from Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), Final, July 2004, Exhibit C-1.

Mirtha Capiro/R5/USEPA/US
05/03/2007 12:50 PM

To Carl J Coker <CCoker@rohmhaas.com>
cc Karen.Fields@parsons.com, Bhooma Sundar/R5/USEPA/US@EPA
bcc

Subject Discussion items for today's call on Rohm and Haas facility

Carl,

Please see list of some discussion items on the Baseline Risk Assessment that our toxicologist Bhooma Sundar and myself would like to cover at the call.

Item 1
2.1 Site History: This section discusses the chemicals manufactures and the raw materials used in the site since 1950. Organophosphates have been manufactured in the site since 1950. Please clarify what types of organophosphates were manufactured at the facility in term of their industrial use (e.g., for use as pesticides, or esters used in the polymer industry, etc).

Item 2
4.2.1: The discussion on bioaccumulation concludes that fish ingestion pathway is considered insignificant due to the presence of very few chemicals and their low concentration. This statement is based on screening the detected chemicals in the sediment against Region 9 PRG industrial soil screening criteria for direct contact not related to fish bioaccumulation. The response from Rohm and Hass to comments on the revised BRA on 9/23/005 stated that in section 4.2.1 under bioaccumulation, the text would be revised to state that fish ingestion would not be quantitatively evaluated based on the USEPA evaluation results that no site-related bio accumulative contaminants were detected at Rohm & Hass. Among the COPC's identified, eldrin is the chemical found to be significantly bio accumulative. Table 1.1 and Table 1.2 of revised BRA list dieldrin as COPC at the maximum concentration of 3.1 ppm below 15 ft and 0.395 ppm at <1 ft respectively. The BRA needs to provide appropriate justification for exclusion of pesticides, such as eldrin and dieldrin, from the risk assessment. The justification should address background data and frequency of detection of pesticide compounds.

Item 3
4.3. Exposure quantification: It is not clear for an active site such as Rohm and Hass, why risk characterization was conducted on a site wide basis rather than SWMU and Area of Concern (AOC) wide basis. Based on Region 5 risk management policy guidance June 2005, at least 8 samples are required per SWMU or unit exposure area. Pooling all the data for an active site tends to underestimate the exposure point concentration if the worker exposure is associated with a small area in a site. At least for onsite indoor and outdoor routine workers, the risk characterization should have been done on a SWMU and AOC wide basis. For instance, this raises a concern with respect to benzo(a)pyrene and chlorobenzene in soil. Refer to Tables 2-1for existing SWMUs and Section 5.3.1 for AOCs identified as a result of the facility investigations (FI). Also, see last comment regarding data discrepancy.

Item 4
Baseball field. Soil sampling was conducted in the baseball field as part of the background characterization sampling. Although no site operations took place in this field, this area may have been subject to migration pathways, such as runoff. Onsite recreational exposure risk characterization should typically have included this area.

Item 5
6.3 Uncertainty: Table 1.1: Given the number of soil borings collected, it is unclear why there are a limited number of surface soil samples available from the FI. Explain the reason for this limitation. Discuss

the lack of sufficient data while addressing the worker exposure to site contamination in the uncertainty analysis section.

Item 6
6.3.1: Third paragraph in this section, provides the rationale as to why vinyl chloride was eliminated as a COPC based on the fact that the one and only detection was due to an off-site source and it is also stated that few chemicals including vinyl chloride were eliminated due to their concentration in groundwater being less than the screening criteria. The data from table 1.2 however contradicts the statements mentioned above. The detection frequency of vinyl chloride in ground water was 5/126. The highest concentration observed at 15 ug/l exceeds the screening criteria of 2 ug/l. Please correct this discrepancy. Vinyl chloride, a VOC degradation product, should not be eliminated from the risk assessment on the basis of low frequency of detection. Also, confirm that VC will be included in the groundwater monitoring list.

Item 7
Soil-groundwater migration/leaching criteria for soil. Any consideration of this criteria is lacking in the BRA. All maximum concentrations need to be compared to soil-groundwater migration/leaching criteria, followed by a discussion on how media are affected based on the screening results. Lastly, the BRA needs to discuss how the affected media will be addressed (e.g., discuss whether measures will be implemented to address groundwater contamination).

Item 8
Benzo(a)pyrene concentrations in soil. There appears to be a discrepancy on the maximum concentration reported in the BRA for this chemical in soil.

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Karen.Fields@parsons.com
03/27/2007 10:57 AM

To Mirtha Capiro/R5/USEPA/US@EPA
cc
bcc

Subject RE: Fw: Additional question--Fw: Questions on BRA aspects -- Rohm and Haas

History: This message has been replied to and forwarded.

Hi Mirtha,

Attached are the responses to the various requests for information concerning the Rohm and Haas Cincinnati plant. Also, per your request, I have attached a file that has several tables presenting the compounds detected at the site (broken down by media) and that shows the number of detections and range of detections for each compound. Please let me know if you have any trouble opening or receiving these files.

As far as a timeframe to schedule a conference call to discuss these responses (if necessary), our earliest available dates would be either this Friday (March 30) or the week of April 16. Thanks and let us know if you have any questions.

- Karen

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RESPONSES TO MARCH 9, 14 and 15, 2007 ADDITIONAL COMMENTS FROM THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (U.S. EPA) ON THE REVISED BASELINE RISK ASSESSMENT

ROHM AND HAAS CHEMICALS LLC (ROHM AND HAAS)
READING, OHIO

27 March 2007

Below are the responses to the additional comments received from Mirtha Capiro of the U.S. EPA on 9 and 14 March 2007 for the Baseline Risk Assessment (BRA) for the Rohm and Haas, Cincinnati Plant. These additional comments were received following a conference call held on 9 March 2007 to discuss Rohm and Haas' proposed action plan for the site in a letter dated 15 December 2006.

COMMENTS RECEIVED 9 MARCH 2007:

Page 78 from Section 7.5.3 of the 6/30/05 draft BRA Report contains a table showing number of detection for some identified chemicals. I noted that some chemicals that have been identified in tables from Sections 7.4.1 and 7.4.2 as COPECs have not been listed in the table I first mentioned (for example, Aroclors-1242 and 1248, and 4,4-DDT are not listed). It would be very useful to have the table from Section 7.5.3 updated to show a consistent list of compounds. That will certainly facilitate my discussions with our risk assessors. Basically, the information on overall number of detects is key for understanding the significance of a potential risk as well as the relationship to background concentrations.

Please check with your team to see if there are additional COPCs identified elsewhere in the risk assessment, including human health-related, that may need to be compiled in the table from Section 7.5.3.

Response: The table on page 78 of the Revised BRA dated 30 June 2005 presented only the detected concentrations of compounds collected from ten (10) background soils at a depth of 0-2 feet. This table was used in the discussion of uncertainty to evaluate whether or not the potential risk to ecological receptors on-site may be at least partially attributed to relatively high area-wide background levels. Some compounds (carbon disulfide, xylenes, 4,4-DDT, Arochlor-1242 and Arochlor-1248) that were identified as compounds of potential ecological concern (COPECs) in site soils were not presented on this table since they were not detected in the site background soils. Previously (on 25 August 2005), USEPA commented (Comments 2 and 14) that a statistical evaluation of the background soils should be included in the risk assessment and that instead of comparing site background concentrations to ecological screening levels, a better evaluation would be to compare site concentrations to site background levels. Thus, Rohm and Haas agreed to delete this table and re-insert a previously submitted appendix into the Final BRA report that presents the statistical evaluation of background samples and revise the text so that a direct comparison is made of site soil concentrations to site background levels. The revised text for the second to last paragraph of Section 7.5.3 is presented as an attachment (Attachment A) to this response letter. However, for discussion purposes, a revised Table 1 showing the number of detections in site background soils (0-2 ft depth) for the detected compounds in site background

soils and for the ecological soil COPECs is included as an attachment (Attachment B) to this document as requested. As stated previously, this revised table will not be included in the Final BRA report. Human health compounds of potential concern (COPCs) were not considered in developing this revised table since additional background soil samples were collected at depths below 4 feet and samples collected from these lower depths do not have relevance for potential ecological receptors.

I need confirmation from Rohm and Haas on whether the description of the BRA aspects below is consistent with their proposal.

Note: proposed maximum constituent concentrations in groundwater are considered reasonable.

Protection of human and ecological receptors/ selection of parameters for groundwater monitoring

a) *Compare the most recent maximum detected constituent concentrations in groundwater site-wide to the hierarchy MRWQC, MCLs and Region 9 PRGs.*
b) *Compare the most recent maximum detected constituent concentrations in groundwater site-wide to the hierarchy OMZA, AWQC and Region 5 ESLs.*
c) *Generate a list of monitoring parameters that includes all constituents that show an exceedance in the comparisons from (a) and (b) (this list will be equivalent to Table 1 from PARSONS, 15 December 2006).*

Response: See attached Tables (Attachment C) as indicated below. Each of the constituents identified via this screening process has been included in Table 1 in the 15 December 2006 submittal. Note: These tables will be updated to reflect collection of additional groundwater samples in 2005 and the 3% contribution from the west side of Mill Creek.

a) Table 8.8 – Comparison of Groundwater Quality Analytical Results and Human Health Surface Water Screening Values (originally presented in 10 October 2005 response to comments)
b) Table 10.4 – Comparison of November 2004 Groundwater Data in the Upper Aquifer to Ohio Surface Water Criteria and Region 5 ESLs
c) Table 1 – List of Proposed Analytes in the Upper Groundwater Aquifer (compounds that pose a drinking water concern and compounds that have potential sediment pore water exceedances)

Protection of human receptors associated with the groundwater to surface water pathway – Recreation scenario

a) *Compare the most recent maximum detected constituent concentrations in groundwater at/near the groundwater-surface water interface to the hierarchy MRWQC, MCLs and Region 9 PRGs .*

b) *Estimate surface water concentrations for those constituents that show an exceedance in groundwater under (a). The estimated surface water concentrations will be based on groundwater contribution to surface water in Mill Creek assuming that the groundwater concentration under (a) is constant over the entire site.*
c) *Compare estimated surface water concentrations to the hierarchy MRWQC, MCLs and Region 9 PRGs.*
d) *Develop site-specific action levels (as an alternative to the hierarchy under (c)) for those constituents that show an exceedance in estimated surface water concentrations from the comparison under (c). Steps are described in Task 2, item 2, PARSONS, 15 December 2006.*
e) *Compare estimated surface water concentrations to developed site-specific action levels.*

Response: See attached Tables (Attachment C) as indicated below. Each of the constituents identified via this screening process has been included in Table 1 in the 15 December 2006 submittal. Note: The tables below will be updated to reflect collection of additional groundwater samples in 2005.

a) Table 8.8 – Comparison of Groundwater Quality Analytical Results and Human Health Surface Water Screening Values (originally presented in 10 October 2005 response to comments)
b) Table 2 – Conservatively Estimated Surface Water Concentrations Compared to Human Health Surface Water Criteria (originally presented in 15 December 2006 submittal)
c) Table 2 – Conservatively Estimated Surface Water Concentrations Compared to Human Health Surface Water Criteria (originally presented in 15 December 2006 submittal)
d) Table 3 – Calculated SSTLs for Surface Water Based on Incidental Ingestion for a Recreational User, Table 4 – Calculated SSTLs for Surface Water Based on Dermal Contact for a Recreational User, and Table 5 – Summary of Calculated SSTLs for Surface Water for the Recreational User Scenario (these tables were originally presented in 15 December 2006 submittal)
e) Table 2 – Conservatively Estimated Surface Water Concentrations Compared to Human Health Surface Water Criteria (originally presented in 15 December 2006 submittal)

Protection of ecological receptors associated with surface water pathway

a) *Compare the most recent maximum detected constituent concentrations in groundwater at/near the groundwater-surface water interface to the hierarchy OMZA, AWQC and Region 5 ESLs.*
b) *Estimate surface water concentrations for those constituents that show an exceedance in groundwater under (a). The estimated surface water concentrations will be based on groundwater contribution to surface water in Mill Creek assuming that the groundwater concentration under (a) is constant over the entire site.*
c) *Compare estimated surface water concentrations to the hierarchy OMZA, AWQC and Region 5 ESLs.*

d) *Compare the estimated surface water concentration for those constituents that show an exceedance in the comparison from (c) to OMZM and IMZM (or other?) as an alternative to the hierarchy under (c).*

Need to contact Rohm and Haas to obtain a list of "other" alternate action levels.

Response: See attached Tables (Attachment C) as indicated below. Each of the constituents identified via this screening process has been included in Table 1 in the 15 December 2006 submittal. Note: The tables below will be updated to reflect collection of additional groundwater samples in 2005.

a) Table 10.4 – Comparison of November 2004 Groundwater Data in the Upper Aquifer to Ohio Surface Water Criteria and Region 5 ESLs
b) Table 6 – Conservatively Estimated Surface Water Concentrations Compared to Ohio Surface Water Criteria and Region 5 ESLs
c) Table 6 – Conservatively Estimated Surface Water Concentrations Compared to Ohio Surface Water Criteria and Region 5 ESLs
d) Not applicable at this time. The detailed model using flow tube assumptions as presented in response to comments dated 20 September 2006 (Additional USEPA Specific Comment 5, page 4) shows that neither of the two constituents of potential ecological concern identified above in item "c" (chlorobenzene and 1,2-dichlorobenzene) will have surface water concentrations that exceed applicable OMZA criteria.

Protection of ecological receptors associated with sediment protection

a) *Compare the most recent maximum detected constituent concentrations in groundwater at/near the groundwater-surface water interface to the hierarchy OMZA, AWQC and Region 5 ESLs.*
b) *Compare the groundwater concentration of those constituents that show an exceedance in the comparison from (a) to OMZM and IMZM as an alternative to the hierarchy under (a).*

Response: See attached Tables (Attachment C) as indicated below. Each of the constituents identified via this screening process has been included in Table 1 in the 15 December 2006 submittal. Note: The tables below will be updated to reflect collection of additional groundwater samples in 2005.

a) Table 10.4 – Comparison of November 2004 Groundwater Data in the Upper Aquifer to Ohio Surface Water Criteria and Region 5 ESLs
b) Table 10.5 – Comparison of November 2004 Groundwater Data in the Upper Aquifer to Ohio OMZM and IMZM criteria

We would like to have more information from Rohm and Haas on the item below, possibly the same level of detail as Task 2, item 2, first paragraph.

"Development of site-specific risk-based action levels for sediment using Region 5 ESLs (for ecological receptors) and Region 9 PRGs (for human health) if the maximum detected groundwater concentration exceeds applicable human health and ecological surface water screening levels (NRWQC and AWQC)."

Response: It was Rohm and Haas' understanding that groundwater-based action levels for sediment would only be developed when maximum groundwater concentrations exceed applicable criteria (OMZA/ESLs for ecological receptors and Region 9 PRGs for human health) AND when the maximum detected sediment concentrations exceed their respective sediment screening levels. For ecological receptors, no COPECs meet both of these criteria and for human health, only arsenic had groundwater and sediment concentrations that exceeded applicable screening levels in both groundwater and sediments. However, calculation of a human health groundwater-based action level for sediments was not conducted since the maximum detected arsenic concentration in sediment did not exceed the site-specific target level for arsenic for the recreational user scenario.

COMMENT RECEIVED 14 MARCH 2007:

This is a follow up to our phone conversation regarding my recent information request on the list of compounds. As we discussed, I would prefer to have a comprehensive list for all compounds that were detected in soil, sediment, groundwater and surface water (this list will be separate from the BRA report). The list will show number of detections and range of detected concentrations for each compound that was detected.

I would like to add that I am interested in all compounds detected over the course of previous sampling events. With respect to sediment and groundwater, please make a distinction between creek bed and creek bank sediment, and seep and groundwater samples.

Response: The tables requested above were previously provided in the Revised BRA report dated June 2005 as follows:

Table 1.1 – Occurrence, Distribution and Selection of Chemicals of Potential Concern (for Human Health) – Soil
Table 1.2 – Occurrence, Distribution and Selection of Chemicals of Potential Concern – Groundwater
Table 1.3 – Occurrence, Distribution and Selection of Chemicals of Potential Concern (for Human Health) – Surface Water
Table 1.4 – Occurrence, Distribution and Selection of Chemicals of Potential Concern (for Human Health) – Sediment

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Table 10.1 – Comparison of Surface Soil Data to Ecological Screening Levels
Table 10.2 – Comparison of Sediment Data to Ecological Screening Levels
Table 10.3 – Comparison of Seep and Surface Water Data to Ecological Screening Levels
Table 15.3 – Toxicity Assessment for Sediment Invertebrates Living in Mill Creek
Table 15.4 – Toxicity Assessment for Aquatic Life Living in Mill Creek

These tables contain site data collected from 2001 through 2004. The groundwater table will be updated to include the November 2005 sample results. No additional samples have been collected of site soils, sediments, seeps or surface water since 2004.

Human health and ecological data were grouped separately due to different assumptions associated with exposure pathways for the various receptors (for example, animals might only be exposed to surface soils (0-4 ft) whereas construction workers may encounter soils at depths of up to 10 feet or more).

Creek bed and creek bank sediment data were combined for both human health and ecological receptors due to the limited number of sample locations. For human receptors, seep data was not included in the groundwater or the surface water data because direct human exposure to seeps was considered an incomplete exposure pathway due to the limited physical (area) extent of the seeps and low to no visible flow Seep data was evaluated separately by comparing the maximum concentrations detected in the seep samples to the human health surface water screening criteria (NRWQC, MCL, and Region 9 PRGs) (originally presented in Table 8-6 of the 10 October 2005 submittal and included in Attachment C of this response).

For ecological receptors, seep and surface water data were combined in the initial screening evaluation due to the limited number of seep locations; however, data collected from the creek bed and the surface water of Mill Creek were also evaluated separately in Tables 15.3 and 15.4 of the Revised BRA (June 2005) to determine the potential risk to aquatic life solely within Mill Creek.

COMMENTS RECEIVED 15 MARCH 2007:

Page 5 of 7, Task 2: Our human health toxicologists noted that the term default action level is misleading, as I pointed out at the call. From the discussion outlined in the document, it appears that NRWQC/MCL/Reg 9 PRG refers to screening criteria. Please provide your explanation for using this terminology, so we can determine to what extent this has to be clarified in the BRA Report.

Response: Although screening criteria are used as the default action levels, the purpose of using these screening criteria is to select compounds of concern (COCs) for the development of the groundwater goals instead of performing a risk assessment. The term default action level is used together with alternative action level to describe the methodology for determination of the

groundwater goals. The following sentence will be add to the text for clarification: "Default action levels are screening criteria used to select COCs for the development of groundwater goals".

Table 2 of this document primarily screens the surface water against NRWQC which is based on ingestion of water and organism from the creek. As long as the surface water is not a source of drinking water, this screening is acceptable to EPA. Please mention what type of information sources/references you plan to include in the BRA Report to support the water use (e.g., TMDL, etc.).

Response: Surface water source protection information provided by Ohio EPA Water Division will be included in the final BRA Report to support the water use.

Table 3: Please provide the rationale for choosing 26 d/year for recreational swimmer scenario. It is not clear why the total hazard index was divided by a factor of 24. The section on Alternative groundwater action level outlines the derivation of site specific target level (SSTL) for a recreational user scenario based on a target level of 1xe-4 and HI of 1. Please refer to the OEPA's guidance which suggests that the cumulative risk for corrective action purposes targeted at 1X10-5 rather than 1E-04.

http://www.epa.state.oh.us/derr/rules/guidance.html

Response: The exposure frequency of 26 days/year for a recreational swimmer scenario is based on 2 days per week and 13 weeks of the summer, which was the exposure frequency used in the June 2005 revised BRA submittal. This parameter was previously approved by USEPA's contractor during various conference call discussions and it has not been modified since additional comments were not received by Rohm and Haas regarding this parameter.

The justification of a factor of 24 for the total hazard index is provided in Table 3 (Attachment C). As stated in footnote (2) of Table 3, the total hazard index is divided by 24 to distribute the total hazard index of 1 to twelve compounds of concern and two exposure pathways (incidental ingestion and dermal contact). The target level of 1×10^{-4} that was used for the calculation of a SSTL for a recreational user scenario was based on the acceptable target risk range, which was used in June 2005 revised BRA report.

Task 2, item 1:
The hierarchy related to protection of ecological receptors from your summary includes AWQC. Note that previous discussions with USEPA and OEPA (see Booz Allen Hamilton 28 July 2005) included the use of an OMZA-ESL hierarchy. Also, previous OEPA memoranda (from Booz Allen Hamilton 28 July 2005) discusses the need for further stream characterization if criteria other than the OMZA-ESL hierarchy is used.

Response: Groundwater and surface water data have been compared to OMZA and Region 5 ESLs for screening for ecological receptors as previously agreed (please refer to attached tables

and previous responses). "AWQC" (Ambient Water Quality Criteria) are the same as NRWQC and refer to USEPA values published in the "Gold Book." AWQC can be used as default aquatic life criteria when other values do not exist; however, AWQC have not been used as screening criteria for this site.

As you know, we have requested information from you regarding alternate criteria mentioned in your latest summary. At this point, it would not be acceptable to alter the course of previous review and discussions on the issue since Rohm and Haas has not proposed to conduct further stream characterization. Therefore, we would like to cancel our request for information on alternate criteria.

Response: Comment noted.

As an informal item, I am curious what reference you would have used for AWQC since it is not NRWQC. Obviously, this is not time critical and you may provide this information in the future. Our ecologist was not certain what reference would be available on this.

Response: Please see previous responses. Development of AWQC are discussed on USEPA's website as follows:

http://www.epa.gov/waterscience/criteria/wqcriteria.html#gold

Development of estimated surface water concentrations:
Your latest summary indicates, as we understand, that estimate surface water concentrations will be based on groundwater contribution to surface water in Mill Creek assuming that the groundwater concentration for the chemical for which a concentration is being estimated is constant over the entire site. Please explain how this relates to the information from Supplemental Responses to USEPA Comments 3 April 2006.

Specifically, we would like to know equation parameters for groundwater flux, width of flow and saturated thickness and how they relate to chemical and well information. So, this can be addressed with minimal clarification based on the previous material.

Response: The equation and parameters for estimating surface water concentrations due to maximum groundwater input are shown on Table 6 – Conservatively Estimated Surface Water Concentrations Compared to Ohio Surface Water Criteria and Region 5 ESLs (Attachment C). Specifically, surface water concentrations were calculated as follows:

Csw = [(Cgw x Qgw) + (Csw x Qsw)] / (Qgw + Qsw)
where:

Cgw - maximum detected concentration in groundwater (ug/L)
Qgw - calculated groundwater flux (ft^3/day) = 13,534 ft^3/day

Csw – maximum detected concentration in surface water (ug/L)
Qsw - $7Q_{10}$ flow for Mill Creek (4.9 cfs multiplied by 86,400 seconds/day) (OEPA, 2004)

where:

maximum saturated thickness = 6 ft
width of plume = shoreline (1120 ft)
hydraulic gradient = 0.019 ft/ft
hydraulic conductivity = 106 ft/day

This equation will be modified as follows to account for groundwater inflow from the west bank of Mill Creek per discussions held on 20 November 2006:

Csw = [(Cgw-east x Qgw-east) + (Cgw-west x Qgw-west) + (Csw x Qsw)] / (Qgw-east + Qgw-west + Qsw)

where:

Cgw-east – maximum detected concentration in groundwater on-site (ug/L)
Qgw-east – calculated groundwater flux from site = 13,534 ft^3/day
Cgw-west – maximum detected concentration in groundwater from west side of Mill Creek (assumed to be uncontaminated and therefore = 0)
Qgw-west – groundwater flux from west side of Mill Creek (assumed to be equal to groundwater flux from east side = 13,534 ft^3/day)
Csw – maximum detected concentration in surface water (ug/L)
Qsw - $7Q_{10}$ flow for Mill Creek (4.9 cfs multiplied by 86,400 seconds/day = 423,600 ft^3/day) (OEPA, 2004)

Since Rohm and Haas has a good network of monitoring wells along Mill Creek and because it is unlikely that concentrations of chemicals will remain constant across the entire site through time and space, a "detailed" site-specific model was developed to determine the estimated concentration of contaminants in surface water via interwell contribution. This detailed model was only used for those chemicals that exceeded surface water criteria using the conservative maximum detected site-wide for chemicals detected in the monitoring wells downgradient of the French Drain (UAW03-20, UAW05-20, UAW07-20, MW-EPA-1, UAW01-30, UAW02-20, UAW02-40 and UAW25-20). Thus, for example, for ecological receptors, the detailed model (Table 7, Attachment C) was run only for chlorobenzene and 1,2-dichlorobenzene. Results of the detailed model show that neither chlorobenzene or 1,2-dichlorobenzene are expected to be present in the surface water of Mill Creek at concentrations exceeding applicable surface water criteria (OMZA). Additional discussions have been held regarding whether additional wells should be included in the "downgradient" monitoring well list; thus, this list of wells may change pending further discussion and concurrence between USEPA and Rohm and Haas.

Supplemental Responses to USEPA Comments 3 April 2006 provides the parameter for surface water flux as 423,360 cubic feet per day based on information from OEPA 2004. Based on the

most recent list of references you have provided, this reference stands as: OEPA, 2004a, Total Maximum Daily Loads for Mill Creek Basin, Draft Report, OEPA Division of Surface Water, June.

Please note that this reference needs updating based on the approved TMDL (attached). Also, please describe the steps you would follow to arrive to the proposed figure for surface water flux, including specific citation of information from TMDL (e.g., section or page) and any further calculations or conversions.

(See attached file: Mill_Creek_sep04_final.pdf)

Response: The cited reference is incorrect. The correct reference is: OEPA, 2004a, Addendum (June 2004) to: Water Quality Permit Support Document to Assess the Proposed Expansion of the Butler County Upper Mill Creek WWTP August 1998.

A copy of the title page of this reference, a graph showing the 7Q10 for Mill Creek, a map of the stream gage location and stream flow data are presented in Attachment D.

ATTACHMENT A

ATTACHMENT A

Proposed second to last paragraph for Section 7.5.3 for final BRA Report:

Additionally, the site is located in a fairly industrialized area along the Mill Creek. Elevated concentrations of some of the COPECs may in part be due to these regional conditions, both naturally and as a result of surrounding industry practices. In order to not underestimate the risk due to these "background" conditions, all detected compounds were assumed to be site-related, which may overestimate the risk to receptors that may have developed adaptations for these higher regional concentrations of COPECs. To determine the non-site related contamination, background samples were collected to evaluate chemicals occurring naturally in soil (e.g., metals) or regionally as a result of neighboring industrial activities. A total of ten off-site background locations were sampled and two samples from each location (total of twenty samples) were analyzed as part of the facility investigation program. Five locations (borings B-01 through B-05) were sampled near the baseball fields and Swimming Pool and Recreational Center (south of the site), and five locations (borings B-06 through B010) were sampled near the Former Municipal Water Supply Well Field owned by the City of Reading (north of the site, Cincinnati Drum and Pristine). Although efforts were made to gain access to all of the properties adjacent to the Rohm and Haas facility, access for off-property sampling could only be obtained from the City of Reading property. Two samples were collected from each location at depths of 1.5 to 2 feet bgs and 9 to 11.5 feet bgs. The background samples were analyzed for CLP-TAL plus aniline, isodrin and tin. The background data showed that metals and other naturally occurring chemicals (e.g. calcium) were detected in the majority of samples analyzed. Twenty-six SVOCs (including 2-methylnaphthalene, acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, bis(2-ethylhexyl)phthalate, carbazole, chrysene, dibenz(a,h)anthracene, dibenzofuran, fluoranthene, fluorine, indeno(1,2,3-cd) pyrene, naphthalene, penanthrene, and pyrene), pesticides (4,4'-DDE, aldrin, dieldrin, endrin ketone, and isodrin) and PCBs (Aroclor 1254 and Aroclor 1260) were also detected in one or more samples from background locations. The presence of SVOCs, pesticides and PCBs in background locations indicate that the detections of these chemicals at the site could be due to surrounding industrial activities. Consequently, PAHs, PCBs, and pesticides were not selected as final COPECs, despite screening value exceedances (USEPA, 2005c). Statistical analysis of the background data is provided in Appendix K.

ATTACHMENT B

ATTACHMENT B

Chemical	Number of Detections in Background Samples (0-2')	Range of Detected Concentrations (mg/kg)
Acenaphthene	1/10	37
Acetone	9/10	0.0039 – 0.012
Aldrin	1/10	0.11
Aluminum	10/10	1870 – 10,800
Anthracene	1/10	26
Antimony	1/10	3.3
Arsenic	10/10	3.7 – 16.2
Barium	10/10	9.8 – 985
Benzo(a)anthracene	3/10	0.063 – 36
Benzo(a)pyrene	3/10	0.076 – 24
Benzo(b)fluoranthene	3/10	0.1 – 29
Benzo(ghi)perylene	3/10	0.072 – 9.2
Benzo(k)fluoranthene	2/10	0.096 – 18
Beryllium	9/10	0.26 – 1.4
Bis(2-ethylhexyl)phthalate	2/10	0.06 – 0.18
Cadmium	10/10	0.14 – 0.7
Carbon Disulfide	0/10	<0.0046 - <0.011
Chromium	10/10	3.7 – 69.7
Chrysene	3/10	0.082 – 37
Cobalt	10/10	2.8 – 8.6
Copper	10/10	12.5 – 64.8
Cyanide	3/10	0.24 – 0.42
4,4-DDE	2/10	0.0015 – 0.019
4,4-DDT	0/10	<0.0019 - <0.02
Dibenz(ah)anthracene	1/10	3.5
Dibenzofuran	1/10	26
Dieldrin	4/10	0.015 – 0.055
Endrin ketone	1/10	0.13
Fluoranthene	2/10	0.15 – 120
Fluorene	1/10	32
Indeno(123-cd)pyrene	2/10	0.15 – 9.2
Iron	10/10	4030 – 19,800
Isodrin	1/10	0.0054
Lead	10/10	2.8 – 410
Manganese	10/10	14.6 – 854
2-Methylnaphthalene	1/10	4.3
Mercury	10/10	0.0098 – 0.16
Methyl acetate	1/10	0.0031
Methyl ethyl ketone	1/10	0.0033
Naphthalene	1/10	3
Nickel	10/10	6.2 – 15.7
Phenanthrene	3/10	0.096 – 19
Pyrene	3/10	0.14 – 83
Selenium	4/10	0.69 – 2.5
Tetrachloroethylene	2/10	0.0028 – 0.0059
Thallium	4/10	0.92 – 1.5
Tin	10/10	0.79 – 2.9
Vanadium	10/10	6.2 – 56.4
Xylenes	0/10	<0.0092 - <0.021
Zinc	10/10	15.7 – 88.1
Arochlor 1242	0/10	<0.035 - <0.044
Arochlor 1248	0/10	<0.035 - <0.044
Aroclor 1254	1/10	0.11
Aroclor 1260	2/10	0.015 – 0.24

Highlighted compounds were identified as potential ecological COPECs in site soils.

Additional compounds were analyzed for in the background soils but they are not presented on this table since they were not detected and they were not identified as potential ecological COPECs. For full analytical results for the background soils, refer to Appendix A of the Baseline Risk Assessment report (June 2005).

ATTACHMENT C

Table 1
LIST OF PROPOSED ANALYTES IN THE UPPER GROUNDWATER AQUIFER
Rohm and Haas Chemicals LLC
Reading, Ohio

Compound	Reason
1,1'-Biphenyl	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances
1,2-Dichlorobenzene	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances and drinking water concern
1,2-Dichloroethane	Potential risk to a recreational user of Mill Creek and a drinking water concern
1,3-Dichlorobenzene	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances
1,4-Dichlorobenzene	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances and drinking water concern
4-Methylphenol	Drinking water concern
Acetone	Drinking water concern
Aluminum	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances, potential risk to recreational users of Mill Creek and drinking water concern
Aniline	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances, potential risk to recreational users of Mill Creek and drinking water concern
Antimony	Drinking water concern
Arsenic	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances, potential risk to recreational users of Mill Creek and drinking water concern
Barium	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances
Benzene	Potential risk to a recreational user of Mill Creek and a drinking water concern
bis(2-ethylhexyl)phthalate	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances, potential risk to recreational users of Mill Creek and drinking water concern
Cadmium	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances and drinking water concern
Carbon Disulfide	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances
Chlorobenzene	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances and drinking water concern
Chloroform	Drinking water concern
Chromium	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances and drinking water concern
Copper	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances and drinking water concern
Iron	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances, potential risk to recreational users of Mill Creek and drinking water concern
Isopropylbenzene	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances
Lead	Drinking water concern
Manganese	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances, potential risk to recreational users of Mill Creek and drinking water concern
Methylene Chloride	Potential risk to a recreational user of Mill Creek and a drinking water concern
Nickel	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances and drinking water concern
Selenium	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances
Tetrachloroethene	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances, potential risk to recreational users of Mill Creek and drinking water concern
Thallium	Potential risk to a recreational user of Mill Creek and a drinking water concern
Tin	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances
Toluene	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances and drinking water concern
Trichloroethene	Drinking water concern
Vanadium	Drinking water concern
Vinyl Chloride	Potential risk to a recreational user of Mill Creek
Xylenes (total)	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances

TABLE 2
CONSERVATIVELY ESTIMATED SURFACE WATER CONCENTRATIONS COMPARED TO HUMAN HEALTH SURFACE WATER CRITERIA
Rohm and Haas Chemicals LLC
Reading, Ohio

Chemicals	NRWQC	MCL	Region 9 PRGs	MAX Detected - All Wells (Cgw)	Location	Estimated Concentration in Surface Water (Csw)	Estimated SW Concentration Exceeds Criteria?	Calculated Surface Water SSTL	Estimated SW Concentration Exceeds Calculated SSTL?
Volatile Organic Compounds (ug/l)									
1,1,2-Trichloroethane	0.59			2.6	UAW23-20	0.08	No	NA	NA
1,2-Dichloroethane	0.38			1200	UAW20-60	37.17	Yes	1,730	No
Benzene	2.2			150	UAW08-20	4.65	Yes	337	No
Carbon tetrachloride	0.23			2.2	UAW15-20	0.07	No	NA	NA
Chlorobenzene	130			2500	MW-EPA-1	77.44	No	NA	NA
Chloroethane	-		4.6	6.8	UAW10-50	0.21	No	NA	NA
Chloroform	5.7			140	UAW15-20	4.59	No	NA	NA
cis-1,2-Dichloroethene	-	70		80	UAW20-60	2.73	No	NA	NA
Methylene chloride	4.6			280	UAW04-20	8.67	Yes	27,400	No
Tetrachloroethene	0.69			75	MW-EPA-2	2.32	Yes	24	No
Toluene	1300			11000	UAW04-20	340.76	No	NA	NA
Trichloroethene	2.5			5.1	UAW23-20	0.48	No	NA	NA
Vinyl chloride	0.025			4	UAW22-20	0.12	Yes	99	No
Semivolatile Organic Compounds (ug/l)									
1,2-Dichlorobenzene	420			1100	MW-EPA-1	34.08	No	NA	NA
1,4-Dichlorobenzene	63			250	MW-EPA-1	7.74	No	NA	NA
2-Methylnaphthalene	-		6.2	8.6	UAW13-20	0.27	No	NA	NA
Aniline	-		12	5900	UAW08-20	182.77	Yes	2,460	No
bis(2-Ethylhexyl) phthalate	1.2			29	UAW11-10	2.25	Yes	167	No
Pesticide/PCBs (ug/l)									
4,4'-DDD	0.00031			0.14	UAW07-20	0.0043	Yes	NA	NA
4,4'-DDE	0.00022			0.3	UAW12-20	0.01	Yes	NA	NA
4,4'-DDT	0.00022			0.036	UAW12-20	0.001	Yes	NA	NA
Aldrin	0.000049			0.076	MW-EPA-1	0.002	Yes	NA	NA
alpha-BHC	0.0026			0.025	UAW20-60	0.001	No	NA	NA
alpha-Chlordane	0.0008			0.039	UAW18-20	0.001	Yes	NA	NA
beta-BHC	0.0091			0.39	UAW12-20	0.012	Yes	NA	NA
delta-BHC	-		0.011	1	UAW23-20	0.031	Yes	NA	NA
Dieldrin	0.000052			0.27	UAW12-20	0.008	Yes	NA	NA
Endrin	0.059			0.15	UAW04-20	0.005	No	NA	NA
Endrin aldehyde	0.29			6.9	UAW15-50	0.214	No	NA	NA
gamma-Chlordane	0.0008			0.37	UAW07-20	0.011	Yes	NA	NA
Heptachlor	0.000079			0.27	UAW12-20	0.008	Yes	NA	NA
Heptachlor epoxide	0.000039			0.97	UAW10-50	0.030	Yes	NA	NA
Toxaphene	0.00028			1	UAW18-20	0.031	Yes	NA	NA
Inorganic Compounds (ug/l)									
Aluminum	-	50		4240	MW-EPA-3	131.346	Yes	351,000	No
Antimony	5.6			8.7	UAW15-50	0.270	No	NA	NA
Arsenic	0.018			215	MW-EPA-1	6.660	Yes	105	No
Chromium	-	100		172	UAW21-30	5.328	No	NA	NA
Iron	300			12500	UAW10-80	387.222	Yes	105,000	No
Manganese	-	50		11800	UAW22-20	365.538	Yes	49,100	No
Thallium	0.24			12.2	UAW06-20	6.97	Yes	23.2	No

TABLE 2
CONSERVATIVELY ESTIMATED SURFACE WATER CONCENTRATIONS COMPARED TO HUMAN HEALTH SURFACE WATER CRITERIA
Rohm and Haas Chemicals LLC
Reading, Ohio

NRWQC - National Recommended Water Quality Criterion
MCL - Maximum Contaminant Level
PRGs - Preliminary Remediation Goals
SSTL - Site-Specific Target Level
"-" - None established
NA - Not applicable
Estimated concentration in surface water calculated according to the following equation: Csw = Cgw x Qgw / (Qgw + Qsw) where:
Cgw - maximum detected concentration in groundwater (ug/L)
Qgw - calculated groundwater flux (ft^3/day) = 13,534 ft^3/day
where: maximum saturated thickness = 6 ft; width of plume = shoreline (1120 ft); hydraulic gradient = 0.019 ft/ft; and hydraulic conductivity = 106 ft/day
Qsw = 423,360 ft^3/day ($7Q_{10}$ flow for Mill Creek (4.9 cfs) multiplied by 86,400 seconds/day) (OEPA, 2004a)
Screening hierarchy was as follows: NRWQC was the preferred value; if no NRWQC then the MCL was used; if no NRWQC or MCL, then PRG was used.
Criteria for metals are for the total fraction since the groundwater analytical results are for the total fraction.
BEHP, chloroform, cis-1,2-dichloroethene, thallium and trichloroethene were detected in the surface water of Mill Creek,
therefore, the maximum detected concentration was included in the estimated surface water concentration calculations for these compounds.
- Estimated surface water concentration exceeds NRWQC, MCL or PRG.
SSTLs were not calculated for pesticides since pesticides are not site-related compounds.
Refer to Tables 3 through 5 for methodology for calculation of SSTLs.

TABLE 3
CALCULATED SSTLs FOR SURFACE WATER BASED ON INCIDENTAL INGESTION FOR A RECREATIONAL USER
Rohm and Haas Chemicals LLC
Reading, Ohio

Noncarcinogen

Hazard Index = (CW x IR x ET x EF x ED)/(BW x AT)/RfDo
Suface Water SSTL (CW) = (1/24*BW*AT*RfDo)/(IR*ET*EF*ED)

Chemical of Concern	Surface Water SSTL (mg/L)	Ingestion Rate (IR) L/hours	Exposure Time (ET) hours/event	Exposure Frequency (EF) (events/yr)	Exposure Duration (ED) (yrs)	Body Weight (BW) (kg)	Averaging Time (AT) (days)	RfDo (mg/kg-day)
Arsenic (child)	1.05E-01	0.05	0.5	26	6	15	2190	3.00E-04
Arsenic (adult)	1.43E+00	0.05	0.5	26	24	70	25550	3.00E-04
Arsenic (adult and child)	**1.05E-01**							3.00E-04
Aluminum (child)	3.51E+02	0.05	0.5	26	6	15	2190	1.00E+00
Aluminum (adult)	4.78E+03	0.05	0.5	26	24	70	25550	1.00E+00
Aluminum (adult and child)	**3.51E+02**							1.00E+00
Iron (child)	1.05E+02	0.05	0.5	26	6	15	2190	3.00E-01
Iron (adult)	1.43E+03	0.05	0.5	26	24	70	25550	3.00E-01
Iron (adult and child)	**1.05E+02**							3.00E-01
Manganese (child)	4.91E+01	0.05	0.5	26	6	15	2190	1.40E-01
Manganese (adult)	6.69E+02	0.05	0.5	26	24	70	25550	1.40E-01
Manganese (adult and child)	**4.91E+01**							1.40E-01
Thallium (child)	2.32E-02	0.05	0.5	26	6	15	2190	6.60E-05
Thallium (adult)	3.15E-01	0.05	0.5	26	24	70	25550	6.60E-05
Thallium (adult and child)	**2.32E-02**							6.60E-05
1,2-Dichloroethane (child)	7.02E+00	0.05	0.5	26	6	15	2190	2.00E-02
1,2-Dichloroethane (adult)	9.55E+01	0.05	0.5	26	24	70	25550	2.00E-02
1,2-Dichloroethane (adult and child)	**7.02E+00**							2.00E-02
Benzene (child)	1.40E+00	0.05	0.5	26	6	15	2190	4.00E-03
Benzene (adult)	1.91E+01	0.05	0.5	26	24	70	25550	4.00E-03
Benzene (adult and child)	**1.40E+00**							4.00E-03
Methylene chloride (child)	2.11E+01	0.05	0.5	26	6	15	2190	6.00E-02
Methylene chloride (adult)	2.87E+02	0.05	0.5	26	24	70	25550	6.00E-02
Methylene chloride (adult and child)	**2.11E+01**							6.00E-02
Tetrachloroethene (child)	3.51E+00	0.05	0.5	26	6	15	2190	1.00E-02
Tetrachloroethene (adult)	4.78E+01	0.05	0.5	26	24	70	25550	1.00E-02
Tetrachloroethene (adult and child)	**3.51E+00**							1.00E-02
Vinyl chloride (child)	1.05E+00	0.05	0.5	26	6	15	2190	3.00E-03
Vinyl chloride (adult)	1.43E+01	0.05	0.5	26	24	70	25550	3.00E-03
Vinyl chloride (adult and child)	**1.05E+00**							3.00E-03
Aniline (child)	2.46E+00	0.05	0.5	26	6	15	2190	7.00E-03
Aniline (adult)	3.34E+01	0.05	0.5	26	24	70	25550	7.00E-03
Aniline (adult and child)	**2.46E+00**							7.00E-03
bis(2-ethylhexyl)phthalate (child)	7.02E+00	0.05	0.5	26	6	15	2190	2.00E-02
bis(2-ethylhexyl)phthalate (adult)	9.55E+01	0.05	0.5	26	24	70	25550	2.00E-02
bis(2-ethylhexyl)phthalate (adult and child)	**7.02E+00**							2.00E-02

Note: SSTL - site-specific target level
1) Target hazard index of 1 is used.
2) The total hazard index is divided by 24 to distribute the total hazard level of 1 to twelve compounds of concern and two exposure pathways.
3) The lower level between adult SW goal and child SW goal is used for the adult and child combined scenario.

TABLE 3

CALCULATED SSTLs FOR SURFACE WATER BASED ON INCIDENTAL INGESTION FOR A RECREATIONAL USER

Rohm and Haas Chemicals LLC

Reading, Ohio

Carcinogen

Cancer Risk=SF x CW x {[(IRa x ETa x EFa x EDa)/(BWa x ATa)]+[(IRc x ETc x EFc x EDc)/(BWc x ATc)]}

Surface Water SSTL (CW) =(10^{-4}/14)/(SF*([(IRa x ETa x EFa x EDa)/(BWa x ATa)] + [(IRc x ETc x EFc x EDc)/(BWc x ATc)]}

Chemical of Concern	Surface Water SSTL (mg/L)	Ingestion Rate (IR) L/hours	Exposure Time (ET) hours/event	Exposure Frequency (EF) (events/yr)	Exposure Duration (ED) (yrs)	Body Weight (BW) (kg)	Averaging Time (AT) (days)	SF (kg-day/mg)
Arsenic (child)	--	0.05	0.5	26	6	15	25550	1.50E+00
Arsenic (adult)	--	0.05	0.5	26	24	70	25550	1.50E+00
Arsenic (adult and child)	2.52E-01							1.50E+00
Aluminum (child)	--	0.05	0.5	26	6	15	25550	--
Aluminum (adult)	--	0.05	0.5	26	24	70	25550	--
Aluminum (adult and child)	--							--
Iron (child)	--	0.05	0.5	26	6	15	25550	--
Iron (adult)	--	0.05	0.5	26	24	70	25550	--
Iron (adult and child)	--							--
Manganese (child)	--	0.05	0.5	26	6	15	25550	--
Manganese (adult)	--	0.05	0.5	26	24	70	25550	--
Manganese (adult and child)	--							--
Thallium (child)	--	0.05	0.5	26	6	15	25550	--
Thallium (adult)	--	0.05	0.5	26	24	70	25550	--
Thallium (adult and child)	--							--
1,2-Dichloroethane (child)	--	0.05	0.5	26	6	15	25550	9.10E-02
1,2-Dichloroethane (adult)	--	0.05	0.5	26	24	70	25550	9.10E-02
1,2-Dichloroethane (adult and child)	4.15E+00							9.10E-02
Benzene (child)	--	0.05	0.5	26	6	15	25550	5.50E-02
Benzene (adult)	--	0.05	0.5	26	24	70	25550	5.50E-02
Benzene (adult and child)	6.87E+00							5.50E-02
Methylene chloride (child)	--	0.05	0.5	26	6	15	25550	7.50E-03
Methylene chloride (adult)	--	0.05	0.5	26	24	70	25550	7.50E-03
Methylene chloride (adult and child)	5.04E+01							7.50E-03
Tetrachloroethene (child)	--	0.05	0.5	26	6	15	25550	5.40E-01
Tetrachloroethene (adult)	--	0.05	0.5	26	24	70	25550	5.40E-01
Tetrachloroethene (adult and child)	7.00E-01							5.40E-01
Vinyl chloride (child)	--	0.05	0.5	26	6	15	25550	1.5
Vinyl chloride (adult)	--	0.05	0.5	26	24	70	25550	1.5
Vinyl chloride (adult and child)	2.52E-01							1.5
Aniline (child)	--	0.05	0.5	26	6	15	25550	--
Aniline (adult)	--	0.05	0.5	26	24	70	25550	--
Aniline (adult and child)	--							
bis(2-ethylhexyl)phthalate (child)	--	0.05	0.5	26	6	15	25550	1.40E-02
bis(2-ethylhexyl)phthalate (adult)	--	0.05	0.5	26	24	70	25550	1.40E-02
bis(2-ethylhexyl)phthalate (adult and child)	2.70E+01							1.40E-02

Note:

SSTL - site-specific target level

1) Target cancer risk of 1 x 10^{-4} is used.

2) The total cancer risk is divided by 14 to distribute the total cancer level of 10^{-4} to seven carcinogenic compounds of concern and two exposure pathways.

3) The adult and child surface water goal combines the adult (24 years) and child (6 years) scenarios.

TABLE 4
CALCULATED SSTLs FOR SURFACE WATER BASED ON DERMAL CONTACT FOR A RECREATIONAL USER
Rohm and Haas Chemicals LLC
Reading, Ohio

NONCARCINOGEN

Inorganics: Hazard Index = (Kp x CW x 0.001 x Tevent x EV x EF x ED x SA)/(BW x AT)/RfDd
Inorganics: Surface Water SSTL (CW) = (1/24*BW*AT*RfDd)/(Kp*Tevent*0.001*EV*EF*ED*SA)
Organics: Hazard Index = (2FA x Kp x CW x 0.001 x (6τ x Tevent/3.14)$^{1/2}$ x EV x EF x ED x SA)/(BW x AT)/RfDd
Organics: Suface Water SSTL (CW) = (1/24*BW*AT*RfDd)/(2FA*Kp*0.001*(6*τ*Tevent/3.14)$^{1/2}$*EV*EF*ED*SA)

Chemical of Concern	Surface Water SSTL (mg/L)	Event Frequency (EV) (events/d)	Exposure Frequency (EF) (days/yr)	Exposure Duration (ED) (yrs)	Skin Surface Area (SA) (cm^2)	Body Weight (BW) (kg)	Averaging Time (AT) (days)	RfDd (mg/kg-day)
Arsenic (child)	7.98E-01	1	26	6	6600	15	2190	3.00E-04
Arsenic (adult)	3.08E+00	1	26	24	18000	70	25550	3.00E-04
Arsenic (adult and child)	7.98E-01							3.00E-04
Aluminum (child)	2.66E+03	1	26	6	6600	15	2190	1.00E+00
Aluminum (adult)	1.33E+04	1	26	24	18000	70	25550	1.00E+00
Aluminum (adult and child)	2.66E+03							1.00E+00
Iron (child)	7.98E+02	1	26	6	6600	15	2190	3.00E-01
Iron (adult)	3.98E+03	1	26	24	18000	70	25550	3.00E-01
Iron (adult and child)	7.98E+02							3.00E-01
Manganese (child)	3.72E+02	1	26	6	6600	15	2190	1.40E-01
Manganese (adult)	1.86E+03	1	26	24	18000	70	25550	1.40E-01
Manganese (adult and child)	3.72E+02							1.40E-01
Thallium (child)	1.75E-01	1	26	6	6600	15	2190	6.60E-05
Thallium (adult)	8.76E-01	1	26	24	18000	70	25550	6.60E-05
Thallium (adult and child)	1.75E-01							6.60E-05
1,2-Dichloroethane (child)	5.25E+00	1	26	6	6600	15	2190	2.00E-02
1,2-Dichloroethane (adult)	2.62E+01	1	26	24	18000	70	25550	2.00E-02
1,2-Dichloroethane (adult and child)	5.25E+00							2.00E-02
Benzene (child)	3.37E-01	1	26	6	6600	15	2190	4.00E-03
Benzene (adult)	1.68E+00	1	26	24	18000	70	25550	4.00E-03
Benzene (adult and child)	3.37E-01							4.00E-03
Methylene chloride (child)	2.06E+01	1	26	6	6600	15	2190	6.00E-02
Methylene chloride (adult)	1.03E+02	1	26	24	18000	70	25550	6.00E-02
Methylene chloride (adult and child)	2.06E+01							6.00E-02
Tetrachloroethene (child)	2.16E-01	1	26	6	6600	15	2190	1.00E-02
Tetrachloroethene (adult)	1.08E+00	1	26	24	18000	70	25550	1.00E-02
Tetrachloroethene (adult and child)	2.16E-01							1.00E-02
Vinyl chloride (child)	7.44E-01	1	26	6	6600	15	2190	3.00E-03
Vinyl chloride (adult)	3.71E+00	1	26	24	18000	70	25550	3.00E-03
Vinyl chloride (adult and child)	7.44E-01							3.00E-03
Aniline (child)	4.23E+00	1	26	6	6600	15	2190	7.00E-03
Aniline (adult)	2.11E+01	1	26	24	18000	70	25550	7.00E-03
Aniline (adult and child)	4.23E+00							7.00E-03
bis(2-ethylhexyl)phthalate (child)	1.67E-01	1	26	6	6600	15	2190	2.00E-02
bis(2-ethylhexyl)phthalate (adult)	8.32E-01	1	26	24	18000	70	25550	2.00E-02
bis(2-ethylhexyl)phthalate (adult and child)	1.67E-01							2.00E-02

Note:
SSTL - site-specific target level
1) Target hazard index of 1 is used.
2) The total hazard index is divided by 24 to distribute the total hazard level of 1 to twelve compounds of concern and two exposure pathways.
3) The lower level between adult SW goal and child SW goal is used for the adult and child combined scenario.

TABLE 4
CALCULATED SSTLs FOR SURFACE WATER BASED ON DERMAL CONTACT FOR A RECREATIONAL USER
Rohm and Haas Chemicals LLC
Reading, Ohio

CARCINOGEN

Inorganics: Cancer Risk = ((Kp x CW x Tevent x 0.001 x EV x EF x SF)/AT) x ((EDc x SAc)/BWc + (EDa x SAa)/BWa)
Inorganics: Surface Water SSTL (CW)= (10^{-4}/14*AT)/((Kp*Tevent*0.001*EV*EF*SF)*((EDc*SAc)/BWc+(EDa*SAa)/BWa)
Organics: Cancer Risk = ((2FA x Kp x CW x 0.001 x (6τ x Tevent/3.14)$^{1/2}$ x EV x EF x SF)/AT)x((EDcxSAc)/BWc+(EDaxSAa)/BWa)
Organics: Surface Water SSTL (CW) = (10^{-4}/14*AT)/((2FA*Kp*0.001*(6*t*Tevent/3.14)$^{1/2}$*EV*EF*SF)*((EDc*SAc)/BWc+(EDa*SAa)/BWa))

Chemical of Concern	Surface Water SSTL (mg/L)	Event Frequency (EV) (events/d)	Exposure Frequency (EF) (days/yr)	Exposure Duration (ED) (yrs)	Skin Surface Area (SA) (cm^2)	Body Weight (BW) (kg)	Averaging Time (AT) (days)	SF (kg-day/mg)
Arsenic (child)	--	1	26	6	6600	15	25550	1.50E+00
Arsenic (adult)	--	1	26	24	18000	70	25550	1.50E+00
Arsenic (adult and child)	1.06E+00							
Aluminum (child)	--	1	26	6	6600	15	25550	--
Aluminum (adult)	--	1	26	24	18000	70	25550	--
Aluminum (adult and child)	--							
Iron (child)	--	1	26	6	6600	15	25550	--
Iron (adult)	--	1	26	24	18000	70	25550	--
Iron (adult and child)	--							
Manganese (child)	--	1	26	6	6600	15	25550	--
Manganese (adult)	--	1	26	24	18000	70	25550	--
Manganese (adult and child)	--							
Thallium (child)	--	1	26	6	6600	15	25550	--
Thallium (adult)	--	1	26	24	18000	70	25550	--
Thallium (adult and child)	--							
1,2-Dichloroethane (child)	--	1	26	6	6600	15	25550	9.10E-02
1,2-Dichloroethane (adult)	--	1	26	24	18000	70	25550	9.10E-02
1,2-Dichloroethane (adult and child)	1.73E+00							9.10E-02
Benzene (child)	--	1	26	6	6600	15	25550	5.50E-02
Benzene (adult)	--	1	26	24	18000	70	25550	5.50E-02
Benzene (adult and child)	9.17E-01							5.50E-02
Methylene chloride (child)	--	1	26	6	6600	15	25550	7.50E-03
Methylene chloride (adult)	--	1	26	24	18000	70	25550	7.50E-03
Methylene chloride (adult and child)	2.74E+01							7.50E-03
Tetrachloroethene (child)	--	1	26	6	6600	15	25550	5.40E-01
Tetrachloroethene (adult)	--	1	26	24	18000	70	25550	5.40E-01
Tetrachloroethene (adult and child)	2.40E-02							5.40E-01
Vinyl chloride (child)	--	1	26	6	6600	15	25550	1.5
Vinyl chloride (adult)	--	1	26	24	18000	70	25550	1.5
Vinyl chloride (adult and child)	9.90E-02							1.5
Aniline (child)	--	1	26	6	6600	15	25550	--
Aniline (adult)	--	1	26	24	18000	70	25550	--
Aniline (adult and child)	--							--
bis(2-ethylhexyl)phthalate (child)	--	1	26	6	6600	15	25550	1.40E-02
bis(2-ethylhexyl)phthalate (adult)	--	1	26	24	18000	70	25550	1.40E-02
bis(2-ethylhexyl)phthalate (adult and child)	3.57E-01							1.40E-02

Note: SSTL - site-specific target level

1) Target cancer risk of 1 x 10^{-4} is used.
2) The total cancer risk is divided by 14 to distribute the total cancer level of 10^{-4} to seven carcinogenic compounds of concern and two exposure pathways.
3) The adult and child surface water goal combines the adult (24 years) and child (6 years) scenarios.

TABLE 4
CALCULATED SSTLs FOR SURFACE WATER BASED ON DERMAL CONTACT FOR A RECREATIONAL USER
Rohm and Haas Chemicals LLC
Reading, Ohio

Absorbed dose (mg/kg-d) = (DA event x EV x EF x ED x SA)/(BW x AT)

DA event is calculated as follows:

Inorganics: DAevent=Kp x CW x CF x Tevent

Organics:

If Tevent < t*, then: DA event = 2FA x Kp x Cw x CF x $(6\tau Tevent/3.14)^{1/2}$

If Tevent>t*, then: DA event = FA x Kp x Cw x CF x $[Tevent/(1+B) + 2\tau(1+3B+3B^2)/(1+B)^2]$

Where: CF = Correction factor of 0.001 L/cm^3

Tevent = 0.5 hrs for dermal contact during each swimming event

Inorganics	Kp(cm/hr)	Tevent (hrs)
Arsenic	1.00E-03	0.5
Aluminum	1.00E-03	0.5
Iron	1.00E-03	0.5
Manganese	1.00E-03	0.5
Thallium	1.00E-03	0.5

Organics	t* (hrs)	Kp(cm/hr)	τ(hr)	B	FA
1,2-Dichloroethane	0.92	4.20E-03	0.38	0	1
Benzene	0.70	1.50E-02	0.29	0.1	1
Methylene chloride	0.76	3.50E-03	0.32	0	1
Tetrachloroethene	2.18	3.30E-02	0.91	0.2	1
Vinyl chloride	0.57	5.60E-03	0.24	0	1
Aniline	0.85	1.90E-03	0.35	0	1
bis(2-ethylhexyl)phthalate	39.93	2.50E-02	16.64	0.2	0.8

TABLE 5
SUMMARY OF CALCULATED SSTLS FOR SURFACE WATER
FOR THE RECREATIONAL USER SCENARIO
Rohm and Haas Chemicals LLC
Reading, Ohio

Compounds	Surface Water SSTL (mg/L)			
	Ingestion		Dermal	
	Cancer	Noncancer	Cancer	Noncancer
Arsenic (child)	--	1.05E-01	--	7.98E-01
Arsenic (adult)	--	1.43E+00	--	3.98E+00
Arsenic (adult and child)	2.52E-01	**1.05E-01**	1.06E+00	7.98E-01
Aluminum (child)	--	3.51E+02	--	2.66E+03
Aluminum (adult)	--	4.78E+03	--	1.33E+04
Aluminum (adult and child)	--	**3.51E+02**	--	2.66E+03
Iron (child)	--	1.05E+02	--	7.98E+02
Iron (adult)	--	1.43E+03	--	3.98E+03
Iron (adult and child)	--	**1.05E+02**	--	7.98E+02
Manganese (child)	--	4.91E+01	--	3.72E+02
Manganese (adult)	--	6.69E+02	--	1.86E+03
Manganese (adult and child)	--	**4.91E+01**	--	3.72E+02
Thallium (child)	--	2.32E-02	--	1.75E-01
Thallium (adult)	--	3.15E-01	--	8.76E-01
Thallium (adult and child)	--	**2.32E-02**	--	1.75E-01
1,2-Dichloroethane (child)	--	7.02E+00	--	5.25E+00
1,2-Dichloroethane (adult)	--	9.55E+01	--	2.62E+01
1,2-Dichloroethane (adult and child)	4.15E+00	7.02E+00	**1.73E+00**	5.25E+00
Benzene (child)	--	1.40E+00	--	3.37E-01
Benzene (adult)	--	1.91E+01	--	1.68E+00
Benzene (adult and child)	6.87E+00	1.40E+00	9.17E-01	**3.37E-01**
Methylene chloride (child)	--	2.11E+01	--	2.06E+01
Methylene chloride (adult)	--	2.87E+02	--	1.03E+02
Methylene chloride (adult and child)	5.04E+01	2.11E+01	**2.74E+01**	2.06E+01
Tetrachloroethene (child)	--	3.51E+00	--	2.16E-01
Tetrachloroethene (adult)	--	4.78E+01	--	1.08E+00
Tetrachloroethene (adult and child)	7.00E-01	3.51E+00	**2.40E-02**	2.16E-01
Vinyl chloride (child)	--	1.05E+00	--	7.44E-01
Vinyl chloride (adult)	--	1.43E+01	--	3.71E+00
Vinyl chloride (adult and child)	2.52E-01	1.05E+00	**9.90E-02**	7.44E-01
Aniline (child)	--	2.46E+00	--	4.23E+00
Aniline (adult)	--	3.34E+01	--	2.11E+01
Aniline (adult and child)	--	**2.46E+00**	--	4.23E+00
bis(2-ethylhexyl)phthalate (child)	--	7.02E+00	--	1.67E-01
bis(2-ethylhexyl)phthalate (adult)	--	9.55E+01	--	8.32E-01
bis(2-ethylhexyl)phthalate (adult and child)	2.70E+01	7.02E+00	3.57E-01	**1.67E-01**

Note: SSTL - site-specific target level
1. Recreational user (adult and child) scenario is used for the final surface water SSTLs.
2. The surface water SSTLs are intended to be used as screening levels because they are developed based on conservative assumptions. For compounds that exceed these goals in the future, a risk assessment may be performed to determine the actual risk.
BOLD value is the lowest calculated surface water SSTL for that compound.

TABLE 6
CONSERVATIVELY ESTIMATED SURFACE WATER CONCENTRATIONS COMPARED TO OHIO SURFACE WATER CRITERIA AND REGION 5 ESLs
Rohm and Haas Chemicals LLC
Reading, Ohio

	OMZA	Region 5 ESL	MAX Detected - All Wells	Location	Estimated Concentration in Surface Water	Calculated HQ for Estimated Maximum Concentration in Surface Water - All Wells	MAX Detected - Downgradient Wells	Location	Estimated Concentration in Surface Water	Calculated HQ for Estimated Maximum Concentration in Surface Water - Downgradient Wells
Volatile Organic Compounds (ug/l)										
Carbon disulfide	15	15	180	UAW13-20	5.58	0.37	7.1	UAW07-20	0.22	0.015
Chlorobenzene	47	47	2500	MW-EPA-1	77.44	1.65	2500	MW-EPA-1	77.44	1.65
Isopropylbenzene	4.8	-	8.9	UAW07-20	0.28	0.06	8.9	UAW07-20	0.28	0.06
Tetrachloroethene	53	45	75	MW-EPA-2	2.32	0.04	ND	NA	NA	NA
Toluene	62	253	11000	UAW04-20	340.76	5.50	ND	NA	NA	NA
Xylenes (total)	27	27	270	UAW08-20	8.36	0.31	130	MW-EPA-1	4.03	0.15
Semivolatile Organic Compounds (ug/l)										
1,1'-Biphenyl	6.5	-	60	UAW07-20	1.86	0.29	60	UAW07-20	1.86	0.29
1,2-Dichlorobenzene	23	14	1100	MW-EPA-1, UAW12-20	34.08	1.48	1100	MW-EPA-1	34.08	1.48
1,3-Dichlorobenzene	22	38	35	MW-EPA-1, UAW12-20	1.08	0.049	35	MW-EPA-1	1.08	0.049
1,4-Dichlorobenzene	9.4	9.4	250	MW-EPA-1	7.74	0.82	250	MW-EPA-1	7.74	0.82
Aniline	4.1	4.1	5900	UAW08-20	182.77	44.58	28	MW-EPA-1	0.87	0.21
bis(2-ethylhexyl)phthalate	8.4	0.3	29	UAW11-10	2.25	0.27	3.2	UAW02-20	1.46	0.17
Pesticide/PCBs (ug/l)										
4,4'-DDE	-	4.51E-09	0.3	UAW12-20	0.01	2.06E+06	0.052	MW-EPA-1	0.002	3.57E+05
4,4'-DDT	-	1.10E-05	0.036	UAW12-20	0.001	101.38	ND	NA	NA	NA
Aldrin	-	1.70E-02	0.076	MW-EPA-1	0.002	0.138	0.076	MW-EPA-1	0.002	0.138
alpha-Chlordane	-	4.30E-03	0.039	UAW18-20	0.001	0.28	ND	NA	NA	NA
Chlordane	-	4.30E-03	0.37	UAW07-20	0.01	2.67	0.37	UAW07-20	0.01	2.67
Dieldrin	0.056	7.10E-05	0.27	UAW12-20	0.01	0.149	0.24	UAW03-20	0.01	0.133
Endosulfan I	-	5.60E-02	0.094	UAW15-20	0.003	0.052	ND	NA	NA	NA
Endosulfan II	-	5.60E-02	0.27	MW-EPA-1	0.01	0.149	0.27	MW-EPA-1	0.01	0.149
Endrin	0.036	3.60E-02	0.15	UAW04-20	0.005	0.129	0.14	UAW07-20	0.004	0.120
Endrin aldehyde	-	1.50E-01	6.9	UAW15-50	0.21	1.42	0.075	UAW05-20	0.002	0.0155
gamma-BHC	0.057	2.60E-02	0.47	UAW08-20	0.01	0.26	0.04	MW-EPA-1	0.001	0.022
Heptachlor	-	3.80E-03	0.27	UAW12-20	0.01	2.20	0.22	UAW03-20 dup	0.01	1.79
Heptachlor epoxide	-	3.80E-03	0.97	UAW10-50	0.03	7.91	0.37	UAW05-20	0.01	3.02
Toxaphene	-	1.40E-04	1	UAW18-20	0.03	221.27	ND	NA	NA	NA
Inorganic Compounds (ug/l)										
Aluminum	-	80	4240	MW-EPA-3	131.35	1.64	365	MW-EPA-1	11.31	0.14
Arsenic	150	148	215	MW-EPA-1	6.66	0.04	215	MW-EPA-1	6.66	0.04
Barium	220	220	759	UAW18-20	83.40	0.38	228	UAW25-20	66.95	0.30
Cadmium	5.1	0.15	2.7	UAW08-20	0.08	0.02	0.5	UAW03-20	0.02	0.00
Chromium	183	42	172	UAW21-30	5.33	0.03	20.3	UAW01-30	0.63	0.00
Copper	20.4	1.58	19.5	UAW21-30	0.60	0.03	4.8	UAW25-20	0.15	0.01
Iron	-	1000	12500	UAW10-80	387.22	0.39	7380	UAW25-20	228.62	0.23
Manganese	-	120	11800	UAW22-20	365.54	3.05	1670	UAW25-20	51.73	0.43
Nickel	113	28.9	518	UAW21-30	16.05	0.14	181	UAW01-30	5.61	0.05
Selenium	4.6	5	15.1	UAW23-20	0.47	0.10	ND	NA	NA	NA
Tin	180	180	5740	UAW08020	177.81	0.99	1340	MW-EPA-1	41.51	0.23

TABLE 6

CONSERVATIVELY ESTIMATED SURFACE WATER CONCENTRATIONS COMPARED TO OHIO SURFACE WATER CRITERIA AND REGION 5 ESLs

Rohm and Haas Chemicals LLC

Reading, Ohio

The applicable surface water criteria is the OMZA; a Region 5 ESL was used for comparison only if an OMZA was unavailable.
OMZA - Ohio Outside the Mixing Zone Average, from Ohio EPA, July 27, 2005.
ID - Insufficient data to develop a value.
"-" - None established
ND - Not detected
NA - Not applicable
Estimated concentration in surface water calculated according to the following equation: Csw = Cgw x Qgw / (Qgw + Qsw) where:
Cgw - maximum detected concentration in groundwater (ug/L)
Qgw - calculated groundwater flux (ft^3/day) = 13,534 ft^3/day
where: maximum saturated thickness = 6 ft; width of plume = shoreline (1120 ft); hydraulic gradient = 0.019 ft/ft; and hydraulic conductivity = 106 ft/day
Qsw - $7Q_{10}$ flow for Mill Creek (4.9 cfs multiplied by 86,400 seconds/day) (OEPA, 2004)
HQ calculated by dividing the maximum detected concentration by the OMZA concentration. If OMZA concentration not available, then the HQ is calculated by dividing the maximum detected concentration by the Region 5 ESL.
Downgradient wells include UAW03-20, UAW05-20, UAW07-20, MW-EPA-1, UAW01-30, UAW02-20, UAW02-40 and UAW25-20.
Criteria for metals are for the total fraction since the groundwater analytical results are for the total fraction.
All values based on an average hardness of 250 mg/L as measured by the OEPA at two locations near the site in 1992.
BEHP and barium were detected in the surface water of Mill Creek, therefore, the maximum detected concentration was included in the estimated surface water concentration calculations for these compounds.
- Estimated surface water concentration exceeds OMZA
- Estimated surface water concentration exceeds Region 5 ESL (an OMZA is unavailable for these compounds)

TABLE 7
ESTIMATED SURFACE WATER CONCENTRATIONS USING SITE-SPECIFIC PLUME WIDTHS AND 2004 SAMPLING DATA AS COMPARED TO AQUATIC LIFE SURFACE WATER CRITERIA

Rohm and Haas Chemicals LLC
Reading, Ohio

	Concentrations in Groundwater Wells (ug/L) (November 2004)											Surface Water Concentration (ug/L) (March 2004)	Estimated Total Concentration in Surface Water (ug/L)	OMZA Surface Water Standard (ug/L)
	UAW07-20	UAW08-20	MW-EPA-1	UAW05-20	UAW06-20	UAW03-20	UAW04-20	UAW02-20	UAW02-40	UAW25-20	UAW01-30			
Compounds														
Chlorobenzene	190	62	2500	560	83	110	165 *	10	0.85 *	7.9	0.23	0.50 *	8.5	47
1,2-Dichlorobenzene	100	380	1100	90	52	220	3.8	10	5 *	6.4	5 *	5 *	8.9	23

OMZA - Ohio Outside the Mixing Zone Average, from Ohio EPA, July 27, 2005.
NA - Not analyzed
* - Compound was not detected; concentration shown is 1/2 of the detection limit.
Estimated concentration in surface water calculated according to the following equation:
Csw = (Cgw-1 x Qgw-1)+(Cgw-2 x Qgw-2)+(Cgw-3 x Qgw-3)+...(Cgw-x x Qgw-x)+(Csw-max x Qsw) / (Qgw-total + Qsw)
where:
Cgw-x - maximum detected concentration in well x (ug/L)
Qgw-x - calculated groundwater flux (ft^3/day) for each plume width
where: maximum saturated thickness = 6 ft; hydraulic gradient = 0.019 ft/ft; and hydraulic conductivity = 106 ft/day
Qsw - $7Q_{10}$ flow for Mill Creek (4.9 cfs multiplied by 86,400 seconds/day) (OEPA, 2004)
Plume widths (ft) for each well are as follows:

UAW07-20	=	55
UAW08-20	=	35
MW-EPA-1	=	80
UAW05-20	=	60
UAW06-20	=	90
UAW03-20	=	95
UAW04-20	=	100
UAW02-20	=	185
UAW02-40	=	185
UAW25-20	=	180
UAW01-30	=	240

(Concentrations in wells UAW02-20 and UAW02-40 were averaged due to their proximity)

TABLE 8.6

Comparison of Seep Water Analytical Results and Human Health Surface Water Screening Values

Rohm and Haas Chemicals LLC

Reading, Ohio

Chemicals	NRWQC	MCL	Region 9 PRGs	Maximum Concentrations	Locations	Exceedance
Volatile Organic Compounds						
Acetone			5500	3.1	SS-5	No
Benzene	2.2			1.1	SS-1	No
Carbon disulfide			1000	1.1	SS-5	No
Chlorobenzene	130			24	SS-5	No
1,1-Dichloroethane			810	1	SS-1	No
Ethylbenzene	530			0.39	SS-1	No
Methylcyclohexane			5200	0.49	SS-1	No
Toluene	1300			0.55	SS-5	No
Xylenes (total)		10000		1.7	SS-1	No
Semi-Volatile Organic Compounds						
1,2-Dichlorobenzene	420			21	SS-1	No
1,4-Dichlorobenzene	63			2.6	SS-1	No
Pesticides						
beta-BHC	0.0091			0.056	SS-5	Yes
alpha-Chlordane	0.0008			0.02	SS-5	Yes
4,4'-DDE	0.00022			0.025	SS-5	Yes
4,4'-DDT	0.00022			0.028	SS-1	Yes
Dieldrin	0.00052			0.053	SS-1	Yes
Endosulfan I	62			0.03	SS-5	No
Endosulfan II	62			0.046	SS-1	No
Heptachlor epoxide	0.000039			0.033	SS-1	Yes
Isodrin				0.005	SS-1	Screening Level not available
Inorganics						
Aluminum		50-200		48300	SS-1	Yes
Arsenic	0.018			25.7	SS-1	Yes
Barium	1000			494	SS-1	No
Beryllium	4			3.1	SS-1	No
Cadmium	5			1.7	SS-1	No
Calcium				430000	SS-1	No, essential nutrient
Chromium		100		174	SS-1	Yes
Cobalt			730	43.8	SS-1	No
Copper	1300			104	SS-1	No
Iron	300			90100	SS-1	Yes
Lead		15		126	SS-1	Yes
Magnesium				90100	SS-1	No, essential nutrient
Manganese		50		2730	SS-5	Yes
Mercury		2		0.18	SS-5	No
Nickel	610			214	SS-1	No
Potassium				14200	SS-1	No, essential nutrient
Sodium				375000	SS-5	No, essential nutrient
Tin			22000	1340	SS-5	No
Vanadium			36	124	SS-1	Yes
Zinc	7400			411	SS-1	No

Unit: ug/l

- Maximum concentration exceeds the screening level.
- Other screening levels applied. Chemical was detected in boundary well exceeding the screening level.

NRWQC - National Recommended Water Quality Criterion

MCL - Maximum Contaminant Level

PRGs - Preliminary Remediation Goals

Screening hierarchy was as follows: NRWQC was the preferred value; if no NRWQC then the MCL was used; if no NRWQC or MCL, then PRG was used.

TABLE 8.8

Comparison of Groundwater Water Analytical Results and Human Health Surface Water Screening Values

Rohm and Haas Chemicals LLC

Reading, Ohio

Chemicals	NRWQC	MCL	Region 9 PRGs	Maximum Concentrations - All Wells	Locations	Exceedance	Maximum Concentrations - Downgradient Wells	Locations	Exceedance
VOCs (ug/l)									
1,1,1-Trichloroethane	200			60	UAW20-60	No	0		No
trifluoroethane (Freon 113)			59000	3.2J	UAQ10-50	No	0		No
1,1,2-Trichloroethane	0.59			2.6	UAW23-20	Yes	0		No
1,1-Dichloroethane			810	42	UAW20-60	No	20	UAW20-40	No
1,1-Dichloroethene	330			19J	UAW20-60	No	3.9	UAW20-40	No
1,2-Dichloroethane	0.38			1200	UAW20-60	Yes	0		No
2-Butanone			7000	29J	UAW08-20	No	0		No
4-Methyl-2-pentanone			2000	66J	UAW08-20	No	0		No
Acetone			5500	980 JB	UAW04-20	No	310 JB	MW-EPA-1	No
Benzene	2.2			150B	UAW08-20	Yes	49 JB	MW-EPA-1	Yes
Bromodichloromethane	0.55			0.26J	UAW09-60	No	0		No
Carbon disulfide			1000	180	UAW13-20	No	7.1	UAW5-20	No
Carbon tetrachloride	0.23			2.2 J	UAW15-20	Yes	0		No
Chlorobenzene	130			2500	MW-EPA-1	Yes	2500	MW-EPA-1	Yes
Chloroethane			4.6	6.8J	UAW10-50	Yes	0		No
Chloroform	5.7			140	UAW15-20	Yes	0		No
cis-1,2-Dichloroethene		70		80	UAW20-60	Yes	48	UAW20-40	No
Cyclohexane			10000	1.2	UAW25-20	No	1.2	UAW25-20	No
Ethylbenzene	530			59	UAW08-20	No	28 J	MW-EPA-1	No
Isopropylbenzene			660	8.9	UAW07-20	No	8.9	UAW07-20	No
Methyl tert-butyl ether			11	0.2J	MW-EPA-3	No	0		No
Methylcyclohexane			5200	17 J	UAW08-20	No	6.2 J	UAW03-20	No
Methylene chloride	4.6			280 JB	UAW04-20	Yes	85 JB	MW-EPA-1	Yes
Tetrachloroethene	0.69			75	MW-EPA-2	Yes	0		No
Toluene	1300			11000	UAW04-20	Yes	0		No
trans-1,2-Dichloroethene	140			2.5	UAW02-40	No	2.5	UAW02-40	No
Trichloroethene	2.5			5.1	UAW23-20	Yes	0		No
Vinyl chloride	0.025			4	UAW22-20	Yes	0.78 J	UAW02-40	Yes
Xylenes (total)		10000		270	UAW08-20	No	130	MW-EPA-1	No
SVOCs (ug/l)									
1,1'-Biphenyl			300	60J	UAW07-20	No	60J	UAW07-20	No
1,2-Dichlorobenzene	420			1100	MW-EPA-1	Yes	1100	MW-EPA-1	Yes
1,3-Dichlorobenzene	320			35 J	MW-EPA-1	No	35 J	MW-EPA-1	No
1,4-Dichlorobenzene	63			250 J	MW-EPA-1	Yes	250 J	MW-EPA-1	Yes
2-Methylnaphthalene*			6.2	8.6 J	UAW13-20	Yes	0		No
2-Methylphenol			1800	15 J	UAW04-20	No	0		No
4-Methylphenol			180	28 J #	UAW04-20	No	0		No
Aniline			12	5900	UAW08-20	Yes	28 J	MW-EPA-1	Yes
Benzaldehyde			3600	1.7 J	UAW05-20	No	1.7 J	UAW05-20	No
bis(2-Ethylhexyl) phthalate	1.2			29 B	UAW11-10	Yes	3.2 J B	UAW02-20	Yes
Caprolactam			18000	5.5 J	UAW06-20	No	0		No
Naphthalene			6.2	0.89 J	UAW22-20	No	0		No
Phenol	21000			160 J	UAW08-20	No	0		No

TABLE 8.8

Comparison of Groundwater Water Analytical Results and Human Health Surface Water Screening Values

Rohm and Haas Chemicals LLC

Reading, Ohio

Chemicals	NRWQC	MCL	Region 9 PRGs	Maximum Concentrations - All Wells	Locations	Exceedance	Maximum Concentrations - Downgradient Wells	Locations	Exceedance
Pesticide and PCBs (ug/l)									
4,4'-DDD	0.00031			0.14 J	UAW07-20	Yes	0.14 J	UAW07-20	Yes
4,4'-DDE	0.00022			0.3 PG	UAW12-20	Yes	0.052 PG	MW-EPA-1	Yes
4,4'-DDT	0.00022			0.036 J	UAW12-20	Yes	0		No
Aldrin	0.000049			0.076 PG	MW-EPA-1	Yes	0.076 PG	MW-EPA-1	Yes
alpha-BHC	0.0026			0.025 J	UAW20-60	Yes	0.021 J	UAW25-20	Yes
alpha-Chlordane	0.0008			0.039J	UAW18-20	Yes	0		No
beta-BHC	0.0091			0.39 PG	UAW12-20	Yes	0.22 PG	AW03-20 (Du	Yes
delta-BHC			0.011	1	UAW23-20	Yes	0.031 J	MW-EPA-1	Yes
Dieldrin	0.000052			0.27 PG	UAW12-20	Yes	0.26 PG	AW03-20 (Du	Yes
Endosulfan I	62			0.094	UAW15-20	No	0		No
Endosulfan II	62			0.27 PG	MW-EPA-1	No	0.27 PG	MW-EPA-1	No
Endosulfan sulfate	62			0.17 PG	UAW12-20	No	0		No
Endrin	0.059			0.15 PG	UAW04-20	Yes	0.14 J	UAW07-20	Yes
Endrin aldehyde	0.29			6.9	UAW15-50	Yes	0.075	UAW05-20	No
Endrin ketone		2		0.032 J	MW-EPA-1	No	0.032 J	MW-EPA-1	No
gamma-BHC (Lindane)	0.98			0.47 PG	UAW08-20	No	0.04 J	MW-EPA-1	No
gamma-Chlordane	0.0008			0.37 J	UAW07-20	Yes	0.37 J	UAW07-20	Yes
Heptachlor	0.000079			0.27 PG	UAW12-20	Yes	0.22 PG	AW03-20 (Du	Yes
Heptachlor epoxide	0.000039			0.97	UAW10-50	Yes	0.37 PG	UAW05-20	Yes
Methoxychlor		40		0.47 J	UAW07-20	No	0.47 J	UAW07-20	No
Toxaphene	0.00028			1J	UAW18-20	Yes	0		No
Metals (ug/l)									
Aluminum		50-200		4240 J	MW-EPA-3	Yes	365J	MW-EPA-3	Yes
Antimony	5.6			8.7 B	UAW15-50	Yes	0		No
Arsenic	0.018			215	MW-EPA-1	Yes	215	MW-EPA-1	Yes
Barium	1000			759	UAW18-20	No	228	UAW25-20	No
Beryllium	4			0.79	UAW13-20	No	0		No
Cadmium	5			2.7 J	UAW08-20	No	0.5BJ	UAW03-20	No
Calcium				1020000	UAW08-20	No	408000	UAW07-20	No
Chromium		100		172	UAW21-30	Yes	20.3	UAW01-30	No
Cobalt			730	11.9	UAW11-40	No	2.7B	UAW01-30	No
Copper	1300			19.5 B	UAW21-30	No	4.8B	UAW25-20	No
Cyanide, Total	140			6.3B	UAW15-20	No	0		No
Iron	300			12500	UAW10-80	Yes	7380	UAW25-20	Yes
Lead		15		5.4	UAW10-80	No	0		No
Magnesium				134000	UAW08-20	No	123000J	MW-EPA-1	No
Manganese		50		11800 J	UAW22-20	Yes	1670	UAW25-20	Yes
Mercury		2		0.082 B	UAW01-30	No	0.082 B	UAW01-30	No
Nickel	610			518	UAW21-30	No	181	UAW01-30	No
Potassium				22400	UAW23-20	No	13300 J	UAW01-30	No
Selenium	170			15.1	UAW23-20	No	0		No
Silver			180	1.1B	UAW10-50	No	0		No
Sodium				1290000	UAW15-20	No	577000	MW-EPA-1	No
Thallium	0.24			12.2	UAW06-20	Yes	8B	UAW03-20	Yes

TABLE 8.8

Comparison of Groundwater Water Analytical Results and Human Health Surface Water Screening Values

Rohm and Haas Chemicals LLC

Reading, Ohio

Chemicals	NRWQC	MCL	Region 9 PRGs	Maximum Concentrations - All Wells	Locations	Exceedance	Maximum Concentrations - Downgradient Wells	Locations	Exceedance
Tin			22000	5740	UAW08-20	No	1340	MW-EPA-1	No
Total Sulfide		250000		160000	UAW13-20	No	22000	UAW07-20	No
Vanadium			36	20.2	UAW06-20	No	7.6	UAW03-20	No
Zinc	7400			54.3	MW-EPA-3	No	0		No

- Maximum concentration exceeds the screening level.

- Other screening levels applied. Chemical was detected in boundary well exceeding the screening level.

NRWQC - National Recommended Water Quality Criterion

MCL - Maximum Contaminant Level

PRGs - Preliminary Remediation Goals

* - Naphthalene screening level is used as a surrogate for 2-methylnaphthalene.

Screening hierarchy was as follows: NRWQC was the preferred value; if no NRWQC then the MCL was used; if no NRWQC or MCL, then PRG was used.

TABLE 10.4
COMPARISON OF NOVEMBER 2004 GROUNDWATER DATA IN THE UPPER AQUIFER TO OHIO SURFACE WATER CRITERIA AND REGION 5 ESLs
Rohm and Haas Chemicals LLC
Reading, Ohio

	OMZA	Region 5 ESL	MAX Detected - All Wells	Location	OMZA Based HQ - All Wells	Retained as COPEC--All Wells?	MAX Detected - Downgradient Wells	Location	OMZA Based HQ - Downgradient Wells	Retained as COPEC--downgradient Wells?
Volatile Organic Compounds (ug/l)										
1,1-Dichloroethane	ID	47	42	UAW20-60	0.89	No; HQ<1	20	UAW02-40	0.43	No; HQ<1
1,1,1-Trichloroethane	76	76	60	UAW20-60	0.79	No; HQ<1	NA	NA	NA	No; not detected
1,1,2-Trichloroethane	740	500	2.6	UAW23-20	0.004	No; HQ<1	NA	NA	NA	No; not detected
1,1,2-Trichloro-1,2,2-trifluoroethane	-	NE	3.2	UAW10-50	-	Yes, screening value unavailable	NA	NA	NA	No; not detected
1,1-Dichloroethene	210	65	19	UAW20-60	0.09	No; HQ<1	3.9	UAW02-40	0.02	No; HQ<1
1,2-Dichloroethane	2000	910	1200	UAW20-60	0.60	No; HQ<1	NA	NA	NA	No; not detected
cis-1,2-Dichloroethene	970	970	80	UAW20-60	0.08	No; HQ<1	48	UAW02-40	0.05	No; HQ<1
4-Methyl-2-pentanone	ID	170	66	UAW08-20	0.39	No; HQ<1	NA	NA	NA	No; not detected
Acetone	-	1700	980	UAW04-20	0.58	No; HQ<1	310	MW-EPA-1	0.18	No; HQ<1
Benzene	160	114	150	UAW08-20	0.94	No; HQ<1	49	MW-EPA-1	0.31	No; HQ<1
Bromodichloromethane	ID	NE	0.26	UAW09-60	-	Yes, screening value unavailable	NA	NA	NA	No; not detected
Carbon disulfide	15	15	180	UAW13-20	**12**	Yes; HQ>1	7.1	UAW07-20	0.47	No; HQ<1
Carbon tetrachloride	240	240	2.2	UAW15-20	0.01	No; HQ<1	NA	NA	NA	No; not detected
Chlorobenzene	47	47	2500	MW-EPA-1	**53**	Yes; HQ>1	2500	MW-EPA-1	**53.19**	Yes; HQ>1
Chloroethane	-	NE	6.8	UAW10-50	-	Yes, screening value unavailable	NA	NA	NA	No; not detected
Chloroform	140	140	140	UAW15-20	1.00	No; HQ=1	NA	NA	NA	No; not detected
Cyclohexane	-	NE	1.2	UAW25-20	-	Yes, screening value unavailable	1.2	UAW25-20	-	Yes, screening value unavailable
Ethylbenzene	61	14	59	UAW08-20	0.97	No; HQ<1	28	MW-EPA-1	0.46	No; HQ<1
Isopropylbenzene	4.8	NE	8.9	UAW07-20	**1.85**	Yes; HQ>1	8.9	UAW07-20	**1.85**	Yes; HQ>1
Methylcyclohexane	-	253	17	UAW08-20	0.07	No; HQ<1	6.2	UAW03-20	0.02	No; HQ<1
Methyl ethyl ketone	22000	2200	29	UAW08-20	0.00	No; HQ<1	NA	NA	NA	No; not detected
Methylene chloride	1900	940	280	UAW04-20	0.15	No; HQ<1	85	MW-EPA-1	0.04	No; HQ<1
Methyl-tert-butyl ether	730	NE	0.2	MW-EPA-3	0.00	No; HQ<1	NA	NA	NA	No; not detected
Tetrachloroethene	53	45	75	MW-EPA-2	**1.42**	Yes; HQ>1	NA	NA	NA	No; not detected
Toluene	62	253	11000	UAW04-20	**177.42**	Yes; HQ>1	NA	NA	NA	No; not detected
trans-1,2-Dichloroethene	970	970	2.5	UAW02-40	0.00	No; HQ<1	2.5	UAW02-40	0.00	No; HQ<1
Trichloroethene	220	47	5.1	UAW23-20	0.02	No; HQ<1	NA	NA	NA	No; not detected
Vinyl chloride	930	930	4	UAW22-20	0.00	No; HQ<1	0.78	UAW02-40	0.00	No; HQ<1
Xylenes (total)	27	27	270	UAW08-20	**10.00**	Yes; HQ>1	130	MW-EPA-1	**4.81**	Yes; HQ>1
Semivolatile Organic Compounds (ug/l)										
1,1'-Biphenyl	6.5	NE	60	UAW07-20	**9.23**	Yes; HQ>1	60	UAW07-20	**9.23**	Yes; HQ>1
1,2-Dichlorobenzene	23	14	1100	MW-EPA-1, UAW12-20	**47.83**	Yes; HQ>1	1100	MW-EPA-1	**47.83**	Yes; HQ>1
1,3-Dichlorobenzene	22	38	35	MW-EPA-1, UAW12-20	**1.59**	Yes; HQ>1	35	MW-EPA-1	**1.59**	Yes; HQ>1
1,4-Dichlorobenzene	9.4	9.4	250	MW-EPA-1	**26.60**	Yes; HQ>1	250	MW-EPA-1	**26.60**	Yes; HQ>1
2-Methylnaphthalene	-	330	8.6	UAW13-20	0.03	No; HQ<1	NA	NA	NA	No; not detected
2-Methylphenol	67	67	15	UAW04-20	0.22	No; HQ<1	NA	NA	NA	No; not detected
4-Methylphenol	53	25	28	UAW04-20	0.53	No; HQ<1	NA	NA	NA	No; not detected
Aniline	4.1	4.1	5900	UAW08-20	**1439.02**	Yes; HQ>1	28	MW-EPA-1	**6.83**	Yes; HQ>1
Benzaldehyde	-	NE	1.7	UAW05-20	-	Yes, screening value unavailable	1.7	UAW05-20	-	Yes, screening value unavailable
bis(2-ethylhexyl)phthalate	8.4	0.3	29	UAW11-10	**3.45**	Yes; HQ>1	3.2	UAW02-20	0.38	No; HQ<1
Naphthalene	21	13	0.89	UAW22-20	0.04	No; HQ<1	NA	NA	NA	No; not detected
Phenol	400	180	160	UAW08-20	0.40	No; HQ<1	NA	NA	NA	No; not detected

TABLE 10.4
COMPARISON OF NOVEMBER 2004 GROUNDWATER DATA IN THE UPPER AQUIFER TO OHIO SURFACE WATER CRITERIA AND REGION 5 ESLs
Rohm and Haas Chemicals LLC
Reading, Ohio

	OMZA	Region 5 ESL	MAX Detected - All Wells	Location	OMZA Based HQ - All Wells	Retained as COPEC--All Wells?	MAX Detected - Downgradient Wells	Location	OMZA Based HQ - Downgradient Wells	Retained as COPEC--downgradient Wells?
Pesticide/PCBs (ug/l)										
4,4'-DDD	-	NE	0.14	UAW07-20	-	Yes, screening value unavailable	0.14	UAW07-20	-	Yes, screening value unavailable
4,4'-DDE	-	4.51E-09	0.3	UAW12-20	**6.65E+07**	Yes; HQ>1	0.052	MW-EPA-1	**1.15E+07**	Yes; HQ>1
4,4'-DDT	-	1.10E-05	0.036	UAW12-20	**3.27E+03**	Yes; HQ>1	NA	NA	NA	No; not detected
Aldrin	-	1.70E-02	0.076	MW-EPA-1	**4.47**	Yes; HQ>1	0.076	MW-EPA-1	**4.47**	Yes; HQ>1
alpha-BHC	-	1.24E+01	0.025	UAW20-60	0.00	No; HQ<1	0.021	UAW25-20	0.00	No; HQ<1
alpha-Chlordane	-	4.30E-03	0.039	UAW18-20	**9.07**	Yes; HQ>1	NA	NA	NA	No; not detected
beta-BHC	-	4.95E-01	0.39	UAW12-20	0.79	No; HQ<1	0.22	UAW03-20 dup	0.44	No; HQ<1
delta-BHC	-	6.67E+02	1	UAW23-20	0.00	No; HQ<1	0.031	MW-EPA-1	0.00	No; HQ<1
Caprolactam	-	NE	5.5	UAW06-20	-	Yes, screening value unavailable	NA	NA	NA	No; not detected
Chlordane	-	4.30E-03	0.37	UAW07-20	**86.05**	Yes; HQ>1	0.37	UAW07-20	**86.05**	Yes; HQ>1
Dieldrin	0.056	7.10E-05	0.27	UAW12-20	**4.82**	Yes; HQ>1	0.24	UAW03-20	**4.29**	Yes; HQ>1
Endosulfan I	-	5.60E-02	0.094	UAW15-20	**1.68**	Yes; HQ>1	NA	NA	NA	No; not detected
Endosulfan II	-	5.60E-02	0.27	MW-EPA-1	**4.82**	Yes; HQ>1	0.27	MW-EPA-1	**4.82**	Yes; HQ>1
Endosulfan sulfate	-	2.22E+00	0.17	UAW12-20	0.08	No; HQ<1	NA	NA	NA	No; not detected
Endrin	0.036	3.60E-02	0.15	UAW04-20	**4.17**	Yes; HQ>1	0.14	UAW07-20	**3.89**	Yes; HQ>1
Endrin aldehyde	-	1.50E-01	6.9	UAW15-50	**46.00**	Yes; HQ>1	0.075	UAW05-20	0.50	No; HQ<1
Endrin ketone	0.036	NE	0.032	MW-EPA-1	0.89	No; HQ<1	0.032	MW-EPA-1	0.89	No; HQ<1
gamma-BHC	0.057	2.60E-02	0.47	UAW08-20	**8.25**	Yes; HQ>1	0.04	MW-EPA-1	0.70	No; HQ<1
Heptachlor	-	3.80E-03	0.27	UAW12-20	**71.05**	Yes; HQ>1	0.22	UAW03-20 dup	**57.89**	Yes; HQ>1
Heptachlor epoxide	-	3.80E-03	0.97	UAW10-50	**255.26**	Yes; HQ>1	0.37	UAW05-20	**97.37**	Yes; HQ>1
Methoxychlor	-	NE	0.47	UAW07-20	-	Yes, screening value unavailable	0.47	UAW07-20	-	Yes, screening value unavailable
Toxaphene	-	1.40E-04	1	UAW18-20	**7142.86**	Yes; HQ>1	NA	NA	NA	No; not detected
Inorganic Compounds (ug/l)										
Aluminum	-	80	4240	MW-EPA-3	**53.00**	Yes; HQ>1	365	MW-EPA-1	**4.56**	Yes; HQ>1
Antimony	190	80	8.7	UAW15-50	0.05	No; HQ<1	NA	NA	NA	No; not detected
Arsenic	150	148	215	MW-EPA-1	**1.43**	Yes; HQ>1	215	MW-EPA-1	**1.43**	Yes; HQ>1
Barium	220	220	759	UAW18-20	**3.45**	Yes; HQ>1	228	UAW25-20	**1.04**	Yes; HQ>1
Beryllium	47.8	3.6	0.79	UAW13-20	0.02	No; HQ<1	NA	NA	NA	No; not detected
Cadmium	5.1	0.15	2.7	UAW08-20	0.53	No; HQ<1	0.5	UAW03-20	0.10	No; HQ<1
Calcium	-	NE	1020000	UAW08-20	-	No; essential nutrient	408000	UAW07-20	-	No; essential nutrient
Chromium	183	42	172	UAW21-30	0.94	No; HQ<1	20.3	UAW01-30	0.11	No; HQ<1
Cobalt	24	24	11.9	MW-EPA-3, UAW11-40	0.50	No; HQ<1	2.7	UAW01-30	0.11	No; HQ<1
Copper	20.4	1.58	19.5	UAW21-30	0.96	No; HQ<1	4.8	UAW25-20	0.24	No; HQ<1
Cyanide	12	5.2	6.3	UAW15-20	0.53	No; HQ<1	NA	NA	NA	No; not detected
Iron	-	1000	12500	UAW10-80	**12.50**	Yes; HQ>1	7380	UAW25-20	**7.38**	Yes; HQ>1
Lead	20.6	1.17	5.4	UAW10-80	0.26	No; HQ<1	NA	NA	NA	No; not detected
Magnesium	-	NE	134000	UAW08-20	-	No; essential nutrient	123000	MW-EPA-1	-	No; essential nutrient
Manganese	-	120	11800	UAW22-20	**98.33**	Yes; HQ>1	1670	UAW25-20	**13.92**	Yes; HQ>1
Mercury	0.91	0.0013	0.082	UAW01-80	0.09	No; HQ<1	0.082	UAW01-30	0.09	No; HQ<1
Nickel	113	28.9	518	UAW21-30	**4.58**	Yes; HQ>1	181	UAW01-30	**1.60**	Yes; HQ>1
Potassium	-	NE	22400	UAW23-20	-	No; essential nutrient	13300	UAW01-30	-	No; essential nutrient
Selenium	5	5	15.1	UAW23-20	**3.02**	Yes; HQ>1	NA	NA	NA	No; not detected
Silver	1.3	0.12	1.1	UAW10-50	0.85	No; HQ<1	NA	NA	NA	No; not detected

TABLE 10.4
COMPARISON OF NOVEMBER 2004 GROUNDWATER DATA IN THE UPPER AQUIFER TO OHIO SURFACE WATER CRITERIA AND REGION 5 ESLs
Rohm and Haas Chemicals LLC
Reading, Ohio

	OMZA	Region 5 ESL	MAX Detected - All Wells	Location	OMZA Based HQ - All Wells	Retained as COPEC--All Wells?	MAX Detected - Downgradient Wells	Location	OMZA Based HQ - Downgradient Wells	Retained as COPEC--downgradient Wells?
Sodium	-	NE	1290000	UAW15-20	-	No; essential nutrient	577000	MW-EPA-1	-	No; essential nutrient
Thallium	17	10	12.2	UAW06-20	0.72	No; HQ<1	8	UAW03-20	0.47	No; HQ<1
Tin	180	180	5740	UAW08020	**31.89**	Yes; HQ>1	1340	MW-EPA-1	**7.44**	Yes; HQ>1
Vanadium	44	12	20.2	UAW06-20	0.46	No; HQ<1	7.6	UAW03-20	0.17	No; HQ<1
Zinc	260	65.7	54.3	MW-EPA-3	0.21	No; HQ<1	NA	NA	NA	No; not detected

OMZA - Ohio Outside the Mixing Zone Average, from Ohio EPA, July 27, 2005.
ID - Insufficient data to develop a value.
NE- None established.
NA - Not applicable
HQ calculated by dividing the maximum detected concentration by the OMZA concentration. If OMZA concentration not available, then the HQ is calculated by dividing the maximum detected concentration by the Region 5 ESL.
Downgradient wells include UAW03-20, UAW05-20, UAW07-20, MW-EPA-1, UAW01-30, UAW02-20, UAW02-40 and UAW25-20.
Criteria for metals are for the total fraction since the groundwater analytical results are for the the total fraction.
All values based on an average hardness of 250 mg/L as measured at two locations near the site by the OEPA in 1992.
- Maximum detected concentration exceeds OMZA or ESL

TABLE 10.5
COMPARISON OF NOVEMBER 2004 GROUNDWATER DATA IN THE UPPER AQUIFER TO OHIO IMZM AND OMZM
Rohm and Haas Chemicals LLC
Reading, Ohio

	IMZM	OMZM	MAX Detected - All Wells	Location	IMZM Based HQ - All Wells	Retained as COPEC--All Wells?	MAX Detected - Downgradient Wells	Location	IMZM Based HQ - Downgradient Wells	Retained as COPEC--downgradient Wells?
Volatile Organic Compounds (ug/l)										
1,1,2-Trichloro-1,2,2-trifluoroethane	-	-	3.2	UAW10-50	-	Yes, screening value unavailable	NA	NA	NA	No; not detected
Bromodichloromethane	ID	ID	0.26	UAW09-60	-	Yes, screening value unavailable	NA	NA	NA	No; not detected
Carbon disulfide	260	130	160	UAW13-20	7.E-01	No; HQ<1	7.1	UAW07-20	3.E-02	No; HQ<1
Chlorobenzene	850	420	2500	MW-EPA-1	**3.E+00**	Yes; HQ>1	2500	MW-EPA-1	**3.E+00**	Yes; HQ>1
Chloroethane	-	-	6.8	UAW10-50	-	Yes, screening value unavailable	NA	NA	NA	No; not detected
Cyclohexane	-	-	1.2	UAW25-20	-	Yes, screening value unavailable	1.2	UAW25-20	-	Yes, screening value unavailable
Isopropylbenzene	86	43	8.9	UAW07-20	1.E-01	No; HQ<1	8.9	UAW07-20	1.E-01	No; HQ<1
Tetrachloroethene	850	430	75	MW-EPA-2	9.E-02	No; HQ<1	NA	NA	NA	No; not detected
Toluene	1100	560	11000	UAW04-20	**1.E+01**	Yes; HQ>1	NA	NA	NA	No; not detected
Xylenes (total)	480	240	270	UAW08-20	6.E-01	No; HQ<1	130	MW-EPA-1	3.E-01	No; HQ<1
Semivolatile Organic Compounds (ug/l)										
1,1'-Biphenyl	51	26	60	UAW07-20	**1.E+00**	Yes; HQ>1	60	UAW07-20	**1.E+00**	Yes; HQ>1
1,2-Dichlorobenzene	190	96	1100	MW-EPA-1, UAW12-20	**6.E+00**	Yes; HQ>1	1100	MW-EPA-1	**6.E+00**	Yes; HQ>1
1,3-Dichlorobenzene	160	79	35	MW-EPA-1, UAW12-20	2.E-01	No; HQ<1	35	MW-EPA-1	2.E-01	No; HQ<1
1,4-Dichlorobenzene	110	57	250	MW-EPA-1	**2.E+00**	Yes; HQ>1	250	MW-EPA-1	**2.E+00**	Yes; HQ>1
Aniline	59	30	5900	UAW08-20	**1.E+02**	Yes; HQ>1	28	MW-EPA-1	5.E-01	No; HQ<1
bis(2-ethylhexyl)phthalate	2100	1100	29	UAW11-10	1.E-02	No; HQ<1	3.2	UAW02-20	2.E-03	No; HQ<1
Pesticide/PCBs (ug/l)										
4,4'-DDD	-	-	0.14	UAW07-20	-	Yes, screening value unavailable	0.14	UAW07-20	-	Yes, screening value unavailable
4,4'-DDE	-	-	0.3	UAW12-20	-	Yes, screening value unavailable	0.052	MW-EPA-1	-	Yes, screening value unavailable
4,4'-DDT	-	-	0.036	UAW12-20	-	Yes, screening value unavailable	NA	NA	NA	No; not detected
Aldrin	-	-	0.076	MW-EPA-1	-	Yes, screening value unavailable	0.076	MW-EPA-1	-	Yes, screening value unavailable
alpha-Chlordane	-	-	0.039	UAW18-20	-	Yes, screening value unavailable	NA	NA	NA	No; not detected
Chlordane	-	-	0.37	UAW07-20	-	Yes, screening value unavailable	0.37	UAW07-20	-	Yes, screening value unavailable
Dieldrin	0.47	2.40E-01	0.27	UAW12-20	6.E-01	No; HQ<1	0.24	UAW03-20	5.E-01	No; HQ<1
Endosulfan I	-	-	0.094	UAW15-20	-	Yes, screening value unavailable	NA	NA	NA	No; not detected
Endosulfan II	-	-	0.27	MW-EPA-1	-	Yes, screening value unavailable	0.27	MW-EPA-1	-	Yes, screening value unavailable
Endrin	0.17	8.60E-02	0.15	UAW04-20	9.E-01	No; HQ<1	0.14	UAW07-20	8.E-01	No; HQ<1
Endrin aldehyde	-	-	6.9	UAW15-50	-	Yes, screening value unavailable	0.075	UAW05-20	-	Yes, screening value unavailable
gamma-BHC	1.9	9.50E-01	0.47	UAW08-20	2.E-01	No; HQ<1	0.04	MW-EPA-1	2.E-02	No; HQ<1
Heptachlor	-	-	0.27	UAW12-20	-	Yes, screening value unavailable	0.22	UAW03-20 dup	-	Yes, screening value unavailable
Heptachlor epoxide	-	-	0.97	UAW10-50	-	Yes, screening value unavailable	0.37	UAW05-20	-	Yes, screening value unavailable
Methoxychlor	-	-	0.47	UAW07-20	-	Yes, screening value unavailable	0.47	UAW07-20	-	Yes, screening value unavailable
Toxaphene	-	-	1	UAW18-20	-	Yes, screening value unavailable	NA	NA	NA	No; not detected
Inorganic Compounds (ug/l)										
Aluminum	-	-	4240	MW-EPA-3	-	Yes, screening value unavailable	365	MW-EPA-1	-	Yes, screening value unavailable
Arsenic	680	340	215	MW-EPA-1	3.E-01	No; HQ<1	215	MW-EPA-1	3.E-01	No; HQ<1
Barium	4000	2000	759	UAW18-20	2.E-01	No; HQ<1	228	UAW25-20	6.E-02	No; HQ<1
Iron	-	-	12500	UAW10-80	-	Yes, screening value unavailable	7380	UAW25-20	-	Yes, screening value unavailable
Manganese	-	-	11800	UAW22-20	-	Yes, screening value unavailable	1670	UAW25-20	-	Yes, screening value unavailable
Nickel	2033	1017	518	UAW21-30	3.E-01	No; HQ<1	181	UAW01-30	9.E-02	No; HQ<1

TABLE 10.5
COMPARISON OF NOVEMBER 2004 GROUNDWATER DATA IN THE UPPER AQUIFER TO OHIO IMZM AND OMZM
Rohm and Haas Chemicals LLC
Reading, Ohio

	IMZM	OMZM	MAX Detected - All Wells	Location	IMZM Based HQ - All Wells	Retained as COPEC--All Wells?	MAX Detected - Downgradient Wells	Location	IMZM Based HQ - Downgradient Wells	Retained as COPEC--downgradient Wells?
Selenium	-	-	15.1	UAW23-20	-	Yes, screening value unavailable	NA	NA	NA	No; not detected
Tin	3200	1600	5740	UAW08-20	**2.E+00**	Yes; HQ>1	1340	MW-EPA-1	4.E-01	No; HQ<1

IMZM - Ohio Inside the Mixing Zone Maximum & OMZM - Ohio Outside the Mixing Zone Maximum, from Ohio EPA, July 27, 2005.
ID - insufficient data to develop a value.
NA - Not applicable
HQ calculated by dividing the maximum detected concentration by the IMZM concentration.
Downgradient wells include UAW03-20, UAW05-20, UAW07-20, MW-EPA-1, UAW01-30, UAW02-20, UAW02-40 and UAW25-20.
Criteria for metals are for the total fraction since the groundwater analytical results are for the the total fraction.
All values based on an average hardness of 250 mg/L as measured at two locations near the site by the OEPA in 1992.
- Maximum detected concentration exceeds IMZM

ATTACHMENT D

ADDENDUM (June 2004) to:

Water Quality Permit Support Document to Assess the Proposed Expansion of the Butler Co. Upper Mill Creek WWTP
(1PK00016)

August 1998

Prepared by the Division of Surface Water,
Monitoring and Assessment Section
Ohio Environmental Protection Agency

Based on Biological and Water Quality Sampling Conducted July-September, 2002

2002 Assessment
Water Chemistry - Louise Snyder
Sediment Chemistry - Greg Buthker
Facility Description -Maryanne Mahr
Bioassays, Pretreatment, Pollutant Loadings - Maryanne Mahr, Charles Webster
Physical Habitat, Fish Communities - Bob Miltner
Macroinvertebrate Communities - Jack Freda
Report Coordinator - Jack Freda
Reviewers - Diana Zimmerman, Jeff DeShon

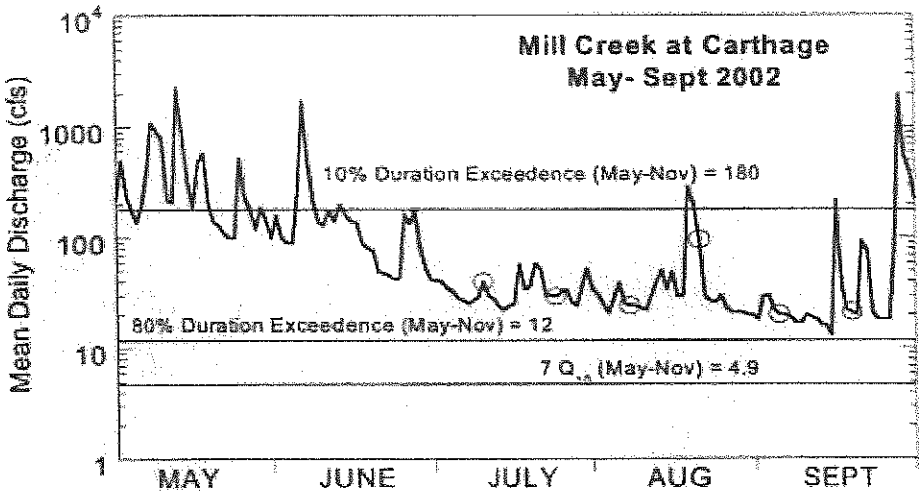


Figure 11. May through September, 2002 flow hydrograph for Mill Creek at Carthage (RM 10.5). Low flow conditions ($7Q_{10}$), 10% and 80% duration exceedence flows are based on USGS station #03259000 (period of record 1952-1997). Open circles indicate river discharge on water chemistry sampling days in the Mill Creek basin.

Water Resources

Data Category: Site Information | Geographic Area: United States | go

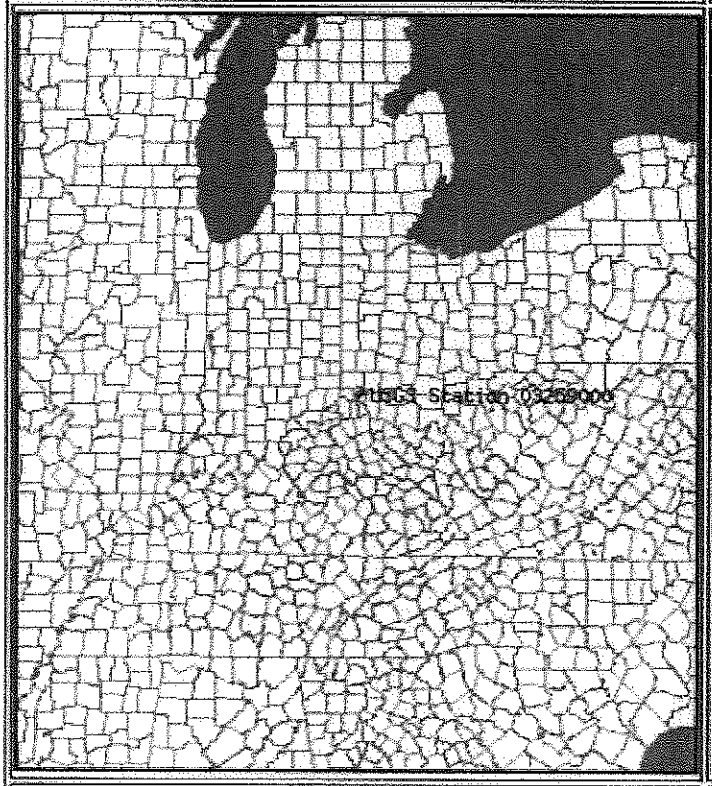
Site Map for the Nation

USGS 03259000 Mill Creek at Carthage OH

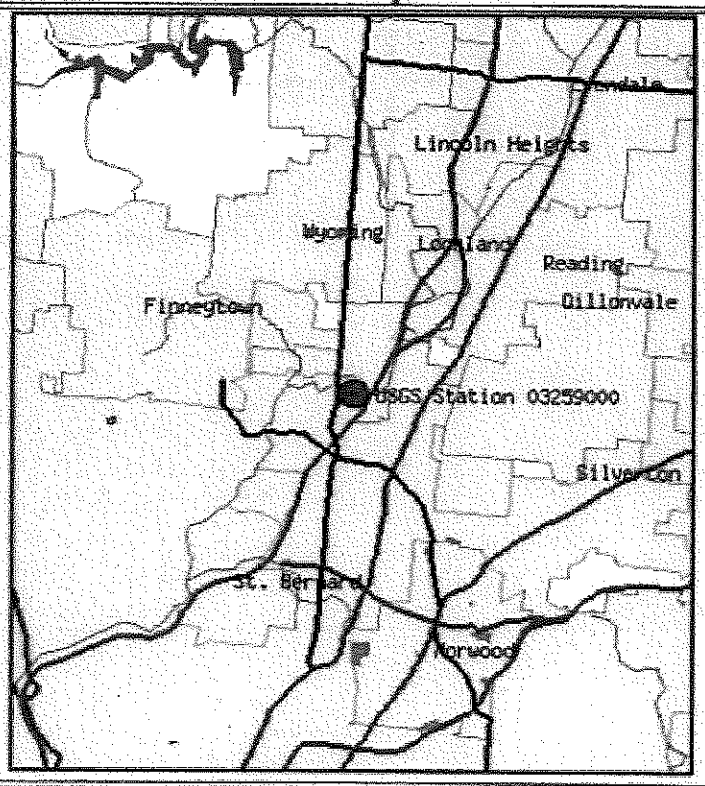
Available data for this site | site map | GO

Hamilton County, Ohio
Hydrologic Unit Code 05090203
Latitude 39°12'07", Longitude 84°28'16" NAD27
Drainage area 115.00 square miles
Contributing drainage area 115 square miles
Gage datum 512.00 feet above sea level NGVD29

Location of the site in USA.



Site map.



ZOOM IN 2X, 4X, 6X, 8X, or ZOOM OUT 2X, 4X, 6X, 8X.

Maps are generated by US Census Bureau TIGER Mapping Service.

Questions about data Water Webserver Team
Feedback on this website NWISWeb Support Team

Top
Explanation of terms

NWIS Site Inventory for USA: Site Map
http://waterdata.usgs.gov/nwis/nwismap?

Retrieved on 2006-01-09 12:30:10 EST
Department of the Interior, U.S. Geological Survey

Water Resources

Data Category: Surface Water | Geographic Area: United States | go

Monthly Streamflow Statistics for the Nation

USGS 03259000 Mill Creek at Carthage OH

Available data for this site Surface-water: Monthly streamflow statistics GO

Hamilton County, Ohio
Hydrologic Unit Code 05090203
Latitude 39°12'07", Longitude 84°28'16" NAD27
Drainage area 115.00 square miles
Contributing drainage area 115 square miles
Gage datum 512.00 feet above sea level NGVD29

Output formats

HTML table of all data
Tab-separated data
Reselect output format

YEAR	Monthly mean streamflow, in ft^3/s											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1946												77.5
1947	289	39.1	47.8	476	408	181	39.1	18.4	12.1	2.46	11.6	8.52
1948	57.7	285	332	403	28.4	8.80	16.9	19.8	13.5	2.84	127	151
1949	643	266	247	42.7	10.3	30.0	27.0	22.6	14.9	10.6	8.86	22.6
1950	666	451	95.7	177	30.5	87.4	34.5	24.3	118	35.3	176	258
1951	382	376	261	144	31.6	19.2	16.6	11.9	14.0	12.4	44.3	265
1952	320	206	294	179	60.0	24.5	19.2	11.8	11.6	8.81	10.7	39.8
1953	208	52.0	117	59.7	138	16.9	33.2	8.47	7.99	10.1	11.4	13.2
1954	15.9	12.5	24.7	22.6	13.1	32.7	45.9	19.5	8.29	17.6	12.2	32.2
1955	67.8	347	334	69.2	30.9	19.5	26.1	18.2	73.0	166	129	41.6
1956	77.9	410	221	233	79.3	42.1	47.6	16.7	16.4	13.3	14.4	33.7
1957	69.6	149	44.5	464	182	82.7	46.2	26.2	22.1	14.8	109	306
1958	135	35.6	67.1	132	141	116	357	164	27.9	11.6	18.2	45.4
1959	493	187	171	73.9	63.1	40.0	21.2	18.5	19.3	18.1	26.1	47.6
1960	109	149	60.3	38.9	43.7	124	114	30.0	18.4	14.8	19.0	26.4
1961	75.8	215	410	193	380	83.3	73.6	26.6	13.5	11.3	34.0	72.2
1962	203	377	314	74.5	54.8	17.0	63.3	13.0	20.1	31.0	32.2	16.9
1963	40.6	40.9	640	55.8	42.9	11.6	24.4	24.7	8.13	5.18	4.51	6.39
1964	25.6	23.0	546	398	19.4	58.6	12.4	9.86	13.8	7.65	18.9	63.5
1965	137	336	198	353	30.2	17.5	25.8	17.8	81.0	57.2	30.7	21.2
1966	216	192	48.8	178	104	25.1	39.6	21.9	37.2	18.1	101	175
1967	31.4	71.8	216	86.6	302	29.9	27.3	13.9	13.1	21.2	44.8	164
1968	62.1	44.4	203	133	516	66.6	80.1	57.3	38.7	15.1	62.9	145

1969	222	167	42.3	122	71.2	47.8	56.6	34.5	71.2	22.6	108	71.8
1970	76.3	110	368	370	71.9	100	55.0	43.1	78.0	32.4	44.3	127
1971	95.0	411	158	43.9	84.9	20.3	42.3	62.6	206	33.1	27.9	139
1972	80.1	60.2	164	332	200	69.2	22.8	24.3	47.0	41.4	298	273
1973	122	94.7	289	348	110	287	304	45.5	22.6	89.1	209	126
1974	218	100	138	242	170	139	31.1	71.5	139	41.5	93.2	168
1975	202	304	371	190	69.4	143	56.8	45.8	54.6	103	39.4	137
1976	223	141	51.2	31.3	23.5	92.2	34.0	87.9	24.8	57.5	18.8	13.2
1977	9.69	66.3	193	93.2	63.5	63.9	41.8	71.2	17.1	134	105	269
1978	177	38.3	316	92.1	193	68.5	91.6	109	30.1	61.6	56.4	299
1979	334	351	140	338	107	122	177	279	327	94.4	259	173
1980	149	63.8	216	147	142	84.2	252	177	20.9	57.2	85.4	43.7
1981	23.4	170	80.0	228	228	170	73.4	42.5	41.4	31.1	51.8	92.7
1982	288	259	336	144	120	158	37.5	57.0	16.6	21.3	52.8	154
1983	78.7	63.0	52.8	190	486	49.0	28.4	27.6	25.2	179	150	130
1984	40.7	123	287	328	190	39.8	74.2	44.3	49.6	70.5	288	234
1985	82.5	199	206	164	232	81.5	115	60.1	11.2	53.5	466	146
1986	71.5	198	195	49.4	107	63.2	69.3	51.4	65.3	77.2	183	97.7
1987	54.2	49.0	142	244	113	65.2	55.1	22.4	17.9	22.4	25.1	61.3
1988	61.7	264	167	143	28.3	14.8	55.1	56.7	63.1	25.4	84.4	104
1989	167	235	281	350	240	64.4	112	84.4	61.4	47.3	102	42.6
1990	111	291	103	107	507	113	60.7	141	101	204	70.3	478
1991	171	250	304	171	85.3	25.9	81.2	67.8	24.3	16.7	22.7	114
1992	108	34.0	96.5	66.3	41.6	40.6	110	171	69.4	100	252	37.3
1993	208	153	229	176	59.0	83.8	50.7	55.0	41.0	55.7	154	108
1994	183	120	100	340	126	90.9	62.2	80.6	31.5	26.6	63.4	81.5
1995	67.7	108	123	124	574	103	56.4	150	34.8	101	70.5	150
1996	321	96.0	285	484	853	253	117	55.2	154	70.4	121	294
1997	167	174	353	75.4	233	461	41.6	100	32.8	28.9	52.7	89.1
1998	169	147	134	561	302	368	212	43.2	54.6	58.4	42.9	128
1999	266	254	181	127	59.8	70.1	37.2	50.7	26.6	51.8	32.5	83.3
2000	216	353	176	254	93.6	87.1	76.3	85.0	83.5	76.7	61.1	134
2001	43.0	97.7	51.2	105	164	191	282	91.1	71.6	192	117	281
2002	107	139	258	410	390	182	33.7	43.9	135			
Mean of monthly streamflows	165	178	205	200	165	91.9	74.9	57.6	50.9	50.6	88.3	123

"Fields, Karen"
<Karen.Fields@parsons.com>
03/16/2007 09:47 AM

To Mirtha Capiro/R5/USEPA/US@EPA, Carl J Coker <CCoker@rohmhaas.com>
cc "Wangcahill, Fan" <Fan.Wangcahill@parsons.com>
bcc

Subject RE: Fw: Additional question--Fw: Questions on BRA aspects -- Rohm and Haas

History: This message has been replied to.

Hi Mirtha,

The tables in the Revised BRA dated June 2005 have the list of detected compounds in the requested format. Specifically, they are as follows:

Table 1.1 - Occurrence, Distribution and Selection of Chemicals of Potential Concern (for Human Health) - Soil
Table 1.2 - Occurrence, Distribution and Selection of Chemicals of Potential Concern - Groundwater
Table 1.3 - Occurrence, Distribution and Selection of Chemicals of Potential Concern (for Human Health) - Surface Water
Table 1.4 - Occurrence, Distribution and Selection of Chemicals of Potential Concern (for Human Health) - Sediment
Table 10.1 - Comparison of Surface Soil Data to Ecological Screening Levels
Table 10.2 - Comparison of Sediment Data to Ecological Screening Levels
Table 10.3 - Comparison of Seep and Surface Water Data to Ecological Screening Levels
Table 15.3 - Toxicity Assessment for Sediment Invertebrates Living in Mill Creek
Table 15.4 - Toxicity Assessment for Aquatic Life Living in Mill Creek

These tables contain site data collected from 2001 through 2004. The groundwater table will be updated to include the November 2005 sample results in the final BRA report. No additional samples have been collected of site soils, sediments, seeps or surface water since 2004.

Human health and ecological data were grouped separately due to different assumptions associated with exposure pathways for the various receptors (for example, animals might only be exposed to surface soils (0-4 ft) whereas construction workers may encounter soils at depths of up to 10 feet or more).

Creek bed and creek bank sediment data were combined for both human health and ecological receptors due to the limited number of sample locations. For human receptors, seep data was not included in the groundwater or the surface water data because direct human exposure to seeps was considered an incomplete exposure pathway due to the limited physical (area) extent of the seeps and low to no visible flow Seep data was evaluated separately by comparing the maximum concentrations detected in the seep samples to the human health surface water screening criteria (NRWQC, MCL, and Region 9 PRGs) (previously presented in Table 8-6 of the 10 October 2005 submittal).

For ecological receptors, seep and surface water data were combined in the initial screening evaluation due to the limited number of seep locations; however, maximum detection of a compound collected just from the creek bed and the surface water of Mill Creek was also evaluated separately in Tables 15.3 and 15.4 of the Revised BRA (June 2005) to determine the potential risk to

aquatic life solely within Mill Creek.

If you need additional information regarding site detected compounds, please let me know and we will include it in the response to be provided 27 March. Thanks!

- Karen

-----Original Message-----
From: Capiro.Mirtha@epamail.epa.gov [mailto:Capiro.Mirtha@epamail.epa.gov]
Sent: Friday, March 16, 2007 10:35 AM
To: Carl J Coker
Cc: Fields, Karen
Subject: Re: Fw: Additional question--Fw: Questions on BRA aspects -- Rohm and Haas

Carl,

I was hoping that you could forward the list of detected compounds alone by early next week since we had agreed to that earlier. However, I agree it would make sense to postpone your responses on the "help notes" summary until March 27 with the rest of the responses.

Please contact me if you have any questions. Thanks.

Mirtha Cápiro
Environmental Scientist
U.S. Environmental Protection Agency
Region 5
77 W. Jackson Blvd. (DE-9J)
Chicago, IL 60604
312/ 886-7567
fax 312/ 353-4342
capiro.mirtha@epa.gov

Carl J Coker
<CCoker@rohmhaas
.com>

03/16/2007 07:08
AM

To
Mirtha Capiro/R5/USEPA/US@EPA

cc
"Karen.Fields"
<Karen.Fields@parsons.com>

Subject
Re: Fw: Additional question--Fw: Questions on BRA aspects -- Rohm and Haas

Mirtha,

The additional questions you raised will require some more follow-up.
Since
Karen and I are out of the office next week, we will not be able to respond to these and the other questions until March 27, 2007.

Regards,

Carl J. Coker
Remediation Project Manager

Rohm and Haas Company | Engineering Div. | 3100 State Road |
Croydon |
PA | 19021
Phone: 215.785.7193 | Fax: 215.785.7077 | Cell: 502.396.7297
|
ccoker@rohmhaas.com
==========

Capiro.Mirtha@epama

il.epa.gov

To

03/15/2007 01:32 PM

Carl J Coker
<CCoker@rohmhaas.com>
cc

Karen.Fields@parsons.com

Subject

Fw: Additional question--Fw:

Questions

on BRA aspects -- Rohm and Haas

Carl,

Just a few minutes ago, I sent the e-mail below to you and included a list of cc's that was incorrect. Fortunately, the e-mail to each of the cc's was undelivered per a system notification. Those individuals formerly assisted with other projects as EPA contractors.

I am resending the e-mail and cc'ing Karen Fields as I originally intended.
Sorry for the inconvenience.

Mirtha Cápiro
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fax 312/ 353-4342
capiro.mirtha@epa.gov
----- Forwarded by Mirtha Capiro/R5/USEPA/US on 03/15/2007 12:27 PM

Mirtha Capiro/R5/USEPA/US
03/15/2007 12:19 PM

To: Carl J Coker <CCoker@rohmhaas.com>

cc: "Nattis, Randy" <Randy.Nattis@ttemi.com>, "Tran, Thuy-Kieu" <ThuyKieu.Tran@ttemi.com>

Subject: Additional question--Fw: Questions on BRA aspects -- Rohm and Haas

Carl,

See additional question below on estimation of surface water concentrations.

Supplemental Responses to USEPA Comments 3 April 2006 provides the parameter for surface water flux as 423,360 cubic feet per day based on information from OEPA 2004. Based on the most recent list of references you have provided, this reference stands as:
OEPA, 2004a, Total Maximum Daily Loads for Mill Creek Basin, Draft Report, OEPA Division of Surface Water, June.

Please note that this reference needs updating based on the approved TMDL (attached). Also, please describe the steps you would follow to arrive to the proposed figure for surface water flux, including specific citation of information from TMDL (e.g., section or page) and any further calculations or conversions.

(See attached file: Mill_Creek_sep04_final.pdf)

As before, please indicate a time frame for response or phone discussion. I don't anticipate any more questions till then.

Thanks for your cooperation.

Mirtha Cápiro
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capiro.mirtha@epa.gov
----- Forwarded by Mirtha Capiro/R5/USEPA/US on 03/15/2007 11:33 AM -----

Mirtha Capiro/R5/USEPA/US

03/15/2007 11:00 AM

To: Carl J Coker <CCoker@rohmhaas.com>

cc: Karen.Fields@parsons.com

Subject: Questions on BRA aspects -- Rohm and Haas

Carl,

These are the questions/comments we have regarding PARSONS 15 December 2006:

Page 5 of 7,Task 2: Our human health toxicologists noted that the term default action level is misleading, as I pointed out at the call. From the discussion outlined in the document, it appears that NRWQC/MCL/Reg 9 PRG refers to screening criteria. Please provide your explanation for using this terminology, so we can determine to what extent this has to be clarified in the BRA Report.

Table 2 of this document primarily screens the surface water against NRWQC which is based on ingestion of water and organism from the creek. As long as the surface water is not a source of drinking water, this screening is acceptable to EPA. Please mention what type of information sources/references you plan to include in the BRA Report to support the water use (e.g., TMDL, etc.).

Table 3: Please provide the rationale for choosing 26d/year for recreational swimmer scenario. It is not clear why the total hazard index was divided by a factor of 24. The section on Alternative groundwater action level outlines the derivation of site specific target level(SSTL) for a recreational user scenario based on a target level of
1xe-4 and HI of 1. Please refer to the OEPA's guidance which suggests that the cumulative risk for corrective action purposes targeted at
1X10-5 rather than 1E-04.

http://www.epa.state.oh.us/derr/rules/guidance.html

Task 2, item 1:
The hierarchy related to protection of ecological receptors from your summary includes AWQC. Note that previous discussions with USEPA and OEPA (see Booz Allen Hamilton 28 July 2005) included the use of an OMZA-ESL hierarchy. Also, previous OEPA memoranda (from Booz Allen Hamilton 28 July 2005) discusses the need for further stream characterization if criteria other than the OMZA-ESL hierarchy is used.
As you know, we have requested information from you regarding alternate criteria mentioned in your latest summary. At this point, it would not be acceptable to alter the course of previous review and discussions on the issue since Rohm and Haas has not proposed to conduct further stream characterization. Therefore, we would like to cancel our request for information on alternate criteria.
As an informal item, I am curious what reference you would have used for AWQC since it is not NRWQC. Obviously, this is not time critical and you may provide this information in the future. Our ecologist was not certain what reference would be available on this.

Development of estimated surface water concentrations:
Your latest summary indicates, as we understand, that estimate surface water concentrations will be based on groundwater contribution to surface water in Mill Creek assuming that the groundwater concentration for the chemical for which a concentration is being estimated is constant over the entire site. Please explain how this relates to the information from Supplemental Responses to USEPA Comments 3 April 2006.
Specifically, we would like to know equation parameters for groundwater flux, width of flow and saturated thickness and how they relate to chemical and well information. So, this can be addressed with minimal clarification based on the previous material.

Please indicate a time frame for your reponses or phone discussions on the above. Thanks for your cooperation.

Mirtha Cápiro
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312/ 886-7567
fax 312/ 353-4342
capiro.mirtha@epa.gov[attachment "Mill_Creek_sep04_final.pdf" deleted by Carl J Coker/NAR/RohmHaas]

Mirtha Capiro/R5/USEPA/US
03/09/2007 07:32 PM

To Carl J Coker <CCoker@rohmhaas.com>
cc
bcc

Subject Follow up to call on Rohm and Haas

Carl,

I put together some notes on some BRA aspects based on my understanding from the discussions at the call, including some questions. I would like to ask if your team could look at my notes and point out any inconsistency with the Rohm and Haas proposal and also address my questions. This will facilitate my discussions with my colleagues. Also, there is a chance that we may not need a call if there are no further questions on our side. I will try to determine that soon after I get your input.

Please see attached notes. Thanks.

Help notes.doc

Mirtha Cápiro
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Help notes -- Mirtha Capiro -- 3/9/07
Rohm and Haas project - draft Baseline Risk Assessment Report

I need confirmation from Rohm and Haas on whether the description of the BRA aspects below is consistent with their proposal.

Note: proposed maximum constituent concentrations in groundwater are considered reasonable.

Protection of human and ecological receptors/ selection of parameters for groundwater monitoring

a) Compare the most recent maximum detected constituent concentrations in groundwater site-wide to the hierarchy MRWQC, MCLs and Region 9 PRGs.
b) Compare the most recent maximum detected constituent concentrations in groundwater site-wide to the hierarchy OMZA, AWQC and Region 5 ESLs.
c) Generate a list of monitoring parameters that includes all constituents that show an exceedance in the comparisons from (a) and (b) (this list will be equivalent to Table 1 from PARSONS, 15 December 2006).

Protection of human receptors associated with the groundwater to surface water pathway – Recreation scenario

a) Compare the most recent maximum detected constituent concentrations in groundwater at/near the groundwater-surface water interface to the hierarchy MRWQC, MCLs and Region 9 PRGs .
b) Estimate surface water concentrations for those constituents that show an exceedance in groundwater under (a). The estimated surface water concentrations will be based on groundwater contribution to surface water in Mill Creek assuming that the groundwater concentration under (a) is constant over the entire site.
c) Compare estimated surface water concentrations to the hierarchy MRWQC, MCLs and Region 9 PRGs.
d) Develop site-specific action levels (as an alternative to the hierarchy under (c)) for those constituents that show an exceedance in estimated surface water concentrations from the comparison under (c). Steps are described in Task 2, item 2, PARSONS, 15 December 2006.
e) Compare estimated surface water concentrations to developed site-specific action levels.

Protection of ecological receptors associated with surface water pathway

a) Compare the most recent maximum detected constituent concentrations in groundwater at/near the groundwater-surface water interface to the hierarchy OMZA, AWQC and Region 5 ESLs.

b) Estimate surface water concentrations for those constituents that show an exceedance in groundwater under (a). The estimated surface water concentrations will be based on groundwater contribution to surface water in Mill Creek assuming that the groundwater concentration under (a) is constant over the entire site.
c) Compare estimated surface water concentrations to the hierarchy OMZA, AWQC and Region 5 ESLs.
d) Compare the estimated surface water concentration for those constituents that show an exceedance in the comparison from (c) to OMZM and IMZM (or other?) as an alternative to the hierarchy under (c).

Need to contact Rohm and Haas to obtain a list of "other" alternate action levels.

Protection of ecological receptors associated with sediment protection

a) Compare the most recent maximum detected constituent concentrations in groundwater at/near the groundwater-surface water interface to the hierarchy OMZA, AWQC and Region 5 ESLs.
b) Compare the groundwater concentration of those constituents that show an exceedance in the comparison from (a) to OMZM and IMZM as an alternative to the hierarchy under (a).

PARSONS, page 2, 15 December 2006
We would like to have more information from Rohm and Haas on the item below, possibly the same level of detail as Task 2, item 2, first paragraph.

"Development of site-specific risk-based action levels for sediment using Region 5 ESLs (for ecological receptors) and Region 9 PRGs (for human health) if the maximum detected groundwater concentration exceeds applicable human health and ecological surface water screening levels (NRWQC and AWQC)."

Mirtha Capiro/R5/USEPA/US
03/09/2007 08:21 PM

To Carl J Coker <CCoker@rohmhaas.com>
cc Karen.Fields@parsons.com
bcc

Subject Need for updated table - Rohm and Haas BRA

Carl,

I realized I need some further information from you regarding the BRA.

Page 78 from Section 7.5.3 of the 6/30/05 draft BRA Report contains a table showing number of detection for some identified chemicals. I noted that some chemicals that have been identified in tables from Sections 7.4.1 and 7.4.2 as COPECs have not been listed in the table I first mentioned (for example, Aroclors-1242 and 1248, and 4,4-DDT are not listed). It would be very useful to have the table from Section 7.5.3 updated to show a consistent list of compounds. That will certainly facilitate my discussions with our risk assessors. Basically, the information on overall number of detects is key for understanding the significance of a potential risk as well as the relationship to background concentrations.

Please check with your team to see if there are additional COPCs identified elsewhere in the risk assessment, including human health-related, that may need to be compiled in the table from Section 7.5.3.

Please let me know when you could provide the updated table. I will be out Monday, but will return Tuesday to the office. Thanks.

Mirtha Cápiro
Environmental Scientist
U.S. Environmental Protection Agency
Region 5
77 W. Jackson Blvd. (DE-9J)
Chicago, IL 60604
312/ 886-7567
fax 312/ 353-4342
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----- Forwarded by Mirtha Capiro/R5/USEPA/US on 03/09/2007 07:55 PM -----

Mirtha Capiro/R5/USEPA/US
03/09/2007 07:32 PM

To Carl J Coker <CCoker@rohmhaas.com>
cc

Subject Follow up to call on Rohm and Haas

Carl,

I put together some notes on some BRA aspects based on my understanding from the discussions at the call, including some questions. I would like to ask if your team could look at my notes and point out any inconsistency with the Rohm and Haas proposal and also address my questions. This will facilitate my discussions with my colleagues. Also, there is a chance that we may not need a call if there are no

further questions on our side. I will try to determine that soon after I get your input.

Please see attached notes. Thanks.

Help notes.doc

Mirtha Cápiro
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15 December 2006

Ms. Mirtha Capiro
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics Division
US EPA Region 5
77 West Jackson Boulevard
Chicago, IL 60604-3590

Re: Completion of the Baseline Risk Assessment and the Formulation of Proposed Groundwater Clean-Up Levels for the Rohm and Haas Cincinnati Plant
Rohm and Haas Chemicals LLC
Reading, Ohio

Dear Ms. Capiro:

On behalf of the Rohm and Haas Company, Parsons is submitting this letter to communicate our understanding of the tasks remaining to complete the Baseline Risk Assessment (BRA) for the above referenced site and our proposed methods for developing groundwater clean-up levels for those compounds identified in the BRA as posing a potential risk to selected receptors at and near the site. The identified tasks are the result of several comment and response discussions held between the United States Environmental Protection Agency (USEPA) and Rohm and Haas, the most recent of which was a telephone conference call on November 20, 2006.

Baseline Risk Assessment

The revised BRA will follow current USEPA guidance for the performance of risk assessments and address previous USEPA comments, as appropriate. Thus, the following tasks will be completed for revising the 2005 June BRA submittal:

- Toxicity values, screening values and other literature-obtained reference values will be verified and the most current values used in the revised BRA.
- November 2005 annual groundwater results will be included in the data evaluation.
- A statistical evaluation of the background samples will be included as an appendix in order to establish site-specific background levels for metals, semi-volatile organic compounds (SVOCs), pesticides and polychlorinated biphenyls (PCBs).
- Inclusion of a statement regarding the intent to implement an environmental covenant limiting future use of the site to industrial use.
- Description of the physical nature of the observed seeps and inclusion of a discussion of those compounds detected in the seeps above screening levels, even though the maximum detected groundwater concentrations of these same compounds are below screening levels (i.e., lead and zinc).
- Comments regarding the influence of the adjacent Pristine Superfund site will be deleted/revised in Section 4.1.2. (Land and Water Use). Specifically, the sentence

"Lower Aquifer groundwater at the facility is already being controlled by the remediation system for the neighboring Pristine Superfund site" will be revised to "Although there is a connection between the Upper and Lower Aquifers, the groundwater analytical results show that groundwater contamination from the facility has not migrated into the lower aquifer."

- Deletion of several statements regarding the bioaccumulation potential of contaminants for fish in Mill Creek.
- Inclusion of incidental ingestion of sediment as an exposure pathway for the recreational user scenario.
- Evaluation and discussion of the potential co-location of infrequently detected compounds that exceed screening values.
- Evaluation of the groundwater to surface water pathway according to the following steps:
  - Compare the most recent detected reasonable maximum concentrations in the upper aquifer to National Recommended Water Quality Criteria (NRWQC), Maximum Contaminant Levels (MCLs) and Region 9 Preliminary Remediation Goals (PRGs) to evaluate the potential risk for human health.
  - Compare the most recent detected reasonable maximum concentrations in the upper aquifer to Ohio Outside the Mixing Zone Average (OMZA), Ambient Water Quality Criteria (AWQC) and Region 5 Ecological Screening Levels (ESLs) to evaluate the potential risk to ecological receptors.
  - Assume that the most reasonable detected maximum groundwater concentration is equivalent to the sediment pore water concentration in Mill Creek to evaluate the potential risk to sediment-dwelling invertebrates.
  - Calculate the groundwater contribution to surface water in Mill Creek assuming that the reasonable maximum detected concentration in groundwater is constant over the entire site.
  - The reasonable maximum concentration will be determined by using the highest detected concentration of the compound that occurs near the western property boundary and may be up- or down-gradient of the French Drain.
  - Assume that the groundwater contribution volume from the west side of Mill Creek is the same as that of the east side (approximately 3% of the total volume) and that chemical contributions from the west side are negligible.
- Development of site-specific risk-based action levels for surface water using the recreational swimmer scenario for those compounds that exceed accepted human health screening levels (i.e., NRWQC, MCLs, or Region 9 PRGs).
- Development of site-specific risk-based action levels for sediment using Region 5 ESLs (for ecological receptors) and Region 9 industrial PRGs (for human health) if the maximum detected groundwater concentration exceeds applicable human health and ecological surface water screening levels (NRWQC and AWQC).
- A detailed description of on-site habitats will be included in the Environmental Setting Section (7.1.1).

- Inclusion of a new subsection (Section 7.1.3.3 – Fate and Transport Mechanisms for Non-Site Related Chemicals Detected at the Site) describing the fate and transport mechanisms for non-site related chemicals.
- Inclusion of the following items in the Uncertainty Discussion:
  - Impact of compounds that have not been detected; however, the detection limits are above the accepted screening levels;
  - Impact of using total versus dissolved concentrations for inorganic compounds in water;
  - Impact of compounds that have been detected; however, no screening values or toxicity values are available; and
  - Impact of using traditional purge methods to collect groundwater samples from select wells versus using low-flow purging techniques.
- Inclusion of more detailed discussion in the Risk Characterization Section (Section 7.4) as to why compounds were determined to pose no significant risk.
- Revision of the Site Conceptual Model (SCM) to include all evaluated pathways.
- Deletion of the statement in Section 7.7 (Scientific Management Decision Endpoint) that interim measures may be conducted to remove three areas with elevated tin concentrations in soil (HA9, DP14 and T3) in order to address ecological concerns. These three areas are located in active operational and/or landscaped areas of the site; thus, this statement will be deleted per U.S. EPA's directive that the comments received on 30 August 2006 *"supercede previous U.S. EPA comments, requirements or determinations on the subject of COPC refinement"* and pursuant to the comment made by USEPA in the 30 August 2006 submittal, whereby U. S. EPA commented: *"With regards to the ecological risk assessment process, it would be appropriate to eliminate as COPCs those constituents that exceed screening values in soil from operational and landscaped areas because there is a lack of complete exposure pathway for ecological receptors. The BRA Report has already adequately supported the lack of complete exposure pathways associated with ecological receptors."*
- Results of a literature search to obtain toxicity values for tin in sediments (to address potential ecological concerns).
- Inclusion of a discussion regarding the prior use of the site, specifically, as a dairy farm.
- Updated References Section.

Development of Groundwater Clean-Up Goals

Following approval of the revised BRA, Rohm and Haas will develop groundwater clean-up goals that are protective of surface water in accordance with the steps outlined below. This process may change slightly—depending upon the revisions made to the BRA as discussed above; however, the general strategy for selecting compounds of concern for monitoring, the development of action levels and the selection of points of compliance is expected to remain the same.

Task 1: Selection of Compounds of Concern for Monitoring in the Upper Aquifer

Compounds that will be monitored in the upper aquifer will be selected as follows:

1. *Compounds identified in the June BRA as posing a current risk to human health or the environment.* Based on the June 2005 BRA results, there are no compounds of concern that currently pose a risk to human health. Tin was identified as posing a potential threat to ecological receptors at three soil locations (HA9, DP14, and T3). Since all three of these locations are in active operational and landscaped areas, these locations do not pose a current significant risk as mentioned above due to a lack of a completed exposure pathway (USEPA "New Additional Comment #1" for Soil, dated 30 August 2006). Therefore, no compounds will be selected for monitoring based on current risk since it is agreed that pesticides, PCBs and PAHs are not site-related compounds.
2. *Compounds identified in the June BRA as posing a future risk to human health or the environment.* Several compounds were identified as posing a potential future risk to human health should the land use at the site change from industrial to residential use or if drinking water wells were installed at the facility. To address these potential future scenarios, Rohm and Haas will implement an environmental covenant for the site limiting its use to industrial and prohibiting drinking water wells from being installed at the site. Except for the three soil locations mentioned above, no compounds were identified in the June BRA as posing a significant risk to future ecological receptors. Since all three of these locations are in active operational areas, these locations do not pose a significant risk to future ecological receptors due to a lack of a completed exposure pathway since future use of the site is to remain industrial.
3. *Compounds Identified in the Groundwater to Surface Water Pathway Evaluation.* Preliminary results from the groundwater to surface water pathway for human health identified the following twelve compounds that may pose a potential risk to human health: 1,2-dichloroethane, benzene, methylene chloride, tetrachloroethene, vinyl chloride, aniline, bis(2-ethylhexyl)phthalate, aluminum, arsenic, iron, manganese and thallium. This is based on comparing the current maximum detected upper aquifer concentrations to human health screening levels such as NRWQC, MCLs, and Region 9 PRGs. Thus, these compounds will be included in the groundwater monitoring analyte list; it should be noted that only three of these compounds (bis(2-ethylhexyl)phthalate, arsenic and thallium) have actually been detected in the surface water of Mill Creek above the applicable action level. For ecological receptors, the following compounds in the upper aquifer were identified as posing a potential risk to macroinvertebrates inhabiting the sediments of Mill Creek, assuming that the maximum detected groundwater concentration is directly representative of the sediment pore water concentration: carbon disulfide, chlorobenzene, isopropylbenzene, tetrachloroethene, toluene, xylenes, 1,1'-biphenyl, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, aniline, bis(2-

ethylhexyl)phthalate, aluminum, arsenic, barium, cadmium, chromium, copper, iron, manganese, nickel, selenium, and tin. However, none of these compounds were actually detected in the samples collected from the sediments of Mill Creek at concentrations exceeding macroinvertebrate sediment screening levels. In addition, based on observations of the physical characteristics of the sediments in Mill Creek that are adjacent to the site, the sediment pore water is likely to be in direct flux with the overlying surface water, as the sediments consist primarily of large-sized cobbles and concrete rubble. No compounds were detected in the surface water of Mill Creek at levels exceeding aquatic life benchmarks. Pesticides, PCBs and PAHs are not included for this pathway since it is agreed that they are not site-related compounds. A list of proposed compounds for monitoring in the upper aquifer is presented on Table 1.

4. *Compounds Identified in the Upper Aquifer to Lower Aquifer Pathway Evaluation.* Although the upper aquifer is not a source of drinking water, the upper aquifer is hydraulically connected to the lower aquifer, which was previously used as a drinking water source. Until an environment covenant is in place for the site restricting the placement of groundwater drinking wells, the following compounds, which have been detected in the upper aquifer at concentrations exceeding MCLs, will be included in the groundwater monitoring analyte list: acetone, benzene, chlorobenzene, chloroform, 1,2-dichloroethane, methylene chloride, tetrachloroethene, toluene, trichloroethene, aniline, bis(2-ethylhexyl)phthalate, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 4-methylphenol, antimony, aluminum, arsenic, cadmium, chromium, copper, iron, lead, manganese, nickel, thallium, and vanadium. Pesticides, PCBs and PAHs are not included in this list since it is agreed that they are not site-related compounds.

Task 2: Selection of Action Levels for Compounds of Concern in the Upper Aquifer

1. *Default action levels.* Default action levels for the upper aquifer for the protection of human health will follow the hierarchy listed below:
   - NRWQC
   - MCLs
   - Region 9 Industrial PRGs

   For the protection of ecological receptors, the following default action levels will be used in the hierarchy listed below:
   - Ohio Outside the Mixing Zone Average (OMZA)
   - AWQC
   - Region 5 Ecological Screening Levels (ESLs)

   If a compound is detected in the upper aquifer, it will be compared to the above action levels for human health and ecological receptors, respectively. If a compound exceeds one or more of these action levels, alternative action levels will be used as described below.

2. *Alternative Groundwater Action Levels.* If the concentration of a compound exceeds one or more of the default action levels, a site-specific risk-based action level will be developed for human health based on a target risk level of 1×10^{-4}, and a target hazard index of 1. The human health site-specific risk-based action level will be developed based on the recreational user scenario for Mill Creek since Mill Creek and site groundwater are not used as a drinking water sources. The exposure pathways associated with the recreational user scenario are incidental ingestion and dermal contact during swimming. The target risk and hazard index will be divided by the total number of chemicals of concern and total pathways assuming that each compound contributes evenly to the total risk and the total hazard. Site-specific target levels (SSTLs) will be calculated for each pathway under carcinogen and non-carcinogen effects for a recreational user scenario. The lowest SSTL among incidental ingestion (carcinogen and non-carcinogen) and dermal contact (carcinogen and non-carcinogen) during swimming will be used as the screening action level for a compound of concern (COC). For carcinogenic effects, the SSTL for a recreational user combines adult (24 years) and child (6 years). For non-carcinogenic effects, the SSTL for a recreational user is the lower of the adult and the child scenarios.

   Example tables and equations that will be used to calculate the human health site-specific action levels are presented in attached Tables 2 through 5. These groundwater action levels are intended to be used for screening purposes only due to the conservative nature of the values. Should a compound exceed the screening levels in the future, a risk assessment may be performed to determine the true risk due to these compounds.

   For ecological receptors, if the concentration of a detected compound exceeds one or more of the default action levels, comparison to alternative action levels, such as Ohio Outside the Mixing Zone Maximum (OMZM) and Inside the Mixing Zone Maximum (IMZM) will be conducted. As with the human health groundwater action levels, these values are meant to be used for screening purposes only and should a compound exceed the screening value in the future, a more detailed evaluation of the actual risk to ecological receptors in Mill Creek may be conducted.

Selection of Wells for Monitoring and Points of Compliance

In order to determine if detected concentrations of compounds of concern in the upper groundwater aquifer exceed applicable action levels, appropriate wells must be selected for monitoring. Currently, Rohm and Haas samples 38 monitoring wells at the Cincinnati plant that are screened in the upper aquifer. Since the primary pathway of concern is the groundwater to surface water pathway, the following perimeter wells on the western portion of the site closest to Mill Creek will continue to be monitored and will therefore serve as the points of compliance:

- UAW07-20

- MW-EPA-1
- UAW05-20
- UAW03-20
- UAW02-20
- UAW02-40
- UAW25-20
- UAW01-30
- UAW01-80

Historically, one of the wells (UAW05-20) that is proposed to be in the long-term monitoring program has been sampled by traditional purging techniques using a bailer. Due to concerns with the sample validity, particularly in regards to collection of volatile organic compound data, Rohm and Haas proposes to re-develop this well in order to facilitate the use of low-flow purge and sampling techniques. If Rohm and Haas is still unable to use low-flow sampling techniques in this well after re-development, Rohm and Haas will consider using alternative non-purge sample techniques or discuss other alternatives for sampling this well with the agency.

Conclusion

Rohm and Haas is proposing to finalize the BRA for the Cincinnati plant by completing the specified tasks outlined in this letter. Once the final BRA report is approved by the USEPA, Rohm and Haas will then proceed to develop groundwater clean-up levels for those compounds identified in the BRA as posing a potential risk to selected receptors following the steps outlined above. As previously agreed, Rohm and Haas will be prepared to discuss comments regarding this process during a follow-up teleconference call in early January 2007. Following the discussion, Rohm and Haas will then propose a schedule for submitting the final BRA report. Since the development of the groundwater clean-up goals is dependent upon the results of the BRA, we suggest that additional discussion of the groundwater clean-up goals be deferred until after the final BRA is approved.

If you have any questions regarding this action plan, please feel free to contact me at 513-552-7016 or Carl Coker at (215) 785-7193.

Sincerely,

Karen A. Fields

Karen A. Fields
Project Manager

cc: Carl Coker, Rohm and Haas

Table 1
LIST OF PROPOSED ANALYTES IN THE UPPER GROUNDWATER AQUIFER
Rohm and Haas Chemicals LLC
Reading, Ohio

Compound	Reason
1,1'-Biphenyl	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances
1,2-Dichlorobenzene	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances and drinking water concern
1,2-Dichloroethane	Potential risk to a recreational user of Mill Creek and a drinking water concern
1,3-Dichlorobenzene	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances
1,4-Dichlorobenzene	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances and drinking water concern
4-Methylphenol	Drinking water concern
Acetone	Drinking water concern
Aluminum	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances, potential risk to recreational users of Mill Creek and drinking water concern
Aniline	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances, potential risk to recreational users of Mill Creek and drinking water concern
Antimony	Drinking water concern
Arsenic	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances, potential risk to recreational users of Mill Creek and drinking water concern
Barium	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances
Benzene	Potential risk to a recreational user of Mill Creek and a drinking water concern
bis(2-ethylhexyl)phthalate	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances, potential risk to recreational users of Mill Creek and drinking water concern
Cadmium	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances and drinking water concern
Carbon Disulfide	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances
Chlorobenzene	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances and drinking water concern
Chloroform	Drinking water concern
Chromium	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances and drinking water concern
Copper	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances and drinking water concern
Iron	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances, potential risk to recreational users of Mill Creek and drinking water concern
Isopropylbenzene	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances
Lead	Drinking water concern
Manganese	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances, potential risk to recreational users of Mill Creek and drinking water concern
Methylene Chloride	Potential risk to a recreational user of Mill Creek and a drinking water concern
Nickel	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances and drinking water concern
Selenium	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances
Tetrachloroethene	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances, potential risk to recreational users of Mill Creek and drinking water concern
Thallium	Potential risk to a recreational user of Mill Creek and a drinking water concern
Tin	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances
Toluene	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances and drinking water concern
Trichloroethene	Drinking water concern
Vanadium	Drinking water concern
Vinyl Chloride	Potential risk to a recreational user of Mill Creek
Xylenes (total)	Potential risk to sediment dwelling macroinvertebrates due to potential sediment pore water exceedances

TABLE 2
CONSERVATIVELY ESTIMATED SURFACE WATER CONCENTRATIONS COMPARED TO HUMAN HEALTH SURFACE WATER CRITERIA
Rohm and Haas Chemicals LLC
Reading, Ohio

Chemicals	NRWQC	MCL	Region 9 PRGs	MAX Detected - All Wells (Cgw)	Location	Estimated Concentration in Surface Water (Csw)	Estimated SW Concentration Exceeds Criteria?	Calculated Surface Water SSTL	Estimated SW Concentration Exceeds Calculated SSTL?
Volatile Organic Compounds (ug/l)									
1,1,2-Trichloroethane	0.59			2.6	UAW23-20	0.08	No	NA	NA
1,2-Dichloroethane	0.38			1200	UAW20-60	37.17	Yes	1,730	No
Benzene	2.2			150	UAW08-20	4.65	Yes	337	No
Carbon tetrachloride	0.23			2.2	UAW15-20	0.07	No	NA	NA
Chlorobenzene	130			2500	MW-EPA-1	77.44	No	NA	NA
Chloroethane	-		4.6	6.8	UAW10-50	0.21	No	NA	NA
Chloroform	5.7			140	UAW15-20	4.59	No	NA	NA
cis-1,2-Dichloroethene	-	70		80	UAW20-60	2.73	No	NA	NA
Methylene chloride	4.6			280	UAW04-20	8.67	Yes	27,400	No
Tetrachloroethene	0.69			75	MW-EPA-2	2.32	Yes	24	No
Toluene	1300			11000	UAW04-20	340.76	No	NA	NA
Trichloroethene	2.5			5.1	UAW23-20	0.48	No	NA	NA
Vinyl chloride	0.025			4	UAW22-20	0.12	Yes	99	No
Semivolatile Organic Compounds (ug/l)									
1,2-Dichlorobenzene	420			1100	MW-EPA-1	34.08	No	NA	NA
1,4-Dichlorobenzene	63			250	MW-EPA-1	7.74	No	NA	NA
2-Methylnaphthalene	-		6.2	8.6	UAW13-20	0.27	No	NA	NA
Aniline	-		12	5900	UAW08-20	182.77	Yes	2,460	No
bis(2-Ethylhexyl) phthalate	1.2			29	UAW11-10	2.25	Yes	167	No
Pesticide/PCBs (ug/l)									
4,4'-DDD	0.00031			0.14	UAW07-20	0.0043	Yes	NA	NA
4,4'-DDE	0.00022			0.3	UAW12-20	0.01	Yes	NA	NA
4,4'-DDT	0.00022			0.036	UAW12-20	0.001	Yes	NA	NA
Aldrin	0.000049			0.076	MW-EPA-1	0.002	Yes	NA	NA
alpha-BHC	0.0026			0.025	UAW20-60	0.001	No	NA	NA
alpha-Chlordane	0.0008			0.039	UAW18-20	0.001	Yes	NA	NA
beta-BHC	0.0091			0.39	UAW12-20	0.012	Yes	NA	NA
delta-BHC	-		0.011	1	UAW23-20	0.031	Yes	NA	NA
Dieldrin	0.000052			0.27	UAW12-20	0.008	Yes	NA	NA
Endrin	0.059			0.15	UAW04-20	0.005	No	NA	NA
Endrin aldehyde	0.29			6.9	UAW15-50	0.214	No	NA	NA
gamma-Chlordane	0.0008			0.37	UAW07-20	0.011	Yes	NA	NA
Heptachlor	0.000079			0.27	UAW12-20	0.008	Yes	NA	NA
Heptachlor epoxide	0.000039			0.97	UAW10-50	0.030	Yes	NA	NA
Toxaphene	0.00028			1	UAW18-20	0.031	Yes	NA	NA
Inorganic Compounds (ug/l)									
Aluminum	-	50		4240	MW-EPA-3	131.346	Yes	351,000	No
Antimony	5.6			8.7	UAW15-50	0.270	No	NA	NA
Arsenic	0.018			215	MW-EPA-1	6.660	Yes	105	No
Chromium	-	100		172	UAW21-30	5.328	No	NA	NA
Iron	300			12500	UAW10-80	387.222	Yes	105,000	No
Manganese	-	50		11800	UAW22-20	365.538	Yes	49,100	No
Thallium	0.24			12.2	UAW06-20	6.97	Yes	23.2	No

TABLE 2
CONSERVATIVELY ESTIMATED SURFACE WATER CONCENTRATIONS COMPARED TO HUMAN HEALTH SURFACE WATER CRITERIA
Rohm and Haas Chemicals LLC
Reading, Ohio

NRWQC - National Recommended Water Quality Criterion
MCL - Maximum Contaminant Level
PRGs - Preliminary Remediation Goals
SSTL - Site-Specific Target Level
"-" - None established
NA - Not applicable
Estimated concentration in surface water calculated according to the following equation: Csw = Cgw x Qgw / (Qgw + Qsw) where:
Cgw - maximum detected concentration in groundwater (ug/L)
Qgw - calculated groundwater flux (ft^3/day) = 13,534 ft^3/day
where: maximum saturated thickness = 6 ft; width of plume = shoreline (1120 ft); hydraulic gradient = 0.019 ft/ft; and hydraulic conductivity = 106 ft/day
Qsw = 423,360 ft^3/day ($7Q_{10}$ flow for Mill Creek (4.9 cfs) multiplied by 86,400 seconds/day) (OEPA, 2004a)
Screening hierarchy was as follows: NRWQC was the preferred value; if no NRWQC then the MCL was used; if no NRWQC or MCL, then PRG was used.
Criteria for metals are for the total fraction since the groundwater analytical results are for the total fraction.
BEHP, chloroform, cis-1,2-dichloroethene, thallium and trichloroethene were detected in the surface water of Mill Creek,
therefore, the maximum detected concentration was included in the estimated surface water concentration calculations for these compounds.
- Estimated surface water concentration exceeds NRWQC, MCL or PRG.
SSTLs were not calculated for pesticides since pesticides are not site-related compounds.
Refer to Tables 3 through 5 for methodology for calculation of SSTLs.

TABLE 3

CALCULATED SSTLs FOR SURFACE WATER BASED ON INCIDENTAL INGESTION FOR A RECREATIONAL USER

Rohm and Haas Chemicals LLC

Reading, Ohio

Noncarcinogen

Hazard Index = (CW x IR x ET x EF x ED)/(BW x AT)/RfDo

Suface Water SSTL (CW) = (1/24*BW*AT*RfDo)/(IR*ET*EF*ED)

Chemical of Concern	Surface Water SSTL (mg/L)	Ingestion Rate (IR) L/hours	Exposure Time (ET) hours/event	Exposure Frequency (EF) (events/yr)	Exposure Duration (ED) (yrs)	Body Weight (BW) (kg)	Averaging Time (AT) (days)	RfDo (mg/kg-day)
Arsenic (child)	1.05E+01	0.05	0.5	26	6	15	2190	3.00E-04
Arsenic (adult)	1.43E+00	0.05	0.5	26	24	70	25550	3.00E-04
Arsenic (adult and child)	**1.05E-01**							3.00E-04
Aluminum (child)	3.51E+02	0.05	0.5	26	6	15	2190	1.00E+00
Aluminum (adult)	4.78E+03	0.05	0.5	26	24	70	25550	1.00E+00
Aluminum (adult and child)	**3.51E+02**							1.00E+00
Iron (child)	1.05E+02	0.05	0.5	26	6	15	2190	3.00E-01
Iron (adult)	1.43E+03	0.05	0.5	26	24	70	25550	3.00E-01
Iron (adult and child)	**1.05E+02**							3.00E-01
Manganese (child)	4.91E+01	0.05	0.5	26	6	15	2190	1.40E-01
Manganese (adult)	6.69E+02	0.05	0.5	26	24	70	25550	1.40E-01
Manganese (adult and child)	**4.91E+01**							1.40E-01
Thallium (child)	2.32E-02	0.05	0.5	26	6	15	2190	6.60E-05
Thallium (adult)	3.15E-01	0.05	0.5	26	24	70	25550	6.60E-05
Thallium (adult and child)	**2.32E-02**							6.60E-05
1,2-Dichloroethane (child)	7.02E+00	0.05	0.5	26	6	15	2190	2.00E-02
1,2-Dichloroethane (adult)	9.55E+01	0.05	0.5	26	24	70	25550	2.00E-02
1,2-Dichloroethane (adult and child)	**7.02E+00**							2.00E-02
Benzene (child)	1.40E+00	0.05	0.5	26	6	15	2190	4.00E-03
Benzene (adult)	1.91E+01	0.05	0.5	26	24	70	25550	4.00E-03
Benzene (adult and child)	**1.40E+00**							4.00E-03
Methylene chloride (child)	2.11E+01	0.05	0.5	26	6	15	2190	6.00E-02
Methylene chloride (adult)	2.87E+02	0.05	0.5	26	24	70	25550	6.00E-02
Methylene chloride (adult and child)	**2.11E+01**							6.00E-02
Tetrachloroethene (child)	3.51E+00	0.05	0.5	26	6	15	2190	1.00E-02
Tetrachloroethene (adult)	4.78E+01	0.05	0.5	26	24	70	25550	1.00E-02
Tetrachloroethene (adult and child)	**3.51E+00**							1.00E-02
Vinyl chloride (child)	1.05E+00	0.05	0.5	26	6	15	2190	3.00E-03
Vinyl chloride (adult)	1.43E+01	0.05	0.5	26	24	70	25550	3.00E-03
Vinyl chloride (adult and child)	**1.05E+00**							3.00E-03
Aniline (child)	2.46E+00	0.05	0.5	26	6	15	2190	7.00E-03
Aniline (adult)	3.34E+01	0.05	0.5	26	24	70	25550	7.00E-03
Aniline (adult and child)	**2.46E+00**							7.00E-03
bis(2-ethylhexyl)phthalate (child)	7.02E+00	0.05	0.5	26	6	15	2190	2.00E-02
bis(2-ethylhexyl)phthalate (adult)	9.55E+01	0.05	0.5	26	24	70	25550	2.00E-02
bis(2-ethylhexyl)phthalate (adult and child)	**7.02E+00**							2.00E-02

Note: SSTL - site-specific target level

1) Target hazard index of 1 is used.

2) The total hazard index is divided by 24 to distribute the total hazard level of 1 to twelve compounds of concern and two exposure pathways.

3) The lower level between adult SW goal and child SW goal is used for the adult and child combined scenario.

TABLE 3
CALCULATED SSTLs FOR SURFACE WATER BASED ON INCIDENTAL INGESTION FOR A RECREATIONAL USER
Rohm and Haas Chemicals LLC
Reading, Ohio

Carcinogen

Cancer Risk=SF x CW x {[(IRa x ETa x EFa x EDa)/(BWa x ATa)]+[(IRc x ETc x EFc x EDc)/(BWc x ATc)]}
Surface Water SSTL (CW) =(10^{-4}/14)/(SF*{[(IRa x ETa x EFa x EDa)/(BWa x ATa)] + [(IRc x ETc x EFc x EDc)/(BWc x ATc)]}

Chemical of Concern	Surface Water SSTL (mg/L)	Ingestion Rate (IR) L/hours	Exposure Time (ET) hours/event	Exposure Frequency (EF) (events/yr)	Exposure Duration (ED) (yrs)	Body Weight (BW) (kg)	Averaging Time (AT) (days)	SF (kg-day/mg)
Arsenic (child)	--	0.05	0.5	26	6	15	25550	1.50E+00
Arsenic (adult)	--	0.05	0.5	26	24	70	25550	1.50E+00
Arsenic (adult and child)	2.52E-01							1.50E+00
Aluminum (child)	--	0.05	0.5	26	6	15	25550	--
Aluminum (adult)	--	0.05	0.5	26	24	70	25550	--
Aluminum (adult and child)	--							--
Iron (child)	--	0.05	0.5	26	6	15	25550	--
Iron (adult)	--	0.05	0.5	26	24	70	25550	--
Iron (adult and child)	--							--
Manganese (child)	--	0.05	0.5	26	6	15	25550	--
Manganese (adult)	--	0.05	0.5	26	24	70	25550	--
Manganese (adult and child)	--							--
Thallium (child)	--	0.05	0.5	26	6	15	25550	--
Thallium (adult)	--	0.05	0.5	26	24	70	25550	--
Thallium (adult and child)	--							--
1,2-Dichloroethane (child)	--	0.05	0.5	26	6	15	25550	9.10E-02
1,2-Dichloroethane (adult)	--	0.05	0.5	26	24	70	25550	9.10E-02
1,2-Dichloroethane (adult and child)	4.15E+00							9.10E-02
Benzene (child)	--	0.05	0.5	26	6	15	25550	5.50E-02
Benzene (adult)	--	0.05	0.5	26	24	70	25550	5.50E-02
Benzene (adult and child)	6.87E+00							5.50E-02
Methylene chloride (child)	--	0.05	0.5	26	6	15	25550	7.50E-03
Methylene chloride (adult)	--	0.05	0.5	26	24	70	25550	7.50E-03
Methylene chloride (adult and child)	5.04E+01							7.50E-03
Tetrachloroethene (child)	--	0.05	0.5	26	6	15	25550	5.40E-01
Tetrachloroethene (adult)	--	0.05	0.5	26	24	70	25550	5.40E-01
Tetrachloroethene (adult and child)	7.00E-01							5.40E-01
Vinyl chloride (child)	--	0.05	0.5	26	6	15	25550	1.5
Vinyl chloride (adult)	--	0.05	0.5	26	24	70	25550	1.5
Vinyl chloride (adult and child)	2.52E-01							1.5
Aniline (child)	--	0.05	0.5	26	6	15	25550	--
Aniline (adult)	--	0.05	0.5	26	24	70	25550	--
Aniline (adult and child)	--							
bis(2-ethylhexyl)phthalate (child)	--	0.05	0.5	26	6	15	25550	1.40E-02
bis(2-ethylhexyl)phthalate (adult)	--	0.05	0.5	26	24	70	25550	1.40E-02
bis(2-ethylhexyl)phthalate (adult and child)	2.70E+01							1.40E-02

Note: SSTL - site-specific target level

1) Target cancer risk of 1 x 10^{-4} is used.
2) The total cancer risk is divided by 14 to distribute the total cancer level of 10^{-4} to seven carcinogenic compounds of concern and two exposure pathways.
3) The adult and child surface water goal combines the adult (24 years) and child (6 years) scenarios.

TABLE 4
CALCULATED SSTLs FOR SURFACE WATER BASED ON DERMAL CONTACT FOR A RECREATIONAL USER
Rohm and Haas Chemicals LLC
Reading, Ohio

NONCARCINOGEN

Inorganics: Hazard Index = (Kp x CW x 0.001 x Tevent x EV x EF x ED x SA)/(BW x AT)/RfDd
Inorganics: Surface Water SSTL (CW) = (1/24*BW*AT*RfDd)/(Kp*Tevent*0.001*EV*EF*ED*SA)
Organics: Hazard Index = (2FA x Kp x CW x 0.001 x (6τ x Tevent/3.14)$^{1/2}$ x EV x EF x ED x SA)/(BW x AT)/RfDd
Organics: Suface Water SSTL (CW) = (1/24*BW*AT*RfDd)/(2FA*Kp*0.001*(6*τ*Tevent/3.14)$^{1/2}$*EV*EF*ED*SA)

Chemical of Concern	Surface Water SSTL (mg/L)	Event Frequency (EV) (events/d)	Exposure Frequency (EF) (days/yr)	Exposure Duration (ED) (yrs)	Skin Surface Area (SA) (cm^2)	Body Weight (BW) (kg)	Averaging Time (AT) (days)	RfDd (mg/kg-day)
Arsenic (child)	7.98E-01	1	26	6	6600	15	2190	3.00E-04
Arsenic (adult)	3.98E+00	1	26	24	18000	70	25550	3.00E-04
Arsenic (adult and child)	7.98E-01							3.00E-04
Aluminum (child)	2.66E+03	1	26	6	6600	15	2190	1.00E+00
Aluminum (adult)	1.33E+04	1	26	24	18000	70	25550	1.00E+00
Aluminum (adult and child)	2.66E+03							1.00E+00
Iron (child)	7.98E+02	1	26	6	6600	15	2190	3.00E-01
Iron (adult)	3.98E+03	1	26	24	18000	70	25550	3.00E-01
Iron (adult and child)	7.98E+02							3.00E-01
Manganese (child)	3.72E+02	1	26	6	6600	15	2190	1.40E-01
Manganese (adult)	1.86E+03	1	26	24	18000	70	25550	1.40E-01
Manganese (adult and child)	3.72E+02							1.40E-01
Thallium (child)	1.75E-01	1	26	6	6600	15	2190	6.60E-05
Thallium (adult)	8.76E-01	1	26	24	18000	70	25550	6.60E-05
Thallium (adult and child)	1.75E-01							6.60E-05
1,2-Dichloroethane (child)	5.26E+00	1	26	6	6600	15	2190	2.00E-02
1,2-Dichloroethane (adult)	2.62E+01	1	26	24	18000	70	25550	2.00E-02
1,2-Dichloroethane (adult and child)	5.26E+00							2.00E-02
Benzene (child)	3.37E-01	1	26	6	6600	15	2190	4.00E-03
Benzene (adult)	1.68E+00	1	26	24	18000	70	25550	4.00E-03
Benzene (adult and child)	3.37E-01							4.00E-03
Methylene chloride (child)	2.06E+01	1	26	6	6600	15	2190	6.00E-02
Methylene chloride (adult)	1.03E+02	1	26	24	18000	70	25550	6.00E-02
Methylene chloride (adult and child)	2.06E+01							6.00E-02
Tetrachloroethene (child)	2.16E-01	1	26	6	6600	15	2190	1.00E-02
Tetrachloroethene (adult)	1.08E+00	1	26	24	18000	70	25550	1.00E-02
Tetrachloroethene (adult and child)	2.16E-01							1.00E-02
Vinyl chloride (child)	7.44E-01	1	26	6	6600	15	2190	3.00E-03
Vinyl chloride (adult)	3.71E+00	1	26	24	18000	70	25550	3.00E-03
Vinyl chloride (adult and child)	7.44E-01							3.00E-03
Aniline (child)	4.23E+00	1	26	6	6600	15	2190	7.00E-03
Aniline (adult)	2.11E+01	1	26	24	18000	70	25550	7.00E-03
Aniline (adult and child)	4.23E+00							7.00E-03
bis(2-ethylhexyl)phthalate (child)	1.67E-01	1	26	6	6600	15	2190	2.00E-02
bis(2-ethylhexyl)phthalate (adult)	8.32E-01	1	26	24	18000	70	25550	2.00E-02
bis(2-ethylhexyl)phthalate (adult and child)	1.67E-01							2.00E-02

Note: SSTL - site-specific target level
1) Target hazard index of 1 is used.
2) The total hazard index is divided by 24 to distribute the total hazard level of 1 to twelve compounds of concern and two exposure pathways.
3) The lower level between adult SW goal and child SW goal is used for the adult and child combined scenario.

TABLE 4
CALCULATED SSTLs FOR SURFACE WATER BASED ON DERMAL CONTACT FOR A RECREATIONAL USER
Rohm and Haas Chemicals LLC
Reading, Ohio

CARCINOGEN

Inorganics: Cancer Risk = ((Kp x CW x Tevent x 0.001 x EV x EF x SF)/AT) x ((EDc x SAc)/BWc + (EDa x SAa)/BWa)
Inorganics: Surface Water SSTL (CW)= (10^{-4}/14*AT)/((Kp*Tevent*0.001*EV*EF*SF)*((EDc*SAc)/BWc+(EDa*SAa)/BWa)
Organics: Cancer Risk = ((2FA x Kp x CW x 0.001 x (6τ x Tevent/3.14)$^{1/2}$ x EV x EF x SF)/AT)x((EDcxSAc)/BWc+(EDaxSAa)/BWa)
Organics: Surface Water SSTL (CW) = (10^{-4}/14*AT)/((2FA*Kp*0.001*(6*t*Tevent/3.14)$^{1/2}$*EV*EF*SF)*((EDc*SAc)/BWc+(EDa*SAa)/BWa))

Chemical of Concern	Surface Water SSTL (mg/L)	Event Frequency (EV) (events/d)	Exposure Frequency (EF) (days/yr)	Exposure Duration (ED) (yrs)	Skin Surface Area (SA) (cm^2)	Body Weight (BW) (kg)	Averaging Time (AT) (days)	SF (kg-day/mg)
Arsenic (child)	--	1	26	6	6600	15	25550	1.50E+00
Arsenic (adult)	--	1	26	24	18000	70	25550	1.50E+00
Arsenic (adult and child)	1.06E+00							
Aluminum (child)	--	1	26	6	6600	15	25550	--
Aluminum (adult)	--	1	26	24	18000	70	25550	--
Aluminum (adult and child)	--							
Iron (child)	--	1	26	6	6600	15	25550	--
Iron (adult)	--	1	26	24	18000	70	25550	--
Iron (adult and child)	--							
Manganese (child)	--	1	26	6	6600	15	25550	--
Manganese (adult)	--	1	26	24	18000	70	25550	--
Manganese (adult and child)	--							
Thallium (child)	--	1	26	6	6600	15	25550	--
Thallium (adult)	--	1	26	24	18000	70	25550	--
Thallium (adult and child)	--							
1,2-Dichloroethane (child)	--	1	26	6	6600	15	25550	9.10E-02
1,2-Dichloroethane (adult)	--	1	26	24	18000	70	25550	9.10E-02
1,2-Dichloroethane (adult and child)	1.73E+00							9.10E-02
Benzene (child)	--	1	26	6	6600	15	25550	5.50E-02
Benzene (adult)	--	1	26	24	18000	70	25550	5.50E-02
Benzene (adult and child)	9.17E-01							5.50E-02
Methylene chloride (child)	--	1	26	6	6600	15	25550	7.50E-03
Methylene chloride (adult)	--	1	26	24	18000	70	25550	7.50E-03
Methylene chloride (adult and child)	2.74E+01							7.50E-03
Tetrachloroethene (child)	--	1	26	6	6600	15	25550	5.40E-01
Tetrachloroethene (adult)	--	1	26	24	18000	70	25550	5.40E-01
Tetrachloroethene (adult and child)	2.40E-02							5.40E-01
Vinyl chloride (child)	--	1	26	6	6600	15	25550	1.5
Vinyl chloride (adult)	--	1	26	24	18000	70	25550	1.5
Vinyl chloride (adult and child)	9.90E-02							1.5
Aniline (child)	--	1	26	6	6600	15	25550	--
Aniline (adult)	--	1	26	24	18000	70	25550	--
Aniline (adult and child)	--							--
bis(2-ethylhexyl)phthalate (child)	--	1	26	6	6600	15	25550	1.40E-02
bis(2-ethylhexyl)phthalate (adult)	--	1	26	24	18000	70	25550	1.40E-02
bis(2-ethylhexyl)phthalate (adult and child)	3.57E-01							1.40E-02

Note: SSTL - site-specific target level

1) Target cancer risk of 1 x 10^{-4} is used.
2) The total cancer risk is divided by 14 to distribute the total cancer level of 10^{-4} to seven carcinogenic compounds of concern and two exposure pathways.
3) The adult and child surface water goal combines the adult (24 years) and child (6 years) scenarios.

TABLE 4
CALCULATED SSTLs FOR SURFACE WATER BASED ON DERMAL CONTACT FOR A RECREATIONAL USER
Rohm and Haas Chemicals LLC
Reading, Ohio

Absorbed dose (mg/kg-d) = (DA event x EV x EF x ED x SA)/(BW x AT)
DA event is calculated as follows:
Inorganics: DAevent=Kp x CW x CF x Tevent
Organics:
If Tevent < t*, then: DA event = 2FA x Kp x Cw x CF x $(6\tau Tevent/3.14)^{1/2}$
If Tevent>t*, then: DA event = FA x Kp x Cw x CF x $[Tevent/(1+B) + 2\tau(1+3B+3B^2)/(1+B)^2]$
Where: CF = Correction factor of 0.001 L/cm^3
Tevent = 0.5 hrs for dermal contact during each swimming event

Inorganics	Kp(cm/hr)	Tevent (hrs)
Arsenic	1.00E-03	0.5
Aluminum	1.00E-03	0.5
Iron	1.00E-03	0.5
Manganese	1.00E-03	0.5
Thallium	1.00E-03	0.5

Organics	t* (hrs)	Kp(cm/hr)	τ(hr)	B	FA
1,2-Dichloroethane	0.92	4.20E-03	0.38	0	1
Benzene	0.70	1.50E-02	0.29	0.1	1
Methylene chloride	0.76	3.50E-03	0.32	0	1
Tetrachloroethene	2.18	3.30E-02	0.91	0.2	1
Vinyl chloride	0.57	5.60E-03	0.24	0	1
Aniline	0.85	1.90E-03	0.35	0	1
bis(2-ethylhexyl)phthalate	39.93	2.50E-02	16.64	0.2	0.8

TABLE 5
SUMMARY OF CALCULATED SSTLS FOR SURFACE WATER
FOR THE RECREATIONAL USER SCENARIO
Rohm and Haas Chemicals LLC
Reading, Ohio

Compounds	Surface Water SSTL (mg/L)			
	Ingestion		Dermal	
	Cancer	Noncancer	Cancer	Noncancer
Arsenic (child)	--	1.05E-01	--	7.98E-01
Arsenic (adult)	--	1.43E+00	--	3.98E+00
Arsenic (adult and child)	2.52E-01	**1.05E-01**	1.06E+00	7.98E-01
Aluminum (child)	--	3.51E+02	--	2.66E+03
Aluminum (adult)	--	4.78E+03	--	1.33E+04
Aluminum (adult and child)	--	**3.51E+02**	--	2.66E+03
Iron (child)	--	1.05E+02	--	7.98E+02
Iron (adult)	--	1.43E+03	--	3.98E+03
Iron (adult and child)	--	**1.05E+02**	--	7.98E+02
Manganese (child)	--	4.91E+01	--	3.72E+02
Manganese (adult)	--	6.69E+02	--	1.86E+03
Manganese (adult and child)	--	**4.91E+01**	--	3.72E+02
Thallium (child)	--	2.32E-02	--	1.75E-01
Thallium (adult)	--	3.15E-01	--	8.76E-01
Thallium (adult and child)	--	**2.32E-02**	--	1.75E-01
1,2-Dichloroethane (child)	--	7.02E+00	--	5.25E+00
1,2-Dichloroethane (adult)	--	9.55E+01	--	2.62E+01
1,2-Dichloroethane (adult and child)	4.15E+00	7.02E+00	**1.73E+00**	5.25E+00
Benzene (child)	--	1.40E+00	--	3.37E-01
Benzene (adult)	--	1.91E+01	--	1.68E+00
Benzene (adult and child)	6.87E+00	1.40E+00	9.17E-01	**3.37E-01**
Methylene chloride (child)	--	2.11E+01	--	2.06E+01
Methylene chloride (adult)	--	2.87E+02	--	1.03E+02
Methylene chloride (adult and child)	5.04E+01	2.11E+01	**2.74E+01**	2.06E+01
Tetrachloroethene (child)	--	3.51E+00	--	2.16E-01
Tetrachloroethene (adult)	--	4.78E+01	--	1.08E+00
Tetrachloroethene (adult and child)	7.00E-01	3.51E+00	**2.40E-02**	2.16E-01
Vinyl chloride (child)	--	1.05E+00	--	7.44E-01
Vinyl chloride (adult)	--	1.43E+01	--	3.71E+00
Vinyl chloride (adult and child)	2.52E-01	1.05E+00	**9.90E-02**	7.44E-01
Aniline (child)	--	2.46E+00	--	4.23E+00
Aniline (adult)	--	3.34E+01	--	2.11E+01
Aniline (adult and child)	--	**2.46E+00**	--	4.23E+00
bis(2-ethylhexyl)phthalate (child)	--	7.02E+00	--	1.67E-01
bis(2-ethylhexyl)phthalate (adult)	--	9.55E+01	--	8.32E-01
bis(2-ethylhexyl)phthalate (adult and child)	2.70E+01	7.02E+00	3.57E-01	**1.67E-01**

Note: SSTL - site-specific target level
1. Recreational user (adult and child) scenario is used for the final surface water SSTLs.
2. The surface water SSTLs are intended to be used as screening levels because they are developed based on conservative assumptions. For compounds that exceed these goals in the future, a risk assessment may be performed to determine the actual risk.
BOLD value is the lowest calculated surface water SSTL for that compound.

Mirtha Capiro/R5/USEPA/US
11/27/2006 09:02 PM

To Carl J Coker <CCoker@rohmhaas.com>

cc Nystrom Jennifer <nystrom_jennifer@bah.com>, Robert A Darner <radarner@usgs.gov>, Karen Fields <karen.fields@parsons.com>, Fan Wang-Cahill

bcc

Subject Clarification following 11/20/06 call on Rohm and Haas facility

Carl,

As a follow-up to our call on November 20, we would like to provide some clarification on the recommended process for selecting chemicals for monitoring and cleanup goal development. Among other technical considerations, groundwater cleanup goals should be developed based on the existing quality of groundwater and reasonably expected groundwater use scenarios, with or without current engineering controls. Groundwater cleanup goals may be either default values or site-specific. As discussed, it may be useful to employ a tiered approach to monitoring and cleanup goal development for the Rohm and Haas facility. Under a tiered approach, site-specific cleanup goals could be set for chemicals of greatest concern, and monitoring for other chemicals could be planned using default values, mainly for streamlining purposes. This suggested approach is summarized below.

Tier 1 - Developing site-specific cleanup goals for monitoring

(1) Chemicals that pose unacceptable risk to human and/or ecological receptors in Mill Creek under an exposure scenario with current engineering controls (i.e., risks are calculated based on existing hydraulically-connected surface water and sediment quality).

(2) Chemicals that pose unacceptable risk to human and/or ecological receptors in Mill Creek under an exposure scenario without current engineering controls (i.e., risks are calculated based on estimated hydraulically-connected surface water and sediment quality associated with failing/decommissioning of the French Drain). Surface water exposure concentrations under the scenario without current engineering controls can be estimated based on conventional solute transport theory. Sediment pore water exposure concentrations under this scenario can be estimated in a similar manner, but no dilution with Mill Creek surface water should be assumed.

Tier 2 - Using default values as cleanup goals for monitoring

(1) To verify compliance with groundwater standards at the point of compliance due to the uncertainties in estimating surface water concentrations as exposure concentrations in Tier 1 (2) above, analytes that are monitored in groundwater should include all chemicals with maximum detected groundwater concentrations exceeding applicable human health and ecological screening values for surface water.

(2) Although it is not a current potential source of drinking water, the upper aquifer is hydraulically interconnected to the lower aquifer, which is a drinking water source. To address the upper-to-lower-aquifer groundwater migration pathway, the facility's monitoring should also include those constituents present in groundwater from the upper aquifer at concentrations that exceed Safe Drinking Water Act Maximum Contaminant Levels (MCLs). Rohm and Haas will be required to monitor for any releases of those constituents from the upper aquifer into the lower aquifer to ensure compliance with MCLs as the media protection standard in groundwater in the lower aquifer.

Below are some additional, general clarifications on the subject of monitoring and groundwater cleanup goal development.

All estimations of exposure concentrations and any other evaluations described above should rely on

monitoring data that are representative of groundwater quality conditions, and sources of contamination and their cumulative impact on the groundwater quality.

In addition, U.S. EPA will coordinate review of groundwater cleanup goals with the Ohio Environmental Protection Agency (OEPA). Refer to OEPA's July 14, 2005, interoffice memorandum found in reference from Rohm and Haas' Draft Baseline Risk Assessment Report as follows: *Booz Allen Hamilton, 2005, U.S. EPA Contract No. 68-W-02-018, Work Assignment R05802-2, Revised Draft Recommended Approach for Development of Groundwater Cleanup Goals, Rohm and Haas, Reading, Ohio.* Please note that the above reference, as cited in Rohm and Haas' September 20, 2006, Response to Comments, is not up to date (see attached final version of the same document).

Please let me know if you have any questions and would like to discuss. We could arrange a call if necessary. Thanks.

REPA3-2502-206v2.cvrltr.pdf REPA3-2502-206v2.doc

Mirtha Cápiro
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Carl J Coker
<CCoker@rohmhaas.com>
11/09/2006 01:01 PM

To Mirtha Capiro/R5/USEPA/US@EPA, Karen Fields <karen.fields@parsons.com>, Fan Wang-Cahill <Fan.Wangcahill@parsons.com>, Ronald J Lantzy
cc
bcc

Subject Cincinnati Risk Assessment Comments Teleconference

History: This message has been forwarded.

All,

We will be having a conference call on Monday, November 20, 2006 at 2:00 EST (1 CST) to discuss the latest set of comments on the Cincinnati Risk Assessment. The call-in Number and passcode are:

Call-In Number: 877.491.4575
Passcode: 131654

Mirtha,

Please share the call-in number and passcode with Booz Allen Hamilton and USGS representatives.

Regards,

Carl J. Coker
Remediation Project Manager

Rohm and Haas Company | Engineering Div. | 3100 State Road | Croydon | PA | 19021
Phone: 215.785.7193 | **Fax:** 215.785.7077 | **Cell:** 502.396.7297 | ccoker@rohmhaas.com

"Fields, Karen"
<Karen.Fields@parsons.com>

09/20/2006 02:18 PM

Subject

Rohm and Haas, Cincinnati Plant - Response to Comments

Hi All,

Attached are responses to comments received on August 2, 2006 (and updated August 30, 2006) on the revised Baseline Risk Assessment for the Rohm and Haas Cincinnati Plant for review and discussion. Please let me know if you have any trouble receiving or opening the attached file. Thanks!

- Karen

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ROH Cincy Sept 2006 Responses.pdf

RESPONSES TO AUGUST 2, 2006
ADDITIONAL COMMENTS FROM THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (U.S. EPA) ON ADDITIONAL TEXT TO INCLUDE IN SECTIONS 6.3.1, 6.4, 7.2.4, 7.5.1 AND NEW SECTION 7.7 OF THE BASELINE RISK ASSESSMENT (BRA) REPORT AND ON ADDITIONAL ASPECTS OF THE BRA
AND
FOLLOW-UP LETTER RECEIVED AUGUST 30, 2006

ROHM AND HAAS CHEMICALS LLC (ROHM AND HAAS)
READING, OHIO

20 September 2006

Below are the responses to the additional comments received from the U.S. EPA on August 2, 2006 and revised August 30, 2006 for the Baseline Risk Assessment (BRA) for the Rohm and Haas, Cincinnati Plant. For clarity, the responses to these additional comments are in italics following each applicable comment. In addition, these responses incorporate the clarifications discussed on August 10, 2006 by Parsons (consultant for Rohm and Haas) and Booz Allen Hamilton (consultant for U.S. EPA).

GENERAL COMMENTS

U.S. EPA has reviewed Rohm and Haas' April 3, 2006 submittal, and some concerns remain regarding the groundwater screening evaluation. These concerns are detailed in the specific comments below. Rohm and Haas should revise the BRA report to incorporate the additional text and tables originally submitted on October 10, 2005, with the modifications discussed below and in Rohm and Haas' December 5, 2005 and April 3, 2006 submittals.

SPECIFIC COMMENTS

Section 6.4 The Potential Future Risk Associated with Migration of Impacted Groundwater to Surface Water, page 4 and 5 of 5

U.S. EPA's November 22, 2005, specific comment 3: In the third paragraph on page 4, Rohm and Haas has provided rationale for why detected concentrations of arsenic in groundwater are not expected to pose a significant risk to identified receptors. Given that this is a baseline risk assessment, potential exposure to arsenic should be evaluated quantitatively to provide a conservative assessment of the potential risks that include potential contribution from background sources and naturally occurring elements. This direction is consistent with U.S. EPA's *Role of Background in the CERCLA Cleanup Program* (OSWER 9285.6-07P) from April 26, 2002. It should be noted that the text in the last paragraph on page 5 does appear to indicate that arsenic will be included in the quantitative evaluation; however, it is not clearly stated. Thus, it is recommended that Rohm and Haas also revise the last paragraph on page 5 to state clearly which compounds will be carried through for quantitative evaluation, and which compounds will not be evaluated quantitatively and for what reasons.

U.S. EPA's December 12, 2005, specific comment 3: Provide any available additional information regarding the possible sources of the arsenic detections in well MW-EPA-1, and discuss the lack of arsenic detections in nearby wells. Also, please discuss the site-wide frequency of detection of arsenic in groundwater, since contaminants with a frequency of detection less than 5% are typically eliminated from further evaluation in human health risk assessments. Finally, if any relevant regional background data can be identified, it would also be useful to include a brief summary of these data.

→**Additional U.S. EPA specific comment 3:** The maximum arsenic concentration in groundwater presented in the Rohm and Haas' responses exceed human health screening values. The screening criterion that is being used to evaluate arsenic in surface water is the National Recommended Water Quality Criteria (NRWQC), which considers ingestion of water and fish consumption. Given that Mill Creek is not a source of potable water, and arsenic has not been detected in six whole body fish samples collected in Mill Creek, this screening value can be considered conservative for the site. The screening criterion that was used in the approved BRA work plan was the Safe Drinking Water Act Maximum Contaminant Level (MCL). Actual surface water concentrations obtained from the reach of Mill Creek adjacent to the site did not exceed MCL, and those recently modeled concentrations based on concentrations in groundwater at downgradient wells do not exceed MCL. Thus, Rohm and Haas response to quantitatively address human exposure to arsenic in surface water is acceptable.

As presented by Rohm and Haas, conditions in the vicinity of well MW-EPA-1 may limit the mobility of arsenic in groundwater. When these conditions are present, it would be reasonable to expect that arsenic in groundwater would not adversely affect the water quality of Mill Creek. However, it is uncertain to what extent the concurrent action from the French Drain may be contributing to the control of unacceptable releases of arsenic into Mill Creek. Due to this uncertainty, arsenic must be included in the development of clean up goals as one of the compounds that may pose risk in the event that the French Drain fails or is decommissioned. Also, refer to specific comment 5.

Additional Response: *Reducing conditions in the vicinity of well MW-EPA-1locally increase the mobility of arsenic in groundwater (field sampling data showed reducing conditions and field personnel noted a sulfur odor when sampling—see attached Table 1 of monitored field conditions and a graph (Figure 1) of redox conditions versus arsenic concentrations). Our previous response dated 9 January 2006 stated that the higher arsenic concentrations in wells MW-EPA-1 and UAW08-20 (as compared to arsenic concentrations in the other groundwater monitoring wells) are because arsenic could be released from soil to groundwater as arsenite under the reducing condition. The reducing condition was likely caused by the presence of high hydrogen sulfide concentrations due to a damaged sewer line in the area. The sewer line was repaired in October/November 2005 and it is expected that aerobic conditions in the groundwater will re-establish in time, and the soluble arsenite will*

be converted back to insoluble arsenate, which will limit the mobility of arsenic in groundwater.

In addition, groundwater analytical data from 2005 show that arsenic was not even detected in three separate samples of groundwater collected from the French Drain (Table 2—data labeled as "Before Groundwater Treatment"). Therefore, arsenic will not pose an unacceptable risk regardless of whether or not the French Drain fails or is decommissioned since arsenic has not even been detected in the groundwater flowing into the French Drain. Thus, arsenic is not a chemical of concern for the groundwater to surface water pathway and groundwater clean-up levels for arsenic do not need to be developed at this time.

Section 6.4 The Potential Future Risk Associated with Migration of Impacted Groundwater to Surface Water
Text to Add to Support the Groundwater to Surface Water Migration Pathway Evaluation for Ecological Receptors
Tables 8.8 and 8.9

U.S. EPA's November 22, 2005, specific comment 4: For this evaluation, Rohm and Haas used the most current maximum detected concentrations in groundwater in all wells in the upper aquifer and in all wells downgradient of the French Drain. The maximum concentration for iron corresponds to well UAW10-80. It is noted that this well is screened in the deepest portion of the upper aquifer which is expected to be extensively below the elevation associated with penetration from Mill Creek. Other selected wells are screened at depths of up to 60 feet, which is still a conservative approach. A possible recommendation would be to use the maximum concentration for iron from shallow wells in the upper aquifer (for depths ranging from 10 to 60 feet). Also, please note that the hydraulic conductivity (K) value used in the evaluation was measured in a shallow well (UAW02-20). Because a K value for the shallow aquifer was used, these assumptions should not be used to determine the groundwater flux from deeper wells, such as UAW10-80.

→**Additional U.S. EPA specific comment 4:** No further comments. Refer to the additional U.S. EPA specific comment 5 regarding the agency's review of the calculated groundwater flux to surface water from Mill Creek.

Additional Response: *See additional response to comment 5 below.*

U.S. EPA's November 22, 2005, specific comment 5: The calculated "output" for estimated surface water (SW) concentrations assumes that there was no existing concentration in the stream. The concentration in surface water due to groundwater (GW) influx and the pre-existing input SW concentration (if there is any) would look as follows:

$$C_{swOUT} = \left[\frac{C_{gw} \times Q_{gw}}{Q_{gw} + Q_{sw}}\right] + \left[\frac{C_{swIN} \times Q_{sw}}{Q_{gw} + Q_{sw}}\right]$$

and the assumption in the Rohm and Haas' evaluation is that $C_{swIN} = 0$
Obviously, if upstream surface-water concentrations were elevated, the output SW concentration would be higher than the calculation. Therefore, SW conditions need to be considered.

Moreover, additional contributions to the stream could be from the aquifer (within the facility) further upgradient of the selected well location and calculations based on a single well with a maximum concentration would not take these additional contributions into account. For example, well A upstream and upgradient from well B adds 1 µg/L of constituent X to the SW. Then, well B adds 10 µg/L of the same constituent. Although the total flux depends on flow and the degree of attenuation taking place, C_{swOUT} would be greater than the 10 µg/L calculated from the maximum GW concentration. Additional contributions to SW should be discussed.

U.S. EPA's December 12, 2005, specific comment 5: Describe a proposed approach for considering inter-well contributions affecting constituent concentrations through out the aquifer as part of the risk screening.

→**Additional U.S. EPA specific comment 5:** U.S. EPA has reviewed the proposed equation and "conservative" and "detailed" models to calculate concentrations in surface water due to groundwater influx from the Rohm and Haas facility. U.S. EPA believes that the equation is appropriate, with the exception that the groundwater inflow from the west side of the creek needs to be included in the water budget. Available information from sources such as Geomatrix (2004), USGS (2002), Booz Allen Hamilton (2005) and U.S. EPA (2006) indicate a strong likelihood that the reach of Mill Creek adjacent to the Rohm and Haas facility is a gaining stream. Assuming a saturated thickness of 6 feet for the model appears to be conservative based on information from Geomatrix (2004) and USGS (2002). The appropriateness of the "conservative" and "detailed" models is discussed below.

The proposed "conservative" model relies on the total length of the property boundary adjacent to Mill Creek as flow width and uses the maximum concentration for each compound for all wells and for downgradient wells based on November 2004 data. The results obtained using this "conservative" model are presented in Tables 1 and 2 (for each table, the results for all wells are presented in the left portion while the right portion contains the results for downgradient wells).

In the proposed "detailed" model, the width of flow is determined by dividing the total length of the property boundary adjacent to Mill Creek into ten sections based on inter-well

distances at the downgradient boundary. Each flow width value is associated with one of eleven downgradient wells and the detected concentration for each compound (per November 2004 data) at each respective well. The results obtained by Rohm and Haas using this "detailed" model are presented in Tables 3 and 4.

After water budget corrections, the proposed equation and "detailed" model (based on inter-well flow width and compound concentrations in groundwater at downgradient wells) will be appropriate for evaluation of current risks in the Baseline Risk Assessment.

The evaluation of future risk needs to rely on the estimated surface water concentrations based on compound concentrations from *all wells* as exposure point concentrations for risk evaluation. Therefore, after water budget corrections, it would be appropriate for Rohm and Haas to use the proposed "conservative" model relying on the maximum concentration of each compound in groundwater from all wells (per the left portion of Tables 1 and 2 of the April 3, 2006 submittal) for evaluating future risk under a scenario where the French Drain fails or is decommissioned.

As part of a future remedy proposal, groundwater cleanup goals should be developed for all compounds (except pesticides, PCBs, and PAHs provided that appropriate reference or justification is presented per specific comment 9 below) exceeding criteria based on *all wells* as identified in the left portion of Tables 1 and 2. This will ensure that appropriate monitoring criteria are in place for all compounds that may pose risk in the event that the French Drain fails or is decommissioned. For development of clean up goals, it would be appropriate to rely on mass fluxes for contaminant concentrations from all wells based on site-specific parameters (e.g., accounting for variability on flow width on a contaminant basis).

Additional Response: *Because the contributions to surface water were calculated using data from a line of monitoring wells parallel to the stream bank, the total mass of compounds contributed from the site groundwater to surface water has been taken into account. The concentration in these stream bank wells represents the mass entering the stream from all groundwater in the flow tube, including groundwater upgradient of the monitoring well on the stream bank in the same flow tube. In conventional solute transport theory, if well A and B were in the same flow tube, the 10 ug/L concentration at well B from EPA's example actually represents the 1 ug/L at well A, minus any reduction in concentration due to attenuation between A and B, plus the addition of any source between A and B. Therefore, the concentration a well A represents the total mass contribution.*

EPA's example appears to assume that groundwater from the vicinity of every monitoring well reaches the creek unchanged. In that case, a separate flow tube to the creek for each well would have to be constructed. This approach is not consistent with conventional solute-transport theory.

Groundwater flow from the west side of the creek can be added to the water budget. Note, however, that the surface water concentrations will not be significantly different from those previously calculated, and will be slightly less conservative. If the groundwater flow from the west side of the creek is assumed to be similar to that from the east side of the creek, the additional flow represents only 3% of the water budget. Accordingly, assuming that the compound concentrations in groundwater from the west side of the creek are non-detect (i.e. zero), the calculated surface water concentrations will be 3% less than those previously calculated.

U.S. EPA's recommendation to use the conservative model and the maximum concentration from all of the wells to evaluate future risk under a scenario where the French Drain fails or is decommissioned is an unrealistic and overly conservative approach. This approach assumes that the highest compound concentrations, typically found near the source areas, will not diminish with distance from the source area. Both conventional solute transport theory and site data indicate that those concentrations will decrease.

A more realistic, but still conservative approach would be to use the groundwater extraction rates and analytical data from the French Drain to calculate hypothetical mass-loading to the creek. This approach is realistic because it would use the actual mass loading to the French Drain. The approach is conservative because the groundwater extraction rate of the French Drain is higher than the natural groundwater flux across the width of the drain.

Additionally, in the April 3, 2006 Response to U.S. EPA Comment #5, Rohm and Haas indicated that the NRWQC for human health are not applicable for Mill Creek. The exposure pathways considered in the development of the NRWQC for human health are ingestion of water and organisms. Of all developed criteria, these are the most appropriate screening values available to evaluate human exposure to surface water given the site conditions. If Rohm and Haas feels these criteria aren't applicable, then it is recommended that Rohm and Haas develop site-specific cleanup levels based on the appropriate site exposure conditions (e.g., recreational use) and use these values as screening levels to evaluate estimated concentrations in surface water using *all wells*.

Additional Response: *Rohm and Haas will develop site-specific clean-up levels for compounds in groundwater that exceed the NRWQC since the NRWQC for human health are not applicable for the site. During a conference call between Parsons and Booz Allen Hamilton personnel on August 10, 2006, it was clarified that the site-specific clean-up levels would be based on the recreational swimmer scenario (as presented in the revised BRA) since it includes both the incidental ingestion and dermal contact pathways. Additionally, as stated previously, using the maximum detected concentration in all wells is not consistent with current conventional solute transport theory or site data results, which indicate concentrations in groundwater are decreasing as the groundwater nears Mill Creek.*

Moreover, the BRA needs to include a brief explanation of the reason for not considering sediment in the evaluation of potential future human health risk associated with migration of impacted groundwater to surface water. It is noted that, in their December 5, 2005 response to comments, Rohm and Haas outlined a proposed approach for evaluating ecological risks in sediment associated with migration of impacted groundwater. This approach is acceptable, with the exception that future ecological risks and selection of chemicals for cleanup goal development should be determined based on *all wells,* rather than downgradient wells only, for the reasons discussed above.

Additional Response: *During the August 10, 2006 conference call, it was clarified for the ecological receptors that if the maximum detected groundwater concentration is below the AWQC, then the sediment does not need to be addressed further. If the maximum groundwater concentration exceeds the AWQC, then Rohm and Haas may need to back calculate a groundwater concentration that is protective of sediment using foc and koc and the Region 5 sediment ESL as presented in the Dec. 5, 2005 submittal to USEPA.*

Similarly, for the human health evaluation, if the maximum detected groundwater concentration is below the NRWQC, then the sediment does not need to be addressed further. If the maximum groundwater concentration exceeds the NRWQC, then the concentration will be compared to site-specific action levels, and if necessary, a groundwater concentration that is protective of sediment will be developed in the same manner as for the ecological receptors except that the Region 9 industrial PRGs will be used instead of the Region 5 sediment ESLs.

As stated previously, using the maximum detected concentration in all wells is not consistent with current conventional solute transport theory or site data results, which indicate concentrations in groundwater are decreasing as the groundwater nears Mill Creek. However, to address the concern about the potential failure or future decommissioning of the French Drain, Rohm and Haas proposes to further evaluate this pathway using the groundwater data collected from the French Drain prior to treatment.

Please revise the proposed model, equation and calculations in the BRA to account for groundwater inflow from the west side of the creek. Also, revise the BRA to briefly describe the scope of clean up goal development for the Rohm and Haas facility, and to address the above comments regarding sediment evaluation.

Additional Response: *See additional responses above.*

U.S. EPA's November 22, 2005, specific comment 6: To estimate surface water concentrations, Rohm and Haas used the values for areas of groundwater discharge presented in the U.S. EPA Environmental Indicator (EI) Determination of Migration of Contaminated Groundwater under Control. Please note that the EI determination relied on the information

available at the time. The estimation of areas of groundwater discharge presented in the EI did not consider the information from the proposed, revised Baseline Risk Assessment. Therefore, Rohm and Haas needs to estimate the size of the plumes intercepting Mill Creek based on the proposed comparison of groundwater analytical results and human health and ecological screening values, including the U.S. EPA comments. The plume delineation needs to address volatile organic compounds, semivolatile organic compounds, pesticides and metals. Upon approval of the Rohm and Haas' Baseline Risk Assessment Report, U.S. EPA will update the EI Determination based on the new available information.

→**Additional U.S. EPA specific comment 6:** Refer to the additional U.S. EPA specific comment 5 regarding the agency's review of the calculated groundwater flux to surface water from Mill Creek.

Additional Response: *See additional responses to comment 5 above.*

→**New additional comment, U.S. EPA specific comment 7, Seep Evaluation:** Additional discussion related to the screening of seep data should be included in Section 7.2.4. Rohm and Haas should note that the groundwater screening evaluation and cleanup goals should adequately protect Mill Creek from groundwater discharge. Those compounds with seep concentration exceedences of screening values (e.g., lead, zinc), but no groundwater concentration exceedences of screening values, should be specifically noted. U.S. EPA has preliminarily evaluated these data, and it appears that no addition of constituents of potential concern (COPCs) is needed based on the seep data.

Additional Response: *Comment noted.*

→**New additional comment, U.S. EPA specific comment 8, Use of low-flow purging techniques for groundwater sampling**: As part of the facility investigation, Rohm and Haas collected groundwater data based on the approved Facility Investigation (FI) Work Plan. Per the work plan, Rohm and Haas conducted groundwater sampling using the low-flow purging techniques as prescribed by U.S. EPA guidance, unless this method could not be implemented (e.g., due to insufficient yield). The purpose of using low-flow purging techniques is to ensure the sampling and analysis of groundwater samples that are representative of groundwater conditions. In accordance with the work plan, Rohm and Haas sampled wells with insufficient well yield using disposable bailers. The FI Report appropriately documented what wells were sampled with bailers per each groundwater sampling event.

In addition to the information provided in the FI Work Plan and Report, please document how the use of the alternate method for groundwater sampling may have affected reported constituent concentrations and/or nondetected results, as well as the goals of the investigation

and risk assessment. Please consider that any data gaps resulting from the use of the alternate method during the facility investigation may be addressed during monitoring as part of a final remedy. Future monitoring must satisfy the following requirements: a) during monitoring, the facility must use low flow sampling for all wells; b) as part of monitoring, the facility must evaluate the results from low flow sampling to determine if they would affect screening results and revise the screening accordingly; and c) if additional COPCs are identified, the facility shall develop groundwater cleanup goals and satisfy any warranted remedial requirements for those additional COPCs, including monitoring.

Additional Response: *The goal of the groundwater sampling program is to obtain samples which are representative of groundwater conditions. This is accomplished by striving to obtain a sample of undisturbed or "fresh" formation water and by avoiding collecting a sample of stagnant water from inside the well casing or sand pack. Groundwater within the well casing is exposed to conditions which may differ from the formation water and may be exhibit an alternate temperature, pH, oxidation-reduction potential (ORP), and/or total dissolved solids (TDS) content. Furthermore, long-term contact with casing/screen materials may result in sorption/leaching effects and microbial degradation of some of the contaminants may occur while water is stored within the well casing. The air-water interface at the top of the water column can effect chemical changes related to gases volatizing to the air or going into solution from the air column.*

Low flow sampling allows recharge into the well from a discreet interval within the well screen. By maintaining the water level during low flow pumping, the sampler ensures that the recharging water is coming from the formation and not from the well boring. Low recharge wells present a problem for low flow sampling techniques in that the pump cannot achieve a flow rate slow enough to maintain the water level in the well. Thus, the water sampled is flowing into the pump from the well boring rather than from the formation.

Prior to the advent and acceptance of low flow sampling techniques, purging 3 to 5 well volumes and/or until field-measured parameters stabilized was the standard practice to get a representative groundwater sample. This procedure removed water from the borehole and sand pack and allowed "fresh" formation water to recharge into the well. When recharge in a well is slow, this method calls for purging until dry and then allowing for recharge prior to sampling.

When a well is completely evacuated and allowed to recharge prior to sampling, the water samples obtained will be "fresh" formation water, thus, using this alternate purge method to sample these wells has minimal impact on the data or the results of the risk assessment. Because flow rates cannot be lowered sufficiently to match the recharge rates in some of the wells at the Cincinnati plant, low flow sampling does not provide a representative sample. The best available method for such wells is to purge until dry and then sample the "fresh" groundwater within 24 hours. Requiring low flow sampling of the low yield wells during ongoing monitoring at the plant will result in decreased sample integrity and representativeness.

→New additional comment, U.S. EPA specific comment 9, Refinement of COPCs.
Section 2.1 Site History
Section 3.2 Selection of Chemicals of Potential Concern
Section 7.1.3 Fate and Transport
Section 7.2 Chemical Screening
Section 7.5.3 Preliminary Exposure Assessment Analysis of Uncertainty

After review of the information from the June 30, 2005, Baseline Risk Assessment (BRA) Report and subsequent revisions to the BRA submitted by Rohm and Haas, USEPA has determined that the refinement of COPCs is appropriate if the media-specific conditions below are met. U.S. EPA considers appropriate any other COPC refinement presented in the BRA report that is not addressed in this comment or the comments above.

Soil

1. With regards to the ecological risk assessment process, it would be appropriate to eliminate as COPCs those constituents that exceed screening values in soil from operational and landscaped areas because there is lack of complete exposure pathway for ecological receptors. The BRA Report has already adequately supported the lack of complete exposure pathway associated with ecological receptors.

Additional Response: *Comment noted.*

2. It would be appropriate to eliminate pesticides as COPCs for the reasons described above, but not on the grounds that they are not site related. Because pesticides are associated with former agricultural practices at what is now the Rohm and Haas property, they are considered hazardous constituents related to the facility under RCRA corrective action.

Additional Response: *Comment noted.*

3. Unless otherwise noted below, all those constituents that exceed screening values in soil are considered COPCs for sediments in Mill Creek based on the groundwater-to-surface water and runoff-to-surface water migration pathways.

Additional Response: *Sediment samples have been collected from Mill Creek adjacent to the Rohm and Haas Cincinnati Plant and comparison of these results to established benchmarks show little or no risk to potential receptors. Since the entire Cincinnati facility is either paved, landscaped or exists as a maintained grass lawn, the potential for soil-related contaminants to enter the sediments of Mill Creek via surface run-off is minimal and the pathway is considered incomplete. The potential groundwater-to-surface water pathway is already being addressed per previous comments received on the BRA, specifically, the*

assumption that groundwater concentrations are equal to sediment pore water concentrations and using groundwater models to estimate the site contribution to Mill Creek. See also the response to specific comment 5 above.

Sediments from Mill Creek

1. May eliminate PCBs as COPCs in sediments provided that a justification that is supported by the distribution of concentrations and screening results is presented (e.g., describe frequency of detection and hazard quotient comparison results).

Additional Response: *During the August 10, 2006 conference call with Booz Allen Hamilton, it was clarified that the information provided in U.S. EPA's "Final Recommended Approach for Development of Groundwater Clean-up Goals" dated July 28, 2005 (regarding exclusion of pesticides, PCBs and PAHs) needs to be explicitly re-stated in the text of the revised BRA and not simply referenced or cited in the document.*

2. May eliminate pesticides and polycyclic aromatic hydrocarbons (PAHs) as COPCs in sediments provided that a justification that is supported by the distribution of concentrations and presence of other not site-related sources is presented (e.g., description of potential impacts from other sources, such as historical contamination from the Superfund Pristine site).

Additional Response: *See above response.*

Please note that some of the risk assessment activities above may not be consistent with previous U.S. EPA comments. When inconsistent, these activities supersede previous U.S. EPA comments, requirements or determinations on the subject of COPCs refinement.

Rohm and Haas shall revise the above-cited sections under this specific comment and any other related sections from the BRA report as necessary to ensure that all COPC refinement is appropriately justified based on this comment.

Additional Clarifications: *During the August 10, 2006 conference call between Parsons and Booz Allen Hamilton personnel, it was agreed that toxicological values and screening values would be updated per current guidance. Also, Booz Allen Hamilton personnel confirmed that the tables and calculations also need to be updated to include current data (ie., November 2005 groundwater data and any other data collected since the issuance of the revised BRA).*

REFERENCES

Geomatrix Consultants Inc., 2004, Revised Facility Investigation Report, prepared for Rohm and Haas Co., Volumes 1 and 2.

Schalk, C, and Schumann, T., 2002, Hydrogeology, ground-water use, and ground-water levels in the Mill Creek valley near Evendale, Ohio: U.S. Geological Survey Water-Resources Investigations Report 02-4167.

Booz Allen Hamilton, 2005, U.S. EPA Contract No. 68-W-02-018, Work Assignment R05802-2, Revised Draft Recommended Approach for Development of Groundwater Cleanup Goals, Rohm and Haas, Reading, Ohio.

United States Environmental Protection Agency, 2006, Elevation data from survey points from Mill Creek in the vicinity of Rohm and Haas Chemicals LLC, and map with survey points.

Additional Comments from U.S. EPA received August 30, 2006:

Using Environmental/Mining Visualization Systems (EVS/MVS), U.S. EPA has prepared three-dimensional visualizations that show the geology of Mill Creek Valley at and in the vicinity of the Rohm and Haas facility. Refer to enclosed CD with EVS/MVS input and output files and associated data sources. We are sharing this information to facilitate discussions regarding corrective action at the site.

Additional Response: *Files received and comment noted.*

Input files

The input data are in "mill_creek_mvs_files.zip". In addition, "mill_creek_mvs_files.zip" contains a notes file, "mill_creek_mvs_notes.txt", on how to open and use the output files.

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The output files contain visualization images and are named "mill_creek_080206_layers.4d", "mill_creek_080206_slices.4d", "mill_creek_081406_split_layers.4d", and "mill_creek_081406_split_layers_expanded.4d".

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A ".4d" viewer, along with a ".doc" file with tips on how to use the viewer for viewing visualization images, are in a file called "4d_viewer.zip.

Data Sources - Rohm and Haas' electronic data deliverable, lithology interpretation from the

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The site geology data include the Rohm and Haas' electronic data deliverable (see EDD) and lithology interpretation conducted by USGS (refer to "Lithology file with geo_unit_code_2.xls"). The source of surface data for Mill Creek are Light Detection and Ranging (LIDAR) data sets from the City of Cincinnati, Hamilton County (see "Data_for_Mirtha.zip"), and elevation data collected by U.S. EPA (see "creek_bottom_1_26_06_adj_final.xols", "well_survey_pts_v1_3.pdf", and "well_survey_pts_v2_3.pdf").

Rohm and Haas shall revise and resubmit the BRA Report based on the August 2, 2006, U.S. EPA comments, the replacement to U.S. EPA specific comment 9, and the facility's previous responses on the subject of the BRA. Please call me to discuss and agree on a schedule for this required submittal.

Additional Response: *Comment noted.*

TABLE 1
Groundwater Sampling Summary Results – Arsenic Concentrations and Redox Potential
November 2005
Rohm and Haas, Cincinnati

Well ID	Arsenic Concentration (ug/L)	Redox Potential (mV)
UAW 07-20	#N/A	-399.1
UAW 08-20	79.7	-326.9
MW-EPA-1	596	-320.1
UAW 13-20	33.4	-312.9
UAW 11-10	29.2	-310.5
UAW 16-10	10.3	-292.8
UAW 12-20	#N/A	-237.4
UAW 03-20	#N/A	-220.8
UAW 06-20	21.7	-209
UAW 10-80	#N/A	-206.9
UAW 01-80	#N/A	-172.8
UAW 18-20	#N/A	-163.9
UAW 15-50	62.9	-143.5
UAW 05-20	45.4	-126.8
UAW 02-20	#N/A	-117.0
UAW 02-40	#N/A	-113.7
UAW 21-80	38.8	-111.6
UAW 25-20	16.3	-108.7
UAW 17-40	#N/A	-99.6
UAW 24-70	15.4	-98.2
UAW 04-20	25.7	-97.4
UAW 26-70	13.2	-75.7
UAW 23-20	#N/A	-74.3
UAW 22-20	#N/A	-57.1
UAW 01-30	11	-54.5
UAW 15-20	#N/A	-50.4
UAW 11-40	#N/A	-8.7
UAW 10-50	#N/A	-1
MW-EPA-2	#N/A	1.5
MW-EPA-3	#N/A	31.4
UAW 14-10	#N/A	46.1
UAW 09-20	#N/A	59.9
MW-EPA-4	#N/A	64.3
UAW 09-60	#N/A	69.3
UAW 27-50	#N/A	96.7
UAW 19-80	#N/A	103.3
UAW 20-60	#N/A	109.8

#N/A - Arsenic was not detected in that sample

FIGURE 1
Plot of Arsenic Concentrations Versus Redox Potential
November 2005
Rohm and Haas, Cincinnati

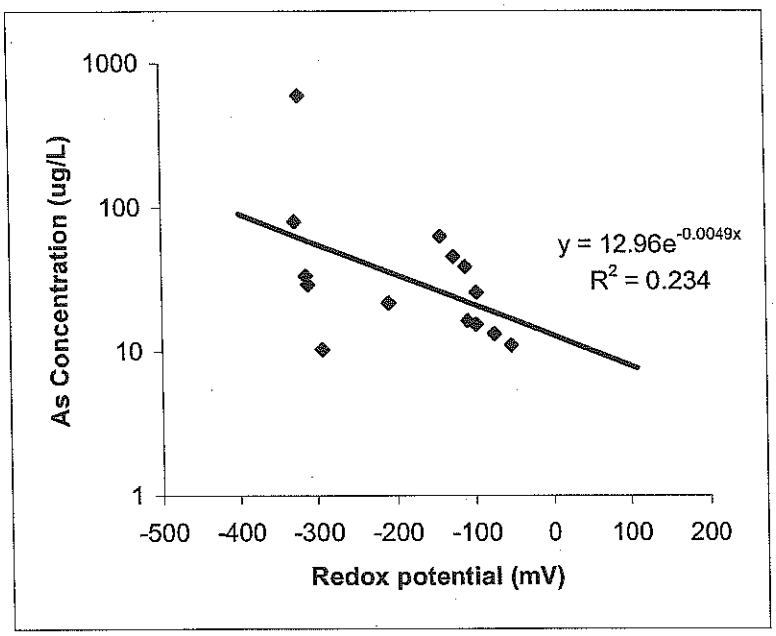

TABLE 2

Groundwater Sampling Summary Results – Metals

Rohm and Haas, Cincinnati

Metal	1/24/2005		2/1/2005		2/4/2005		Reporting Limit (mg/L)
	Before GW Treatment (mg/L)	After GW Treatment (mg/L)	Before GW Treatment 2/1/05 (mg/L)	After GW Treatment 2/1/05 (mg/L)	Before GW Treatment 2/4/05 (mg/L)	After GW Treatment 2/4/05 (mg/L)	
Aluminum	0.053 B, J	0.057 B, J	0.14 B, J	0.14 B, J	ND	0.023 B	0.20
Antimony	ND	ND	ND	ND	ND	ND	0.060
Arsenic	ND	ND	ND	ND	ND	0.0028 B	0.010
Barium	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	0.20
Beryllium	ND	ND	< 0.005	< 0.005	ND	ND	0.0050
Cadmium	ND	ND	ND	ND	ND	ND	0.0050
Calcium	192	197	208	219	200	215	5.0
Chromium	ND	ND	ND	ND	ND	ND	0.010
Cobalt	ND	ND	< 0.05	< 0.05	ND	ND	0.050
Copper	ND	ND	ND	ND	ND	< 0.025	0.0250
Iron	1.0	ND	1.4	ND	1.8	0.12	0.1
Lead	ND	ND	ND	ND	ND	ND	0.0030
Magnesium	39.2	40.1	43.3	43.5	42.8	42.8	5.0
Manganese	0.95	0.24	1.0	0.55	1	0.34	0.015
Mercury	ND	ND	ND	ND	ND	ND	0.0002
Nickel	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	0.040
Potassium	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	5.0
Selenium	ND	ND	ND	ND	ND	< 0.005	0.0050
Silica	13 J	13.2	11.6	12.2	11.8 J	12.6 J	1.07
Silver	ND	ND	ND	ND	ND	ND	0.010
Sodium	224	406	238	383	241	979	25.0
Thallium	ND	ND	< 0.01	< 0.01	ND	ND	0.010
Tin	0.17	0.5	0.20	0.50	< 0.10	0.68	0.10
Vanadium	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.050
Zinc	ND	ND	ND	ND	ND	< 0.02	0.020

ND = Analyte not detected at the reporting limit

J = Estimated result. Result is less than the reporting limit.

B = Method blank contamination. The associated method blank contains the target analyte at a reportable level.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF: DE-9J

AUG 3 0 2006

VIA ELECTRONIC MAIL AND
FEDERAL EXPRESS MAIL

Carl J. Coker
Rohm and Haas Company
Engineering Division
3100 State Road
Croydon, Pennsylvania 19021

Re: Baseline Risk Assessment Report and Supplemental Information
Rohm and Haas Chemicals LLC (Former Morton International, Inc.)
U.S. EPA ID No. OHD 000 724 138

Dear Mr. Coker:

This is a follow up to our letter of August 2, 2006, with comments from the United States Environmental Protection Agency (U.S. EPA) on the April 3, 2006, supplement to the revised Baseline Risk Assessment (BRA) Report from Rohm and Haas Chemicals LLC (Rohm and Haas). The U.S. EPA comments also addressed Rohm and Haas' supplements dated May 31 and July 24, 2006 as well as additional aspects from the BRA, including seep evaluation, use of low-flow purging techniques for groundwater sampling, and refinement of constituents of potential concern. The purpose of this follow up is to clarify U.S. EPA specific comment 9 (below) and to share information on U.S. EPA's data analysis for Mill Creek Valley as contained in the enclosed compact disk (CD).

The soil-related item under U.S. EPA specific comment 9 is concerning the ecological risk assessment process. The replacement comment below clarifies this aspect. For easier reading, the format has changed to numeric-alphabetical.

→<u>New additional comment, U.S. EPA specific comment 9</u>, Refinement of COPCs.
Section 2.1 Site History
Section 3.2 Selection of Chemicals of Potential Concern
Section 7.1.3 Fate and Transport

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Section 7.2 Chemical Screening
Section 7.5.3 Preliminary Exposure Assessment Analysis of Uncertainty

After review of the information from the June 30, 2005, Baseline Risk Assessment (BRA) Report and subsequent revisions to the BRA submitted by Rohm and Haas, USEPA has determined that the refinement of COPCs is appropriate if the media-specific conditions below are met. U.S. EPA considers appropriate any other COPC refinement presented in the BRA report that is not addressed in this comment or the comments above.

Soil

a) With regards to the ecological risk assessment process, it would be appropriate to eliminate as COPCs those constituents that exceed screening values in soil from operational and landscaped areas because there is lack of complete exposure pathway for ecological receptors. The BRA Report has already adequately supported the lack of complete exposure pathway associated with ecological receptors.

b) It would be appropriate to eliminate pesticides as COPCs for the reasons described above, but not on the grounds that they are not site related. Because pesticides are associated with former agricultural practices at what is now the Rohm and Haas property, they are considered hazardous constituents related to the facility under RCRA corrective action.

c) Unless otherwise noted below, all those constituents that exceed screening values in soil are considered COPCs for sediments in Mill Creek based on the groundwater-to-surface water and runoff-to-surface water migration pathways.

Sediments from Mill Creek

a) May eliminate PCBs as COPCs in sediments provided that a justification that is supported by the distribution of concentrations and screening results is presented (e.g., describe frequency of detection and hazard quotient comparison results).

b) May eliminate pesticides and polycyclic aromatic hydrocarbons (PAHs) as COPCs in sediments provided that a justification that is supported by the distribution of concentrations and presence of other not site-related sources is presented (e.g., description of potential impacts from other sources, such as historical contamination from the Superfund Pristine site).

Please note that some of the risk assessment activities above may not be consistent with previous U.S. EPA comments. When inconsistent, these activities supersede previous U.S. EPA comments, requirements or determinations on the subject of COPCs refinement.

Rohm and Haas shall revise the above-cited sections under this specific comment and any other related sections from the BRA report as necessary to ensure that all COPC refinement is appropriately justified based on this comment.

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Rohm and Haas shall revise and resubmit the BRA Report based on the August 2, 2006, U.S. EPA comments, the replacement to U.S. EPA specific comment 9, and the facility's previous responses on the subject of the BRA. Please call me to discuss and agree on a schedule for this required submittal.

For any questions regarding this letter and to discuss a schedule, please contact me at 312/ 886-7567 or at capiro.mirtha@epa.gov.

Sincerely yours,

Mirtha Capiro
Project Manager/Coordinator
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics Division

cc: Harold O'Connell, OEPA
Thomas C. Nash, C-14J

Enclosure

- ENCLOSURE -
ADDITIONAL COMMENTS FROM THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (U.S. EPA) ON ADDITIONAL TEXT TO INCLUDE IN SECTIONS 6.3.1, 6.4, 7.2.4, 7.5.1 AND NEW SECTION 7.7 OF THE BASELINE RISK ASSESSMENT (BRA) REPORT
AND
ON ADDITIONAL ASPECTS OF THE BRA

ROHM AND HAAS CHEMICALS LLC (ROHM AND HAAS)
READING, OHIO

GENERAL COMMENTS

U.S. EPA has reviewed Rohm and Haas' April 3, 2006 submittal, and some concerns remain regarding the groundwater screening evaluation. These concerns are detailed in the specific comments below. Rohm and Haas should revise the BRA report to incorporate the additional text and tables originally submitted on October 10, 2005, with the modifications discussed below and in Rohm and Haas' December 5, 2005 and April 3, 2006 submittals.

SPECIFIC COMMENTS

Section 6.4 The Potential Future Risk Associated with Migration of Impacted Groundwater to Surface Water, page 4 and 5 of 5

U.S. EPA's November 22, 2005, specific comment 3: In the third paragraph on page 4, Rohm and Haas has provided rationale for why detected concentrations of arsenic in groundwater are not expected to pose a significant risk to identified receptors. Given that this is a baseline risk assessment, potential exposure to arsenic should be evaluated quantitatively to provide a conservative assessment of the potential risks that include potential contribution from background sources and naturally occurring elements. This direction is consistent with U.S. EPA's *Role of Background in the CERCLA Cleanup Program* (OSWER 9285.6-07P) from April 26, 2002. It should be noted that the text in the last paragraph on page 5 does appear to indicate that arsenic will be included in the quantitative evaluation; however, it is not clearly stated. Thus, it is recommended that Rohm and Haas also revise the last paragraph on page 5 to state clearly which compounds will be carried through for quantitative evaluation, and which compounds will not be evaluated quantitatively and for what reasons.

U.S. EPA's December 12, 2005, specific comment 3: Provide any available additional information regarding the possible sources of the arsenic detections in well MW-EPA-1, and discuss the lack of arsenic detections in nearby wells. Also, please discuss the site-wide frequency of detection of arsenic in groundwater, since contaminants with a frequency of detection less than 5% are typically eliminated from further evaluation in human health risk assessments. Finally, if any relevant regional background data can be identified, it would also be useful to include a brief summary of these data.

→ **Additional U.S. EPA specific comment 3:** The maximum arsenic concentration in groundwater presented in the Rohm and Haas' responses exceed human health screening values. The screening criterion that is being used to evaluate arsenic in surface water is the National Recommended Water Quality Criteria (NRWQC), which considers ingestion of water and fish consumption. Given that Mill Creek is not a source of potable water, and arsenic has not been detected in six whole body fish samples collected in Mill Creek, this screening value can be considered conservative for the site. The screening criterion that was used in the approved BRA work plan was the Safe Drinking Water Act Maximum Contaminant Level (MCL). Actual surface water concentrations obtained from the reach of Mill Creek adjacent to the site did not exceed MCL, and those recently modeled concentrations based on concentrations in groundwater at downgradient wells do not exceed MCL. Thus, Rohm and Haas response to quantitatively address human exposure to arsenic in surface water is acceptable.

As presented by Rohm and Haas, conditions in the vicinity of well MW-EPA-1 may limit the mobility of arsenic in groundwater. When these conditions are present, it would be reasonable to expect that arsenic in groundwater would not adversely affect the water quality of Mill Creek. However, it is uncertain to what extent the concurrent action from the French Drain may be contributing to the control of unacceptable releases of arsenic into Mill Creek. Due to this uncertainty, arsenic must be included in the development of clean up goals as one of the compounds that may pose risk in the event that the French Drain fails or is decommissioned. Also, refer to specific comment 5.

Section 6.4 The Potential Future Risk Associated with Migration of Impacted Groundwater to Surface Water
Text to Add to Support the Groundwater to Surface Water Migration Pathway Evaluation for Ecological Receptors
Tables 8.8 and 8.9

U.S. EPA's November 22, 2005, specific comment 4: For this evaluation, Rohm and Haas used the most current maximum detected concentrations in groundwater in all wells in the upper aquifer and in all wells downgradient of the French Drain. The maximum concentration for iron corresponds to well UAW10-80. It is noted that this well is screened in the deepest portion of the upper aquifer which is expected to be extensively below the elevation associated with penetration from Mill Creek. Other selected wells are screened at depths of up to 60 feet, which is still a conservative approach. A possible recommendation would be to use the maximum concentration for iron from shallow wells in the upper aquifer (for depths ranging from 10 to 60 feet). Also, please note that the hydraulic conductivity (K) value used in the evaluation was measured in a shallow well (UAW02-20). Because a K value for the shallow aquifer was used, these assumptions should not be used to determine the groundwater flux from deeper wells, such as UAW10-80.

→ **Additional U.S. EPA specific comment 4:** No further comments. Refer to the additional

U.S. EPA's November 22, 2005, specific comment 5: The calculated "output" for estimated surface water (SW) concentrations assumes that there was no existing concentration in the stream. The concentration in surface water due to groundwater (GW) influx and the pre-existing input SW concentration (if there is any) would look as follows:

$$C_{swOUT} = \left[\frac{C_{gw} \times Q_{gw}}{Q_{gw} + Q_{sw}}\right] + \left[\frac{C_{swIN} \times Q_{sw}}{Q_{gw} + Q_{sw}}\right]$$

and the assumption in the Rohm and Haas' evaluation is that $C_{swIN} = 0$

Obviously, if upstream surface-water concentrations were elevated, the output SW concentration would be higher than the calculation. Therefore, SW conditions need to be considered.

Moreover, additional contributions to the stream could be from the aquifer (within the facility) further upgradient of the selected well location and calculations based on a single well with a maximum concentration would not take these additional contributions into account. For example, well A upstream and upgradient from well B adds 1 µg/L of constituent X to the SW. Then, well B adds 10 µg/L of the same constituent. Although the total flux depends on flow and the degree of attenuation taking place, C_{swOUT} would be greater than the 10 µg/L calculated from the maximum GW concentration. Additional contributions to SW should be discussed.

U.S. EPA's December 12, 2005, specific comment 5: Describe a proposed approach for considering inter-well contributions affecting constituent concentrations through out the aquifer as part of the risk screening.

→ **Additional U.S. EPA specific comment 5:** U.S. EPA has reviewed the proposed equation and "conservative" and "detailed" models to calculate concentrations in surface water due to groundwater influx from the Rohm and Haas facility. U.S. EPA believes that the equation is appropriate, with the exception that the groundwater inflow from the west side of the creek needs to be included in the water budget. Available information from sources such as Geomatrix (2004), USGS (2002), Booz Allen Hamilton (2005) and U.S. EPA (2006) indicate a strong likelihood that the reach of Mill Creek adjacent to the Rohm and Haas facility is a gaining stream. Assuming a saturated thickness of 6 feet for the model appears to be conservative based on information from Geomatrix (2004) and USGS (2002). The appropriateness of the "conservative" and "detailed" models is discussed below.

The proposed "conservative" model relies on the total length of the property boundary adjacent to Mill Creek as flow width and uses the maximum concentration for each compound for all wells and for downgradient wells based on November 2004 data. The

results obtained using this "conservative" model are presented in Tables 1 and 2 (for each table, the results for all wells are presented in the left portion while the right portion contains the results for downgradient wells).

In the proposed "detailed" model, the width of flow is determined by dividing the total length of the property boundary adjacent to Mill Creek into ten sections based on inter-well distances at the downgradient boundary. Each flow width value is associated with one of eleven downgradient wells and the detected concentration for each compound (per November 2004 data) at each respective well. The results obtained by Rohm and Haas using this "detailed" model are presented in Tables 3 and 4.

After water budget corrections, the proposed equation and "detailed" model (based on inter-well flow width and compound concentrations in groundwater at downgradient wells) will be appropriate for evaluation of current risks in the Baseline Risk Assessment.

The evaluation of future risk needs to rely on the estimated surface water concentrations based on compound concentrations from *all wells* as exposure point concentrations for risk evaluation. Therefore, after water budget corrections, it would be appropriate for Rohm and Haas to use the proposed "conservative" model relying on the maximum concentration of each compound in groundwater from all wells (per the left portion of Tables 1 and 2 of the April 3, 2006 submittal) for evaluating future risk under a scenario where the French Drain fails or is decommissioned.

As part of a future remedy proposal, groundwater cleanup goals should be developed for all compounds (except pesticides, PCBs, and PAHs provided that appropriate reference or justification is presented per specific comment 9 below) exceeding criteria based on *all wells* as identified in the left portion of Tables 1 and 2. This will ensure that appropriate monitoring criteria are in place for all compounds that may pose risk in the event that the French Drain fails or is decommissioned. For development of clean up goals, it would be appropriate to rely on mass fluxes for contaminant concentrations from all wells based on site-specific parameters (e.g., accounting for variability on flow width on a contaminant basis).

Additionally, in the April 3, 2006 Response to U.S. EPA Comment #5, Rohm and Haas indicated that the NRWQC for human health are not applicable for Mill Creek. The exposure pathways considered in the development of the NRWQC for human health are ingestion of water and organisms. Of all developed criteria, these are the most appropriate screening values available to evaluate human exposure to surface water given the site conditions. If Rohm and Haas feels these criteria aren't applicable, then it is recommended that Rohm and Haas develop site-specific cleanup levels based on the appropriate site exposure conditions (e.g., recreational use) and use these values as screening levels to evaluate estimated concentrations in surface water using *all wells*.

Moreover, the BRA needs to include a brief explanation of the reason for not considering sediment in the evaluation of potential future human health risk associated with migration of impacted groundwater to surface water. It is noted that, in their December 5, 2005 response to comments, Rohm and Haas outlined a proposed approach for evaluating ecological risks in sediment associated with migration of impacted groundwater. This approach is acceptable, with the exception that future ecological risks and selection of chemicals for cleanup goal development should be determined based on *all wells,* rather than downgradient wells only, for the reasons discussed above.

Please revise the proposed model, equation and calculations in the BRA to account for groundwater inflow from the west side of the creek. Also, revise the BRA to briefly describe the scope of clean up goal development for the Rohm and Haas facility, and to address the above comments regarding sediment evaluation.

U.S. EPA's November 22, 2005, specific comment 6: To estimate surface water concentrations, Rohm and Haas used the values for areas of groundwater discharge presented in the U.S. EPA Environmental Indicator (EI) Determination of Migration of Contaminated Groundwater under Control. Please note that the EI determination relied on the information available at the time. The estimation of areas of groundwater discharge presented in the EI did not consider the information from the proposed, revised Baseline Risk Assessment. Therefore, Rohm and Haas needs to estimate the size of the plumes intercepting Mill Creek based on the proposed comparison of groundwater analytical results and human health and ecological screening values, including the U.S. EPA comments. The plume delineation needs to address volatile organic compounds, semivolatile organic compounds, pesticides and metals. Upon approval of the Rohm and Haas' Baseline Risk Assessment Report, U.S. EPA will update the EI Determination based on the new available information.

→ **Additional U.S. EPA specific comment 6:** Refer to the additional U.S. EPA specific comment 5 regarding the agency's review of the calculated groundwater flux to surface water from Mill Creek.

→ **New additional comment, U.S. EPA specific comment 7, Seep Evaluation:** Additional discussion related to the screening of seep data should be included in Section 7.2.4. Rohm and Haas should note that the groundwater screening evaluation and cleanup goals should adequately protect Mill Creek from groundwater discharge. Those compounds with seep concentration exceedences of screening values (e.g., lead, zinc), but no groundwater concentration exceedences of screening values, should be specifically noted. U.S. EPA has preliminarily evaluated these data, and it appears that no addition of constituents of potential concern (COPCs) is needed based on the seep data.

→ **New additional comment, U.S. EPA specific comment 8, Use of low-flow purging techniques for groundwater sampling**: As part of the facility investigation, Rohm and Haas collected groundwater data based on the approved Facility Investigation (FI) Work Plan. Per the work plan, Rohm and Haas conducted groundwater sampling using the low-flow purging techniques as prescribed by U.S. EPA guidance, unless this method could not be implemented (e.g., due to insufficient yield). The purpose of using low-flow purging techniques is to ensure the sampling and analysis of groundwater samples that are representative of groundwater conditions. In accordance with the work plan, Rohm and Haas sampled wells with insufficient well yield using disposable bailers. The FI Report appropriately documented what wells were sampled with bailers per each groundwater sampling event.

In addition to the information provided in the FI Work Plan and Report, please document how the use of the alternate method for groundwater sampling may have affected reported constituent concentrations and/or nondetected results, as well as the goals of the investigation and risk assessment. Please consider that any data gaps resulting from the use of the alternate method during the facility investigation may be addressed during monitoring as part of a final remedy. Future monitoring must satisfy the following requirements: a) during monitoring, the facility must use low flow sampling for all wells; b) as part of monitoring, the facility must evaluate the results from low flow sampling to determine if they would affect screening results and revise the screening accordingly; and c) if additional COPCs are identified, the facility shall develop groundwater cleanup goals and satisfy any warranted remedial requirements for those additional COPCs, including monitoring.

→ **New additional comment, U.S. EPA specific comment 9, Refinement of COPCs.**
Section 2.1 Site History
Section 3.2 Selection of Chemicals of Potential Concern
Section 7.1.3 Fate and Transport
Section 7.2 Chemical Screening
Section 7.5.3 Preliminary Exposure Assessment Analysis of Uncertainty

After review of the information from the June 30, 2005, Baseline Risk Assessment (BRA) Report and subsequent revisions to the BRA submitted by Rohm and Haas, USEPA has determined that the refinement of COPCs is appropriate if the media-specific conditions below are met. U.S. EPA considers appropriate any other COPC refinement presented in the BRA report that is not addressed in this comment or the comments above.

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1. It would be appropriate to eliminate as COPCs those constituents that exceed screening values in soil from operational and landscaped areas because there is lack of complete exposure pathway. The BRA Report has already adequately supported the lack of complete exposure pathway.

2. It would be appropriate to eliminate pesticides as COPCs for the reasons described above, but not on the grounds that they are not site related. Because pesticides are associated with former agricultural practices at what is now the Rohm and Haas property, they are considered hazardous constituents related to the facility under RCRA corrective action.

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1. May eliminate PCBs as COPCs in sediments provided that a justification that is supported by the distribution of concentrations and screening results is presented (e.g., describe frequency of detection and hazard quotient comparison results).

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Rohm and Haas shall revise the above-cited sections under this specific comment and any other related sections from the BRA report as necessary to ensure that all COPC refinement is appropriately justified based on this comment.

REFERENCES

Geomatrix Consultants Inc., 2004, Revised Facility Investigation Report, prepared for Rohm and Haas Co., Volumes 1 and 2.

Schalk, C, and Schumann, T., 2002, Hydrogeology, ground-water use, and ground-water levels in the Mill Creek valley near Evendale, Ohio: U.S. Geological Survey Water-Resources Investigations Report 02-4167.

Booz Allen Hamilton, 2005, U.S. EPA Contract No. 68-W-02-018, Work Assignment R05802-2, Revised Draft Recommended Approach for Development of Groundwater Cleanup Goals, Rohm and Haas, Reading, Ohio.

United States Environmental Protection Agency, 2006, Elevation data from survey points from Mill Creek in the vicinity of Rohm and Haas Chemicals LLC, and map with survey points.

"Fields, Karen" <Karen.Fields@parsons.com >

05/31/2006 02:39 PM

To

Subject Request for clarification on evaluation of pesticides from BaselineRisk Assessment Report for Rohm and Haas facility

History: This message has been forwarded.

Hi All,

Attached are the suggested excerpts (highlighted in yellow) for inclusion with the revised final BRA for the Cincinnati plant regarding pesticides per USEPA's request below. Should you have any trouble receiving/opening this file, please let me know and I will re-send it or send it in another format. Thanks!

- Karen

<<Pesticide Inserts.doc>>

Capiro.Mirtha@epamail.epa.gov

04/12/2006 02:32 PM To Carl J Coker <CCoker@rohmhaas.com>

cc Nystrom Jennifer <nystrom_jennifer@bah.com>

Subject Request for clarification on evaluation of pesticides from Baseline Risk Assessment Report for Rohm and Haas facility

Carl,

General comment 1 from the USEPA's November 22, 2005, letter and enclosure regarding the draft revised Baseline Risk Assessment (BRA) Report stated that "Pesticides are not considered to be site-related and do not need to be further evaluated" (a copy of the letter and enclosure is attached for your reference). I would like to request further information from Rohm and Haas to corroborate this statement and ensure that the revisions to be included in the BRA report would appropriately address this subject. Below I provide more details on the subject needing clarification.

Among other information, Section 3.0 of the Current Conditions Report documents the following: "The southern part of the property was comprised of the Reisenberg estate. Operations consisted of an active dairy, farm, and milk bottling facility. A 1949 site map (E.A Gast Engineering Co., 1949) and a 1949 aerial photograph (Appendix A) show a house, barns, and outbuildings at the approximate current locations of

Building 40, in the southwestern portion of the Morton facility." The text also cites the subsequent purchase and use of the Facility property as a whole by other entities.

Among other findings, Section 2.4.1 Soil of the draft revised BRA report indicated the following: "Of the twenty pesticides detected, only gamma-BHC, 4-4'-DDE, endosulfan sulfate, endrin and methoxychlor were detected in more than five percent of the samples analyzed. Maximum concentrations of gamma-BHC (1.7 mg/kg), 4-4'-DDE (0.2 mg/kg) , endosulfan sulfate (0.48 mg/kg) , endrin (3.1 mg/kg) and methoxychlor (5.5 mg/kg) were detected in samples between 10.5 and 13.5 feet bgs."

Please provide clarification on the evaluation of pesticides from the draft revised BRA report with respect to the following:

- Explain whether there is presence or absence of a relationship between the pesticides that were detected in soil samples and the former operations related to the Reisenberg estate.
- Provide similar clarification for detection of pesticides in other site media.

You may provide this clarification in the form of a summary or in some other fashion that may facilitate documentation regarding this subject. Also, as a minor comment for need of correction in the BRA report, please note that the maximum concentration for 4-4'-DDE is 2.0 mg/kg at sample location DP56A -9.5 -10.5'.

Please let me know if you have any questions on my request. Thanks.

(See attached file: Comments on risk screening evaluation for GW to Mill Creek media - letter.doc)(See attached file: Comments on risk screening evaluation for GW to Mill Creek Media.doc)

Mirtha Cápiro
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capiro.mirtha@epa.gov Pesticide Inserts.doc

2.1 SITE HISTORY

The Rohm and Haas Facility was constructed in 1949 and commenced chemical manufacture operations in 1950. Prior to 1949, the northern portion of the property was used as a winery or distillery, and reportedly as a smokehouse and fireworks manufacturer. The southern portion of the property was a dairy, farm, and milk bottling facility.

Cincinnati Milling Machine Co., Inc. originally developed the Rohm and Haas Facility for chemical operations associated with the Carlisle Chemical Works, which was acquired in 1948. The operation retained the Carlisle Chemical Works name from 1949 to 1970. The name was changed to Cincinnati Milacron Chemicals, Inc. in 1970 as part of the division of Cincinnati Milling Machine Co., Inc. into separate business entities. It operated under that name until 1980, when Carstab, a subsidiary of Thiokol, Inc. (Thiokol), purchased it. Morton International, Inc. and Thiokol merged in 1982, but separated in 1989, at which time Morton retained the ownership and operation of the facility. In 1999, Rohm and Haas purchased all of Morton's assets, and Morton became a wholly-owned subsidiary of Rohm and Haas.

The following chemical products have been manufactured at the Rohm and Haas Facility since approximately 1950:

- Synthetic waxes, used as lubricants in plastic extrusion processes and defoamers in the paper industry;
- Asphalt additives, specifically anti-stripping agents;
- Antioxidants (this process has been sold to another manufacturer and is anticipated to be terminated at the facility);
- Organophosphates, specifically for epoxy catalysts; and
- Plastic stabilizers, specifically organotin and cyoglycolate organotin stabilizers.

The raw materials used to manufacture these products include metallic tin, methylene chloride, chlorine, ammonia, 2-mercaptyl ethanol, tall oil fatty acid, 2-ethyl hexanol, thioglycolic acid, ethylene diamine, stearic acid, paraffin waxes, ethyl chloride, benzyl chloride, triphenyl phosphene, and others. Chemical intermediates produced on-site include stannic chloride, dimethyl tin dichloride, esters, and glycolates. The Morton facility has never been involved in the manufacture, blending, or compounding of pesticides or herbicides. These compounds, which have been detected at low concentrations at and near the site in subsurface soils, groundwater and sediments of Mill Creek, are likely associated with activities pre-dating chemical manufacture at the site (i.e., dairy farming) or the result of surface water run-off and aerial drift from surrounding commercial and residential applications of these chemicals. This conclusion is based on the following:

- The scattered and low concentrations of these compounds that have been detected at and near the site;

- There are no site records indicating manufacture, storage or spills of such compounds at the facility;

- Historically, pesticides have been used by dairy farmers since the 1940s to control flies on livestock, control noxious weeds in pastures, and for sanitation in the milking parlors (Cornell University, 1991 and American Chemical Society, 1991); and

- The detected pesticides at the site were commonly used for commercial and residential applications to control pests starting in the 1940s (ATSDR, 2002).

For a more detailed discussion of the chemical products used and manufactured at the facility, please refer to the Supplemental RI report (Geomatrix, 2004).

3.2 SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Not all chemicals detected at a site warrant a quantitative evaluation. In many cases, chemicals are detected at such low concentrations as to pose negligible risk, and may be eliminated from further consideration. Chemicals posing negligible risk were identified for each environmental medium by comparing detected concentrations to risk-based screening criteria. The following sections summarize the selection of COPCs for each medium. For the purpose of identifying COPCs, the maximum chemical concentration detected in each media was used as the point of comparison. At the request of USEPA, chemicals exceeding screening criteria were not eliminated as COPCs even if they were thought to be associated with off-site sources or were consistent with chemicals in background soil, however, the impact on the risk assessment from the inclusion of these chemicals is discussed in the risk characterization and/or uncertainty section of this report (i.e., pesticides, herbicides, PAHs and PCBs).

7.1.3 Fate and Transport

The fate and transport of chemicals in the environment are influenced by a variety of physicochemical- and site-specific factors. The chemical constituents detected in samples at the Rohm and Haas Facility include VOCs, SVOCs (primarily PAHs), pesticides/PCBs, and inorganic constituents. Environmental fate and transport processes for chemicals potentially associated with the Rohm and Haas Facility are briefly discussed in the following subsections. It should be noted that PAHs are ubiquitous in Mill Creek and elevated concentrations cannot be directly attributed to the Rohm and Haas facility (USEPA, 2005c). Similarly, based on an analysis of spatial trends in polychlorinated biphenyl (PCB) and pesticide concentrations, these two classes of chemicals cannot be attributed to the Rohm and Haas facility.

7.2 CHEMICAL SCREENING

Chemicals of potential ecological concern (COPECs) were identified by comparing available chemical concentrations detected in various media with ESLs from USEPA Region 5. The levels used in this process are intended only for screening purposes and identification of COPECs. They are not meant to imply any definitive level of risk or to be indicative of risk-based cleanup or remediation goals. No chemicals exceeding screening criteria were eliminated as COPECs even if they are thought to be associated with off-site sources or were consistent with chemicals in background soil (i.e., pesticides, herbicides, PAHs and PCBs). Additionally, chemicals were retained as COPECs if they were detected and no screening value is available for the compound. The impact of chemicals that were non-detect but have detection limits exceeding screening criteria are discussed in Section 7.5.1.

7.5.3 Preliminary Exposure Assessment Analysis of Uncertainty

Factors that can contribute to uncertainty in the exposure assessment include identification and evaluation of exposure pathways, assumptions for scenario development, intake parameters, and the use of the conservative EPC.

The identification of potential exposure pathways and receptors is based on site-specific reasonable current use and future ecological habitat. Site-specific receptors were identified to the extent possible and exposure parameters tailored to these receptors to minimize uncertainty in the defined scenarios and exposure assessments.

Values assumed for exposure parameters (e. g., feeding rates and dietary intake) used in calculations for intakes are based on USEPA (1997), and Ohio EPA (2003) guidance. These assumptions may result in underestimating or overestimating the intakes calculated for specific receptors, depending on the accuracy of the assumptions relative to actual site conditions and uses. The use of the conservative EPC may overestimate risk since the receptor is actually exposed to a broader range of contaminant concentrations rather than the maximum detected concentration.

Exposure and toxicity information are not available for dermal or inhalation exposure for all COPECs; hence, their lack of evaluation may underestimate risk. On-site exposure of COPECs to receptors may occur via dermal and inhalation pathways. Although these exposure routes are expected to be negligible compared to exposure via ingestion routes, intake of contaminants from these additional pathways may occur. Therefore, the overall contaminant exposure may be underestimated.

Another source of exposure estimation uncertainty is that contamination is assumed to remain constant over time. Fate and transport mechanisms, which would result in the degradation and loss of some COPECs from the environment, may not be considered in the exposure evaluation for ecological receptors. In addition, the risk calculations are

based on the EPC, which is reflective of the reasonable maximum exposure at a single point. Exposure would occur throughout the site at various levels, including the EPC. Thus, actual risks may be lower than those presented in the assessment.

Additionally, the site is located in a fairly industrialized area along the Mill Creek. Elevated concentrations of some of the COPECs may in part be due to these regional conditions, both naturally and as a result of surrounding industry practices. In order to not underestimate the risk due to these "background" conditions, all detected compounds were assumed to be site-related, which may overestimate the risk to receptors that may have developed adaptations for these higher regional concentrations of COPECs. To determine the non-site related contamination, background samples were collected to evaluate chemicals occurring naturally in soil (e.g., metals) or regionally as a result of neighboring industrial activities. A total of ten off-site background locations were sampled and two samples from each location (total of twenty samples) were analyzed as part of the facility investigation program. Five locations (borings B-01 through B-05) were sampled near the baseball fields and Swimming Pool and Recreational Center (south of the site), and five locations (borings B-06 through B010) were sampled near the Former Municipal Water Supply Well Field owned by the City of Reading (north of the site, Cincinnati Drum and Pristine). Although efforts were made to gain access to all of the properties adjacent to the Rohm and Haas facility, access for off-property sampling could only be obtained from the City of Reading property. Two samples were collected from each location at depths of 1.5 to 2 feet bgs and 9 to 11.5 feet bgs. The background samples were analyzed for CLP-TAL plus aniline, isodrin and tin. The background data showed that metals and other naturally occurring chemicals (e.g. calcium) were detected in the majority of samples analyzed. Twenty-six SVOCs (including 2-methylnaphthalene, acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, bis(2-ethylhexyl)phthalate, carbazole, chrysene, dibenz(a,h)anthracene, dibenzofuran, fluoranthene, fluorine, indeno(1,2,3-cd) pyrene, naphthalene, penanthrene, and pyrene), pesticides (4,4'-DDE, aldrin, dieldrin, endrin ketone, and isodrin) and PCBs (Aroclor 1254 and Aroclor 1260) were also detected in one or more samples from background locations. The presence of SVOCs, pesticides and PCBs in background locations indicate that the detections of these chemicals at the site could be due to surrounding industrial activities or former agricultural practices. Consequently, PAHs, PCBs, and pesticides were not selected as final COPECs, despite screening value exceedances (USEPA, 2005c). Statistical analysis of the background data is provided in Appendix K.

Additionally, estimations of uptake and retention of COPECs using BAFs often do not account for the depuration of COPECs from the organism's system over time. BAFs are also reflective of the most contaminated source of the organisms diet fraction. For example, a terrestrial receptor's invertebrate diet may consist of a variety of insects, yet the invertebrate BAF used was reflective of earthworm bioaccumulation since the earthworm BAFs are generally more conservative than other invertebrate BAFs.

Mirtha Capiro /R5/USEPA/US
04/12/2006 01:32 PM

To Carl J Coker <CCoker@rohmhaas.com>
cc Nystrom Jennifer <nystrom_jennifer@bah.com>
bcc

Subject Request for clarification on evaluation of pesticides from Baseline Risk Assessment Report for Rohm and Haas facility

Carl,

General comment 1 from the USEPA's November 22, 2005, letter and enclosure regarding the draft revised Baseline Risk Assessment (BRA) Report stated that "Pesticides are not considered to be site-related and do not need to be further evaluated" (a copy of the letter and enclosure is attached for your reference). I would like to request further information from Rohm and Haas to corroborate this statement and ensure that the revisions to be included in the BRA report would appropriately address this subject. Below I provide more details on the subject needing clarification.

Among other information, Section 3.0 of the Current Conditions Report documents the following: "The southern part of the property was comprised of the Reisenberg estate. Operations consisted of an active dairy, farm, and milk bottling facility. A 1949 site map (E.A Gast Engineering Co., 1949) and a 1949 aerial photograph (Appendix A) show a house, barns, and outbuildings at the approximate current locations of Building 40, in the southwestern portion of the Morton facility." The text also cites the subsequent purchase and use of the Facility property as a whole by other entities.

Among other findings, Section 2.4.1 Soil of the draft revised BRA report indicated the following: "Of the twenty pesticides detected, only gamma-BHC, 4-4'-DDE, endosulfan sulfate, endrin and methoxychlor were detected in more than five percent of the samples analyzed. Maximum concentrations of gamma-BHC (1.7 mg/kg), 4-4'-DDE (0.2 mg/kg) , endosulfan sulfate (0.48 mg/kg) , endrin (3.1 mg/kg) and methoxychlor (5.5 mg/kg) were detected in samples between 10.5 and 13.5 feet bgs."

Please provide clarification on the evaluation of pesticides from the draft revised BRA report with respect to the following:

- Explain whether there is presence or absence of a relationship between the pesticides that were detected in soil samples and the former operations related to the Reisenberg estate.
- Provide similar clarification for detection of pesticides in other site media.

You may provide this clarification in the form of a summary or in some other fashion that may facilitate documentation regarding this subject. Also, as a minor comment for need of correction in the BRA report, please note that the maximum concentration for 4-4'-DDE is 2.0 mg/kg at sample location DP56A -9.5 -10.5'.

Please let me know if you have any questions on my request. Thanks.

Comments on risk screening evaluation for GW to Mill Creek media - letter.doc

Comments on risk screening evaluation for GW to Mill Creek Media.doc

Mirtha Cápiro
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From: "Fields, Karen" <Karen.Fields@parsons.com>
Recipients: Mirtha Capiro/R5/USEPA/US@EPA, Nystrom Jennifer <nystrom_jennifer@bah.com>, Rogovin I
<CCoker@rohmhaas.com>,Ronald J Lantzy <RLantzy@rohmhaas.com>,Mark Hemingway <MH
<Fan.Wangcahill@parsons.com>
Subject: RE: Supplemental responses from Rohm and Haas facility -- Revised BRAReport
Date: 04/03/2006 02:20:46 PM

All,

Per the message below, Parsons is submitting on the behalf of Rohm and Haas the additional information as requested. Since our original submittal on January 9, 2006 did not correspond to USEPA's numbering system on their letter dated November 22, 2006, we are re-submitting the entire response, with the correct numbering system, for clarity. Should you have any trouble receiving/opening this file, please let me know. Thanks!

- Karen

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3 April 2006 GW Flux Submittal.pdf

SUPPLEMENTAL RESPONSES TO USEPA COMMENTS
ROHM AND HAAS
CINCINNATI PLANT

Comment #3 - Section 6.4 - The Potential Future Risk Associated with Migration of Impacted Groundwater to Surface Water, page 4 and 5 of 5

In the third paragraph on page 4, Rohm and Haas has provided rationale for why detected concentrations of arsenic in groundwater are not expected to pose a significant risk to identified receptors. Given that this is a baseline risk assessment, potential exposure to arsenic should be evaluated quantitatively to provide a conservative assessment of the potential risks that include potential contribution from background sources and naturally occurring elements. This direction is consistent with U.S. EPA's *Role of Background in the CERCLA Cleanup Program* (OSWER 9285.6-07P) from April 26, 2002. It should be noted that the text in the last paragraph on page 5 does appear to indicate that arsenic will be included in the quantitative evaluation; however, it is not clearly stated. Thus, it is recommended that Rohm and Haas also revise the last paragraph on page 5 to state clearly which compounds will be carried through for quantitative evaluation, and which compounds will not be evaluated quantitatively and for what reasons.

Original Response: Arsenic contributions from background sources will be evaluated in accordance with the above-cited document. In addition, the last paragraph on page 5 will be revised to clarify which compounds will be quantitatively evaluated.

Additional Comment: Provide any available additional information regarding the possible sources of the arsenic detections in well MW-EPA-1, and discuss the lack of arsenic detections in nearby wells. Also, please discuss the site-wide frequency of detection of arsenic in groundwater, since contaminants with a frequency of detection less than 5% are typically eliminated from further evaluation in human health risk assessments. Finally, if any relevant regional background data can be identified, it would also be useful to include a brief summary of these data.

Supplemental Response: The groundwater analytical results show that arsenic concentrations detected in MW-EPA-1 are much higher than the concentrations detected at other locations. Site-wide arsenic concentrations typically range between 10 to 20 ug/L, which are within the background range of 3 to 20 ug/L for the area based on Ohio EPA Division of Drinking and Ground Waters' studies on the distribution of arsenic in ground water. Ohio EPA collected data from over 2,900 public water systems, combining over 11,700 measurements (http://www.epa.state.oh.us/ddagw/pdu/gw_map_as.html).

The relationship between arsenic, groundwater, and aquifer solids is controlled mainly by the redox condition of the groundwater and its effect on the dissolution of arsenic-bearing iron and manganese hydroxide minerals. Arsenic is strongly adsorbed onto the hydroxide minerals and exists as secondary coatings that cement the aquifer matrix.

Arsenic will be released under reducing condition. If oxidizing conditions prevail in an aquifer, such as in a shallow setting relatively close in time and space to recharge waters, the waters will be less likely to dissolve the arsenic-bearing coatings.

Review of the revised RI report shows that MW-EPA-1 is located very close to the main sewer line that exits the plant. It was reported that the camera survey could not be completed near MW-EPA-1 because of high H_2S concentrations in this area. In addition, field sampling data collected from wells near this main sewer line show reducing conditions and in some cases, field personnel noted a sulfur odor when sampling these wells. H_2S is an indicator of strong reducing conditions. Under reducing condition, arsenic could be released from soil to groundwater as arsenite. Consequently, the arsenic concentrations near the sewer line (specifically, MW-EPA-1 and UAW08-20) are higher than arsenic concentrations in other monitoring wells. As the groundwater becomes aerobic, the soluble arsenite is converted back to insoluble arsenate.

Thus, the elevated concentrations detected inMW-EPA-1 and UAW08-20 appear to be due to a strongly reducing environment, which has resulted in a release of naturally-occurring arsenite into solution. As the groundwater approaches Mill Creek, it is exposed to more aerobic conditions and the arsenite reverts back to arsenate and does not affect the water quality of Mill Creek. Additionally, the reducing conditions appear to be caused by releases from the sewer system. Once the repairs to the sewer system have been completed, it is likely that the aquifer will revert to more aerobic conditions, and the concentration of arsenic in groundwater near MW-EPA-1 and UAW08-20 will decrease.

Comment #5 - The calculated "output" for estimated surface water (SW) concentrations assumes that there was no existing concentration in the stream. The concentration in surface water due to groundwater (GW) influx and the pre-existing input SW concentration (if there is any) would look as follows:

$$C_{swOUT} = \left[\frac{C_{gw} \times Q_{gw}}{Q_{gw} + Q_{sw}}\right] + \left[\frac{C_{swIN} \times Q_{sw}}{Q_{gw} + Q_{sw}}\right]$$

and the assumption in the Rohm and Haas' evaluation is that $C_{swIN} = 0$
Obviously, if upstream surface-water concentrations were elevated, the output SW concentration would be higher than the calculation. Therefore, SW conditions need to be considered.

Moreover, additional contributions to the stream could be from the aquifer (within the facility) further upgradient of the selected well location and calculations based on a single well with a maximum concentration would not take these additional contributions into account. For example, well A upstream and upgradient from well B adds 1 µg/L of constituent X to the SW. Then, well B adds 10 µg/L of the same constituent. Although the total flux depends on flow and the degree of

attenuation taking place, C_{swOUT} would be greater than the 10 µg/L calculated from the maximum GW concentration. Additional contributions to SW should be discussed.

Original Response: There are only two compounds detected in surface water that have also been detected in groundwater (bis(2-ethylhexyl)phthalate and barium). Since the detected concentrations in surface water and the estimated concentrations in surface water for these compounds are well below applicable surface water criteria, adding the measured surface water concentrations to the groundwater concentrations adds little contribution to the overall concentration value. Additionally, since the measured surface water concentrations were collected at a different time than the groundwater samples, it may not be representative of actual stream conditions. However, for completeness, measured surface water concentrations will be added to the estimated groundwater concentrations as indicated.

As far as discussing the contributions from the potential additivity of various concentrations throughout the aquifer, this scenario seems unlikely since the groundwater has been monitored regularly since 2001and the wells closest to Mill Creek and downgradient of the French Drain have not shown increasing trends as might be suggested by the above comment. As long as the wells at the point of compliance (i.e., the wells downgradient of the French Drain and closest to Mill Creek) have concentrations of contaminants that are below the final groundwater cleanup goals, then the surface water and sediments of Mill Creek should be adequately protected regardless of the relative contributions from differently contaminated areas within the aquifer.

Additional Comment: Describe a proposed approach for considering inter-well contributions affecting constituents concentrations through out the aquifer as part of the risk screening.

Supplemental Response: To calculate potential inter-well contributions, the following model and equation was used:

$$C_{swOUT} = \frac{\left(C_1 \times Q_1 + C_2 \times Q_2 + C_3 \times Q_3 + C_4 \times Q_4 + C_5 \times Q_5 + C_{swIN} \times Q_{sw}\right)}{\left(Q_1 + Q_2 + Q_3 + Q_4 + Q_5 + Q_{sw}\right)}$$

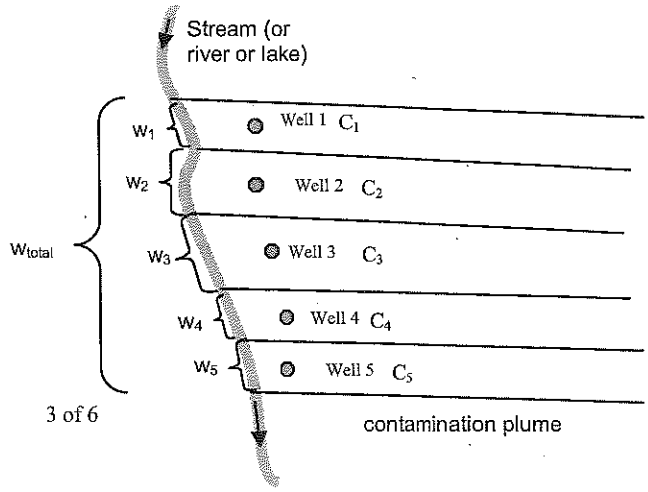
Where:

C_x = concentration (M/L^3)
Q_x = groundwater flux (L^3/T)

And:

$$Q_x = Kiw_x m$$

Where:



Q_x = groundwater flux (L^3/T)
K = hydraulic conductivity (L/T)
i = hydraulic gradient
w_x = width of flow (L)
m = saturated thickness (L)

Due to the total number of detected compounds in groundwater, a conservative screening process was utilized to reduce the number of compounds that need such detailed flux analysis. The conservative screening consisted of calculating the groundwater flux to the stream using the maximum detected concentration of a compound (C_{max}) and the total width of the plume (W_{total}), which was assumed to be equal to the total property boundary adjacent to Mill Creek (1120 feet). Thus, the conservative screening equation is as follows:

$$C_{swOUT} = \frac{(C_{\max} \times Q_x) + (C_{swIN} \times Q_{sw})}{(Q_x + Q_{sw})}$$

Where:

C_{max} = maximum detected concentration of a compound in groundwater (ug/L)
Q_x = groundwater flux (ft^3/day)
C_{swIN} = maximum detected concentration of a compound in surface water (ug/L)
Q_{sw} = 423,360 ft^3/day (based on the $7Q_{10}$ flow for Mill Creek of 4.9 cfs) (OEPA, 2004)

And:

$$Q_x = Kiw_{total}m$$

Where:
Q_x = groundwater flux (13,534 ft^3/day)
K = hydraulic conductivity (106 ft/day as measured in well UAW02-20)
i = hydraulic gradient (0.019 ft/ft, average measured gradient in shallow upper aquifer)
w_{total} = width of flow (1120 ft)
m = saturated thickness (6 ft, conservative estimate across entire aquifer)

The attached tables (Tables 1 and 2) show the results of this conservative screening process for ecological and human health receptors, respectively. Note, that surface water contributions were included for bis(2-ethylhexyl)phthalate, barium, chloroform, cis-1,2-dichloroethene, thallium and trichloroethene since they were detected in both surface water and groundwater samples. In addition, please note that these calculations are based on using a $7Q_{10}$ flow (4.9 cfs) for Mill Creek. Typical flow for Mill Creek is

much higher (monthly streamflow averages for the Mill Creek range from 50-205 cfs for the period of record from 1946 – 2002). Thus, using the $7Q_{10}$ flow predicts a much higher concentration of a contaminant versus using an average streamflow for Mill Creek.

For ecological receptors, thirteen (13) compounds, seven of which are pesticides, have estimated surface water concentrations above applicable surface water standards (the Ohio Mixing Zone Average (OMZA) or the Region 5 Ecological Screening Level if an OMZA was unavailable) (Table 1). However, based on the wells downgradient of the French Drain system (the point of compliance), only six compounds (four of which are pesticides) have estimated surface water concentrations that exceed applicable surface water standards. Since pesticides are not site-related compounds, these compounds were not evaluated further. For the two remaining compounds (chlorobenzene and 1,2-dichlorobenzene), further evaluation using the detailed groundwater flux model was conducted.

For human health, twenty four (24) compounds, twelve of which are pesticides, have estimated surface water concentrations above applicable surface water standards (National Recommended Water Quality Criterion (NRWQC), Maximum Contaminat Levels (MCLs), or Region 9 Tap Water PRGs) (Table 2). However, based on the wells downgradient of the French Drain system (the point of compliance), only twelve compounds (eight of which are pesticides) have estimated surface water concentrations that exceed applicable surface water standards. Since pesticides are not site-related compounds, these compounds were not evaluated further. For the four remaining compounds (bis(2-ethylhexyl)phthalate, arsenic, manganese and thallium), further evaluation using the detailed groundwater flux model was conducted.

For the detailed groundwater flux model, to determine the width of the flow for each compound, the total length of the flow (assumed to be equal to the amount of shoreline adjacent to Mill Creek (1120 feet)), was divided into ten sections based on distances between the shallow wells. Thus, the distances for the flow width and the concentration utilized for each flow width are as follows (and as shown on Figure 1):

W1 = 55 ft (for the measured concentrations in UAW07-20)
W2 = 35 ft (for the measured concentrations in UAW08-20)
W3 = 80 ft (for the measured concentrations in MW-EPA-1)
W4 = 60 ft (for the measured concentrations in UAW05-20)
W5 = 90 ft (for the measured concentrations in UAW06-20)
W6 = 95 ft (for the measured concentrations in UAW03-20)
W7 = 100 ft (for the measured concentrations in UAW04-20)
W8 = 185 ft (for the averaged concentrations of UAW02-20 and UAW02-40)
W9 = 180 ft (for the measured concentrations in UAW25-20)
W10 = 240 ft (for the measured concentrations in UAW01-30)

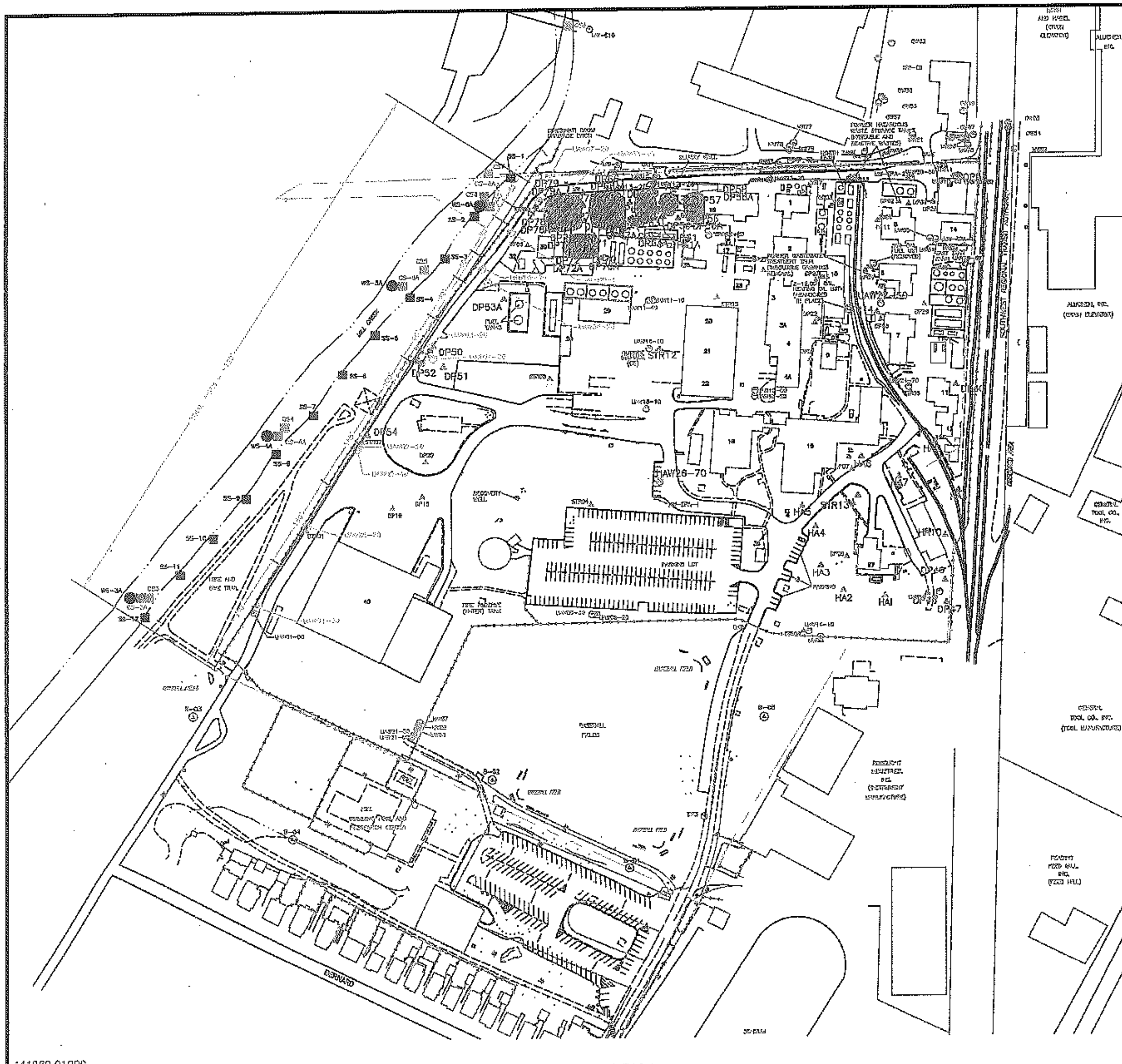
Concentrations were based on results obtained from the November 2004 sampling event. All other parameters (such as hydraulic gradient, hydraulic conductivity and saturated

thickness) were not changed from the screening process. If a compound was not detected in a well or in surface water, half of the detection limit was utilized to estimate the concentration in that well or medium.

For ecological receptors, as shown in Table 3, estimated concentrations in surface water are as follows: chlorobenzene – 8.5 ug/L and 1,2-dichlorobenzene – 8.9 ug/L. These concentrations are below their applicable surface water standards (47 ug/L and 23 ug/L, respectively); therefore, the concentrations detected in site groundwater are not adversely affecting aquatic life in Mill Creek.

For human health, as shown in Table 4, estimated concentrations in surface water are as follows: bis-(2-ethyhexyl)phthalate – 3.3 ug/L, arsenic – 5.7 ug/L, manganese – 30.7 ug/L, and thallium – 5.0 ug/L. The concentration of manganese is below its surface water screening standard of 50 ug/L; however, surface water samples were not analyzed for manganese; therefore, the surface water contribution is not included in the estimated surface water concentration for manganese. Although the estimated concentrations of bis(2-ethylhexyl)phthalate, arsenic and thallium are above the human health surface water screening criteria of 1.2 ug/L, 0.018 ug/L and 0.24 ug/L, respectively, the criteria (NAWQCs) are based on ingestion of water and organisms, which is not applicable for the Mill Creek because the Mill Creek is not a drinking water source nor is it routinely used for fishing. Additionally, a default value of one-half of the detection limit was used to estimate concentrations that were not detected in groundwater or surface water. Due to some relatively high detection limits (particularly for bis(2-ethylhexyl)phthalate), the estimated surface water concentration is likely to be overestimated.

Based on the calculations presented in Tables 1 through 4 and the uncertainty surrounding the applicability of the human health criteria for the Mill Creek, the recommended action levels for the groundwater to surface water pathway are the OMZA (or Region 5 ESLs if OMZA are unavailable) for the protection of aquatic life. Since the estimated concentrations in surface water are below the aquatic life criteria, the concentrations of contaminants detected in groundwater should not adversely affect aquatic life in Mill Creek.



Base Map Source: Abercrombie & Associates, Inc., May 2001
and by GEOMATRIX, 2004

200' 100' 0 200'
Approximate Scale in Feet

LEGEND

B-06 ⊙ BACKGROUND SAMPLE LOCATION
WS-1A ● SURFACE WATER SAMPLE LOCATION
CS-1A ▨ CREEK BED SEDIMENT SAMPLE LOCATION
SS-1 ▩ STREAM STATION (CREEK BANK SEDIMENT/ OR SEEP SAMPLE LOCATION)
UAW01-30 ⊕ MONITORING WELL
— — — MORTON FACILITY PROPERTY BOUNDARY

ROHM AND HAAS CHEMICAL LLC

ROHM AND HAAS
READING, OH

FIGURE 1

PLUME WIDTHS
AND
ASSOCIATED WELLS

PARSONS

441969.01000
\\CINFS01\PROJECTS\441-\441969 R & H Cincinnati BRA & GW Goals\CAD\441969_PLUME WIDTH & ASSOC WELLS.dwg

TABLE 1
CONSERVATIVELY ESTIMATED SURFACE WATER CONCENTRATIONS COMPARED TO OHIO SURFACE WATER CRITERIA AND REGION 5 ESLs
Rohm and Haas Chemicals LLC
Reading, Ohio

	OMZA	Region 5 ESL	MAX Detected - All Wells	Location	Estimated Concentration in Surface Water	Calculated HQ for Estimated Maximum Concentration in Surface Water - All Wells	MAX Detected - Downgradient Wells	Location	Estimated Concentration in Surface Water	Calculated HQ for Estimated Maximum Concentration in Surface Water - Downgradient Wells
Volatile Organic Compounds (ug/l)										
Carbon disulfide	15	15	180	UAW13-20	5.58	0.37	7.1	UAW07-20	0.22	0.015
Chlorobenzene	47	47	2500	MW-EPA-1	77.44	1.65	2500	MW-EPA-1	77.44	1.65
Isopropylbenzene	4.8	-	8.9	UAW07-20	0.28	0.06	8.9	UAW07-20	0.28	0.06
Tetrachloroethene	53	45	75	MW-EPA-2	2.32	0.04	ND	NA	NA	NA
Toluene	62	253	11000	UAW04-20	340.76	5.50	ND	NA	NA	NA
Xylenes (total)	27	27	270	UAW08-20	8.36	0.31	130	MW-EPA-1	4.03	0.15
Semivolatile Organic Compounds (ug/l)										
1,1'-Biphenyl	6.5	-	60	UAW07-20	1.86	0.29	60	UAW07-20	1.86	0.29
1,2-Dichlorobenzene	23	14	1100	MW-EPA-1, UAW12-20	34.08	1.48	1100	MW-EPA-1	34.08	1.48
1,3-Dichlorobenzene	22	38	35	MW-EPA-1, UAW12-20	1.08	0.049	35	MW-EPA-1	1.08	0.049
1,4-Dichlorobenzene	9.4	9.4	250	MW-EPA-1	7.74	0.82	250	MW-EPA-1	7.74	0.82
Aniline	4.1	4.1	5900	UAW08-20	182.77	44.58	28	MW-EPA-1	0.87	0.21
bis(2-ethylhexyl)phthalate	8.4	0.3	29	UAW11-10	2.25	0.27	3.2	UAW02-20	1.46	0.17
Pesticide/PCBs (ug/l)										
4,4'-DDE	-	4.51E-09	0.3	UAW12-20	0.01	2.06E+06	0.052	MW-EPA-1	0.002	3.57E+05
4,4'-DDT	-	1.10E-05	0.036	UAW12-20	0.001	101.38	ND	NA	NA	NA
Aldrin	-	1.70E-02	0.076	MW-EPA-1	0.002	0.138	0.076	MW-EPA-1	0.002	0.138
alpha-Chlordane	-	4.30E-03	0.039	UAW18-20	0.001	0.28	ND	NA	NA	NA
Chlordane	-	4.30E-03	0.37	UAW07-20	0.01	2.67	0.37	UAW07-20	0.01	2.67
Dieldrin	0.056	7.10E-05	0.27	UAW12-20	0.01	0.149	0.24	UAW03-20	0.01	0.133
Endosulfan I	-	5.60E-02	0.094	UAW15-20	0.003	0.052	ND	NA	NA	NA
Endosulfan II	-	5.60E-02	0.27	MW-EPA-1	0.01	0.149	0.27	MW-EPA-1	0.01	0.149
Endrin	0.036	3.60E-02	0.15	UAW04-20	0.005	0.129	0.14	UAW07-20	0.004	0.120
Endrin aldehyde	-	1.50E-01	6.9	UAW15-50	0.21	1.42	0.075	UAW05-20	0.002	0.0155
gamma-BHC	0.057	2.60E-02	0.47	UAW08-20	0.01	0.26	0.04	MW-EPA-1	0.001	0.022
Heptachlor	-	3.80E-03	0.27	UAW12-20	0.01	2.20	0.22	UAW03-20 dup	0.01	1.79
Heptachlor epoxide	-	3.80E-03	0.97	UAW10-50	0.03	7.91	0.37	UAW05-20	0.01	3.02
Toxaphene	-	1.40E-04	1	UAW18-20	0.03	221.27	ND	NA	NA	NA
Inorganic Compounds (ug/l)										
Aluminum	-	80	4240	MW-EPA-3	131.35	1.64	365	MW-EPA-1	11.31	0.14
Arsenic	150	148	215	MW-EPA-1	6.66	0.04	215	MW-EPA-1	6.66	0.04
Barium	220	220	759	UAW18-20	83.40	0.38	228	UAW25-20	66.95	0.30
Cadmium	5.1	0.15	2.7	UAW08-20	0.08	0.02	0.5	UAW03-20	0.02	0.00
Chromium	183	42	172	UAW21-30	5.33	0.03	20.3	UAW01-30	0.63	0.00
Copper	20.4	1.58	19.5	UAW21-30	0.60	0.03	4.8	UAW25-20	0.15	0.01
Iron	-	1000	12500	UAW10-80	387.22	0.39	7380	UAW25-20	228.62	0.23
Manganese	-	120	11800	UAW22-20	365.54	3.05	1670	UAW25-20	51.73	0.43
Nickel	113	28.9	518	UAW21-30	16.05	0.14	181	UAW01-30	5.61	0.05
Selenium	4.6	5	15.1	UAW23-20	0.47	0.10	ND	NA	NA	NA
Tin	180	180	5740	UAW08020	177.81	0.99	1340	MW-EPA-1	41.51	0.23

TABLE 1
CONSERVATIVELY ESTIMATED SURFACE WATER CONCENTRATIONS COMPARED TO OHIO SURFACE WATER CRITERIA AND REGION 5 ESLs
Rohm and Haas Chemicals LLC
Reading, Ohio

The applicable surface water criteria is the OMZA; a Region 5 ESL was used for comparison only if an OMZA was unavailable.
OMZA - Ohio Outside the Mixing Zone Average, from Ohio EPA, July 27, 2005.
ID - Insufficient data to develop a value.
"-" - None established
ND - Not detected
NA - Not applicable
Estimated concentration in surface water calculated according to the following equation: Csw = Cgw x Qgw / (Qgw + Qsw) where:
Cgw - maximum detected concentration in groundwater (ug/L)
Qgw - calculated groundwater flux (ft^3/day) = 13,534 ft^3/day
where: maximum saturated thickness = 6 ft; width of plume = shoreline (1120 ft); hydraulic gradient = 0.019 ft/ft; and hydraulic conductivity = 106 ft/day
Qsw - $7Q_{10}$ flow for Mill Creek (4.9 cfs multiplied by 86,400 seconds/day) (OEPA, 2004)
HQ calculated by dividing the maximum detected concentration by the OMZA concentration. If OMZA concentration not available, then the HQ is calculated by dividing the maximum detected concentration by the Region 5 ESL.
Downgradient wells include UAW03-20, UAW05-20, UAW07-20, MW-EPA-1, UAW01-30, UAW02-20, UAW02-40 and UAW25-20.
Criteria for metals are for the total fraction since the groundwater analytical results are for the total fraction.
All values based on an average hardness of 250 mg/L as measured by the OEPA at two locations near the site in 1992.
BEHP and barium were detected in the surface water of Mill Creek, therefore, the maximum detected concentration was included in the estimated surface water concentration calculations for these compounds.
- Estimated surface water concentration exceeds OMZA
- Estimated surface water concentration exceeds Region 5 ESL (an OMZA is unavailable for these compounds)

TABLE 2
CONSERVATIVELY ESTIMATED SURFACE WATER CONCENTRATIONS COMPARED TO HUMAN HEALTH SURFACE WATER CRITERIA
Rohm and Haas Chemicals LLC
Reading, Ohio

Chemicals	NRWQC	MCL	Region 9 PRGs	MAX Detected - All Wells	Location	Estimated Concentration in Surface Water	Exceeds Criteria?	MAX Detected - Downgradient Wells	Location	Estimated Concentration in Surface Water	Exceeds Criteria?
Volatile Organic Compounds (ug/l)											
1,1,2-Trichloroethane	0.59			2.6	UAW23-20	0.08	No	ND	NA	NA	No
1,2-Dichloroethane	0.38			1200	UAW20-60	37.17	Yes	ND	NA	NA	No
Benzene	2.2			150	UAW08-20	4.65	Yes	49	MW-EPA-1	1.52	No
Carbon tetrachloride	0.23			2.2	UAW15-20	0.07	No	ND	NA	NA	No
Chlorobenzene	130			2500	MW-EPA-1	77.44	No	2500	MW-EPA-1	77.44	No
Chloroethane	-		4.6	6.8	UAW10-50	0.21	No	ND	NA	NA	No
Chloroform	5.7			140	UAW15-20	4.59	No	ND	NA	NA	No
cis-1,2-Dichloroethene	-	70		80	UAW20-60	2.73	No	48	UAW20-40	1.74	No
Methylene chloride	4.6			280	UAW04-20	8.67	Yes	85	MW-EPA-1	2.63	No
Tetrachloroethene	0.69			75	MW-EPA-2	2.32	Yes	ND	NA	NA	No
Toluene	1300			11000	UAW04-20	340.76	No	ND	NA	NA	No
Trichloroethene	2.5			5.1	UAW23-20	0.48	No	ND	NA	NA	No
Vinyl chloride	0.025			4	UAW22-20	0.12	Yes	0.78	UAW02-40	0.02	No
Semivolatile Organic Compounds (ug/l)											
1,2-Dichlorobenzene	420			1100	MW-EPA-1	34.08	No	1100	MW-EPA-1	34.08	No
1,4-Dichlorobenzene	63			250	MW-EPA-1	7.74	No	250	MW-EPA-1	7.74	No
2-Methylnaphthalene	-		6.2	8.6	UAW13-20	0.27	No	ND	NA	NA	No
Aniline	-		12	5900	UAW08-20	182.77	Yes	28	MW-EPA-1	0.87	No
bis(2-Ethylhexyl) phthalate	1.2			29	UAW11-10	2.25	Yes	3.2	UAW02-20	1.46	Yes
Pesticide/PCBs (ug/l)											
4,4'-DDD	0.00031			0.14	UAW07-20	0.0043	Yes	0.14	UAW07-20	0.004	Yes
4,4'-DDE	0.00022			0.3	UAW12-20	0.01	Yes	0.052	MW-EPA-1	0.002	Yes
4,4'-DDT	0.00022			0.036	UAW12-20	0.001	Yes	ND	NA	NA	No
Aldrin	0.000049			0.076	MW-EPA-1	0.002	Yes	0.076	MW-EPA-1	0.002	Yes
alpha-BHC	0.0026			0.025	UAW20-60	0.001	No	0.021	UAW25-20	0.001	No
alpha-Chlordane	0.0008			0.039	UAW18-20	0.001	Yes	ND	NA	NA	No
beta-BHC	0.0091			0.39	UAW12-20	0.012	Yes	0.22	UAW03-20 (Dup)	0.007	Yes
delta-BHC	-		0.011	1	UAW23-20	0.031	Yes	0.031	MW-EPA-1	0.001	No
Dieldrin	0.000052			0.27	UAW12-20	0.008	Yes	0.26	UAW03-20 (Dup)	0.008	Yes
Endrin	0.059			0.15	UAW04-20	0.005	No	0.14	UAW07-20	0.004	No
Endrin aldehyde	0.29			6.9	UAW15-50	0.214	No	0.075	UAW05-20	0.002	No
gamma-Chlordane	0.0008			0.37	UAW07-20	0.011	Yes	0.37	UAW07-20	0.011	Yes
Heptachlor	0.000079			0.27	UAW12-20	0.008	Yes	0.22	UAW03-20 (Dup)	0.007	Yes
Heptachlor epoxide	0.000039			0.97	UAW10-50	0.030	Yes	0.37	UAW05-20	0.011	Yes
Toxaphene	0.00028			1	UAW18-20	0.031	Yes	ND	NA	NA	No
Inorganic Compounds (ug/l)											
Aluminum	-	50		4240	MW-EPA-3	131.346	Yes	365	MW-EPA-3	11.307	No
Antimony	5.6			8.7	UAW15-50	0.270	No	ND	NA	NA	No
Arsenic	0.018			215	MW-EPA-1	6.660	Yes	215	MW-EPA-1	6.66	Yes
Chromium	-	100		172	UAW21-30	5.328	No	20.3	UAW01-30	0.629	No
Iron	300			12500	UAW10-80	387.222	Yes	7380	UAW25-20	228.616	No
Manganese	-	50		11800	UAW22-20	365.538	Yes	1670	UAW25-20	51.733	Yes
Thallium	0.24			12.2	UAW06-20	6.97	Yes	8	UAW03-20	6.84	Yes

TABLE 2
CONSERVATIVELY ESTIMATED SURFACE WATER CONCENTRATIONS COMPARED TO HUMAN HEALTH SURFACE WATER CRITERIA
Rohm and Haas Chemicals LLC
Reading, Ohio

NRWQC - National Recommended Water Quality Criterion
MCL - Maximum Contaminant Level
PRGs - Preliminary Remediation Goals
"-" - None established
ND - Not detected
NA - Not applicable
Estimated concentration in surface water calculated according to the following equation: Csw = Cgw x Qgw / (Qgw + Qsw) where:
Cgw - maximum detected concentration in groundwater (ug/L)
Qgw - calculated groundwater flux (ft^3/day)
Qgw = 3,222 ft^3/day for VOCs (from Form CA750 Environmental Indicators Report, USEPA, 2002)
Qgw = 403 ft^3/day for SVOCs and pesticides (from Form CA750 Environmental Indicators Report, USEPA, 2002)
Qgw = 12,890 ft^3/day for metals (from Form CA750 Environmental Indicators Report, USEPA, 2002)
Qsw = 423,360 ft^3/day ($7Q_{10}$ flow for Mill Creek (4.9 cfs) multiplied by 86,400 seconds/day) (OEPA, 2004a)
Screening hierarchy was as follows: NRWQC was the preferred value; if no NRWQC then the MCL was used; if no NRWQC or MCL, then PRG was used.
Downgradient wells include UAW03-20, UAW05-20, UAW07-20, MW-EPA-1, UAW01-30, UAW02-20, UAW02-40 and UAW25-20.
Criteria for metals are for the total fraction since the groundwater analytical results are for the total fraction.
BEHP, chloroform, cis-1,2-dichloroethene, thallium and trichloroethene were detected in the surface water of Mill Creek,
therefore, the maximum detected concentration was included in the estimated surface water concentration calculations for these compounds.
- Estimated surface water concentration exceeds NRWQC, MCL or PRG.

TABLE 3

ESTIMATED SURFACE WATER CONCENTRATIONS USING SITE-SPECIFIC PLUME WIDTHS AND 2004 SAMPLING DATA AS COMPARED TO AQUATIC LIFE SURFACE WATER CRITERIA

Rohm and Haas Chemicals LLC

Reading, Ohio

	Concentrations in Groundwater Wells (ug/L) (November 2004)											Surface Water Concentration (ug/L) (March 2004)	Estimated Total Concentration in Surface Water (ug/L)	OMZA Surface Water Standard (ug/L)
	UAW07-20	UAW08-20	MW-EPA-1	UAW05-20	UAW06-20	UAW03-20	UAW04-20	UAW02-20	UAW02-40	UAW25-20	UAW01-30			
Compounds														
Chlorobenzene	190	62	2500	560	83	110	165 *	10	0.85 *	7.9	0.23	0.50 *	8.5	47
1,2-Dichlorobenzene	100	380	1100	90	52	220	3.8	10	5 *	6.4	5 *	5 *	8.9	23

OMZA - Ohio Outside the Mixing Zone Average, from Ohio EPA, July 27, 2005.

NA - Not analyzed

* - Compound was not detected; concentration shown is 1/2 of the detection limit.

Estimated concentration in surface water calculated according to the following equation:

Csw = (Cgw-1 x Qgw-1)+(Cgw-2 x Qgw-2)+(Cgw-3 x Qgw-3)+...(Cgw-x x Qgw-x)+(Csw-max x Qsw) / (Qgw-total + Qsw)

where:

Cgw-x - maximum detected concentration in well x (ug/L)

Qgw-x - calculated groundwater flux (ft^3/day) for each plume width

where: maximum saturated thickness = 6 ft; hydraulic gradient = 0.019 ft/ft; and hydraulic conductivity = 106 ft/day

Qsw - $7Q_{10}$ flow for Mill Creek (4.9 cfs multiplied by 86,400 seconds/day) (OEPA, 2004)

Plume widths (ft) for each well are as follows:

UAW07-20	=	55
UAW08-20	=	35
MW-EPA-1	=	80
UAW05-20	=	60
UAW06-20	=	90
UAW03-20	=	95
UAW04-20	=	100
UAW02-20	=	185
UAW02-40	=	185
UAW25-20	=	180
UAW01-30	=	240

(Concentrations in wells UAW02-20 and UAW02-40 were averaged due to their proximity)

TABLE 4

ESTIMATED SURFACE WATER CONCENTRATIONS USING SITE-SPECIFIC PLUME WIDTHS AND 2004 SAMPLING DATA AS COMPARED TO HUMAN HEALTH SURFACE WATER CRITERIA

Rohm and Haas Chemicals LLC

Reading, Ohio

	Concentrations in Groundwater Wells (ug/L) (November 2004) (and data qualifier)											Surface Water Concentration (ug/L) (March 2004)	Estimated Total Concentration in Surface Water (ug/L)	Surface Water Standard (ug/L)
	UAW07-20	UAW08-20	MW-EPA-1	UAW05-20	UAW06-20	UAW03-20	UAW04-20	UAW02-20	UAW02-40	UAW25-20	UAW01-30			
Compounds														
bis(2-Ethylhexyl) phthalate	50 *	1000 *	250 *	20 *	20 *	20 *	25 *	3.2 JB	5 *	2.3 JB	5.0 *	1.4 J	3.3	1.2
Arsenic	2.9 B	75.2	215	3.7 B	20.4	3.1 B	10.7	5 *	5 *	14.3	10.1	5 *	5.7	0.018
Manganese	852 J	632 J	338	843 J	1480 J	557 J	1720 J	322	612	1670	777	0 ^	30.7	50
Thallium	4.8 B	8.4 B	6.4 B	5 *	12.2	6.8	6 B	5 *	5 *	5 *	5 *	5 *	5.0	0.24

NA - Not analyzed

* - Compound was not detected; concentration shown is 1/2 of the detection limit.

^ - Compound was not analyzed for; therefore, the surface water contribution could not be added.

Estimated concentration in surface water calculated according to the following equation:

Csw = (Cgw-1 x Qgw-1)+(Cgw-2 x Qgw-2)+(Cgw-3 x Qgw-3)+...(Cgw-x x Qgw-x)+(Csw-max x Qsw) / (Qgw-total + Qsw)

where:

Cgw-x - maximum detected concentration in well x (ug/L)

Qgw-x - calculated groundwater flux (ft^3/day) for each plume width

where: maximum saturated thickness = 6 ft; hydraulic gradient = 0.019 ft/ft; and hydraulic conductivity = 106 ft/day

Qsw - $7Q_{10}$ flow for Mill Creek (4.9 cfs multiplied by 86,400 seconds/day) (OEPA, 2004)

Plume widths (ft) for each well are as follows:

UAW07-20	=	55
UAW08-20	=	35
MW-EPA-1	=	80
UAW05-20	=	60
UAW06-20	=	90
UAW03-20	=	95
UAW04-20	=	100
UAW02-20	=	185
UAW02-40	=	185
UAW25-20	=	180
UAW01-30	=	240

(Concentrations in wells UAW02-20 and UAW02-40 were averaged due to their proximity)

"Fields, Karen"
<Karen.Fields@parsons.com
>

To

Subject RE: Rohm and Haas Cincinnati Plant - GW to SW Screening

12/06/2005 05:54 AM

History: This message has been forwarded.

Hi Everyone,

Attached are our responses to the comments received on the groundwater to surface water evaluation for the Rohm and Haas Cincinnati Plant. These responses are being provided for review and discussion for our teleconference on Wednesday, Dec. 7th. Should anyone have any problems opening this file, please contact me. Thanks!

- Karen

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<<Responses to Comments for GW to Mill Creek Screening - Dec 5-2005.doc>>

Responses to Comments for GW to Mill Creek Screening - Dec 5-2005.doc

RESPONSES TO COMMENTS FROM THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (U.S. EPA) ON ADDITIONAL TEXT TO INCLUDE IN SECTIONS 6.3.1, 6.4, 7.2.4, 7.5.1 AND NEW SECTION 7.7 OF THE BASELINE RISK ASSESSMENT REPORT

ROHM AND HAAS CHEMICALS LLC (ROHM AND HAAS)
READING, OHIO

I. GENERAL COMMENTS

1. Rohm and Haas has not followed recommendations presented in the July 28, 2005 guidance document (*Final Recommended Approach for Development of Groundwater Cleanup Goals*) regarding evaluation of potential future risks to benthic biota due to contaminated groundwater discharge. Rohm and Haas should evaluate not only the groundwater to surface water pathway, but rather the groundwater to Mill Creek pathway, which includes the benthic zone of Mill Creek. As discussed in that document, for the purposes of determining potential future risk and identifying chemicals requiring cleanup goals, it is not sufficient to simply screen measured concentrations in sediments because: 1) current sediment concentrations are not reflective of possible future concentrations in the absence of the French Drain; and 2) to fully protect benthic biota, pore water concentrations that may be present in the interstices of the concrete rubble must be considered. To this end, the guidance document recommends that Rohm and Haas assume pore water concentrations are equivalent to undiluted groundwater concentrations for screening purposes. Consequently, all contaminants of potential ecological concern (COPECs), except pesticides, identified in the third paragraph of Section 7.2.4 (under "All Wells") should be retained for development of cleanup goals for the protection of benthic biota in Mill Creek. Pesticides are not considered to be site-related and do not need to be further evaluated. Additionally, because detected concentrations of acetone, 3-methylphenol, and 4-methylphenol in sediment exceeded screening levels, these chemicals should also be retained as COPECs. Cleanup goals are needed for all these chemicals to ensure that appropriately protective decision criteria are in place to monitor the future effectiveness of the French Drain or any other selected remedy.

<u>Response</u>: *Maximum detected concentrations in groundwater (from all wells) were compared to applicable surface water criteria, as presented on Table 10.4. This comparison was done to fulfill USEPA's requirement that groundwater concentrations be assumed to equal sediment pore water concentrations. From this comparison, 35 chemicals were identified (highlighted on Table 10.4 and listed in Section 7.2.4) as posing a potential risk to aquatic life. However, 14 of these chemicals are pesticides and therefore, are not site-related and do not require further evaluation. For the remaining 21 COPECs, 15 were detected at concentrations exceeding applicable water quality criteria in at least one well downgradient of the French Drain. Thus, groundwater cleanup goals would be equivalent to the applicable surface water quality criteria in these downgradient wells, which would be*

used as the point of compliance. Rohm and Haas will clarify this in Section 7.2.4 of the revised risk assessment.

Also, USEPA states that "...current sediment concentrations are not reflective of possible future concentrations in the absence of the French Drain." This might be true if the releases to groundwater had been recent. In fact, the releases at the site have occurred at least several decades ago and several interim actions have occurred at the site to remove possible remaining source areas. Thus, current sediment concentrations are indeed likely to represent future sediment concentrations, whether or not the French Drain is operational and assuming that no new releases occur.

Regarding the last comment stating that

> *"...because detected concentrations of acetone, 3-methylphenol and 4-methylphenol in sediment exceeded screening levels, these chemicals should be retained as COPECs. Cleanup goals are needed for all these chemicals to ensure that appropriately protective decision criteria are in place to monitor future effectiveness of the French Drain or any other selected remedy."*

Rohm and Haas understands that USEPA would like an evaluation to be conducted to determine whether the detections of these three compounds may be due, at least in part, to input from site groundwater. If so, then groundwater cleanup goals (based on sediment criteria) should be calculated for these compounds.

Both 3-methylphenol and 4-methylphenol are commonly detected compounds in urban environments (both are by-products of combustion from sources such as car exhaust). The site has sampled for 3-methylphenol and 4-methylphenol six times since October 2001 and because of co-elution of 3-methylphenol and 4-methylphenol (where the laboratory cannot distinguish between the two compounds), only detections of 4-methylphenol are reported in the data validation process. When evaluating the data, 4-methylphenol has only been detected 10 times in over 200 samples. Detections have ranged from a high of 330 ug/L (UAW08-20 in November 13, 2001) to a low of 2.4 ug/L (UAW16-10 in October 12, 2001). For the most recent sampling for which data are available (November 2004), 4-methylphenol was detected once at a concentration of 11 ug/L (a duplicate sample had a concentration of 12 ug/L). Given the low and infrequent detections of methylphenols in groundwater, the inability of the laboratory to distinguish between 3-methylphenol and 4-methylphenol, and the presence of methlyphenols in urban environments, it seems unlikely that the low, estimated concentrations of 3-methylphenol and 4-methylphenol (both detected in sediments at estimated concentrations of 0.24 mg/kg at location CS-3A) would be a result of input from site groundwater. Therefore, Rohm and Haas believes that groundwater cleanup goals based on sediment criteria for 3-methylphenol and 4-methylphenol are not necessary.

Acetone is a common laboratory contaminant and the detected concentrations in sediments may be due to analytical error; however, acetone has been used at the Rohm and Haas Cincinnati plant and detections in groundwater have ranged from 1.1 – 45,000 ug/L (detections in sediment range from 0.0029 mg/kg to 0.018 mg/kg, with all detections "J"

flagged). The highest most recent detection in groundwater (in November 2004) was 980 ug/L in well UAW11-10; however, this detection was flagged "JB", meaning that it is an estimated concentration and it was detected in the laboratory analytical blank sample. Nevertheless, assuming that the highest sediment detected concentration of acetone (0.018 mg/kg) is due in part to input of site groundwater, a groundwater cleanup goal for acetone can be calculated based on the Region 5 Ecological Screening Level of 9.9 ug/kg, and koc value of 0.575 L/kg for acetone as follows:

$$\text{Sediment pore water concentration (ug/L)} = \frac{\text{sediment concentration (ug/kg)}}{\text{foc x koc (L/kg)}}$$

where:

foc = fraction of organic carbon in sediments (unitless; site-specific value of 0.0039 measured at location SS-1)
koc = chemical specific organic-carbon partition coefficient (L/kg; equal to 0.575 L/kg for acetone)

Assuming that the sediment pore water concentration is equal to the groundwater concentration, then the applicable cleanup goal would be as follows:

$$\text{Groundwater Cleanup Goal} = \frac{\text{sediment screening value (i.e., Region 5 ESL)}}{\text{foc x koc}}$$

Thus, the sediment-based groundwater cleanup goal for acetone is 4414 ug/L (9.9 ug/kg / (0.0039 x 0.575 L/kg)) and the point of compliance for groundwater would be the wells downgradient of the French Drain. At present, all of the wells across the entire site are meeting this groundwater cleanup goal for acetone.

This evaluation will be added to the text of the revised risk assessment with the conclusion that no further evaluation of the groundwater to sediment pore water pathway is required at this time.

II SPECIFIC COMMENTS

Section 6.4 The Potential Future Risk Associated with Migration of Impacted Groundwater to Surface Water, page 2 of 5

2. Based upon a review of Table 8.8, the maximum detected concentration of gamma-BHC (0.47 PG µg/L) does not exceed its corresponding U.S. EPA's National Recommended Water Quality Criteria (NRWQC) (0.98 µg/L). However, gamma-BHC has been included as a COPC for groundwater in all wells. This discrepancy should be corrected, as appropriate, and the number of COPCs adjusted as necessary.

Response: The discrepancy will be corrected in the revised risk assessment.

Section 6.4 The Potential Future Risk Associated with Migration of Impacted Groundwater to Surface Water, page 4 of 5

3. The second paragraph on page 4 is confusing as written. For example, the first sentence in paragraph two reads, "using this approach to estimate surface water concentrations of COPCs discharging into Mill Creek is very conservative...." It would appear that Rohm and Haas is actually referring to the surface water concentrations of COPCs in Mill Creek. Additionally, the last sentence of paragraph two reads, "using this approach, the following COPCs have calculated [hazard quotients] HQs that exceed surface water criteria...." There are no calculated HQs presented in the information provided by Rohm and Haas. Thus, it appears that Rohm and Haas is actually referring to estimated surface water concentrations, rather than calculated HQs. Finally, it appears that Rohm and Haas has incorrectly referred to Table 8.7, rather than table 8.9, in the last sentence of paragraph two. These discrepancies should be reviewed and corrected, as appropriate.

Response: The noted discrepancies will be reviewed and corrected in the revised risk assessment.

Section 6.4 The Potential Future Risk Associated with Migration of Impacted Groundwater to Surface Water, page 4 and 5 of 5

4. In the third paragraph on page 4, Rohm and Haas has provided rationale for why detected concentrations of arsenic in groundwater are not expected to pose a significant risk to identified receptors. Given that this is a baseline risk assessment, potential exposure to arsenic should be evaluated quantitatively to provide a conservative assessment of the potential risks that include potential contribution from background sources and naturally occurring elements. This direction is consistent with U.S. EPA's *Role of Background in the CERCLA Cleanup Program* (OSWER 9285.6-07P) from April 26, 2002. It should be noted that the text in the last paragraph on page 5 does appear to indicate that arsenic will be included in the quantitative evaluation; however, it is not clearly stated. Thus, it is recommended that Rohm and Haas also revise the last paragraph on page 5 to state clearly which compounds will be carried through for quantitative evaluation, and which compounds will not be evaluated quantitatively and for what reasons.

Response: Arsenic contributions from background sources will be evaluated in accordance with the above-cited document. In addition, the last paragraph on page 5 will be revised to clarify which compounds will be quantitatively evaluated.

Section 6.4 The Potential Future Risk Associated with Migration of Impacted Groundwater to Surface Water
Text to Add to Support the Groundwater to Surface Water Migration Pathway Evaluation for Ecological Receptors
Tables 8.8 and 8.9

5. For this evaluation, Rohm and Haas used the most current maximum detected concentrations in groundwater in all wells in the upper aquifer and in all wells downgradient of the French Drain. The maximum concentration for iron corresponds to well UAW10-80. It is noted that this well is screened in the deepest portion of the upper aquifer which is expected to be extensively below the elevation associated with penetration from Mill Creek. Other selected wells are screened at depths of up to 60 feet, which is still a conservative approach. A possible recommendation would be to use the maximum concentration for iron from shallow wells in the upper aquifer (for depths ranging from 10 to 60 feet). Also, please note that the hydraulic conductivity (K) value used in the evaluation was measured in a shallow well (UAW02-20). Because a K value for the shallow aquifer was used, these assumptions should not be used to determine the groundwater flux from deeper wells, such as UAW10-80.

Response: The maximum detected concentrations were used in this screening level risk assessment to be conservative. Since the highest concentration of iron in the aquifer was at a depth of 80 feet, that was the iron concentration used even though it likely overestimates the risk. Note that the maximum detected lead concentration was also at 80 feet. Similarly, the K value for UAW01-20 was used because it provides a more conservative estimate of the risk (ie., likely overestimates the risk) versus using a K value from a deeper well, such as UAW20-60 (the deepest well for which K values are available) where the K value was measured at 1.7 ft/day.

6. The calculated "output" for estimated surface water (SW) concentrations assumes that there was no existing concentration in the stream. The concentration in surface water due to groundwater (GW) influx and the pre-existing input SW concentration (if there is any) would look as follows:

$$C_{swOUT} = \left[\frac{C_{gw} \times Q_{gw}}{Q_{gw} + Q_{sw}}\right] + \left[\frac{C_{swIN} \times Q_{sw}}{Q_{gw} + Q_{sw}}\right]$$

and the assumption in the Rohm and Haas' evaluation is that $C_{swIN} = 0$

Obviously, if upstream surface-water concentrations were elevated, the output SW concentration would be higher than the calculation. Therefore, SW conditions need to be considered.

Moreover, additional contributions to the stream could be from the aquifer (within the facility) further upgradient of the selected well location and calculations based on a single well with a maximum concentration would not take these additional contributions into account. For example, well A upstream and upgradient from well B adds 1 µg/L of constituent X to the SW. Then, well B adds 10 µg/L of the same constituent. Although the total flux depends on flow and the degree of attenuation taking place, C_{swOUT} would

be greater than the 10 μg/L calculated from the maximum GW concentration. Additional contributions to SW should be discussed.

Response: There are only two compounds detected in surface water that have also been detected in groundwater (bis(2-ethylhexyl)phthalate and barium). Since the detected concentrations in surface water and the estimated concentrations in surface water for these compounds are well below applicable surface water criteria, adding the measured surface water concentrations to the groundwater concentrations adds little contribution to the overall concentration value. Additionally, since the measured surface water concentrations were collected at a different time than the groundwater samples, it may not be representative of actual stream conditions. However, for completeness, measured surface water concentrations will be added to the estimated groundwater concentrations as indicated.

As far as discussing the contributions from the potential additivity of various concentrations throughout the aquifer, this scenario seems unlikely since the groundwater has been monitored regularly since 2001and the wells closest to Mill Creek and downgradient of the French Drain have not shown increasing trends as might be suggested by the above comment. As long as the wells at the point of compliance (i.e., the wells downgradient of the French Drain and closest to Mill Creek) have concentrations of contaminants that are below the final groundwater cleanup goals, then the surface water and sediments of Mill Creek should be adequately protected regardless of the relative contributions from differently contaminated areas within the aquifer.

7. To estimate surface water concentrations, Rohm and Haas used the values for areas of groundwater discharge presented in the U.S. EPA Environmental Indicator (EI) Determination of Migration of Contaminated Groundwater under Control. Please note that the EI determination relied on the information available at the time. The estimation of areas of groundwater discharge presented in the EI did not consider the information from the proposed, revised Baseline Risk Assessment. Therefore, Rohm and Haas needs to estimate the size of the plumes intercepting Mill Creek based on the proposed comparison of groundwater analytical results and human health and ecological screening values, including the U.S. EPA comments. The plume delineation needs to address volatile organic compounds, semivolatile organic compounds, pesticides and metals. Upon approval of the Rohm and Haas' Baseline Risk Assessment Report, U.S. EPA will update the EI Determination based on the new available information.

Response: Rohm and Haas used the same parameters as in the EI report in order to be conservative (i.e., to not underestimate the risk) and we did in fact use different areas for groundwater discharge of VOCs, SVOCs and metals (i.e., an area of 1600 sf was used for VOCs, 200 sf was used for SVOCs and pesticides and 6400 sf was used for metals). The areas were calculated for the EI report using distances between wells of 80 ft for VOCs, 10 ft for SVOCs and pesticides, and 320 ft for metals and assuming an aquifer thickness of 20 ft. These distances are still valid although the actual thickness of the aquifer is probably closer to 6 ft rather than 20 ft as used in these calculations. A hydraulic conductivity of 106 ft/day

(measured in well UAW02-20) was used since it was the highest value recorded from an unconfined aquifer that had 100% penetration of the aquifer by the test well.

Conservative assumptions and parameters were used to determine if there is the potential for groundwater to have an impact on the surface water and sediments of Mill Creek. The screening level evaluation has determined that there is a potential risk and remedial measures should be implemented (i.e., full and expanded operation of the French Drain). For the purposes of this risk assessment, we have assumed that groundwater cleanup goals will be the lowest value of the applicable criteria—either as promulgated by regulations (i.e., OMZA or MCLs), or calculated based on conservative screening values. The points of compliance are the wells downgradient and adjacent to the French Drain. Should Rohm and Haas determine that the French Drain cannot adequately capture groundwater and these conservative groundwater cleanup goals cannot be achieved, then Rohm and Haas will re-consider the groundwater model for the site and determine if additional, site-specific groundwater cleanup goals should be calculated or if other remedial measures may need to be implemented at the site.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

NOV 22 2005

REPLY TO THE ATTENTION OF

DE-9J

VIA ELECTRONIC MAIL AND
CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Carl J. Coker
Rohm and Haas Company
Engineering Division
3100 State Road
Croydon, Pennsylvania 19021

Re: Additional Discussions on Baseline Risk Assessment Report
Rohm and Haas Chemicals LLC (Former Morton International, Inc.)
U.S. EPA ID No. OHD 000 724 138

Dear Mr. Coker:

The United States Environmental Protection Agency (U.S. EPA) has completed review of and prepared comments on the October 10, 2005, submittal from Rohm and Haas Chemicals LLC (Rohm and Haas). The submittal included additional discussions on the Baseline Risk Assessment Report, including additional text to include in Sections 6.3.1, 6.4, 7.5.1 and 7.7 and new section 7.2.4. Section 6.3.1 pertains to distribution of chemicals in media. Sections 6.4, 7.5.1 and 7.7 and new section 7.2.4 address the risk screening evaluation for groundwater to media in Mill Creek. The U.S. EPA comments are enclosed.

Rohm and Haas should revise the risk screening evaluation for groundwater to media in Mill Creek in accordance with the enclosed comments and re-submit to U.S. EPA. Please call me to discuss and agree on a schedule for this required submittal.

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To discuss a schedule or for any questions regarding this letter, please contact me at 312/ 886-7567 or at capiro.mirtha@epa.gov.

Sincerely yours,

Mirtha Capiro
Project Manager/Coordinator
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics Division

cc: Harold O'Connell, OEPA
Thomas C. Nash, C-14J
Mark Hemingway, Geomatrix

COMMENTS FROM THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (U.S. EPA) ON ADDITIONAL TEXT TO INCLUDE IN SECTIONS 6.3.1, 6.4, 7.2.4, 7.5.1 AND NEW SECTION 7.7 OF THE BASELINE RISK ASSESSMENT REPORT

ROHM AND HAAS CHEMICALS LLC (ROHM AND HAAS)
READING, OHIO

I. GENERAL COMMENTS

1. Rohm and Haas has not followed recommendations presented in the July 28, 2005 guidance document (*Final Recommended Approach for Development of Groundwater Cleanup Goals*) regarding evaluation of potential future risks to benthic biota due to contaminated groundwater discharge. Rohm and Haas should evaluate not only the groundwater to surface water pathway, but rather the groundwater to Mill Creek pathway, which includes the benthic zone of Mill Creek. As discussed in that document, for the purposes of determining potential future risk and identifying chemicals requiring cleanup goals, it is not sufficient to simply screen measured concentrations in sediments because: 1) current sediment concentrations are not reflective of possible future concentrations in the absence of the French Drain; and 2) to fully protect benthic biota, pore water concentrations that may be present in the interstices of the concrete rubble must be considered. To this end, the guidance document recommends that Rohm and Haas assume pore water concentrations are equivalent to undiluted groundwater concentrations for screening purposes. Consequently, all contaminants of potential ecological concern (COPECs), except pesticides, identified in the third paragraph of Section 7.2.4 (under "All Wells") should be retained for development of cleanup goals for the protection of benthic biota in Mill Creek. Pesticides are not considered to be site-related and do not need to be further evaluated. Additionally, because detected concentrations of acetone, 3-methylphenol, and 4-methylphenol in sediment exceeded screening levels, these chemicals should also be retained as COPECs. Cleanup goals are needed for all these chemicals to ensure that appropriately protective decision criteria are in place to monitor the future effectiveness of the French Drain or any other selected remedy.

II SPECIFIC COMMENTS

Section 6.4 The Potential Future Risk Associated with Migration of Impacted Groundwater to Surface Water, page 2 of 5

1. Based upon a review of Table 8.8, the maximum detected concentration of gamma-BHC (0.47 PG μg/L) does not exceed its corresponding U.S. EPA's National Recommended Water Quality Criteria (NRWQC) (0.98 μg/L). However, gamma-BHC has been included as a COPC for groundwater in all wells. This discrepancy should be corrected, as appropriate, and the number of COPCs adjusted as necessary.

Section 6.4 The Potential Future Risk Associated with Migration of Impacted Groundwater to Surface Water, page 4 of 5

2. The second paragraph on page 4 is confusing as written. For example, the first sentence in paragraph two reads, "using this approach to estimate surface water concentrations of COPCs discharging into Mill Creek is very conservative...." It would appear that Rohm and Haas is actually referring to the surface water concentrations of COPCs in Mill Creek. Additionally, the last sentence of paragraph two reads, "using this approach, the following COPCs have calculated [hazard quotients] HQs that exceed surface water criteria...." There are no calculated HQs presented in the information provided by Rohm and Haas. Thus, it appears that Rohm and Haas is actually referring to estimated surface water concentrations, rather than calculated HQs. Finally, it appears that Rohm and Haas has incorrectly referred to Table 8.7, rather than table 8.9, in the last sentence of paragraph two. These discrepancies should be reviewed and corrected, as appropriate.

Section 6.4 The Potential Future Risk Associated with Migration of Impacted Groundwater to Surface Water, page 4 and 5 of 5

3. In the third paragraph on page 4, Rohm and Haas has provided rationale for why detected concentrations of arsenic in groundwater are not expected to pose a significant risk to identified receptors. Given that this is a baseline risk assessment, potential exposure to arsenic should be evaluated quantitatively to provide a conservative assessment of the potential risks that include potential contribution from background sources and naturally occurring elements. This direction is consistent with U.S. EPA's *Role of Background in the CERCLA Cleanup Program* (OSWER 9285.6-07P) from April 26, 2002. It should be noted that the text in the last paragraph on page 5 does appear to indicate that arsenic will be included in the quantitative evaluation; however, it is not clearly stated. Thus, it is recommended that Rohm and Haas also revise the last paragraph on page 5 to state clearly which compounds will be carried through for quantitative evaluation, and which compounds will not be evaluated quantitatively and for what reasons.

Section 6.4 The Potential Future Risk Associated with Migration of Impacted Groundwater to Surface Water
Text to Add to Support the Groundwater to Surface Water Migration Pathway Evaluation for Ecological Receptors
Tables 8.8 and 8.9

4. For this evaluation, Rohm and Haas used the most current maximum detected concentrations in groundwater in all wells in the upper aquifer and in all wells downgradient of the French Drain. The maximum concentration for iron corresponds to well UAW10-80. It is noted that this well is screened in the deepest portion of the upper aquifer which is expected to be extensively below the elevation associated with penetration from Mill Creek. Other selected wells are screened at depths of up to 60 feet, which is still a conservative approach. A possible recommendation would be to use the

maximum concentration for iron from shallow wells in the upper aquifer (for depths ranging from 10 to 60 feet). Also, please note that the hydraulic conductivity (K) value used in the evaluation was measured in a shallow well (UAW02-20). Because a K value for the shallow aquifer was used, these assumptions should not be used to determine the groundwater flux from deeper wells, such as UAW10-80.

5. The calculated "output" for estimated surface water (SW) concentrations assumes that there was no existing concentration in the stream. The concentration in surface water due to groundwater (GW) influx and the pre-existing input SW concentration (if there is any) would look as follows:

$$C_{swOUT} = \left[\frac{C_{gw} \times Q_{gw}}{Q_{gw} + Q_{sw}}\right] + \left[\frac{C_{swIN} \times Q_{sw}}{Q_{gw} + Q_{sw}}\right]$$

and the assumption in the Rohm and Haas' evaluation is that $C_{swIN} = 0$
Obviously, if upstream surface-water concentrations were elevated, the output SW concentration would be higher than the calculation. Therefore, SW conditions need to be considered.

Moreover, additional contributions to the stream could be from the aquifer (within the facility) further upgradient of the selected well location and calculations based on a single well with a maximum concentration would not take these additional contributions into account. For example, well A upstream and upgradient from well B adds 1 μg/L of constituent X to the SW. Then, well B adds 10 μg/L of the same constituent. Although the total flux depends on flow and the degree of attenuation taking place, C_{swOUT} would be greater than the 10 μg/L calculated from the maximum GW concentration. Additional contributions to SW should be discussed.

6. To estimate surface water concentrations, Rohm and Haas used the values for areas of groundwater discharge presented in the U.S. EPA Environmental Indicator (EI) Determination of Migration of Contaminated Groundwater under Control. Please note that the EI determination relied on the information available at the time. The estimation of areas of groundwater discharge presented in the EI did not consider the information from the proposed, revised Baseline Risk Assessment. Therefore, Rohm and Haas needs to estimate the size of the plumes intercepting Mill Creek based on the proposed comparison of groundwater analytical results and human health and ecological screening values, including the U.S. EPA comments. The plume delineation needs to address volatile organic compounds, semivolatile organic compounds, pesticides and metals. Upon approval of the Rohm and Haas' Baseline Risk Assessment Report, U.S. EPA will update the EI Determination based on the new available information.

From: Carl J Coker <CCoker@rohmhaas.com>
Recipients: Mirtha Capiro/R5/USEPA/US@EPA
Subject: Re: Sewer system information - Rohm and Haas site
Date: 10/17/2005 12:55:54 PM

Mirtha,

Here is the additional information you requested.

For the South Sewer, the highest structure is Catch Basin (C.B.) 19B at N407.4,
W98.5 Rim El. 576.65, Inv. El. 574.65.
The closest monitoring well to this location is UAW24-70, which is located about
100 feet south west of this location.

For the South Sewer, the lowest structure is Manhole (M.H.) 6C at N6.9, W341.9
Rim Elev. 564.00, Inv. El. 559.04.
The closest monitoring well to this location is UAW14-10, which is located about
90 feet North East of this location. Pristine has a lower aquifer well (MW86)
located about 110 feet north east of this location.

For the West Sewer, the highest structure is C.B. 11A at N496.1, W55.3, Rim El.
557.82, Inv. El. 574.63.
The closest monitoring well to this location is also UAW24-70, which is located
about 15 feet due south east of this location.

For the West Sewer, the lowest structure is M.H. 1W at N855.8, W913.3, Rim EL.
550.46, Inv. El. 536.56.
The closest monitoring well to this location is MW-EPA-1, which is located about
90 feet south east of this location.

The attached figure shows the approximate locations described above. Let me
know if this is the information you need.

(See attached file: SITE MODEL 2-092205-Model.PDF)

Regards,

Carl J. Coker
Remediation Project Manager

Rohm and Haas Company | Engineering Div. | 3100 State Road | Croydon |
PA | 19021
Phone: 215.785.7193 | Fax: 215.785.7077 | Cell: 502.396.7297 |
ccoker@rohmhaas.com

==========

Capiro.Mirtha@epama
il.epa.gov

To

10/11/2005 11:36 AM Carl J Coker <CCoker@rohmhaas.com>

cc

Subject

Sewer system information - Rohm and Haas site

Carl,

Your letter of September 9th with an update on the sewer system upgrade project was very helpful as well as the figures. Based on the information from the letter, I would like to request some further details. Please see below.

We are looking for information that would describe the vertical location and extent of the sewer system in terms of an elevation range. For this, we would need to know the elevation at the lowest and highest

points. It appears that these points would be respectively at the SE and NW areas of the site. If possible, please identify an approximate location from each of these areas and the corresponding elevation. It would be preferable to rely on site features with known coordinates, such as well or sampling locations, to establish the approximate lowest and highest points.

Please call me if you have questions on what we are looking for. Thanks.

Mirtha Cápiro
Environmental Scientist
U.S. Environmental Protection Agency
Region 5
77 W. Jackson Blvd. (DE-9J)
Chicago, IL 60604
312/ 886-7567
fax 312/ 353-4342
capiro.mirtha@epa.gov

SITE MODEL 2-092205-Model.PDF

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF

OCT 14 2005

DE-9J

VIA ELECTRONIC MAIL AND
CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Carl J. Coker
Rohm and Haas Company
Engineering Division
3100 State Road
Croydon, Pennsylvania 19021

Re: Revised Baseline Risk Assessment Report
Rohm and Haas Chemicals LLC
USEPA ID No. OHD 000 724 138

Dear Mr. Coker:

The United States Environmental Protection Agency (USEPA) has completed review of and prepared comments on the responses from Rohm and Haas Chemicals LLC (Rohm and Haas) to the agency's comments on the Revised Baseline Risk Assessment (BRA) Report, dated June 30, 2005. A September 23, 2005, electronic mail from Ms. Karen Fields of Parsons transmitted the Rohm and Haas' responses to the agency. The USEPA comments on the Rohm and Haas' responses are enclosed.

In addition, we received your submittal of a groundwater to surface water screening evaluation following our September 29, 2005, teleconference. The groundwater to surface water screening evaluation is intended to complement the information from the June 30, 2005, Revised BRA Report. Please note that the agency has not completed review of this evaluation.

With exception of the groundwater to surface water screening evaluation which is currently under agency's review, Rohm and Haas shall finalize the BRA Report in accordance with the September 23, 2005, responses and the enclosed USEPA comments.

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Please contact me to discuss a schedule for submission of a final BRA Report in coordination with the agency's review of the groundwater to surface water screening evaluation. To discuss the required schedule or for any questions regarding this letter, please contact me at 312/ 886-7567 or at capiro.mirtha@epa.gov.

Sincerely yours,

Mirtha Capiro
Project Manager/Coordinator
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics Division

cc: Harold O'Connell, OEPA
Thomas C. Nash, C-14J

Enclosure

COMMENTS ON THE SEPTEMBER 23, 2005, RESPONSES TO USEPA'S AUGUST 24, 2005, COMMENTS ON THE JUNE 30, 2005, BASELINE RISK ASSESSMENT

ROHM AND HAAS CHEMICALS LLC
READING, OHIO

I. GENERAL COMMENTS

Rohm and Haas Chemicals LLC (Rohm and Haas) has adequately responded to all General Comments from the August 24, 2005, Comments on the June 30, 2005 Baseline Risk Assessment (BRA). However, as discussed in the September 29, 2005, teleconference between USEPA and Rohm and Haas, additional clarification is requested on several of the Specific Comments as outlined below.

II. SPECIFIC COMMENTS

Specific Comment 3

The initial portion of the proposed statement from Rohm and Haas quoted as "Pristine's groundwater pump and treat system is remediating the upper and lower aquifer groundwater contamination related to the Pristine site, ..." adequately addresses the USEPA's Specific Comment 3. The remainder of the proposed statement portrays the groundwater pump and treat system from the Pristine Superfund site as able to capture all water in the lower aquifer from beneath the Rohm and Haas site. Please note that USEPA has not evaluated that aspect as part of the scope of corrective action for the Rohm and Haas facility.

Specific Comment 6

The response is not adequate. As discussed during the September 29, 2005, teleconference, the rationale provided in the response for eliminating the sediment ingestion exposure pathway is not adequate. It cannot be assumed that all sediment will be washed away before it would be ingested, and despite the predominance of concrete rubble in the stream bed, there are areas where sediment is present. Rohm and Haas should revise the risk calculations for recreational users to include incidental ingestion of sediment in Mill Creek.

Specific Comment 8

The response is adequate, however, it is noted that any additional risk evaluations presented in the Technical Memorandum should ultimately be incorporated in, or appended to, the Final BRA Report. In addition, USEPA is currently reviewing the groundwater to surface water screening evaluation.

Specific Comment 15

The response to this comment does not address concerns related to tin hot spots in soil. Based on discussions during the July 26, 2005, meeting and the September 29, 2005, teleconference between USEPA and Rohm and Haas, it is understood that Rohm and Haas intends to conduct soil removal actions as an interim measure to remediate tin hot spots.

Specific Comment 18

Based on the response to this comment and discussion during the September 29, 2005, teleconference, the approach used to evaluate surface water risk is acceptable. It is also understood that some metals were detected in the dissolved analyses, but were not detected in the total recoverable analyses, because lower detection limits were used in the dissolved analyses. Table C-1 should be footnoted, and discussion should be added to relevant text sections to provide this explanation.

Specific Comment 21

The response is adequate. However, it is noted that the lack of a toxicity reference value for tin in sediments is a significant gap in the ecological risk evaluation. A literature search should be conducted to identify relevant toxicological data, or the screening value listed in the National Oceanic and Atmospheric Administration's *Screening Quick Reference Tables* (http://response.restoration.noaa.gov/book_shelf/122_squirt_cards.pdf) should be used.

Specific Comments 22 and 23

Rohm and Haas has adequately clarified the sources of uptake factors used in Tables 11.1 through 11.6. However, preferred sources of uptake factors have not been used. In most cases, Rohm and Haas has used uptake factors from the Oak Ridge National Laboratory (ORNL) Risk Assessment Information System (RAIS) database, which provides values used to calculate human health risk-based preliminary remediation goals. Recommended uptake factors are central tendency values from the series of documents published by ORNL in 1998. These documents (i.e., Bechtel Jacobs 1998a,b; Sample et al. 1998a,b) are listed in the reference section below. Recently developed USEPA Ecological Soil Screening Levels (Eco-SSLs, URL: www.epa.gov/ecotox/ecossl) also utilize the 1998 ORNL uptake factors as the primary source of uptake factors used in exposure calculations. The Eco-SSL guidance document (USEPA 2003) is also a good source of uptake factors for some chemicals that are not included in the ORNL documents.

Despite these concerns, revisions to the uptake factors used to estimate tissue concentrations for terrestrial plants (Table 11.1), aquatic plants (Table 11.2), benthos (Table 11.3), and fish (Table 11.4) are not necessary. The uptake factors for these receptors that are used in the BRA are similar to recommended values (e.g., values from Bechtel Jacobs 1998a). However, the uptake

factors used to estimate earthworm and vole tissue concentrations (Tables 11.5 and 11.6, respectively) are not acceptable because they are often as much as one to two orders of magnitude less than recommended values. Consequently, the uptake factors used in the BRA may significantly underestimate earthworm and vole tissue concentrations. Rohm and Haas should revise the uptake factors used for earthworms and voles with central tendency uptake factors from the series of ORNL documents listed below. Note that in cases where the 1998 ORNL documents provide regression models that are significant (i.e., the slope differed from zero ($p \leq 0.05$) and the coefficient of determination (r^2) was greater than or equal to 0.2), these models should be used to estimate tissue concentrations. Otherwise, median uptake factors should be used. See also the guidance provided in Attachment 4-1 of USEPA's *Guidance for Developing Ecological Soil Screening Levels* (USEPA 2003).

Finally, it is noted that dry-to-wet weight conversion factors are not needed for all uptake factors. For example, USEPA (1999) guidance presents uptake factors in terms of wet weight tissue concentrations. Rohm and Haas should ensure that the uptake factors used are presented on a dry-weight tissue basis before applying a conversion factor. Uptake factors presented on a wet weight tissue basis require no conversion, even if the factors were derived using dry weight soil or sediment concentrations. All relevant calculations, text, and tables should be revised to address these comments.

Specific Comment 24

Rohm and Haas has adequately revised Table 12 to summarize dietary assumptions and has adequately revised Tables 13.1 through 13.11 to present corrected risk calculations. However, to avoid any future confusion, the column heading in Table 12 should be revised to delete the "g/g-day" units for fraction of soil in diet (S_F), since this parameter is simply a unitless fraction, and not an ingestion rate.

Specific Comment 28

Rohm and Haas has adequately revised the site conceptual model (SCM) in response to this comment. However, in order to finalize the BRA, the SCM should also be revised to reflect recommendations made for Specific Comment 6 regarding incidental ingestion of sediment in Mill Creek.

II. REFERENCES

Bechtel Jacobs Company. 1998a. Empirical Models for the Uptake of Inorganic Chemicals from Soil by Plants. BJC/OR-113. U.S. Department of Energy. (URL: http://www.esd.ornl.gov/programs/ecorisk/biological_uptake.html)

Bechtel Jacobs Company. 1998b. Biota Sediment Accumulation Factors for Invertebrates: Review and Recommendations for the Oak Ridge Reservation. BJC/OR-112. U.S. Department of Energy. (URL: http://www.esd.ornl.gov/programs/ecorisk/biological_uptake.html)

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, G.W. Suter,II, and T.L. Ashwood. 1998a. Development and Validation of Bioaccumulation Models for Earthworms. Oak Ridge National Laboratory, Oak Ridge TN. 93 pp, ES/ER/TM-220. (URL: http://www.esd.ornl.gov/programs/ecorisk/biological_uptake.html)

Sample, B. E., J.J. Beauchamp, R.A. Efroymson, and G.W. Suter,II. 1998b. Development and Validation of Bioaccumulation Models for Small Mammals. ES/ER/TM-219. U.S. Department of Energy. (URL: http://www.esd.ornl.gov/programs/ecorisk/biological_uptake.html)

U.S. Environmental Protection Agency (USEPA). 2003. Guidance for Developing Ecological Soil Screening Levels. OSWER Directive 9285.7-55. Office of Solid Waste and Emergency Response, Washington, D.C. November 2003. (URL: http://www.epa.gov/ecotox/ecossl/SOPs.htm)

U.S. Environmental Protection Agency (USEPA). 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Peer Review Draft. August 1999. U.S. Environmental Protection Agency, USEPA 530-D-99-001A.

From: Fields, Karen [mailto:Karen.Fields@parsons.com]
Sent: Monday, October 10, 2005 3:10 PM
To: Capiro.Mirtha@epamail.epa.gov; Nystrom Jennifer; Rogovin Kathy
Cc: CCoker@rohmhaas.com; Wangcahill, Fan
Subject: RE: Rohm and Haas Cincinnati Plant - GW to SW Screening

Hi All,

Attached is the groundwater to surface water screening evaluation as discussed previously. Tables and text are included in the attachment. Please let me know if you have any questions or trouble opening the file. Thanks!

- Karen

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The following discussions will be added to Section 6.3.1 of the Uncertainty Section in response to Comment #7.

In soil, three VOCs (acrylonitrile, iodomethane, and tetrachloroethene), three SVOCs (dibenz(a,h)anthracene, 2,4-dimethylphenol and indeno(1,2,3-cd)pyrene), and seven pesticides (aldrin, alpha-BHC, beta-BHC, gamma-BHC, chlorobenzilate, dieldrin, and Endosulfan II) were eliminated from the chemicals of potential concern list due to infrequent detection (detected at a frequency of less than 5%). All concentrations for VOCs are estimated with a "J" qualifier, and iodomethane and tetrachloroethene were also detected in the blanks with a "B" qualifier. In addition, the maximum detected concentrations are within one order of magnitude of the screening levels. The infrequent detections of PAHs and pesticides could represent ambient conditions because these compounds are not related to the historical site activities.

In groundwater, two VOCs (1,1,2-trichloroethane and vinyl chloride), one SVOC (2-methylnaphthalene), and four pesticides and PCBs (Aldrin, Aroclor 1242, alpha-BHC, and Isodrin) were eliminated from the chemicals of potential concern list due to infrequent detection. The low detections of 1,1,2-trichloroethane and vinyl chloride may represent an anomaly, especially when considering the lack of a soil source. The infrequent detections of PAHs, pesticides and PCBs could represent ambient conditions because these compounds are not related to the historical site activities.

Therefore, chemicals eliminated due to infrequent detections should not result in significantly underestimating the overall risk.

In addition, the following paragraphs will be added to Section 6.3.1 of the Uncertainty Section.

The maximum detected concentrations in surface water, including seep water, were compared to EPA's National Recommended Water Quality Criteria (NRWQC) for human health consumption of surface water and aquatic organisms (e.g., fish, crayfish) to determine additional COPCs in surface water associated with potential surface water exposure pathways. The comparison results (Tables 8.6 and 8.7) show that beta-BHC, alpha-chlordane, 4,4'-DDE, 4,4'-DDT, Dieldrin, Heptachlor epoxide, aluminum, arsenic, chromium, iron, lead, manganese, and vanadium were identified as additional COPCs in seep water, and bis(2-ethylhexyl)phthalate, and arsenic were additional COPCs in surface water. Dibromochloromethane and thallium were previously identified and included in the risk calculations. The pesticides were not further evaluated because they are not site-related. The detected surface water concentration of 1.4 ug/l for bis(2-ethylhexyl)phthalate is very close to the conservative screening level of 1.2 ug/l. The NRWQC for arsenic of 0.018 ug/l includes consumption of water and organism pathways. Considering the fish ingestion is an insignificant exposure pathway (see Section 4.2.1), the detected arsenic concentration of 3.6 ug/l is below the MCL of 10 ug/l. Excluding metals detected in seep water may result in underestimating the risk; however,

direct human exposure to seeps was considered an incomplete exposure pathway because of the limited physical areal extent of the seeps and low to no visible flow.

Section 6.4 will be added in Section 6: Risk Characterization

6.4 The Potential Future Risk Associated with Migration of Impacted Groundwater to Surface Water

The potential future risk associated with migration of impacted groundwater to surface water was evaluated for the site because groundwater may be discharging into surface water at Mill Creek. The migration of impacted groundwater to surface water is not currently a pathway of concern due to the operation of a French Drain that collects groundwater from the shallow upper aquifer; however, this pathway is a potential concern in the future if the French Drain system is decommissioned or otherwise becomes non-operational. It should be noted that continuous operation of the French Drain is planned and in fact, increasing the operational capacity of the French Drain is currently being evaluated by Rohm and Haas.

A conservative screening approach was used by comparing the most current maximum detected concentrations in groundwater in all wells and in eight wells down-gradient of the French Drain system (MW-EPA-1, UAW01-30, UAW02-20, UAW02-40, UAW03-20, UAW05-20, UAW07-20, and UAW25-20) to EPA's NRWQC for human health consumption of surface water and aquatic organisms (e.g., fish, crayfish) to determine COPCs in groundwater. MCLs were used as the screening levels if NRWQC were unavailable, and Region 9 PRGs for tap water were used if neither NRWQC nor MCL were available. Results of this comparison (Table 8.8) identified the following COPCs in groundwater:

> <u>All Wells</u>: 1,1,2-trichloroethane, 1,2-dichloroethane, benzene, carbon tetrachloride, chlorobenzene, chloroethane, chloroform, cis-1,2-dichloroethene, methylene chloride, tetrachloroethene, toluene, trichloroethene, vinyl chloride, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 2-methylnaphthalene, aniline, bis(2-ethylhexyl)phthalate, 4,4'-DDD, 4,4-DDE, 4,4'-DDT, aldrin, alpha-BHC, alpha-chlordane, beta-BHC, delta-BHC, dieldrin, Endrin, Endrin aldehyde, gamma-BHC, gamma-Chlordane, Heptachlor, Heptachlor epoxide, Toxaphene, aluminum, antimony, arsenic, chromium, iron, manganese, and thallium.
>
> <u>Downgradient Wells:</u> benzene, chlorobenzene, methylene chloride, vinyl chloride, 1,2-dichlorobenzene, 1,4-dichlorobenzene, aniline, bis(2-Ethylhexyl)phthalate, 4,4'-DDD, 4,4'-DDE, aldrin, alpha-BHC, beta-BHC, delta-

BHC, dieldrin, Endrin, gamma-Chlordane, Heptachlor, Heptachlor epoxide, aluminum, arsenic, iron, manganese, and thallium.

These 41 COPCs in groundwater were identified for the groundwater to surface water discharge pathway when comparing the maximum detected concentrations in groundwater to the most conservative surface water screening value (NRWQC, MCL or Region 9 PRGs for tap water). However, the flow of groundwater into Mill Creek is much less than the flow of Mill Creek itself. To better represent the concentration of a COPC in surface water due to groundwater discharge, an estimated surface water concentration was calculated using the following equation:

$$Csw = Cgw \times Qgw / (Qgw + Qsw)$$

Where:

Csw = estimated concentration in surface water (ug/L)
Cgw = maximum detected concentration in groundwater (ug/L)
Qgw = calculated groundwater flux (ft^3/day) (USEPA, 2003c)
Qsw = 423,360 ft^3/day ($7Q_{10}$ flow for Mill Creek) (OEPA, 2004a)

Where:

Qgw = 3,222 ft^3/day for VOCs; 403 ft^3/day for SVOCs and pesticides and 12,890 ft^3/day for metals.

The parameter Qgw is calculated using the following equation:

$$Qgw = K \times i \times A$$

Where:

Qgw = groundwater flux (ft^3/day)
K = hydraulic conductivity (106 ft/day as measured in well UAW02-20)
i = hydraulic gradient (0.019 ft/ft, average measured gradient in shallow upper aquifer)
A = area of groundwater discharge (ft^2) calculated as follows:

A_{VOC} = 80 ft x 20 ft = 1,600 ft^2
A_{SVOC} = 10 ft x 20 ft = 200 ft^2
A_{metals} = 320 ft x 20 ft = 6,400 ft^2

The area of groundwater discharge is based on the maximum saturated thickness of the aquifer and the total distance across well areas associated with the discharge. A 20-foot profile is a conservative measure since that value is expected to exceed the thickness of the shallow sand aquifer in the northwest corner of the site where the discharges are found (typically 1 – 2 feet). Distances across well areas were determined by USEPA on a case-by-case basis taking into consideration the constituent concentrations from adjacent wells (USEPA, 2003c).

Using this approach to estimate surface water concentrations of COPCs discharging into Mill Creek is very conservative since the releases at the site are associated with historical site activities, which may have occurred several decades ago. Given this timeframe, COPCs in groundwater due to these historic releases would have likely already migrated to surface water and, therefore, current detections in surface water also best represent expected future conditions. Nevertheless, using this approach, the following COPCs have calculated HQs that exceed surface water criteria when using the maximum detected groundwater concentration to estimate the surface water concentration (Table 8.7):

> All Wells: 1,2-Dichloroethane, vinyl chloride, 4,4'-DDE, Aldrin, Dieldrin, Heptachlor, Heptachlor epoxide, toxaphene, aluminum, arsenic, iron, manganese, and thallium
>
> Down-gradient Wells: Aldrin, Dieldrin, Heptachlor, Heptachlor epoxide, and arsenic

Four COPCs identified in down-gradient wells are pesticides, which are not site-related. The NRWQC criterion of 0.018 ug/l for arsenic is extremely conservative, which includes all potential exposure pathways (water ingestion, dermal contact and fish ingestion). However, the potential exposure to the elevated arsenic in surface water is limited at the site. The complete surface water exposure pathways that apply to the site are the direct contact exposure pathways for a recreational user. Water ingestion is not complete because Mill Creek is not a drinking water source and is unlikely to be considered a source in the future given the proximity of the area to the Ohio River, which is the main drinking water source for the area. Fish ingestion is an insignificant exposure pathway because contaminated fish tissue is not expected to occur at Mill Creek based on the USEPA evaluation results that no site-related bioaccumulative contaminants were detected at Rohm and Haas facility (USEPA, 2005) and sampling data collected by the OEPA in 1992 where arsenic was not detected in six whole body fish samples collected

from three locations (one upstream and two downstream of the Rohm and Haas site) in the Mill Creek (OEPA, 1994). Therefore, the concentrations of arsenic detected in groundwater in the shallow upper aquifer are not expected to pose a significant risk to the identified receptors.

For the groundwater to surface water migration pathway, estimated surface water concentrations for 1,2-Dichloroethane, vinyl chloride, 4,4'-DDE, Aldrin, Dieldrin, Heptachlor, Heptachlor epoxide, toxaphene, aluminum, arsenic, iron, manganese, and thallium exceed current surface water criteria for all wells. Since pesticides are not site-related compounds, 4,4'-DDE, Aldrin, Dieldrin, Heptachlor, Heptachlor epoxide, and toxaphene will not be further evaluated (USEPA, 2005c).

Text to Add to Support the Groundwater to Surface Water Migration Pathway Evaluation for Ecological Receptors:

New Section to be added:

7.2.4 Groundwater to Surface Water

An additional pathway that was evaluated is the potential for groundwater to discharge to surface water. Although not currently a pathway of concern due to the operation of a French Drain that collects groundwater from the shallow upper aquifer, this pathway is a potential concern in the future should the French Drain system be decommissioned or otherwise become non-operational. It should be noted that continuous operation of the French Drain is planned and in fact, increasing the operational capacity of the French Drain is currently being evaluated by Rohm and Haas.

Nevertheless, to evaluate this potential pathway, the most current maximum detected concentrations in groundwater in all wells and in eight wells downgradient of the French Drain system (MW-EPA-1, UAW01-30, UAW02-20, UAW02-40, UAW03-20, UAW05-20, UAW07-20, and UAW25-20) were compared to Ohio surface water criteria for Outside the Mixing Zone Average (OMZA) concentrations (or Region 5 ESLs if OMZA were unavailable) as shown on Table 10.4 to determine COPECs in groundwater. Results of this comparison identified the following COPECs in groundwater:

> All Wells: carbon disulfide, chlorobenzene, isopropylbenzene, tetrachloroethene, toluene, xylenes, 1,1'-biphenyl, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, aniline, bis(2-ethylhexyl)phthalate, 4,4'-DDE, 4,4'-DDT, aldrin, alpha-chlordane, chlordane, dieldrin, Endosulfan I, Endosulfan II, Endrin, Endrin aldehyde, gamma-BHC, Heptachlor, Heptachlor epoxide, Toxaphene, aluminum, arsenic, barium, chromium, iron, manganese, nickel, selenium, and tin.
>
> Downgradient Wells: chlorobenzene, isopropylbenzene, xylenes, 1,1'-biphenyl, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, aniline, 4,4'-DDE, aldrin, chlordane, dieldrin, Endosulfan II, Endrin, Heptachlor, Heptachlor epoxide, aluminum, arsenic, barium, iron, manganese, nickel, and tin.

Insert the following after the Second Paragraph of Section 7.5.1 of the Uncertainty Section:

35 COPECs in groundwater were identified for the groundwater to surface water discharge pathway (Table 10.4) when comparing the maximum detected concentrations in groundwater to surface water screening values (OMZA or Region 5 ESL if an OMZA

is unavailable). However, the flow of groundwater into Mill Creek is much less than the flow of Mill Creek itself. To better represent the concentration of a COPEC in surface water due to groundwater discharge, an estimated surface water concentration was calculated using the following equation and conservative assumptions:

$$Csw = Cgw \times Qgw / (Qgw + Qsw)$$

Where:

Csw = estimated concentration in surface water (ug/L)
Cgw = maximum detected concentration in groundwater (ug/L)
Qgw = calculated groundwater flux (ft^3/day) (USEPA, 2002)
Qsw = 423,360 ft^3/day ($7Q_{10}$ flow for Mill Creek) (OEPA, 2004a)

Where:

Qgw = 3,222 ft^3/day for VOCs; 403 ft^3/day for SVOCs and pesticides and 12,890 ft^3/day for metals

The parameter Qgw is calculated using the following equation:

$$Qgw = K \times i \times A$$

Where:

Qgw = groundwater flux (ft^3/day)
K = hydraulic conductivity (106 ft/day as measured in well UAW02-20)
i = hydraulic gradient (0.019 ft/ft, average measured gradient in shallow upper aquifer)
A = area of groundwater discharge (ft^2) calculated as follows:
A_{VOC} = 80 ft x 20 ft = 1,600 ft^2
A_{SVOC} = 10 ft x 20 ft = 200 ft^2
A_{metals} = 320 ft x 20 ft = 6,400 ft^2

The area of groundwater discharge is based on the maximum saturated thickness of the aquifer and the total distance across well areas associated with the discharge. A 20-foot profile is a conservative measure since that value is expected to exceed the thickness of the shallow sand aquifer in the northwest corner of the site where the discharges are found (typically 1 – 2 feet). Distances across well areas were determined by USEPA on a case-by-case basis taking into consideration the constituent concentrations from adjacent wells (USEPA, 2003c).

Using this approach to estimate surface water concentrations of COPECs discharging into Mill Creek is very conservative since the releases at the site are associated with historical site activities, which may have occurred several decades ago. Given this timeframe, COPCs in groundwater due to these historic releases would have likely already migrated to surface water and, therefore, current detections in surface water also best represent expected future conditions. Nevertheless, using this approach, the following COPECs have calculated HQs greater than one when using the estimated surface water concentrations compared to applicable surface water criteria (Table 16):

> All Wells: toluene, aniline, 4,4'-DDE, 4,4'-DDT, toxaphene, aluminum, and manganese
>
> Downgradient Wells: 4,4'-DDE

As an additional evaluation of the groundwater – surface water interface, USEPA also requested that Mill Creek sediment and surface water sampling results and seep sampling results be compared to alternative screening criteria. For the creek bed sediments, results were compared to Region 5 ESLs and to Ohio Sediment Reference Values (SRVs). Concentrations in the sediment must exceed both screening values to be retained as a COPEC in the Mill Creek sediments. Concentrations must exceed both values since in cases where the maximum concentration exceeds the ESL, but not the SRV, concentrations of the chemical are consistent with regional background levels and benthic organisms are likely to be adapted to local concentrations. Conversely, in cases where the SRV is exceeded but the ESL is not, the chemical may be present at elevated concentrations, but these concentrations are unlikely to be sufficiently high to cause toxicity to benthic organisms (USEPA, 2005). As presented on Table 17, the following COPECs were identified in the sediments of Mill Creek as a result of this comparison:

> Acetone, 2-methylnaphthalene, 3-methylphenol, 4-methylphenol, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, dibenz(ah)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(123-cd)pyrene, naphthalene, phenanthrene, pyrene, 4,4'-DDT, beta-BHC, dieldrin, Aroclor-1248 and Aroclor-1254.

For the seep, maximum detected concentrations were compared to Ohio OMZA surface criteria or Region 5 ESLs if OMZA were unavailable. As a result of this comparison (Table 18), the following COPECs were identified in the two seep samples:

4,4'-DDE, 4,4'-DDT, alpha-Chlordane, Heptachlor epoxide, aluminum, barium, cobalt, copper, iron, lead, manganese, nickel, tin, vanadium and zinc.

The exceedances of screening criteria for the above compounds in the sediments and the seeps are not thought to be significant since most of these COPECs are PAHs, pesticides or PCBs and, therefore, are probably representative of ambient conditions in an urbanized area, and since these compounds are not associated with historical site activities. In addition, the metal detections in the seep are not significant since the seeps have very limited flow and no standing water and, therefore, cannot support aquatic life for which the surface water criteria are designed to protect.

Comparison of surface water data from the Mill Creek was discussed previously in Section 7.4.3 and no COPECs were identified in the surface waters of Mill Creek as shown on Table 15.4.

Additional Paragraph to be added at end of Section 7.7:

For the groundwater to surface water migration pathway, estimated surface water concentrations for toluene, aniline, 4,4'-DDE, 4,4'-DDT, toxaphene, aluminum and manganese exceed current surface water criteria and may pose a future risk to ecological receptors within Mill Creek. Since pesticides are not site-related compounds, 4,4'-DDE, 4,4'-DDT and toxaphene will not be evaluated further in the risk assessment (USEPA, 2005c).

TABLE 8.6

Comparison of Seep Water Analytical Results and Human Health Surface Water Screening Values

Rohm and Haas Chemicals LLC

Reading, Ohio

Chemicals	NRWQC	MCL	Region 9 PRGs	Maximum Concentrations	Locations	Exceedance
Volatile Organic Compounds						
Acetone			5500	3.1	SS-5	No
Benzene	2.2			1.1	SS-1	No
Carbon disulfide			1000	1.1	SS-5	No
Chlorobenzene	130			24	SS-5	No
1,1-Dichloroethane			810	1	SS-1	No
Ethylbenzene	530			0.39	SS-1	No
Methylcyclohexane			5200	0.49	SS-1	No
Toluene	1300			0.55	SS-5	No
Xylenes (total)		10000		1.7	SS-1	No
Semi-Volatile Organic Compounds						
1,2-Dichlorobenzene	420			21	SS-1	No
1,4-Dichlorobenzene	63			2.6	SS-1	No
Pesticides						
beta-BHC	0.0091			0.056	SS-5	Yes
alpha-Chlordane	0.0008			0.02	SS-5	Yes
4,4'-DDE	0.00022			0.025	SS-5	Yes
4,4'-DDT	0.00022			0.028	SS-1	Yes
Dieldrin	0.00052			0.053	SS-1	Yes
Endosulfan I	62			0.03	SS-5	No
Endosulfan II	62			0.046	SS-1	No
Heptachlor epoxide	0.000039			0.033	SS-1	Yes
Isodrin				0.005	SS-1	Screening Level not available
Inorganics						
Aluminum		50-200		48300	SS-1	Yes
Arsenic	0.018			25.7	SS-1	Yes
Barium	1000			494	SS-1	No
Beryllium	4			3.1	SS-1	No
Cadmium	5			1.7	SS-1	No
Calcium				430000	SS-1	No, essential nutrient
Chromium		100		174	SS-1	Yes
Cobalt			730	43.8	SS-1	No
Copper	1300			104	SS-1	No
Iron	300			90100	SS-1	Yes
Lead		15		126	SS-1	Yes
Magnesium				90100	SS-1	No, essential nutrient
Manganese		50		2730	SS-5	Yes
Mercury		2		0.18	SS-5	No
Nickel	610			214	SS-1	No
Potassium				14200	SS-1	No, essential nutrient
Sodium				375000	SS-5	No, essential nutrient
Tin			22000	1340	SS-5	No
Vanadium			36	124	SS-1	Yes
Zinc	7400			411	SS-1	No

Unit: ug/l

- Maximum concentration exceeds the screening level.
- Other screening levels applied. Chemical was detected in boundary well exceeding the screening level.

NRWQC - National Recommended Water Quality Criterion

MCL - Maximum Contaminant Level

PRGs - Preliminary Remediation Goals

Screening hierarchy was as follows: NRWQC was the preferred value; if no NRWQC then the MCL was used; if no NRWQC or MCL, then PRG was used.

TABLE 8.7

Comparison of Surface Water Analytical Results and Human Health Surface Water Screening Values

Rohm and Haas Chemicals LLC

Reading, Ohio

Chemicals	NRWQC	MCL	Region 9 PRGs	Maximum Concentrations	Locations
Volatile Organic Compounds					
Acetone			5500	6.3	WS-1A
Chloroform	5.7			0.26	WS-6A+DUP
cis-1,2-Dichloroethene		70		0.26	WS-5A
Dibromochloromethane	0.55			0.86	WS-3A
1,1,1-Trichloroethane	200			0.4	WS-6A+DUP
Trichloroethene	2.5			0.33	WS-2A
Semi-Volatile Organic Compounds					
1,4-Dioxane			6.1	1.1	WS-4A
bis(2-Ethylhexyl) phthalate	1.2			1.4	WS-3A
Inorganics					
Arsenic	0.018			3.6	WS-6A (Dup)
Barium	1000			61.8	WS-4A
Beryllium	4			0.78	WS-1A
Cobalt			730	1.2	WS-6A (Dup)
Copper	1300			6.7	WS-1A
Mercury		2		0.094	WS-2A
Thallium	0.24			6.8	WS-6A (Dup)
Zinc	7400			23.1	WS-6A (Dup)

Unit: ug/l

- Maximum concentration exceeds the screening level.

NRWQC - National Recommended Water Quality Criterion

MCL - Maximum Contaminant Level

PRGs - Preliminary Remediation Goals

Screening hierarchy was as follows: NRWQC was the preferred value; if no NRWQC then the MCL was used; if no NRWQC or MCL, then PRG was used.

TABLE 8.8

Comparison of Groundwater Water Analytical Results and Human Health Surface Water Screening Values

Rohm and Haas Chemicals LLC

Reading, Ohio

Chemicals	NRWQC	MCL	Region 9 PRGs	Maximum Concentrations - All Wells	Locations	Exceedance	Maximum Concentrations - Downgradient Wells	Locations	Exceedance
VOCs (ug/l)									
1,1,1-Trichloroethane	200			60	UAW20-60	No	0		No
trifluoroethane (Freon 113)			59000	3.2J	UAQ10-50	No	0		No
1,1,2-Trichloroethane	0.59			2.6	UAW23-20	Yes	0		No
1,1-Dichloroethane			810	42	UAW20-60	No	20	UAW20-40	No
1,1-Dichloroethene	330			19J	UAW20-60	No	3.9	UAW20-40	No
1,2-Dichloroethane	0.38			1200	UAW20-60	Yes	0		No
2-Butanone			7000	29J	UAW08-20	No	0		No
4-Methyl-2-pentanone			2000	66J	UAW08-20	No	0		No
Acetone			5500	980 JB	UAW04-20	No	310 JB	MW-EPA-1	No
Benzene	2.2			150B	UAW08-20	Yes	49 JB	MW-EPA-1	Yes
Bromodichloromethane	0.55			0.26J	UAW09-60	No	0		No
Carbon disulfide			1000	180	UAW13-20	No	7.1	UAW5-20	No
Carbon tetrachloride	0.23			2.2 J	UAW15-20	Yes	0		No
Chlorobenzene	130			2500	MW-EPA-1	Yes	2500	MW-EPA-1	Yes
Chloroethane			4.6	6.8J	UAW10-50	Yes	0		No
Chloroform	5.7			140	UAW15-20	Yes	0		No
cis-1,2-Dichloroethene		70		80	UAW20-60	Yes	48	UAW20-40	No
Cyclohexane			10000	1.2	UAW25-20	No	1.2	UAW25-20	No
Ethylbenzene	530			59	UAW08-20	No	28 J	MW-EPA-1	No
Isopropylbenzene			660	8.9	UAW07-20	No	8.9	UAW07-20	No
Methyl tert-butyl ether			11	0.2J	MW-EPA-3	No	0		No
Methylcyclohexane			5200	17 J	UAW08-20	No	6.2 J	UAW03-20	No
Methylene chloride	4.6			280 JB	UAW04-20	Yes	85 JB	MW-EPA-1	Yes
Tetrachloroethene	0.69			75	MW-EPA-2	Yes	0		No
Toluene	1300			11000	UAW04-20	Yes	0		No
trans-1,2-Dichloroethene	140			2.5	UAW02-40	No	2.5	UAW02-40	No
Trichloroethene	2.5			5.1	UAW23-20	Yes	0		No
Vinyl chloride	0.025			4	UAW22-20	Yes	0.78 J	UAW02-40	Yes
Xylenes (total)		10000		270	UAW08-20	No	130	MW-EPA-1	No
SVOCs (ug/l)									
1,1'-Biphenyl			300	60J	UAW07-20	No	60J	UAW07-20	No
1,2-Dichlorobenzene	420			1100	MW-EPA-1	Yes	1100	MW-EPA-1	Yes
1,3-Dichlorobenzene	320			35 J	MW-EPA-1	No	35 J	MW-EPA-1	No
1,4-Dichlorobenzene	63			250 J	MW-EPA-1	Yes	250 J	MW-EPA-1	Yes
2-Methylnaphthalene*			6.2	8.6 J	UAW13-20	Yes	0		No
2-Methylphenol			1800	15 J	UAW04-20	No	0		No
4-Methylphenol			180	28 J #	UAW04-20	No	0		No
Aniline			12	5900	UAW08-20	Yes	28 J	MW-EPA-1	Yes
Benzaldehyde			3600	1.7 J	UAW05-20	No	1.7 J	UAW05-20	No
bis(2-Ethylhexyl) phthalate	1.2			29 B	UAW11-10	Yes	3.2 J B	UAW02-20	Yes
Caprolactam			18000	5.5 J	UAW06-20	No	0		No
Naphthalene			6.2	0.89 J	UAW22-20	No	0		No
Phenol	21000			160 J	UAW08-20	No	0		No

TABLE 8.8

Comparison of Groundwater Water Analytical Results and Human Health Surface Water Screening Values

Rohm and Haas Chemicals LLC

Reading, Ohio

Chemicals	NRWQC	MCL	Region 9 PRGs	Maximum Concentrations - All Wells	Locations	Exceedance	Maximum Concentrations - Downgradient Wells	Locations	Exceedance
Pesticide and PCBs (ug/l)									
4,4'-DDD	0.00031			0.14 J	UAW07-20	Yes	0.14 J	UAW07-20	Yes
4,4'-DDE	0.00022			0.3 PG	UAW12-20	Yes	0.052 PG	MW-EPA-1	Yes
4,4'-DDT	0.00022			0.036 J	UAW12-20	Yes	0		No
Aldrin	0.000049			0.076 PG	MW-EPA-1	Yes	0.076 PG	MW-EPA-1	Yes
alpha-BHC	0.0026			0.025 J	UAW20-60	Yes	0.021 J	UAW25-20	Yes
alpha-Chlordane	0.0008			0.039J	UAW18-20	Yes	0		No
beta-BHC	0.0091			0.39 PG	UAW12-20	Yes	0.22 PG	AW03-20 (Du	Yes
delta-BHC			0.011	1	UAW23-20	Yes	0.031 J	MW-EPA-1	Yes
Dieldrin	0.000052			0.27 PG	UAW12-20	Yes	0.26 PG	AW03-20 (Du	Yes
Endosulfan I	62			0.094	UAW15-20	No	0		No
Endosulfan II	62			0.27 PG	MW-EPA-1	No	0.27 PG	MW-EPA-1	No
Endosulfan sulfate	62			0.17 PG	UAW12-20	No	0		No
Endrin	0.059			0.15 PG	UAW04-20	Yes	0.14 J	UAW07-20	Yes
Endrin aldehyde	0.29			6.9	UAW15-50	Yes	0.075	UAW05-20	No
Endrin ketone		2		0.032 J	MW-EPA-1	No	0.032 J	MW-EPA-1	No
gamma-BHC (Lindane)	0.98			0.47 PG	UAW08-20	No	0.04 J	MW-EPA-1	No
gamma-Chlordane	0.0008			0.37 J	UAW07-20	Yes	0.37 J	UAW07-20	Yes
Heptachlor	0.000079			0.27 PG	UAW12-20	Yes	0.22 PG	AW03-20 (Du	Yes
Heptachlor epoxide	0.000039			0.97	UAW10-50	Yes	0.37 PG	UAW05-20	Yes
Methoxychlor		40		0.47 J	UAW07-20	No	0.47 J	UAW07-20	No
Toxaphene	0.00028			1J	UAW18-20	Yes	0		No
Metals (ug/l)									
Aluminum		50-200		4240 J	MW-EPA-3	Yes	365J	MW-EPA-3	Yes
Antimony	5.6			8.7 B	UAW15-50	Yes	0		No
Arsenic	0.018			215	MW-EPA-1	Yes	215	MW-EPA-1	Yes
Barium	1000			759	UAW18-20	No	228	UAW25-20	No
Beryllium	4			0.79	UAW13-20	No	0		No
Cadmium	5			2.7 J	UAW08-20	No	0.5BJ	UAW03-20	No
Calcium				1020000	UAW08-20	No	408000	UAW07-20	No
Chromium		100		172	UAW21-30	Yes	20.3	UAW01-30	No
Cobalt			730	11.9	UAW11-40	No	2.7B	UAW01-30	No
Copper	1300			19.5 B	UAW21-30	No	4.8B	UAW25-20	No
Cyanide, Total	140			6.3B	UAW15-20	No	0		No
Iron	300			12500	UAW10-80	Yes	7380	UAW25-20	Yes
Lead		15		5.4	UAW10-80	No	0		No
Magnesium				134000	UAW08-20	No	123000J	MW-EPA-1	No
Manganese		50		11800 J	UAW22-20	Yes	1670	UAW25-20	Yes
Mercury		2		0.082 B	UAW01-30	No	0.082 B	UAW01-30	No
Nickel	610			518	UAW21-30	No	181	UAW01-30	No
Potassium				22400	UAW23-20	No	13300 J	UAW01-30	No
Selenium	170			15.1	UAW23-20	No	0		No
Silver			180	1.1B	UAW10-50	No	0		No
Sodium				1290000	UAW15-20	No	577000	MW-EPA-1	No
Thallium	0.24			12.2	UAW06-20	Yes	8B	UAW03-20	Yes

TABLE 8.8

Comparison of Groundwater Water Analytical Results and Human Health Surface Water Screening Values

Rohm and Haas Chemicals LLC

Reading, Ohio

Chemicals	NRWQC	MCL	Region 9 PRGs	Maximum Concentrations - All Wells	Locations	Exceedance	Maximum Concentrations - Downgradient Wells	Locations	Exceedance
Tin			22000	5740	UAW08-20	No	1340	MW-EPA-1	No
Total Sulfide		250000		160000	UAW13-20	No	22000	UAW07-20	No
Vanadium			36	20.2	UAW06-20	No	7.6	UAW03-20	No
Zinc	7400			54.3	MW-EPA-3	No	0		No

- Maximum concentration exceeds the screening level.
- Other screening levels applied. Chemical was detected in boundary well exceeding the screening level.

NRWQC - National Recommended Water Quality Criterion

MCL - Maximum Contaminant Level

PRGs - Preliminary Remediation Goals

* - Naphthalene screening level is used as a surrogate for 2-methylnaphthalene.

Screening hierarchy was as follows: NRWQC was the preferred value; if no NRWQC then the MCL was used; if no NRWQC or MCL, then PRG was used.

TABLE 8.9

Comparison of Estimated Surface Water Concentrations and Human Health Surface Water Screening Values

Rohm and Haas Chemicals LLC

Reading, Ohio

Chemicals	NRWQC	MCL	Region 9 PRGs	Maximum Concentrations - All Wells	Locations	Estimated Concentration in Surface Water	Exceeds Criteria?	Maximum Concentrations - Downgradient Wells	Locations	Estimated Concentration in Surface Water	Exceeds Criteria?
VOCs											
1,1,2-Trichloroethane	0.59			2.6	UAW23-20	0.02	No	0		0.00	No
1,2-Dichloroethane	0.38			1200	UAW20-60	9.06	Yes	0		0.00	No
Benzene	2.2			150	UAW08-20	1.13	No	49	MW-EPA-1	0.37	No
Carbon tetrachloride	0.23			2.2	UAW15-20	0.02	No	0		0.00	No
Chlorobenzene	130			2500	MW-EPA-1	18.88	No	2500	MW-EPA-1	18.88	No
Chloroethane			4.6	6.8	UAW10-50	0.05	No	0		0.00	No
Chloroform	5.7			140	UAW15-20	1.06	No	0		0.00	No
cis-1,2-Dichloroethene		70		80	UAW20-60	0.60	No	48	UAW20-40	0.36	No
Methylene chloride	4.6			280	UAW04-20	2.11	No	85	MW-EPA-1	0.64	No
Tetrachloroethene	0.69			75	MW-EPA-2	0.57	No	0		0.00	No
Toluene	1300			11000	UAW04-20	83.08	No	0		0.00	No
Trichloroethene	2.5			5.1	UAW23-20	0.04	No	0		0.00	No
Vinyl chloride	0.025			4	UAW22-20	0.03	Yes	0.78	UAW02-40	0.01	No
SVOCs											
1,2-Dichlorobenzene	420			1100	MW-EPA-1	1.05	No	1100	MW-EPA-1	1.05	No
1,4-Dichlorobenzene	63			250	MW-EPA-1	0.24	No	250	MW-EPA-1	0.24	No
2-Methylnaphthalene			6.2	8.6	UAW13-20	0.01	No	0		0.00	No
Aniline			12	5900	UAW08-20	5.61	No	28	MW-EPA-1	0.03	No
bis(2-Ethylhexyl) phthalate	1.2			29	UAW11-10	0.03	No	3.2	UAW02-20	0.00	No
Pesticide and PCBs											
4,4'-DDD	0.00031			0.14	UAW07-20	0.0001	No	0.14	UAW07-20	0.00	No
4,4'-DDE	0.00022			0.3	UAW12-20	0.0003	Yes	0.052	MW-EPA-1	0.00	No
4,4'-DDT	0.00022			0.036	UAW12-20	3.42E-05	No	0		0.00	No
Aldrin	0.000049			0.076	MW-EPA-1	0.0001	Yes	0.076	MW-EPA-1	0.00	Yes
alpha-BHC	0.0026			0.025	UAW20-60	2.38E-05	No	0.021	UAW25-20	0.00	No
alpha-Chlordane	0.0008			0.039	UAW18-20	3.71E-05	No	0		0.00	No
beta-BHC	0.0091			0.39	UAW12-20	0.0004	No	0.22	UAW03-20 (Dup)	0.00	No
delta-BHC			0.011	1	UAW23-20	0.0010	No	0.031	MW-EPA-1	0.00	No
Dieldrin	0.000052			0.27	UAW12-20	0.0003	Yes	0.26	UAW03-20 (Dup)	0.00	Yes
Endrin	0.059			0.15	UAW04-20	0.0001	No	0.14	UAW07-20	0.00	No
Endrin aldehyde	0.29			6.9	UAW15-50	0.0066	No	0.075	UAW05-20	0.00	No
gamma-Chlordane	0.0008			0.37	UAW07-20	0.0004	No	0.37	UAW07-20	0.00	No
Heptachlor	0.000079			0.27	UAW12-20	0.0003	Yes	0.22	UAW03-20 (Dup)	0.00	Yes
Heptachlor epoxide	0.000039			0.97	UAW10-50	0.0009	Yes	0.37	UAW05-20	0.00	Yes
Toxaphene	0.00028			1	UAW18-20	0.0010	Yes	0		0.00	No
Metals											
Aluminum		50		4240	MW-EPA-3	125.28	Yes	365	MW-EPA-3	10.78	No
Antimony	5.6			8.7	UAW15-50	0.26	No	0		0.00	No
Arsenic	0.018			215	MW-EPA-1	6.35	Yes	215	MW-EPA-1	6.35	Yes
Chromium		100		172	UAW21-30	5.08	No	20.3	UAW01-30	0.60	No
Iron	300			12500	UAW10-80	369.34	Yes	7380	UAW25-20	218.06	No
Manganese		50		11800	UAW22-20	348.66	Yes	1670	UAW25-20	49.34	No
Thallium	0.24			12.2	UAW06-20	0.36	Yes	8	UAW03-20	0.24	No

TABLE 8.9

Comparison of Estimated Surface Water Concentrations and Human Health Surface Water Screening Values

Rohm and Haas Chemicals LLC

Reading, Ohio

Unit: ug/l

NRWQC - National Recommended Water Quality Criterion

MCL - Maximum Contaminant Level

PRGs - Preliminary Remediation Goals

Estimated concentration in surface water calculated according to the following equation: Csw = Cgw x Qgw / (Qgw + Qsw) where:

Cgw - maximum detected concentration in groundwater (ug/L)

Qgw - calculated groundwater flux (ft^3/day)

Qgw = 3,222 ft^3/day for VOCs (from Form CA750 Environmental Indicators Report, USEPA, 2002)

Qgw = 403 ft^3/day for SVOCs and pesticides (from Form CA750 Environmental Indicators Report, USEPA, 2002)

Qgw = 12,890 ft^3/day for metals (from Form CA750 Environmental Indicators Report, USEPA, 2002)

Qsw = 423,360 ft^3/day ($7Q_{10}$ flow for Mill Creek (4.9 cfs) multiplied by 86,400 seconds/day) (OEPA, 2004a)

Screening hierarchy was as follows: NRWQC was the preferred value; if no NRWQC then the MCL was used; if no NRWQC or MCL, then PRG was used.

Downgradient wells include UAW03-20, UAW05-20, UAW07-20, MW-EPA-1, UAW01-30, UAW02-20, UAW02-40 and UAW25-20.

Criteria for metals are for the total fraction since the groundwater analytical results are for the total fraction.

- Estimated surface water concentration exceeds NRWQC, MCL or PRG.

TABLE 10.4
COMPARISON OF NOVEMBER 2004 GROUNDWATER DATA IN THE UPPER AQUIFER TO OHIO SURFACE WATER CRITERIA AND REGION 5 ESLs
Rohm and Haas Chemicals LLC
Reading, Ohio

	OMZA	Region 5 ESL	MAX Detected - All Wells	Location	OMZA Based HQ - All Wells	Retained as COPEC--All Wells?	MAX Detected - Downgradient Wells	Location	OMZA Based HQ - Downgradient Wells	Retained as COPEC--downgradient Wells?
Volatile Organic Compounds (ug/l)										
1,1-Dichloroethane	ID	47	42	UAW20-60	0.89	No; HQ<1	20	UAW02-40	0.43	No; HQ<1
1,1,1-Trichloroethane	76	76	60	UAW20-60	0.79	No; HQ<1	NA	NA	NA	No; not detected
1,1,2-Trichloroethane	740	500	2.6	UAW23-20	0.004	No; HQ<1	NA	NA	NA	No; not detected
1,1,2-Trichloro-1,2,2-trifluoroethane	-	NE	3.2	UAW10-50	-	Yes, screening value unavailable	NA	NA	NA	No; not detected
1,1-Dichloroethene	210	65	19	UAW20-60	0.09	No; HQ<1	3.9	UAW02-40	0.02	No; HQ<1
1,2-Dichloroethane	2000	910	1200	UAW20-60	0.60	No; HQ<1	NA	NA	NA	No; not detected
cis-1,2-Dichloroethene	970	970	80	UAW20-60	0.08	No; HQ<1	48	UAW02-40	0.05	No; HQ<1
4-Methyl-2-pentanone	ID	170	66	UAW08-20	0.39	No; HQ<1	NA	NA	NA	No; not detected
Acetone	-	1700	980	UAW04-20	0.58	No; HQ<1	310	MW-EPA-1	0.18	No; HQ<1
Benzene	160	114	150	UAW08-20	0.94	No; HQ<1	49	MW-EPA-1	0.31	No; HQ<1
Bromodichloromethane	ID	NE	0.26	UAW09-60	-	Yes, screening value unavailable	NA	NA	NA	No; not detected
Carbon disulfide	15	15	180	UAW13-20	**12**	Yes; HQ>1	7.1	UAW07-20	0.47	No; HQ<1
Carbon tetrachloride	240	240	2.2	UAW15-20	0.01	No; HQ<1	NA	NA	NA	No; not detected
Chlorobenzene	47	47	2500	MW-EPA-1	**53**	Yes; HQ>1	2500	MW-EPA-1	**53.19**	Yes; HQ>1
Chloroethane	-	NE	6.8	UAW10-50	-	Yes, screening value unavailable	NA	NA	NA	No; not detected
Chloroform	140	140	140	UAW15-20	1.00	No; HQ=1	NA	NA	NA	No; not detected
Cyclohexane	-	NE	1.2	UAW25-20	-	Yes, screening value unavailable	1.2	UAW25-20	-	Yes, screening value unavailable
Ethylbenzene	61	14	59	UAW08-20	0.97	No; HQ<1	28	MW-EPA-1	0.46	No; HQ<1
Isopropylbenzene	4.8	NE	8.9	UAW07-20	**1.85**	Yes; HQ>1	8.9	UAW07-20	**1.85**	Yes; HQ>1
Methylcyclohexane	-	253	17	UAW08-20	0.07	No; HQ<1	6.2	UAW03-20	0.02	No; HQ<1
Methyl ethyl ketone	22000	2200	29	UAW08-20	0.00	No; HQ<1	NA	NA	NA	No; not detected
Methylene chloride	1900	940	280	UAW04-20	0.15	No; HQ<1	85	MW-EPA-1	0.04	No; HQ<1
Methyl-tert-butyl ether	730	NE	0.2	MW-EPA-3	0.00	No; HQ<1	NA	NA	NA	No; not detected
Tetrachloroethene	53	45	75	MW-EPA-2	**1.42**	Yes; HQ>1	NA	NA	NA	No; not detected
Toluene	62	253	11000	UAW04-20	**177.42**	Yes; HQ>1	NA	NA	NA	No; not detected
trans-1,2-Dichloroethene	970	970	2.5	UAW02-40	0.00	No; HQ<1	2.5	UAW02-40	0.00	No; HQ<1
Trichloroethene	220	47	5.1	UAW23-20	0.02	No; HQ<1	NA	NA	NA	No; not detected
Vinyl chloride	930	930	4	UAW22-20	0.00	No; HQ<1	0.78	UAW02-40	0.00	No; HQ<1
Xylenes (total)	27	27	270	UAW08-20	**10.00**	Yes; HQ>1	130	MW-EPA-1	**4.81**	Yes; HQ>1
Semivolatile Organic Compounds (ug/l)										
1,1'-Biphenyl	6.5	NE	60	UAW07-20	**9.23**	Yes; HQ>1	60	UAW07-20	**9.23**	Yes; HQ>1
1,2-Dichlorobenzene	23	14	1100	MW-EPA-1, UAW12-20	**47.83**	Yes; HQ>1	1100	MW-EPA-1	**47.83**	Yes; HQ>1
1,3-Dichlorobenzene	22	38	35	MW-EPA-1, UAW12-20	**1.59**	Yes; HQ>1	35	MW-EPA-1	**1.59**	Yes; HQ>1
1,4-Dichlorobenzene	9.4	9.4	250	MW-EPA-1	**26.60**	Yes; HQ>1	250	MW-EPA-1	**26.60**	Yes; HQ>1
2-Methylnaphthalene	-	330	8.6	UAW13-20	0.03	No; HQ<1	NA	NA	NA	No; not detected
2-Methylphenol	67	67	15	UAW04-20	0.22	No; HQ<1	NA	NA	NA	No; not detected
4-Methylphenol	53	25	28	UAW04-20	0.53	No; HQ<1	NA	NA	NA	No; not detected
Aniline	4.1	4.1	5900	UAW08-20	**1439.02**	Yes; HQ>1	28	MW-EPA-1	**6.83**	Yes; HQ>1
Benzaldehyde	-	NE	1.7	UAW05-20	-	Yes, screening value unavailable	1.7	UAW05-20	-	Yes, screening value unavailable
bis(2-ethylhexyl)phthalate	8.4	0.3	29	UAW11-10	**3.45**	Yes; HQ>1	3.2	UAW02-20	0.38	No; HQ<1
Naphthalene	21	13	0.89	UAW22-20	0.04	No; HQ<1	NA	NA	NA	No; not detected
Phenol	400	180	160	UAW08-20	0.40	No; HQ<1	NA	NA	NA	No; not detected

TABLE 10.4
COMPARISON OF NOVEMBER 2004 GROUNDWATER DATA IN THE UPPER AQUIFER TO OHIO SURFACE WATER CRITERIA AND REGION 5 ESLs
Rohm and Haas Chemicals LLC
Reading, Ohio

	OMZA	Region 5 ESL	MAX Detected - All Wells	Location	OMZA Based HQ - All Wells	Retained as COPEC--All Wells?	MAX Detected - Downgradient Wells	Location	OMZA Based HQ - Downgradient Wells	Retained as COPEC--downgradient Wells?
Pesticide/PCBs (ug/l)										
4,4'-DDD	-	NE	0.14	UAW07-20	-	Yes, screening value unavailable	0.14	UAW07-20	-	Yes, screening value unavailable
4,4'-DDE	-	4.51E-09	0.3	UAW12-20	**6.65E+07**	Yes; HQ>1	0.052	MW-EPA-1	**1.15E+07**	Yes; HQ>1
4,4'-DDT	-	1.10E-05	0.036	UAW12-20	**3.27E+03**	Yes; HQ>1	NA	NA	NA	No; not detected
Aldrin	-	1.70E-02	0.076	MW-EPA-1	**4.47**	Yes; HQ>1	0.076	MW-EPA-1	**4.47**	Yes; HQ>1
alpha-BHC	-	1.24E+01	0.025	UAW20-60	0.00	No; HQ<1	0.021	UAW25-20	0.00	No; HQ<1
alpha-Chlordane	-	4.30E-03	0.039	UAW18-20	**9.07**	Yes; HQ>1	NA	NA	NA	No; not detected
beta-BHC	-	4.95E-01	0.39	UAW12-20	0.79	No; HQ<1	0.22	UAW03-20 dup	0.44	No; HQ<1
delta-BHC	-	6.67E+02	1	UAW23-20	0.00	No; HQ<1	0.031	MW-EPA-1	0.00	No; HQ<1
Caprolactam	-	NE	5.5	UAW06-20	-	Yes, screening value unavailable	NA	NA	NA	No; not detected
Chlordane	-	4.30E-03	0.37	UAW07-20	**86.05**	Yes; HQ>1	0.37	UAW07-20	**86.05**	Yes; HQ>1
Dieldrin	0.056	7.10E-05	0.27	UAW12-20	**4.82**	Yes; HQ>1	0.24	UAW03-20	**4.29**	Yes; HQ>1
Endosulfan I	-	5.60E-02	0.094	UAW15-20	**1.68**	Yes; HQ>1	NA	NA	NA	No; not detected
Endosulfan II	-	5.60E-02	0.27	MW-EPA-1	**4.82**	Yes; HQ>1	0.27	MW-EPA-1	**4.82**	Yes; HQ>1
Endosulfan sulfate	-	2.22E+00	0.17	UAW12-20	0.08	No; HQ<1	NA	NA	NA	No; not detected
Endrin	0.036	3.60E-02	0.15	UAW04-20	**4.17**	Yes; HQ>1	0.14	UAW07-20	**3.89**	Yes; HQ>1
Endrin aldehyde	-	1.50E-01	6.9	UAW15-50	**46.00**	Yes; HQ>1	0.075	UAW05-20	0.50	No; HQ<1
Endrin ketone	0.036	NE	0.032	MW-EPA-1	0.89	No; HQ<1	0.032	MW-EPA-1	0.89	No; HQ<1
gamma-BHC	0.057	2.60E-02	0.47	UAW08-20	**8.25**	Yes; HQ>1	0.04	MW-EPA-1	0.70	No; HQ<1
Heptachlor	-	3.80E-03	0.27	UAW12-20	**71.05**	Yes; HQ>1	0.22	UAW03-20 dup	**57.89**	Yes; HQ>1
Heptachlor epoxide	-	3.80E-03	0.97	UAW10-50	**255.26**	Yes; HQ>1	0.37	UAW05-20	**97.37**	Yes; HQ>1
Methoxychlor	-	NE	0.47	UAW07-20	-	Yes, screening value unavailable	0.47	UAW07-20	-	Yes, screening value unavailable
Toxaphene	-	1.40E-04	1	UAW18-20	**7142.86**	Yes; HQ>1	NA	NA	NA	No; not detected
Inorganic Compounds (ug/l)										
Aluminum	-	80	4240	MW-EPA-3	**53.00**	Yes; HQ>1	365	MW-EPA-1	**4.56**	Yes; HQ>1
Antimony	190	80	8.7	UAW15-50	0.05	No; HQ<1	NA	NA	NA	No; not detected
Arsenic	150	148	215	MW-EPA-1	**1.43**	Yes; HQ>1	215	MW-EPA-1	**1.43**	Yes; HQ>1
Barium	220	220	759	UAW18-20	**3.45**	Yes; HQ>1	228	UAW25-20	**1.04**	Yes; HQ>1
Beryllium	47.8	3.6	0.79	UAW13-20	0.02	No; HQ<1	NA	NA	NA	No; not detected
Cadmium	5.1	0.15	2.7	UAW08-20	0.53	No; HQ<1	0.5	UAW03-20	0.10	No; HQ<1
Calcium	-	NE	1020000	UAW08-20	-	No; essential nutrient	408000	UAW07-20	-	No; essential nutrient
Chromium	183	42	172	UAW21-30	0.94	No; HQ<1	20.3	UAW01-30	0.11	No; HQ<1
Cobalt	24	24	11.9	MW-EPA-3, UAW11-40	0.50	No; HQ<1	2.7	UAW01-30	0.11	No; HQ<1
Copper	20.4	1.58	19.5	UAW21-30	0.96	No; HQ<1	4.8	UAW25-20	0.24	No; HQ<1
Cyanide	12	5.2	6.3	UAW15-20	0.53	No; HQ<1	NA	NA	NA	No; not detected
Iron	-	1000	12500	UAW10-80	**12.50**	Yes; HQ>1	7380	UAW25-20	**7.38**	Yes; HQ>1
Lead	20.6	1.17	5.4	UAW10-80	0.26	No; HQ<1	NA	NA	NA	No; not detected
Magnesium	-	NE	134000	UAW08-20	-	No; essential nutrient	123000	MW-EPA-1	-	No; essential nutrient
Manganese	-	120	11800	UAW22-20	**98.33**	Yes; HQ>1	1670	UAW25-20	**13.92**	Yes; HQ>1
Mercury	0.91	0.0013	0.082	UAW01-80	0.09	No; HQ<1	0.082	UAW01-30	0.09	No; HQ<1
Nickel	113	28.9	518	UAW21-30	**4.58**	Yes; HQ>1	181	UAW01-30	**1.60**	Yes; HQ>1
Potassium	-	NE	22400	UAW23-20	-	No; essential nutrient	13300	UAW01-30	-	No; essential nutrient
Selenium	5	5	15.1	UAW23-20	**3.02**	Yes; HQ>1	NA	NA	NA	No; not detected
Silver	1.3	0.12	1.1	UAW10-50	0.85	No; HQ<1	NA	NA	NA	No; not detected

TABLE 10.4
COMPARISON OF NOVEMBER 2004 GROUNDWATER DATA IN THE UPPER AQUIFER TO OHIO SURFACE WATER CRITERIA AND REGION 5 ESLs
Rohm and Haas Chemicals LLC
Reading, Ohio

	OMZA	Region 5 ESL	MAX Detected - All Wells	Location	OMZA Based HQ - All Wells	Retained as COPEC--All Wells?	MAX Detected - Downgradient Wells	Location	OMZA Based HQ - Downgradient Wells	Retained as COPEC--downgradient Wells?
Sodium	-	NE	1290000	UAW15-20	-	No; essential nutrient	577000	MW-EPA-1	-	No; essential nutrient
Thallium	17	10	12.2	UAW06-20	0.72	No; HQ<1	8	UAW03-20	0.47	No; HQ<1
Tin	180	180	5740	UAW08020	**31.89**	Yes; HQ>1	1340	MW-EPA-1	**7.44**	Yes; HQ>1
Vanadium	44	12	20.2	UAW06-20	0.46	No; HQ<1	7.6	UAW03-20	0.17	No; HQ<1
Zinc	260	65.7	54.3	MW-EPA-3	0.21	No; HQ<1	NA	NA	NA	No; not detected

OMZA - Ohio Outside the Mixing Zone Average, from Ohio EPA, July 27, 2005.
ID - Insufficient data to develop a value.
NE- None established.
NA - Not applicable
HQ calculated by dividing the maximum detected concentration by the OMZA concentration. If OMZA concentration not available, then the HQ is calculated by dividing the maximum detected concentration by the Region 5 ESL.
Downgradient wells include UAW03-20, UAW05-20, UAW07-20, MW-EPA-1, UAW01-30, UAW02-20, UAW02-40 and UAW25-20.
Criteria for metals are for the total fraction since the groundwater analytical results are for the the total fraction.
All values based on an average hardness of 250 mg/L as measured at two locations near the site by the OEPA in 1992.
- Maximum detected concentration exceeds OMZA or ESL

TABLE 15.4
COMPARISON OF SURFACE WATER DATA TO OHIO OMZA AND REGION 5 ESLs
Rohm and Haas Chemicals LLC
Reading, Ohio

	Ohio OMZA	Region 5 ESL	Frequency of Detection	Range of Detection Limits	Range of Detected Concentrations	HQ[1]	Retained as COPEC?
Volatile Organic Compounds (ug/l)							
1,1-Dichloroethane	-	47	0/7	1 - 1	NA - NA	NA	No; not detected
1,1,1-Trichloroethane	76	76	7/7	1 - 1	0.19 - 0.4	0.01	No; HQ<1
1,1,1,2-Tetrachloroethane	260	380	0/7	1 - 1	NA - NA	NA	No; not detected
1,1,2-Trichloroethane	740	500	0/7	1 - 1	NA - NA	NA	No; not detected
1,1-Dichloroethene	210	65	0/7	1 - 1	NA - NA	NA	No; not detected
1,2-Dibromo-3-Chloropropane	-	NE	0/7	2 - 2	NA - NA	NA	No; not detected
1,2-Dibromomethane	-	176	0/7	1 - 1	NA - NA	NA	No; not detected
1,2-Dichloroethane	2000	910	0/7	1 - 1	NA - NA	NA	No; not detected
cis-1,2-Dichloroethene	970 70	970	1/7	0.5 - 0.5	0.26 - 0.26	0.00	No; HQ<1
1,2-Dichloropropane	520	360	0/7	1 - 1	NA - NA	NA	No; not detected
1,2,3-Trichloropropane	-	NE	0/7	1 - 1	NA - NA	NA	No; not detected
cis-1,3-Dichloropropene	1.7	1.7	0/7	1 - 1	NA - NA	NA	No; not detected
2-Butanone	22000	2200	0/7	10 - 10	NA - NA	NA	No; not detected
2-Hexanone	-	99	0/7	10 - 10	NA - NA	NA	No; not detected
2,2'-Oxybis(1-chloro)propane	-	NE	0/7	10 - 10	NA - NA	NA	No; not detected
4-Methyl-2-pentanone	-	170	0/7	5 - 5	NA - NA	NA	No; not detected
Acetone	-	1700	5/7	10 - 10	1.2 - 6.3	0.00	No; HQ<1
Acetophenone	-	NE	0/7	10 - 10	NA - NA	NA	No; not detected
Benzene	160	114	0/7	1 - 1	NA - NA	NA	No; not detected
bis(2-chloroethoxy)methane	-	NE	0/7	10 - 10	NA - NA	NA	No; not detected
bis(2-chloroethyl) ether	-	19000	0/7	10 - 10	NA - NA	NA	No; not detected
Bromodichloromethane	-	NE	0/7	1 - 1	NA - NA	NA	No; not detected
Bromoform	230	230	0/7	1 - 1	NA - NA	NA	No; not detected
Bromomethane	16	16	0/7	2 - 2	NA - NA	NA	No; not detected
Carbon disulfide	15	15	0/7	1 - 1	NA - NA	NA	No; not detected
Carbon tetrachloride	240	240	0/7	1 - 1	NA - NA	NA	No; not detected
CFC-11	-	NE	0/7	2 - 2	NA - NA	NA	No; not detected
CFC-12	-	NE	0/7	2 - 2	NA - NA	NA	No; not detected
Chlorobenzene	47	47	0/7	1 - 1	NA - NA	NA	No; not detected
Chloroethane	-	NE	0/7	2 - 2	NA - NA	NA	No; not detected
Chloroform	140	140	4/7	1 - 1	0.23 - 0.26	0.00	No; HQ<1
Chloromethane	-	NE	0/7	2 - 2	NA - NA	NA	No; not detected
Dibromochloromethane	-	9.7	2/7	1 - 1	0.82 - 0.86	0.09	No; HQ<1
Dibromomethane	-	NE	0/7	1 - 1	NA - NA	NA	No; not detected

TABLE 15.4
COMPARISON OF SURFACE WATER DATA TO OHIO OMZA AND REGION 5 ESLs
Rohm and Haas Chemicals LLC
Reading, Ohio

	Ohio OMZA	Region 5 ESL	Frequency of Detection	Range of Detection Limits	Range of Detected Concentrations	HQ(1)	Retained as COPEC?
Ethylbenzene	61	14	0/7	1 - 1	NA - NA	NA	No; not detected
Hexachloro-1,3-butadiene	-	0.053	0/7	10 - 10	NA - NA	NA	No; not detected
Hexachlorobenzene	-	0.0003	0/7	10 - 10	NA - NA	NA	No; not detected
Hexachlorocyclopentadiene	-	77	0/7	50 - 50	NA - NA	NA	No; not detected
Hexachloroethane	-	8	0/7	10 - 10	NA - NA	NA	No; not detected
Hexachloropropene	-	NE	0/7	100 - 100	NA - NA	NA	No; not detected
Iodomethane	-	NE	0/7	1 - 1	NA - NA	NA	No; not detected
Isosafrole	-	NE	0/7	20 - 20	NA - NA	NA	No; not detected
Kepone	-	0.132	0/7	1 - 1	NA - NA	NA	No; not detected
Methylene chloride	1900	940	0/7	1 - 1	NA - NA	NA	No; not detected
Styrene	32	32	0/7	1 - 1	NA - NA	NA	No; not detected
Tetrachloroethene	53	45	0/7	1 - 1	NA - NA	NA	No; not detected
Toluene	62	253	0/7	1 - 1	NA - NA	NA	No; not detected
trans-1,2-Dichloroethene	970	970	0/7	0.5 - 0.5	NA - NA	NA	No; not detected
trans-1,3-Dichloropropene	1.7	1.7	0/7	1 - 1	NA - NA	NA	No; not detected
trans-1,4-Dichlorobutene	-	NE	0/7	1 - 1	NA - NA	NA	No; not detected
Trichloroethene	220	47	6/7	1 - 1	0.24 - 0.33	0.00	No; HQ<1
Vinyl acetate	-	248	0/7	2 - 2	NA - NA	NA	No; not detected
Vinyl chloride	930	930	0/7	2 - 2	NA - NA	NA	No; not detected
Xylenes (total)	27	27	0/7	1 - 1	NA - NA	NA	No; not detected
Semivolatile Organic Compounds (ug/l)							
1,2,4-Trichlorobenzene	-	30	0/7	10 - 10	NA - NA	NA	No; not detected
1,2,4,5-Tetrachlorobenzene	-	3	0/7	1 - 1	NA - NA	NA	No; not detected
1,2-Dichlorobenzene	23	14	0/7	10 - 10	NA - NA	NA	No; not detected
1,3-Dichlorobenzene	22	38	0/7	10 - 10	NA - NA	NA	No; not detected
1,4-Dichlorobenzene	9.4	9.4	0/7	10 - 10	NA - NA	NA	No; not detected
1,3,5-Trinitrobenzene	11	11	0/7	50 - 50	NA - NA	NA	No; not detected
1,4-Dioxane	-	22000	1/7	10 - 10	1.1 - 1.1	0.00	No; HQ<1
1,4-Naphthoquinone	-	NE	0/7	50 - 50	NA - NA	NA	No; not detected
1-Naphthylamine	-	NE	0/7	10 - 10	NA - NA	NA	No; not detected
2-Acetylaminofluorene	-	535	0/7	100 - 100	NA - NA	NA	No; not detected
2-Aminonaphthalene	-	NE	0/7	10 - 10	NA - NA	NA	No; not detected
2-Chlor-1,3-Butadiene	-	NE	0/7	1 - 1	NA - NA	NA	No; not detected
2-Chloronaphthalene	-	0.396	0/7	10 - 10	NA - NA	NA	No; not detected
2-Chlorophenol	32	24	0/7	10 - 10	NA - NA	NA	No; not detected

TABLE 15.4
COMPARISON OF SURFACE WATER DATA TO OHIO OMZA AND REGION 5 ESLs
Rohm and Haas Chemicals LLC
Reading, Ohio

	Ohio OMZA	Region 5 ESL	Frequency of Detection	Range of Detection Limits	Range of Detected Concentrations	HQ(1)	Retained as COPEC?
2-Methyl-1-propanol	-	NE	0/7	50 - 50	NA - NA	NA	No; not detected
2-Methylnaphthalene	-	330	0/7	10 - 10	NA - NA	NA	No; not detected
2-Methylphenol	67	67	0/7	10 - 10	NA - NA	NA	No; not detected
2-Nitroaniline	-	NE	0/7	50 - 50	NA - NA	NA	No; not detected
2-Nitrophenol	73	73	0/7	10 - 10	NA - NA	NA	No; not detected
2-Picoline	-	NE	0/7	20 - 20	NA - NA	NA	No; not detected
2,4-Dichlorophenol	11	11	0/7	10 - 10	NA - NA	NA	No; not detected
2,4-Dimethylphenol	15	100	0/7	10 - 10	NA - NA	NA	No; not detected
2,4-Dinitrophenol	-	19	0/7	50 - 50	NA - NA	NA	No; not detected
2,4-Dinitrotoluene	44	44	0/7	10 - 10	NA - NA	NA	No; not detected
2,4,5-Trichlorophenol	-	NE	0/7	10 - 10	NA - NA	NA	No; not detected
2,4,6-Trichlorophenol	4.9	4.9	0/7	10 - 10	NA - NA	NA	No; not detected
2,6-Dichlorophenol	-	NE	0/7	10 - 10	NA - NA	NA	No; not detected
2,6-Dinitrotoluene	81	81	0/7	10 - 10	NA - NA	NA	No; not detected
3,3'-Dichlorobenzidine	-	4.5	0/7	50 - 50	NA - NA	NA	No; not detected
3,3'-Dimethylbenzidine	-	NE	0/7	50 - 50	NA - NA	NA	No; not detected
3,5,5-Trimethyl-2-cyclohexene-1	-	NE	0/7	10 - 10	NA - NA	NA	No; not detected
3-Methylchloranthrene	-	NE	0/7	20 - 20	NA - NA	NA	No; not detected
3-Methylphenol	62	62	0/7	10 - 10	NA - NA	NA	No; not detected
3-Nitroaniline	-	NE	0/7	50 - 50	NA - NA	NA	No; not detected
4-Aminobiphenyl	-	NE	0/7	50 - 50	NA - NA	NA	No; not detected
4-Bromophenyl phenyl ether	-	1.5	0/7	10 - 10	NA - NA	NA	No; not detected
4-Chloro-3-methylphenol	-	34.8	0/7	10 - 10	NA - NA	NA	No; not detected
4-Chlorophenyl phenyl ether	-	NE	0/7	10 - 10	NA - NA	NA	No; not detected
4-Dimethylaminoazobenzene	-	NE	0/7	20 - 20	NA - NA	NA	No; not detected
4-Methylphenol	53	25	0/7	10 - 10	NA - NA	NA	No; not detected
4-Nitrophenol	-	60	0/7	50 - 50	NA - NA	NA	No; not detected
4-Nitroquinoline-N-Oxide	-	NE	0/7	100 - 100	NA - NA	NA	No; not detected
4,6-Dinitro-2-Methylphenol	-	NE	0/7	50 - 50	NA - NA	NA	No; not detected
5-Nitro-O-Toluidine	-	NE	0/7	20 - 20	NA - NA	NA	No; not detected
7,12-Dimethylbenz(a)anthracene	-	0.548	0/7	20 - 20	NA - NA	NA	No; not detected
Acenaphthene	15	38	0/7	10 - 10	NA - NA	NA	No; not detected
Acenaphthylene	-	4840	0/7	10 - 10	NA - NA	NA	No; not detected
Acetonitrile	12000	12000	0/7	20 - 20	NA - NA	NA	No; not detected
Acrolein	-	0.19	0/7	20 - 20	NA - NA	NA	No; not detected
Acrylonitrile	78	66	0/7	20 - 20	NA - NA	NA	No; not detected

TABLE 15.4
COMPARISON OF SURFACE WATER DATA TO OHIO OMZA AND REGION 5 ESLs
Rohm and Haas Chemicals LLC
Reading, Ohio

	Ohio OMZA	Region 5 ESL	Frequency of Detection	Range of Detection Limits	Range of Detected Concentrations	HQ[1]	Retained as COPEC?
Allyl chloride	-	NE	0/7	2 - 2	NA - NA	NA	No; not detected
alpha, alpha Dimethylphenethyla	-	NE	0/7	50 - 50	NA - NA	NA	No; not detected
Aniline	4.1	4.1	0/7	10 - 10	NA - NA	NA	No; not detected
Anthracene	0.02	0.035	0/7	10 - 10	NA - NA	NA	No; not detected
Aramite	-	3.09	0/7	20 - 20	NA - NA	NA	No; not detected
Benzo(a)anthracene	-	0.025	0/7	10 - 10	NA - NA	NA	No; not detected
Benzo(a)pyrene	-	0.014	0/7	10 - 10	NA - NA	NA	No; not detected
Benzo(b)fluoranthene	-	9.07	0/7	10 - 10	NA - NA	NA	No; not detected
Benzo(ghi)perylene	-	7.64	0/7	10 - 10	NA - NA	NA	No; not detected
Benzo(k)fluoranthene	-	NE	0/7	10 - 10	NA - NA	NA	No; not detected
Benzyl alcohol	-	8.6	0/7	10 - 10	NA - NA	NA	No; not detected
bis(2-ethylhexyl)phthalate	8.4	0.3	6/7	10 - 10	0.55 - 1.4	0.17	No; HQ<1
Butyl benzyl phthalate	23	23	0/7	10 - 10	NA - NA	NA	No; not detected
Chlorobenzilate	-	7.16	0/7	10 - 10	NA - NA	NA	No; not detected
Chlorophenols	-	24	0/7	50 - 50	NA - NA	NA	No; not detected
Chrysene	-	NE	0/7	10 - 10	NA - NA	NA	No; not detected
Dibenz(a,h)anthracene	-	NE	0/7	10 - 10	NA - NA	NA	No; not detected
Dibenzofuran	4	4	0/7	10 - 10	NA - NA	NA	No; not detected
Diethyl phthalate	220	110	0/7	10 - 10	NA - NA	NA	No; not detected
Dimethyl phthalate	1100	1100	0/7	10 - 10	NA - NA	NA	No; not detected
Di-n-butyl phthalate	-	9.7	0/7	10 - 10	NA - NA	NA	No; not detected
Di-n-octyl phthalate	-	30	0/7	10 - 10	NA - NA	NA	No; not detected
Diphenylamine	-	412	0/7	10 - 10	NA - NA	NA	No; not detected
Ethyl methacrylate	-	NE	0/7	1 - 1	NA - NA	NA	No; not detected
Ethyl methanesulfonate	-	NE	0/7	10 - 10	NA - NA	NA	No; not detected
Fluoranthene	0.8	1.9	0/7	10 - 10	NA - NA	NA	No; not detected
Fluorene	19	19	0/7	10 - 10	NA - NA	NA	No; not detected
Indeno(1,2,3-cd)pyrene	-	4.31	0/7	10 - 10	NA - NA	NA	No; not detected
m-Dinitrobenzene	22	22	0/7	10 - 10	NA - NA	NA	No; not detected
N-Methyl-N-nitroso-methanamin	-	NE	0/7	10 - 10	NA - NA	NA	No; not detected
Methapyrilene	-	NE	0/7	50 - 50	NA - NA	NA	No; not detected
Methylacrylonitrile	-	NE	0/7	1 - 1	NA - NA	NA	No; not detected
Methyl methacrylate	-	2800	0/7	1 - 1	NA - NA	NA	No; not detected
Methyl methanesulfonate	-	NE	0/7	10 - 10	NA - NA	NA	No; not detected
Naphthalene	21	13	0/7	10 - 10	NA - NA	NA	No; not detected
Nitrobenzene	380	220	0/7	10 - 10	NA - NA	NA	No; not detected

TABLE 15.4
COMPARISON OF SURFACE WATER DATA TO OHIO OMZA AND REGION 5 ESLs
Rohm and Haas Chemicals LLC
Reading, Ohio

	Ohio OMZA	Region 5 ESL	Frequency of Detection	Range of Detection Limits	Range of Detected Concentrations	HQ[1]	Retained as COPEC?
Nitrosomethylethylamine	-	NE	0/7	10 - 10	NA - NA	NA	No; not detected
N-Nitrosodiethylamine	-	768	0/7	10 - 10	NA - NA	NA	No; not detected
N-Nitrosodi-N-butylamine	-	NE	0/7	10 - 10	NA - NA	NA	No; not detected
N-Nitrosodi-N-propylamine	-	NE	0/7	10 - 10	NA - NA	NA	No; not detected
N-Nitrosodiphenylamine	-	NE	0/7	10 - 10	NA - NA	NA	No; not detected
N-Nitrosomorpholine	-	NE	0/7	10 - 10	NA - NA	NA	No; not detected
N-Nitrosopiperidine	-	NE	0/7	10 - 10	NA - NA	NA	No; not detected
N-Nitrosopyrrolidine	-	NE	0/7	10 - 10	NA - NA	NA	No; not detected
o-Dinitrobenzene	22	22	0/7	10 - 10	NA - NA	NA	No; not detected
o-Toluidine	-	NE	0/7	20 - 20	NA - NA	NA	No; not detected
o,o,o-Triethyl phosphorothioate	-	58.2	0/7	50 - 50	NA - NA	NA	No; not detected
o,o-Diethyl o-pyrazinyl phosphot	-	NE	0/7	50 - 50	NA - NA	NA	No; not detected
p-Chloroaniline	-	232	0/7	10 - 10	NA - NA	NA	No; not detected
Pentachlorobenzene	-	0.019	0/7	10 - 10	NA - NA	NA	No; not detected
Pentachlorophenol	18	4	0/7	10 - 10	NA - NA	NA	No; not detected
Phenacetin	-	NE	0/7	20 - 20	NA - NA	NA	No; not detected
Phenanthrene	2.3	3.6	0/7	10 - 10	NA - NA	NA	No; not detected
Phenol	400	180	0/7	10 - 10	NA - NA	NA	No; not detected
p-Nitroaniline	-	NE	0/7	50 - 50	NA - NA	NA	No; not detected
p-Phenylenediamide	-	NE	0/7	100 - 100	NA - NA	NA	No; not detected
Propane nitrile	-	NE	0/7	4 - 4	NA - NA	NA	No; not detected
Pyrene	4.6	0.3	0/7	10 - 10	NA - NA	NA	No; not detected
Pyridine	-	2380	0/7	20 - 20	NA - NA	NA	No; not detected
Safrole	-	NE	0/7	20 - 20	NA - NA	NA	No; not detected
Pesticide/PCBs (ug/l)							
4,4'-DDD	-	NE	0/7	0.05 - 0.05	NA - NA	NA	No; not detected
4,4'-DDE	-	4.51E-09	0/7	0.05 - 0.05	NA - NA	NA	No; not detected
4,4'-DDT	-	1.10E-05	0/7	0.05 - 0.05	NA - NA	NA	No; not detected
Aldrin	-	1.70E-02	0/7	0.05 - 0.05	NA - NA	NA	No; not detected
alpha-BHC	-	1.24E+01	0/7	0.05 - 0.05	NA - NA	NA	No; not detected
beta-BHC	-	4.95E-01	0/7	0.05 - 0.05	NA - NA	NA	No; not detected
delta-BHC	-	6.67E+02	0/7	0.05 - 0.05	NA - NA	NA	No; not detected
Chlordane	-	4.30E-03	0/7	0.5 - 0.5	NA - NA	NA	No; not detected
Cygon	-	NE	0/7	20 - 20	NA - NA	NA	No; not detected
Diallate	-	NE	0/7	1 - 1	NA - NA	NA	No; not detected

TABLE 15.4
COMPARISON OF SURFACE WATER DATA TO OHIO OMZA AND REGION 5 ESLs
Rohm and Haas Chemicals LLC
Reading, Ohio

	Ohio OMZA	Region 5 ESL	Frequency of Detection	Range of Detection Limits	Range of Detected Concentrations	HQ[1]	Retained as COPEC?
Dieldrin	0.056	7.10E-05	0/7	0.05 - 0.05	NA - NA	NA	No; not detected
Disulfoton	-	4.02E-02	0/7	50 - 50	NA - NA	NA	No; not detected
Endosulfan I	-	5.60E-02	0/7	0.05 - 0.05	NA - NA	NA	No; not detected
Endosulfan II	-	5.60E-02	0/7	0.05 - 0.05	NA - NA	NA	No; not detected
Endosulfan sulfate	-	2.22E+00	0/7	0.05 - 0.05	NA - NA	NA	No; not detected
Endrin	0.036	3.60E-02	0/7	0.05 - 0.05	NA - NA	NA	No; not detected
Endrin aldehyde	- 2	1.50E-01	0/7	0.05 - 0.05	NA - NA	NA	No; not detected
Famphur	-	NE	0/7	100 - 100	NA - NA	NA	No; not detected
gamma-BHC	0.057	2.60E-02	0/7	0.05 - 0.05	NA - NA	NA	No; not detected
Heptachlor	-	3.80E-03	0/7	0.05 - 0.05	NA - NA	NA	No; not detected
Heptachlor epoxide	-	3.80E-03	0/7	0.05 - 0.05	NA - NA	NA	No; not detected
Isodrin	-	3.09E-02	0/7	0.1 - 0.1	NA - NA	NA	No; not detected
Methoxychlor	- 40	NE	0/7	0.1 - 0.1	NA - NA	NA	No; not detected
Pentachloronitrobenzene	-	NE	0/7	50 - 50	NA - NA	NA	No; not detected
Phorate	-	3.62E+00	0/7	50 - 50	NA - NA	NA	No; not detected
Propyzamide	-	NE	0/7	20 - 20	NA - NA	NA	No; not detected
Toxaphene	-	1.40E-04	0/7	2 - 2	NA - NA	NA	No; not detected
Aroclor-1016	0.001	1.20E-04	0/7	1 - 1	NA - NA	NA	No; not detected
Aroclor-1221	0.001	1.20E-04	0/7	1 - 1	NA - NA	NA	No; not detected
Aroclor-1232	0.001	1.20E-04	0/7	1 - 1	NA - NA	NA	No; not detected
Aroclor-1242	0.001	1.20E-04	0/7	1 - 1	NA - NA	NA	No; not detected
Aroclor-1248	0.001	1.20E-04	0/7	1 - 1	NA - NA	NA	No; not detected
Aroclor-1254	0.001	1.20E-04	0/7	1 - 1	NA - NA	NA	No; not detected
Aroclor-1260	0.001	1.20E-04	0/7	1 - 1	NA - NA	NA	No; not detected
Inorganic Compounds (ug/l)							
Antimony	190	80	0/7	10 - 10	NA - NA	NA	No; not detected
Arsenic	150	148	1/7	10 - 10	3.6 - 3.6	0.02	No; HQ<1
Barium	220	220	7/7	200 - 200	53 - 61.8	0.28	No; HQ<1
Beryllium	47.8	3.6	7/7	5 - 5	0.66 - 0.78	0.02	No; HQ<1
Cadmium	4.6	0.15	0/7	2 - 2	NA - NA	NA	No; not detected
Chromium	157	42	0/7	5 - 5	NA - NA	NA	No; not detected
Chromium, hexavalent	-	11	0/2	20 - 20	NA - NA	NA	No; not detected
Cobalt	24	24	2/7	7 - 7	1.1 - 1.2	0.05	No; HQ<1
Copper	20	1.58	7/7	25 - 25	5.4 - 6.7	0.34	No; HQ<1
Cyanide	12	5.2	0/7	10 - 10	NA - NA	NA	No; not detected

TABLE 15.4
COMPARISON OF SURFACE WATER DATA TO OHIO OMZA AND REGION 5 ESLs
Rohm and Haas Chemicals LLC
Reading, Ohio

	Ohio OMZA	Region 5 ESL	Frequency of Detection	Range of Detection Limits	Range of Detected Concentrations	HQ[1]	Retained as COPEC?
Lead	16.3	1.17	0/7	3 - 3	NA - NA	NA	No; not detected
Mercury	0.77	1.30E-03	5/7	0.2 - 0.2	0.04 - 0.094	0.12	No; HQ<1
Nickel	113	28.9	0/7	40 - 40	NA - NA	NA	No; not detected
Selenium	4.6	5	0/7	5 - 5	NA - NA	NA	No; not detected
Silver	-	0.12	0/7	5 - 5	NA - NA	NA	No; not detected
Thallium	17	10	1/7	10 - 10	6.8 - 6.8	0.40	No; HQ<1
Tin	180	180	0/7	100 - 100	NA - NA	NA	No; not detected
Vanadium	44	12	0/7	7 - 7	NA - NA	NA	No; not detected
Zinc	257	65.7	7/7	20 - 20	14.5 - 23.1	0.09	No; HQ<1

OMZA - Ohio Outside the Mixing Zone Average, from Ohio EPA, 2004, Region 5 ESLs from USEPA, 2003.
[1] HQ is calculated by dividing the maximum detected concentration by the Ohio OMZA or the Region 5 ESL if OMZA value unavailable.
Benchmarks assume a hardness of 100 mg/L CaCO.
Criteria for metals are for dissolved fraction since the surface water analytical results are for the dissolved fraction.
Inorganic OMZA values based on an average hardness of 250 mg/L as measured at two locations near the site by the OEPA in 1992.
NE - Not Established
NA - Not Applicable
Note: The maximum surface water concentrations are for detections within Mill Creek only. It does not include any seep data or groundwater input to surface water.

TABLE 16
ESTIMATED SURFACE WATER CONCENTRATIONS COMPARED TO OHIO SURFACE WATER CRITERIA AND REGION 5 ESLs
Rohm and Haas Chemicals LLC
Reading, Ohio

	OMZA	Region 5 ESL	MAX Detected - All Wells	Location	Estimated Concentration in Surface Water	Calculated HQ for Estimated Maximum Concentration in Surface Water - All Wells	MAX Detected - Downgradient Wells	Location	Estimated Concentration in Surface Water	Calculated HQ for Estimated Maximum Concentration in Surface Water - Downgradient Wells
Volatile Organic Compounds (ug/l)										
Carbon disulfide	15	15	180	UAW13-20	1.36	0.09	7.1	UAW07-20	0.05	0.004
Chlorobenzene	47	47	2500	MW-EPA-1	18.88	0.40	2500	MW-EPA-1	18.88	0.40
Isopropylbenzene	4.8	-	8.9	UAW07-20	0.07	0.01	8.9	UAW07-20	0.07	0.01
Tetrachloroethene	53	45	75	MW-EPA-2	0.57	0.01	ND	NA	NA	NA
Toluene	62	253	11000	UAW04-20	83.08	**1.34**	ND	NA	NA	NA
Xylenes (total)	27	27	270	UAW08-20	2.04	0.08	130	MW-EPA-1	0.98	0.04
Semivolatile Organic Compounds (ug/l)										
1,1'-Biphenyl	6.5	-	60	UAW07-20	0.06	0.01	60	UAW07-20	0.06	0.01
1,2-Dichlorobenzene	23	14	1100	MW-EPA-1, UAW12-20	1.05	0.05	1100	MW-EPA-1	1.05	0.05
1,3-Dichlorobenzene	22	38	35	MW-EPA-1, UAW12-20	0.03	0.002	35	MW-EPA-1	0.03	0.002
1,4-Dichlorobenzene	9.4	9.4	250	MW-EPA-1	0.24	0.03	250	MW-EPA-1	0.24	0.03
Aniline	4.1	4.1	5900	UAW08-20	5.61	**1.37**	28	MW-EPA-1	0.03	0.01
bis(2-ethylhexyl)phthalate	8.4	0.3	29	UAW11-10	0.03	0.003	3.2	UAW02-20	0.00	0.0004
Pesticide/PCBs (ug/l)										
4,4'-DDE	-	4.51E-09	0.3	UAW12-20	2.85E-04	**6.33E+04**	0.052	MW-EPA-1	4.95E-05	**1.10E+04**
4,4'-DDT	-	1.10E-05	0.036	UAW12-20	3.42E-05	**3.11**	ND	NA	NA	NA
Aldrin	-	1.70E-02	0.076	MW-EPA-1	7.23E-05	0.004	0.076	MW-EPA-1	7.23E-05	0.004
alpha-Chlordane	-	4.30E-03	0.039	UAW18-20	3.71E-05	0.01	ND	NA	NA	NA
Chlordane	-	4.30E-03	0.37	UAW07-20	3.52E-04	0.08	0.37	UAW07-20	3.52E-04	0.08
Dieldrin	0.056	7.10E-05	0.27	UAW12-20	2.57E-04	0.005	0.24	UAW03-20	2.28E-04	0.004
Endosulfan I	-	5.60E-02	0.094	UAW15-20	8.94E-05	0.002	ND	NA	NA	NA
Endosulfan II	-	5.60E-02	0.27	MW-EPA-1	2.57E-04	0.005	0.27	MW-EPA-1	2.57E-04	0.005
Endrin	0.036	3.60E-02	0.15	UAW04-20	1.43E-04	0.004	0.14	UAW07-20	1.33E-04	0.004
Endrin aldehyde	-	1.50E-01	6.9	UAW15-50	6.56E-03	0.04	0.075	UAW05-20	7.13E-05	0.0005
gamma-BHC	0.057	2.60E-02	0.47	UAW08-20	4.47E-04	0.01	0.04	MW-EPA-1	3.80E-05	0.001
Heptachlor	-	3.80E-03	0.27	UAW12-20	2.57E-04	0.07	0.22	UAW03-20 dup	2.09E-04	0.06
Heptachlor epoxide	-	3.80E-03	0.97	UAW10-50	9.22E-04	0.24	0.37	UAW05-20	3.52E-04	0.09
Toxaphene	-	1.40E-04	1	UAW18-20	9.51E-04	**6.79**	ND	NA	NA	NA
Inorganic Compounds (ug/l)										
Aluminum	-	80	4240	MW-EPA-3	125.28	**1.57**	365	MW-EPA-1	10.78	0.13
Arsenic	150	148	215	MW-EPA-1	6.35	0.04	215	MW-EPA-1	6.35	0.04
Barium	220	220	759	UAW18-20	22.43	0.10	228	UAW25-20	6.74	0.03
Cadmium	5.1	0.15	2.7	UAW08-20	0.08	0.02	0.5	UAW03-20	0.01	0.00
Chromium	183	42	172	UAW21-30	5.08	0.03	20.3	UAW01-30	0.60	0.00
Copper	20.4	1.58	19.5	UAW21-30	0.58	0.03	4.8	UAW25-20	0.14	0.01
Iron	-	1000	12500	UAW10-80	369.34	0.37	7380	UAW25-20	218.06	0.22
Manganese	-	120	11800	UAW22-20	348.66	**2.91**	1670	UAW25-20	49.34	0.41
Nickel	113	28.9	518	UAW21-30	15.31	0.14	181	UAW01-30	5.35	0.05
Selenium	4.6	5	15.1	UAW23-20	0.45	0.10	ND	NA	NA	NA
Tin	180	180	5740	UAW08020	169.60	0.94	1340	MW-EPA-1	39.59	0.22

TABLE 16
ESTIMATED SURFACE WATER CONCENTRATIONS COMPARED TO OHIO SURFACE WATER CRITERIA AND REGION 5 ESLs
Rohm and Haas Chemicals LLC
Reading, Ohio

	OMZA	Region 5 ESL	MAX Detected - All Wells	Location	Estimated Concentration in Surface Water	Calculated HQ for Estimated Maximum Concentration in Surface Water - All Wells	MAX Detected - Downgradient Wells	Location	Estimated Concentration in Surface Water	Calculated HQ for Estimated Maximum Concentration in Surface Water - Downgradient Wells

OMZA - Ohio Outside the Mixing Zone Average, from Ohio EPA, July 27, 2005.
ID - Insufficient data to develop a value.
"-" - None established
ND - Not detected
NA - Not applicable
Estimated concentration in surface water calculated according to the following equation: Csw = Cgw x Qgw / (Qgw + Qsw) where:
Cgw - maximum detected concentration in groundwater (ug/L)
Qgw - calculated groundwater flux (ft^3/day)
Qgw = 3,222 ft^3/day for VOCs (from Form CA750 Environmental Indicators Report, USEPA, 2003b)
Qgw = 403 ft^3/day for SVOCs and pesticides (from Form CA750 Environmental Indicators Report, USEPA, 2003b)
Qgw = 12,890 ft^3/day for metals (from Form CA750 Environmental Indicators Report, USEPA, 2003b)
Qsw - $7Q_{10}$ flow for Mill Creek (4.9 cfs multiplied by 86,400 seconds/day) (OEPA, 2004a)
HQ calculated by dividing the maximum detected concentration by the OMZA concentration. If OMZA concentration not available, then the HQ is calculated by dividing the maximum detected concentration by the Region 5 ESL.
Downgradient wells include UAW03-20, UAW05-20, UAW07-20, MW-EPA-1, UAW01-30, UAW02-20, UAW02-40 and UAW25-20.
Criteria for metals are for the total fraction since the groundwater analytical results are for the total fraction.
All values based on an average hardness of 250 mg/L as measured by the OEPA at two locations near the site in 1992.
- Estimated surface water concentration exceeds OMZA or ESL

TABLE 17
COMPARISON OF MILL CREEK BED SEDIMENT DATA TO REGION 5 ESLs AND OHIO SRVs
Rohm and Haas Chemicals LLC
Reading, Ohio

	Region 5 ESL[1]	Ohio SRV[2]	Frequency of Detection	Range of Detection Limits	Range of Detected Concentrations	HQ[3]	Retained as a COPEC?
Volatile Organic Compounds (mg/kg)							
1,1-Dichloroethane	0.000575	-	0/16	0.0054 - 0.0066	NA - NA	NA	No; not detected
1,1,1-Trichloroethane	0.213	-	0/7	0.0054 - 0.0079	NA - NA	NA	No; not detected
1,1,1,2-Tetrachloroethane	NE	-	0/7	0.0054 - 0.0079	NA - NA	NA	No; not detected
1,1,2-Trichloroethane	0.518	-	0/7	0.0054 - 0.0079	NA - NA	NA	No; not detected
1,1-Dichloroethene	0.0194	-	0/7	0.0054 - 0.0079	NA - NA	NA	No; not detected
1,2-Dichloroethane	0.26	-	0/16	0.0054 - 0.0066	NA - NA	NA	No; not detected
1,2,3-Trichloropropane	NE	-	0/7	0.0054 - 0.0079	NA - NA	NA	No; not detected
1,2-Dibromo-3-Chloropropane	NE	-	0/7	0.011 - 0.016	NA - NA	NA	No; not detected
1,2-Dibromoethane	NE	-	0/7	0.0054 - 0.0079	NA - NA	NA	No; not detected
1,2-Dichloropropane	0.333	-	0/7	0.0054 - 0.0079	NA - NA	NA	No; not detected
2-Butanone	0.0424	-	2/7	0.022 - 0.031	0.0027 - 0.0035	0.08	No; HQ<1
2,2'-Oxybis(1-chloro)propane	NE	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
2-Hexanone	0.0582	-	0/7	0.022 - 0.031	NA - NA	NA	No; not detected
4-Methyl-2-pentanone	0.0251	-	0/7	0.022 - 0.031	NA - NA	NA	No; not detected
Acetone	0.0099	-	3/16	0.021 - 0.031	0.0094 - 0.012	**1.21**	Yes; HQ>1
Benzene	0.142	-	0/16	0.0054 - 0.0079	NA - NA	NA	No; not detected
bis(2-chloroethoxy) methane	NE	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
bis(2-chloroethyl) ether	3.52	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
Bromodichloromethane	NE	-	0/16	0.0054 - 0.0079	NA - NA	NA	No; not detected
Bromomethane	0.00137	-	0/7	0.0054 - 0.0079	NA - NA	NA	No; not detected
Carbon disulfide	0.0239	-	0/16	0.0054 - 0.0079	NA - NA	NA	No; not detected
Carbon tetrachloride	1.45	-	0/7	0.0054 - 0.0079	NA - NA	NA	No; not detected
CFC-11	NE	-	0/7	0.0054 - 0.0079	NA - NA	NA	No; not detected
CFC-12	NE	-	0/16	0.0054 - 0.0079	NA - NA	NA	No; not detected
Chlorobenzene	0.291	-	3/16	0.0054 - 0.0079	0.0011 - 0.0046	0.02	No; HQ<1
Chloroethane	NE	-	0/16	0.0054 - 0.013	NA - NA	NA	No; not detected
Chloroform	0.121	-	0/16	0.0054 - 0.0079	NA - NA	NA	No; not detected
Chloromethane	NE	-	0/7	0.0054 - 0.0079	NA - NA	NA	No; not detected
cis-1,2-Dichloroethene	0.654	-	0/7	0.0027 - 0.0039	NA - NA	NA	No; not detected
cis-1,3-Dichloropropene	NE	-	0/7	0.0054 - 0.0079	NA - NA	NA	No; not detected

TABLE 17
COMPARISON OF MILL CREEK BED SEDIMENT DATA TO REGION 5 ESLs AND OHIO SRVs
Rohm and Haas Chemicals LLC
Reading, Ohio

	Region 5 ESL[1]	Ohio SRV[2]	Frequency of Detection	Range of Detection Limits	Range of Detected Concentrations	HQ[3]	Retained as a COPEC?
Dibromochloromethane	NE	-	0/7	0.0054 - 0.0079	NA - NA	NA	No; not detected
Dibromomethane	NE	-	0/7	0.0054 - 0.0079	NA - NA	NA	No; not detected
Dichloromethane	0.159	-	3/16	0.0054 - 0.0079	0.0037 - 0.0052	0.03	No; HQ<1
Ethylbenzene	0.175	-	0/16	0.0054 - 0.0079	NA - NA	NA	No; not detected
Hexachloro-1,3-butadiene	0.0265	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
Hexachlorobenzene	0.02	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
Hexachlorocyclopentadiene	0.901	-	0/7	1.8 - 9.3	NA - NA	NA	No; not detected
Hexachloroethane	0.584	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
Hexachloropropene	NE	-	0/7	3.6 - 19	NA - NA	NA	No; not detected
Iodomethane	NE	-	0/7	0.0054 - 0.0079	NA - NA	NA	No; not detected
Isosafrole	NE	-	0/7	0.72 - 3.8	NA - NA	NA	No; not detected
Kepone	0.00331	-	0/7	0.072 - 2.1	NA - NA	NA	No; not detected
Methylcyclohexane	1.22	-	0/9	0.011 - 0.013	NA - NA	NA	No; not detected
Styrene	0.254	-	0/7	0.0054 - 0.0079	NA - NA	NA	No; not detected
Tetrachloroethene	0.99	-	0/7	0.0054 - 0.0079	NA - NA	NA	No; not detected
Toluene	1.22	-	0/16	0.0054 - 0.0079	NA - NA	NA	No; not detected
trans-1,2-Dichloroethene	0.654	-	0/7	0.0027 - 0.0039	NA - NA	NA	No; not detected
trans-1,3-Dichloropropene	NE	-	0/7	0.0054 - 0.0079	NA - NA	NA	No; not detected
trans-1,4-Dichlorobutene	NE	-	0/7	0.0054 - 0.0079	NA - NA	NA	No; not detected
Tribromomethane	NE	-	0/7	0.0054 - 0.0079	NA - NA	NA	No; not detected
Trichloroethene	0.112	-	0/7	0.0054 - 5.7	NA - NA	NA	No; not detected
Vinyl acetate	0.013	-	0/7	0.011 - 0.016	NA - NA	NA	No; not detected
Vinyl chloride	0.202	-	0/7	0.0054 - 0.0079	NA - NA	NA	No; not detected
Xylenes (total)	0.433	-	0/16	0.011 - 0.016	NA - NA	NA	No; not detected
Semivolatile Organic Compounds (mg/kg)							
1,2-Dichlorobenzene	0.294	-	1/16	0.36 - 1.9	0.16 - 0.16	0.54	No; HQ<1
1,4-Dichlorobenzene	0.318	-	0/16	0.36 - 1.9	NA - NA	NA	No; not detected
1,2,4,5-Tetrachlorobenzene	1.252	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
1,2,4-Trichlorobenzene	5.062	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
1,3,5-Trinitrobenzene	NE	-	0/7	1.8 - 9.3	NA - NA	NA	No; not detected
1,4-Dioxane	0.119	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected

TABLE 17
COMPARISON OF MILL CREEK BED SEDIMENT DATA TO REGION 5 ESLs AND OHIO SRVs
Rohm and Haas Chemicals LLC
Reading, Ohio

	Region 5 ESL[1]	Ohio SRV[2]	Frequency of Detection	Range of Detection Limits	Range of Detected Concentrations	HQ[3]	Retained as a COPEC?
1,4-Naphthoquinone	NE	-	0/7	1.8 - 9.3	NA - NA	NA	No; not detected
1-Naphthylamine	NE	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
2-Acetylaminofluorene	0.0153	-	0/7	3.6 - 19	NA - NA	NA	No; not detected
2-Aminonaphthalene	NE	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
2-Chlor-1,3-Butadiene	NE	-	0/7	0.0054 - 0.0079	NA - NA	NA	No; not detected
2-Chloronaphthalene	0.417	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
2-Chlorophenol	0.0319	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
2-Methyl-1-Propanol	NE	-	0/7	0.22 - 0.31	NA - NA	NA	No; not detected
2-Methylnaphthalene	0.0202	-	1/7	0.36 - 0.47	0.25 - 0.25	**12.38**	Yes; HQ>1
2-Methylphenol	0.0554	-	0/16	0.36 - 1.9	NA - NA	NA	No; not detected
2-Nitroaniline	NE	-	0/7	1.8 - 9.3	NA - NA	NA	No; not detected
2-Nitrophenol	NE	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
2-Picoline	NE	-	0/7	0.72 - 3.8	NA - NA	NA	No; not detected
2,4-Dichlorophenol	NE	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
2,4-Dimethylphenol	0.304	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
2,4-Dinitrophenol	0.00621	-	0/7	1.8 - 9.3	NA - NA	NA	No; not detected
2,4-Dinitrotoluene	0.0144	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
2,4,5-Trichlorophenol	NE	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
2,4,6-Trichlorophenol	0.208	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
2,6-Dichlorophenol	NE	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
2,6-Dinitrotoluene	0.0398	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
3-Methylchloranthrene	8190	-	0/7	0.72 - 3.8	NA - NA	NA	No; not detected
3-Methylphenol	0.0524	-	1/7	0.36 - 1.9	0.24 - 0.24	**4.58**	Yes; HQ>1
3-Nitroaniline	NE	-	0/7	1.8 - 9.3	NA - NA	NA	No; not detected
3,3'-Dichlorobenzidine	0.127	-	0/7	1.8 - 9.3	NA - NA	NA	No; not detected
3,3'-Dimethylbenzidine	NE	-	0/7	1.8 - 9.3	NA - NA	NA	No; not detected
3,5,5-Trimethyl-2-cyclohexene-1-one	NE	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
4-Aminobiphenyl	NE	-	0/7	1.8 - 9.3	NA - NA	NA	No; not detected
4-Bromophenyl phenyl ether	1.55	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
4-Chloro-3-methylphenol	NE	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
4-Chlorophenyl phenyl ether	NE	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
4-Dimethylaminoazobenzene	NE	-	0/7	0.72 - 3.8	NA - NA	NA	No; not detected
4-Methylphenol	0.0202	-	1/16	0.36 - 1.9	0.24 - 0.24	**11.88**	Yes; HQ>1
4-Nitrophenol	0.0133	-	0/7	1.8 - 9.3	NA - NA	NA	No; not detected

TABLE 17
COMPARISON OF MILL CREEK BED SEDIMENT DATA TO REGION 5 ESLs AND OHIO SRVs
Rohm and Haas Chemicals LLC
Reading, Ohio

	Region 5 ESL[1]	Ohio SRV[2]	Frequency of Detection	Range of Detection Limits	Range of Detected Concentrations	HQ[3]	Retained as a COPEC?
4-Nitroquinoline-N-oxide	NE	-	0/7	3.6 - 19	NA - NA	NA	No; not detected
4,6-Dinitro-2-methylphenol	NE	-	0/7	1.8 - 9.3	NA - NA	NA	No; not detected
5-Nitro-O-toluidine	NE	-	0/7	0.72 - 3.8	NA - NA	NA	No; not detected
7,12-Dimethylbenz(a)anthracene	66.4	-	0/7	0.72 - 3.8	NA - NA	NA	No; not detected
Acenaphthene	0.00671	-	1/7	0.36 - 0.47	0.25 - 0.25	**37.26**	Yes; HQ>1
Acenaphthylene	0.00587	-	1/7	0.36 - 0.47	0.3 - 0.3	**51.11**	Yes; HQ>1
Acetonitrile	0.056	-	0/7	0.11 - 0.16	NA - NA	NA	No; not detected
Acetophenone	NE	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
Acrolein	0.00000152	-	0/7	0.11 - 0.16	NA - NA	NA	No; not detected
Acrylonitrile	0.0012	-	0/7	0.11 - 0.16	NA - NA	NA	No; not detected
Allyl chloride	NE	-	0/7	0.11 - 0.16	NA - NA	NA	No; not detected
alpha, aplha Dimethylphenethylamine	NE	-	0/7	1.8 - 9.3	NA - NA	NA	No; not detected
Aniline	0.00031	-	0/16	0.36 - 1.9	NA - NA	NA	No; not detected
Anthracene	0.0572	-	5/7	0.36 - 0.39	0.033 - 1.3	**22.73**	Yes; HQ>1
Aramite	0.00111	-	0/7	0.72 - 3.8	NA - NA	NA	No; not detected
Benzaldehyde	NE	-	0/9	0.38 - 0.41	NA - NA	NA	No; not detected
Benzo(a)anthracene	0.108	-	5/7	0.36 - 0.39	0.087 - 1.4	**12.96**	Yes; HQ>1
Benzo(a)pyrene	0.15	-	5/7	0.36 - 0.39	0.1 - 1.2	**8.00**	Yes; HQ>1
Benzo(b)fluoranthene	10.4	-	7/7	0.36 - 1.9	0.027 - 1.3	0.13	No; HQ<1
Benzo(ghi)perylene	0.17	-	5/7	0.36 - 1.9	0.067 - 0.63	**3.71**	Yes; HQ>1
Benzo(k)fluoranthene	0.24	-	5/7	0.36 - 0.39	0.054 - 0.62	**2.58**	Yes; HQ>1
Benzyl alcohol	0.00104	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
Benzyl butyl phthalate	1.97	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
bis(2-ethylhexyl)phthalate	0.182	-	5/7	0.36 - 1.9	0.03 - 0.13	0.71	No; HQ<1
Chlorophenols	0.0319	-	0/7	1.8 - 9.3	NA - NA	NA	No; not detected
Chrysene	0.166	-	5/7	0.36 - 0.39	0.16 - 1.7	**10.24**	Yes; HQ>1
Dibenz(ah)anthracene	0.033	-	3/7	0.36 - 0.42	0.031 - 0.19	**5.76**	Yes; HQ>1
Dibenzofuran	0.449	-	1/7	0.36 - 0.47	0.47 - 0.47	**1.05**	Yes; HQ>1
Diethyl phthalate	0.295	-	1/7	0.36 - 1.9	0.04 - 0.04	0.14	No; HQ<1
Dimethyl phthalate	NE	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
Di-n-butyl phthalate	1.114	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
Di-n-octyl phthalate	40.6	-	1/7	0.36 - 1.9	0.022 - 0.022	0.00	No; HQ<1
Diphenylamine	0.0346	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
Ethyl methacrylate	NE	-	0/7	0.0054 - 0.0079	NA - NA	NA	No; not detected

TABLE 17
COMPARISON OF MILL CREEK BED SEDIMENT DATA TO REGION 5 ESLs AND OHIO SRVs
Rohm and Haas Chemicals LLC
Reading, Ohio

	Region 5 ESL[1]	Ohio SRV[2]	Frequency of Detection	Range of Detection Limits	Range of Detected Concentrations	HQ[3]	Retained as a COPEC?
Ethyl methanesulfonate	NE	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
Fluoranthene	0.423	-	7/7	NA - NA	0.027 - 4.6	**10.87**	Yes; HQ>1
Fluorene	0.0774	-	1/7	0.36 - 0.47	0.9 - 0.9	**11.63**	Yes; HQ>1
Indeno(123-cd)pyrene	0.2	-	5/7	0.36 - 0.39	0.06 - 0.58	**2.90**	Yes; HQ>1
m-Dinitrobenzene	0.00861	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
N-Methyl-N-nitroso-methanamine	NE	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
Methyl methacrylate	0.168	-	0/7	0.0054 - 0.0079	NA - NA	NA	No; not detected
Methyl methanesulfonate	NE	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
Methylpyrilene	NE	-	0/7	1.8 - 9.3	NA - NA	NA	No; not detected
Methylacrylonitrile	NE	-	0/7	0.0054 - 0.0079	NA - NA	NA	No; not detected
Naphthalene	0.176	-	1/7	0.36 - 0.47	0.7 - 0.7	**3.98**	Yes; HQ>1
Nitrobenzene	0.145	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
Nitrosomethylethylamine	NE	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
N-Nitrosodiethylamine	0.0228	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
N-Nitrosodi-N-butylamine	NE	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
N-Nitrosodi-N-propylamine	NE	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
N-Nitrosodiphenylamine	NE	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
N-Nitrosomorpholine	NE	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
N-Nitrosopiperidine	NE	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
N-Nitrosopyrrolidine	NE	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
o-Dinitrobenzene	0.00861	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
o-Toluidine	NE	-	0/7	0.72 - 3.8	NA - NA	NA	No; not detected
o,o,o-Triethyl phosphorothioate	0.189	-	0/7	1.8 - 9.3	NA - NA	NA	No; not detected
o,o-Diethyl o-pyrazinyl phosphothioate	NE	-	0/7	1.8 - 9.3	NA - NA	NA	No; not detected
p-Chloroaniline	0.146	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
Pentachlorobenzene	0.024	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
Pentachlorophenol	23	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
Phenacetin	NE	-	0/7	0.72 - 3.8	NA - NA	NA	No; not detected
Phenanthrene	0.204	-	5/7	0.36 - 0.39	0.2 - 4.8	**23.53**	Yes; HQ>1
Phenol	0.0491	-	0/7	0.36 - 1.9	NA - NA	NA	No; not detected
p-Nitroaniline	NE	-	0/7	1.8 - 9.3	NA - NA	NA	No; not detected
p-Phenylenediamine	NE	-	0/7	3.6 - 19	NA - NA	NA	No; not detected
Propane nitrile	NE	-	0/7	0.022 - 0.031	NA - NA	NA	No; not detected
Pyrene	0.195	-	7/7	0.36 - 1.9	0.021 - 3.1	**15.90**	Yes; HQ>1

TABLE 17
COMPARISON OF MILL CREEK BED SEDIMENT DATA TO REGION 5 ESLs AND OHIO SRVs
Rohm and Haas Chemicals LLC
Reading, Ohio

	Region 5 ESL[1]	Ohio SRV[2]	Frequency of Detection	Range of Detection Limits	Range of Detected Concentrations	HQ[3]	Retained as a COPEC?
Pyridine	0.106	-	0/7	0.72 - 3.8	NA - NA	NA	No; not detected
Safrole	NE	-	0/7	0.72 - 3.8	NA - NA	NA	No; not detected
Pesticides/PCBs (mg/kg)							
4,4'-DDD	0.00488	-	0/16	0.002 - 0.11	NA - NA	NA	No; not detected
4,4'-DDE	0.00316	-	5/16	0.002 - 0.11	0.00091 - 0.0018	0.57	No; HQ<1
4,4'-DDT	0.00416	-	1/16	0.002 - 0.11	0.0056 - 0.0056	**1.35**	Yes; HQ>1
Aldrin	0.002	-	1/16	0.002 - 0.11	0.001 - 0.001	0.50	No; HQ<1
alpha-BHC	0.006	-	0/16	0.002 - 0.11	NA - NA	NA	No; not detected
beta-BHC	0.005	-	3/16	0.002 - 0.11	0.0046 - 0.01	**2.00**	Yes; HQ>1
delta-BHC	0.005	-	0/16	0.002 - 0.11	NA - NA	NA	No; not detected
gamma-BHC (Lindane)	0.00237	-	0/7	0.0037 - 0.11	NA - NA	NA	No; not detected
Camphechlor	NE	-	0/7	0.15 - 4.2	NA - NA	NA	No; not detected
Chlordane	0.00324	-	0/7	0.037 - 1.1	NA - NA	NA	No; not detected
alpha-Chlordane	0.00324	-	0/9	0.002 - 0.0043	NA - NA	NA	No; not detected
Chlorobenzilate	0.86	-	2/7	0.037 - 0.21	0.0087 - 0.024	0.03	No; HQ<1
Cygon	NE	-	0/7	0.72 - 3.8	NA - NA	NA	No; not detected
Diallate	0.452	-	2/7	0.072 - 2.1	0.029 - 0.032	0.07	No; HQ<1
Dieldrin	0.0019	-	4/16	0.002 - 0.11	0.002 - 0.024	**12.63**	Yes; HQ>1
Disulfoton	0.324	-	0/7	1.8 - 9.3	NA - NA	NA	No; not detected
Endosulfan I	0.00326	-	0/16	0.002 - 0.11	NA - NA	NA	No; not detected
Endosulfan II	0.00194	-	0/16	0.002 - 0.11	NA - NA	NA	No; not detected
Endosulfan sulfate	0.0346	-	0/7	0.0037 - 0.021	NA - NA	NA	No; not detected
Endrin	0.00222	-	0/16	0.002 - 0.11	NA - NA	NA	No; not detected
Endrin aldehyde	0.48	-	0/16	0.002 - 0.11	NA - NA	NA	No; not detected
Endrin ketone	0.00222	-	1/9	0.002 - 0.022	0.0014 - 0.0014	0.63	No; HQ<1
Famphur	NE	-	0/7	3.6 - 19	NA - NA	NA	No; not detected
Heptachlor	0.0006	-	0/16	0.002 - 0.11	NA - NA	NA	No; not detected
Heptachlor epoxide	0.00247	-	0/16	0.002 - 0.11	NA - NA	NA	No; not detected
Isodrin	0.0552	-	0/16	0.0038 - 0.21	NA - NA	NA	No; not detected
Methoxychlor	0.0136	-	3/7	0.0072 - 0.21	0.0034 - 0.0056	0.41	No; HQ<1
Pentachloronitrobenzene	NE	-	0/7	1.8 - 9.3	NA - NA	NA	No; not detected
Phorate	0.000861	-	0/7	1.8 - 9.3	NA - NA	NA	No; not detected
Propyzamide	NE	-	0/7	0.72 - 3.8	NA - NA	NA	No; not detected

TABLE 17
COMPARISON OF MILL CREEK BED SEDIMENT DATA TO REGION 5 ESLs AND OHIO SRVs
Rohm and Haas Chemicals LLC
Reading, Ohio

	Region 5 ESL[1]	Ohio SRV[2]	Frequency of Detection	Range of Detection Limits	Range of Detected Concentrations	HQ[3]	Retained as a COPEC?
Vanadium	2	40	16/16	5.5 - 7.1	5.9 - 11.7	0.2925	No; HQ<1
Zinc	121	100	16/16	2.2 - 2.8	16.4 - 50.6	0.42	No; HQ<1

[1] The following compounds did not have Region 5 ESLs; therefore the following surrogate/alternate screening benchmarks were used:

Methylcyclohexane - toluene used as a surrogate
Carbazole - diphenyl amine used as a surrogate
Dibenzofuran - Washington State NEL Sediment Screening Benchmark used as a surrogate
Diallate - Region 5 Residential Soil ESL used as a surrogate
Endrin ketone - endrin used as a surrogate
Aluminum - ARCS PEL used as a surrogate
Barium - Eco SSL for soil invertebrates used as a surrogate
Beryllium - Eco SSL for soil invertebrates used as a surrogate
Iron - Region 4 Soil Screening Benchmark used as a surrogate
Manganese - Region 4 Soil Screening Benchmark used as a surrogate
Selenium - Region 3 BTAG Screening Benchmark used as a surrogate
Thallium - Region 4 Soil Screening Benchmark used as a surrogate
Tin - Region 4 Soil Screening Benchmark used as a surrogate
Vanadium - Region 4 Soil Screening Benchmark used as a surrogate

[2] Ohio Sediment Refernce Values (SRVs) are from OEPA, 2003, for the Interior Plateau region. Ohio SRVs are only available for inorganic compounds.

[3] HQ is calculated by dividing the maximum detected concentration by the Region 5 ESL. For inorganic compounds that also have a SRV that is higher than the Region 5 ESL, then the HQ is calculated by dividing the maximum detected concentration by the SRV.

NE - Not Established
NA - Not Applicable

- Maximum detected concentration exceeds OMZA and SRV.

TABLE 17
COMPARISON OF MILL CREEK BED SEDIMENT DATA TO REGION 5 ESLs AND OHIO SRVs
Rohm and Haas Chemicals LLC
Reading, Ohio

	Region 5 ESL[1]	Ohio SRV[2]	Frequency of Detection	Range of Detection Limits	Range of Detected Concentrations	HQ[3]	Retained as a COPEC?
Sulfotep (TEDP)	0.56	-	0/7	1.8 - 9.3	NA - NA	NA	No; not detected
Aroclor-1016	0.0598	-	0/7	0.036 - 0.047	NA - NA	NA	No; not detected
Aroclor-1221	0.0598	-	0/7	0.036 - 0.047	NA - NA	NA	No; not detected
Aroclor-1232	0.0598	-	0/7	0.036 - 0.047	NA - NA	NA	No; not detected
Aroclor-1242	0.0598	-	0/7	0.036 - 0.047	NA - NA	NA	No; not detected
Aroclor-1248	0.0598	-	4/7	0.038 - 0.047	0.015 - 0.07	**1.17**	Yes; HQ>1
Aroclor-1254	0.0598	-	1/7	0.036 - 0.047	0.1 - 0.1	**1.67**	Yes; HQ>1
Aroclor-1260	0.0598	-	0/7	0.036 - 0.047	NA - NA	NA	No; not detected
Inorganic Compounds (mg/kg)							
Aluminum	58000	28000	9/9	23.1 - 25.1	1690 - 2720	0.05	No; HQ<1
Antimony	NE	NA	0/16	1.1 - 1.4	NA - NA	NA	No; not detected
Arsenic	9.79	11	16/16	1.1 - 1.4	2.8 - 6	0.61	No; HQ<1
Barium	330	170	16/16	21.9 - 28.3	8.9 - 42.6	0.13	No; HQ<1
Beryllium	40	0.8	16/16	0.55 - 0.63	0.069 - 0.25	0.01	No; HQ<1
Cadmium	0.99	0.3	16/16	0.22 - 0.28	0.11 - 0.41	0.41	No; HQ<1
Calcium	NE	94000	9/9	615 - 3130	70000 - 178000	-	No; essential nutrient
Chromium	43.4	30	16/16	0.55 - 0.71	4 - 14.2	0.33	No; HQ<1
Chromium, hexavalent	NE	NA	0/3	0.88 - 1	NA - NA	NA	No; not detected
Cobalt	50	12	16/16	5.8 - 7.1	2.4 - 5.5	0.11	No; HQ<1
Copper	31.6	25	16/16	2.7 - 3.5	4.2 - 10.8	0.34	No; HQ<1
Iron	200	31000	9/9	11.5 - 12.5	6220 - 10800	0.3484	No; HQ<1
Lead	35.8	47	16/16	0.33 - 0.42	4 - 22.8	0.4851	No; HQ<1
Magnesium	NE	20000	9/9	576 - 627	17200 - 64400	-	No; essential nutrient
Manganese	100	1400	9/9	1.7 - 1.9	245 - 670	0.4786	No; HQ<1
Mercury	0.174	0.12	12/16	0.11 - 0.14	0.01 - 0.033	0.19	No; HQ<1
Nickel	22.7	33	16/16	4.4 - 5.7	4.7 - 12.1	0.53	No; HQ<1
Potassium	NE	5900	9/9	576 - 627	228 - 461	-	No; essential nutrient
Selenium	2	1.6	0/16	0.55 - 0.71	NA - NA	NA	No; not detected
Silver	0.5	0.43	1/7	0.55 - 0.63	0.2 - 0.2	0.40	No; HQ<1
Sodium	NE	NA	9/9	576 - 627	134 - 258	-	No; essential nutrient
Thallium	1	4.7	11/16	1.1 - 1.4	0.57 - 2.2	0.4681	No; HQ<1
Tin	53	NA	16/16	11 - 14.1	2.7 - 9.8	0.18	No; HQ<1

TABLE 18
COMPARISON OF SEEP DATA TO OHIO OMZA AND REGION 5 ESLs
Rohm and Haas Chemicals LLC
Reading, Ohio

	Ohio OMZA	Region 5 ESL	Ohio OMZM	Ohio IMZM	Frequency of Detection	Range of Detection Limits	Range of Detected Concentrations	HQ(1)	Retained as COPEC?
Volatile Organic Compounds (ug/l)									
1,1-Dichloroethane	ID	47	ID	ID	2/2	NA - NA	0.55 - 1	0.02	No; HQ<1
1,2-Dichloroethane	2000	910	9600	19000	0/2	1 - 1.8	NA - NA	NA	No; not detected
Acetone	-	1700	-	-	2/2	10 - 18	2.1 - 3.1	0.00	No; HQ<1
Benzene	160	114	700	1400	2/2	1 - 1.8	0.92 - 1.1	0.01	No; HQ<1
Bromodichloromethane	ID	NE	ID	ID	0/2	1 - 1.8	NA - NA	NA	No; not detected
Carbon disulfide	15	15	130	260	2/2	1 - 1.8	0.97 - 1.1	0.07	No; HQ<1
CFC-12	-	NE	-	-	0/2	1 - 1.8	NA - NA	NA	No; not detected
Chlorobenzene	47	47	420	850	2/2	1 - 1.8	11 - 24	0.51	No; HQ<1
Chloroethane	-	NE	-	-	0/2	2 - 3.6	NA - NA	NA	No; not detected
Chloroform	140	140	1300	2600	0/2	1 - 1.8	NA - NA	NA	No; not detected
Ethylbenzene	61	14	550	1100	1/2	1 - 1.8	0.39 - 0.39	0.01	No; HQ<1
Methylcyclohexane	-	253	-	-	2/2	NA - NA	0.3 - 0.49	0.00	No; HQ<1
Methylene chloride	1900	940	11000	22000	0/2	1 - 1.8	NA - NA	NA	No; not detected
Toluene	62	253	560	1100	2/2	1 - 1	0.45 - 0.55	0.01	No; HQ<1
Xylenes (total)	27	27	240	480	1/2	1 - 1.8	1.7 - 1.7	0.06	No; HQ<1
Semivolatile Organic Compounds (ug/l)									
1,2-Dichlorobenzene	23	14	96	190	2/2	10 - 10	14 - 21	0.91	No; HQ<1
1,4-Dichlorobenzene	9.4	9.4	57	110	2/2	10 - 10	1.7 - 2.6	0.28	No; HQ<1
2-Methylphenol	67	67	600	1200	0/2	10 - 10	NA - NA	NA	No; not detected
4-Methylphenol	53	25	480	960	0/2	10 - 10	NA - NA	NA	No; not detected
Aniline	4.1	4.1	30	59	0/2	10 - 10	NA - NA	NA	No; not detected
Benzaldehyde	-	NE	-	-	0/2	10 - 10	NA - NA	NA	No; not detected
Pesticide/PCBs (ug/l)									
4,4'-DDD	-	0.00488	-	-	0/2	0.05 - 0.05	NA - NA	NA	No; not detected
4,4'-DDE	-	0.00316	-	-	1/2	0.05 - 0.05	0.025 - 0.025	**7.91**	Yes; HQ>1
4,4'-DDT	-	0.00416	-	-	1/2	0.05 - 0.05	0.028 - 0.028	**6.73**	Yes; HQ>1
Aldrin	-	1.70E-02	-	-	0/2	0.05 - 0.05	NA - NA	NA	No; not detected
alpha-BHC	-	1.24E+01	-	-	0/2	0.05 - 0.05	NA - NA	NA	No; not detected
alpha-Chlordane	-	4.30E-03	-	-	1/2	0.05 - 0.05	0.02 - 0.02	**4.65**	Yes; HQ>1
beta-BHC	-	4.95E-01	-	-	2/2	0.05 - 0.05	0.042 - 0.056	0.11	No; HQ<1
delta-BHC	-	6.67E+02	-	-	0/2	0.05 - 0.05	NA - NA	NA	No; not detected
Dieldrin	0.056	7.10E-05	2.40E-01	4.70E-01	1/2	0.05 - 0.05	0.053 - 0.053	0.9	No; HQ<1
Endosulfan I	-	5.60E-02	-	-	1/2	0.05 - 0.05	0.03 - 0.03	0.54	No; HQ<1
Endosulfan II	-	5.60E-02	-	-	1/2	0.05 - 0.05	0.046 - 0.046	0.82	No; HQ<1
Endrin	0.036	3.60E-02	8.60E-02	1.70E-01	0/2	0.05 - 0.05	NA - NA	NA	No; not detected
Endrin aldehyde	-	1.50E-01	-	-	0/2	0.05 - 0.05	NA - NA	NA	No; not detected
Endrin ketone	-	NE	-	-	0/2	0.05 - 0.05	NA - NA	NA	No; not detected

TABLE 18
COMPARISON OF SEEP DATA TO OHIO OMZA AND REGION 5 ESLs
Rohm and Haas Chemicals LLC
Reading, Ohio

	Ohio OMZA	Region 5 ESL	Ohio OMZM	Ohio IMZM	Frequency of Detection	Range of Detection Limits	Range of Detected Concentrations	HQ[1]	Retained as COPEC?
Heptachlor	-	3.80E-03	-	-	0/2	0.05 - 0.05	NA - NA	NA	No; not detected
Heptachlor epoxide	-	3.80E-03	-	-	1/2	0.05 - 0.05	0.033 - 0.033	**8.68**	Yes; HQ>1
Isodrin	-	3.09E-02	-	-	1/2	0.1 - 0.1	0.005 - 0.005	0.16	No; HQ<1
Inorganic Compounds (ug/l)									
Aluminum	-	80	-	-	2/2	NA - NA	14300 - 48300	**604**	Yes; HQ>1
Antimony	190	80	900	1800	0/2	10 - 10	NA - NA	NA	No; not detected
Arsenic	150	148	340	680	2/2	10 - 10	6.1 - 25.7	0.17	No; HQ<1
Barium	220	220	2000	4000	2/2	200 - 200	233 - 494	**2.25**	Yes; HQ>1
Beryllium	47.8	3.6	407.5	814.9	2/2	NA - NA	1.2 - 3.1	0.06	No; HQ<1
Cadmium	5.1	0.15	12.7	25.4	2/2	2 - 2	0.28 - 1.7	0.33	No; HQ<1
Calcium	-	NE	-	-	2/2	NA - NA	417000 - 430000	-	No; essential nutrient
Chromium	183	42	3819	7637	2/2	5 - 5	36.7 - 174	0.95	No; HQ<1
Cobalt	24	24	220	440	2/2	7 - 7	12.4 - 43.8	**1.83**	Yes; HQ>1
Copper	20.4	1.58	33	66	2/2	25 - 25	31.9 - 104	**5.10**	Yes; HQ>1
Cyanide	12	5.2	46	92	0/2	10 - 10	NA - NA	NA	No; not detected
Iron	-	1000	-	-	2/2	NA - NA	23800 - 90100	**90.10**	Yes; HQ>1
Lead	20.6	1.17	393	786	2/2	3 - 3	24.2 - 126	**6.12**	Yes; HQ>1
Magnesium	-	NE	-	-	2/2	NA - NA	67100 - 90100	-	No; essential nutrient
Manganese	-	120	-	-	2/2	NA - NA	2150 - 2730	**22.75**	Yes; HQ>1
Mercury	0.91	0.0013	1.7000	3.40	1/2	0.2 - 0.2	0.18 - 0.18	0.20	No; HQ<1
Nickel	113	28.9	1019	2037	2/2	40 - 40	85.9 - 214	**1.89**	Yes; HQ>1
Potassium	-	NE	-	-	2/2	NA - NA	14100 - 14200	-	No; essential nutrient
Selenium	5	5	-	-	0/2	5 - 5	NA - NA	NA	No; not detected
Silver	1.3	0.12	7.7	15.5	0/3	5 - 5	NA - NA	NA	No; not detected
Sodium	-	NE	-	-	2/2	NA - NA	361000 - 375000	-	No; essential nutrient
Thallium	17	10	79	160	0/2	10 - 10	NA - NA	NA	No; not detected
Tin	180	180	1600	3200	2/2	100 - 100	782 - 1340	**7.44**	Yes; HQ>1
Vanadium	44	12	150	300	2/2	7 - 7	33.2 - 124	**2.82**	Yes; HQ>1
Zinc	260	65.7	260	521	2/2	20 - 20	219 - 411	**1.58**	Yes; HQ>1

OMZA - Ohio Outside the Mixing Zone Average, from Ohio EPA, July 27, 2005.
OMZM - Ohio Outside the Mixing Zone Maximum, from OEPA, July 27, 2005
IMZM - Ohio Inside the Mixing Zone Maximum, from Ohio EPA, July 27, 2005.
[1] HQ is calculated by dividing the maximum detected concentration by the Ohio OMZA (if available) or the Region 5 ESL.
Criteria for metals are for the total fraction since the seep analytical results are for the total fraction.
Criteria for certain metals (beryllium, cadmium, chromium, copper, lead, nickel, silver and zinc are based on an average hardness of 250 mg/L as measured at two locations in the Mill Creek near the site by the OEPA in 1992.
NE - Not Established
NA - Not Applicable
- Maximum detected concentration exceeds OMZA or ESL

Mirtha Capiro /R5/USEPA/US
09/29/2005 03:45 PM

To "Fields, Karen" <Karen.Fields@parsons.com>
cc CCoker@rohmhaas.com, nystrom_jennifer@bah.com, rogovin_kathy@bah.com
bcc
Subject RE: Rohm and Haas Cincinnati Plant - Baseline Risk Assessment Responses to Comments

Thanks for your prompt response. We agree with your proposed schedule.

Mirtha Cápiro
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09/29/2005 03:24 PM

To Mirtha Capiro/R5/USEPA/US@EPA, nystrom_jennifer@bah.com, rogovin_kathy@bah.com
cc CCoker@rohmhaas.com

Subject RE: Rohm and Haas Cincinnati Plant - Baseline Risk Assessment Responses to Comments

As discussed during our conference call earlier today, we propose to submit our groundwater to surface water screening evaluation to you to review by Oct. 10th. Please let us know if there are any comments/concerns with this schedule. Thanks!

- Karen

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---- Forwarded by Carl J Coker/NAR/RohmHaas on 01/15/2008 10:31 AM -----

"Fields, Karen" <Karen.Fields@parsons.com>

09/23/2005 07:10 AM

To: <Capiro.Mirtha@epamail.epa.gov>, <nystrom_jennifer@bah.com>, <rogovin_kathy@bah.com>

cc: <CCoker@rohmhaas.com>, <RLantzy@rohmhaas.com>, <MHemingway@geomatrix.com>, <StevenBrown@rohmhaas.com>

Subject: Rohm and Haas Cincinnati Plant - Baseline Risk Assessment Responses to Comments

All,

Attached are the Responses to Comments on the Revised Baseline Risk Assessment for the Rohm and Haas Cincinnati Plant for your review prior to our conference call next week. Should you have any trouble opening these files, please let me know and I will re-send them or fax hard copies of the information to you. Thanks!

- Karen Fields

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RESPONSES TO AUGUST 24, 2005 COMMENTS ON THE JUNE 30, 2005 BASELINE RISK ASSESSMENT

ROHM AND HAAS CHEMICALS, LLC
READING, OHIO

October 14, 2005

I. GENERAL COMMENTS

1. Rohm and Haas Chemicals , LLC (Rohm and Haas) evaluated the site considering future industrial use of the facility. Although it is stated (page 20) that Rohm and Haas intends to retain ownership and will continue to operate as an industrial facility, the June 2005 Baseline Risk Assessment (BRA) does not indicate that the facility is considering implementing a deed restriction on the property to preclude future residential use. Per USEPA's request, the BRA does include a zoning map of the surrounding properties (Appendix F), and it is clear that the area is classified as heavy industry. However, given the potential for unknown future ownership and land use at facilities subject to corrective action, such as Rohm and Haas, the BRA should clearly indicate that, as part of the final remedy for the site, Rohm and Haas intends to implement a deed restriction as part of the final remedy for the site to limit potential future use to commercial/industrial.

   Response: *The following sentence will be added to the text to clarify that a deed restriction will be implemented as part of the final remedy for the site to ensure that future use of the site will remain industrial:*
   "Rohm and Haas intends to implement a deed restriction on the property to preclude future residential use."

2. As discussed previously with USEPA during the review of the June 2002 BRA, Rohm and Haas appropriately included all chemicals of potential concern (COPCs) and chemicals of potential ecological concern (COPECs) above relevant risk-based screening levels, and did not screen constituents based on determined background concentrations. The BRA appropriately carries all COPCs exceeding risk-based screening levels through the quantitative risk assessment, and then qualitatively discussed those COPCs with concentrations comparable to background (page 40). The Screening Ecological Risk Assessment (SERA) compares background concentrations to Region 5 Ecological Screening Levels (ESLs) in the uncertainty section to evaluate the possible contribution of background conditions to risk.

   However, the BRA did not provide a quantitative discussion of those constituents that are believed to represent background conditions but exceed screening levels. Although this was discussed previously and Rohm and Haas agreed to provide a quantitative assessment of background contribution of total site risks, Rohm and Haas provided the minimum amount of qualitative discussion necessary in Section 6.3, Uncertainty Analysis. The

BRA should be revised to present the background data and a statistical comparison to site-specific values to support the assertion that some contaminants are not the result of site activities. This comment is applicable to both the human health and the ecological risk assessment. Rohm and Haas should refer to USEPA guidance on conducting background comparisons (USEPA 2002). In addition, as requested in comments on the June 2002 SERA, Rohm and Haas should provide a more detailed discussion of background sample locations to demonstrate that appropriate locations were selected.

Response: *A statistical evaluation of the background samples was conducted by Geomatrix and was presented as Appendix E in the June 2002 Baseline Risk Assessment (copy attached). This evaluation was removed from the revised BRA since background was not used as a screening tool (i.e., no compounds were eliminated from further evaluation in the risk assessment solely as a result of a comparison to background concentrations). Since no compounds were eliminated based on comparison to background concentrations, a statistical evaluation of background samples was not needed since there are no compounds that pose a risk to human health above acceptable levels. An evaluation of the contribution of background concentrations to the estimated risk to ecological receptors was conducted since several compounds pose a potential risk to various ecological receptors. It was our understanding from our discussions during the 26 July 2005 meeting that only more detailed description of the background sample locations was necessary for inclusion in the revised BRA since USEPA agrees that certain compounds (i.e., PAHs, pesticides and PCBs) with elevated concentrations are not site-related and do not have to be addressed in the revised BRA (USEPA, 28 July, 2005). Appendix E will be included in the final BRA to support the conclusions regarding the background contribution to overall risk for the naturally occurring compounds.*

The justification for the locations of the background samples was provided in the 2002 Facility Investigation Report prepared by Geomatrix. The information presented in the 2002 RI will be referenced in the revised BRA. Specifically, the following information will be included in the text of the revised RA:

Twenty background samples were collected using DPT from ten off-site locations that could not reasonably have been affected by current or historic Rohm and Haas releases. Borings B-01 through B-05 were located south of the Rohm and Haas fenceline, including locations on recreational use portions of Rohm and Haas property. Borings B-06 through B-10 were located on the former City of Reading Municipal Well Field, north of the Rohm and Haas facility, Cincinnati Drum, and Pristine. Although efforts were made to gain access to all of the properties adjacent to the Rohm and Haas facility, access for off-property sampling could only be obtained from the City of Reading property. At each location, one soil sample was collected from shallow surface soils (<2 feet bgs) and one soil sample was collected from subsurface soils (approximately 9 to 11 feet bgs). The background samples were analyzed for CLP-TAL plus aniline, isodrin and tin.

II SPECIFIC COMMENTS

Section 2.4.3 Surface Water/Seeps, page 9

1. The BRA indicates that seep data were not used in the evaluation of human health risks because actual surface water was recently collected as part of the Supplemental Remedial Investigations. However, the locations of these seeps (e.g., creek bed, creek bank), and the potential for human exposure to them, is unclear. As requested during previous discussions with the facility, the BRA was expected to include an expanded discussion of the physical nature of the observed seeps with estimates of seep rates and approximate flows. While some of this information is presented in Section 7.2.3., a detailed discussion regarding the physical nature of the observed seeps is not presented in this report. This question should be addressed to determine whether the potential exists, either under present or future conditions, for direct human receptor exposure to contaminants in seep water. The report should be revised to address this potential exposure pathway as part of the human health risk assessment.

   Response: *The following discussion concerning the location of the seeps, physical nature of the observed seeps, and the potential for human exposure to them will be included in the next version:*

   For the Mill Creek seeps, both the physical extent (maximum of a few feet across) and the volume of water being discharged (no apparent flow) are small. These seeps were only present during portions of the year, were very localized, and were volumetrically insignificant compared to the volume of water passing them in Mill Creek. Therefore, direct human exposure to these seeps was considered an incomplete exposure pathway.

Section 4.1.2 Land and Water Use, page 17

2. Previous review comments submitted on the BRA and the Facility Investigation (FI) Work Plan (Geomatrix 2000) required that additional specific information be provided on the constituents in groundwater associated with the Rohm and Haas facility and the ability of the neighboring Pristine Superfund site remediation system to control COPCs from the Rohm and Haas facility. Previous comments also asked for a determination of whether Rohm and Haas COPCs in the upper aquifer had reached the lower aquifer; if so, a discussion of exposures associated with domestic use of groundwater should be included. In response to the previous review, Rohm and Haas indicated that they would provide a determination of whether the lower aquifer had been impacted by Rohm and Haas site COPCs, along with any necessary evaluations as to the effectiveness of the neighboring Pristine Superfund site in controlling Rohm and Haas COPCs. This

information was provided in the September, 2004 Revised FI Report, and the BRA references this document. USEPA provided conditional approval in a letter to the facility dated January 25, 2005. Specifically, USEPA states, "USEPA concludes that there is connection between the Upper and Lower Aquifers. USEPA has no information to refute statement(s) that groundwater contamination from the facility has not migrated into the lower aquifer. USEPA will require confirmation of site conditions through monitoring requirements as part of remedy." On this basis, it is acceptable that Rohm and Haas did not evaluate the lower aquifer as a potential drinking water source in the BRA.

Response: *Comment noted.*

Section 4.1.2 Land and Water Use, page 20

3. The second full paragraph, last sentence, states the following: "Lower Aquifer groundwater at the facility is already being controlled by the remediation system for the neighboring Pristine Superfund site." This statement should be corrected to indicate that Pristine's groundwater pump and treat system is remediating the upper and lower aquifer groundwater contamination related to the Pristine site.

   Response: *The sentence will be revised to "Pristine's groundwater pump and treat system is remediating the upper and lower aquifer groundwater contamination related to the Pristine site, and as such, capturing all water in the lower aquifer from beneath the Rohm and Haas site."*

4. The third full paragraph, second sentence, states the following: "These [City of Reading] well fields were closed after chlorinated solvents attributable to the Pristine Superfund site were detected." Although groundwater contamination from the Pristine Site may have likely migrated into the Reading well fields, other nearby sites may also represent potential sources of contamination. Thus, the phrase, "...attributable to the Pristine Superfund site" may be misleading. Please delete.

   Response: *The sentence will be revised as follows: "These [City of Reading] well fields were closed after chlorinated solvents attributable to off-site sources were detected.".*

Section 4.2.1 Sources, Mechanisms of Releases, and mechanisms of Transport, page 24

5. The BRA indicates that the potential bioaccumulation pathway was considered an insignificant exposure pathway and was not quantitatively evaluated due to several reasons, as outlined in the text on page 24. The rationale provided in the risk assessment is partially acceptable; however, additional detail should be provided for the following:

(1) detected chemicals in Mill Creek are few and concentrations are low.
The text should be revised to identify the actual criteria used to determine which constituents present a potential to bioacccumulate, the bioaccumulative contaminants that were detected and their concentrations, and provide the actual screening level used to determine that the concentration is considered "low".

(2) insignificant accumulation would occur in fish due to limited amount of surface water potentially impacted by site-related chemicals
The text should be revised to discuss how this conclusion was reached. For example, if there is groundwater discharging into surface water, then the text should provide the flow analysis and specific detailed information to support this statement.

(3) fish live in a larger area than just the minor potentially impacted portion of the creek adjacent to the site
If there is fish migratory information to support this statement, than this should be provided in the risk assessment. If this conclusion can't be supported, then it is recommend that it be deleted, as it does not provide adequate justification for elimination of this pathway.

(4) There are insignificant game fish in the area where surface water has potentially been impacted by site-related COPCs
As discussed during the review of the June 2002 BRA, the lack of fish noted during the field visits conducted at the facility is not sufficient reason to exclude fish tissue exposures. The potential for Mill Creek to serve as a fishing source currently and in the future should be discussed in further detail.

Finally, the text states that Ohio EPA has issued a fish consumption advisory for Mill Creek due to the presence of mercury. However, a fish consumption advisory only affects the evaluation of current exposure conditions, but does not address future potential conditions where the possibility exists that the fish advisory could be lifted. Thus, this argument is not supportive for the purposes of a baseline risk assessment, in which both current and future conditions are of concern.

Response: *The statements listed above are rather general and will be deleted from the text in the revised risk assessment. The text will be revised as follows: "This pathway (fish ingestion) was considered an insignificant exposure pathway and was not quantitatively evaluated because contaminated fish tissue are not expected to occur at Mill Creek based on the USEPA evaluation results that no site-related bioaccumulative contaminants were detected at Rohm and Haas (Attachment 1 of Recommended Approach for Development of Groundwater Cleanup Goals, Rohm and Haas Facility, Reading, Ohio)."*

Section 4.2.3 Exposure Pathways

6. The recreational users of Mill Creek were assumed to contact surface water via incidental ingestion and dermal contact, and sediment via dermal contact. It is unclear why incidental ingestion of sediment was not considered a complete exposure pathway. Unless site-specific conditions dictate otherwise, this pathway should be considered potentially complete and quantitatively evaluated in the risk assessment.

Response: *Incidental ingestion of sediment was not considered a complete exposure pathway because the sediment is beneath the water and it is washed off before it would be ingested by a receptor. Additionally, there is very limited sediment present in Mill Creek due to the extensive amount of concrete rubble in the creek bed. However, the potential for incidental ingestion of sediment by a recreational user will be discussed in the Uncertainty Section of the report.*

Section 6.3.2 Exposure Assessment, page 41

7. Response to previous BRA review comments committed to evaluating the potential for "hot spots" to exist (i.e., localized areas of contamination), with the concern that the frequency of detection screen might inappropriately eliminate constituents and areas of concern. It was agreed that the revised BRA would evaluate whether there are any patterns associated with the infrequently detected constituents (e.g., whether or not they are generally co-located) and whether the infrequently detected constituents correspond to the high detections of other constituents that were included as COPCs. This analysis cannot be located in the revised BRA. Instead, page 41 merely discusses that receptors are unlikely to be consistently exposed to "hot-spots."

Response: *The magnitude of infrequently detected constituents compared to the RBSLs, and the evaluation of whether other chemicals were detected at the same location, will be included in the next version of the BRA.*

Section 7.1 Problem Formulation, pages 47 to 59

8. In general, the problem formulation adequately addresses previous comments on the June 2002 SERA, and selects appropriate exposure pathways and receptors for evaluation of current ecological risks at the Rohm and Haas site. However, the SERA does not address the potential for future risks in Mill Creek under different groundwater discharge conditions. This future scenario should evaluate risks under the assumption that the operation of the French Drain is discontinued, which could occur in the event of a change in ownership of the property. The SERA also does not explicitly address current risks to groundwater-surface water transition zone biota in Mill Creek. Rohm and Haas should address these potential future and current risks according to recommendations made in the document entitled, *Final Recommended Approach for the Development of Groundwater Cleanup Goals*, dated July 28, 2005 (refer to additional enclosure).

Response: *A screening-level analysis of the groundwater-to-surface water pathway will be included in the revised document. Should a potential risk be identified to receptors as a result of this screening level comparison, additional evaluation of the groundwater-to-surface water pathway will be addressed in a separate Technical Memorandum.*

Section 7.1.1.1 Terrestrial, pages 47 to 48

9. This section should include the approximate area of successional old field and riparian forest habitat available at the Rohm and Haas site. This information is needed because risk management decisions may be made on the basis of the limited extent of habitat available at the site.

Response: *Approximate acreages of various site habitats will be provided in the revised BRA. Outlines of the various site habitats will also be superimposed over an aerial photograph as discussed during the 26 July 2005 meeting.*

Section 7.1.3 Fate and Transport, page 53

10. Rohm and Haas should discuss in this section, or another appropriate section of the Problem Formulation, those chemicals detected at the site that are not expected to be site related. Note that USEPA concurs that the pesticides, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs) detected in Mill Creek sediments do not appear to be site related.

Response: *A discussion of non-site related chemicals will be added to this section.*

Section 7.2 Chemical Screening, pages 59 to 61

11. Rohm and Haas has not complied with previous comments that non-detected chemicals with detection limits exceeding screening levels should be retained for evaluation in the SERA. To ensure that detection limits are sufficiently low to allow elimination of non-detected chemicals from further evaluation, comparisons of detection limits to screening values should be included in the SERA. Non-detected chemicals with detection limits exceeding screening values should be discussed in the uncertainty section of the SERA.

Response: *Non-detected chemicals with detection limits exceeding screening values will be discussed in the Uncertainty Section as suggested.*

Section 7.4 Risk Characterization, pages 71 to 74

12. Very little discussion is included in the risk characterization section, making it difficult for the reader to assess the appropriateness of recommendations included in later sections that rule out further evaluation or remediation of most chemicals in the various media. This section should be revised to discuss the magnitude and spatial extent of risks, and any chemical-specific considerations that may impact the risk characterization (e.g., discuss high hazard quotient [HQ] values for wildlife for chemicals that do not tend to bioaccumulate).

Response: *Additional discussion will be provided to explain why the COPECs were eliminated from further consideration in the SERA.*

Section 7.4.1 Soil, page 72

13. HQs for the American robin have been omitted from the table that is presented in this section. This table should be revised to include results for the robin.

Response: *The table will be revised as indicated.*

Section 7.5.3 Preliminary Exposure Assessment Analysis of Uncertainty, pages 77 to 79

14. In this section, the SERA compares background concentrations to Region 5 Ecological Screening Levels, rather than comparing background to site concentrations. This latter comparison would be more instructive, and it is recommended that Rohm and Haas revise the SERA to include such a comparison. Refer to General Comment 2 for additional discussion.

Response: *The background discussion will be revised as indicated previously in response to General Comment 2.*

Section 7.7 Scientific Management Decision Point, page 81

15. The SERA recommends no further evaluation or remediation of soil, other than for tin. However, as discussed above, Rohm and Haas should present the rationale for this decision more clearly. Rationale could include: the very limited amount of terrestrial habitat available on site, the fact that available terrestrial habitat is predominantly mowed lawns, a more complete comparative evaluation of site and background concentrations (as discussed above), the apparent health of the mowed lawns as an indication that plant risks may be overestimated, and the low potential for bioaccumulation of some of the metals for which wildlife risks were calculated.

    Regarding tin hot spots in soil, Rohm and Haas proposes remediation or further evaluation of the form of tin present. Considering the magnitude of the tin concentrations, and the potential for transport to groundwater and to Mill Creek, the

remediation of the hot spots may be warranted regardless of the chemical form of the tin in soil.

The SERA also proposes no additional evaluation or remediation of Mill Creek surface water and sediments. It is agreed that pesticides, PCBs, and PAHs in Mill Creek cannot be attributed to the Rohm and Haas facility, and no further evaluation or remediation of these contaminants is necessary. The rationale for eliminating aluminum, lead, thallium, and tin in sediments should be more clearly presented. Note that future Mill Creek risks due to potential migration of contaminants in groundwater, and current risks to groundwater-surface water transition zone biota, have not been fully evaluated. This section will need to be revised based on results of these additional risk evaluations.

Response: *Reasons for eliminating potential COPECs will be expanded in the revised BRA. Future risks to Mill Creek as a result of the groundwater to surface water pathway will be evaluated in the revised BRA. If potential risks are identified as a result of this screening level comparison, the groundwater to surface water pathway will be further evaluated in a separate Technical Memorandum.*

Table 1.1 Occurrence, Distribution, and Selection of Chemicals of Potential Concern - Soil
Table 3.1 Exposure Point Concentration Summary - Soil

16. Table 1.1 indicates that the maximum detected concentration of Aroclor 1254 is 0.98 mg/kg. However, Table 1.3 indicates that the maximum is 37.5 mg/kg. This discrepancy should be rectified and the appropriate changes made to the report.

Response: *The maximum detected concentration of Aroclor 1254 is 0.98 mg/kg as shown in Table 1.1. The maximum concentration of 37.5 mg/kg presented in Table 3.1 is the maximum concentration of half of the detection limit used in the 95% UCL calculations for a non-detection. As a conservative approach, the 95% UCL value of 4.19 mg/kg, which was calculated using half of the detection limit for non-detects, was used as the exposure point concentration instead of the maximum detected concentration of 0.98 mg/kg. The maximum concentration of 0.98 mg/kg instead of 95% UCL will be used in the revised risk calculations. In addition, the maximum concentrations of acetone, benzene, methylene chloride, benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene were revised in Table 3.1 for this same reason. The maximum concentrations of benzene, benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene instead of 95% UCL will be used in the revised risk calculations. The revised Table 3.1 is attached.*

Table 1.2 Occurrence, Distribution, and Selection of Chemicals of Potential Concern - Groundwater
Table 3.2 Exposure Point Concentration Summary - Groundwater

17. Table 1.2 indicates that the maximum detected concentration for 4-Methylphenol is 330 ug/L. However, Table 3.2 indicates that the maximum is 300 ug/L. In addition, the units for several of the pesticide/PCB groundwater constituents in Table 3.2 appear incorrect. Specifically, beta-BHC, delta-BHC, gamma-BHC, 4,4-DDE, dieldrin, heptachlor, and heptachlor epoxide appear to have units in mg/L rather than ug/L, as presented in Table 1.2. These issues should be addressed and appropriate changes made to the report.

Response: *Table 3.2 was revised to show that the maximum concentration of 4-Methylphenol is 330 ug/L and the concentrations for beta-BHC, delta-BHC, gamma-BHC, 4,4-DDE, dieldrin, heptachlor, and heptachlor epoxide are revised to the correct units. The revised Table 3.2 is attached. Revised calculations will be made for 4-Methylphenol in the revised report, and no revised calculations will be made for beta-BHC, delta-BHC, gamma-BHC, 4,4-DDE, dieldrin, heptachlor, and heptachlor epoxide since the correct concentrations were used in the risk calculations.*

Table 1.3 Occurrence, Distribution, and Selection of Chemicals of Potential Concern - Surface Water
Appendix C, Table C-1 Summary of Surface Water Analytical Results

18. Table 1.3 suggests that arsenic, cobalt, and thallium were analyzed only for their dissolved water concentrations and that these dissolved concentrations were compared to screening criteria to select the final COPCs. The response to previous BRA review comments on this issue indicated that total concentrations of inorganics would be more representative of exposures during swimming, wading, and incidental ingestion. The impact of using dissolved water concentrations was supposed to be discussed in the uncertainty analysis. This discussion was not found in the report.

Response: *Total concentrations of inorganics would be more representative of exposures during swimming, wading, and incidental ingestion. As indicated in the response to previous BRA review comments, total concentrations of inorganics were analyzed in the 2004 sampling event. Table 1.3 includes all detected chemicals (total and dissolved). Total concentrations for arsenic, cobalt and thallium were not included in Table 1.3 because total concentrations for these compounds were not detected. Total concentrations were used for the risk evaluation. The dissolved concentrations were only used when the total concentrations were not detected. This explanation and the resultant impact of using dissolved water concentrations will be discussed in the uncertainty analysis of the report.*

Table 1.4 Occurrence, Distribution, and Selection of Chemicals of Concern - Sediment

19. Concentrations and frequency of detection of dibenz(a,h)anthracene indicate that this constituent should have been included as a COPC in the risk assessment.

Response: *Dibenz(a,h)anthracene will be included as a COPC for sediment in the revised risk assessment.*

Table 7.4 Calculation of Chemical Cancer Risks and Non-Cancer Hazards - Adult
Table 7.5 Calculation of Chemical Cancer Risks and Non-Cancer Hazards - Child

20. Dieldrin was not included in the calculation of dermal contact of sediment in Mill Creek. Risks should be recalculated to include this constituent.

    Response: *Dieldrin will be included in the risk calculation of dermal contact of sediment in Mill Creek.*

Tables 10.1 through 10.3 Comparison of Surface Soil, Sediment, Surface Water, and Seep Data to ESLs

21. In several instances, the ESLs listed in this table are incorrect (e.g., benzene and chlorobenzene in Table 10.1, ethylbenzene in Table 10.2). Rohm and Haas should review these tables to identify errors in ESL values, and revise the tables to correct these errors. Additionally, detected chemicals lacking ESLs must be selected as COPECs (e.g., dichloromethane in sediment). If no toxicity data are available to further evaluate these chemicals, they should be discussed as uncertainties in the uncertainty section.

    Response: *The tables will be re-checked to verify that the correct ESL has been used. In addition, the Uncertainty Section will include a discussion of those compounds for which ESL values are lacking and that have no toxicity values.*

Tables 11.1 through 11.4 Determination of Terrestrial Plant, Aquatic Plant, Benthos, and Fish Tissue Concentrations

22. These tables cite USEPA (1999) as the source of all uptake factors listed. However, the values presented in these tables are not consistent with the values presented in USEPA (1999). For example, the vanadium uptake factor listed in this Table 11.1 is 0.0055, but USEPA (1999) does not include an applicable value. Another example is the fish bioconcentration factor (BCF) for cadmium, which is listed as 3.2 L/kg in Table 11.4, but is listed as 907 L/kg in USEPA (1999). These tables should be revised to identify the correct source of all listed uptake factors. Note that Oak Ridge National Laboratory references are typically the preferred sources for uptake factors, as these references include more complete literature reviews and documentation of recommended values. Also note that some sources present uptake factors in terms of wet weight concentrations; no dry weight to wet weight conversion factor is needed when such uptake factors are used. The SERA should be revised accordingly.

Response: *The tables will be verified as to the source for the uptake factors and the correct reference cited for each factor. In addition, the rationale for using a particular uptake factor will be included as a footnote on the table when several different factors are available.*

Table 11.5 Determination of Earthworm Tissue Concentrations

23. This table cites Sample et al. (1999) as the source of many of the soil-to-earthworm uptake factors listed. However, the table does not discuss whether the values used are central tendency or upper estimates. For a screening level assessment, it is normally recommended that the 90th percentile values or the 95% upper prediction limit for the single-variable regression be used. If a central tendency uptake factor has been selected, it should be cited as such and discussed in the uncertainty section of the SERA. Central tendency uptake factors do not provide conservative estimates of exposure, since the probability of underestimation is equal to the probability of overestimation.

Response: *The cited reference: "Sample et. al., (1999)" is incorrect. The soil-to-earthworm uptake factors in question were obtained from USEPA, 1999 (Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities). This reference will be corrected on the table.*

Table 12 Intake Parameters for the Key Receptor Species

24. It appears that the SERA has incorrectly used values for fraction of soil in diet (from Ohio EPA guidance, as cited in the SERA) as incidental soil ingestion rate (S_F, in g/g-day). To determine the soil ingestion rates, the fraction of soil in diet must be multiplied by the food ingestion rate. Table 12 should be revised, as should any subsequent tables that utilize this parameter in relevant calculations. Table 12 should also summarize dietary assumptions (e.g., cottontail diet is 100% terrestrial plants).

Response: *The parameter SF is actually the fraction of soil in the diet as suggested. Table 12 will be revised as suggested. Calculations based on Table 12 will also be corrected, as necessary.*

Tables 13.1 through 13.8 Estimated Intake and Hazard Quotient Calculation for Key Receptor Species

25. It is unclear why there are so many zero values in these tables. Footnotes should be added to these tables to explain the zero values.

Response: *Not all of the detected compounds are COPECs for every receptor (i.e., compounds detected only in soils are not COPECs for aquatic-based receptors and, similarly, compounds detected in sediments are not COPECs for terrestrial-based*

receptors). To clarify this, the tables will be revised to show only the applicable COPECs for the specific receptor.

Table 15.3Toxicity Assessment for Sediment Invertebrates Living in Mill Creek

26. In addition to the sediment invertebrate benchmarks already included in Table 15.3, Rohm and Haas should also consider Ohio Sediment Reference Values for the Interior Plateau Ecoregion. Refer to the document entitled, *Final Recommended Approach for the Development of Groundwater Cleanup Goals*, dated July 28, 2005, for a more detailed discussion of recommended screening values.

    Response: *The Ohio Sediment Reference Values for the Interior Plateau Ecoregion will also be used to evaluate potential risks to sediment-dwelling invertebrates.*

Table 15.4 Toxicity Assessment for Aquatic Life Living in Mill Creek

27. It is unclear why some COPECs selected in Table 10.3 are not included in Table 15.4 (e.g., 1,2-dichlorobenzene). If some COPECs are omitted because they were detected in seeps, but not in surface water, explanatory footnotes should be added to this table as appropriate. Refer to the document entitled, *Final Recommended Approach for the Development of Groundwater Cleanup Goals*, dated July 28, 2005, for a more detailed discussion of recommended treatment of seep data.

    Response: *As suggested, the compounds presented in Table 15.4 are for those compounds detected in the surface water of Mill Creek only. A footnote will be added to Table 15.4 as suggested to explain the difference between the tables.*

Figure 4 Site Conceptual Model

28. It appears that the Site Conceptual Model (SCM) was extracted from the June 2002 BRA and does not accurately reflect information presented in the current BRA report. Specifically, the SCM incorrectly indicates that no chemicals of potential concern were identified in sediment; thus, sediment is not shown as a potential exposure medium. However, several semi-volatile organic compounds (SVOCs) and pesticides/PCBs were identified in sediment above relevant screening criteria. The SCM also indicates that no volatile chemicals of potential concern were identified in surface water and the volatilization from surface water pathway is thus shown as incomplete. However, the volatile organic compound (VOC) dibromochloromethane was identified in surface water above relevant screening criteria. The SCM should be updated to reflect the current analysis as presented in this report.

    Response: *A revised SCM is attached.*

Appendix K Correspondence with Agencies Concerning Endangered and Threatened Species

29. Letters referenced in Appendix K are missing and should be added.

Response: *Letters from the USFWS and Ohio Division of Natural Areas regarding endangered and threatened species are attached to this document and will be included in the final BRA report.*

III. REFERENCES

Geomatrix. 2000. Facility Investigation Work Plan, Morton International, Inc., Facility, Reading, Ohio, November.

Sample, B.E., G.W. Suter II, J.J. Beauchamp, and R.A. Efroymson. 1999. Literature-derived bioaccumulation models for earthworms: development and validation. Environ. Toxicol. Chem. 18:2110-2120.

U.S. Environmental Protection Agency (USEPA). 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities*. Peer Review Draft. August 1999. EPA 530-D-99-001A.

U.S. Environmental Protection Agency (USEPA). 2002. Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites. September 2002. EPA 540-R-01-003. OSWER 9285.7-41.

September 9, 2005

Ms. Mirtha Capiro
Project Coordinator
U.S. Environmental Protection Agency
Region 5
77 W. Jackson Boulevard, (DE-9J)
Chicago, Illinois 60604-3590

RE: Combined Sewer System Upgrade Project
Rohm and Haas Chemicals LLC
2000 West Street
Reading, Hamilton County, Ohio
RCRA Docket No. R3013-5-00-001
OHD 000 724 138

Dear Ms. Capiro:

At our July 26, 2005 meeting in Chicago, you requested a written update on the sewer upgrade work conducted at the site and any planned future work, with figures of the sewer system.

The overall sewer project originally focused on separating the storm water sewer from the process water sewer. This separation would reduce the possibility of having to discharge large quantities of water to the Metropolitan Sewer District (MSD) during heavy rain events. During the facility investigation and sewer camera survey, it was determined that the integrity of some portions of the sewer system had been breached.

With the integrity of some of the piping being compromised, it was determined that the separation of the storm sewer from the process sewer would also require that some of the existing piping be replaced. It was determined that a phased approach should be taken to replace the process sewer piping that was most damaged. This has to be done while the plant continues operations. Because the plant has to continue to run, it was determined that putting in replacement pipe was the best option rather than excavate old piping, and replace with new piping.

The replacement piping put in for the southeastern portion of the plant was put in at a depth of 8 to 9 feet. The piping being put in for the northwestern portion of the plant will be at a depth of 4 to 5 feet. These depths are approximately the same depth as existing piping. The plan is to complete the northwestern piping by the end of October, 2005.

Following is a description of the drawings included:

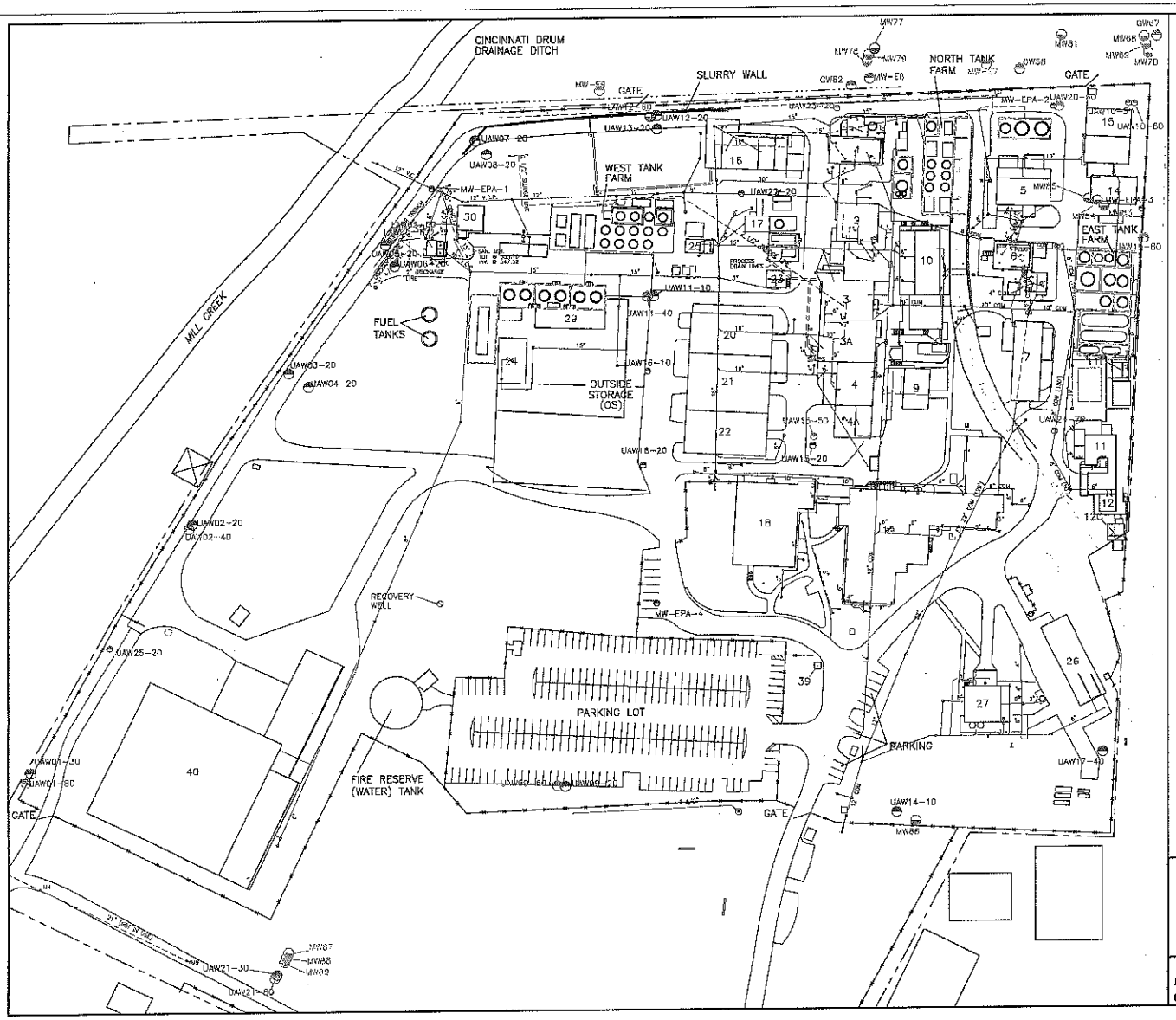
- The file " CSS and MW network.pdf ("Combined Sewer System Solid Waste Management Unit 11" figure) shows the plant sewer system relative to all the monitoring wells BEFORE any sewer replacement/repairs (~ early 2004) were performed.
- In 2004, we separated the south storm sewer from the process sewer. This work focused on the southeastern part of the plant around buildings 18, 19, 26 and 27. There was also a by-pass line installed west of and parallel to buildings 20, 21 and 22. A total of approximately 1250 linear feet of pipe was replaced. The new piping is depicted by a solid red line with ST (storm) or SAN (sanitary/process). Remaining existing piping is also shown on this figure as thin red lines. This is depicted in the file "South Sewer Repairs.pdf ("South Sewers Repairs Plot Plan" figure).
- In 2005, we plan to install approximately 850 linear feet of new process sewer piping. This piping would tie into the by-pass line installed in 2004 (around buildings 20, 21 and 22). Also, a large portion of this piping will be a horizontal (east to west) run in the vicinity of buildings 25, 29, 30 and 32. The new piping is shown in magenta. This is shown in the file "West Sewer Repairs.pdf" file ("Overall Project Plan—2005 West Sewer Repairs").
- In 2006, a detention basin is planned to be installed to manage large volumes of water during heavy rain events.

The actual effects on groundwater cannot be quantified in advance, but because we have replaced sewer piping that was identified as most severely damaged, we know that this will substantially reduce and/or eliminate any contributions of chlorobenzene, toluene and acetone to the groundwater that may have resulted from the damaged sewer pipe.

If you have any questions, please contact me at 215.785.7193 or ccoker@rohmhaas.com.

Sincerely,

Carl J. Coker
Remediation Project Manager
Rohm and Haas Company



Base Map Source: American Process Design, Inc., Cincinnati, OH, Proj. No. 16151, 410, 6/4/98.

0 90 120
APPROXIMATE SCALE (FEET)

N

EXPLANATION

- COMBINED SEWER (IN USE)
- COMBINED SEWER (NOT IN USE)
- MORTON FACILITY PROPERTY BOUNDARY
- FENCE
- UAW11-10 UPPER AQUIFER MONITORING WELL LOCATION COMPLETED IN SHALLOW SAND
- UAW11-40 UPPER AQUIFER MONITORING WELL LOCATION COMPLETED IN LOWER SAND
- LAW12-60 LOWER AQUIFER MONITORING WELL LOCATION
- MW-EPA-1 UPPER AQUIFER MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (PRC, 1993)
- GW58 PRISTINE SHALLOW AQUIFER MONITORING WELL LOCATION AND IDENTIFICATION NUMBER
- MW70 PRISTINE LOWER AQUIFER MONITORING WELL LOCATION AND IDENTIFICATION NUMBER

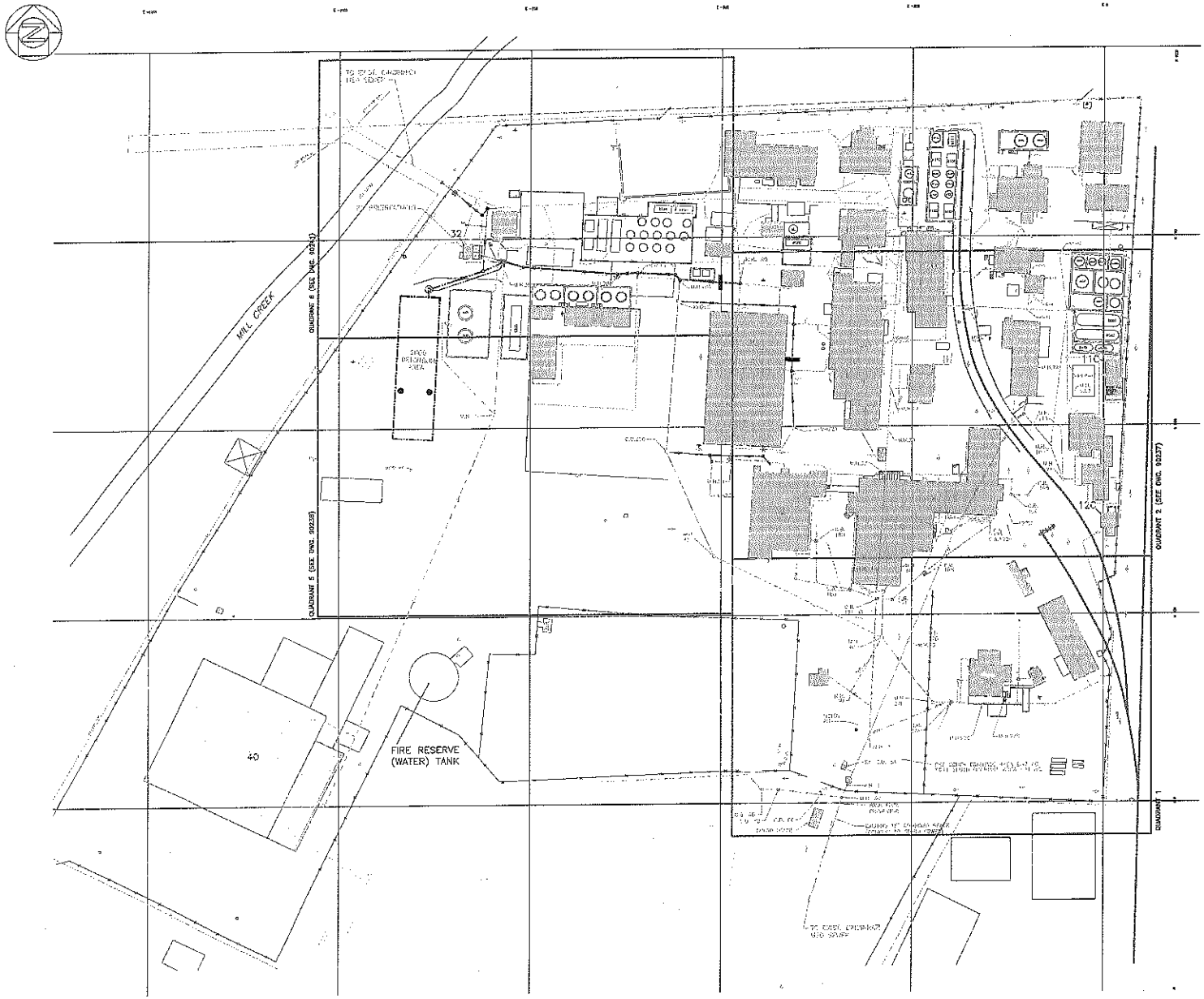
COMBINED SEWER SYSTEM
SOLID WASTE MANAGEMENT UNIT 11

PREPARED FOR

ROHM AND HAAS CO.
READING, OHIO

GEOMATRIX

Project No.
7168



JACOBS

NOTES:

1. FOR SURVEY CONTROL POINTS, GRID INDEX AND SPECIFICATION INDEX SEE DWG. 90243
2. FOR LEGEND AND GENERAL NOTES SEE DWG. 90200

GLENN T. ROBERTS, P.E.

REV.	DATE	DESCRIPTION	APPROVED
1	8/23/2005	ISSUED FOR CONSTRUCTION	GARTOS
0	04/20/2005	ISSUED FOR PERMIT	GARTOS

REVISIONS

OVERALL PROJECT PLAN
2005 WEST SEWER REPAIRS

SS No. 5587A (Private)

ROHM AND HAAS
ENGINEERING DIVISION
BRISTOL, PA.

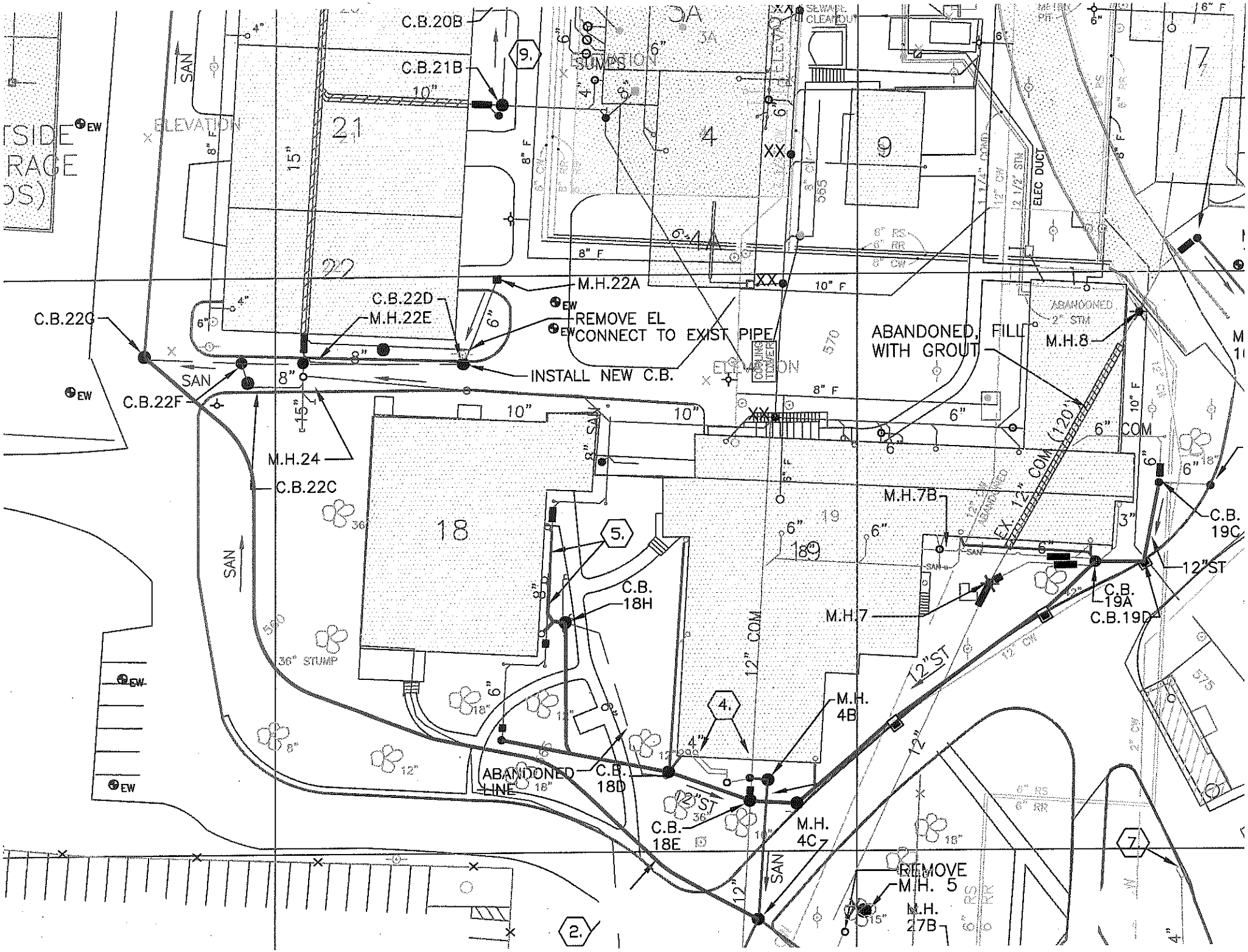
THIS DRAWING IS THE PROPERTY OF THE ROHM AND HAAS CO. AND IS LENT WITH THE UNDERSTANDING THAT THE CONFIDENTIAL AGREEMENT THAT IT SHALL NOT BE REPRODUCED, COPIED, LENT, OR DISCLOSED IN WHOLE OR IN PART, NOR SHALL THIS ITEM BE USED FOR ANY PURPOSE OTHER THAN THAT FOR WHICH IT IS SPECIFICALLY ENGAGED.

DRAWN BY	DATE	CHECKED	DATE	APPROVED
NSMITH	2/05	GROBERS	2/05	T. AGOSTON

CAD NUMBER	CAD OPERATOR	SCALE
90238	N. SMITH	1" = 50'

AF NUMBER	PLANT LOCATION	SHEET LOCATION
	READING OHIO	

SYS	SUB AREA	DISC. AREA	UNIT NUMBER	SEQ. NUMBER	DIVISION
513	00	00	00	00	1


C.B.20B
C.B.21B
9.
SUMPS
SEWAGE CLEANOUT
ELEVATOR
ELEVATION
21
22
4
9
7
18
19
SAN
10"
8" F
15"
6"
4"
XX
M.H.22A
C.B.22D
M.H.22E
C.B.22G
REMOVE EL
CONNECT TO EXIST PIPE
INSTALL NEW C.B.
ABANDONED, FILL WITH GROUT
M.H.8
ELEC DUCT
ABANDONED 2" STM
10" F
8"
C.B.22F
M.H.24
C.B.22C
5.
C.B. 18H
M.H.7B
EX. 12" COM (120')
12" COM
C.B. 19C
12"ST
C.B. 19A
C.B.19D
M.H.7
36" STUMP
4.
M.H. 4B
ABANDONED LINE
C.B. 18D
C.B. 18E
M.H. 4C
REMOVE M.H. 5
M.H. 27B
7.
2.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF

31 AUG 2005

DE-9J

VIA ELECTRONIC MAIL AND
CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Carl J. Coker
Rohm and Haas Company
Engineering Division
3100 State Road
Croydon, Pennsylvania 19021

Re: Revised Baseline Risk Assessment Report
Rohm and Haas Chemicals LLC.
USEPA ID No. OHD 000 724 138

Dear Mr. Coker:

The United States Environmental Protection Agency (USEPA) has completed review of and prepared comments on the Revised Baseline Risk Assessment Report for Rohm and Haas Chemicals LLC (Rohm and Haas), dated June 30, 2005. The USEPA comments are enclosed.

Please contact me to discuss a schedule for Rohm and Haas to address the USEPA comments and resubmit the Baseline Risk Assessment Report. To discuss the required schedule or for any questions regarding this letter, please contact me at 312/ 886-7567 or at capiro.mirtha@epa.gov.

Sincerely yours,

Mirtha Capiro
Project Manager/Coordinator
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics Division

cc: Harold O'Connell, OEPA
Thomas C. Nash, C-14J

Enclosures

Recycled/Recyclable • Printed with Vegetable Oil Based Inks on 50% Recycled Paper (20% Postconsumer)

COMMENTS ON THE
JUNE 30, 2005 BASELINE RISK ASSESSMENT

ROHM AND HAAS CHEMICALS, LLC
READING, OHIO

I. GENERAL COMMENTS

1. Rohm and Haas Chemicals , LLC (Rohm and Haas) evaluated the site considering future industrial use of the facility. Although it is stated (page 20) that Rohm and Haas intends to retain ownership and will continue to operate as an industrial facility, the June 2005 Baseline Risk Assessment (BRA) does not indicate that the facility is considering implementing a deed restriction on the property to preclude future residential use. Per USEPA's request, the BRA does include a zoning map of the surrounding properties (Appendix F), and it is clear that the area is classified as heavy industry. However, given the potential for unknown future ownership and land use at facilities subject to corrective action, such as Rohm and Haas, the BRA should clearly indicate that, as part of the final remedy for the site, Rohm and Haas intends to implement a deed restriction as part of the final remedy for the site to limit potential future use to commercial/industrial.

2. As discussed previously with USEPA during the review of the June 2002 BRA, Rohm and Haas appropriately included all chemicals of potential concern (COPCs) and chemicals of potential ecological concern (COPECs) above relevant risk-based screening levels, and did not screen constituents based on determined background concentrations. The BRA appropriately carries all COPCs exceeding risk-based screening levels through the quantitative risk assessment, and then qualitatively discussed those COPCs with concentrations comparable to background (page 40). The Screening Ecological Risk Assessment (SERA) compares background concentrations to Region 5 Ecological Screening Levels (ESLs) in the uncertainty section to evaluate the possible contribution of background conditions to risk.

   However, the BRA did not provide a quantitative discussion of those constituents that are believed to represent background conditions but exceed screening levels. Although this was discussed previously and Rohm and Haas agreed to provide a quantitative assessment of background contribution of total site risks, Rohm and Haas provided the minimum amount of qualitative discussion necessary in Section 6.3, Uncertainty Analysis. The BRA should be revised to present the background data and a statistical comparison to site-specific values to support the assertion that some contaminants are not the result of site activities. This comment is applicable to both the human health and the ecological risk assessment. Rohm and Haas should refer to USEPA guidance on conducting background comparisons (USEPA 2002). In addition, as requested in comments on the June 2002 SERA, Rohm and Haas should provide a more detailed discussion of background sample locations to demonstrate that appropriate locations were selected.

II SPECIFIC COMMENTS

Section 2.4.3 Surface Water/Seeps, page 9

1. The BRA indicates that seep data were not used in the evaluation of human health risks because actual surface water was recently collected as part of the Supplemental Remedial Investigations. However, the locations of these seeps (e.g., creek bed, creek bank), and the potential for human exposure to them, is unclear. As requested during previous discussions with the facility, the BRA was expected to include an expanded discussion of the physical nature of the observed seeps with estimates of seep rates and approximate flows. While some of this information is presented in Section 7.2.3., a detailed discussion regarding the physical nature of the observed seeps is not presented in this report. This question should be addressed to determine whether the potential exists, either under present or future conditions, for direct human receptor exposure to contaminants in seep water. The report should be revised to address this potential exposure pathway as part of the human health risk assessment.

Section 4.1.2 Land and Water Use, page 17

2. Previous review comments submitted on the BRA and the Facility Investigation (FI) Work Plan (Geomatrix 2000) required that additional specific information be provided on the constituents in groundwater associated with the Rohm and Haas facility and the ability of the neighboring Pristine Superfund site remediation system to control COPCs from the Rohm and Haas facility. Previous comments also asked for a determination of whether Rohm and Haas COPCs in the upper aquifer had reached the lower aquifer; if so, a discussion of exposures associated with domestic use of groundwater should be included. In response to the previous review, Rohm and Haas indicated that they would provide a determination of whether the lower aquifer had been impacted by Rohm and Haas site COPCs, along with any necessary evaluations as to the effectiveness of the neighboring Pristine Superfund site in controlling Rohm and Haas COPCs. This information was provided in the September, 2004 Revised FI Report, and the BRA references this document. USEPA provided conditional approval in a letter to the facility dated January 25, 2005. Specifically, USEPA states, "USEPA concludes that there is connection between the Upper and Lower Aquifers. USEPA has no information to refute statement(s) that groundwater contamination from the facility has not migrated into the lower aquifer. USEPA will require confirmation of site conditions through monitoring requirements as part of remedy." On this basis, it is acceptable that Rohm and Haas did not evaluate the lower aquifer as a potential drinking water source in the BRA.

Section 4.1.2 Land and Water Use, page 20

3. The second full paragraph, last sentence, states the following: "Lower Aquifer groundwater at the facility is already being controlled by the remediation system for the neighboring Pristine Superfund site." This statement should be corrected to indicate that Pristine's groundwater pump and treat system is remediating the upper and lower aquifer groundwater contamination related to the Pristine site.

4. The third full paragraph, second sentence, states the following: "These [City of Reading] well fields were closed after chlorinated solvents attributable to the Pristine Superfund site were detected." Although groundwater contamination from the Pristine Site may have likely migrated into the Reading well fields, other nearby sites may also represent potential sources of contamination. Thus, the phrase, "...attributable to the Pristine Superfund site" may be misleading. Please delete.

Section 4.2.1 Sources, Mechanisms of Releases, and mechanisms of Transport, page 24

5. The BRA indicates that the potential bioaccumulation pathway was considered an insignificant exposure pathway and was not quantitatively evaluated due to several reasons, as outlined in the text on page 24. The rationale provided in the risk assessment is partially acceptable; however, additional detail should be provided for the following:

(1) detected chemicals in Mill Creek are few and concentrations are low.
The text should be revised to identify the actual criteria used to determine which constituents present a potential to bioacccumulate, the bioaccumulative contaminants that were detected and their concentrations, and provide the actual screening level used to determine that the concentration is considered "low".

(2) insignificant accumulation would occur in fish due to limited amount of surface water potentially impacted by site-related chemicals
The text should be revised to discuss how this conclusion was reached. For example, if there is groundwater discharging into surface water, then the text should provide the flow analysis and specific detailed information to support this statement.

(3) fish live in a larger area than just the minor potentially impacted portion of the creek adjacent to the site
If there is fish migratory information to support this statement, than this should be provided in the risk assessment. If this conclusion can't be supported, then it is recommend that it be deleted, as it does not provide adequate justification for elimination of this pathway.

(4) There are insignificant game fish in the area where surface water has potentially been impacted by site-related COPCs
As discussed during the review of the June 2002 BRA, the lack of fish noted during the field visits conducted at the facility is not sufficient reason to exclude fish tissue

exposures. The potential for Mill Creek to serve as a fishing source currently and in the future should be discussed in further detail.

Finally, the text states that Ohio EPA has issued a fish consumption advisory for Mill Creek due to the presence of mercury. However, a fish consumption advisory only affects the evaluation of current exposure conditions, but does not address future potential conditions where the possibility exists that the fish advisory could be lifted. Thus, this argument is not supportive for the purposes of a baseline risk assessment, in which both current and future conditions are of concern.

Section 4.2.3 Exposure Pathways

6. The recreational users of Mill Creek were assumed to contact surface water via incidental ingestion and dermal contact, and sediment via dermal contact. It is unclear why incidental ingestion of sediment was not considered a complete exposure pathway. Unless site-specific conditions dictate otherwise, this pathway should be considered potentially complete and quantitatively evaluated in the risk assessment.

Section 6.3.2 Exposure Assessment, page 41

7. Response to previous BRA review comments committed to evaluating the potential for "hot spots" to exist (i.e., localized areas of contamination), with the concern that the frequency of detection screen might inappropriately eliminate constituents and areas of concern. It was agreed that the revised BRA would evaluate whether there are any patterns associated with the infrequently detected constituents (e.g., whether or not they are generally co-located) and whether the infrequently detected constituents correspond to the high detections of other constituents that were included as COPCs. This analysis cannot be located in the revised BRA. Instead, page 41 merely discusses that receptors are unlikely to be consistently exposed to "hot-spots."

Section 7.1 Problem Formulation, pages 47 to 59

8. In general, the problem formulation adequately addresses previous comments on the June 2002 SERA, and selects appropriate exposure pathways and receptors for evaluation of current ecological risks at the Rohm and Haas site. However, the SERA does not address the potential for future risks in Mill Creek under different groundwater discharge conditions. This future scenario should evaluate risks under the assumption that the operation of the French Drain is discontinued, which could occur in the event of a change in ownership of the property. The SERA also does not explicitly address current risks to groundwater-surface water transition zone biota in Mill Creek. Rohm and Haas should address these potential future and current risks according to recommendations made in the document entitled, *Final Recommended Approach for the Development of Groundwater Cleanup Goals*, dated July 28, 2005 (refer to additional enclosure).

Section 7.1.1.1 Terrestrial, pages 47 to 48

9. This section should include the approximate area of successional old field and riparian forest habitat available at the Rohm and Haas site. This information is needed because risk management decisions may be made on the basis of the limited extent of habitat available at the site.

Section 7.1.3 Fate and Transport, page 53

10. Rohm and Haas should discuss in this section, or another appropriate section of the Problem Formulation, those chemicals detected at the site that are not expected to be site related. Note that USEPA concurs that the pesticides, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs) detected in Mill Creek sediments do not appear to be site related.

Section 7.2 Chemical Screening, pages 59 to 61

11. Rohm and Haas has not complied with previous comments that non-detected chemicals with detection limits exceeding screening levels should be retained for evaluation in the SERA. To ensure that detection limits are sufficiently low to allow elimination of non-detected chemicals from further evaluation, comparisons of detection limits to screening values should be included in the SERA. Non-detected chemicals with detection limits exceeding screening values should be discussed in the uncertainty section of the SERA.

Section 7.4 Risk Characterization, pages 71 to 74

12. Very little discussion is included in the risk characterization section, making it difficult for the reader to assess the appropriateness of recommendations included in later sections that rule out further evaluation or remediation of most chemicals in the various media. This section should be revised to discuss the magnitude and spatial extent of risks, and any chemical-specific considerations that may impact the risk characterization (e.g., discuss high hazard quotient [HQ] values for wildlife for chemicals that do not tend to bioaccumulate).

Section 7.4.1 Soil, page 72

13. HQs for the American robin have been omitted from the table that is presented in this section. This table should be revised to include results for the robin.

Section 7.5.3 Preliminary Exposure Assessment Analysis of Uncertainty, pages 77 to 79

14. In this section, the SERA compares background concentrations to Region 5 Ecological Screening Levels, rather than comparing background to site concentrations. This latter

comparison would be more instructive, and it is recommended that Rohm and Haas revise the SERA to include such a comparison. Refer to General Comment 2 for additional discussion.

Section 7.7 Scientific Management Decision Point, page 81

15. The SERA recommends no further evaluation or remediation of soil, other than for tin. However, as discussed above, Rohm and Haas should present the rationale for this decision more clearly. Rationale could include: the very limited amount of terrestrial habitat available on site, the fact that available terrestrial habitat is predominantly mowed lawns, a more complete comparative evaluation of site and background concentrations (as discussed above), the apparent health of the mowed lawns as an indication that plant risks may be overestimated, and the low potential for bioaccumulation of some of the metals for which wildlife risks were calculated.

    Regarding tin hot spots in soil, Rohm and Haas proposes remediation or further evaluation of the form of tin present. Considering the magnitude of the tin concentrations, and the potential for transport to groundwater and to Mill Creek, the remediation of the hot spots may be warranted regardless of the chemical form of the tin in soil.

    The SERA also proposes no additional evaluation or remediation of Mill Creek surface water and sediments. It is agreed that pesticides, PCBs, and PAHs in Mill Creek cannot be attributed to the Rohm and Haas facility, and no further evaluation or remediation of these contaminants is necessary. The rationale for eliminating aluminum, lead, thallium, and tin in sediments should be more clearly presented. Note that future Mill Creek risks due to potential migration of contaminants in groundwater, and current risks to groundwater-surface water transition zone biota, have not been fully evaluated. This section will need to be revised based on results of these additional risk evaluations.

Table 1.1 Occurrence, Distribution, and Selection of Chemicals of Potential Concern - Soil
Table 3.1 Exposure Point Concentration Summary - Soil

16. Table 1.1 indicates that the maximum detected concentration of Aroclor 1254 is 0.98 mg/kg. However, Table 1.3 indicates that the maximum is 37.5 mg/kg. This discrepancy should be rectified and the appropriate changes made to the report.

Table 1.2 Occurrence, Distribution, and Selection of Chemicals of Potential Concern - Groundwater
Table 3.2 Exposure Point Concentration Summary - Groundwater

17. Table 1.2 indicates that the maximum detected concentration for 4-Methylphenol is 330 μg/L. However, Table 3.2 indicates that the maximum is 300 μg/L. In addition, the units

for several of the pesticide/PCB groundwater constituents in Table 3.2 appear incorrect. Specifically, beta-BHC, delta-BHC, gamma-BHC, 4,4-DDE, dieldrin, heptachlor, and heptachlor epoxide appear to have units in mg/L rather than μg/L, as presented in Table 1.2. These issues should be addressed and appropriate changes made to the report.

Table 1.3 Occurrence, Distribution, and Selection of Chemicals of Potential Concern - Surface Water
Appendix C, Table C-1 Summary of Surface Water Analytical Results

18. Table 1.3 suggests that arsenic, cobalt, and thallium were analyzed only for their dissolved water concentrations and that these dissolved concentrations were compared to screening criteria to select the final COPCs. The response to previous BRA review comments on this issue indicated that total concentrations of inorganics would be more representative of exposures during swimming, wading, and incidental ingestion. The impact of using dissolved water concentrations was supposed to be discussed in the uncertainty analysis. This discussion was not found in the report.

Table 1.4 Occurrence, Distribution, and Selection of Chemicals of Concern - Sediment

19. Concentrations and frequency of detection of dibenz(a,h)anthracene indicate that this constituent should have been included as a COPC in the risk assessment.

Table 7.4 Calculation of Chemical Cancer Risks and Non-Cancer Hazards - Adult
Table 7.5 Calculation of Chemical Cancer Risks and Non-Cancer Hazards - Child

20. Dieldrin was not included in the calculation of dermal contact of sediment in Mill Creek. Risks should be recalculated to include this constituent.

Tables 10.1 through 10.3 Comparison of Surface Soil, Sediment, Surface Water, and Seep Data to ESLs

21. In several instances, the ESLs listed in this table are incorrect (e.g., benzene and chlorobenzene in Table 10.1, ethylbenzene in Table 10.2). Rohm and Haas should review these tables to identify errors in ESL values, and revise the tables to correct these errors. Additionally, detected chemicals lacking ESLs must be selected as COPECs (e.g., dichloromethane in sediment). If no toxicity data are available to further evaluate these chemicals, they should be discussed as uncertainties in the uncertainty section.

Tables 11.1 through 11.4 Determination of Terrestrial Plant, Aquatic Plant, Benthos, and Fish Tissue Concentrations

22. These tables cite USEPA (1999) as the source of all uptake factors listed. However, the values presented in these tables are not consistent with the values presented in USEPA

(1999). For example, the vanadium uptake factor listed in this Table 11.1 is 0.0055, but USEPA (1999) does not include an applicable value. Another example is the fish bioconcentration factor (BCF) for cadmium, which is listed as 3.2 L/kg in Table 11.4, but is listed as 907 L/kg in USEPA (1999). These tables should be revised to identify the correct source of all listed uptake factors. Note that Oak Ridge National Laboratory references are typically the preferred sources for uptake factors, as these references include more complete literature reviews and documentation of recommended values. Also note that some sources present uptake factors in terms of wet weight concentrations; no dry weight to wet weight conversion factor is needed when such uptake factors are used. The SERA should be revised accordingly.

Table 11.5 Determination of Earthworm Tissue Concentrations

23. This table cites Sample et al. (1999) as the source of many of the soil-to-earthworm uptake factors listed. However, the table does not discuss whether the values used are central tendency or upper estimates. For a screening level assessment, it is normally recommended that the 90th percentile values or the 95% upper prediction limit for the single-variable regression be used. If a central tendency uptake factor has been selected, it should be cited as such and discussed in the uncertainty section of the SERA. Central tendency uptake factors do not provide conservative estimates of exposure, since the probability of underestimation is equal to the probability of overestimation.

Table 12 Intake Parameters for the Key Receptor Species

24. It appears that the SERA has incorrectly used values for fraction of soil in diet (from Ohio EPA guidance, as cited in the SERA) as incidental soil ingestion rate (S_F, in g/g-day). To determine the soil ingestion rates, the fraction of soil in diet must be multiplied by the food ingestion rate. Table 12 should be revised, as should any subsequent tables that utilize this parameter in relevant calculations. Table 12 should also summarize dietary assumptions (e.g., cottontail diet is 100% terrestrial plants).

Tables 13.1 through 13.8 Estimated Intake and Hazard Quotient Calculation for Key Receptor Species

25. It is unclear why there are so many zero values in these tables. Footnotes should be added to these tables to explain the zero values.

Table 15.3 Toxicity Assessment for Sediment Invertebrates Living in Mill Creek

26. In addition to the sediment invertebrate benchmarks already included in Table 15.3, Rohm and Haas should also consider Ohio Sediment Reference Values for the Interior Plateau Ecoregion. Refer to the document entitled, *Final Recommended Approach for the*

Development of Groundwater Cleanup Goals, dated July 28, 2005, for a more detailed discussion of recommended screening values.

Table 15.4 Toxicity Assessment for Aquatic Life Living in Mill Creek

27. It is unclear why some COPECs selected in Table 10.3 are not included in Table 15.4 (e.g., 1,2-dichlorobenzene). If some COPECs are omitted because they were detected in seeps, but not in surface water, explanatory footnotes should be added to this table as appropriate. Refer to the document entitled, *Final Recommended Approach for the Development of Groundwater Cleanup Goals*, dated July 28, 2005, for a more detailed discussion of recommended treatment of seep data.

Figure 4 Site Conceptual Model

28. It appears that the Site Conceptual Model (SCM) was extracted from the June 2002 BRA and does not accurately reflect information presented in the current BRA report. Specifically, the SCM incorrectly indicates that no chemicals of potential concern were identified in sediment; thus, sediment is not shown as a potential exposure medium. However, several semi-volatile organic compounds (SVOCs) and pesticides/PCBs were identified in sediment above relevant screening criteria. The SCM also indicates that no volatile chemicals of potential concern were identified in surface water and the volatilization from surface water pathway is thus shown as incomplete. However, the volatile organic compound (VOC) dibromochloromethane was identified in surface water above relevant screening criteria. The SCM should be updated to reflect the current analysis as presented in this report.

Appendix K Correspondence with Agencies Concerning Endangered and Threatened Species

29. Letters referenced in Appendix K are missing and should be added.

III. REFERENCES

Geomatrix. 2000. Facility Investigation Work Plan, Morton International, Inc., Facility, Reading, Ohio, November.

Sample, B.E., G.W. Suter II, J.J. Beauchamp, and R.A. Efroymson. 1999. Literature-derived bioaccumulation models for earthworms: development and validation. Environ. Toxicol. Chem. 18:2110-2120.

U.S. Environmental Protection Agency (USEPA). 1999. *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities*. Peer Review Draft. August 1999. EPA 530-D-99-001A.

U.S. Environmental Protection Agency (USEPA). 2002. Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites. September 2002. EPA 540-R-01-003. OSWER 9285.7-41.

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July 28, 2005
B-09075-0143-2502
REPA3-2502-206v2

Mr. Bernie Orenstein
Regional Project Officer
U.S. EPA Region 5 (DM-7J)
77 West Jackson Boulevard
Chicago, IL 60604

Subject: EPA Contract No. 68-W-02-018, Work Assignment R05802-2, Task 02, TDM No. 17. Final Recommended Approach for Development of Groundwater Cleanup Goals, Rohm and Haas, Reading, Ohio.

Dear Mr. Orenstein:

In response to Work Assignment R05802-2, Task 02, under EPA Contract No. 68-W-02-018, please find attached our Final Recommended Approach for Development of Groundwater Cleanup Goals for the Rohm and Haas facility in Reading, Ohio.

This deliverable incorporates comments made by several reviewers from agencies including EPA Region 5, EPA Office of Research and Development, Ohio EPA, and the U.S. Geological Survey.

If you have any questions regarding this deliverable, please contact me at (312) 578-4579.

Sincerely,

Kari Thompson

BOOZ ALLEN HAMILTON (for)

Daniel L. Briller, P.E.
Work Assignment Manager

Enclosures

cc: Allen Wojtas, EPA Work Assignment Manager
Mirtha Capiro, EPA Technical Advisor
Thomas Valentino, EPA Contracting Officer (cover letter only)
LaShawn Smith, EPA Contract Specialist (cover letter only)
Booz Allen EPMT QA/QC Coordinator

FINAL RECOMMENDED APPROACH FOR DEVELOPMENT OF GROUNDWATER CLEANUP GOALS ROHM AND HAAS FACILITY READING, OHIO

July 28, 2005
REPA3-2502-206v2

1.0 PURPOSE

EPA Region 5 has tasked Booz Allen Hamilton (Booz Allen) with providing ecological and human health risk assessment support on the Rohm and Haas facility (formerly known as the Morton facility) in Reading, OH. At this facility, contaminated groundwater discharges into the adjacent stretch of Mill Creek. In response to EPA direction, Booz Allen has prepared recommended methods for developing groundwater cleanup goals that will be protective of both ecological and human health exposures in Mill Creek.

In the process of developing this document, Booz Allen consulted with EPA Region 5 and EPA Office of Research and Development during a conference call on May 13, 2005. Recommendations made during this conference call have been incorporated into this document, as appropriate.

The sections that follow briefly summarize the hydrogeology of Mill Creek, present guidance on applicable exposure pathways and selection of chemicals of potential concern (COPCs) for ecological and human health, and discuss risk-based methods for developing groundwater cleanup goals. While these recommendations are intended to meet all EPA requirements, it is noted that Rohm and Haas must also meet Ohio EPA (OEPA) regulatory requirements. OEPA requirements are briefly discussed in Section 5.0; Rohm and Haas should consult with OEPA for further direction or clarification.

2.0 MILL CREEK HYDROGEOLOGY

As reported in the Revised Facility Investigation Report (FI Report) (Geomatrix 2004), Mill Creek is the only body of surface water in the vicinity of the Rohm and Haas Facility. Mill Creek is a tributary of the Ohio River, and the confluence of Mill Creek and the Ohio River is located approximately 14 miles south of the Rohm and Haas Facility.

The FI Report (pg. 8) indicates that, "Mill Creek currently lies 80 to 100 feet west of the Morton Facility property boundary. Before about 1950, however, aerial photographs indicate that, in the vicinity of the Morton Facility, the creek lay about 300 feet west of its current location. The change is reported to be part of drainage and flow control improvements performed by the U.S. Army Corps of Engineers around 1950."

The FI Report (pg. 64 - 65) characterizes Mill Creek as "typically shallow (less than 24 inches), with intermittent rapids and pools. The pools in vicinity of the Morton Facility exhibited depths up to 5 feet during normal flow conditions." The bed of the creek has been characterized as "comprised predominately of rock and concrete, probably reflecting the materials used during the U.S. Army Corps of Engineers rechannelization. Sediment is completely absent through most of the streambed, with small accumulations, typically less that 1 inch downstream on larger rocks. One area of streambed sediment was observed west of the Morton Facility, this is believed to represent the remains of a major bank collapse associated with flooding in July 2001." The general absence of sediment is likely due to the strong scour resulting from increased flow during and after major storm events.

The FI Report (pg. 59) has identified "a single shallow sand bed, termed the Shallow Upper Aquifer (UA) Sand [that] was observed at typical depth of 10 to 20 feet below ground surface (bgs) across most of the Morton Facility," and was observed to be absent only in the northeast corner of the facility. The FI Report further indicates that water-level data "consistently indicated groundwater flow (in the Shallow UA Sand) is generally from the east and northeast of the Morton Facility, across the site toward the west and west-southwest to Mill Creek." The FI Report (pg. 61) has acknowledged that, "the Shallow UA Sand is the hydrogeologic unit most likely to be affected by surface releases at the Morton Facility." Groundwater quality data support this conclusion.

The FI Report (pg. 65) has further acknowledged that, "shallow UA Sand is in hydraulic communication with Mill Creek, and is discharging groundwater through the banks and bed of the creek." However, the lack of hydrogeologic data between the western boundary of the facility and the creek, combined with the variability exhibited by the Shallow US Sand, renders uncertain the extent to which the Shallow UA Sand may discharge through both the bank and streambed of the portion of Mill Creek along the northern segment of the western facility boundary. The Shallow UA Sand thins significantly along this portion of the facility's western boundary, and the Shallow UA Sand may not discharge up through the streambed. However, several seeps have been noted on the bank of the creek along this portion of the property. The FI (pg. 80) indicates that, "sampling of these seeps has identified several constituents also observed in shallow Morton Facility groundwater, including tin, BTEX, chlorobenzenes, and dichlorobenzenes." Unless hydrogeologic data and/or analysis is presented that clearly indicates otherwise, discharge through both the bank and streambed should be assumed along this portion of the facility boundary.

A French drain has been installed and is operated along the northern portion of the western facility boundary in an effort to control the discharge of groundwater contaminants in the Shallow UA Sand to Mill Creek. Groundwater quality data downgradient of the French drain indicate that the French drain is only partially effective in controlling the discharge of contaminated groundwater into Mill Creek.

3.0 ECOLOGICAL RISK EVALUATION AND CLEANUP GOAL DEVELOPMENT

3.1 Exposure Pathways and Assessment Endpoints

Groundwater and associated contaminants flow downgradient and may enter the hyporheic zone beneath the streambed near Mill Creek, where the water may be a mixture of surface water and groundwater. The zone where groundwater and surface water mixing occurs is hereafter referred to as the 'transition zone'. The transition zone is usually located below or near the sediment-water interface; however, its exact depth and extent depends on hydraulic and geological conditions. This transition zone may extend for many meters from the streambed (both vertically and laterally), or it may be relatively small, especially if it is primarily at or near the sediment-water interface. In gaining reaches of Mill Creek, the transition zone may be at or very near the sediment-water interface. In this situation, the benthic zone (i.e., the area inhabited by benthic biota) may consist almost entirely of groundwater, and mixing with surface waters would occur predominantly in the stream channel above the streambed. The streambed sediments will be saturated primarily with undiluted groundwater (as pore water), and the organisms of this zone will be exposed essentially to the physical and chemical conditions of the groundwater. Seepage meter tests could be attempted to determine the rate at which groundwater flows into Mill Creek, which would permit a better understanding of the transition zone in the segment of Mill Creek adjacent to the Rohm and Haas site.

In contrast, if there were losing reaches of Mill Creek where the stream surface water flowed at a high rate down through the sediments, the pore water environment would consist almost entirely of surface water, and mixing with groundwater would occur predominantly further beneath the bed of the stream channel. The streambed sediments would be saturated primarily with undiluted surface water (as pore water), and the benthic organisms of the streambed would be exposed essentially to the physical and chemical conditions of the surface water.

Between these two extreme situations, there could be stream segments where the pore water of the sediments resembled neither undiluted groundwater nor undiluted surface water, but rather, some intermediate condition. Depending on local topography, water table heights, streamflow, and geological and soil characteristics, segments of streams could have many alternating gaining and losing reaches over relatively short distances, or could alternate between these two conditions over shorter or longer time intervals. Thus, the transition zone could be located at a variety of depths along the length of the stream and could vary through time as well. Given what is currently known about the hydrogeology of Mill Creek, as discussed in Section 2.0, a reasonably conservative assumption is that the benthic zone contains pore water with characteristics of undiluted groundwater. The benthic organisms may therefore be exposed, at a maximum, to contaminants at the concentrations in undiluted groundwater. In addition, the aquatic organisms in the water column of the stream will be exposed to groundwater contaminants as determined by the mixing and dilution of groundwater and surface water, which in most cases will be at lower concentrations than in groundwater.

Flows of groundwater to streams provide important microhabitats for a variety of organisms, including: thermal refugia for fish spawning, feeding, and nursery habitats; primary or temporary habitat for many invertebrates at all or some stages of their life cycle; and habitat for bacteria, fungi, protozoans, diatoms, and other organisms that provide for nutrient cycling as well as food items for higher trophic level organisms.

Since the bottom of Mill Creek consists primarily of rock and concrete rubble with very little soft sediments, it should have a predominately hard substrate epibenthic fauna that would live on hard surfaces of the substrate, including beneath the surface layer of the rubble where some part of the transition zone conditions probably extends. These organisms, typically algae, insects, crustaceans, and molluscs, are often present in significant numbers in such substrates, and can provide a significant food source for fish and other higher trophic level organisms. The softer substrate beneath the rubble would also provide habitat to a community of organisms specialized for existence in the hyporheic zone. The presence or absence of organisms within the benthic areas and in the transition zone will depend on a number of existing environmental conditions, notably factors such as toxicity, oxygen concentration, particle size, and food availability (which may or may not be influenced by groundwater characteristics), that determine the actual distribution and abundance of organisms in this zone. In Mill Creek, the benthic zone is likely to encompass surficial sediments, rock and concrete rubble, and perhaps even the sand layer beneath the rock and concrete.

Accordingly, the following assessment endpoints are recommended:

- Maintenance and sustainability of the infaunal and epifaunal community of the benthic zone in Mill Creek
- Maintenance and sustainability of the aquatic life community inhabiting overlying surface water in Mill Creek.

Because fish and invertebrates may be exposed to contaminants in Mill Creek, trophic transfer of contaminants through the aquatic food web to wildlife must also be considered. Based on a review of contaminants detected in groundwater, seeps, surface water and sediment, however, appreciable bioaccumulation is unlikely to occur as a result of contaminants discharging to Mill Creek via groundwater. Refer to Attachment 1 for a detailed discussion of each potentially bioaccumulative contaminant detected at Rohm and Haas. Due to this limited potential for bioaccumulation, a detailed discussion of methodologies for developing groundwater cleanup goals to protect wildlife through the Mill Creek food web pathway is not included in this document. Brief recommendations are provided in Section 3.3.1. Uncertainty regarding bioaccumulation could be reduced by conducting site-specific tissue residue analyses of fish and/or invertebrates, but these additional evaluations do not appear to be warranted, given the low levels of bioaccumulative contaminants detected in surface water and sediments.

Comparison of media concentrations to water and sediment screening values is recommended to assess the potential risk of direct toxicity to benthic infauna and epifauna and aquatic life in Mill Creek surface water, as discussed below in Section 3.2.

3.2 Selection of Ecological COPCs

The recommended process for selecting COPCs for further evaluation and cleanup goal development is described in the following sections.

3.2.1 Exposure Concentrations

To select COPCs, available data for surface water, sediment, seeps, and groundwater should be considered. Chemicals with maximum detected concentrations in any of the above media that exceed applicable screening values should be retained for further risk evaluation and cleanup goal development.

Those monitoring wells screened in the Shallow UA Sand along the western boundary of the facility, immediately upgradient of Mill Creek, should provide the water quality most likely to be representative of that discharging into Mill Creek. These monitoring wells include UAW03-20, UAW05-20, UAW07-20, and MW-EPA-1 along the downgradient edge of the French drain, and UAW-1-30, UAW02-20, UAW02-40, and UAW25-20 along the western boundary of the facility and south of the expected location of the French drain. However, it is recommended that groundwater quality data from all on-site monitoring wells screened in the Shallow UA Sand be used to identify COPCs. Inclusion of wells upgradient of the French drain in the COPC selection process will ensure that cleanup goals are developed for any chemical that could pose future risk threat in case of reduced effectiveness of the French drain or any other selected remedy.

As discussed in Section 2.0, groundwater is currently discharging through the banks into Mill Creek. During their October 2001 field event, Rohm and Haas identified and sampled seeps at two locations along the bank that were discharging to Mill Creek. Although these data may not be fully representative of groundwater concentrations discharging to Mill Creek, they are considered indicative of groundwater contaminants that are discharging to the creek. Consequently, the seep data should be used in the screening process to determine COPCs that may require groundwater cleanup goals. It is noted that, since the sampled seeps were discharging through the creek bank and not the creek bed, seep concentrations may not be representative of transition zone pore water concentrations. Groundwater discharge at the creek bank is not considered to be part of the transition zone, as described in Section 3.1, because the discharge occurs mostly above level of the surface water (subject to water level fluctuation), and mixing of groundwater and surface water within the sediments is not occurring in this area. Transition zone pore water concentrations have not been directly measured by Rohm and Haas. Seep concentrations may also not be representative of the average concentrations in groundwater discharging through the entire Shallow UA Sand to Mill Creek because these seeps only represent groundwater traveling in the shallowest portion of the Shallow UA Sands. In addition,

due to other sampling considerations, samples taken from seeps may not be as representative of groundwater conditions as those taken from monitoring wells.

It is noted that, based on Ohio EPA's recommendation that polycyclic aromatic hydrocarbons (PAHs) are ubiquitous in Mill Creek and elevated concentrations cannot be directly attributed to the Rohm and Haas facility, we do not recommend further evaluation of PAHs in Mill Creek. Similarly, based on Booz Allen's analysis of spatial trends in polychlorinated biphenyl (PCB) and pesticide concentrations, these two classes of chemicals cannot be attributed to the Rohm and Haas facility. Consequently, PAHs, PCBs, and pesticides should not be selected as COPCs, despite screening value exceedances. Refer to Attachment 2 for a more detailed discussion of PCBs and pesticides.

3.2.2 Screening Values

Ohio EPA outside mixing zone average (OMZA) aquatic life criteria (from Ohio Administrative Code (OAC) Section 3745-1-07, Tables 7-1 and 7-9) and Tier II values for the Ohio River Basin (http://www.epa.state.oh.us/dsw/wqs/criteria.html) should be the primary source of screening values applied to measured concentrations in groundwater, surface water, and seeps. For those chemicals lacking an appropriate OMZA value, EPA Region 5 Ecological Screening Levels (ESLs) (USEPA 2003a) should be used. According to this hierarchy, chemicals with maximum concentrations exceeding the ESL but not the OMZA value should *not* be retained as COPCs.

In accordance with EPA guidance (Prothro 1993), dissolved metals concentrations should be used as exposure point concentrations, in preference to total metals concentrations, because dissolved metals concentrations are thought to better represent the bioavailable fraction. In cases where the measured total metal concentrations exceed total metal screening values, but measured dissolved metal concentrations do not exceed dissolved metal screening value, the metal should not be retained as a COPC.

For sediment, EPA Region 5 ESLs (USEPA 2003a) should be used in combination with Ohio EPA Sediment Reference Values (SRV) for the Interior Plateau ecoregion (OEPA 2003). Only those chemicals with a maximum concentration that exceeds both the ESL and the SRV should be selected as a COPC. In cases where the maximum concentration exceeds the ESL, but not the SRV, concentrations of the chemical are consistent with regional background levels and benthic organisms are likely to be adapted to local concentrations. Conversely, in cases where the SRV is exceeded but the ESL is not, the chemical may be present at elevated concentrations, but these concentrations are unlikely to be sufficiently high to cause toxicity to benthic organisms.

It is noted that both EPA Region 5 and Ohio EPA use MacDonald et al. (2000) threshold effect concentrations as the preferred source of sediment screening values.

3.3 Methods for Groundwater Cleanup Goal Development

3.3.1 Target Ambient Surface Water and Sediment Concentrations

To develop groundwater cleanup goals that will be protective of Mill Creek ecological receptors, target ambient surface water and sediment concentrations must first be developed. These targets can then be used to calculate appropriate groundwater cleanup goals, as outlined below in Section 3.3.2.

For surface water, target concentrations could be set as the screening values described in Section 3.2.2 (i.e., OMZA and ESL values). These OMZA and ESL values should be sufficiently protective of aquatic life in Mill Creek, but may be lower than necessary as a result of site-specific factors that affect the bioavailability and toxicity of certain chemicals.

For sediments, additional sampling of sediments and biota below or between hard substrate objects would be needed to delineate the density and abundance of various species in the benthos.

A conservative assumption, would require no additional data collection or evaluation, would be that the benthic zone pore water concentration is equal to the groundwater concentration. The toxicological targets could then be set as pore water concentrations, rather than as bulk sediment concentrations, since pore water best represents exposure to most benthic taxa. Target ambient concentrations for surface water (i.e., OMZA and ESLs), should be applied to sediment pore waters. Application of surface water quality criteria to pore water is fairly well supported, as recent EPA guidance (e.g., USEPA 2003b) on Equilibrium Partitioning Sediment Benchmarks indicates that benthic-dwelling aquatic life are similar to water column-dwelling aquatic life with respect to toxicological sensitivity.

If the facility prefers not to rely on the default OMZA and ESL values, then toxicity tests using standard test organisms could be conducted to develop more definitive site-specific target concentrations. The groundwater dilution that would result in non-toxic surface waters could be estimated by conducting toxicity tests using groundwater collected from the site in a series of dilutions with Mill Creek surface water collected from the site. The results of these toxicity tests could then be used to develop protective, site-specific target surface water and sediment pore water concentrations. Should the facility choose to develop site-specific target surface water and sediment concentrations, it is recommended that a work plan be submitted to EPA for review and approval prior to the initiation of any toxicity tests. Selection of test methods, taxa, and endpoints should be considered carefully to ensure that an ambient toxicity-based approach to establishing target concentrations does not inappropriately ignore effects on untested sensitive taxa. For well-studied COPCs, it should be possible to place the expected sensitivity of the site-specific toxicity tests within the broader spectrum of species and endpoint sensitivity.

Once target sediment pore water and surface water values are determined as discussed above, risks to wildlife through the aquatic food web pathway should be calculated using the target concentrations as exposure point concentrations. These calculations are only needed for those COPCs for which wildlife risks were indicated in the June 2005 Screening Ecological Risk Assessment (SERA) or that are highly bioaccumulative (see Attachment 1). Based on a preliminary review of the SERA and site-wide groundwater concentrations, it appears that these risk calculations may be necessary for lead, mercury, and tin. It is expected that target concentrations will be sufficiently low to protect wildlife, but the target concentrations should be adjusted if calculated risks indicate hazard quotients greater than one.

3.3.2 Calculation of Groundwater Cleanup Goals

It is recommended that groundwater cleanup goals be set for all COPCs identified according to the recommendations provided above in Section 3.2. Although additional ecological evaluation could demonstrate that the current flux of groundwater contaminants into Mill Creek is not causing ecological impacts, setting cleanup goals for these COPCs will provide decision criteria to judge whether the French drain or any other selected remedy remains effective in the future.

To develop groundwater cleanup goals that are protective of both surface water and sediment exposures, two separate cleanup goals for each constituent may need to be calculated based on surface water exposure to aquatic organisms and sediment pore water exposure to benthic zone epifauna and infauna. Methods for calculating cleanup goals are described in more detail below.

Cleanup Goals Based on Surface Water Exposure

Once target ambient surface water concentrations have been developed as described in Section 3.3.1 above, the groundwater concentration that will result in this target surface water concentration under seven day, ten year low flow (7Q10) flow conditions can be calculated. It is noted that, if benthic zone pore water is assumed to be equivalent to groundwater (i.e., no dilution), then cleanup goals based on surface water do not need to be calculated. Under these circumstances, the pore water-based groundwater cleanup goal will drive the overall ecological groundwater cleanup goal because target concentrations are the same for pore water and surface water. However, if additional investigation demonstrates that groundwater does not contribute significantly to benthic zone pore water, then the surface water-based groundwater cleanup goals will need to be calculated as described in Attachment 3. As discussed in this attachment, it is recommended that groundwater cleanup goals be set in terms of mass flux to Mill Creek, rather than as target groundwater concentrations.

Cleanup Goals Based on Sediment Exposure

As previously discussed, a conservative assumption would be that the sediment pore water concentration is equal to the groundwater concentration. Under this assumption, no additional

data collection or evaluation would be required, and groundwater cleanup goals would be set as the target sediment pore water concentration. This is a reasonable assumption where the stream reach is gaining from groundwater or the hydrologic conditions are unknown, and concentrations of COPCs in groundwater have been measured from monitoring wells or other samples located near the stream channel itself. A more detailed discussion of associated assumptions is included below. Note that in contrast to the recommended procedure for developing cleanup goals based on surface water exposure, which should be set in terms of mass flux, cleanup goals based on sediment exposure can be set in terms of target groundwater concentrations.

Discussion of Assumptions Made in Cleanup Goal Recommendations

Groundwater cleanup goals that are protective of benthic zone infauna and epifauna can be determined as outlined above, with little or no additional data collection, under the following assumptions:

- The benthic zone infaunal and epifaunal communities in Mill Creek are significant enough to warrant protection, either currently or in the future
- Contaminated groundwater from the Rohm and Haas facility is discharging up through the bed of Mill Creek
- Benthic zone pore water chemical concentrations are equivalent to groundwater (i.e, pore water is not diluted by surface water)
- Contaminants present in groundwater are unlikely to bioaccumulate in Mill Creek biota to a significant degree, and do not warrant further risk evaluation

With the exception of the final two assumptions, the above assumptions are more likely to produce overprotective cleanup goals than underprotective ones. Consequently, it is our best professional judgement that cleanup goals developed according to the above recommendations will be adequately protective of the infaunal and epifaunal community of the benthic zone in Mill Creek, as well as the aquatic life community in the overlying surface water. Some additional discussion regarding these assumptions is provided below for reference.

Benthic zone pore water should not be considered similar to groundwater under the following circumstances:

- Creek bed is highly disturbed and not likely to support significant hyporheic or benthic biota
- In losing reaches of streams where the pore water would resemble stream surface water rather than groundwater
- The contaminant is found in denser layers of plumes (i.e., dense non-aqueous phase liquids [DNAPLs]) that are below the hyporheic zone
- There is a geological barrier or hydrologic condition that prevents contaminated groundwater from entering the hyporheic zone (such as low or non-permeable soils or rock, channeling away from the stream before interception)

EPA and Rohm and Haas may wish to further consider whether any of the above conditions apply at Mill Creek before setting groundwater cleanup goals as described in this document.

4.0 HUMAN HEALTH RISK EVALUATION AND CLEANUP GOAL DEVELOPMENT

4.1 Exposure Pathways

Potential exposure at the site is a function of the current and potential future land uses, both of the site and its surrounding area. The Rohm and Haas facility is an active industrial facility, and is anticipated to remain such for the foreseeable future, as the site is zoned for heavy industrial land use. As described in Section 2.0, there is a shallow upper aquifer and a lower aquifer. The upper aquifer is not used as a potable water supply source. The lower aquifer is widely used as a source of potable water; however, there are no known active supply wells at or in the immediate area of the site. The shallow groundwater flow is generally from the east and northeast towards the west and west-southwest and discharges into Mill Creek. Thus, contaminated groundwater may potentially interact with the surface water and sediment in the creek. While there is no direct human contact with the groundwater in the vicinity, human contact with Mill Creek surface water (including seep water), and sediment is possible. The potential pathways of human exposure for Mill Creek include the following:

- Recreational adult and child exposures to surface water during wading via incidental ingestion, dermal contact, and inhalation
- Recreational adult and child exposures to sediment during wading via incidental ingestion, dermal contact, and inhalation
- Recreational adult and child exposures to contaminated fish tissue via consumption

The following sections will recommend the screening values that should be used to determine COPCs for Rohm and Haas groundwater, and Mill Creek surface water, sediment, and fish tissue.

4.2 Selection of Human Health COPCs

The recommended process for selecting COPCs for further evaluation and cleanup goal development is described in the sections that follow.

It should be noted that PAHs, PCBs, and pesticides were not selected as COPCs despite screening value exceedances since these compounds can not be attributed to the Rohm and Haas facility, as previously discussed in Section 3.2.1 (see Attachment 2).

4.2.1 Exposure Concentrations

Those monitoring wells screened in the Shallow UA Sand along the western boundary of the facility, immediately upgradient of Mill Creek, should provide the water quality most likely to be representative of that discharging into Mill Creek. These monitoring wells include UAW03-20, UAW05-20, UAW07-20, and MW-EPA-1 along the downgradient edge of the French drain, and UAW-1-30, UAW02-20, UAW02-40, and UAW25-20 along the western boundary of the facility and south of the expected location of the French drain (as discussed in Section 3.2.1). However, it is recommended that groundwater quality data from all on-site monitoring wells screened in the Shallow UA Sand be used to identify COPCs. Inclusion of wells upgradient of the French drain in the COPC selection process will ensure that cleanup goals are developed for any chemical that could pose future risk threat in case of reduced effectiveness of the French drain or any other selected remedy. Chemicals with maximum detected concentrations above applicable screening criteria are retained for further risk evaluation and cleanup goal development. Refer to Section 3.2.1 for a discussion of seep data.

To select COPCs, groundwater, surface water, seep, and sediment data should be screened. For all media, the maximum detected concentration should be used, and if a contaminant is not detected, the maximum detection limit should be used for evaluation.

4.2.2 Screening Criteria

Groundwater at or in the vicinity of the site is not used as potable water. However, groundwater is discharging into surface water at Mill Creek. Thus, EPA's National Recommended Ambient Water Quality Criteria (NAWQC) for human health consumption of surface water and aquatic organisms (e.g., fish, crayfish) represent conservative screening values for the groundwater discharging into Mill Creek, and are compared with measured concentrations in groundwater and surface water (including seep water) (USEPA 2004). Given the recreational use of Mill Creek and potential for direct contact with surface water, the NAWQC are the most appropriate criteria, as they account for both ingestion of surface water and the bioaccumulation of appropriate contaminants in the tissues of aquatic organisms using established EPA methodology and published bioconcentration factors (BCFs).

Ohio EPA's non-drinking OMZA human health criteria (from OAC Section 3745-1-32 for the Ohio River Basin), are based solely on the ingestion of organisms from which concentrations are derived using laboratory studies (e.g., exposure to mammals such as rats or mice). These criteria are protective of people against adverse exposure to chemicals via the fish ingestion pathway. Based on the results of the evaluation of bioaccumulative contaminants detected at Rohm and Haas (see Attachment 1), contaminated fish tissue are not expected to occur at Mill Creek. Thus, the Ohio non-drinking OMZA human health criteria are not entirely appropriate considering the ingestion of contaminated fish is not expected to be a complete exposure pathway. While Ohio does have drinking OMZA human health criteria, these criteria are also not appropriate as there are no potable water intakes at or in the vicinity of Rohm and Haas site.

To evaluate contaminant concentrations in sediment, the EPA Region 9 Preliminary Remediation Goals (PRGs) for residential soil were used. This is consistent with Ohio EPA, Division of Emergency and Remedial Response Technical Decision Compendium dated April 28, 2004.

4.3 Recommended Methods for Developing Cleanup Goals

4.3.1 Target Cleanup Criteria for Fish Ingestion

The development of groundwater cleanup criteria for the protection of human health from fish consumption is not necessary because the identified COPCs are either not bioaccumulative or only slightly bioaccumulative. In addition, groundwater concentrations of these COPC are less than two orders of magnitude above the NAWQC, which are based upon $1x10^{-6}$ risk. Finally, fish will not be exposed directly to these groundwater concentrations but will be exposed to much lower concentrations in surface water, given the 7Q10 flow conditions and the potential for dilution (Attachment 3).

4.3.2 Target Ambient Surface Water and Sediment Concentrations

To develop groundwater cleanup goals that will be protective of Mill Creek recreators (i.e., children and adults), target surface water (including seep water) and sediment concentrations first need to be developed. These targets can then be used to calculate appropriate groundwater cleanup goals, as outlined below.

For surface water (including seep water), target concentrations could be set as the NAWQC values described in Section 4.2.2. These NAWQC values will be sufficiently protective of human health exposures at Mill Creek, but may be overly conservative due to lower exposure conditions experienced by recreators. Alternatively, site-specific recreator target concentrations could be back-calculated for surface water using the inverse of standard risk equations, a target risk of $1x10^{-6}$, and site-specific exposure factors. Current risk assessment guidance (i.e., EPA's 1997 Exposure Factors Handbook Volumes I-III, 2004 Risk Assessment Guidance for Superfund, Part E: Supplemental Guidance for Dermal Risk Assessment, etc.) and professional judgement should be used to develop the exposure frequency, incidental ingestion rate, skin surface area and other exposure factors relevant to Mill Creek recreational exposures. The regional climate for this part of Ohio as well as the local physical setting should be considered when developing these site-specific recreator target levels.

For sediments, target concentrations could be set as the EPA Region 9 PRG for residential soil exposures. When sediment data for Mill Creek are compared to soil PRGs, only arsenic and PAHs exceed screening levels. As previously discussed, PAHs cannot be attributed to the Rohm and Haas facility and should not be considered COPCs. Arsenic concentrations in sediment samples averaged 4.7 mg/kg with a maximum detection of 6.3 mg/kg. These concentrations likely represent ubiquitous, regional levels of arsenic.

In addition, there are no persistent, bioaccumulative, and toxic (PBT) constituents present in groundwater. Consequently, it is unlikely that groundwater COPCs are a significant future source of sediment contaminant load. Chlorobenzene and dichlorobenzene only exhibit minor sediment adsorption potential, with log K_{ow}s of 2.18 and 3.4 (Hansch et al. 1995), respectively. The metals in groundwater, while ranging in adsorption potential, are present at concentrations only moderately above the NAWQC; thus, they are unlikely to represent a significant source of sediment contamination. Due to the lack of PBT constituents, the minor adsorption potential for chlorobenzenes and the moderate exceedances of detected metals, the development of groundwater cleanup goals for the protection of sediment exposures to human receptors is not recommended.

4.3.3 Calculation of Groundwater Cleanup Goals

It is recommended that groundwater cleanup goals for protection of surface water human exposures be set for all COPCs identified according to recommendations in Section 4.2 above. The screening evaluation suggests a human health concern from exposures to groundwater COPC concentrations but assumes direct exposure of recreators to groundwater concentrations. This does not represent the actual surface water exposures for recreators in Mill Creek because it does not account for mixing and dilution naturally occurring at and downgradient of the groundwater/ surface water interface. Thus, once target ambient surface water concentrations have been determined, as described in Section 4.3.2 above, the groundwater concentration that will result in this target surface water concentration, under 7Q10 flow conditions, can be calculated. It is recommended that groundwater cleanup goals be set in terms of mass flux to surface water, based on the NAWQC for each COPC, and according to calculation methods outlined in Attachment 3. If the current mass flux of groundwater COPCs exceed these cleanup goals, further risk evaluation should be conducted by back-calculating groundwater cleanup goals using the inverse of standard risk equations along with recreator-specific exposure factors.

5.0 OHIO EPA REQUIREMENTS

While the above text summarizes recommendations that will meet EPA requirements, Rohm and Haas must also meet OEPA requirements in developing groundwater cleanup goals. EPA has consulted with OEPA regarding the acceptability of the methodologies described in this document. OEPA has responded that, in general, these methodologies will meet State requirements (refer to Attachment 4). However, as discussed in OEPA's letter (Attachment 4), OEPA may require further stream characterization prior to cleanup goal development.

For reference, OEPA has indicated that Ohio state law prohibits, with few exceptions, the discharge of pollutants into waters of the state, including groundwater. The discharge of contaminated groundwater to surface water is also prohibited. Limited exceptions are granted to permit-holders or for specified activities. Relevant sections of the Ohio Revised Code are copied below, also for reference purposes.

6111.04 Acts of pollution prohibited; exceptions.
(A) (1) No person shall cause pollution or place or cause to be placed any sewage, sludge, sludge materials, industrial waste, or other wastes in a location where they cause pollution of waters of the state.

6111.01 Definitions.
(A) "Pollution" means the placing of any sewage, sludge, sludge materials, industrial waste, or other wastes in any waters of the state.
(C) "Industrial waste" means any liquid, gaseous, or solid waste substance resulting from any process of industry, manufacture, trade, or business, or from the development, processing, or recovery of any natural resource, together with such sewage as is present.
(D)"Other wastes" means garbage, refuse, decayed wood, sawdust, shavings, bark, and other wood debris, lime, sand, ashes, offal, night soil, oil, tar, coal dust, dredged or filled material, or silt, other substances that are not sewage, sludge materials, or industrial waste, and any other "pollutants" or "toxic pollutants" as defined in the Federal Water Pollution Control Act that are not sewage, sludge, sludge materials, or industrial waste.
(H) "Waters of the state" means all streams, lakes, ponds, marshes, watercourses, waterways, wells, springs, irrigation systems, drainage systems, and other bodies or accumulations of water, surface and underground, natural or artificial, regardless of the depth of the strata in which underground water is located, that are situated wholly or partly within, or border upon, this state, or are within its jurisdiction, except those private waters that do not combine or effect a junction with natural surface or underground waters.

6.0 SUMMARY

This document has presented recommended risk-based methods for developing risk-based groundwater cleanup goals that will be protective of both human health and ecological exposures in Mill Creek. Table 1 below presents a brief summary of these recommendations.

For ecological COPCs, concentration-based groundwater cleanup goals must be developed to protect benthic zone infauna and epifauna, as described in Section 3.3.2 above. Because sediment exposures are expected to drive the ecological cleanup goals for groundwater, development of separate cleanup goals intended to protect aquatic organisms from surface water exposures may not be necessary. Nonetheless, methods for developing cleanup goals based on surface water exposures are presented in Section 3.3.2 and Attachment 3. It is recommended that cleanup goals based on surface water exposures be set in terms of mass flux of groundwater COPCs to surface water, rather than in terms of specific groundwater concentrations.

Similarly, groundwater cleanup goals designed to protect human health exposures to Mill Creek surface water should be set in terms of mass flux of groundwater to surface water, as described in Section 4.3.3 and Attachment 3.

While the risk-based methodologies presented herein are intended to meet EPA Corrective Action requirements, Rohm and Haas should ensure that State requirements are also met, as discussed in Section 5.0 and Attachment 4.

Table 1
Summary of Recommended Methods for Establishing Groundwater Cleanup Goals

Rohm and Haas Chemicals LLC., Reading, Ohio						
	Human Health			Ecological		
Media	Screening values used for selection of COPCs	Target value	Development of groundwater cleanup levels	Screening values for selection of COPCs	Target value	Development of groundwater cleanup levels
Surface water and bank seeps (seep data treated as surface water)	National Ambient Water Quality Criteria (NAWQC)	Set as screening levels for surface water or calculate target for recreation scenario using the inverse of risk equation for target risk of 10^{-5} and site-specific exposure factors.	Determine maximum contaminant mass flux in groundwater to surface water that will meet target levels under seven-day ten year low flow (7Q10) conditions.	OEPA's Outside mixing zone average (OMZA) aquatic life criteria and Tier II values for the Ohio River Basin (use Region 5 Ecological Screening Levels [ESL] if these values are not available).	Screening levels for surface water; alternatively, develop site-specific target values (for surface water) based on toxicity tests.	Determine maximum contaminant mass flux in groundwater to surface water that will meet target levels under 7Q10 conditions.
Groundwater	NAWQC			OEPA's OMZA aquatic life criteria and Tier II values for the Ohio River Basin (Region 5 ESL if these values are not available)		
Sediment (Benthic Zone)	Region 9 Preliminary Remediation Goals for Residential Soil	Set as screening levels for sediment (may not consider site-specific target values because the development of cleanup goals based on sediment is not recommended).	The development of clean up goals based on sediment target values is not recommended due to lack of PBTs, minor adsorption potential for chlorobenzenes, and presence of metal concentrations at levels that moderately exceed screening criteria.	Region 5 ESL in combination with OEPA Sediment Reference Value (SRV)	Apply screening levels for surface water to pore water or, alternatively, develop site-specific target values for surface water based on toxicity tests. Target concentrations are the same for pore water and surface water. Assumptions: Toxicological targets can be set for pore water, which best represents exposure to benthic taxa. Contaminated groundwater discharges to the bed of Mill Creek.	Groundwater cleanup goals protective of benthic biota are equivalent to target values. Assumption: Benthic zone pore water is equivalent to groundwater (i.e., no dilution).

7.0 REFERENCES

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ATTACHMENT 1

Chemicals of Potential Bioaccumulative Concern

The sections that follow discuss the potential for chemicals detected in groundwater, surface water, seeps, and/or sediments to bioaccumulate, and as a result, present risk to higher trophic level wildlife receptors. Based on the bioaccumulative potential of the chemicals discussed below, in combination with the concentrations detected, it is not expected that appreciable bioaccumulation of Rohm and Haas contaminants will occur. Although uncertainty could be reduced by conducting site-specific tissue residue analyses of fish and/or invertebrates, these additional evaluations do not appear to be warranted, given the low levels of bioaccumulative contaminants detected in surface water and sediments.

METALS

For many metals, tissue residue-toxicity relationships can be highly variable because organisms might sequester metal in various forms that might be analytically measurable as tissue residue but are actually stored in unavailable forms within the organism as a form of detoxification (Suter et al. 2000). Consequently, bioconcentration factors (BCFs) and bioaccumulation factors (BAFs) from the literature are unreliable substitutes for site-specific values.

ANTIMONY

There was no bioaccumulation information for freshwater organisms found in the literature, and there is no biota-sediment accumulation factor (BSAF) included in EPA (2000). Antimony is not generally considered a problem from bioaccumulation, and since it exceeds the OMZA criteria and Region 5 ESL at only one well upgradient of the French drain, is probably not a concern for bioaccumulative effects in Mill creek.

ARSENIC

Arsenic (As) is accumulated by aquatic organisms primarily through dietary exposure, and not directly from water (EPA 2000). There is also no evidence of magnification along the aquatic food chain. BCFs experimentally determined for arsenic in aquatic organisms (except for algae) are relatively low, not exceeding 17 (summarized in Eisler 1988). Arsenic may bioconcentrate to a higher degree in lower trophic levels, but diminishes significantly in higher trophic levels such as fish (Chen and Folt 2000). There is no BSAF included in EPA (2000).

Arsenic was detected downgradient of the French drain at UAW03-20 and MW-EPA-1, at 905 μg/L and 483 μg/L, respectively. These are relatively slight exceedances of the OMZA criteria and ESL of 150 and 148 μg/L, respectively (about three- to six-fold). Therefore, for higher trophic level organisms exposed to the contribution of groundwater to surface water, arsenic does not appear to be a concern through bioaccumulation in Mill Creek.

BARIUM

Barium is not typically a significant concern for bioaccumulative effects. There was no bioaccumulation information for freshwater organisms found in the literature. In water, the more toxic soluble barium salts are likely to precipitate out as the less toxic insoluble sulfate or carbonate. Marine animals concentrate barium approximately seven- to 100-fold from seawater (EPA technical fact sheet on Barium (http://www.epa.gov/OGWDW/dwh/t-ioc/barium.html). There is no BSAF listed in Appendix D of the EPA National Sediment Quality Survey.

Barium was detected downgradient of the French drain at UAW03-20 and MW-EPA-1, and at UAW02-20 (not influenced by French drain) at 227 µg/L, 246 µg/L, and 271 µg/L, respectively. These are relatively slight exceedances of the OMZA criteria and ESL of 220 µg/L. Therefore, for higher trophic level organisms exposed to the contribution of groundwater to surface water, barium does not appear to be a concern through bioaccumulation in Mill Creek.

CADMIUM

Most studies reviewed contained data which suggest that cadmium is not a highly mobile element in aquatic food webs, and there appears to be little evidence to support the general occurrence of biomagnification of cadmium within marine or freshwater food webs (EPA 2000). Shephard (2000) lists a BCF of 64, which is relatively low. The evidence for cadmium transfer through various trophic levels suggests that only the lower trophic levels exhibit biomagnification. Experimentally, fish fed cadmium-contaminated cladocerans for four days showed no change in body burdens (Eisler 2000).

The highest concentration of cadmium detected on site was 1.2 µg/L upgradient of the French drain at UAW04-20, which exceeded the R5 ESL of 0.15 µg/L (about nine times), but not the OMZA aquatic life criteria of 5.2 µg/L. Since barium does not biomagnify significantly, it does not appear to be a concern for higher trophic level organisms exposed to the contribution of groundwater to surface water in Mill Creek.

CHROMIUM

Chromium (Cr) appears to have limited mobility under typical conditions in most aquatic habitats because the trivalent form tends to bind to sediments. A log BCF of 2.74 was reported for *Daphnia magna*, and little evidence exists for the bioaccumulation/ biomagnification of chromium in aquatic food webs, although sediments frequently contain elevated concentrations of trivalent chromium (EPA 2000). In virtually all studies in both marine and freshwater environments involving birds and mammals, there was no biomagnification of chromium in the food web, but rather decreasing concentrations with increasing trophic level (Outridge and Scheuhammer 1993). Sensitive species of freshwater aquatic organisms showed reduced growth, inhibited reproduction, and increased bioaccumulation at about 10.0 µg/L and higher of Cr+6, and other adverse effects at 30.0 µg/L and higher of Cr+3.

A concentration of 505 μg/L of chromium was found in groundwater at monitoring well UAW25-20, which should be re-confirmed. A concentration of 37.2 μg/L was recorded downgradient of the French drain at MW-EPA-1, which is within the range of adverse effects noted above. Bioaccumulative effects would therefore be limited to the hyporheic and benthic burrowing biota if exposed to undiluted groundwater, but bioaccumulative effects in surface water organisms should not be significant.

COBALT

There was no bioaccumulation information for freshwater organisms found in the literature, and there is no BSAF included in EPA (2000). Cobalt is not generally considered a problem from bioaccumulation, and since it exceeds the OMZA criteria and Region 5 ESL only one seep (SS-1, at 43.8 μg/L) by less than two times the OMZA aquatic life criteria and Region 5 ESL of 24 μg/L, cobalt is probably not a concern for bioaccumulative effects in Mill Creek.

COPPER

Little evidence exists to support the general occurrence of biomagnification of copper in the aquatic environment; copper is taken up by aquatic organisms primarily through dietary exposure, and is highly variable between species (EPA 2000; Eisler 2000). The bioavailability of copper is also influenced to some extent by total water hardness and the acid-volatile sulfide (AVS) concentration.

Copper was detected in seeps SS-1 and SS-2 at 104 μg/L and 31.9 μg/L, respectively. These concentrations exceed the OMZA criteria and ESL of 21 μg/L and 1.58 μg/L, respectively; however they would be diluted significantly after mixing with surface water. The groundwater concentrations have been much lower, and close to the aquatic life toxicity criteria level, so copper is probably not accumulating significantly even at the lower trophic levels. Therefore, for higher trophic level organisms exposed to the contribution of groundwater to surface water, copper does not appear to be a concern through bioaccumulation from surface water in Mill Creek.

LEAD

Although methylated lead is rapidly taken out from the water by some fish, there is no evidence of biomagnification in the aquatic environment (EPA 2000; Eisler 2000). Among aquatic biota, lead concentrations were usually highest in algae and benthic organisms, and lowest in upper trophic level predators. In water, lead is most soluble and bioavailable at low pH, low organic content, and with low concentrations of calcium, iron, manganese, zinc, and cadmium, and is capable of forming insoluble metal sulfides and easily complexes with humic acid. Most lead entering surface waters is precipitated in the sediment as carbonates or hydroxides.

Log BCFs of 5.15 (cladoceran) and 3.56 (midge) were reported in the literature (EPA 2000). Lead is accumulated by aquatic organisms equally from water and through dietary exposure; in

sediments, a portion of lead can be transformed to trimethyllead and tetraalkyllead compounds through chemical and microbial processes. Bioaccumulation of organolead compounds is rapid and high; these compounds concentrate in the fatty tissues of aquatic organisms.

Lead was not detected in surface water, and was not detected in sediments at concentrations above Ohio reference values, so currently, lead is likely not a concern for bioaccumulative effects in Mill Creek.

MERCURY

Mercury is accumulated by all trophic levels, with biomagnification occurring up the food web (EPA 2000). Fish bioconcentrate methylmercury directly from water by uptake across the gills , and piscivores readily accumulate mercury from dietary sources. Methylmercury accumulation from either source may be substantial, but the relative contribution of each pathway may vary with fish species. Invertebrates generally have a lower percentage of methylmercury in their tissues than fish. The percentage of methylmercury increases with age in both fish and invertebrates. While sediment is usually the primary source of methylmercury in most aquatic systems, and the food web is the main pathway for accumulation, methylmercury can be accumulated directly from the water by uptake across the gills.

High trophic level species tend to accumulate the most methylmercury, with concentrations highest in fish-eating predators. Methylmercury concentrations in higher trophic species often do not correlate with concentrations in environmental media. Correlations have been made between sediment and lower trophic species that typically have a high percentage of inorganic mercury, and between mercury concentrations in higher trophic species and their prey items. Because of the complex environmental chemistry of mercury, the best measure of bioavailability of mercury in any system can be obtained through analysis of mercury concentrations in the biota at the specific site.

NICKEL

Nickel in the aquatic environment can partition to dissolved and particulate organic carbon, and although fish can accumulate nickel from food and water (Eisler 2002), there is little evidence to support the general occurrence of biomagnification of nickel in the aquatic environment (EPA 2000, Eisler 2000).

Concentrations of nickel were 128 µg/L at UAW25-20 and 214 µg/L at seep SS-1. After dilution with surface water, nickel is probably not a concern for bioaccumulative effects in Mill Creek.

THALLIUM

There was no bioaccumulation information for freshwater organisms found in the literature, and there is no BSAF included in EPA (2000). Thallium is not normally of concern for bioaccumulative effects, and is probably not of concern at this site.

TIN

The chemical, physical, and biochemical properties of inorganic tin compounds differ dramatically from those of representative organotin compounds. There is general agreement that inorganic tins are not highly toxic due to their poor absorption and rapid turnover rate in tissues (Eisler 2000). Although inorganic tin can be biomethylated by microorganisms in the aquatic environment and subsequently mobilized in the ecosystem, the process is slow and usually does not proceed beyond the monomethyltin stage. Methyltins are ubiquitous in the environment and have been measured in seawater, freshwater, rain, wastewaters, sediments, fish, invertebrates, birds, and humans. The monoorganotin compounds generally have a low toxicity. Among aquatic organisms, tributyltin compounds were especially potent. Bioconcentration of inorganic and organic tin compounds from the medium is considerable, but degradation is sufficiently rapid to preclude food chain biomagnification.

Relatively high concentrations of tin were found in several groundwater samples and seeps at the site. If these are inorganic or naturally produced mono-organotin forms of tin, there is probably little risk of adverse effects through bioaccumulation. If it is suspected that the form of tin is a manufactured form of organotin, then chemical analyses to confirm the species of tin present would be required for further assessment.

VANADIUM

There was no bioaccumulation information for freshwater organisms found in the literature, and there is no BSAF included in EPA (2000). Vanadium is not normally of concern for bioaccumulative effects, and is probably not of concern at this site.

ZINC

BCFs for zinc accumulation varied widely between and within species of aquatic organisms (Eisler 2000). Zinc is not a highly mobile element in aquatic food webs, and there appears to be little evidence to support the general occurrence of biomagnification of zinc within freshwater food webs (EPA 2000). Tissue residue-toxicity relationships can also be variable because organisms sequester metals in different forms that are measurable as tissue residue but can actually be stored in unavailable forms within the organism as a form of detoxification. Bioavailability of zinc in sediments is controlled by the AVS concentration.

Although zinc was detected in seeps SS-1 and SS-2 at 411 μg/L and 219 μg/L, respectively, dilution in surface water should reduce concentrations below screening levels (120 μg/L at hardness of 100 mg/L), and since it does not bioaccumulate or biomagnify significantly, it should not pose a risk to aquatic biota at these levels.

ORGANICS

CHLOROBENZENES and DICHLOROBENZENES

The bioaccumulation of chlorobenzenes by aquatic organisms is determined by their relative water and lipid solubility (thus reflecting the octanol/water partition coefficients) and the number of chlorine substitutions (summarized in IPCS 1991). Uptake from water increases with increasing chlorination. BCFs ranging from 270 for 1,2-dichlorobenzene to 20,000 for pentachlorobenzene (PeCB) were reported for laboratory studies on rainbow trout (*Oncorhynchus mykiss*). BCFs for a variety of fish species ranged from 7,000 to 24,000 (lipid weight) for 1,2,4-trichlorobenzene, with a positive correlation between bioaccumulation and lipid content. BCFs (lipid weight) ranged from 4,000 to 22,000 for 1,2,3-trichlorobenzene and 1,2,4-trichlorobenzene in rainbow trout, with newly hatched fish accumulating two to four times the amount found in eyed eggs or young fish (alevins). The rate of elimination of chlorobenzenes decreases with increasing chlorination, and elimination half-lives for dichlorobenzenes to PeCB in laboratory-exposed fish ranged from 0.05 to 1.6 days.

Tissue burdens of 1,070, 138, 1,440, and 47 mg/kg wet weight were the lowest concentrations for significant mortality value for chlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, and 1,4-dichlorobenzene, respectively, in the ERED database (for rainbow trout). From the higher concentrations detected on site, such as the 1,300 µg/L 1,2-dichlorobenzene detected at MW-EPA-1, these would be reached at log BCFs of 2 to 3, which is near or just above the approximate range of BCFs for some dichlorobenzenes. However, since elimination for monochlorobenzenes and dichlorobenzenes is relatively rapid, and dilution from groundwater concentrations would reduce ambient water concentrations below that of groundwater, there is probably little or no bioaccumulative risk.

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ATTACHMENT 2

Discussion of Whether Historic Activities at the Rohm and Haas Site Have Contributed to PCB and Pesticide Impacts in Mill Creek

Booz Allen Hamilton (Booz Allen) has conducted a review of several documents related to the Rohm and Haas facility in Reading, Ohio, to determine if polychlorinated biphenyls (PCBs) and pesticides reported in sediment in Mill Creek can be attributed to historic activities at the Rohm and Haas facility, or are more likely related to off-site sources and/or background contamination. The September 2004 Revised Facility Investigation Report (FI Report) indicates that PCBs and several pesticides (dieldrin, beta-BHC, and 4,4'-DDE) are present in Mill Creek sediment at levels above relevant ecological screening criteria (i.e., Region 5 Ecological Screening Levels [ESLs]). In the FI Report, Rohm and Haas argues that the PCB and pesticide contamination is not site related, but rather is due to migration of contaminants from off-site sources. Booz Allen has reviewed several historic documents[1,2,3] to determine the validity of Rohm and Haas' claim. It should be noted that these documents were reviewed because they contained historic information on impacts identified at surrounding properties (i.e., the Pristine, Inc., and Cincinnati Drum, Inc., sites). These sites have been identified as possible sources of off-site contamination, but are <u>not</u> considered the only potential off-site sources. Other off-site sources likely exist in the vicinity of the Rohm and Haas site, and it is also likely that documentation exists in support of other potential off-site sources that were not reviewed by Booz Allen[4]. However, for the purpose of this analysis, the identified historic documents were reviewed as examples of information pertaining to off-site sources in the vicinity of the Rohm and Haas site, in order to assess the validity of Rohm and Haas' claim. Results of this analysis are presented below, by contaminant class.

<u>PCBs</u>

Aroclor 1248 was detected at two sample locations, the furthest upstream sample (CS-6A, 0.06 mg/kg) located near the northwest property boundary and downgradient (west) of the former

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[1] Hydrogeologic Report of the Pristine-Cincinnati Drum-Carstab Site in Reading, Ohio. Prepared by Ecology and Environment, Inc. Dated November 1982.

[2] Final Remedial Investigation (RI) Report, Pristine, Inc. Site, Reading, Ohio. Prepared by Camp Dresser & McKee, Inc. Dated July 18, 1986.

[3] Note that Booz Allen also reviewed sections of the Current Conditions Report, Morton International, Inc. Facility, Reading, Ohio, prepared by Geomatrix Consultants, Inc., dated September 2000, provided by EPA Region 5. This report does not provide substantial relevant information for this analysis. Thus, the information in this report has not been included in this summary.

[4] As an example, the "Addendum to the RI Report for the Pristine, Inc. Site", dated December 29, 1987, was identified as a document potentially containing information on off-site sources in the area.

surface impoundments (SWMU 1), and the furthest downstream sample (CS-1A, 0.07 mg/kg) located approximately 900 feet downstream of the southwestern property boundary. Aroclor 1254 was detected in one sample location (CS-3A, 0.1 mg/kg) located immediately west of the southwestern corner of the site. Aroclor 1248 was also detected at sample location CS-5A (0.023 J mg/kg), located downgradient (west) of the French Drain; however, this detected concentration is below Region 5 ESLs.

A review of available soil data indicates that PCBs are detected at relatively low concentrations throughout the entire site. PCBs were detected in all quadrants of the site ranging from 0.011 mg/kg to 0.98 mg/kg. Over 70 on-site soil sampling locations (not including differentiated sample depths) have been sampled, but only 17 sample locations reported PCB detections. The attached Table 1, PCB Detections in Soil and Sediment During Recent Sampling Events Associated with the Rohm and Haas Facility, should be referenced for detected concentrations and sample locations. Approximately 23% of the on-site soil samples contained minimal concentrations of PCBs. Minimal concentrations (i.e., concentrations up to 0.24 mg/kg [Aroclor 1260, Sample B09]) of PCBs were also reported in three of ten (i.e., 30%) background samples. In addition, based upon a review of the data, there is not a clear source of PCB contamination at the Rohm and Haas facility. All concentrations reported are minimal and sporadically detected throughout the site. Thus, the physical distribution and levels of PCBs reported would appear to indicate that PCBs are not related to historic activities at the site.

Recent groundwater samples (2004) did not report PCB contamination. However, in November 2001, PCBs were detected at four sample locations throughout the site at concentrations ranging from 0.45 μg/L to 0.92 J μg/L. PCBs have also not been reported in surface water.

The two historic reports (e.g., Hydrogeologic Report and RI Report cited in Footnotes 1 and 2) were reviewed to determine if a clear off-site source of PCBs existed. The RI Report indicates that PCB-contaminated solvents and PCB-contaminated soybean oil were stored at the Pristine site. The report also indicates that from June 1980 to November 1983, much of the waste at the site, including PCB-contaminated soil, was removed in accordance with consent decree between Pristine, Inc., and Ohio EPA. The reports do not provide substantial information on off-site PCB analysis; however, Aroclor 1248 was reported in the southwestern portion of the site at concentrations as high as 55 mg/kg. The report indicates that this detection corresponded with a PCB storage tank. The report did not provide PCB results for sediment or surface water. No other relevant information was obtained from these reports.

Based upon a review of available information, a source of PCB contamination at the Rohm and Haas site was not identified. Sources of PCB contamination were historically present at the Pristine site; however, limited data are available. Thus it is impossible to correlate the off-site PCB contamination to PCB impacts on the Rohm and Haas site or in the adjacent Mill Creek. Due to the physical distribution of contamination reported at the Rohm and Haas site, and the lack of an identified historical source at the site, it appears that PCBs detected in Mill Creek bed sediment may be related to off-site sources and/or elevated background concentrations.

Pesticides

Three pesticides (dieldrin, beta-BHC, and 4,4'-DDE) were reported in Mill Creek bed sediment, while only two (4,4'-DDE and beta-BHC) were reported in creek bank sediment above Region 5 ESLs. Creek bed sediment samples were collected in March 2004, while the most recent creek bank sediments were collected in October 2001. As with PCBs, pesticides were detected in the most upstream creek bed sample (CS-6A, dieldrin = 0.024 mg/kg) and the most downstream sample (CS-1A, dieldrin = 0.002 J mg/kg). Creek bank pesticide detections were reported along the central site boundary (SS-4, beta-BHC = 0.094 PG mg/kg) and the southwestern site boundary (SS-10, 4,4'-DDE = 0.0046 PG mg/kg; SS-12, 4,4'-DDE = 0.023 PG mg/kg).

A review of on-site soil sample results indicates that beta-BHC, dieldrin, and 4,4'-DDE were also detected throughout the site at relatively low levels. Beta-BHC was reported at concentrations ranging from 0.0017 mg/kg to 0.25 mg/kg; dieldrin was reported at concentrations ranging from 0.00015 mg/kg to 0.064 mg/kg; and 4,4'-DDE was reported at concentrations ranging from 0.0002 mg/kg to 0.2 mg/kg. Out of the over 70 on-site soil samples collected (not including differentiated sample depths), only 16 sample locations reported one or more of these three pesticides. Thus, approximately 22% of the on-site soil samples contained one or more of these three pesticides that were also reported in sediments in Mill Creek. 4,4'-DDE and dieldrin were also reported in four of ten background samples (i.e., 40% of background samples collected), with maximum concentrations of 0.019 mg/kg and 0.055 mg/kg, respectively. Based upon a review of the data, pesticides were minimally reported in the northeast, southeast and southwest quadrants of the site. Pesticides were more routinely reported in the northwest quadrant of the site in the area of the former surface impoundments (SWMU 1) (i.e., nine sample locations). However, the concentrations detected are consistent with those detected elsewhere on site and in background locations. Thus, the physical distribution and levels of pesticides reported would appear to indicate that pesticides are not related to historic activities at the site.

Recent groundwater samples (2004) did not report pesticide contamination. However, the pesticides detected in sediment have been reported at low concentrations in on-site groundwater samples during previous sampling events conducted between 2001 and 2003. Pesticides have not been reported in surface water.

The two reports related to the Pristine and Cincinnati Drum sites were again reviewed to determine if a clear off-site source of pesticides existed. During operation, the Pristine facility managed a liquid waste disposal unit where solvents and other organic compounds—including pesticides—were incinerated. The RI Report indicates that DDT and other pesticides were stored at the Pristine site, and that from June 1980 to November 1983, much of the waste at the site, including DDT and other pesticides, was removed in accordance with a consent decree between Pristine, Inc., and Ohio EPA. The reports provide pesticide analysis for soil areas, borings, and groundwater and sediment sampling conducted in 1985. Pesticides, including dieldrin and 4,4'-DDE and its parent product DDT, were detected in soil areas and soil borings throughout the Pristine site. Based upon sample results, concentrations of DDT were reported at much higher

concentrations in soil (up to 18 mg/kg in soil borings and 10 mg/kg in soil area samples[5]) than DDE (up to 0.37 mg/kg in soil borings, and 3 mg/kg in soil area samples) or DDD. Similar results were observed in sediment samples, with DDT reported up to 20.7 mg/kg, and DDE reported up to 2.8 mg/kg. DDT and DDE were also detected in surface water (up to 1.82 μg/L and 0.86 μg/L, respectively) and storm water (up to 1.45 μg/L and 0.06 J[6] μg/L, respectively) samples. Dieldrin was also reported in soil borings (up to 0.149 mg/kg), soil area samples (up to 1.5 mg/kg), and sediment samples (up to 0.075 J mg/kg). Beta-BHC (up to 0.4 μg/L) and DDD (0.14 μg/L) were detected in upper aquifer groundwater samples in the northeastern and southeastern section of the Pristine site. Based upon a review of the data, pesticides were routinely reported in media samples collected at the Pristine site, and at much higher levels than were reported for background samples collected as part of the Pristine investigation (e.g., dieldrin was reported up to 0.46 mg/kg and DDT was reported up to 0.019 mg/kg in background soil samples). In fact, the RI Report indicates that pesticides, along with volatile organic compounds, are the predominant contaminant at the facility.

The RI Report indicates that runoff from the site drains to Mill Creek via surface ditches running along the northern and southern sides (adjacent to the Rohm and Haas property) of the Cincinnati Drum property. Surface water and sediment sample results collected in these drainage ditches reported elevated levels of pesticides, including beta-BHC, DDE and its parent DDT, and dieldrin. The report also indicates that during extremely wet periods, runoff from the Pristine site could pond and extend into off-site areas at the adjacent Cincinnati Drum property. Thus, runoff could have possibly impacted off-site soil at other adjacent industrial properties as well. Thus, it appears that historic releases of DDT and other pesticide materials/wastes impacted surrounding media at the Pristine site, as well as off-site sediment, surface water, and possibly soil.

Based upon a review of available information, a source of pesticide contamination at the Rohm and Haas site was not identified. Sources of pesticide contamination were historically present at the Pristine site, and available data appear to support Pristine as a potential off-site source of pesticide contamination. However, as mentioned above, pesticides have also been reported in background sampling conducted as part of the Rohm and Haas and Pristine investigations; pesticides also appear to be present at low levels in soil in areas surrounding the Rohm and Haas site. Thus, due to the physical distribution of contamination reported at the Rohm and Haas site, the lack of an identified historical source at the site, and the historic sample results indicating a potential source of pesticide contamination at the off-site, adjacent Pristine site, it appears that the pesticides detected in Mill Creek sediment above Region 5 ESLs may be related to off-site sources (e.g., Pristine, Cincinnati Drum, and others) and/or elevated background concentrations.

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[5] The Pristine site was divided into ten on-site soil areas. Two off-site soil area was also identified. Soil area samples consisted of soil collected from five different locations within the designated soil area that were composited into one sample for analysis.

[6] Contract laboratory program qualifier that indicates an estimated value (not added to total fraction).

ATTACHMENT 3

Methods for Calculating Groundwater Contaminant Mass Flux to Surface Water

With only minor modification, the basic methodology utilized during the CA750 Environmental Indicator (EI) evaluation (Question 6) to determine contaminant loadings and the surface water concentration resulting from the discharge of contaminants from the Rohm and Haas site into Mill Creek remains appropriate for determining the ambient surface water concentration in Mill Creek. In its September 15, 2004 letter regarding the CA750 EI analysis, Rohm and Haas's consultant, Geomatrix, identified no fundamental problems with the basic methodology, although Geomatrix indicated some concern with the conservative nature of the analysis.

As indicated in EPA's *Supplemental Guidance for Environment Indicator CA750, Migration of Contaminated Groundwater Under Control: Groundwater-Surface Water Interactions*, the first step in estimating the contaminant concentrations in the receiving surface water is to determine contaminant mass fluxes to the surface water body. This can be accomplished by first estimating the groundwater volumetric flux to the surface water body using Darcy's Law:

$$Q_{gw} = K \times i \times A \qquad \text{(Eq. 1)}$$

where

Q_{gw} = groundwater volumetric flux (l^3/t),
K = hydraulic conductivity of subsurface materials upgradient of discharge (l/t),
I = hydraulic gradient upgradient of the discharge (l/l), and
A = discharge area (cross section of the contaminant plume area at the point of discharge) (l^2).

All units are expressed in terms of length (l), time (t), and mass (m).

The contaminant mass flux due to groundwater discharge into the surface water body is then determined by multiplying the groundwater volumetric flux by the contaminant concentration in groundwater using the following equation:

$$M_{gw} = C_{gw} \times Q_{gw} \qquad \text{(Eq. 2)}$$

where

M_{gw} = contaminant mass flux in groundwater (m/t), and
C_{gw} = contaminant concentration in groundwater immediately upgradient of point of discharge (m/l^3).

The resulting contaminant concentration in surface water may be computed by averaging the

contaminant mass flux over the combined surface water flow upstream of the point of discharge and groundwater volumetric flux of the discharge using the following equation:

$$C_{sw} = (M_{gw})/(Q_{gw} + Q_{sw}) = (C_{gw} \times Q_{gw})/(Q_{gw} + Q_{sw}) \qquad \text{(Eq. 3)}$$

where

C_{sw} = resulting contaminant concentration in surface water (m/l), and
Q_{sw} = volumetric surface water flow rate (l/t).

It is important to note that Equation 3 differs from that used during the CA750 analysis because it does not include the dilution factor of 10 used in that analysis.

Equation 3 can be reexpressed to determine the maximum allowable contaminant mass flux in groundwater to a surface water body that will meet a specified ambient surface water criteria based on a known volumetric surface water flow rate:

$$M_{gwmax} = C_{swcrit} \times (Q_{gw} + Q_{sw}) \qquad \text{(Eq. 4)}$$

where

M_{gwmax} = maximum allowable contaminant mass flux in groundwater, and
C_{swcrit} = ambient surface water criteria.

If the volumetric groundwater flux (Q_{gw}) is known, Eq. 4 can be reexpressed to determine the maximum allowable contaminant concentration in groundwater that will meet a specified ambient surface water flow rate based on a known volumetric surface water flow rate:

$$C_{gwmax} = (C_{swcrit}/Q_{gw}) \times (Q_{gw} + Q_{sw}) \qquad \text{(Eq. 5)}$$

where

C_{gwmax} = maximum allowable contaminant concentration in groundwater based on a specified ambient surface water criteria and known groundwater and surface water volumetric fluxes.

The application of Equation 5 is problematic along the northern portion of the western boundary of the Rohm and Haas facility because the French drain system operated along this section of the property boundary not only controls some portion of the groundwater flux to Mill Creek but also appears to influence the concentration of contaminants migrating past the French drain (see discussion of groundwater concentrations below). Thus, the groundwater flux and concentration of groundwater contaminants downgradient of the French drain are not independent, but the exact relationship between the two is unclear. As a result, the application of Equation 4, in which a maximum allowable contaminant mass flux in groundwater is established, will likely be

more appropriate than the establishment of maximum contaminant concentrations in groundwater along the portion of the boundary influenced by the French drain using Equation 5. Such an approach would require that the French drain or other hydraulic control system be designed and operated in a manner that allows only a specified contaminant mass flux in groundwater to discharge to Mill Creek. In the area along the western facility border, south of the influence of the French drain system, it may be possible to establish a maximum allowable contaminant concentration in groundwater using Equation 5. However, if a remedial measure that requires partial hydraulic control is required along this portion of the boundary, the application of Equation 5 along the southern portion of the boundary may become problematic as well.

Use of these equations requires the estimation of values for each of the component parameters. All of these parameters have previously been estimated for use in the CA750 analysis previously completed. In their letter of September 15, 2004, Geomatrix indicated that the parameters used were frequently unduly conservative, although Geomatrix acknowledged that such conservative assumptions were appropriate for the CA750.

When computing the contaminant mass flux, the CA750 used a value of 0.019 for the hydraulic gradient. Geomatrix did not comment on this parameter, and the basis for this parameter was not provided in the CA750. For determining groundwater cleanup goals, the most appropriate way to determine the hydraulic gradient for computation of contaminant mass flux appears to be to use the difference between the water level in Mill Creek adjacent to the site and the water levels of those monitoring wells immediately downgradient of the French drain. Use of these wells will help to eliminate the impact on groundwater flow resulting from the operation of the French drain.

When computing the contaminant mass flux, the CA750 also used a value of 106 feet per day (ft/day) for the hydraulic conductivity. This value was based on aquifer testing performed on the Rohm and Haas site in 2001. Geomatrix indicated that this was not an appropriate value, as it was based on recent pump testing of the French drain that resulted in a yield of only 10 gallons per minute (gal/min) rather than the 60 gal/min predicted using the previous hydraulic conductivity measurement of 106 feet per minute (ft/min). Based on the 10 gal/min yield of the French drain pump test, Rohm and Haas's consultants indicated that a value of approximately 20 ft/day was more appropriate. It is important to note that Rohm and Haas did not perform any formal quantitative analysis of the data resulting from the French drain pump test upon which to base the 20 ft/day hydraulic conductivity estimate. More significantly, the pump testing of the French drain did not clearly establish that the 10 gal/min yield of the test was sufficient to capture all of the shallow groundwater passing across the drain to Mill Creek. The low yield of the pump test may be attributable to a number of factors beside the low hydraulic conductivity of the Shallow Upper Aquifer (UA) Sand, including the hydraulic inefficiencies of the French drain system. Consequently, the French drain pump test does not appear to provide an adequate basis for estimating the hydraulic conductivity value to be used in calculating contaminant mass flux to Mill Creek. The most appropriate approach to estimating this parameter may be to use slug test data from those wells located immediately downgradient of the French drain. Hydraulic conductivity data from these wells should provide the most direct measurement of the hydraulic

facility and Mill Creek, groundwater monitored by UAW02-40 may discharge to Mill Creek. Rohm and Haas may wish to provide further data and/or analysis to resolve this issue.

Should Rohm & Haas cease to operate or abandon the French drain, it may be useful to expand the monitoring network to include those Shallow UA Sand monitoring wells located immediately upgradient and adjacent to the French drain, to determine compliance with cleanup goals. However, since the intention of such a monitoring program is to characterize the quality of groundwater actually discharging to Mill Creek, the inclusion of monitoring wells further upgradient, throughout the site would not appear necessary.

It is strongly recommended that when performing the analysis of contaminant mass flux to Mill Creek, Rohm and Haas should divide the western boundary into a series of segments centered on each monitoring well used to evaluate groundwater quality. This approach would best account for the variability observed in contaminant concentrations, Shallow UA Sand thickness, and groundwater gradients between the western boundary of the facility and Mill Creek.

characteristics of the Shallow UA Sand in the area between the French drain and Mill Creek.

When calculating the area through which the contaminated groundwater discharged to Mill Creek, the CA750 used an aquifer thickness of 20 feet. Rohm and Haas's consultants have indicated that the saturated thickness of the Shallow UA Sand ranges only between 0.5 and six feet. Based on the water levels depicted on the Groundwater Gradient Map shown in Figure 5-1 and the vertical distribution of the Shallow UA Sand depicted on Cross-Section E-E' shown on Figure 5-7 of the September 2004 Revised Facility Investigation Report, the range of saturated aquifer reported by Geomatrix appears to be reasonable. However, to verify the actual saturated thickness of the Shallow UA Sand in the area downgradient of the French drain, Rohm and Haas should provide a detailed comparison of the vertical distribution of the Shallow UA Sand and water level in each monitoring well downgradient of the French drain.

When calculating the resultant contaminant concentration in Mill Creek, the CA750 used the annual mean stream flow value reported from the United States Geological Survey (USGS) gauging station at Mill Creek. However for the chronic effects consider in this analysis, the appropriate flow estimate is the seven day, ten year low flow (7Q10) value. According to the U.S. Geological Survey (USGS), the USGS gage on Mill Creek probably has sufficient period of record to calculate the 7Q10.

When establishing contaminant concentrations in groundwater, the CA750 included the maximum values observed along the western edge of the site, including several locations upgradient of the French drain system. Geomatrix has indicated that groundwater quality data from only those wells located downgradient of the French drain system should be used in determining the contaminant concentrations of groundwater discharge to Mill Creek. The concentrations for some contaminants on the upgradient and downgradient sides of the French drain do appear to be significantly different. The factors that lead to these differences are unclear since similar concentrations on both sides of the French drain would normally be expected. One factor may be groundwater mixing due to incomplete hydraulic capture.

Geomatrix has further indicated that the wells used to establish the quality of groundwater discharging to the Mill Creek should include only UAW07-20, MW-EPA-1, UAW05-20, UAW03-20, UAW02-20, UAW25-20, and UAW01-30. Since some portion of the upgradient groundwater flow is being captured by the French drain system, the use of only those wells located downgradient of the French drain to establish the quality of groundwater discharging to Mill Creek appears appropriate. Those specific wells suggested by Geomatrix similarly appear appropriate. However, consideration should be given to including UAW02-40 in the list of monitoring wells used to determine the quality of groundwater discharging to Mill Creek. The Deep UA Sand as depicted on Cross-Section D-D' shown on Figure 5-6 of the September 2004 Revised Facility Investigation Report indicates that the Shallow UA Sand extends to approximately 530 feet above mean sea level (msl) at Mill Creek, and UAW02-40 is screened in the Deep UA Sand which extends upward to approximately 525 feet msl at UAW02-40. Since stratigraphic control is weak in the area between the western boundary of the Rohm and Haas

ATTACHMENT 4

Memorandum from Ohio EPA

OhioEPA

Interoffice Memorandum

Date: July 14, 2005
Subject: Comments Regarding the Recommended Approach for Development of Groundwater Cleanup Goals at the Rohm and Haas Facility, Reading, Ohio, June 29, 2005
To: Harold O'Connell, Division of Hazardous Waste Management, Southwest District Office
From: Mylynda Shaskus and John Estenik, Division of Surface Water, Central Office

As per Diana Zimmerman's (DSW-SWDO) request on July 8th, we have reviewed the document "Recommended Approach for Development of Groundwater Cleanup Goals, Rohm and Haas Facility, Reading, Ohio, June 29th, 2005", and offer our comments below.

Because this document is not a stand-alone document, we assumed that the chemicals of potential concern (COPCs) selected were correct based on available data and according to the screening procedure specified in the document. What we would like to see in order to make this determination for ourselves is a table that contains a summary of surface water and sediment concentrations of all detected chemicals, including ranges of detection, detection frequency, quartile concentrations and detection limits.

Ecological Cleanup Goal Development

In general, we agree with the approach suggested in developing groundwater, surface water, and sediment cleanup goals. We agree that using the OMZA and ESL values will be a protective approach for groundwater, surface water, and sediment pore water. We also agree that site-specific toxicity tests, developed in conjunction with EPA, could be used to develop cleanup goals if OMZA and ESL values are not chosen.

However, there appears to be continued uncertainty as stated in the document regarding sediment depositional areas, transitional water zones, and macroinvertebrate taxa in Mill Creek. Before a mass flux calculation could be performed to develop surface water cleanup goals, a significant amount of further stream characterization would need to be undertaken.

Human Health Cleanup Goal Development

We agree with the approach to screening for COPCs using national ambient water quality standards (NAWQCs) for surface water and Region 9 preliminary remediation goals (PRGs) for soil for sediment goals.

We agree with the assessment that cleanup criteria for fish ingestion are not necessary. However, as stated earlier in the document, we would like to see the data summaries for the COPCs, in particular those for the dichlorobenzenes, chlorobenzene, benzene, and bis(2-ethylhexyl)phthalate, to ensure that this conclusion is correct.

We agree with the use of the NAWQC values as cleanup goals in surface water. We also agree that site-specific values for surface water goals could be developed instead of using the NAWQC values, provided that the exposure parameters are developed in conjunction with input from EPA.

For sediment cleanup goals, we agree that using the Region 9 PRGs for residential soil would be protective of human receptors.

In regard to groundwater cleanup goals, we want to reiterate that if mass flux calculations are to be used, site-specific inputs need to be justified through further characterization of the stream.

Summary of Review

To summarize, we feel that Booz Allen's proposal to develop cleanup goals for the Rohm and Haas Facility would result in concentrations protective of ecological and human receptors.

However, because the document is not stand-alone, and relies on data and information presented in other documents, we could not compare actual site data and information to that presented in this document. Therefore, we would like to see summaries of the available surface water, sediment, and groundwater data before finalizing our conclusions.

In addition, the document expresses uncertainty regarding the amount of groundwater that is contributing to surface water in the vicinity of the facility, the macroinvertebrate taxa found in Mill Creek in the vicinity of the facility, and the stream morphology in the vicinity of the facility, in particular the quantity and nature of stream sediments. If options for cleanup goals other than the most conservative options are chosen (i.e., site-specific evaluations or toxicity tests are to be conducted in lieu of using OMZA, ESL, NAWQC, and Region 9 PRG values, or if mass flux equations are used), more site-specific information regarding the contribution of groundwater to surface water, the present or potentially present macroinvertebrate community, and the amount and type of sediment found in the vicinity of the facility will need to be developed further.

Baseline Risk Assessment
Morton International Inc.
Cincinnati, Ohio Facility

January 14, 2003
1:30 Central Time (2:30 Eastern Time) Conference Call

Host: Geomatrix
Call Title/Reference: Cincinnati-Baseline Risk Assessment
Confirmation Number: 6376844
Dial In: 1 (800) 569-0883
Alternate Dial-In:
Passcode: 6376844

Attendees:

Mirtha Capiro, USEPA Region 5
Kathy Rogovin, BAH
Richard Kuhlthau, BAH
Peter Palena, Rohm and Haas Company
Mark Hemingway, Geomatrix
Anne Haikola, Geomatrix
Ann Holbrow, Geomatrix

----- Agenda Topics -----

Introductions	ALL	5
Meeting Objectives	Peter Palena	5
Discussion of Specific BRA Comments	Geomatrix, BAH	90
Summarize Results of Discussion	Geomatrix	10
Review Action Items	Peter Palena	10
Meeting Wrap Up	Peter Palena	5

Attachments

- Summary of specific comments and issues for discussion

BASELINE RISK ASSESSMENT – GENERAL COMMENTS

USEPA GENERAL COMMENTS 1, 2, 3 and SPECIFIC COMMENTS 6, 7, 8, 10, 11, 14, 16, 17, 35, and 37 (these comments generally deal with similar or the same issues, and so are addressed collectively by the following):

General Positions:

- **Compounds likely to be originating from off-site sources, regardless of their chemical character, are background for the Morton Facility, and should not be considered in the BRA.**
- **EPA guidance issued concurrently with or after finalization of the BRA should not be applied.**
- **The BRA methods and procedures specified in the FI Work Plan should dictate the manner in which the BRA is performed.**

Specific Issue(s) for Discussion:

- **Whether and how to consider chemicals from known and unknown off-site sources in the risk assessment process.**
- **Interpretation and applicability of new EPA guidance document published essentially concurrently with or after the Baseline Risk Assessment**
- **Modification in approach from that specified in FI Work Plan**

Primary Materials Needed for Discussion

- **FI Work Plan**
- **U.S. EPA, 2002, Role of Background in CERCLA Cleanup Program**
- **Tables 1.1 to 1.4 from the BRA listing COPCs**
- **The Current Conditions Report, particularly Sections 2.2, 3.4, 4.0, and Appendix C.**
- **The EPA's regulatory files on the Pristine Superfund Site, particularly summary documents from the Pristine Site (e.g., the RI/FS Report, recent monitoring reports).**
- **Project correspondence relating to Target Analyte Lists (e.g., Geomatrix's letter to Ms. Capiro dated June 29, 2001)**
- **FI Report Figures 5-13 and 5-17, Tables 5-2 and 5-6**

4. Although the approved FI Work Plan (Morton, 2000) indicates that the federal maximum contaminant levels (MCLs) or the U.S. EPA Region 9 preliminary remediation goals (PRGs) for tap water if an MCL is not available, will be used to screen groundwater and surface water data to select COPCs, the MCLs are not entirely appropriate. Previous review comments on the FI Work Plan (Morton, 2000) requested that Morton demonstrate the appropriateness of any PRGs and risk-based screening levels (RBSLs) used to identify COPCs in the HHRA. This information is missing

from the BRA report. MCLs are more appropriately applied to select cleanup levels because it is not generally U.S. EPA's position that groundwater or surface water be remediated beyond MCLs unless more stringent levels are appropriate for ecosystem protection. Additionally, MCLs are not exclusively derived using risk-based criteria that consider multiple exposure pathways. While it would be acceptable to use the MCL to select a COPC when the MCL is more conservative than its corresponding risk-based screening level, the risk-based criterion must be used as the screening level when it is lower than the MCL. Thus, the U.S. EPA Region 9 PRG for tap water should be applied as the RBSL where it is more conservative than the MCL.

Issue(s) for Discussion:

- **Modification in approach from that specified in FI Work Plan**

Primary Materials Needed for Discussion

- **FI Work Plan**

5. It should be noted that the U.S. EPA Region 9 PRGs were updated in October 2002. This update is a major revision from the previous version, and contains several changes to the toxicity values. In addition, the updated PRG table was reviewed by the National Center for Environmental Assessment (NCEA) and is the only published source of the latest NCEA provisional toxicity values for certain constituents. Thus, Morton should use this updated version of the PRGs in the revised risk assessment to ensure that the latest toxicological information and screening values are applied.

Issue(s) for Discussion:

- **Interpretation and applicability of new EPA guidance document published after the completion of the Baseline Risk Assessment**

Primary Materials Needed for Discussion

- **FI Work Plan**
- **Previous and updated PRG tables.**

7. The BRA relies on the use of industrial soil screening criteria because the site is anticipated to be used for industrial purposes into the foreseeable future. U.S. EPA Region 5 policy outlined in *Use of Institutional Controls in the RCRA Corrective Action Program* (www.epa.gov/reg5rcra/ca) describes information that should be discussed in regard to land use determinations. Former review comments on the FI Work Plan (Morton, 2000) requested that this information be included in the HHRA. This information is missing from the BRA. Sources of information about current land use restrictions and future land use expectations should explicitly include a discussion of

zoning laws and maps, consultation with local planning authorities, and assessment of property development trends in the vicinity of the facility. U.S. EPA has also specifically cautioned against automatically assuming restricted future land use assumptions on the basis of extrapolation of current land use and relying on current zoning/industrial use codes [55 Federal Register 19452; May 1, 1996]. The BRA should provide a more detailed discussion of the decision to assume industrial land use in screening for COPCs and to select only on-site industrial exposure scenarios and exposure pathways.

Issue(s) for Discussion:

- **Information needed to resolve issue of future on-site land use.**

Primary Materials Needed for Discussion

- **FI Report**
- **BRA**

8. The BRA indicates (Section 4.1.2, page 17) that the Upper Aquifer is not known to be used as a source of potable water. The text also states that although the lower portion of the Lower Aquifer is widely used as a source of potable water, there are no known active supply wells at or in the immediate vicinity of the Morton Facility. The BRA also indicates that the Lower Aquifer groundwater is being controlled by the remediation system for the neighboring Pristine Superfund site. Thus, Morton does not evaluate groundwater as a potable water source in the BRA.

   It is noted that Morton does not have in place appropriate institutional controls to restrict current and future groundwater use on site. In addition, Morton does not have any control over groundwater use in off-site areas. It is also noted that any consideration of the remediation system for the neighboring Pristine Superfund site is to be included as a risk management activity, the impact of which should be assessed independent of, and following, a human health and ecological risk assessment. Therefore, Morton should revise the risk assessment to consider this exposure pathway and include the potential for groundwater to be used as a source of potable water.

Issue(s) for Discussion:

- **Use of institutional controls to manage future on-site groundwater use**
- **Potential for groundwater to migrate to off-site areas that would be used as source of drinking water.**
- **Clarification of EPA/BAH's intent regarding the Pristine Superfund site.**

Primary Materials Needed for Discussion

- **FI Report**
- **BRA**

9. With respect to chromium, the BRA assumes that all exposures reflect the less toxic trivalent form of chromium. None of the text discussion or the data summary tables indicate that chromium speciation was performed during the analyses of site samples. Without speciation information, it is common practice in risk assessment (and a more conservative assumption) to presume that chromium detections are present in the more toxic hexavalent form. The BRA should be revised to provide evidence that all chromium is present in the trivalent state, or the risk calculations should be re-run using hexavalent chromium chemical parameters and toxicity criteria.

Issue(s) for Discussion:

- **Analytical requirements specified in FI Work Plan**
- **Appropriate assumptions regarding occurrence of hexavalent chromium vs. trivalent chromium**

Primary Materials Needed for Discussion

- **FI Work Plan, Appendix A (QAPP), Tables A1-1 and A1-2**
- **FI Report, Figures 5-16 and 5-20, Tables 5-5 and 5-9**
- **BRA**

10. The SERA, Section 7 of the BRA, is not acceptable because it does not adequately follow current U.S. EPA ecological risk assessment guidance (i.e., EPA, 1997; EPA, 2001a, 2001b) and there are inconsistencies with the FI Work Plan (Morton, 2000). Key deficiencies include (1) some likely complete pathways are omitted; (2) contaminants of potential concern are inappropriately screened out because they are not detected, do not have screening values, or are below selected background concentrations; and (3) food chain risks to wildlife are not assessed.

Issue(s) for Discussion:

- **Specific pathways, contaminants, and food chain risks identified by EPA that were omitted, screened out, or otherwise not assessed.**

Primary Materials Needed for Discussion

- **FI Work Plan**
- **EPA Guidance Referenced in Comment**
- **BRA**

12. Vinyl chloride is also eliminated on the basis that it is infrequently detected. However, the detection limits for all the vinyl chloride samples range from 2 to 2000 μg/L, which significantly exceed the risk-based screening level (Region 9 PRG) of 0.02 μg/L. Vinyl chloride is also typically associated with the other chlorinated chemicals that have been detected on site. For all these reasons, vinyl chloride should be retained as a COPC in groundwater.

Issue(s) for Discussion:

- **Likely source of vinyl chloride.**
- **Whether and how to consider vinyl chloride in BRA.**

Items Needed for Discussion

- **FI Report Figures 5-13 and 5-17, Tables 5-2 and 5-6**

BASELINE RISK ASSESSMENT – SPECIFIC COMMENTS

Section 2.4.4 Sediment, page 9

3. Page 9 states that 20 sediment samples were analyzed for potential contaminants, but only one sample was analyzed for semivolatile organic compounds (SVOCs). SVOCs would be expected to accumulate in sediment to a greater degree than volatile constituents. This particular sample contains multiple PAHs that exceed screening values (e.g., Table 10.2). This section should include justification for only analyzing SVOCs at one location and why that specific location was selected. Morton shall address any identified data gaps.

Issue(s) for Discussion:

- **Likely source of PAHs.**
- **Whether and how to consider PAHs in the BRA.**
- **Rationale for analysis of single sample for PAHs.**

Primary Materials Needed for Discussion

- **FI Report, Figure 5-22, Table 5-3**
- **BRA**

Section 4.2.1 Sources, Mechanisms of Releases, and Mechanisms of Transport, pages 19 and 20

21. The HHRA addresses only the generation of windborne fugitive dusts. Additional dusts that would be generated by construction or excavation activities are not modeled, although page 21 of the BRA states that construction activity dust generation is addressed. Explain why the methodology used to calculate a specific construction particulate emission factor (PEF) that would be relevant to construction workers outlined in U.S. EPA's *Supplemental Guidance for Developing Soil Screening Levels at Superfund Sites* (OSWER Directive 9355.4-24, March 2001) was not used. The BRA cites this document in Tables 4-1 through 4-10. (Note that this document is missing from the references list in Section 9.0 of the report.)

Issue(s) for Discussion:

- **How to estimate particulate emissions from a non-specific construction scenario**

Primary Materials Needed for Discussion

- **BRA**

22. The decision to exclude potential exposure to contaminated fish through bioaccumulation of constituents in surface water and sediment should be revisited in light of the fact that many additional organic constituents should be retained as COPCs since they exceed risk-based screening criteria. Additionally, the lack of fish noted during the field visit conducted at the facility is not sufficient reason to exclude fish tissue exposures. The potential for Mill Creek to serve as a fishing source currently and in the future should be discussed in further detail.

Issue(s) for Discussion:

- **Additional information needs for Mill Creek regarding potential use as a fishing source with potential human consumption.**

Primary Materials Needed for Discussion

- **Current Condiftions Report**
- **FI Report**
- **BRA**

Section 7.1.6 Ecological Receptors, page 50

32. Page 50 lists the ecological receptors that will be assessed in the SERA, but plants and soil invertebrates are omitted. These receptors should be included in the SERA, or rationale should be provided on why they should be excluded (e.g., absence of habitat).

Issue(s) for Discussion:

- **Appropriate rationales for exclusion or inclusion of ecological receptors at the Morton Facility.**

Primary Materials Needed for Discussion

- **Applicable EPA Guidance Identified by EPA/BAH**
- **FI Report**
- **BRA**

33. The statement on page 50 that fish and macroinvertebrates were not observed in Mill Creek should be either supported or deleted. Morton's description of the site reconnaissance indicates that it was not designed to evaluate the presence of invertebrates and fish in Mill Creek. For example, electroshocking or minnow trapping do not appear to have been performed to detect the presence of fish. Also, benthic sampling does not appear to have been performed, so it is unclear how Morton would detect the presence of benthic invertebrates. Any statements regarding the absence of biota observations must be qualified relative to the ability to detect the species in question.

Issue(s) for Discussion:

- **Intent and scope of BRA and FI statements on observation of fish and macroinvertebrates.**
- **Character of benthic environment in Mill Creek.**

Primary Materials Needed for Discussion

- **FI Report**
- **BRA**

Section 7.2 Chemical Screening, page 51

35. Pages 51 through 54 describe the process for screening out COPCs, which included eliminating chemicals that were (1) not associated with historical activities, (2) were not detected, (3) did not have a screening value, or (4) were below background. Current U.S. EPA (1997; 2001a; 2001b) states that non-detected compounds and compounds without benchmarks should be included as COPCs. Additionally, background data cannot be used to screen out COPCs in a SERA. The FI Work Plan (Morton, 2000) states that one half of the detection limit of a non-detected compound will be used to screen for COPCs (Section 6, p. 5), but this was not followed in the SERA. Morton must revise the SERA to be consistent with current U.S. EPA screening level guidance, including considering all chemicals that cannot be appropriately screened out. Also, chemicals cannot be eliminated as COPCs if they are presumed not to be associated with Morton facility releases (p. 53), without additional justification and explanation in the SERA. For example, it is unclear how an apparently localized area of PCB contamination in site groundwater would not be attributed to site releases; this must be explained. The COPCs determined in the SERA can then be further examined in subsequent tiers of the assessment, such as the problem formulation phase of a baseline ecological risk assessment.

Issue(s) for Discussion:

- **Appropriate methods for screening out compounds in ecological risk assessment.**
- **Consideration or screening out of background compounds (see global discussion issues at top of list)**

Primary Materials Needed for Discussion

- **Applicable EPA Guidance Identified by EPA/BAH**
- **FI Work Plan**
- **FI Report**
- **BRA**

Section 7.2.1 Soil, page 51

36. The SERA discusses the use of soil data to a depth of four feet. Standard practice in ecological risk assessment is to use only surface soil data (e.g., to a depth of one foot). Morton may use only surface soil data if there are adequate data available for use in the SERA.

Issue(s) for Discussion:

- **Appropriate definition of surface soil for purposes of ecological risk assessment.**

Primary Materials Needed for Discussion

- **Applicable EPA Guidance Identified by EPA/BAH**
- **FI Report**
- **BRA**

Section 7.2.3 Seep, page 53

39. Page 54 suggests that seep contributions to Mill Creek are very limited. Rather than speculate, this section should include a worst case calculation of surface water concentrations using maximum seep flows and minimum stream flows. The calculation should include all seeps that may discharge contaminants to the creek. The seep locations on the figures should be clearly labeled. For example, stream stations are shown on Figure 4, but it is unclear what samples were collected at these locations (e.g., sediment, and seep samples).

Issue(s) for Discussion:

- **Character of seepage into Mill Creek**
- **Appropriate consideration of seepage in risk assessment**

Primary Materials Needed for Discussion

- **FI Report**
- **BRA**

Section 7.3 Risk Characterization, page 54

40. Pages 54 to 55 discuss ecological risks from contaminated soil, sediment, and seeps, but wildlife risks are not characterized. Bioaccumulative contaminants were used on site (e.g., organotin compounds noted on page 4), and have been detected on site (e.g., PCBs in groundwater). The SERA must be revised to include an assessment of wildlife risks to potentially bioaccumulative compounds; see Table 4-2 of EPA (2000) for a candidate list of bioaccumulative compounds. The SERA must include the specific rationale and justification for any excluded contaminants and potentially complete exposure pathways (e.g., why a chemical was detected but did not result from site activities, and what were potential non-facility sources).

Issue(s) for Discussion:

- **Character of wildlife occurrence at Morton Facility and surroundings**
- **Appropriate consideration of wildlife in risk assessment**

Primary Materials Needed for Discussion

- **FI Report**
- **BRA**